



Risk Factors for Seclusion in Children and Adolescents Inpatient Psychiatry: The Role of Demographic Characteristics, Clinical Severity, Life Experiences and Diagnoses

Carol Vidal¹ · Elizabeth K. Reynolds¹ · Nancy Pragliowski² · Marco Grados¹

© Springer Science+Business Media, LLC, part of Springer Nature 2020

Abstract

Objective To understand the risk factors for seclusion in a sample of children and adolescents admitted to an inpatient psychiatry unit looking at demographic, clinical severity, life experience, and diagnostic characteristics.

Methods An unmatched case–control retrospective analysis of psychiatric records in a pediatric inpatient unit from December 2011 to December 2015 (N = 1986)

Results Individual characteristics, including demographics, clinical severity, and clinical presentation as per the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) jointly predicted seclusion in adolescents, with younger age, male sex, black race, having a prior admission, and having a disruptive behavior or bipolar and related disorder diagnoses being predictive of seclusion. While demographic and clinical severity factors were predictive of seclusion in multivariate models, clinical diagnoses only added modestly to the variance explained.

Conclusions High-risk demographic and clinical characteristics for seclusion events in children and adolescents can provide valuable information to guide interventions to prevent seclusion events during their hospitalization.

Introduction

Seclusion and restraints are used to manage aggressive behaviors in pediatric acute mental health service settings, with utilization rates much higher than those seen in adult services [1–3]. In youth, reported rates are as high as 26% of patients experiencing seclusion and 29% receiving restraints [4]. For centuries, the use of seclusion and restraints has been debated [5]. While these practices are intended to maintain safety in acute psychiatric settings, they have raised concern for serious associated risks. In practice, psychological and physical harm, including death, can be unintended consequences of the use of seclusion and restraints [6–8]. Between 1993 and 2003, there were 45 seclusion and restraint related fatalities in child and adolescent residential units in the United States, 7 of which were related to seclusions [9]. Additionally, their use can be re-traumatizing

for children who have been victims of violence in the past [10–12]. Federal Health and Educational agencies have thus promoted the monitoring of seclusion and restraints [13, 14], with an emphasis on their regulation in psychiatric units for youth [15]. Additionally, a recent focus on the influence of traumatic life experiences on the regulation of emotions and behaviors [16], and an emphasis on providing trauma informed services [17] to prevent re-traumatization, make a better understanding of factors leading to seclusion and restraint critical in the management of patients in acute settings.

Identified factors leading to seclusion or restraints in *adult* psychiatric units in high-income countries include male sex, a lifetime history of violence, and diagnoses of schizophrenia or substance use [18]. Other suggested risk factors in adults include longer hospitalizations, greater number of prior admissions, the aggressor and the victim being of the same sex [19], younger age, being single, impulsivity, hostility, and a history of self-destructive behaviors [20].

Less is known about predictors of seclusion and restraints in children and adolescents. Previous research has indicated that individual patient characteristics such as age (both younger [12, 15] and older [21]), male sex [22–24], non-white race [15, 21], severe psychopathology such as

✉ Carol Vidal
cvidal2@jhmi.edu

¹ School of Medicine, Johns Hopkins University, 1800 Orleans St, Baltimore, MD 21287-3335, USA

² Johns Hopkins Hospital, Baltimore, MD, USA

psychosis [25], past or current aggression, suicidal behavior [21, 26], out of home placement [22], poor family functioning [26], and emergency admissions [4] can predict seclusions. However, the research on predictors of seclusion is scarce and more research is needed to inform practices in order to prevent the use of seclusion [4]. A previous study [12] conducted in a youth day hospital program with children ages 5–17 identified greater psychiatric comorbidity and a history of trauma as predictive factors of seclusion. The current study builds upon this prior work by (1) replicating the study within an inpatient clinical setting and (2) focusing exclusively on seclusion events to differentiate specific predictors and outcomes in seclusions versus both seclusions and restraints. Therefore, the aim of this study is to understand the risk factors for seclusion in a sample of children and adolescents admitted to an inpatient child and adolescent psychiatry unit. Based on previous research in the area, we chose to explore the role of demographics, clinical severity, life experiences, and clinical diagnoses.

Methods

Study Design and Data Source

We conducted an unmatched case–control retrospective analysis of psychiatric records in a pediatric inpatient unit from December 2011 to December 2015. Cases were participants who experienced one or more events of locked door seclusion. Controls were patients who did not experience seclusion. The retrospective chart review was approved by the University’s Institutional Review Board.

Definition of Seclusion

Seclusion was defined as the involuntary confinement of a person alone in a room or area from which the person is physically prevented from leaving [14]. In the setting of this inpatient unit, seclusion occurred exclusively in a dedicated seclusion room.

Description of the Inpatient Hospital Program

The setting was a pediatric psychiatry inpatient unit in an urban academic hospital. The unit serves patients from ages 5 to 17 for acute treatment and stabilization who are voluntarily admitted by their parents or guardians. During the time of the study, the census, or number of inpatients on the ward at any one time, varied between 12 and 15, and the staff: patient ratio was 5 patients per registered nurse and psychiatric assistant. The patients remain in the unit overnight for an average stay of approximately 8 days. The program included group therapy and daily contact with

physicians, a psychologist, occupational therapists, social workers and nurses. A doctoral-level psychologist coordinated the implementation of Positive Behavior Reinforcement Systems (PBIS) [27] as a universal intervention to prevent seclusion starting in December 2011. This intervention significantly reduced seclusion rates (number of seclusion hours per thousand patient hours) from 1.49 to 0.73 ($p < 0.02$) since its inception [27]. During the study period, clinical practice stipulated that when a patient exhibited dysregulated or aggressive behaviors, staff used de-escalation techniques such as distraction and encouraged patients to use individualized coping skills. The staff also offered patients to take space in a comfort room and/or PRN medications. If aggression towards staff or peers continued and there was imminent risk of harm, patients were placed in seclusion.

Study Variables

Demographic variables included age, sex, race and public/private insurance carrier. *Life experience variables* included history of abuse, including physical abuse and history of involvement of child protective services (CPS). Abuse was assessed with the clinical interview and admission screen, which is a standard part of the intake, and it was defined as any type of physical or sexual abuse, or neglect. Clinical variables included measures of *clinical severity*, such as having prior admissions, treatment with a standing antipsychotic medication, attempted suicide that prompted the admission, and having a history of self-injurious behaviors. *Diagnoses* associated with seclusion were given at discharge by two physician psychiatrists (one of them being board certified in child and adolescent psychiatry) and were queried using DSM-IV [1] categories. These diagnoses were then grouped into the following larger diagnostic categories following DSM-V [28] classifications: Disruptive Behavior Disorders (including Oppositional Defiant Disorder, Conduct Disorder, and a diagnosis of “Disruptive Behavior Disorder”), Neurodevelopmental Disorders (including Intellectual Disability, Borderline Intellectual Disability, Learning disorder, Communication disorder, Pervasive Developmental Disorder, Attention Deficit Hyperactivity Disorder and Tourette’s Disorder), Depressive Disorders, Bipolar and Related Disorders (including those diagnosed with “Mood Disorders”), Trauma and Stress Related Disorders (including Acute Stress disorder, Posttraumatic Stress disorder, and Adjustment Disorder), Eating Disorders, Substance Abuse Disorders, Psychotic Disorders, Obsessive Compulsive Disorder, Anxiety Disorders (including Panic, Agoraphobia, Generalized Anxiety, and Social Anxiety Disorder), and Somatoform Disorder.

Data Analysis

Cases and controls were compared to identify risk factors for seclusion. Chi-squared was used for categorical variables and independent-sample t-tests were used for continuous variables. Pearson and Spearman correlations were employed to find associations for variables of interest. In order to avoid multicollinearity, given the sample size [29], a cut off of $r^2 > 0.30$ was used to exclude variables in the final multivariate analysis. For categorical variables a point biserial correlation was used as appropriate. To model a risk factor profile, hierarchical multivariate logistic regression models were tested using significant variables in the univariate regressions. Model fit or “pseudo- R^2 ” for logistic regression was calculated as a Cox and Snell R^2 and by the Nagelkerke correction. Among candidate variables were age, race, clinical severity (having prior admissions), history of physical abuse, and psychiatric diagnoses. Psychiatric diagnostic categories were included as a second step to assess whether clinical diagnosis by a psychiatrist improved the prediction seclusion rates.

Results

The sample consisted of 1986 admissions to an inpatient unit between December 2011 and December 2015. The number of admissions corresponded to 1946 unique patients and thus observations were not independent. The sample patients were children and adolescents between the ages of 5 and 17 years, with a mean age of 13.49 ± 2.73 years. The mean length of stay in the unit was 8.13 ± 5.462 days with a range

from 0 to 86 days. The sample consisted of a majority of female patients (58.9%). The majority of the patients were black (54.0%), followed by white (36.9%), and other races (9.1%). Most patients (67.2%) had public health insurance (medical assistance) and 32.8% had other insurances (mostly private insurance carriers). Of the total sample, 253 patients (12.7%) experienced one or more seclusion events.

Demographic Factors

Patients who experienced seclusion events were younger ($p \leq 0.001$), more frequently male ($p \leq 0.001$) and more frequently identified as black ($p \leq 0.001$). Seclusions were considerably more frequent in patients with public medical insurance ($p \leq 0.001$) than in those patients who had private insurance (see Table 1 for Descriptive and Univariate Logistic Regression for Demographics).

Clinical Severity

Readmitted patients had significantly higher rates of seclusion than those who were admitted to the unit for the first time ($p < 0.001$). Neither suicide attempts nor self-injurious behaviors on admission were associated with increased frequency of seclusion (Table 2).

Life Experience: Trauma

There were significant differences in rates of seclusion only for having a history of physical abuse ($p < 0.001$), but not for any abuse or sexual abuse. Those patients with prior CPS

Table 1 Demographic characteristics in relation to seclusion events in 1986 admissions to a children and adolescent inpatient unit

Variable	No seclusion (N = 1733)	Seclusion (N = 253) N (%)	Test		V-Cramer	Wald test
			T-test	OR (CI)		
Age (M (SD))	13.8 (2.6)	11.5 (3.0)	13.032***	0.762 (0.728–0.797)***		137.124***
Sex at birth						
Male (N (%))	655 (80.2)	162 (19.8)		0.341 (0.259–0.449)***	0.178***	58.908***
Race						
White (ref) (N (%))	681 (93.0)	51 (7.0)				
Black (N (%))	881 (82.1)	192 (17.9)		2.910 (2.104–4.026)***		41.612***
Other (N (%))	171 (94.5)	10 (5.5)		0.781 (0.388–1.570)	0.168***	0.482
Insurance						
Medical assistance (ref) (N (%))	1123 (84.2)	211 (15.8)				
Other Insurances (N (%))	610 (93.6)	42 (6.4)		0.366 (0.259–0.518)***	0.132***	32.427***

^aUnweighted counts

^bWeighted percentages

* $p \leq 0.05$

** $p \leq 0.01$

*** $p \leq 0.001$

Table 2 Clinical severity and life experiences in relation to seclusion events in 1986 admissions to a children and adolescent inpatient psychiatry unit

	Total sample		Test OR (CI)	V-Cramer	Wald test
	No seclusion (<i>n</i> = 1733) <i>N</i> (%)	Seclusion (<i>n</i> = 253) <i>N</i> (%)			
CPS involvement	723 (81.5)	164 (18.5)	2.740 (2.050–3.663)***	0.162***	46.359***
Prior admission	529 (82.3)	114 (17.7)	1.867 (1.428–2.440)***	0.104***	20.846***
Admission suicide attempt	288 (93.8)	19 (6.2)	0.407 (0.251–0.661)***	0.084***	13.204***
Physical abuse	359 (82.0)	79 (18.0)	1.726 (1.281–2.325)***	0.087***	12.889***
History of SIB	864 (88.0)	118 (12.0)	0.870 (0.668–1.134)	0.023	1.055

* $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$

involvement presented seclusion at higher rates than those without prior CPS involvement (Table 2).

Clinical Diagnoses

A number of diagnostic groups conferred risk for seclusion: disruptive behavior disorders, neurodevelopmental disorders, and bipolar and related disorders. Having a depressive disorder was protective of seclusion [$OR = 0.369$; $CI: 0.0277–0.491$; $p < 0.001$]. Trauma and Stress disorders were

also protective [$OR = 0.615$; $CI = 0.428–0.884$; $p < 0.01$] (Table 3).

Multivariate Analysis

For the multivariate models, variables with a correlation index higher than 0.30 were removed to avoid multicollinearity. For example, given that CPS and physical abuse were correlated ($r^2 = 0.48$; $P < 0.01$), and CPS is very inclusive and less specific, physical abuse was the only life experience

Table 3 DSM-IV clinical diagnoses in relation to seclusion events in 1986 admissions to a children and adolescent inpatient unit

	Sample		Test OR (CI)	V-Cramer	Wald test
	No seclusion (<i>N</i> = 1733) <i>N</i> (%)	Seclusion (<i>N</i> = 253) <i>N</i> (%)			
Disruptive behavior disorders [ODD, CD, DBD]	443 (75.0)	148 (25.0)	4.104 (3.126–5.390)***	0.240***	103.244***
Neurodevelopmental disorders [ID, BIF, learning disorder, communication disorder, PDD, ADHD, Tourette's]	805 (80.7)	193 (19.3)	3.708 (2.734–5.029)***	0.199***	71.066***
Depressive Disorder	916 (92.5)	74 (7.5)	0.369 (0.277–0.491)***	0.157***	46.480***
Bipolar disorder and related disorders (Includes Mood disorder)	461 (80.0)	115 (20.0)	2.299 (1.756–3.010)***	0.139***	36.686***
Trauma and stress disorders [acute stress disorder, PTSD, adjustment disorder]	387 (91.1)	38 (8.9)	0.615 (0.428–0.884)**	0.059**	6.904**
Eating disorders	96 (96.0)	4 (4.0)	0.274 (0.100–0.751)*	0.060**	6.326*
Substance Abuse disorders	269 (91.8)	24 (8.2)	0.570 (0.367–0.886)*	0.057*	6.250*
Psychotic disorders	94 (95.9)	4 (4.1)	0.280 (0.102–0.769)*	0.059**	6.105*
Obsessive compulsive disorder	112 (91.8)	10 (8.2)	0.596 (0.308–1.153)	0.035	2.362
Anxiety disorders [panic, agoraphobia, GAD, SAD]	706 (88.0)	96 (12.0)	0.889 (0.678–1.167)	0.019	0.715
Somatiform disorder	7 (100)	0 (0.0)	0.000	0.023	0.000

* $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$

variable included. Race and Insurance type were also highly correlated and not included together in the multivariate model ($r^2 = -0.305$; $p < 0.001$). Finally, the models were 1) age, sex, race, prior admission, and history of physical abuse; 2) Model 1 + psychiatric diagnosis categories that were significantly associated with seclusion. In Model 1, age, black race, and having been admitted in the past were significantly associated with seclusion. In Model 2, the addition of psychiatric diagnosis categories did not substantially alter the predicted variance (Cox & Snell pseudo- $R^2 = 0.117$ to 0.133), but disruptive behaviors and bipolar and related disorders were significant (Table 4).

Discussion

Rates of seclusion are historically high among children and adolescents hospitalized in acute mental health services. These coercive interventions are not per se therapeutic and can pose psychological and physical risks. Significant regulatory efforts have been expended to decrease the number of seclusions in residential and acute treatment settings in the United States [14]. Yet, additional research is still needed to pinpoint the risk factors for seclusion among children and adolescents particularly within a sample of patients from an inpatient service that has significantly reduced the use of seclusion. This study allows us to understand which patients remain at risk for seclusion following a significant reduction in use of this practice. Furthermore, this study attempts to identify those risk factors for seclusion among youth treated at a psychiatric inpatient unit in order to buttress future preventive interventions. Having a history of physical abuse, being of younger age, black race, having public health insurance and having prior admissions were all predictors

of higher rates of seclusion. Physical abuse was a predictor of seclusion, while a history of self-injurious behaviors and admission for suicide attempt were protective of seclusion events. Disruptive Behavior Disorders, Neurodevelopmental disorders, and Bipolar and related disorders were also independently positively associated with seclusion. All other diagnostic groups were either protective (depressive and trauma-related disorders), or had no significant association with seclusion.

Similar to previous studies, younger age [12, 15, 30, 31], and having been admitted in the past [22, 23, 25, 32] predicted a higher probability of seclusion. Contrary to previous findings [22, 23, 25, 33], having psychotic symptoms and self-injurious behaviors were not predictive of seclusion in this sample but were significantly protective. This lower rate of seclusions in the groups with psychotic disorders and history of self-injurious may be due to staff giving more support to these patients preventively, by zoning them to areas of less stimulation and providing *Patient Safety Attendants*, which are healthcare team members who carry a nursing license or a certified nursing assistant state certification and provide observation to ensure patient safety. These practices are common in this unit and would have prevented episodes of agitation and seclusions. Male sex was more predictive of seclusion as shown in previous studies [22–24]. In line with previous research, belonging to a minority group was a predictor of seclusion [21]. While race of the providers was not considered here, racial discrepancy between patients and providers can in theory be a cause for the larger number of seclusions in patients of minority backgrounds. It is possible that minority patients feel more mistrust or unease with non-minority staff members [34] or, conversely, non-minority staff may be unfamiliar with the children and adolescent's cultural

Table 4 Multivariate models for seclusion events by demographic and clinical characteristics in 1986 admissions to a children and adolescent inpatient psychiatry unit

Variables	OR (95% CI)	
	Model 1	Model 2
Age	0.790 (0.750–0.833)***	0.814 (0.768–0.862)***
Sex at birth	0.454 (0.329–0.628)***	0.510 (0.365–0.712)***
Race (ref = White)		
Black	2.497 (1.739–3.585)***	2.358 (1.627–3.418)***
Others	0.811 (0.378–1.739)	0.738 (0.340–1.604)
Prior admission (ref = no)	2.031 (1.488–2.772)***	1.740 (1.260–2.405)**
History of physical abuse (ref = no)	1.252 (0.904–1.733)	1.162 (0.834–1.619)
Disruptive behavior disorders (ref = no)		1.984 (1.438–2.737)***
Bipolar and mood disorders (ref = no)		1.649 (1.196–2.274)**
Neurodevelopmental disorders (ref = no)		1.059 (0.717–1.563)
– 2 Log Likelihood	1126.387	1095.549
Cox & Snell R square	0.117	0.133
Nagelkerke R2	0.218	0.247
Hosmer & Lemeshow χ^2 (p)	7.237 (p = 0.511)	26.177 (p = 0.001)

background, misperceiving patients as dangerous [35]. Another potential contributor to higher rates of seclusion in black children and adolescents could be the delayed access to services in minority groups [36], reaching services only when symptoms are severe.

This study did not examine a history of overt aggression as a predictor of seclusion [22, 30] but rather used disruptive behavior disorders, often involving aggression, to predict seclusion. The current findings support a significant association between disruptive behavior disorders in children and adolescents and seclusion. Other studies have found global psychosocial functioning measures to be the only predictors when controlling for other socio-demographic and clinical severity measures [22, 34, 37], but measures of functioning level were not explored in this study.

As shown previously [12], physical abuse is a risk factor for seclusion among youth. The notion that prior history of physical abuse can lead to increased seclusions supports a cycle of re-enacting trauma for a subgroup of adolescents, as seclusions themselves are traumatizing. This occurrence in children and adolescents with a history of trauma makes trauma-informed care an essential approach to break the cycle of exposure to traumatic events and aggression [17] that should be considered in acute care services. In our analysis, physical abuse was associated with seclusion only in the univariate analysis, but the effect disappeared when controlling for other variables. Additionally, we did not find an association between PTSD diagnosis and increased seclusion. This finding of increased seclusion with history of physical abuse, but not with PTSD could be due to the differences by sex, as males were more likely to present histories of physical abuse but less likely to be diagnosed with PTSD than females. It could also be that those patients diagnosed with PTSD included those with sexual abuse histories, which prior research has associated with internalizing but not externalizing behaviors [12]. The possible explanations for this finding are beyond the scope of this paper but worthy of exploration.

Limitations for this study should be noted. A retrospective chart review using electronic medical records can result in incomplete data in the charts reviewed and the possibility of recall bias during the interview, such as the reporting of physical abuse. The cases were not unique patients but unique admissions, which may have contributed to confounding. Additionally, the variability of staff approaches may have affected the patients' behaviors. Prospective data-gathering techniques can surmount these limitations in future research. Finally, the study was conducted in a single inpatient unit. Multisite studies are needed in order to generalize the findings, however the relatively large sample leads to clear key variables for the question of risk factors for seclusion. In a multisite context, facility staffing, presence of trauma-informed approaches and funding variables may

be further studied for their propensity to predict or prevent seclusions.

In conclusion, younger age, black race, and a history of prior admissions predict seclusion events. In multivariate models, diagnostic categories only add marginally to the significant demographic and clinical care variables. The identified high-risk demographic and clinical characteristics for seclusion events can provide valuable information in the prevention of seclusions in child and adolescent psychiatry unit program development.

Summary

The use of seclusion to manage aggressive behaviors in pediatric acute mental health service settings is more common than in adult services and has raised concern for serious associated psychological and physical risks. Additionally, a recent focus on the influence of traumatic life experiences on the regulation of emotions and behaviors and an emphasis on preventing re-traumatization, make the understanding of factors leading to seclusion critical in the management of patients in acute settings. This study examined the risk factors for seclusion in a sample of children and adolescents admitted to an inpatient psychiatry unit that had undergone implementation of a universal intervention with a significant decrease in seclusion events. We conducted an unmatched case-control retrospective analysis of psychiatric records in a pediatric inpatient unit. Results showed that younger age, black race, and having a prior admission were factors significantly associated with seclusion. In multivariate models, demographic and clinical severity factors were predictive of seclusion, while clinical diagnoses only added modestly to the variance explained. The identified high-risk demographic and clinical characteristics for seclusion events can provide valuable information in the prevention of seclusions. Future studies are needed to replicate the present findings and test additional interventions to prevent seclusions in children and adolescents who continue to be at risk after the implementation of a universal intervention.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

References

1. (1994) Diagnostic and Statistical Manual of Mental Disorders: DSM-IV. Washington, DC: American Psychiatric Association.
2. LeBel J, Stromberg N, Duckworth K et al (2004) Child and adolescent inpatient restraint reduction: a state initiative to

- promote strength-based care. *J Am Acad Child Adolesc Psychiatry* 43(1):37–45. <https://doi.org/10.1097/00004583-200401000-00013>
3. Allen DE, de Nesnera A, Moreau MA, Barnett RJ (2014) Seclusion and restraint use in children and adults: differences between age groups. *J Psychosoc Nurs Mental Health Services* 52(3):1. <https://doi.org/10.3928/02793695-20131028-02>
 4. De Hert M, Dirix N, Demunter H, Correll C (2011) Prevalence and correlates of seclusion and restraint use in children and adolescents: a systematic review. *Eur Child Adolesc Psychiatry* 20(5):221–230. <https://doi.org/10.1007/s00787-011-0160-x>
 5. Ozarin L (2018) The Question of Restraint: 200 Years of Debate. History Notes. *Psychiatric News*, American Academy of Psychiatry. Available at <https://psychnews.psychiatryonline.org/doi/full/10.1176/pn.36.18.0027>. Accessed 1 Jan 2018
 6. National Association of State Mental Health Program Directors (NASMHPD) (2001) Medical Directors Council Reducing the use of seclusion and restraint. Part II: Findings, principles, and recommendations for special needs populations. Alexandria
 7. Sailas E, Fenton M (2000) Seclusion and restraint for people with serious mental illnesses. The Cochrane database of systematic reviews: CD001163. Available at <https://www.ncbi.nlm.nih.gov/pubmed/10796606>
 8. Weiss E, Altimari D, Blint D, & Megan K (1998) Deadly restraint: a nationwide pattern of death. *Hartford Courant*, 11–15 Oct 1998
 9. Nunno MA, Holden MJ, Tollar A (2006) Learning from tragedy: a survey of child and adolescent restraint fatalities. *Child Abuse Neglect* 30(12):1333–1342. <https://doi.org/10.1016/j.chiabu.2006.02.015>
 10. Frueh BC, Knapp RG, Cusack KJ et al (2005) Special section on seclusion and restraint: patients' reports of traumatic or harmful experiences within the psychiatric setting. *Psychiatr Serv* 56(9):1123–1133. <https://doi.org/10.1176/appi.ps.56.9.1123>
 11. Hammer JH, Springer J, Beck NC, Menditto A, Coleman J (2011) The relationship between seclusion and restraint use and childhood abuse among psychiatric inpatients. *J Interpers Violence* 26(3):567–579. <https://doi.org/10.1177/0886260510363419>
 12. Timbo W, Sriram A, Reynolds E et al (2016) Risk factors for seclusion and restraint in a pediatric psychiatry day hospital. *Child Psychiatry Hum Dev* 47(5):771–779. <https://doi.org/10.1007/s10578-015-0608-1>
 13. U.S. Department of Education, Restraint and Seclusion: Resource Document, Washington, D.C. (2012) This resource is available on the Department's website at www.ed.gov/policy/restraintseclusion
 14. U.S. Department of Health and Human Services (2010) Substance Abuse and Mental Health Services Administration (SAMHSA). Promoting alternatives to the use of seclusion and restraint major a national strategy to prevent seclusion issue brief and restraint in behavioral health services
 15. Donovan A, Plant R, Peller A, Siegel L, Martin A (2003) Two-year trends in the use of seclusion and restraint among psychiatrically hospitalized youths. *Psychiatr Serv* 54(7):987–993. <https://doi.org/10.1176/appi.ps.54.7.987>
 16. van der Kolk BA (2007) The complexity of adaptation of trauma: self-regulation, stimulus discrimination, and characterological development. In van der Kolk BA, McFarlane AC, Weisaeth L (eds) *Traumatic stress: the effects of overwhelming experience on mind, body, and society*. Guildford Press, New York, pp 183–213
 17. Fallot R, Harris M (2002) Trauma-informed services: a self-assessment and planning protocol, Version 1.4. Community Connections. Washington, DC
 18. Iozzino L, Ferrari C, Large M, Nielssen O, de Girolamo G (2015) Prevalence and risk factors of violence by psychiatric acute inpatients: a systematic review and meta-analysis. *PLoS ONE* 10(6):e0128536. <https://doi.org/10.1371/journal.pone.0128536>
 19. Cornaggia CM, Beghi M, Pavone F et al (2011) Aggression in psychiatry wards: a systematic review. *Psychiatry Res* 189:10–20
 20. Dack C, Ross J, Papadopoulos C, Stewart D, Bowers L (2013) A review and meta-analysis of the patient factors associated with psychiatric in-patient aggression. *Acta Psychiatr Scand* 127(4):255–268. <https://doi.org/10.1111/acps.12053>
 21. Martin A, Krieg H, Esposito F, Stubbe D, Cardona L (2008) Reduction of restraint and seclusion through collaborative problem solving: a five-year prospective inpatient study. *Psychiatr Serv* 59(12):1406–1412. <https://doi.org/10.1176/ps.2008.59.12.1406>
 22. Sourander A, Ellilä H, Välimäki M, Piha J (2002) Use of holding, restraints, seclusion and time-out in child and adolescent psychiatric in-patient treatment. *Eur Child Adolesc Psychiatry* 11(4):162–167. <https://doi.org/10.1007/s00787-002-0274-2>
 23. Delaney KR, Fogg L (2005) Patient characteristics and setting variables related to use of restraint on four inpatient psychiatric units for youths. *Psychiatr Serv* 56(2):186–192. <https://doi.org/10.1176/appi.ps.56.2.186>
 24. Siponen U, Valimäki M, Kältiala-Heino R (2012) The use of coercive measures in adolescent psychiatric inpatient treatment: a nation-wide register study. *Soc Psychiatry Psychiatr Epidemiol* 47(9):1401–1408. <https://doi.org/10.1007/s00127-011-0456-7>
 25. Swadi H, Bobier C (2012) Lessons from an investigation of seclusion at an older adolescent inpatient unit. *Australas Psychiatry* 20(2):98–101. <https://doi.org/10.1177/1039856212437431>
 26. Gullick K, McDermott B, Stone P, Gibbon P (2005) Seclusion of children and adolescents: psychopathological and family factors. *Int J Mental Health* 14:37–43
 27. Reynolds EK, Grados MA, Pragowski N et al (2016) Use of modified positive behavioral interventions and supports in a psychiatric inpatient unit for high-risk youths. *Psychiatr Serv* 67(5):570–573. <https://doi.org/10.1176/appi.ps.201500039>
 28. American Psychiatric Association (2013) *Diagnostic and statistical manual of mental disorders*, 5th edn. Author, Arlington
 29. Vatcheva KP, Lee M, McCormick JB, Rahbar MH (2016) Multicollinearity in regression analyses conducted in epidemiologic studies. *Epidemiology (Sunnyvale)* 6(12):1–20
 30. Duke SG, Scott J, Dean AJ (2014) Use of restrictive interventions in a child and adolescent inpatient unit—predictors of use and effect on patient outcomes. *Australas Psychiatry* 22(4):360–365. <https://doi.org/10.1177/1039856214532298>
 31. Stewart SL, Baiden P, Theall-Honey L (2013) Factors associated with the use of intrusive measures at a tertiary care facility for children and youth with mental health and developmental disabilities. *Int J Mental Health Nurs* 22(1):56–68. <https://doi.org/10.1111/j.1447-0349.2012.00831.x>
 32. Earle KA, Forquer SL (1995) Use of seclusion with children and adolescents in public psychiatric hospitals. *Am J Orthopsychiatr* 65(2):238–244. <https://doi.org/10.1037/h0079621>
 33. Ulla S, Maritta V, Riittakerttu KH (2012) The use of coercive measures in adolescent psychiatric inpatient treatment: a nationwide register study. *Social Psychiatry Psychiatr Epidemiol* 47(9):1401–1408
 34. Furre A, Sandvik L, Heyerdahl S, Friis S, Knutzen M, Hanssen-Bauer K (2014) Characteristics of adolescents subjected to restraint in acute psychiatric units in Norway: a

- case-control study. *Psychiatr Serv* 65(11):1367–1372. <https://doi.org/10.1176/appi.ps.201300429>
35. Dorfman D, Mehta S (2006) Restraint use for psychiatric patients in the pediatric emergency department. *Pediatr Emerg Care* 22(1):7–12. <https://doi.org/10.1097/01.pec.0000195758.12447.69>
36. Hamilton JE, Heads AM, Cho RY, Lane SD, Soares JC (2015) Racial disparities during admission to an academic psychiatric hospital in a large urban area. *Compr Psychiatry* 63:113–122. <https://doi.org/10.1016/j.comppsy.2015.08.010>
37. Hottinen A, Välimäki M, Sailas E et al (2013) Mechanical restraint in adolescent psychiatry: a Finnish register study. *Nordic J Psychiatry* 67(2):132–139. <https://doi.org/10.3109/08039488.2012.699552>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.