



## REVIEW ARTICLE

# A systematic review of interventions to reduce mechanical restraint in adult mental health inpatient settings

Martin Locht Pedersen<sup>1,2</sup> | Frederik Alkier Gildberg<sup>1,2</sup> | John Baker<sup>3</sup> |  
Ellen Boldrup Tingleff<sup>1,2</sup>

<sup>1</sup>Forensic Mental Health Research Unit  
Middelfart, Department of Regional  
Health Research, University of Southern  
Denmark, Middelfart, Denmark

<sup>2</sup>Psychiatric Department Middelfart,  
Mental Health Services in the Region of  
Southern Denmark, Middelfart, Denmark

<sup>3</sup>School of Healthcare, University of Leeds,  
Leeds, UK

**Correspondence**

Martin Locht Pedersen, Forensic Mental  
Health Research Unit Middelfart,  
University of Southern Denmark,  
Østre Hougvej 70, Middelfart DK-5500,  
Denmark.  
Email: [martin.locht.pedersen@rsyd.dk](mailto:martin.locht.pedersen@rsyd.dk)

**Funding information**

Psychiatric Research Fund in the Region of  
Southern Denmark

**Abstract**

Mechanical restraint is a commonly used restrictive practice worldwide, although reducing its use is an international priority. Interventions to reduce mechanical restraint are needed if reducing mechanical restraint is to succeed. Therefore, this systematic review aimed to examine evaluated evidence-based interventions that seek to reduce the incidence of and/or time in mechanical restraint in adult mental health inpatient settings. The JBI framework was used to guide this systematic review. The search strategy included peer-reviewed primary research literature published between 1999 and 2023. Two authors independently conducted the systematic search, selection process and data extraction process. Forty-one studies were included in this review. Using content analysis, we grouped interventions into four categories: (I) calm-down methods, (II) staff resources, (III) legal and policy changes and (IV) changing staff culture. Interventions to reduce mechanical restraint in adult mental health inpatient settings have shown some promise. Evidence suggests that a range of interventions can reduce the incidence of and/or time in mechanical restraint. However, controlled trials were lacking and consensus was lacking across studies. Furthermore, specific findings varied widely, and reporting was inconsistent, hampering the development of interventions for this issue. Further research is needed to strengthen the evidence base for reducing mechanical restraint in mental health inpatient settings.

**KEYWORDS**

mechanical restraint, mental health, physical restraint, psychiatry, restrictive practices

## INTRODUCTION

Mechanical restraint (MR) is a commonly used restrictive practice in mental health to immobilise or restrict people's movement in response to violent and aggressive behaviour (National Institute for Health and Care Excellence, 2015). It involves and is defined as the use of equipment, such as belts, straps or cuffs, by trained staff (Baker et al., 2021; Völm & Nedopil, 2016). However, compared to holding, forced medication or other restrictive practices, MR is especially associated with traumatic experiences for those involved, and psychological and physiological adverse outcomes have been reported, such as re-traumatisation, physical injuries,

venous thromboembolism and death (Aguilera-Serrano et al., 2018; Cusack et al., 2018; Kersting et al., 2019; Rakhmatullina et al., 2013; Tingleff et al., 2017). Furthermore, strong evidence supporting the value of MR in managing violent and aggressive behaviour is lacking (Gleerup et al., 2019; Sailas & Fenton, 2012). For these reasons, MR is a particularly controversial procedure, and reducing its use has therefore been an international priority (LeBel et al., 2014; National Institute for Health and Care Excellence, 2015; Pedersen et al., 2023; Sugiura et al., 2020). However, MR use varies across countries. For instance, the use of MR is more common in the United States than in the United Kingdom, where it may only be used in adults in relation

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2023 The Authors. *International Journal of Mental Health Nursing* published by John Wiley & Sons Australia, Ltd.



to high-security settings, and its usage seems relatively rare in New Zealand (National Institute for Health and Care Excellence, 2015; Newton-Howes et al., 2020; Steinert et al., 2010; Völlm & Nedopil, 2016). A recent international analysis found rates of MR per one million population per day to be 0.03 in New Zealand, 0.17 in Australia, 0.37 in the United States and 98.8 in Japan (Newton-Howes et al., 2020). Nurses are the professionals who are most likely to use MR, typically with lower approval ratings for its use compared to other restrictive practices (Gerace & Muir-Cochrane, 2019; Whittington et al., 2009).

Interventions to reduce MR may address two main areas of interest. First, they seek to reduce the occurrence of MR (Flammer et al., 2021; Guzman-Parra et al., 2016), a crucial focus as these interventions may be able to prevent some individuals from experiencing MR altogether, and the risk of repeated restraint may be curbed. Second, they seek to reduce the length of its use (Allen et al., 2020; Celofiga et al., 2022). Prolonged episodes of MR may amount to ill-treatment, and the procedure has been criticised by The Council of Europe's Committee for the Prevention of Torture and Inhuman or Degrading Treatment or Punishment (2020), among others. Thus, a focus on minimising the time people spend in MR is important. Ideally, interventions that reduce both the incidence of and time in MR simultaneously may be beneficial (Baker et al., 2021; Flammer et al., 2021; Steinert et al., 2008).

Reducing the use of MR relies on being able to identify appropriate interventions that may ensure this goal. Two recent reviews have identified several interventions that can reduce MR in adult mental health inpatient settings, such as staff training, risk assessment, regulations and the implementation of programmes, for example, the Safewards Model and Six Core Strategies (Fernández-Costa et al., 2020; Väkiparta et al., 2019). The latter interventions are widely promoted programmes in this area. Safewards focuses on reducing conflict rates and containment by implementing a package of 10 interventions, while the Six Core Strategies programme includes a six-component framework for developing policies and practices that minimise the use of restrictive practices in mental health (Fernández-Costa et al., 2020; Ward-Stockham et al., 2022). However, these two recent reviews have significant limitations. First, a limited study design and date range was examined (max. 10 years). These restrictions excluded relevant interventions explored in certain study designs, such as mixed methods (Fernández-Costa et al., 2020) or of complex programmes (Väkiparta et al., 2019), and may have overlooked valuable insights from older studies, yet without providing appropriate justifications for the restrictions (Aromataris & Munn, 2020). Second, only one researcher conducted the review processes, which may raise methodological issues. According to the JBI, at least two researchers are recommended to reduce the risk of bias

in the review process (Aromataris & Munn, 2020). In addition to the limitations in these reviews, it may be difficult to tease out evidence-based interventions on MR reduction specifically from other research because different types of restraint, for example, mechanical, chemical and manual, tend to be included without findings for each type being independently reported (Baker et al., 2021; Pedersen et al., 2023; Raveesh et al., 2019).

Given the above, a need exists to develop knowledge about interventions targeting MR towards adult mental health inpatients to improve mental health practice and strengthen the foundation for developing future interventions to reduce MR (Baker et al., 2021). This is urgent for the safety of both patients and staff. To our knowledge, no studies have conducted a comprehensive review of the evidence concerning interventions to reduce MR in mental health for adult inpatients. Therefore, the purpose of this review was to examine reported and evaluated evidence-based interventions that seek to reduce the use of MR in adult mental health inpatient settings to inform and improve practice in this field.

## Aim

To review extant international peer-reviewed research literature concerning evaluated evidence-based interventions that seek to reduce the incidence of and/or time in MR in adult mental health inpatient settings.

## METHOD

This systematic review incorporates five steps: (I) locating studies through searching, (II) selecting studies for inclusion, (III) assessing the quality of studies, (IV) extracting data and (V) analysing and synthesising the relevant studies (Aromataris & Munn, 2020). The following research question guided this review: what characterises international peer-reviewed research literature on evaluated evidence-based interventions that seek to reduce the incidence of and/or time in MR in adult mental health inpatient settings? The following two analytical questions guided the analysis: (I) which reported interventions seek to reduce the incidence of and/or time in MR? and (II) what characterises the content and outcomes of these interventions? The findings were reported using the Reporting Checklist for Systematic Reviews (PRISMA) (Page et al., 2021), PROSPERO registration: CRD42022371967.

## Search strategy

To identify relevant studies, a two-phased approach was used. First, we reviewed the systematic mapping review by Baker et al. (2021) to identify relevant studies



between 1999 and April 2019. The starting date indicates a significant shift in standards for mental health concerning the quality and orientation of mental health services (Baker et al., 2021). To our knowledge, this is the most comprehensive review to date of evaluated interventions to reduce restrictive practices (including MR) in adult mental health inpatient settings. Second, and based on the search strategy adopted in Baker et al. (2021) for capturing as much potential research as possible, we conducted an updated systematic search with the timeframe from 01 January 2019 to 04 July 2023 (the final search date) in the following databases: CINAHL (EBSCO), Embase Classic+Embase (Ovid) and PubMed (National Library of Medicine). The search string in PubMed is provided in Table 1 as an example, and the full literature search is shown in the Data S1. Endnote was used to remove duplicates, followed by screening in Covidence to ensure systematic study selection by the first and last authors.

## Screening and selection

Title/abstracts and full-text papers were independently reviewed sequentially by the first and last authors based on the following inclusion criteria: (I) peer-reviewed primary research literature, (II) studies describing evaluated interventions that seek to reduce the incidence of and/or time in MR (or seclusion/MR reported simultaneously) in adult mental health inpatient settings and (III) studies available in full-text and English. Included study outcomes for assessing the effectiveness of the interventions were the incidence of and/or time spent in the practice. The main exclusion criteria were the following: (I) studies that, in addition to adult settings, also included findings for children or adolescents, but which were not reported

independently and (II) studies that, in addition to the practice of interest, also included findings for other types of restraint (or restrictive practices more generally), but which were not reported independently. In case of disagreement between the first and last authors, the second author was consulted for the final decision.

The literature search identified 175 studies in the review by Baker et al. (2021) and 6301 studies in the updated search. From the studies identified in the review by Baker et al. (2021), 109 studies had been evaluated and, of these, 51 reported interventions to reduce restraint (not further specified). In line with the purpose of this review, the titles and abstracts of these 51 studies were screened to determine whether or not the information they provided related to restraint was comparable with the practice of MR. Of these, 46 were full-text screened for their eligibility and 21 were included. From the studies identified in the updated search, the titles and abstracts of 5711 studies were screened after duplicate removal. Of these, 95 were full-text screened for their eligibility and 20 studies were included. As illustrated in Figure 1, 41 studies in total were included in this review on the basis of the searches.

## Data extraction and critical appraisal

Data from the studies were extracted as follows: (I) general information, such as author and year of publication; (II) study attributes, such as design, inpatient setting and country; (III) characteristics of interventions; (IV) area of interest, that is, whether the intervention relates to the incidence of and/or time in MR; and (V) key findings relevant to the purpose of this review. Data were extracted from each study by the first author and reviewed by the last author. The Mixed Methods Appraisal Tool was used to determine whether the interventions had been evaluated or not and to assess the overall quality of included studies independently by the first and last authors (Baker et al., 2021; Hong et al., 2018). We assessed whether the studies met criteria that indicate an evidence-based intervention approach, such as the presence of research study designs, methodology and reported outcome measures to evaluate the interventions' effectiveness, contributing to a higher level of confidence in the effectiveness of the interventions. The second author was consulted in case of disagreement.

## Analysis

Interventions from the studies were categorised and analysed using content analysis, a scientific method allowing data processing of various research types (Krippendorff, 2004). Content analysis has likewise been used in similar review studies (Baker et al., 2021; Väkiparta et al., 2019). First, the interventions were coded, compared and sorted into initial categories. In this step,

**TABLE 1** Search string in PubMed.

```
((((((((("Restraint, Physical"[Mesh]) OR "Patient Isolation"[Mesh])
OR "Coercion"[Mesh]) OR (((Restrain* or coercion
or coerced or coercive or seclusion or seclude* or de-
escalat* or (restric* and (practice* or intervention*)) or
(physical* and (immobili* or isolation)) or ((involuntary or
forced) and (medic* or sedat* or drug? or treatment?)))))))))
AND (((("Psychiatric Department, Hospital"[Mesh])
OR "Hospitals, Psychiatric"[Mesh]) OR "Psychiatric
Nursing"[Mesh]) OR "Mental Disorders"[Mesh])
OR "Mentally Ill Persons"[Mesh]) OR (((psyc*[Title/
Abstract] or schizo*[Title/Abstract] or mental*[Title/
Abstract] or agitat*[Title/Abstract])) AND (diseas*[Title/
Abstract] or disorder*[Title/Abstract] or illness*[Title/
Abstract] or patient*[Title/Abstract] or inpatient*[Title/
Abstract] or ward*[Title/Abstract] or unit*[Title/Abstract]
or hospital*[Title/Abstract] or center*[Title/Abstract] or
centre*[Title/Abstract] or department?[Title/Abstract]))))
NOT (((("Child"[Mesh] or "Adolescent"[Mesh] or
"Infant"[Mesh]) not "Adult"[Mesh])) OR ((("Animals"[Mesh]
not "Humans"[Mesh])))) AND (((pubstatusaheadofprint or
publisher[sb] or pubmednotmedline[sb]) or inprocess[sb]))
```

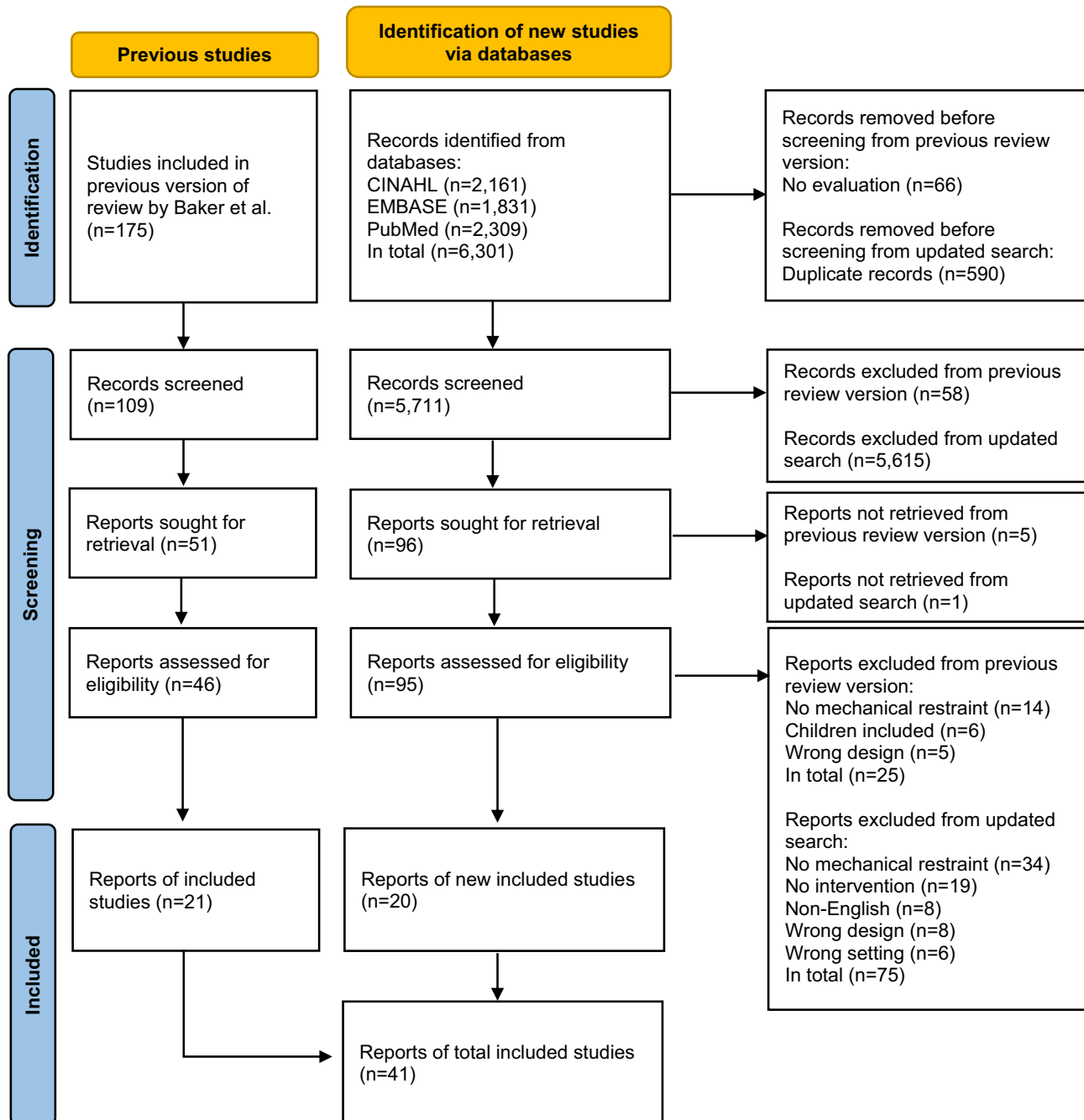


FIGURE 1 PRISMA flow diagram of the study selection process.

notes were made about the area of interest (incidence and/or time). Second, patterns between interventions both focusing on incidence of and time in MR were identified. Third, interventions were categorised into final categories based on their similarities and differences.

## RESULTS

### Characteristics of studies

General information, study attributes, intervention(s), whether the study investigated the incidence of and/or

time in MR and quality assessment are presented in Table 2. Only five studies were controlled trials (Celofiga et al., 2022; Hamann et al., 2020; Hvidhjelm et al., 2022; Kontio et al., 2014; Putkonen et al., 2013). The evidence in this review is therefore primarily based on interventions from other study designs. The geographical setting was Western countries, i.e., European, Northern America and Australia. Only 10 studies were conducted across more than one hospital (Celofiga et al., 2022; Flammer et al., 2021; Guzman-Parra et al., 2021; Hamann et al., 2020; Kontio et al., 2014; Shields, 2022; Shields & Busch, 2020; Smith et al., 2023; Stensgaard et al., 2018; Stoll et al., 2022). The inclusion of acute/intensive settings





was most often reported in the studies ( $n=20$ ) (Badouin et al., 2023; Blair & Moulton-Adelman, 2015; Celofiga et al., 2022; Cummings et al., 2010; Dixon & Long, 2022; Geoffrion et al., 2018; Goulet et al., 2018; Guzman-Parra et al., 2015, 2016, 2021; Hamann et al., 2020; Khadivi et al., 2004; Kontio et al., 2014; Lewis et al., 2009; Manning et al., 2022; Steinert et al., 2008; Stoll et al., 2022; Sullivan et al., 2005; Yakov et al., 2018; Yang et al., 2014). The number of beds ranged from 18 to 615, but the information available in the studies did not always report on details of the settings, including bed numbers. Of the studies, seven reported on seclusion/MR simultaneously, but they did not report individual changes in MR (Cummings et al., 2010; Donat, 2002a, 2002b; Khadivi et al., 2004; Putkonen et al., 2013; Sullivan et al., 2005; Yang et al., 2014). In the remaining studies, it was possible to extract data on MR specifically. All the studies received a positive assessment in response to the two screening questions in the Mixed Methods Appraisal Tool and the methodological quality of the studies was generally rated as medium or above (see Table 2 for a more detailed presentation (Hong et al., 2018)).

## Interventions

As illustrated in Table 2, most interventions consisted of various components combined into complex interventions. The content of the interventions varied widely. Moreover, interventions consisting of various components were often only evaluated as a whole, and the individual intervention components were not evaluated independently, which ruled out comparative analysis. However, content analysis identified certain comparisons that are described below in the following categories: (I) calm-down methods, (II) staff resources, (III) legal and policy changes and (IV) changing staff culture. Twelve studies reported only on the incidence of MR (Andersen et al., 2017; Blair & Moulton-Adelman, 2015; Chandler, 2012; Christensen et al., 2021; Dixon & Long, 2022; Godfrey et al., 2014; Hamann et al., 2020; Hoffmann et al., 2022; Khadivi et al., 2004; Shields, 2022; Whitecross et al., 2020; Yang et al., 2014), while six studies reported only on time in MR (Allen et al., 2020; Ayres & Tracy, 2021; Badouin et al., 2023; Dike et al., 2021; Donat, 2002b; Putkonen et al., 2013). The remaining studies reported on both incidence of and time in MR. The studies ( $n=23$ ) that reported statistically significant findings are summarised in Table 3.

## Categories from the content analysis

### Calm-down methods

Calm-down methods were used in four studies to regulate stimuli or patient response to stimuli to reduce

stress levels. These methods could include reducing the overall sensory level in the unit environment during periods of high stress (Yakov et al., 2018) or providing a separate room to which patients could retreat (Andersen et al., 2017; Cummings et al., 2010). Furthermore, there were reports of helping patients regulate their emotions and arousal, sensory integration and coping strategies, for example, sensory aids, which could heighten patient satisfaction (Andersen et al., 2017; Christensen et al., 2021; Cummings et al., 2010). Two studies reported significant associations between calm-down methods and MR, where the incidence of or time in MR was reduced (Christensen et al., 2021; Yakov et al., 2018). Non-significant findings in relation to changes in MR use were reported in four studies (Andersen et al., 2017; Christensen et al., 2021; Cummings et al., 2010; Yakov et al., 2018).

### Staff resources

Six studies reported on staff resources in terms of having the right level of staff on duty for a given task. This could involve increasing the number of staff in comparison to the number of patients (Allen et al., 2020; Donat, 2002b; Hoffmann et al., 2022; Yang et al., 2014). Another approach reported was to use available staff resources more effectively and target them to a specific patient group (Allen et al., 2020; Badouin et al., 2023; Hoffmann et al., 2022; Steinert et al., 2008). Three studies reported significant associations between staff resources and MR (Donat, 2002b; Steinert et al., 2008; Yang et al., 2014). Incidence of or time in MR was reduced in all but one study where the reverse association was reported for the time in MR among some individuals (Steinert et al., 2008). Non-significant findings in relation to changes in MR use were reported in five studies (Allen et al., 2020; Badouin et al., 2023; Hoffmann et al., 2022; Steinert et al., 2008; Yang et al., 2014).

### Legal and policy changes

Legal and policy changes were reported in nine studies and concerned the application and evaluation of MR to ensure its proper use. These changes could include revising legislation at a wider regional or national level (Flammer et al., 2021; Guzman-Parra et al., 2015) or implementing mandatory approval and assessment procedures at local level (Godfrey et al., 2014; Hvidhjelm et al., 2022; Manning et al., 2022). Additionally, efforts to optimise and standardise monitoring and evaluation of MR procedures were reported, such as registration, measurement and case review, which could promote reflection and improve the quality of care and safety for organisations, patients and staff (Donat, 2002a; Goulet et al., 2018; Guzman-Parra et al., 2015;

**TABLE 2** Overview of included studies.

Study	Year	Design	Settings	Country
Allen et al.	2020	Quality improvement project	1 hospital; 6 units	USA
Andersen et al.	2017	Case-control	1 hospital; 2 open units with a secluded area; 40 beds	Denmark
Ayres and Tracy	2021	Quality improvement project	1 hospital; 1 unit; 14 beds	USA
Badouin et al.	2023	Experimental	1 hospital; 2 units	Germany
Baumgardt et al.	2019	Experimental	1 hospital; 2 locked units	Germany
Blair and Moulton-Adelman	2015	Experimental	1 hospital; 1 acute unit	USA
Celofiga et al.	2022	Cluster-randomised controlled trial	6 hospitals; 12 acute units	Slovenia
Chandler	2012	Case study	1 hospital; 1 locked unit; 20 beds	USA
Christensen et al.	2021	Quality improvement project	1 hospital; 3 specialised units	Denmark
Cummings et al. <sup>a</sup>	2010	Quality improvement project	1 hospital; 2 acute, admission units	USA
Dike et al.	2021	Experimental	1 hospital; 27 forensic, addictions and general units; 615 beds	USA
Dixon and Long	2022	Experimental	1 hospital; acute units; 163 beds	USA
Donat <sup>a</sup>	2002	Case-control	1 hospital	USA
Donat <sup>a</sup>	2002	Cross-sectional	1 hospital; 245 beds	USA
Flammer et al.	2021	Cohort	Units across 32 hospitals	Germany
Geoffrion et al.	2018	Experimental	1 hospital; 1 intensive unit and 1 emergency unit; 24 beds	Canada
Godfrey et al.	2014	Experimental	1 hospital; 1 acute unit and 1 rehabilitation unit; 216 beds	USA
Goulet et al.	2018	Case study	1 hospital; 1 acute, specialised unit; 27 beds	Canada
Guzman-Parra et al.	2015	Experimental	1 hospital; 1 acute unit; 42 beds	Spain
Guzman-Parra et al.	2016	Experimental	1 hospital; 1 acute unit; 42 beds	Spain
Guzman-Parra et al.	2021	Cohort	20 acute units across hospitals	Spain
Hamann et al.	2020	Cluster-randomised controlled trial	4 hospitals; 12 acute units	Germany
Hoffmann et al.	2022	Experimental	1 hospital	Germany
Hvidhjelm et al.	2022	Cluster-randomised controlled trial	1 hospital; eight forensic units	Denmark



Interventions	Area of interest		Summary of critical appraisal
	Incidence	Time	
Increasing assessment and surveillance (II)	NR	X	High. Uncertain if the confounders are accounted for in the design and analysis
Sensory modulation (I)	X	NR	High
Recovery model (IV)	NR	X	Medium. Uncertain if the confounders are accounted for in the design and analysis
Peer support (II)	NR	X	High
Safewards model (IV)	X	X	High. Uncertain if the confounders are accounted for in the design and analysis
Engagement Model (IV)	X	NR	Low. Uncertain if the participants are representative of the target population, if measurements are appropriate regarding both the outcome and intervention (or exposure), if there are complete outcome data, if the confounders are accounted for in the design and analysis and if the intervention during the study period is administered (or exposure occurred) as intended
De-escalation education (IV)	X	X	Medium. Uncertain if there are complete outcome data and if outcome assessors are blinded to the intervention provided
Trauma Informed Care (IV)	X	NR	High
Physical therapy (I)	X	NR	High
Comfort room (I)	X	X	Medium. Uncertain if there are complete outcome data and if the confounders are accounted for in the design and analysis
Patient-staff collaboration, case review, staff training, employee recognition, restraint prevention tools (IV)	NR	X	Medium. Uncertain if the confounders are accounted for in the design and analysis and if the intervention during the study period is administered (or exposure occurred) as intended
De-escalation education (IV)	X	NR	High. Uncertain if the confounders are accounted for in the design and analysis
New case review procedures (III)	X	X	Medium. Uncertain if there are complete outcome data and if the confounders are accounted for in the design and analysis
Improved staffing (II)	NR	X	High. Uncertain if the confounders are accounted for in the design and analysis
Immediate judge's decisions (III)	X	X	High. Uncertain if the confounders are accounted for in the design and analysis
Omega training programme (IV)	X	X	High
Staff training in the use of de-escalation techniques and response team (IV), and policy change (III)	X	NR	High
Post-seclusion and/or restraint review (III)	X	X	High. Uncertain if divergences and inconsistencies between quantitative and qualitative results are adequately addressed
New mandatory regulatory protocol (III)	X	X	High
Multimodal intervention programme based on the principles of six core strategies (IV)	X	X	High
Multi-component intervention based on the six core strategies (IV)	X	X	High
Shared decision-making (IV)	X	NR	High
Track system (II)	X	NR	Medium. Uncertain if there are complete outcome data, if the confounders are accounted for in the design and analysis and if the intervention during the study period is administered (or exposure occurred) as intended
Short-Term Assessment of Risk and Treatability (III)	X	X	High

TABLE 2 (Continued)

Study	Year	Design	Settings	Country
Khadivi et al. <sup>a</sup>	2004	Cross-sectional	1 hospital; 3 acute units	USA
Kontio et al.	2014	Cluster-randomised controlled trial	2 hospitals; 10 acute, closed units; 169 beds	Finland
Lewis et al.	2009	Quality improvement project	1 hospital; 4 speciality-based units and 1 acute unit; 88 beds	USA
Lickiewicz et al.	2021	Experimental	1 hospital; 1 unit with observation rooms and a secluded area; 50 beds	Poland
Manning et al.	2022	Experimental	1 hospital; 1 acute unit	USA
Putkonen et al. <sup>a</sup>	2013	Cluster-randomised controlled trial	1 hospital; 4 high-security units; 88 beds	Finland
Riahi et al.	2016	Cohort	1 hospital; 326 beds	Canada
Shields	2022	Experimental	50 hospitals	USA
Shields and Busch	2020	Experimental	1841 units across hospitals	USA
Smith et al.	2023	Experimental	8 hospitals	USA
Steinert et al.	2008	Experimental	1 hospital; 1 acute, specialised unit; 18 beds	Germany
Stensgaard et al.	2018	Experimental	26 units across hospitals	Denmark
Stoll et al.	2022	Experimental	2 hospitals, 1 closed and 1 open acute, specialised unit with seclusion rooms; 38 beds	Switzerland
Sullivan et al. <sup>a</sup>	2005	Experimental	1 hospital; 5 acute units; 117 beds	USA
Whitecross et al.	2020	Quality improvement project	1 hospital; 58 beds	Australia
Yakov et al.	2018	Quality improvement project	1 hospital; 1 locked, intensive unit; 20 beds	USA
Yang et al. <sup>a</sup>	2014	Cohort	1 hospital; 4 acute, specialised units	USA

Note: Interventions in relation to categories identified through content analysis: (I) calm-down methods, (II) staff resources, (III) legal and policy changes, (IV) changing staff culture.

Abbreviations: X, investigated; NR, not reported.

<sup>a</sup>Seclusion/mechanical restraint-findings.

Shields, 2022; Shields & Busch, 2020). Seven studies reported significant associations between legal and policy changes and MR (Donat, 2002a; Flammer et al., 2021; Godfrey et al., 2014; Guzman-Parra et al., 2015; Hvidhjelm et al., 2022; Manning et al., 2022; Shields & Busch, 2020). The incidence of and/or time in MR was reduced in all studies, two of which also reported the

reverse association in some cases (Flammer et al., 2021; Guzman-Parra et al., 2015). Non-significant findings in relation to changes in MR use were reported in eight studies (Donat, 2002a; Flammer et al., 2021; Godfrey et al., 2014; Goulet et al., 2018; Guzman-Parra et al., 2015; Manning et al., 2022; Shields, 2022; Shields & Busch, 2020).





Interventions	Area of interest		Summary of critical appraisal
	Incidence	Time	
Staff education, change of admission forms, nursing monitoring, debriefing, a senior case review committee (IV)	X	NR	Medium. Uncertain if the confounders are accounted for in the design and analysis and if the intervention during the study period is administered (or exposure occurred) as intended
E-learning course (IV)	X	X	High. Uncertain if outcome assessors are blinded to the intervention provided
Crisis Prevention Management programme built upon the Public Health Prevention Model (IV)	X	X	Low. Uncertain if there are complete outcome data, if the confounders are accounted for in the design and analysis and if the intervention during the study period is administered (or exposure occurred) as intended
Three aspects of the Safewards model (IV)	X	X	High
Modified aggression scale and treatment protocol (III)	X	X	Medium. Uncertain if measurements are appropriate regarding both the outcome and intervention (or exposure) and if there are complete outcome data
Six Core Strategies (IV)	NR	X	High. Uncertain if outcome assessors are blinded to the intervention provided
Six Core Strategies (IV)	X	X	Medium. Uncertain if the confounders are accounted for in the design and analysis and if the intervention during the study period is administered (or exposure occurred) as intended
Inpatient Psychiatric Facility Quality Reporting Program (III)	X	NR	High
Inpatient Psychiatric Facility Quality Reporting Program (III)	X	X	High. Uncertain if the confounders are accounted for in the design and analysis
Recovery approach (IV)	X	X	Medium. Uncertain if measurements are appropriate regarding both the outcome and intervention (or exposure) the confounders are accounted for in the design and analysis
Crisis intervention ward (II)	X	X	High
Safewards model (IV)	X	X	High. Uncertain if the intervention during the study period is administered (or exposure occurred) as intended
Clinical ethics support (IV)	X	X	Medium. Uncertain if the participants are representative of the target population and if there are complete outcome data
Violence assessment tool, staff training in working with aggressive patients and case review (IV)	X	X	Medium. Uncertain if the confounders are accounted for in the design and analysis and if the intervention during the study period is administered (or exposure occurred) as intended
Multidisciplinary response team (IV)	X	NR	High. Uncertain if the confounders are accounted for in the design and analysis
Sensory reduction (I)	X	X	Medium. Uncertain if the confounders are accounted for in the design and analysis
Staff empathy skills and training (II)	X	NR	High

## Changing staff culture

In 23 studies, staff culture changes involved the implementation of complex programmes or approaches, often grounded on the Six Core Strategies (Guzman-Parra et al., 2016, 2021; Putkonen et al., 2013; Riahi et al., 2016),

the Safewards Model (Baumgardt et al., 2019; Lickiewicz et al., 2021; Stensgaard et al., 2018) or other predefined concepts (Geoffrion et al., 2018; Hamann et al., 2020; Lewis et al., 2009). Furthermore, the implementation of different recovery models was reported (Ayres & Tracy, 2021; Blair & Moulton-Adelman, 2015; Chandler, 2012; Smith

**TABLE 3** Significant findings as reported in the studies.

Study	Settings	Interventions	Key findings	<i>p</i> -Value	Categories from the content analysis
Celofiga et al.	6 hospitals; 12 acute units	De-escalation education	Incidence of MR decreased by 49.4% from 377 to 192 The proportion of people exposed to MR decreased from 9.7% to 4.9% among certain individuals The proportion of recurrent MR episodes decreased from 4.8% to 2.2%	<0.001 0.000 0.000	Changing staff culture
Christensen et al.	1 hospital; 3 specialised units	Physical therapy	The number of MR hours per 100 treatment hours decreased from 1.447 to 0.255 among certain individuals	0.000	
			The mean duration of individual MR episodes decreased from 12.44 (SD=14.043) to 8.67 (SD=9.487). The median decreased from 10.04 (IQR: 7.92–11.58) to 4.38 (IQR: 4–7)	0.000	
	1 hospital; 27 forensic, addictions and general units; 615 beds	Patient-staff collaboration, case review, staff training, employee recognition, restraint prevention tools	The proportion of people exposed to MR decreased from 17.5% to 9% (95% CI [0.1%; 17.14%])	0.045	Calm-down methods
Dike et al.	1 hospital	New case review procedures	Mean annual restraint hours per 100 patient days decreased by 89% from 5300 h to 570 h	<0.01	Changing staff culture
Donat	1 hospital	Improved staffing	Average seclusion/restraint use per month decreased from 1199 h per month (SD=954) to 256 h per month (SD=94). The intervention was a three-phased programme, with a 58% reduction between phases 1 and 2, and a 51% reduction between phases 2 and 3	<0.01	Legal and policy changes
Donat	1 hospital; 245 beds	Immediate judge's decisions	The monthly seclusion/restraint reliance ranged from a high of 423 h to a low of 75 h. Simultaneously, the staff-patient ratio for 24-coverage ranged from a low of 2.4:1 to a high of 3.6:1. A relationship was found between a lower staff-patient ratio and less seclusion/restraint reliance in hours across months	<0.01	Staff resources
Flammer et al.	Units across 32 hospitals	Omega training programme (intensive)	The proportion of cases subject to MR decreased from 4.8% (5420 cases) to 3.6% (4202 cases) The percentage of MRs <30 min increased from 1.8% (314 measures) to 10.5% (1147 measures) The median cumulated duration of MR per affected case decreased from 11.5 h (IQR: 4.5–28.3) to 8.6 h (IQR: 2.8–24)	0.000 0.000 0.000	Legal and policy changes
Geoffrion et al.	1 hospital; 1 intensive unit and 1 emergency unit; 24 beds	Omega training programme (intensive)	1-year mean in the daily number of MR decreased by 40 incidents during the intervention, followed by a decrease of 18.9 incidents pre-intervention 1-year mean in the daily duration in hours of MR decreased by 141.7 h during the intervention	0.0354 0.0327	Changing staff culture



TABLE 3 (Continued)

Study	Settings	Interventions	Key findings	<i>p</i> -Value	Categories from the content analysis
Godfrey et al.	1 hospital; 1 acute unit and 1 rehabilitation unit; 216 beds	Staff training in the use of de-escalation techniques and response team (acute) Policy change (acute)	The mean daily incidence rate of MR decreased from 0.57 events (SD=1.04) to 0.24 events (SD=0.49)  The mean daily incidence rate of MR decreased from 0.24 events (SD=0.49) to 0.01 events (SD=2.19). The intervention was the second phase of a two-phased programme, where MR use decreased by 98% (2910 individuals) across all phases  The mean daily incidence rate of MR decreased from 0.09 events (SD=0.45) to 0.02 events (SD=0.16)	<0.001  <0.001  <0.001	Changing staff culture  Legal and policy changes  Changing staff culture
Guzman-Parra et al.	1 hospital; 1 acute unit; 42 beds	Staff training in the use of de-escalation techniques and response team (rehabilitation) Policy change (rehabilitation)	The mean daily incidence rate of MR decreased from 0.02 events (SD=0.16 events) to 0 events. The intervention was the second phase of a two-phased programme, where MR use decreased by 100% (334 individuals) across all phases  The mean duration of each MR episode decreased from 27.91 to 15.33 h	<0.001  <0.01  <0.05	Legal and policy changes  Legal and policy changes
Guzman-Parra et al.	1 hospital; 1 acute unit; 42 beds	New mandatory regulatory protocol  Multimodal intervention programme based on the principles of six core strategies	The mean of MR episodes per individual increased from 1.5 episodes to 2 episodes  The mean number of monthly incidents per 1000 patient days decreased from 18.54 (SD=8.78) to 8.53 (SD=7)  The mean duration of each MR episode increased from 15.33 h to 18.35 h	0.005  0.03	Changing staff culture  Changing staff culture
Guzman-Parra et al.	20 acute units across hospitals	Multi-component intervention based on the six core strategies	The monthly restraint hours per 1000 bed days decreased by 1.79% from 266.40 to 177.29	<0.001	Changing staff culture
Hvidhjelm et al.	1 hospital; eight forensic units	Short-Term Assessment of Risk and Treatability	The median duration of the restraint episodes decreased in the five different semesters of the intervention from 10.4 in the first semester (IQR: 5.25–19) to 9 in the fifth semester (IQR: 4.75–15.5)  The mean rate of monthly MR episodes decreased from 0.18 (SD=0.39) to 0.03 (SD=0.1)  The mean duration in minutes of MR episodes decreased from 609 (SD=1950) to 274 (SD=1652)	<0.001  <0.01  <0.01	Legal and policy changes  Legal and policy changes
Khadiivi et al.	1 hospital; 3 acute units	Staff education, change of admission forms, nursing monitoring, debriefing, a senior case review committee	The total number of seclusion and restraint episodes decreased by 52% from 310 to 148	<0.001	Changing staff culture

TABLE 3 (Continued)

Study	Settings	Interventions	Key findings	<i>p</i> -Value	Categories from the content analysis
Kontio et al.	2 hospitals; 10 acute, closed units; 169 beds	E-learning course	The mean duration hours of the MR incidents decreased from 70.5 (SD=102.1) to 27.4 (SD=67.2). The median hours decreased from 36 (IQR: 7) to 4 (IQR: 9.3)	<0.001	Changing staff culture
Lickiewicz et al.	1 hospital; 1 unit with observation rooms and a secluded area; 50 beds	Three aspects of the Safewards model	The mean number of MRs per day decreased from 1.8 (SD=1.2) episodes to 1.5 (SD=1.2) episodes The number of individuals subjected to MR decreased by 31% from 173 to 119 The mean number of individuals restrained per month decreased from 21.6 to 14.9	0.000 <0.001 <0.0001	Changing staff culture
Manning et al.	1 hospital; 1 acute unit	Modified aggression scale and treatment protocol	Average restraint minutes per incident decreased by 44.4% from 18 (SD=22) to 10 (SD=15)	0.047	Legal and policy changes
Putkonen et al.	1 hospital; 4 high-security units; 88 beds	Six Core Strategies	Seclusion-restraint hours per 100 patient days decreased from 100 to 56	<0.001	Changing staff culture
Shields and Busch	184 units across hospitals	Inpatient Psychiatric Facility Quality Reporting Program	Duration of restraint decreased by 48.96% (95% CI [16.69%; 68.73%])	0.03	Legal and policy changes
Steinert et al.	1 hospital; 1 acute, specialised unit; 18 beds	Crisis intervention ward	The mean duration of MR increased from 3.7 h to 12.4 h among certain individuals, corresponding to an increase of 230%	<0.01	Staff resources
Stensgaard et al.	26 units across hospitals	Safewards model	The median duration of MR hours decreased from 24 (IQR: 12–58) to 18 (IQR: 8–39)	<0.001	Changing staff culture
Stoll et al.	2 hospitals, 1 closed and 1 open acute, specialised unit with seclusion rooms; 38 beds	Clinical ethics support	The intensity of MR hours decreased from 86.8 (SD=45.3) to 14.5 (SD=12.1)	0.019	Changing staff culture
Yakov et al.	1 hospital; 1 locked, intensive unit; 20 beds	Sensory reduction	The mean duration of MR episodes decreased from 55.2 (SD=24.7) to 10.1 (SD=9.9) hours	0.01	Changing staff culture
Yang et al.	1 hospital; 4 acute, specialised units	Staff empathy skills and training	The median percentage of restraint hours per 1000 patient hours decreased from 1.37% to 0.18% A relationship was found between more staff with high empathy skills and reduction in the use of seclusion/restraint	0.02 <0.01	Calm-down methods Staff resources

Abbreviations: CI, confidence interval; IQR, interquartile range; MR, mechanical restraint; SD, standard deviation.



et al., 2023; Sullivan et al., 2005). Other approaches were mostly reported to contain independent, concurrent components with varying content, such as staff training and knowledge, case review and rapid response teams (Celofiga et al., 2022; Dike et al., 2021; Dixon & Long, 2022; Godfrey et al., 2014; Khadivi et al., 2004; Kontio et al., 2014; Stoll et al., 2022; Whitecross et al., 2020). Twelve studies reported significant associations between staff culture changes and MR (Celofiga et al., 2022; Dike et al., 2021; Geoffrion et al., 2018; Godfrey et al., 2014; Guzman-Parra et al., 2016, 2021; Khadivi et al., 2004; Kontio et al., 2014; Lickiewicz et al., 2021; Putkonen et al., 2013; Stensgaard et al., 2018; Stoll et al., 2022). The incidence of and/or time in MR was reduced in all studies, one of which also reported a reverse association for the time in MR for each episode (Guzman-Parra et al., 2016). Non-significant findings in relation to changes in MR use were reported in 21 studies (Ayres & Tracy, 2021; Baumgardt et al., 2019; Blair & Moulton-Adelman, 2015; Celofiga et al., 2022; Chandler, 2012; Dike et al., 2021; Dixon & Long, 2022; Geoffrion et al., 2018; Guzman-Parra et al., 2016, 2021; Hamann et al., 2020; Kontio et al., 2014; Lewis et al., 2009; Lickiewicz et al., 2021; Putkonen et al., 2013; Riahi et al., 2016; Smith et al., 2023; Stensgaard et al., 2018; Stoll et al., 2022; Sullivan et al., 2005; Whitecross et al., 2020).

## DISCUSSION

This review has synthesised studies reporting interventions seeking to reduce MR in adult mental health inpatient settings. We found that from 1999 to 2023, 41 studies were published in this field. The main findings from content analysis were four categories grouping interventions that primarily decreased the incidence of and/or time in MR. However, the studies were characterised by profound variation in terms of the quality of the research and specific findings; moreover, research using controlled trials was lacking. Staff culture changes were the most common evidence-based interventions conducted, followed by legal and policy changes, staff resources and calm-down methods. The interventions mostly combined various components which were evaluated as a whole. Thus, this review provides important knowledge about variables to be considered in mental health practice and in future rigorous analysis of single interventions to support efforts to reduce MR in adult mental health inpatient settings.

The lack of comparative analysis across interventions in this review due to difficulties in distinguishing intervention components from each other is not surprising as it has also been reported in other international analyses within the field (Baker et al., 2021; Fernández-Costa et al., 2020; Stewart et al., 2010; Väkiparta et al., 2019). Thus, the heterogeneity in the implementation and administration of interventions is mirrored in the findings.

Like others (Baker et al., 2021; Väkiparta et al., 2019), we overcame these difficulties by using content analysis. Hence, practices should pay more attention to the roll-out of single interventions when appropriate to generate highly usable effect data rather than to complex programmes where intervention components are administered concurrently. As suggested by Baker et al. (2021), it should be clear which components or combination of components may be effective. This review illustrated the potential value of interventions within different categories for reducing the use of MR, which has been reported to cause trauma, harm and even death (Aguilera-Serrano et al., 2018; Cusack et al., 2018; Kersting et al., 2019; Rakhmatullina et al., 2013; Tingleff et al., 2017). The findings of this review, therefore, provide important and critical knowledge that can be used as a basis for focusing on and developing future interventions in this field (Baker et al., 2021).

As the studies assessed had varied quality, a meta-analysis of the controlled trials could have been a useful method to assess the efficacy of alternatives to the use of MR in mental health, especially as we overall assessed these studies as having high quality, and several significant findings were extracted from these studies. However, it was difficult to conduct such an analysis as only five of the included studies were controlled trials and much variability was observed in intervention content, targets and outcome measures in these trials. The difficulties that precluded meta-analysis in this review are similar to those reported in research elsewhere within the field of restrictive practice use (Baker et al., 2021; Fernández-Costa et al., 2020). Therefore, additional controlled trials focusing on individual components as described above are needed and could be performed to further understand the effectiveness of alternative interventions to MR. Alternatively, more well-conducted comprehensive approaches with of well-defined outcomes reporting should be developed, facilitating meaningful comparisons among similar programmes. However, given the limited number of appropriate studies, conducting a comprehensive meta-analysis remains a challenging endeavour in this area at present. In such cases, the focus should shift towards employing robust research approaches to consolidate findings, and in the future, these efforts may lay the foundation for more extensive meta-analyses. Our findings support that interventions or particular intervention components may be individually effective in practice. The focus on understanding the effectiveness of individual interventions underscores their significance in shaping mental health practice, regardless of whether they are part of broader initiatives like the Safewards Model or Six Cores Strategies or implemented in the absence of these wider programmes.

In our review, we have highlighted the potential value of interventions within different categories for reducing MR in adult mental health inpatient settings. It is essential to recognise that many well-researched interventions,





such as the Six Core Strategies and Safewards, are complex and systemic in nature (Baker et al., 2021; Fernández-Costa et al., 2020). Such programmes may encompass a range of components and strategies that synergistically create a comprehensive approach to reducing MR. While such approaches have demonstrated promise in the field, as evident in the present review, and are potentially more realistic for researchers to explore as a whole, it remains important to address the issue of evaluating individual components within them to identify which are most effective in reducing MR (Baker et al., 2021). This focused approach may not only assist in fine-tuning interventions but also provides valuable insights into their standalone effectiveness. Our findings underscore the need for a nuanced understanding of what specific elements within these complex programmes contribute to their overall effectiveness. In clinical practice, isolating and assessing the impact of each component can be challenging, especially when they are administered concurrently, as was often the case in the studies in the present review. Therefore, we recognise the importance of exploring methods to evaluate complex intervention programmes effectively, by striking a balance between evaluating these comprehensive approaches and examining their individual components. Both avenues of research contribute to our understanding of how to best reduce MR in adult mental health inpatient settings and improve the overall quality of care.

From a clinical and practical perspective, it would be relevant to focus on interventions that can reduce both the incidence of and the time spent in MR if the effect on both areas can be linked to the same intervention (Baker et al., 2021). As in comparative analyses in the field (Baker et al., 2021; Fernández-Costa et al., 2020; Stewart et al., 2010; Väkiparta et al., 2019), many studies in the present review already focus on both areas, and thus the issue is receiving attention. Furthermore, interventions that are effective in multiple areas of interest, including reducing the concurrent use of other restrictive practices, may be expected to be cost effective in clinical practice as they can reduce the overall high risk of injury associated with MR use (Aguilera-Serrano et al., 2018; Cusack et al., 2018; Kersting et al., 2019; Rakhmatullina et al., 2013; Tingleff et al., 2017). However, it is important to note that efforts to reduce MR use may also be counterproductive and increase the risk of harm along with reduction of MR (Khadivi et al., 2004; Putkonen et al., 2013). Although a decrease in injury and violence in patients and staff following the implementation of interventions was reported in several studies in this review (e.g., Guzman-Parra et al., 2016; Lewis et al., 2009; Putkonen et al., 2013; Steinert et al., 2008), the review emphasises that efforts to reduce MR should prioritise safety for all, for example, through intensive safety monitoring (Khadivi et al., 2004). Additionally, during their project years, Putkonen et al. (2013) observed more sick days and sick time per injury resulting from physical

violence management training between staff than from incidents involving patient-to-staff violence. This suggests the importance of adopting a balanced approach to achieving a reduction in MR and acknowledges the potential risks associated with such reductions. In preventive efforts, it is crucial to consider not only the safety and well-being of patients and staff in clinical practice but also any potential danger arising from even staff training (Guzman-Parra et al., 2016; Putkonen et al., 2013), a conclusion supported by our findings. Moreover, an important consideration in reducing restrictive practices is whether other such practices, formal or informal, may be introduced as alternatives in clinical practice when we what to reduce specific practices, such as MR. Therefore, exploring the cultural and contextual factors that may have a bearing on the use of MR is an important area of interest; and our findings highlight this concern, for example, in relation to the category of 'changing staff culture'. This is especially pertinent as many staff report in research that the use of restrictive practices is a necessary element to manage violent and aggressive behaviour, suggesting that they may replace one type of practice with another in certain situations (Muir-Cochrane et al., 2018).

While most studies in this review did find a reduction in the use of MR, these findings were not always reported as significant outcomes. The existence of studies reported as without effect on this basis is well known within this field (Baker et al., 2021; Väkiparta et al., 2019). However, it is important to consider that there may be other benefits than significant findings from the implementation of interventions. The three phases programme by Donat (2002a) may serve to exemplify this: the reduction in MR in phase three of this programme was non-significant, but the changes in this phase improved and facilitated a more interdisciplinary approach to care and treatment. Hence, mental health professionals should focus on a wider range of benefits from intervention programmes that aim to reduce MR rather than focus exclusively on whether the reduction is statistically significant.

As has been shown by our findings in the category 'calm-down methods', interventions to regulate stimuli or patient response to stimuli were reported as useful for reducing MR. These results are consistent with previous international reviews where such interventions to reduce patients' stress levels are referred to as 'treatment planning' (Väkiparta et al., 2019 p. 772) or 'restructuring the physical environment' (Baker et al., 2021 p. 41). Therefore, to fully understand the potential of these methods for improving clinical practice, it may be necessary to thoroughly review the underlying studies.

In the present review, we found that interventions that focus on staff resources may also help reduce the use of MR. This is not surprising as increased staffing has repeatedly proven to optimise healthcare services, including during the recent coronavirus pandemic (Al-Amin



et al., 2022). However, other ways may also be used to improve interventions between patients and staff to reduce MR beyond those identified in this review. For instance, others have suggested that providing greater time available for appointments with patients and their direct care could be beneficial (Baker et al., 2021; Stewart et al., 2010). Our review also supported this conclusion as it found that using staff resources more effectively could be a way to reduce MR.

Moreover, our findings about the impact of changing staff culture on reducing the use of MR further emphasise the importance of staff and the complexity of successful interventions. Most studies in this review reported on interventions aimed at changing staff culture that employed complex approaches based on predefined concepts. Other researchers have also highlighted the implementation of complex programmes and approaches as useful for managing this issue, including elements we also found such as staff training in de-escalation and risk assessment (Baker et al., 2021; Fernández-Costa et al., 2020; Stewart et al., 2010; Väkiparta et al., 2019). However, as in the present review, more precise details about content and patterns between components were generally lacking in these studies, hindering understanding of vital elements.

Finally, we have shown that legal and policy changes may reduce MR use. This may be a very important finding because it removes responsibility from staff and promotes consistency across settings. As suggested by Stewart et al. (2010), new policies to reduce the use of restrictive practices are a direct way of changing practice. Furthermore, supporting our findings, Baker et al. (2021) also found that interventions such as changes in rules and policies can reduce restrictive practices. Thus, as indicated by our findings, both on national and local levels, it may be possible to reduce the use of MR by changing the application and evaluation of MR through legislation. Thus, to further understand the associations between changes in legislation and policy and the use of MR, we recommend conducting more research on the impact of specific legal and policy changes on MR use.

## Limitations

The following limitations must be taken into consideration. First, we conducted a broad, systematic literature search to identify relevant studies, but use of additional databases could have identified other relevant studies and potentially yielded different results. Second, we only included English-language literature and this may have resulted in a bias towards Western settings in the studies that were included. Relevant studies in other languages may have been produced, which could have broadened the results. This one-sided geographic dominance may also mean, as others have suggested, that research outputs

depend on the focus and resources of healthcare systems or the risk of bias in publication and reporting procedures (Pedersen et al., 2023; Pedersen et al., 2022). Third, unlike the other recent reviews in this field (Fernández-Costa et al., 2020; Väkiparta et al., 2019), the review process was conducted by two researchers independently, as recommended by the JBI (Aromataris & Munn, 2020), which is a strength of this review. Fourth, and relatedly, our broader approach, which included various study types, primarily based on interventions from other study designs than controlled trials, provided valuable insights, but it is essential to acknowledge their potential methodological limitations and lesser robustness in establishing causal relationships. Fifth, we used content analysis for categorisation and analysis, which has been shown to yield relevant and effective findings; however, the variation and quality of interventions were reported in a way that raises the question of the most meaningful method for managing such disparate data. Further controlled trials could resolve this debate and strengthen the analysis of the field. Sixth, the studies were conducted across different countries, which is a strength of this review of international peer-reviewed research literature. However, preferences for types of restrictive practices vary across countries, with some using MR infrequently (National Institute for Health and Care Excellence, 2015; Newton-Howes et al., 2020; Steinert et al., 2010; Völlm & Nedopil, 2016). Therefore, the implementation of some interventions may not necessarily translate into statistically significant reductions of MR. Furthermore, this variation may also explain why studies from some countries, for example, the United Kingdom, are not included in the present review although its geographic region is strongly represented and the country generally focuses on reducing the use of restrictive practices in mental health.

## CONCLUSIONS

In conclusion, interventions to reduce MR have received some attention in mental health research. This research has shown some promise; primarily a reduction in the incidence of and/or time in MR, although the quality of research and specific findings varied widely. We found four categories to group interventions, with staff culture changes being the most common, followed by legal and policy changes, staff resources and, finally, calm-down methods. Further research using stringent and controlled designs is required. Specifically, it is important to examine the effect of single interventions in reducing MR as this may help identify which interventions are the most effective.

## Relevance for clinical practice

We found that interventions to reduce MR in adult mental health inpatient settings show promise, with some



research demonstrating a decrease in the incidence and duration of MR. Staff culture changes, legal and policy changes, staff resources and calm-down methods are potential intervention categories to address MR in clinical practice. Future research should focus on examining the impact of individual interventions using stringent and controlled designs to determine which interventions are most effective in reducing MR.

### AUTHOR CONTRIBUTIONS

The authors all contributed to the study concept and design, with MLP and EBT responsible for conducting literature searches, screening, selection and quality assessment of studies for inclusion. MLP performed the analysis, with the other authors contributing by discussing the analysis and interpreting the data and findings. MLP drafted the first manuscript, and all other authors participated in the revision process. Finally, all authors reviewed and approved the final manuscript before it was submitted for publication.

### FUNDING INFORMATION

The work has been supported by the Psychiatric Research Fund in the Region of Southern Denmark (Grant number: A3620). The funder played no role in the study design, collection, analysis or interpretation of data; preparation, review or approval of the paper; or the decision to submit for publication.

### CONFLICT OF INTEREST STATEMENT

MLP has received grants from FOSTREN, Harboefonden, Danish Nurses Organisation and Novo Nordisk Foundation. The remaining authors declare no conflicts of interest.

### DATA AVAILABILITY STATEMENT

All data and material generated and analysed are available in the published paper or the Data S1.

### ORCID

Martin Loch Pedersen  <https://orcid.org/0000-0003-3620-3523>

Frederik Alkier Gildberg  <https://orcid.org/0000-0001-9075-6108>

John Baker  <https://orcid.org/0000-0001-9985-9875>

Ellen Boldrup Tingleff  <https://orcid.org/0000-0001-6464-4911>

### REFERENCES

- Aguilera-Serrano, C., Guzman-Parra, J., Garcia-Sanchez, J.A., Moreno-Küstner, B. & Mayoral-Cleries, F. (2018) Variables associated with the subjective experience of coercive measures in psychiatric inpatients: a systematic review. *The Canadian Journal of Psychiatry*, 63, 129–144.
- AL-Amin, M., Islam, M.N., Li, K., Shiels, N. & Buresh, J. (2022) Is there an association between hospital staffing levels and inpatient-COVID-19 mortality rates? *PLoS One*, 17, e0275500.
- Allen, D.E., Fetzer, S.J. & Cummings, K.S. (2020) Decreasing duration of mechanical restraint episodes by increasing registered nurse assessment and surveillance in an acute psychiatric hospital. *Journal of the American Psychiatric Nurses Association*, 26, 245–249.
- Andersen, C., Kolmos, A., Andersen, K., Sippel, V. & Stenager, E. (2017) Applying sensory modulation to mental health inpatient care to reduce seclusion and restraint: a case control study. *Nordic Journal of Psychiatry*, 71, 525–528.
- Aromataris, E. & Munn, Z. (2020) JBI systematic reviews. In: Aromataris, E. & Munn, Z. (Eds.) (Eds.) *JBI manual for evidence synthesis*. JBI: Adelaide.
- Ayres, S. & Tracy, M.F. (2021) Recovery model implementation for a medical/geriatric psychiatric unit to decrease restraint and seclusion episodes: a quality improvement project. *Journal of the American Psychiatric Nurses Association*, 27, 355–360.
- Badouin, J., Bechdorf, A., Bermpohl, F., Baumgardt, J. & Weinmann, S. (2023) Preventing, reducing, and attenuating restraint: a prospective controlled trial of the implementation of peer support in acute psychiatry. *Frontiers in Psychiatry*, 14, 1089484.
- Baker, J., Berzins, K., Canvin, K., Benson, I., Kellar, I., Wright, J. et al. (2021) Non-pharmacological interventions to reduce restrictive practices in adult mental health inpatient settings: the COMPARE systematic mapping review. *Health Services and Delivery Research*, 9, 1–184.
- Baumgardt, J., Jäckel, D., Helber-Böhlen, H., Stiehm, N., Morgenstern, K., Voigt, A. et al. (2019) Preventing and reducing coercive measures—An evaluation of the implementation of the Safewards model in two locked wards in Germany. *Frontiers in Psychiatry*, 10, 340.
- Blair, M. & Moulton-Adelman, F. (2015) The engagement model for reducing seclusion and restraint: 13 years later. *Journal of Psychosocial Nursing and Mental Health Services*, 53, 39–45.
- Celofiga, A., Kores Plesnicar, B., Koprivsek, J., Moskon, M., Benkovic, D. & Gregoric Kumperscak, H. (2022) Effectiveness of De-escalation in reducing aggression and coercion in acute psychiatric units. A cluster randomized study. *Front Psychiatry*, 13, 856153.
- Chandler, G.E. (2012) Reducing use of restraints and seclusion to create a culture of safety. *Journal of Psychosocial Nursing and Mental Health Services*, 50, 29–36.
- Christensen, J.B., Lassen, I.S., Helles Carlsen, A., Strazek, S. & Nyboe, L. (2021) Physical therapy for reducing arousal and mechanical restraint among in-patients with mania. *Nordic Journal of Psychiatry*, 75, 49–53.
- Cummings, K.S., Grandfield, S.A. & Coldwell, C.M. (2010) Caring with comfort rooms. Reducing seclusion and restraint use in psychiatric facilities. *Journal of Psychosocial Nursing and Mental Health Services*, 48, 26–30.
- Cusack, P., Cusack, F.P., McAndrew, S., Mckeown, M. & Duxbury, J. (2018) An integrative review exploring the physical and psychological harm inherent in using restraint in mental health inpatient settings. *International Journal of Mental Health Nursing*, 27, 1162–1176.
- Dike, C.C., Lamb-Pagone, J., Howe, D., Beavers, P., Bugella, B.A. & Hillbrand, M. (2021) Implementing a program to reduce restraint and seclusion utilization in a public-sector hospital: clinical innovations, preliminary findings, and lessons learned. *Psychological Services*, 18, 663–670.
- Dixon, M. & Long, E.M. (2022) An educational intervention to decrease the number of emergency incidents of restraint and seclusion on a behavioral health unit. *Journal of Continuing Education in Nursing*, 53, 70–76.
- Donat, D.C. (2002a) Employing behavioral methods to improve the context of care in a public psychiatric hospital: reducing hospital reliance on seclusion/restraint and psychotropic PRN medication. *Cognitive and Behavioral Practice*, 9, 28–37.





- Donat, D.C. (2002b) Impact of improved staffing on seclusion/restraint reliance in a public psychiatric hospital. *Psychiatric Rehabilitation Journal*, 25, 413–416.
- Fernández-Costa, D., Gómez-Salgado, J., Fagundo-Rivera, J., Martín-Pereira, J., PRIETO-Callejero, B. & García-Iglesias, J.J. (2020) Alternatives to the use of mechanical restraints in the Management of Agitation or aggressions of psychiatric patients: a scoping review. *Journal of Clinical Medicine*, 9, 2791.
- Flammer, E., Hirsch, S. & Steinert, T. (2021) Effect of the introduction of immediate judge's decisions in 2018 on the use of coercive measures in psychiatric hospitals in Germany: a population-based study. *The Lancet Regional Health—Europe*, 11, 100233.
- Geoffrion, S., Goncalves, J., Giguère, C.-É. & Guay, S. (2018) Impact of a program for the Management of Aggressive Behaviors on seclusion and restraint use in two high-risk units of a mental health Institute. *Psychiatric Quarterly*, 89, 95–102.
- Gerace, A. & Muir-Cochrane, E. (2019) Perceptions of nurses working with psychiatric consumers regarding the elimination of seclusion and restraint in psychiatric inpatient settings and emergency departments: an Australian survey. *International Journal of Mental Health Nursing*, 28, 209–225.
- Gleerup, C.S., Ostergaard, S.D. & Hjulær, R.S. (2019) Seclusion versus mechanical restraint in psychiatry - a systematic review. *Acta Neuropsychiatrica*, 31, 237–245.
- Godfrey, J.L., McGill, A.C., Jones, N.T., Oxley, S.L. & Carr, R.M. (2014) Anatomy of a transformation: a systematic effort to reduce mechanical restraints at a state psychiatric hospital. *Psychiatric Services*, 65, 1277–1280.
- Goulet, M.H., Larue, C. & Lemieux, A.J. (2018) A pilot study of "post-seclusion and/or restraint review" intervention with patients and staff in a mental health setting. *Perspectives in Psychiatric Care*, 54, 212–220.
- Guzman-Parra, J., Aguilera Serrano, C., García-Sánchez, J.A., Pino-Benítez, I., Alba-Vallejo, M., Moreno-Küstner, B. et al. (2016) Effectiveness of a multimodal intervention program for restraint prevention in an acute Spanish psychiatric Ward. *Journal of the American Psychiatric Nurses Association*, 22, 233–241.
- Guzman-Parra, J., Aguilera-Serrano, C., Huizing, E., Bono Del Trigo, A., Villagrán, J.M., García-Sánchez, J.A. et al. (2021) A regional multicomponent intervention for mechanical restraint reduction in acute psychiatric wards. *Journal of Psychiatric and Mental Health Nursing*, 28, 197–207.
- Guzman-Parra, J., Garcia-Sanchez, J.A., Pino-Benitez, I., Alba-Vallejo, M. & Mayoral-Cleries, F. (2015) Effects of a regulatory protocol for mechanical restraint and coercion in a Spanish psychiatric Ward. *Perspectives in Psychiatric Care*, 51, 260–267.
- Hamann, J., John, M., Holzthüter, F., Siafis, S., Brieger, P. & Heres, S. (2020) Shared decision making, aggression, and coercion in inpatients with schizophrenia. *European Psychiatry*, 63, e90.
- Hoffmann, K., Hausleiter, I.S., Efke, S.A., Brand, M. & Juckel, G. (2022) Effects of structural features of psychiatric hospital settings on coercive measures. *European Journal of Psychiatry*, 36, 43–50.
- Hong, Q.N., Pluye, P., Fábregues, S., Bartlett, G., Boardman, F., Cargo, M. et al. (2018) *Mixed methods appraisal tool (MMAT), version 2018: user guide*. Montréal: McGill University.
- Hvidhjelm, J., Brandt-Christensen, M., Delcomyn, C., Møllerhøj, J., Siersma, V. & Bak, J. (2022) Effects of implementing the short-term assessment of risk and treatability for mechanical restraint in a forensic male population: a stepped-wedge, cluster-randomized design. *Front Psychiatry*, 13, 822295.
- Kersting, X.A.K., Hirsch, S. & Steinert, T. (2019) Physical harm and death in the context of coercive measures in psychiatric patients: a systematic review. *Frontiers in Psychiatry*, 10, 400.
- Khadivi, A.N., Patel, R.C., Atkinson, A.R. & Levine, J.M. (2004) Association between seclusion and restraint and patient-related violence. *Psychiatric Services*, 55, 1311–1312.
- Kontio, R., Pitkänen, A., Joffe, G., Katajisto, J. & Välimäki, M. (2014) eLearning course may shorten the duration of mechanical restraint among psychiatric inpatients: a cluster-randomized trial. *Nordic Journal of Psychiatry*, 68, 443–449.
- Krippendorff, K. (2004) *Content analysis. An introduction to its methodology*. Thousand Oaks: Sage Publications.
- Lebel, J.L., Duxbury, J.A., Putkonen, A., Sprague, T., Rae, C. & Sharpe, J. (2014) Multinational experiences in reducing and preventing the use of restraint and seclusion. *Journal of Psychosocial Nursing and Mental Health Services*, 52, 22–29.
- Lewis, M., Taylor, K. & Parks, J. (2009) Crisis prevention management: a program to reduce the use of seclusion and restraint in an inpatient mental health setting. *Issues in Mental Health Nursing*, 30, 159–164.
- Lickiewicz, J., Adamczyk, N., Hughes, P.P., Jagielski, P., Stawarz, B. & Makara-Studzinska, M. (2021) Reducing aggression in psychiatric wards using Safewards—a polish study. *Perspectives in Psychiatric Care*, 57, 50–55.
- Manning, T., Bell, S.B., Dawson, D., Kezbers, K., Crockett, M. & Gleason, O. (2022) The utilization of a rapid agitation scale and treatment protocol for patient and staff safety in an inpatient psychiatric setting. *The Psychiatric Quarterly*, 93, 915–933.
- Muir-Cochrane, E., O'kane, D. & Oster, C. (2018) Fear and blame in mental health nurses' accounts of restrictive practices: implications for the elimination of seclusion and restraint. *International Journal of Mental Health Nursing*, 27, 1511–1521.
- National Institute for Health and Care Excellence. (2015) *Violence and aggression: short term Management in Mental Health*. London, National Institute for Health and Care Excellence: Health and Community Settings.
- Newton-Howes, G., Savage, M.K., Arnold, R., Hasegawa, T., Staggs, V. & Kisely, S. (2020) The use of mechanical restraint in Pacific rim countries: an international epidemiological study. *Epidemiology and Psychiatric Sciences*, 29, e190.
- Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D. et al. (2021) The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*, 372, n71.
- Pedersen, M.L., Gildberg, F., Baker, J., Damsgaard, J.B. & Tingleff, E. (2023) Ethnic disparities in the use of restrictive practices in adult mental health inpatient settings: a scoping review. *Social Psychiatry and Psychiatric Epidemiology*, 58, 505–522.
- Pedersen, M.L., Handberg, C. & Dreyer, P. (2022) Mental health reported in adult invasive home mechanical ventilation through a tracheostomy: a scoping review. *International Journal of Nursing Studies Advances*, 4, 100110.
- Putkonen, A., Kuivalainen, S., Louheranta, O., Repo-Tiihonen, E., Ryyänänen, O.P., Kautiainen, H. et al. (2013) Cluster-randomized controlled trial of reducing seclusion and restraint in secured care of men with schizophrenia. *Psychiatric Services*, 64, 850–855.
- Rakhmatullina, M., Taub, A. & Jacob, T. (2013) Morbidity and mortality associated with the utilization of restraints: a review of literature. *Psychiatric Quarterly*, 84, 499–512.
- Raveesh, B.N., Gowda, G.S. & Gowda, M. (2019) Alternatives to use of restraint: a path toward humanistic care. *Indian Journal of Psychiatry*, 61, S693–S697.
- Riahi, S., Dawe, I.C., Stuckey, M.I. & Klassen, P.E. (2016) Implementation of the six Core strategies for restraint minimization in a specialized mental health organization. *Journal of Psychosocial Nursing and Mental Health Services*, 54, 32–39.
- Sailas, E.E.S. & Fenton, M. (2012) Seclusion and restraint for people with serious mental illnesses. *Cochrane Database of Systematic Reviews*, 1, CD001163.
- Shields, M.C. (2022) Effects of the CMS' public reporting program for inpatient psychiatric facilities on targeted and nontargeted safety: differences between for-profits and nonprofits. *Medical Care Research and Review*, 79, 233–243.



- Shields, M.C. & Busch, A.B. (2020) The effect of centers for Medicare and Medicaid's inpatient psychiatric facility quality reporting program on the use of restraint and seclusion. *Medical Care*, 58, 889–894.
- Smith, G.M., Altenor, A., Altenor, R.J., Davis, R.H., Steinmetz, W., Adair, D.K. et al. (2023) Effects of ending the use of seclusion and mechanical restraint in the Pennsylvania state hospital system, 2011–2020. *Psychiatric Services*, 74, 173–181.
- Steinert, T., Eisele, F., Goesser, U., Tschöcke, S., Uhlmann, C. & Schmid, P. (2008) Successful interventions on an organisational level to reduce violence and coercive interventions in in-patients with adjustment disorders and personality disorders. *Clinical Practice and Epidemiology in Mental Health*, 4, 27.
- Steinert, T., Lepping, P., Bernhardsgrütter, R., Conca, A., Hatling, T., Janssen, W. et al. (2010) Incidence of seclusion and restraint in psychiatric hospitals: a literature review and survey of international trends. *Social Psychiatry and Psychiatric Epidemiology*, 45, 889–897.
- Stensgaard, L., Andersen, M.K., Nordentoft, M. & Hjorthøj, C. (2018) Implementation of the safeguards model to reduce the use of coercive measures in adult psychiatric inpatient units: an interrupted time-series analysis. *Journal of Psychiatric Research*, 105, 147–152.
- Stewart, D., van der Merwe, M., Bowers, L., Simpson, A. & Jones, J. (2010) A review of interventions to reduce mechanical restraint and seclusion among adult psychiatric inpatients. *Issues in Mental Health Nursing*, 31, 413–424.
- Stoll, J., Westermair, A.L., Kübler, U., Reisch, T., Cattapan, K., Bridler, R. et al. (2022) A two-center pilot study on the effects of clinical ethics support on coercive measures in psychiatry. *BMC Psychiatry*, 22, 370.
- Sugiura, K., Mahomed, F., Saxena, S. & Patel, V. (2020) An end to coercion: rights and decision-making in mental health care. *Bulletin of the World Health Organization*, 98, 52–58.
- Sullivan, A.M., Bezmen, J., Barron, C.T., Rivera, J., Curley-Casey, L. & Marino, D. (2005) Reducing restraints: alternatives to restraints on an inpatient psychiatric service—Utilizing safe and effective methods to evaluate and treat the violent patient. *The Psychiatric Quarterly*, 76, 51–65.
- The Council of Europe's Committee for the Prevention of Torture and Inhuman or Degrading Treatment or Punishment. (2020) *Report to the Danish Government on the visit to Denmark carried out by the European Committee for the Prevention of Torture and Inhuman or Degrading Treatment or Punishment (CPT) from 3 to 12 April 2019*.
- Tingleff, E.B., Bradley, S.K., Gildberg, F.A., Munksgaard, G. & Hounsgaard, L. (2017) “Treat me with respect”. A systematic review and thematic analysis of psychiatric patients' reported perceptions of the situations associated with the process of coercion. *Journal of Psychiatric and Mental Health Nursing*, 24, 681–698.
- Väkiparta, L., Suominen, T., Paaivilainen, E. & Kylmä, J. (2019) Using interventions to reduce seclusion and mechanical restraint use in adult psychiatric units: an integrative review. *Scandinavian Journal of Caring Sciences*, 33, 765–778.
- Völlm, B. & Nedopil, N. (2016) *The use of coercive measures in forensic psychiatric care: legal*. Switzerland, Springer: Ethical and Practical Challenges.
- Ward-Stockham, K., Kapp, S., Jarden, R., Gerdtz, M. & Daniel, C. (2022) Effect of Safewards on reducing conflict and containment and the experiences of staff and consumers: a mixed-methods systematic review. *International Journal of Mental Health Nursing*, 31, 199–221.
- Whitecross, F., Lee, S., Bushell, H., Kang, M., Berry, C., Hollander, Y. et al. (2020) Implementing a psychiatric behaviours of concern team can reduce restrictive intervention use and improve safety in inpatient psychiatry. *Australasian Psychiatry*, 28, 401–406.
- Whittington, R., Bowers, L., Nolan, P., Simpson, A. & Neil, L. (2009) Approval ratings of inpatient coercive interventions in a National Sample of mental health service users and staff in England. *Psychiatric Services*, 60, 792–798.
- Yakov, S., Birur, B., Bearden, M.F., Aguilar, B., Ghelani, K.J. & Fargason, R.E. (2018) Sensory reduction on the general milieu of a high-acuity inpatient psychiatric unit to prevent use of physical restraints: a successful open quality improvement trial. *Journal of the American Psychiatric Nurses Association*, 24, 133–144.
- Yang, C.P., Hargreaves, W.A. & Bostrom, A. (2014) Association of empathy of nursing staff with reduction of seclusion and restraint in psychiatric inpatient care. *Psychiatric Services*, 65, 251–254.

## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

**How to cite this article:** Pedersen, M.L., Gildberg, F.A., Baker, J. & Tingleff, E.B. (2023) A systematic review of interventions to reduce mechanical restraint in adult mental health inpatient settings. *International Journal of Mental Health Nursing*, 00, 1–18. Available from: <https://doi.org/10.1111/inm.13267>