Coding for Physical Restraint Status Among Hospitalized Patients: a 2019 National Inpatient Sample Analysis

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ABSTRACT

BACKGROUND: The reduction of physical restraint utilization in the hospital setting is a key goal of high-quality care, but little is known about the rate of restraint use in general hospitals in the USA.

OBJECTIVE: This study reports the rate of physical restraint coding among acute care hospital discharges in the USA and explores associated demographic and diagnostic factors.

DESIGN: The National Inpatient Sample, a de-identified all-payors database of acute care hospital discharges in the USA, was queried for patients aged 18 and older with a diagnosis code for physical restraint status in 2019.

PARTICIPANTS: Hospitalized patients aged 18 and older.

MAIN MEASURES: Demographics, discharge diagnoses, in-hospital mortality, length of stay, total hospital charges.

KEY RESULTS: In total, 220,470 (95% CI: 208,114 to 232,826) hospitalizations, or 0.7% of overall hospitalizations, included a discharge code for physical restraint status. There was a 700-fold difference in coding for restraint utilization based on diagnosis, with 7.4% of patients with encephalitis receiving restraint diagnosis codes compared to < 0.01% of patients with uncomplicated diabetes. In an adjusted model, male sex was associated with an odds ratio of 1.4 (95% CI: 1.4 to 1.5) for restraint utilization coding, and Black race was associated with an odds ratio of 1.3 (95% CI: 1.2 to 1.4) relative to white race.

CONCLUSIONS: In the general hospital setting, there is variability in physical restraint coding by sex, race, and clinical diagnosis. More research is needed into the appropriate utilization of restraints in the hospital setting and possible inequities in restraint utilization.

KEY WORDS: restraint; physical; cohort studies; demography

INTRODUCTION

A physical restraint is defined as "any action or procedure that prevents a person's free body movement to a position of choice and/or normal access to his/her body by the use of any method, attached or adjacent to a person's body that he/she cannot control or remove easily."[1] In the hospital setting, physical restraint can take many forms, including raised bed rails, limb restraints, hand mitts, and vests. The use of restraint has been justified as preventing greater harm to patients or medical staff,[2] although some authors argue that restraint use is rarely, if ever, justified,[3] and should be considered evidence of treatment failure.[4] Physical restraints are associated with medical complications including skin breakdown, thrombosis, rhabdomyolysis, aspiration, positional asphyxia, and death,[5] although precise rates of these complications are unclear, and are likely confounded by the underlying medical condition for which restraints were applied. Additionally, restraint is associated with psychological distress among patients,[6] and may be associated with subsequent trauma syndromes.[7] The effectiveness of physical restraints at reducing patient injuries is unclear, and is further confounded by severity of illness. For instance, one systematic review found that physical restraint utilization was not associated with changes in fall rates among older adults,[8] and studies have indicated that patients who are physically restrained have higher rates of unplanned extubation in the intensive care unit (ICU), although these analyses could not control for the fact that patients may have been restrained precisely because the treating teams considered them to be at high risk of extubation.[9,10]

National guidelines from the Joint Commission have emphasized reduced use of restraints, and mandated restraint rate reporting in psychiatric hospitals.[11] The rate of restraint usage varies widely among countries and medical settings. For example, studies have documented physical restraint use in 4.8% of general hospital patients in Switzerland and Austria,[12] 1.7% in psychiatric hospitals in Norway,[13] 23% in a tertiary care hospital in South Africa (with wide variation of 0 to 54.5% depending on inpatient unit),[14] 3.4% in Malaysian hospitals,[15] 61.2% in Chinese

ICUs,[16] and 50.1% of geriatric patients in Japanese hospitals during the COVID-19 pandemic.[17] Moreover, there is substantial variability in restraint utilization even within the same region and health care setting, with one cross-sectional study of European ICUs finding the prevalence of physical restraint to vary between 0 and 100% depending on individual unit[18]; thus, pooling rates may mask important underlying variability.

Numerous studies have explored care programs for reducing physical restraint utilization,[19,20] and improved understanding of restraint utilization in hospitals could help target evidenced-based interventions toward patients at highest risk of receiving physical restraints and guide subsequent quality improvement efforts. This study characterizes the occurrence of administrative claims diagnosis of physical restraint using nationally representative data to characterized encounters which included recorded use of restraints.

METHODS

Data Source

To assess nationwide occurrence of in-hospital physical restraints, this analysis utilized the 2019 edition of the National Inpatient Sample (NIS), from the Healthcare Cost and Utilization Project (HCUP) of the Agency for Healthcare Research and Quality. The NIS is a claims database including demographic information, discharge diagnoses (up to 40), and inpatient procedures (up to 25) drawn from 4568 acute care hospitals in 49 states covering 98% of the US population. The NIS is designed to provide nationally representative estimates of hospital discharges using a stratified sampling of 20% of overall discharges. Data are provided for hospitalizations in a de-identified format, with no mechanism for linking database entries to identified individuals. Of note, the NIS samples general hospitals only, and thus, estimates do not include facilities such as rehabilitation hospitals, freestanding psychiatric hospitals, or federally operated facilities. As this is a de-identified, publicly available database, this study was determined to be Not Human Subjects Research by the Mass General Brigham Institutional Review Board.

Data Selection

Hospitalizations involving physical restraint coding were identified using *International Statistical Classification of Diseases, Tenth Revision, Clinical Modification* (*ICD-10-CM*) code Z78.1 "physical restraint status." Discharges were included in this analysis for patients aged 18 or older if Z78.1 was included among the discharge diagnosis codes. Primary diagnoses of hospitalizations involving physical restraint were classified into diagnostic categories using the Clinical Classifications Software Refined (CCSR) (v2021.2. Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality, Rockville, MD), which groups ICD-10-CM codes into clinically relevant categories. Patients who received mechanical ventilation were identified based on ICD-10 procedural codes 5A1935Z, 5A1945Z, and 5A1955Z. All data are presented as reported in the NIS.

Statistical Analysis

All analyses were conducted on data weighted according to the appropriate NIS discharge weight to obtain nationwide estimates. The survey design of the NIS, in which individual hospitals are clustered within strata (based on geographic region, hospital ownership, teaching status, and bed size) and then discharges sampled at 20% without replacement within strata, produces variance around all reported continuous and categorical variables. This variance is used to present sample uncertainty for the total number of discharges with a physical restraint code, whereas weighted point estimates are reported for all other analyses. Due to the non-normal distribution of age, length of stay, and total hospital charges, these values are reported as medians with interquartile range (IQR). All tests were two-sided, with an α level of 5% for all outcomes, without correction for multiple comparisons.

For the primary statistical analysis, a logistic regression was performed on the binary outcome of a hospitalization including vs. not including a billing code for physical restraint status. This logistic regression incorporates the sampling methodology of the NIS, so it explicitly considers the NIS stratum and hospital identifier as part of variance calculations. In this model, age (z score), sex, race, admission type (elective vs. non-elective), hospital bed size (small/medium/large), primary service line, region, income quartile of the patient's ZIP code, and patient severity (defined based off of All Patient Refined-Diagnosis Related Groups' (APR-DRGs) Severity of Illness)[21,22] are descriptor variables. As a sensitivity analysis, this analysis was repeated separately for patients with a procedure code for mechanical ventilation during hospitalization. In a model of cost, the log-transformed total hospital charges were modeled using a general linear model (GLM) incorporating the sampling methodology of the NIS, with physical restraint code (yes or no), age (z score), sex, hospital region, hospital bed size (small/medium/large), admission type (elective vs. non-elective), primary service line, whether the admission involved a major operative procedure, primary payor, the log-transformed sum of total length of stay plus 1, and APR-DRGs Severity Of Illness as descriptor variables. All analyses were conducted using SPSS (version 29; IBM Software, Inc., Armonk, NY). This study is reported in accordance with the REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) statement.[23]

RESULTS

Among the 30,218,268 hospitalizations for patients aged 18 and older in the USA in the 2019 NIS, 220,470 (95% CI: 208,114 to 232,826) included a discharge diagnosis code for physical restraint status, for an overall restraint coding rate of 0.7%. Demographically, 42.9% of overall hospitalizations were for male patients, but 61.9% of coded restraints involved male patients. The proportion of hospitalizations involving a diagnosis code for physical restraint varied between 0.5 and 0.9% depending on the age of the patient, with peaks for those aged 18–20, 46–55, and 81–90 + years old (Fig. 1). Full demographic information for hospitalizations involving and not involving restraint coding are listed in Table 1.

In a GLM model of the log-transformed total hospital charge, adjusting for physical restraint code (yes or no), age (z score), sex, hospital region, hospital bed size (small/medium/large), admission type (elective vs. non-elective), primary service line, whether the admission involved a major operative procedure, primary payor, the log-transformed sum of total length of stay plus 1, and APR-DRGs Severity Of Illness, a physical restraint code was associated with an increased hospital charge of $5,445 per hospitalization, or an aggregate adjusted cost of $1.2 billion in 2019 (Table S1).

Hospitalizations with a coded restraint diagnosis included a wide variety of principal discharge diagnoses. Table 2 lists the most common CCSR categories diagnosed for hospitalizations involving restraint, while the raw ICD-10 codes are listed in Table S2. The most common diagnostic categories for hospitalizations involving restraint were septicemia (30,325 hospitalizations; 13.8% of coded restraints), schizophrenia spectrum and other psychotic disorders (11,985 hospitalizations; 5.4% of coded restraints), poisoning by drug (11,790 hospitalizations; 5.3% of coded restraints), respiratory failure (11,580 hospitalizations; 5.3% of coded

restraints), and alcohol-related disorders (10,125 hospitalizations; 4.6% of coded restraints).

The overall rate of physical restraint coding differed based on the primary discharge diagnostic category (Table 3; Table S3). While overall 0.7% of hospitalizations involved physical restraint coding, when examining CCSR categories diagnosed at least 5000 times in 2019, 7.4% of the 5010 hospitalizations with a principal discharge diagnosis of encephalitis utilized a physical restraint code, the highest proportion of any diagnostic category. In contrast, < 0.01% of hospitalizations for diabetes mellitus without complication or uncomplicated pregnancy, the two categories with the lowest restraint rate, involved a code for physical restraints.

In order to explore factors associated with physical restraint coding, a logistic regression was performed on the binary outcome of a hospitalization including a diagnosis code for physical restraint (yes/no), adjusting for age (z score), sex, race, admission type (elective vs. non-elective), hospital bed size (small/medium/large), primary service line, region, income quartile of the patient's ZIP code, and patient severity (Table 4). In this model, male sex (aOR 1.4; 95% CI: 1.4 to 1.5); Black (aOR 1.3; 95% CI: 1.2 to 1.4), Asian or Pacific Islander (aOR 1.2; 95% CI: 1.0 to 1.3), and Other (aOR 1.2; 95% CI: 1.1 to 1.4) races; non-elective admission (aOR 1.7; 95% CI: 1.6 to 1.8); mental health/substance abuse (aOR 6.5; 95% CI: 6.1 to 6.8), injury (aOR 2.8; 95% CI: 2.6 to 2.9), or surgical primary diagnosis (aOR 1.3; 95% CI 1.2 to 1.3); hospital region; and increasing disease severity (aOR 3.0; 95% CI: 3.0 to 3.1) were all associated with a higher odds of physical restraint coding. Increasing age (aOR 0.9; 95% CI: 0.9 to 0.9), small hospital size (aOR 0.8; 95% CI: 0.7 to 0.9), maternal and neonatal service line (aOR 0.1; 95% CI: 0.1 to 0.1), and second quartile of income ZIP code (aOR 0.9; 95% CI: 0.8 to 1.0) were associated with lower odds of physical restraint coding. In a
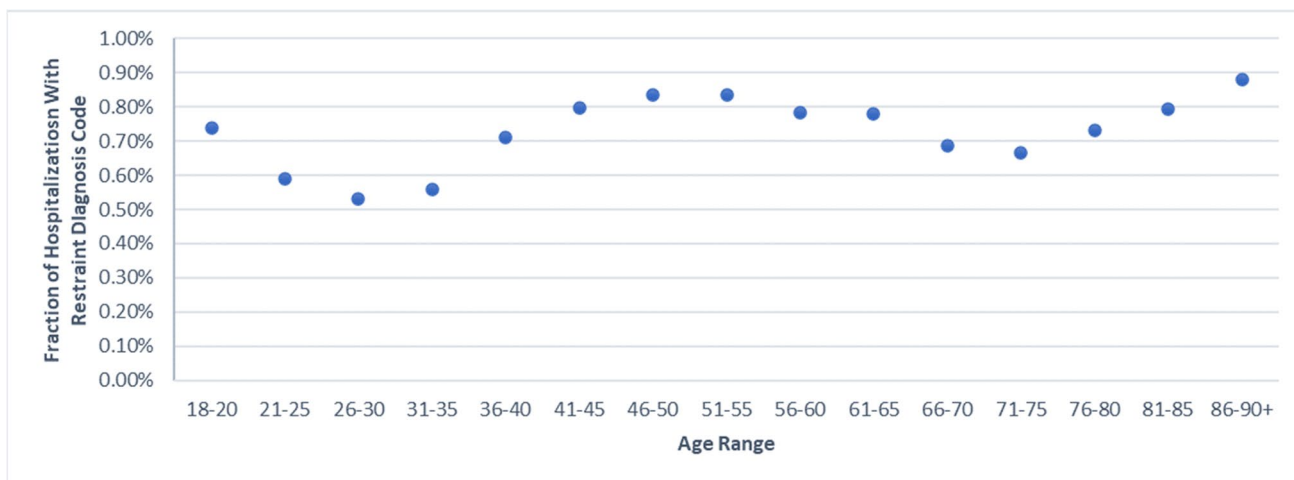
Figure 1 **Percentage of overall hospitalizations that involve a diagnosis of physical restraint status vs. the age of the patient. While the absolute number of hospitalizations and restraints varies by age, the proportion of hospitalizations with a restraint diagnosis is within the range of 0.5 to 0.9% for all ages.**

Table 1 Demographics of Hospitalizations With and Without a Discharge Diagnosis of Physical Restraint Status in the 2019 NIS

	Restraint		No restraint	
	n	%	*n*	%
N (95% CI)	220,470 (208,114 to 232,826)		29,997,798	
Age (years)	64 (46 to 76)		62 (41 to 75)	
Sex				
Male	136,460	61.9	12,842,225	42.8
Female	83,955	38.1	17,152,273	57.2
Race				
White	136,990	62.1	19,714,053	65.7
Black	42,040	19.1	4,477,110	14.9
Hispanic	20,190	9.2	3,242,510	10.8
Asian or Pacific Islander	6075	2.8	820,195	2.7
Native American	1750	0.8	199,405	0.7
Other	7140	3.2	851,296	2.8
Missing	6285	2.9	693,229	2.3
Region				
Northeast	36,405	16.5	5,531,856	18.4
Midwest	53,120	24.1	6,660,838	22.2
South	79,725	36.2	11,960,280	39.9
West	51,220	23.2	5,844,825	19.5
Population of county of residence				
Central metro county > 1 million	73,755	33.5	8,662,269	28.9
Fringe metro county > 1 million	53,275	24.2	7,240,449	24.1
Metro area 250,000–999,999	46,530	21.1	6,266,717	20.9
Metro area 50,000–249,000	15,635	7.1	2,807,631	9.4
Micropolitan	16,155	7.3	2,775,906	9.3
Non-core county	11,105	5.0	2,061,996	6.9
Household income quartile for Pt ZIP code				
1	70,765	32.1	9,013,769	30.0
2	51,295	23.3	7,499,841	25.0
3	50,815	23.0	7,156,220	23.9
4	40,825	18.5	5,793,103	19.3
Discharge quarter				
Jan–Mar	56,030	25.4	7,509,590	25.0
Apr–Jun	54,545	24.7	7,507,689	25.0
Jul–Sep	54,735	24.8	7,479,270	24.9
Oct–Dec	54,835	24.9	7,468,155	24.9
Hospital bed size				
Small	37,275	16.9	6,687,006	22.3
Medium	59,840	27.1	8,691,218	29.0
Large	123,355	56.0	14,619,575	48.7
Admission type				
Elective	14,460	6.6	6,691,750	22.3
Non-elective	205,730	93.3	23,271,424	77.6
Primary payor				
Medicare	114,045	51.7	14,401,199	48.0
Medicaid	50,720	23.0	5,402,614	18.0
Private insurance	35,900	16.3	7,904,966	26.4
Self-pay	12,395	5.6	1,273,715	4.2
No charge	605	0.3	104,045	0.3
Other	6590	3.0	874,730	2.9
Admission status				
Not transferred in	174,960	79.4	26,642,929	88.8
Transferred from acute care hospital	29,390	13.3	2,024,990	6.8
Transferred from another facility	15,235	6.9	1,173,564	3.9
Disposition of patient				
Discharged home	74,260	33.7	18,947,098	63.2
Transfer to short-term hospital	8785	4.0	600,914	2.0
Transfer to other facility type	84,860	38.5	4,847,954	16.2
Home health care	28,100	12.7	4,431,841	14.8
Against medical advice	6430	2.9	493,195	1.6
Died during hospitalization	17,880	8.1	661,410	2.2
Primary service line				
Maternal and neonatal	605	0.3	3,848,509	12.8
Mental health/substance use	34,965	15.9	1,687,856	5.6
Injury	28,095	12.7	1,552,880	5.2
Surgical	43,930	19.9	6,923,852	23.1
Medical	112,875	51.2	15,984,702	53.3

Table 1 (continued)

	Restraint		No restraint	
	n	*%*	*n*	*%*
Major surgical procedure during admission				
No	166,910	75.7	20,503,442	68.3
Yes	53,560	24.3	9,494,357	31.7
Injury diagnoses				
None	164,805	74.8	27,243,744	90.8
Primary diagnosis	33,435	15.2	1,646,020	5.5
Secondary diagnosis	22,230	10.1	1,108,035	3.7
Procedure code for mechanical ventilation				
No	143,585	65.1	29,039,203	96.8
Yes	76,885	34.9	958,595	3.2
APR-DRG Severity of Illness				
No class specified	15	0.0	10,935	0.0
Minor loss of function	11,085	5.0	8,517,404	28.4
Moderate loss of function	51,715	23.5	11,958,114	39.9
Major loss of function	65,885	29.9	6,779,790	22.6
Extreme loss of function	91,770	41.6	2,731,555	9.1
Hospital length of stay, d (median, IQR)	7 (4 to 13)		3 (2 to 5)	
Total charges (median, IQR)	$74,340 ($35,966 to $156,630)		$34,556 ($18,521 to $66,615)	

Table 2 CCSR Categories for the Primary Discharge Diagnosis of Hospitalizations with a Coded Diagnosis Physical Restraint Status. Included in the Table Are All Diagnostic Categories Representing at Least 1% of Coded Restraints

CCSR category	N	%
Septicemia	30,325	13.8
Schizophrenia spectrum and other psychotic disorders	11,985	5.4
External cause codes: poisoning by drug	11,790	5.3
Respiratory failure; insufficiency; arrest	11,580	5.3
Alcohol-related disorders	10,125	4.6
Traumatic brain injury (TBI); concussion, initial encounter	8040	3.6
Epilepsy; convulsions	7070	3.2
Cerebral infarction	6870	3.1
Acute hemorrhagic cerebrovascular disease	5390	2.4
Hypertension with complications and secondary hypertension	5150	2.3
Acute myocardial infarction	5115	2.3
Bipolar and related disorders	4650	2.1
Neurocognitive disorders	3920	1.8
Acute and unspecified renal failure	3520	1.6
Other nervous system disorders (neither hereditary nor degenerative)	3145	1.4
Fracture of the neck of the femur (hip), initial encounter	2745	1.2
Coronary atherosclerosis and other heart disease	2735	1.2
Diabetes mellitus with complication	2735	1.2
Urinary tract infections	2690	1.2
Hepatic failure	2350	1.1
Pneumonia (except that caused by tuberculosis)	2125	1
Depressive disorders	2105	1

sensitivity analysis of patients receiving mechanical ventilation during hospitalization, male sex, Black or Other race, non-elective admission, mental health or substance abuse, or injury primary diagnosis remained positively associated with higher odds of physical restraint coding (Table S4).

DISCUSSION

Among adult hospitalizations in general hospitals in the USA in 2019, 220,470 (95% CI: 208,114 to 232,826), or 0.7%, included a discharge diagnosis code for physical restraint status. Physical restraints were coded for patients with a range of primary diagnoses, including systemic medical illness, poisoning, psychiatric illness, substance use disorders, and neurologic illness. In an adjusted model, restraint coding was associated with an increased hospital charge of $5445 per hospitalization, or an aggregate adjusted cost of $1.2 billion.

The reduction of the use of physical restraints has been a target for quality improvement interventions, and has led to interdisciplinary quality improvement efforts.[24] A 2020 scoping review found 31 studies targeting restraint reduction,

Table 3 CCSR Categories for the Primary Discharge Diagnoses with the Highest Fraction of Patients with Physical Restraint Coding. Analysis Is Limited to Categories with at Least 5000 Overall Diagnoses. Shown Are All Categories with a Restraint Rate > 2.5%

CCSR category	No. restrained	No. overall	% restrained
Encephalitis	370	5010	7.4%
External cause codes: poisoning by drug	11,790	224,130	5.3%
External cause codes: poisoning by non-drug	870	16,835	5.2%
Disruptive, impulse-control and conduct disorders	260	5825	4.5%
Acute hemorrhagic cerebrovascular disease	5390	131,355	4.1%
Traumatic brain injury (TBI); concussion, initial encounter	8040	198,035	4.1%
Neurocognitive disorders	3920	98,885	4.0%
Injury to blood vessels, initial encounter	295	7465	4.0%
External cause codes: suffocation/inhalation; initial encounter	235	6225	3.8%
Drug induced or toxic related condition	2010	62,985	3.2%
Cardiac arrest and ventricular fibrillation	925	29,180	3.2%
Epilepsy; convulsions	7070	228,465	3.1%
Alcohol-related disorders	10,125	333,480	3.0%
Stimulant-related disorders	680	23,210	2.9%
Schizophrenia spectrum and other psychotic disorders	11,985	411,355	2.9%
External cause codes: other specified, classifiable and NEC; initial encounter	435	14,980	2.9%
Open wounds of head and neck, initial encounter	455	15,760	2.9%
Arterial dissections	590	21,715	2.7%
Sedative-related disorders	270	10,350	2.6%

with most involving multicomponent interventions.[19] There were few common elements among these interventions, and limited evaluation of the effectiveness of these techniques. Some evidence suggests that front line staff can experience benefits from interventions focused on behavior management[25]; however, additional research is needed to develop and identify maximally effective behavior management strategies toward the goal of a safe environment of care which is not dependent on restraints.

The results of this study indicate that coding of physical restraint use occurs at different rates across clinical conditions, with a more than 700-fold variation in coding of restraint usage between patients diagnosed with encephalitis and those diagnosed with uncomplicated diabetes, the conditions with the highest and lowest restraint utilization in this sample. Overall, the conditions with the highest fractional utilization of restraint coding involve illnesses associated with neurologic impairment, including encephalitis, poisoning, stroke, traumatic brain injury, and neurocognitive disorders. While the NIS does not include the primary indication for restraint status, prior literature has implicated encephalopathy/delirium[26,27] and dementia[28,29] in agitation with high risk to caregivers, which may explain the utilization of physical restraints in these patients. As evidence suggests limitations in the use of coded data for identification of both dementia and delirium, interpretation of this association is limited[30–33]; nevertheless, given the specific morbidity of these groups, further research is on optimal use of restraints in service of health outcomes.

Demographic factors were associated with the use of physical restraints as a discharge diagnosis. These include male sex, which is consistent with prior literature finding higher rates of physical restraint in males.[34,35] Likewise,

non-elective admissions were more likely to involve restraint than elective admission, which may be explained by different diagnoses and comorbidities among elective and non-elective hospitalizations. Notably, there was a significant association between race and physical restraint as a discharge diagnosis, with Black, Asian or Pacific Islander, and Other race categories with higher odds of restraint than white patients. This result remained significant even controlling for primary diagnosis and disease severity, and in a sensitivity analysis looking only at patients who received mechanical ventilation, who are expected to be among the most seriously ill. Similar disparities in restraint utilization have been identified in the emergency department setting.[36,37] For this study, race was reported by the treating hospital and no information is available on the procedure used to ascertain race at the various participating hospitals; this is significant as race defined in this way may differ from self-identified race, and may have important impacts on differences in healthcare outcomes.[38] Nonetheless, the association warrants further focused investigation.

The results of this observational study based on routinely collected data must be considered in view of its inherent strengths and limitations. The strength of the study is the use of nationally representative data which provides real-world evidence of hospital care as it is delivered in the USA. This dataset includes treatment for all conditions and in all wards of general hospitals, and thus minimizes bias that may come from studies focusing on an individual healthcare system, region, or payment source. As such, this study describes the experience of those who used hospitals in the USA in 2019.

As is true of any real-world evidence, limitations of the study follow from the clinical data generating process on which these results are based.[39–42] As a claims study, this

Table 4 Logistic Regression on the Binary Outcome of a Hospitalization Including a Diagnosis Code for Physical Restraint (Yes/No), Adjusting for Age (z Score), Sex, Race, Admission Type (Elective vs. Non-elective), Hospital Bed Size (Small/Medium/Large), Primary Service Line, Region, Income Quartile of the Patient's ZIP Code, and Illness Patient Severity. Shown Are the Adjusted Odds Ratio (aOR) and Corresponding 95% Confidence Interval (CI)

Parameter	aOR	95% CI	
		Lower	Upper
Age (z score)	0.9	0.9	0.9
Sex			
Male	1.4	1.4	1.5
Female	1.0		
Race			
White	1.0		
Black	1.3	1.2	1.4
Hispanic	1.0	0.9	1.1
Asian or Pacific Islander	1.2	1.0	1.3
Native American	1.0	0.8	1.2
Other	1.2	1.1	1.4
Admission type			
Non-elective	1.7	1.6	1.8
Elective	1.0		
Hospital bed size			
Small	0.8	0.7	0.9
Medium	0.9	0.8	1.0
Large	1.0		
Primary service line			
Maternal and neonatal	0.1	0.1	0.1
Mental health/substance use	6.5	6.1	6.8
Injury	2.8	2.6	2.9
Surgical	1.3	1.2	1.3
Medical	1.0		
Region			
Northeast	0.8	0.7	0.9
Midwest	1.0	0.8	1.1
South	0.8	0.7	0.9
West	1.0		
Household income quartile for Pt ZIP code			
1	1.0	0.9	1.0
2	0.9	0.8	1.0
3	1.0	0.9	1.0
4	1.0		
APR-DRG Severity of Illness	3.0	3.0	3.1

analysis is necessarily limited to the billing for physical restraint status, and not on objective observation of restraint during hospitalization of the sort which studies based on electronic health records or proactive observation may have. If physical restraints are applied during a hospitalization but not coded for in the final discharge claim, then that hospitalization will be erroneously misclassified as not involving restraint. While we are not aware of literature assessing the accuracy of claims data for restraint, the fact that the 0.7% restraint rate found in the NIS is lower than the restraint rate in nearly all cross-sectional studies from different countries worldwide suggests that these results undercount the true incidence of restraint. As a speculative matter, we expect such a validation would show that coding of restraints is specific but not sensitive, but the present data are unable to test this expectation. Validation of this physical restraint status code will thus be important for future work in this area. Similarly, it is not known whether under-coding varies by clinical or demographic characteristics. As a result, systematic coding effects, meaning structural variation in who is diagnostically coded with restraint as opposed to true differences in clinical restraint rates, could explain the associations described here. The nature and duration of restraint, even when coded, are not captured by the available codes, making true outcomes a heterogenous group. That is, those who were restrained once briefly and those who spent most of their encounter restrained produce the same coded outcome despite the difference in clinical pictures. Understanding where or when during the hospital stay restraints were applied, such as critical care vs. general care, may provide better insight into restraint use as a safety intervention or a response to behavior. Finally, as the unit of sampling of the NIS is hospitalizations, and not individual patients, some individuals may be counted more than once for distinct hospitalizations (at the same or different healthcare facilities), which may bias the demographic information presented here.

CONCLUSION

A coded diagnosis of physical restraint status was present for 220,470 (95% CI: 208,114 to 232,826) hospitalizations in the 2019 NIS, or 0.7% of overall hospitalizations. There was significant variability in restraint coding based on sex and race, and restraint rate varied by more than 700-fold among clinical diagnoses. These results highlight potential care disparities in restraint utilization, which may have consequences for equity and health outcomes; however, validation of restrain coding in claims data is a critical further step in extending this of research.

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Declarations:

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