International Journal of Mental Health Nursing

International Journal of Mental Health Nursing (2022) *31*, 35–50 doi: 10.1111/inm.12940

Review Article

Non-restrictive interventions to reduce self-harm amongst children in mental health inpatient settings: Systematic review and narrative synthesis

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ABSTRACT: *Rates of self-harm amongst children appear to be increasing. This presents challenges for practitioners responsible for maintaining the safety of children admitted to mental health inpatient settings. Policy guidelines recommend that practitioners should aim to avoid the use of restrictive practices for children. It is currently unclear, however, what evidence-based alternatives to restrictive practices are available. We aimed to identify what non-restrictive interventions have been proposed to reduce self-harm amongst children in mental health inpatient settings and to evaluate the evidence supporting their use in clinical practice. A systematic search of five databases (CINAHL, Embase, Ovid MEDLINE, APA Psycinfo, and Cochrane) was conducted to identify articles reporting on non-restrictive interventions aimed at reducing self-harm amongst children in mental health inpatient settings. Articles were quality assessed and relevant data were extracted and synthesized using narrative synthesis. Searches identified relatively few relevant articles* (n = 7) *and these were generally of low methodological quality. The underlying theoretical assumptions and putative mechanisms of change for the interventions described were often unclear. Despite concerns about the rates of self-harm amongst children in mental health inpatient settings, there is a lack of high-quality research to inform clinical practice. There is an urgent need to develop effective non-restrictive interventions aimed at reducing self-harm for children using inpatient mental health services. Intervention development should be theoretically informed and be conducted in collaboration with people who have lived experience of this issue.*

KEY WORDS: *children, inpatient, mental health, restrictive practices, self-harm.*

INTRODUCTION

Background

Rates of self-harm (defined as intentional self-poisoning or self-injury) amongst children appear to be increasing (Griffin *et al*. 2018; Morgan *et al*. 2017) and repeated self-harm is strongly associated with suicide (Hawton *et al*. 2015; Morgan *et al*. 2017). This creates particular challenges for practitioners working in

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Declaration of conflict of interest: The authors have no conflicts of interest to declare.

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Accepted September 27 2021.

inpatient mental health settings. Staff working in these settings, who have a duty of care to maintain the safety of children they are working with, are frequently required to make judgements about when it might be appropriate to use restrictive interventions to prevent service users harming themselves or others (McDougall & Nolan 2017).

Restrictive interventions have been defined as '...deliberate acts on the part of other person(s) that restrict a patient's movement, liberty and/or freedom to act independently' (Department of Health & Social Care 2019, p.51). Examples of restrictive interventions include physical restraint, restricting independent actions (e.g. through the use of coercion or the threat of physical restraint), chemical restraint (the use of medication for the purpose of controlling or subduing a person), mechanical restraint (e.g. through the use of belts or cuffs), seclusion (supervised confinement or isolation), and segregation (limiting a person's ability to freely mix with others) (Department of Health & Social Care 2019; LeBel *et al*. 2004).

Concerns have been expressed about high rates of seclusion and restraint of children in mental health inpatient settings (Eblin 2019). One survey of United States' child and adolescent units found that rates of restraint and seclusion were six times higher than in adult services in the same state (LeBel *et al*. 2004). A systematic review of international literature found that 26% of children and young people treated in mental health inpatient settings have had at least one seclusion episode and 29% at least one restraint episode (De Hert *et al*. 2011). Attempts to self-harm by children have been identified as a precursor to the use of restrictive practices in inpatient settings (Pogge *et al*. 2011).

There is increasing evidence that restrictive practices can be both physically and psychologically harmful. A recent integrative review explored the psychological impact of restraint on adults in mental health inpatient settings (Cusack *et al*. 2018). The findings suggest that experiences of restraint are frequently traumatic and associated with feelings of distress, fear, dehumanization, and loss of control. The impact of restraint on children has the potential to be even more damaging than its use in adults (Department of Health & Social Care 2019). A recent themed review concluded that the use of restrictive practices can be frightening for children and often undermines therapeutic relationships with staff (National Institute for Health Research 2021). There is also evidence that children who have experienced traumatic events in the past, such as physical or sexual abuse, are at greater risk of being restrained or secluded, potentially exacerbating already significant levels of trauma and distress (Hammer *et al*. 2011).

Girls and young women appear to be disproportionately subjected to restrictive practices in inpatient settings (Furre *et al*. 2017). Recent UK figures revealed that 17% of girls in Child and Adolescent Mental Health Service (CAMHS) facilities had been physically restrained compared to 13% of boys (Agenda 2017). Gender differences in rates of self-harm might offer a partial explanation for why girls are disproportionately experiencing restrictive practices, with evidence from epidemiological studies suggesting that girls are more likely to engage in self-harm compared to boys (Bresin & Schoenleber 2015; Morgan *et al*. 2017).

Improving mental health service provision and outcomes for children has been a longstanding policy declaration for the National Health Service in England (Mental Health Task Force 2016, NHS England 2019). To achieve this, the NHS plans to increase levels of financial investment in mental health services for children (NHS England 2019). Policy documents have clearly signalled an intention to reduce the use of restraint for children (Department of Health & Social Care 2019; NHS England 2019), although questions remain about the most effective methods for achieving this. This uncertainty increases the risk of iatrogenic harm (i.e. harm occurring as a result of healthcare practices or procedures) for children in mental health inpatient settings. There is also evidence that restrictive practices are associated with negative emotional and relational outcomes for the staff who are using them (Sequeira & Halstead 2004; Wilson *et al*. 2017).

A diverse range of approaches aimed at limiting the use of restrictive practices for children in mental health settings have been proposed and evaluated. These include the use of cognitive-behavioural problem-solving techniques (Greene *et al*. 2006), behavioural interventions to reduce aggression (Dean *et al*. 2007), and improving staff–patient relationships (Donovan *et al*. 2003). The issue of reducing the use of restrictive practices for children, however, remains an underresearched area (Valenkamp *et al*. 2014; Witt *et al*. 2021). Given that children who self-harm in mental health inpatient settings appear to be at greater risk of exposure to potentially harmful restrictive practices (Pogge *et al*. 2011), interventions which aim to reduce self-harm play a potentially important role in reducing the use of restrictive practices for this population.

Several systematic reviews have been published that explore therapeutic approaches to self-harm reduction

for children (Labelle *et al*. 2015; Ougrin *et al*. 2015). To our knowledge, however, no reviews have been conducted that focus specifically on interventions which are designed to reduce self-harm amongst children in mental health inpatient settings, or which attempt to synthesize both qualitative and quantitative evidence. Such a review could inform clinical practice guidelines and contribute to the development of interventions designed to reduce the use of potentially harmful restrictive practices for children in these settings.

Review aims

The aim of this systematic review is to answer the following questions. First, what interventions have been developed that aim to reduce self-harm amongst children in mental health inpatient settings? We are specifically interested in interventions that do not rely on using restrictive practices. Second, what evidence exists to support the use of these interventions in clinical practice? This review was conducted as part of a larger project that aims to reduce restrictive practices for children who self-harm in inpatient settings.

METHOD

Protocol and registration

This review has been conducted in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA; Moher *et al*. 2009) guidelines and the protocol was prospectively registered with the PROSPERO International Prospective Register of Systematic Reviews (ID CRD42020197891).

Eligibility criteria

We aimed to include any potentially relevant research into the topic of interest, regardless of publication date or methodology. Inclusion criteria were, therefore, as follows: (1) primary qualitative, quantitative, or mixed methods research; (2) published in peer-reviewed journals; (3) describing or evaluating interventions to reduce self-harm; and (4) for children in an inpatient mental health setting. The following exclusion criteria were applied: (1) reviews, case studies, or single case designs; (2) conference papers or unpublished theses; (3) research where the majority of participants (>50%) were over 18 years old; and (4) non-English language research.

Information sources

Searches were performed using the following electronic databases: CINAHL, Embase, Ovid MEDLINE, APA Psycinfo, and Cochrane. Database searches were performed separately.

Search

The Sample, Phenomenon of Interest, Design, Evaluation, and Research Type (SPIDER; Cooke *et al*. 2012) framework was used to develop appropriate research questions and generate search terms. The sample for our review was children in mental health inpatient settings and the phenomenon of interest was non-restrictive interventions designed to reduce self-harm. We were interested in all research designs, evaluation methods, and research types. The Medical Subject Headings (MeSH) Browser was also used to generate and refine search terms, which are presented in Table 1. Searches were performed in August 2020.

Study selection

Study selection took place in four stages. First, after deduplication, the titles of articles returned by the database searches were screened against the review's inclusion and exclusion criteria by the first author (RG). An inclusive approach to screening was taken at this point and any potentially relevant articles were retained. Second, the abstracts of retained articles were read and, again, screened against the review inclusion and exclusion criteria. Third, the full text of articles retained at this point were read and a final decision was made about their suitability for inclusion in the review. Fourth, reference and citation checks were

TABLE 1 *Search terms*

Category of search term	Specific search terms
Child terms	Child* OR Youth OR Young OR Adolescen* OR Teen* OR Minor OR OR Juvenile
AND	
Self-harm terms	Self-Harm* OR Self-Injur* OR Deliberate Self-Harm OR DSH OR Non-Suicidal Self Injur* OR Self-Destruct* OR Self-Mutilat* OR Parasuicide OR Self-Poison* OR Automutilation
AND	
Setting terms	Psychiatr* OR Mental Health OR Institution* OR Psychiatric Nursing

performed on articles deemed eligible for inclusion in order to identify other potentially relevant research. We also contacted researchers with expertise in this area and asked them to identify any other potentially relevant articles missed in our original database searches. Title and full-text screening were conducted by RG. Abstract screening was performed by RG and AD, who each screened a proportion of retained abstracts. Where there was uncertainty about the eligibility of articles, a decision about inclusion or exclusion was reached through discussion with the research team.

Data collection process

Study quality of eligible articles was assessed by RG using the Mixed Methods Appraisal Tool (MMAT; Hong *et al*. 2018). This tool is suitable for assessing the quality of both quantitative and qualitative research. Pilot testing has revealed that the MMAT is an efficient tool for assessing the quality of research and has good inter-rater reliability (Pace *et al*. 2012). Studies were not excluded based on quality. The following data were extracted from eligible articles: citation details; country of origin; study aims; study design; population and setting; method of allocation to intervention/control; intervention details; outcomes and methods of analysis; and results. Data extraction forms were based on templates recommended by NICE (National Institute for Health and Care Excellence 2012).

Synthesis of results

Evidence from studies meeting the review criteria were combined following the principles for Narrative Synthesis described by Popay *et al*. (2006). The integration of evidence was also informed by the use of a results-based convergent synthesis design, as described by Noyes *et al*. (2019). Data from included studies were extracted, analysed, quality assessed, and presented separately, before being combined. Tabulation was used to identify salient features of the data extracted from included studies. Initial tabulation was performed by the first author (RG), before being subsequently checked and refined by the wider research team (AD, TM, SM, and JB).

RESULTS

Figure 1 shows the flow of studies through the screening process. A total of seven studies met the criteria for inclusion in this systematic review. Returned studies were conducted in Australia (Berntsen *et al*. 2011), Canada (Katz *et al*. 2004), the UK (Hancock-Johnson *et al*. 2019; Reen *et al*. 2020), and the USA (Loveridge 2013; McDonell *et al*. 2010; Tebbett-Mock *et al*. 2020). Study details are presented in Table 2.

Study aims

Most studies in this review had the broad aim of reducing overall rates of self-harm by children in inpatient units or the proportion of children engaging in self-harm in these settings. The exception to this was the study by Loveridge (2013), the stated aim of which was to address the hypothesis that safe kits '. . .could be a tool to prevent [the] escalation of care' when children self-harm in mental health inpatient settings (Loveridge 2013, p. 34). In addition to investigating approaches to self-harm reduction, some studies also examined the effects of interventions on other outcomes, such as aggression and the use of seclusion (Berntsen *et al*. 2011). For the purposes of this review, we have focused on study findings that relate specifically to self-harm reduction.

Study designs

All studies used quantitative designs. Using the algorithm included in the MMAT (Hong *et al*. 2018), all included studies were categorized as quantitative non-randomized studies, apart from Berntsen *et al*. (2011), which used a quantitative descriptive design.

Sampling

Study sample sizes ranged from $N = 22$ to $N = 801$ ($M = 234.9$; $SD = 269.2$). Participants were all patients admitted to child and adolescent mental health service (CAMHS) inpatient units. Most participants were female (72%). Although ethnicity data were not reported in all studies, available data suggest that the ethnicity of most participants was described as white.

Study settings

Although all studies were conducted in CAMHS inpatient units, there was some variation in the terminology used to describe these settings, with some units described as 'low secure' (Hancock-Johnson *et al*. 2019), 'long-term' (McDonell *et al*. 2010), or 'co-educational, acute' (Tebbett-Mock *et al*. 2020) inpatient

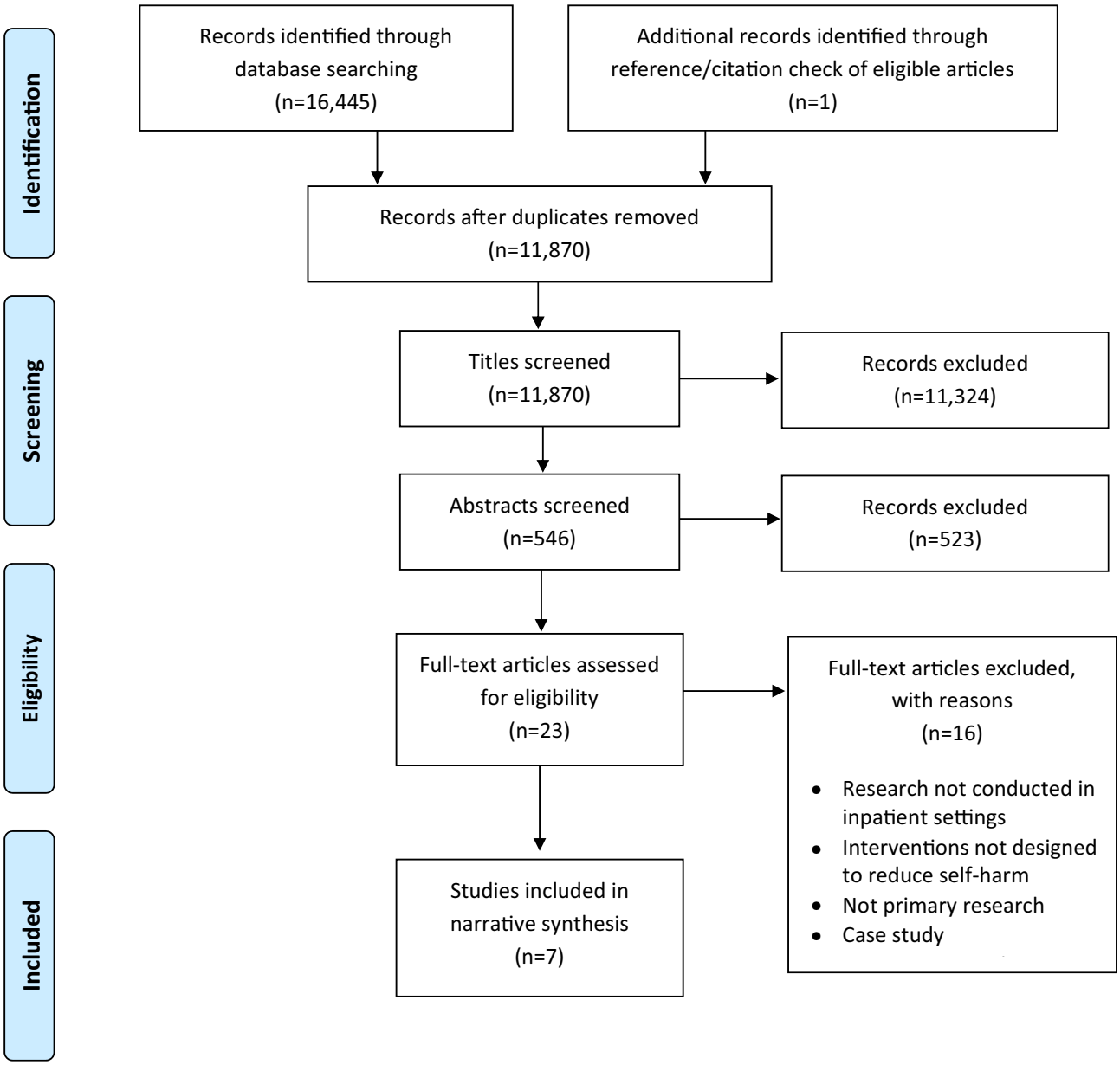

FIG. 1 Study flow chart.

units. All studies were conducted in a single CAMHS inpatient unit, apart from Katz *et al*. (2004), which took place across two units.

Interventions designed to reduce self-harm

Types of intervention evaluated in the studies are presented in Table 3. Five studies (Berntsen *et al*. 2011; Hancock-Johnson *et al*. 2019; Katz *et al*. 2004; McDonell *et al*. 2010; Tebbett-Mock *et al*. 2020) used interventions informed by Dialectical Behaviour Therapy (DBT; Linehan 1993), a form of cognitive behavioural therapy that aims to directly address suicidal and self-injurious behaviours, which has been adapted for use with adolescents (Miller *et al*. 2006). DBT interventions were delivered in a variety of forms, including as individual psychotherapy, family therapy, skills groups, staff training, as the basis of a therapeutic milieu, or in some combination of these modalities. Two studies used interventions that were not related to DBT. Loveridge (2013) focused on the use of a safe kit, which consisted of a box that patients were encouraged

TABLE 2 *Study details*

Authors	Country	Aims and design	Sample characteristics	Setting	Intervention	Control	Measures	Findings
Berntsen *et al.* (2011)	Australia	Quantitative descriptive study of the association between intervention and self-harm incidents	- *N* = 294 - 61% female - Mean age 13 years (SD = 2) - 34 (12%) participants harmed themselves whilst on ward - Study inclusion criteria: (1) admitted to the unit during study period (January 2006–August 2009)	Eight-bed paediatric mental health ward for children aged 6–16 years	- Staff training on seclusion and restraint - Staff training on DBT - Behavioural programme where patients are given more freedom for safe and appropriate behaviour - Patients offered five sessions of structured exercise per week	N/A	Self-harm data collected from routine adverse incident reports	Total self-harm incidents reduced from 60 in 2006 to 20 in 2008
Hancock-Johnson *et al.* (2019)	UK	Retrospective non-randomized quantitative study designed to assess the effects of a single DBT training cycle on frequency of deliberate self-harm in adolescent inpatients	- *N* = 22 - 82% female - 73% white British - Mean age 16 years (range 13–17) - Study inclusion criteria: (1) Admitted to the unit, (2) suicidal or parasuicidal urges or attempts, (3) traits consistent with criteria for borderline personality disorder, and (4) a sole or comorbid diagnosis of mixed disorders of conduct and emotion	Low-secure adolescent unit for people with challenging mental health needs	- DBT skills training consisting of four core modules: mindfulness, distress tolerance, interpersonal effectiveness, and emotion regulation - A 'Walking the Middle Path' module, focusing on relationships between patients and caregivers, was also introduced	N/A	Frequency of engaging in deliberate self-harm for at least 4 weeks pre- and post-intervention was extracted from participants' clinical records. HoNOSCA scores were also assessed pre- and post-intervention for some participants (n = 17)	Statistically significant reduction in overall frequency of deliberate self-harm incidents from pre- (M = 6.45; SD=11.30) to post-intervention (M = 2; SD=3.48), and intervention (Z=−2.433; p = 0.015) with medium effect size (r = 0.37)
Katz *et al.* (2004)	Canada	Quantitative non-randomized study to evaluate the feasibility of DBT implementation in an adolescent inpatient unit, and to gather preliminary effectiveness data	- *N* = 62 - 84% female - 73% white - Mean age 15 years (range 14–17) - Study inclusion criteria: (1) admission following suicide attempt or suicidal ideation, and (2) patient agreed to stay	Two separate general child and adolescent psychiatric inpatient units, one using a modified DBT treatment programme, the other oriented towards a	Admission to an inpatient unit and access to a 2-week DBT skills training programme, consisting of: - 10 daily, manualized DBT skills training sessions - Twice weekly individual DBT psychotherapy sessions	Admission to an inpatient unit with access to: - Daily psychodynamic psychotherapy group - Individual psychodynamic		

(*Continued*)

TABLE 2 (Continued)

Authors	Country	Aims and design	Sample characteristics	Setting	Intervention	Control	Measures	Findings
		for DBT compared to treatment as usual in this setting	in hospital for brief treatment - Psychodynamic-oriented milieu	psychodynamic treatment model. Participants were allocated to one of the two units based on bed availability Parasuicidal behaviours in the year following discharge assessed using the LPC	- Participation in a DBT-informed milieu (with DBT-trained nursing staff) Medium effect sizes found for inpatient treatment on future parasuicidal behaviour for both intervention (d = 0.63) and control (d = 0.73) groups	psy-chotherapy at least once per week		
Loveridge (2013)	USA	Quantitative non-randomized study to investigate the hypothesis that use of safe kits would decrease the 'escalation of care' that can occur when adolescents self-harm in inpatient settings	- N = 50 - n = 39 completed the study and n = 23 included in the final analysis - Participants who completed the study were 72% female, 87% white, and aged 13–18 years - Study inclusion criteria: (1) admitted to the inpatient unit during study period, (2) aged 13–18, and (3) a history of self-injurious behaviour in the previous 6 months	Inpatient child and adolescent psychiatric unit	Participants were given a 'safe kit' at the point of admission, a box which they were encouraged to decorate and fill with items such as stress balls, journals to record feelings, stuffed animals, temporary tattoos, bubbles, and tactile toys	N/A	DSHI-9 was administered at the point of admission and at an unspecified time later in the study. The Adolescent Safe Kit Usage Questionnaire, a bespoke measure designed for this study, collected demographic data and data on safe kit use	No correlation found between frequency of self-harm and the use of safe kits. Amongst participants included in final analysis (n = 23), 69.5% used the safe kit frequently (>5 times); and 60.9% strongly agreed that the safe kit use reduced urges to self-harm
McDonell *et al.* (2010)	USA	Quantitative non-randomized study to evaluate whether DBT was associated with reduced levels of non-suicidal self-injurious	- N = 210 (n = 106 DBT participants and n = 104 historical controls) - Mean age of DBT participants was 16 years (SD = 1.20; range = 12–17)	Long-term adolescent psychiatric inpatient unit.	DBT participants assigned to one of three groups based on clinical judgement: - (1) 'milieu DBT' (milieu only) - (2) 'group DBT' (milieu + DBT skills group)	Patients admitted to the unit prior to implementation of DBT intervention acted as historical controls	NSIB data gathered from 'hospital quality assurance databases'	DBT participants had lower rates of NSIB across the 12 months of the study (M = 0.59, CI = 0.49–0.69) compared to historical controls

(*Continued*)

TABLE 2 (Continued)

Authors	Country	Aims and design	Sample characteristics	Setting	Intervention	Control	Measures	Findings
		behaviour. DBT participant outcomes were compared to historical controls	- Mean age of historical controls was 16 years (SD = 1.1; range = 12–15) - 58% of overall sample female - Inclusion criteria for DBT participants: Admission to unit during the study period		- (3) 'full DBT' (milieu + skills group + individual DBT)			(M = 0.75, CI = 0.64–0.86)
Reen *et al.* (2020)	UK	Quantitative non-randomized study using an interrupted time-series analysis to evaluate environmental changes to an adolescent inpatient unit aimed at (1) reducing the overall rates of self-harm on the ward and (2) reducing the proportion of patients self-harming on the ward	- *N* = 205 - Mean age 16 years (SD 1.48; range = 12–18) - 85% female - Inclusion criteria: Admission to the ward during study period - *n* = 124 present on the ward pre-intervention; *n* = 71 post-intervention; and *n* = 10 pre- and post-intervention	12-bed child and adolescent psychiatric inpatient ward.	- The addition of a regular twilight shift for nursing staff (3pm–11pm; Sun–Thu) - One month later, a programme of structured evening activities was introduced (e.g. pet groups, drama and games groups, podcasting sessions)	N/A	Self-harm data collected through routine incident reporting procedures	Rates of self-harm dropped from pre- (M = 5.49; SD=3.47; range = 1.07–13.61) to post-intervention (M = 3.23; SD = 2.27; range = 0–9.20). Intervention had significant effect on proportion of people self-harming but not on overall rates of self-harm
Tebbett-Mock *et al.* (2020)	USA	Quantitative non-randomized study that aimed to test the hypothesis that participants who received DBT would have fewer incidents of non-suicidal self-injury	- *N* = 801 - *n* = 425 were admitted to the unit in the 8 months following implementation of DBT on the unit - *n* = 376 historical controls admitted prior to DBT	Co-educational, acute care psychiatric inpatient unit	- Initial intensive DBT training for staff - Strategic planning day facilitated by DBT trainers. - DBT milieu treatment - Nine 1-hour DBT skills group per week. (5) Intense	- Milieu treatment comprising a token economy system - CBT skills group (3–4 sessions per week)	Data on self-injurious behaviour were extracted from participants' medical records and the total number of incidents per	Self-injurious behaviour was lower in DBT group (M = 0.04; SD = 0.27; median = 0; range = 0–3) compared to TAU (M = 0.09; SD = 0.39;

(*Continued*)

TABLE 2 (Continued)

Authors	Country	Aims and design	Sample characteristics	Setting	Intervention	Control	Measures	Findings
		compared to historical controls who received TAU	implementation received TAU - DBT participants had a mean age of 16 years (SD = 1.44; range = 12–17.92), were 66% female, and 41% white - Historical controls had a mean age of 16 years (SD = 1.54; range = 12–17.92), were 63% female, and 53% white - Inclusion criteria: Admission to the ward during study period		psychotherapy (≈ three individual sessions and 1–2 family collateral therapy sessions per week) - Ongoing staff supervision and training in DBT implementation - Additional therapeutic and leisure groups (e.g. pottery making, pet therapy)	- 10 activity groups per week - Intensive psychotherapy (≈ 3 individual sessions and 1–2 family therapy sessions per week)	patient was calculated.	median = 0, range = 0–4). Authors report a small effect size (r = 0.07)

Abbreviations: CBT, Cognitive Behavioural Therapy; DBT, Dialectical Behaviour Therapy; DSHI, Deliberate Self-Harm Inventory; HoNOSCA, Health of the Nation Outcome Scales for Children and Adolescents; LPC, Lifetime Parasuicide Count; TAU, treatment as usual.

TABLE 3 *Intervention components*

	Dialectical Behaviour Therapy-based interventions					Other interventions				
	Family therapy	Individual therapy	Milieu	Staff training/ supervision	Skills group	Behavioural programme	Structured exercise	Safe kit	Twilight nursing shift (3pm–11pm)	Structured activities
Berntsen *et al.* (2011)				✓		✓	✓			
Hancock-Johnson *et al.* (2019)					✓					
Katz *et al.* (2004)		✓	✓		✓					
Loveridge (2013)								✓		
McDonell *et al.* (2010)		✓	✓		✓					
Reen *et al.* (2020)									✓	✓
Tebbett-Mock *et al.* (2020)	✓	✓	✓	✓	✓					✓

✓ indicates that a component was included in the intervention.

to decorate and then fill with personally meaningful objects (e.g. toys, stress balls, bubbles). Reen *et al.* (2020) evaluated the effects of changes to the ward environment on overall rates and proportion of patients engaging in self-harm, including the addition of a 'Twilight shift' for nursing staff and providing structured evening activities. Of the seven studies, six evaluated interventions aimed at reducing self-harm within the ward environment, while one study (Katz *et al.* 2004) focused on longer-term self-harm reduction and measured outcomes post-discharge. It was notable that most of the interventions evaluated comprised multiple elements. Aside from one article, the articles did not discuss the proposed mechanisms through which interventions would lead to a reduction in self-harm. The exception to this was Reen *et al.* (2020), who identified a lack of clarity about mechanisms as a limitation of their study. The study by Reen *et al.* (2020) was also the only one that described involving people with lived experience of self-harm in the process of intervention development.

Controls

Of the three studies that included some form of control group, two studies used historical controls comprising patients admitted before the intervention commenced (McDonell *et al.* 2010; Tebbett-Mock *et al.* 2020), and participants in one study were non-randomly allocated to intervention or control groups based on bed availability (Katz *et al.* 2004).

Measures

The majority of studies (Berntsen *et al.* 2011; Hancock-Johnson *et al.* 2019; McDonell *et al.* 2010; Reen *et al.* 2020; Tebbett-Mock *et al.* 2020) used routine incident data extracted from patients' medical records to evaluate the association between interventions and rates of self-harm. Additionally, Hancock-Johnson *et al.* (2019) used the Health of the Nation Outcome Scales for Children and Adolescents (HoNOSCA; Gowers *et al.* 1999) to collect information about pre- and post-intervention rates of self-harm. Rather than collect routine incident data, Katz *et al.* (2004) used the Lifetime Parasuicide Count LPC (Linehan *et al.*, unpublished instrument 1997) and Loveridge (2013) used the Deliberate Self-Harm Inventory (DSHI-9; Lundh *et al.* 2007) along with the Adolescent Safe Kit Usage Questionnaire (Loveridge, unpublished instrument 2013).

Quality

The results of the MMAT (Hong *et al.* 2018) quality assessments are presented in Table 4. MMAT screening questions indicated that the studies included in this review were generally of low methodological quality. All seven studies used non-randomized designs. Most studies ($n = 6$) were conducted at one site, which could limit the generalizability of findings. The appropriateness of study outcome measures was often unclear. Studies generally collected routine incident data ($n = 5$) or used unpublished instruments ($n = 2$).

TABLE 4 *Results of MMAT quality assessments*

	3. Quantitative non-randomized					4. Quantitative descriptive				
	3.1 Are the participants representative of the target population?	3.2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?	3.3. Are there complete outcome data?	3.4. Are the confounders accounted for in the design and analysis?	3.5. During the study period, is the intervention administered (or exposure occurred) as intended?	4.1. Is the sampling strategy relevant to address the research question?	4.2. Is the sample representative of the target population?	4.3. Are the measurements appropriate?	4.4. Is the risk of non-response bias low?	4.5. Is the statistical analysis appropriate to answer the research question?
Berntsen *et al.* (2011)	N/A	N/A	N/A	N/A	N/A	✔	?	✔	✔	X
Hancock-Johnson *et al.* (2019)	✔	?	X	X	✔	N/A	N/A	N/A	N/A	N/A
Katz *et al.* (2004)	✔	X	✔	X	✔	N/A	N/A	N/A	N/A	N/A
Loveridge (2013)	✔	X	X	X	✔	N/A	N/A	N/A	N/A	N/A
McDonell *et al.* (2010)	✔	X	X	X	✔	N/A	N/A	N/A	N/A	N/A
Reen *et al.* (2020)	✔	X	✔	✔	✔	N/A	N/A	N/A	N/A	N/A
Tebbett-Mock *et al.* (2020)	✔	X	✔	X	✔	N/A	N/A	N/A	N/A	N/A

✔, Yes; X, No; ?, Can't tell; N/A, Not applicable.

Incomplete outcome data were also an issue for a number of studies. The study conducted by Loveridge (2013), for example, had a total sample size of $N = 50$, but just 39 participants completed the study and, of those, only 23 participants were included in the final analysis. Similarly, data were missing for 53% of historical controls in the study conducted by McDonell *et al*. (2010). Interventions appear to have been delivered as intended in all studies, but the absence of intervention fidelity measures means that it is not possible to be certain of this.

Summary of study findings

Three studies reported that DBT-based interventions led to significant reductions in rates of self-harm (Hancock-Johnson *et al*. 2019; McDonell *et al*. 2010; Tebbett-Mock *et al*. 2020). Katz *et al*. (2004) reported significant reductions in parasuicidal behaviour at 1-year follow up in both the DBT group and the psychodynamically informed control group. Berntsen *et al*. (2011) reported a reduction in the aggregate number of self-harm incidents over the course of the study. Berntsen *et al*. (2011), however, did not report beta values for the self-harm regression line, although these were reported for other outcomes evaluated in the study (incidents of aggression and use of seclusion). The reasons for this were not stated. Reen *et al*. (2020) found that environmental changes to the ward did not lead to a significant reduction in overall rates of self-harm incidents but that there was a significant reduction in the proportion of patients engaging in self-harm. The authors explain that, although the overall proportion of patients engaging in self-harm reduced after the intervention was introduced, rates of self-harm actually increased for a small number of patients. Loveridge (2013) did not find any correlation between safe kit use and frequency of self-harm. The majority of participants (60.9%), however, reported that safe kit use reduced the urge to self-harm.

DISCUSSION

This systematic review aimed to identify and synthesize research into alternatives to restrictive practices for children who self-harm in mental health inpatient settings. We also aimed to establish what evidence exists to support the use of these interventions in clinical practice. Only seven articles met inclusion criteria for this review, which confirms the view of Valenkamp *et al*. (2014) that reducing restrictive practices in CAMHS inpatient settings is an underresearched area. Problems created by limited evidence are compounded by several other issues. These include the fact that studies conducted in this area are generally of low methodological quality, describe heterogeneous interventions with poorly specified mechanisms of change, have insufficient involvement from key stakeholders, and often lack valid and reliable measures of outcome.

Most studies included in this review aimed to evaluate interventions that were informed by Dialectical Behaviour Therapy (DBT; Linehan 1993). The exact nature of the interventions described, however, varied considerably. DBT-informed interventions ranged from individual psychotherapy, family therapy, DBT skills groups, staff training, adaptations to the ward environment, and changes to ward milieu. Given the diversity of approaches described, the extent to which these interventions can be considered homogenous or comparable is, in our view, questionable.

A common feature of the interventions included in this review was that they comprised multiple elements. In the study conducted by Tebbett-Mock *et al*. (2020), for example, which aimed to evaluate a DBT intervention, participants in the treatment group were offered individual therapy, family therapy, access to a DBT milieu, a DBT skills group, and structured activities. In addition, staff at the unit were provided with training and ongoing supervision in the use of DBT. This makes it difficult to discern which, if any, of these components was responsible for the observed reduction in self-harm amongst participants. Similarly, Berntsen *et al*. (2011) evaluated an intervention comprising training in DBT for staff, a behavioural programme that aimed to reward patients for behaviour deemed 'appropriate', and access to five sessions of structured exercise each week. These changes were introduced to the ward at the same time as changes to ward leadership and staffing numbers. Because many of the interventions contained multiple elements, it is difficult to determine which, if any, of the included components are essential to the effectiveness of the intervention.

Related to the problem that the effective ingredients of interventions were often unclear is the issue of the interventions' underlying theoretical assumptions and putative mechanisms of change. Aside from the study by Reen *et al*. (2020), which acknowledged that their intervention's mechanisms were unknown, there was very little discussion in any of the included studies regarding *how* the proposed interventions might lead to a reduction in self-harm. Guidelines for the development of complex interventions are clear that

researchers should have a good theoretical understanding of the mechanisms through which interventions exert their effects (Craig *et al*. 2008). Since many of the studies in this review described DBT-informed interventions, study authors might have assumed that the intervention's theoretical assumptions and mechanisms of change had been adequately described. While it is true that the mechanisms of change in DBT have been explored elsewhere (Lynch, Chapman *et al*. 2006; Rudge *et al*. 2020), a recent review has suggested that the standard for what is considered a mechanism for psychotherapeutic interventions should be raised considerably (Carey *et al*. 2020).

Most studies included in this review did not appear to involve people with lived experience of using CAMHS inpatient services either as part of the study team or in designing the interventions tested. The exception to this was the study conducted by Reen *et al*. (2020), who described co-designing the intervention and making iterative changes to how it was implemented based on staff and patient feedback. There is growing recognition of the importance that participatory approaches can play in improving the quality and relevance of research involving children and young people (Hawton *et al*. 2015; Larsson *et al*. 2018).

Finally, there appeared to be a lack of consistency across studies in terms of how self-harm outcomes were measured. Most studies relied on the use of either routinely collected data or unvalidated and bespoke outcome measures. While there are some advantages to the use of routinely collected data, errors and biases – such as underreporting and misclassification – can frequently reduce the validity of findings (Hemkens *et al*. 2016). Progress in the area of reducing rates and prevalence of self-harm amongst children in inpatient settings could be accelerated by using standardized outcome measures that permit comparisons between interventions to determine their relative effectiveness. A number of valid and reliable tools are available to measure outcomes relating to self-harm (Latimer *et al*. 2013), and future research in this area should consider incorporating these. Additionally, the findings of a recent qualitative study have challenged the view that less frequent self-harming is necessarily the most important criteria for assessing improvement in people who self-harm (Owens *et al*. 2020). Study participants highlighted severity and type of self-harm as important factors to consider. Other potential indicators of improvements, which move beyond self-harm itself, were also highlighted by participants. These included an increased ability to perform activities of daily living and greater levels of social participation. Future research should carefully consider the preferences of children who self-harm when considering what outcomes to measure.

STRENGTHS AND LIMITATIONS OF THIS REVIEW

This review aimed to systematically review the available literature to identify effective non-restrictive interventions designed to reduce self-harm amongst children in CAMHS inpatient settings. It is possible that relevant research was inappropriately excluded or missed during the review process. Our search terms, however, were deliberately kept broad in order to increase the likelihood of capturing relevant articles. Consequently, a large number of records were screened in the process of conducting this review. We also engaged with researchers with expertise in this area, both in person and via social media, to identify any potentially relevant articles that were not returned through our original database searches. No additional articles were identified through this process. As with all research, pragmatic and resource issues had an impact on conducting this systematic review. To complete the review in a timely manner and within the resources available, a proportion of records returned by our searches were screened separately by two members of the research team (RG and AD). Comparing the screening decisions of separate team members for a sample of returned records could have increased confidence that relevant articles were not excluded inappropriately. The use of the MMAT (Hong *et al*. 2018) to conduct quality appraisals was pre-specified in our review protocol. Given that only quantitative studies were returned from our searches, however, the use of a tool that was designed specifically for quantitative research might have resulted in a more rigorous assessment of study quality. The small number of studies identified reflects the paucity of literature that exists in this area and limits the clinical utility of our review findings.

CLINICAL AND RESEARCH IMPLICATIONS

The lack of evidence-based interventions that avoid the use of restrictive practices for children who self-harm in CAMHS inpatient settings creates challenges for practitioners working with this population. Recent policy documents have clearly indicated that health professionals should aim to reduce and, where possible,

eliminate the use of restrictive practices for children (Department of Health & Social Care 2019; NHS England 2019). Given the current lack of evidence, however, it is currently unclear what alternative approaches should be adopted. One option for health professionals might be to explore the possibility of adapting and implementing non-restrictive interventions for children that have proved effective in other contexts or with other populations. One issue with this approach, however, is lack of clarity about whether interventions developed in other contexts might be effective for children in CAMHS inpatient settings. It is also not clear what interventions might be suitable for use in inpatient settings given the paucity of evidence that exists relating to effective interventions for reducing self-harm for children in any context (Valenkamp *et al*. 2014; Witt *et al*. 2021).

Conducting research in CAMHS settings can be practically, ethically, and methodologically challenging. To minimize the risk of iatrogenic harm and optimize outcomes for children who engage in self-harm in inpatient settings, however, there is an urgent need to develop effective interventions that avoid the use of restrictive practices. In line with best practice guidance for developing complex interventions, the process of intervention development should be theoretically informed with clearly specified and measurable putative mechanisms of change (Craig *et al*. 2008; Hawton *et al*. 2015). While the focus of this review has been on the effectiveness of non-restrictive interventions for children who self-harm, future research should also aim to establish the acceptability of interventions designed for this population (Sekhon *et al*. 2017). Ensuring that intervention development is conducted in collaboration with people who have lived experience of self-harm in CAMHS inpatient settings will also be an important aspect of future research in this area (Hawton *et al*. 2015; Larsson *et al*. 2018).

FUNDING INFORMATION

This project was funded by The Burdett Trust for Nursing.

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