National Institute for Health and Care Excellence

Final

Self-harm: assessment, management and preventing recurrence

[G] Evidence review for risk assessment and formulation

NICE guideline number NG225

Evidence reviews underpinning recommendations 1.5.10 to 1.5.14 and 1.6.1 to 1.6.6 in the NICE guideline

September 2022

Final

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Local commissioners and/or providers have a responsibility to enable the guideline to be applied when individual health professionals and their patients or service users wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with compliance with those duties.

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Risk assessment and formulation

Review question

What are the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed?

Introduction

Risk assessment is commonly used as part of the management of self-harm to assess the likelihood of repeat self-harm or suicide. It is also sometimes used by both specialist and non-specialist staff in order to determine access to treatment, hospitalisation, or other measures such as observation. Risk formulation describes the process where risk factors are drawn together in order to construct a meaningful narrative that will inform a treatment plan. On the one hand, assessment of risk provides necessary information vital to the recovery of a person who has self-harmed. On the other hand, it has been suggested than an overreliance on risk assessment to decide the management of self-harm can be misleading. The aim of this review is to identify the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed.

Summary of the protocol

See Table 1 for a summary of the Population, Intervention, Comparison and Outcome (PICO) characteristics of this review.

Table 1: Summary of the protocol (PICO table)

Population	Inclusion: • All people who have self-harmed, including those with a mental health problem, neurodevelopmental disorder or a learning disability, who have presented to a non-specialist or specialist setting. Exclusion: • People displaying repetitive stereotypical self-injurious behaviour, for example head-banging in people with a significant learning disability
Intervention	• Risk assessment (label people as low/ medium/ high risk; for example, using check lists, structured clinical judgement, risk scoring, computer-aided risk assessment) + risk formulation (take into account all different risks in person when formulating a management plan) • Risk assessment (label people as low/ medium/ high risk; for example, using check lists, structured clinical judgement, risk scoring, computer-aided risk assessment) alone • No risk assessment (or formulation)

Comparator	• Each other
Outcome	**Critical** • Self-harm repetition (for example, self-poisoning or self-cutting) • Service user satisfaction (dignity, compassion and respect) • Suicide **Important** • Quality of life • Distress • Service utilisation (voluntary/compulsory)

For further details, see the review protocol in appendix A.

Methods and process

A modified version of the GRADE approach to rate the certainty of evidence in systematic reviews was used as part of a pilot project undertaken by NICE. Instead of using predefined clinical decision/minimal important difference (MID) thresholds to assess imprecision in GRADE tables, imprecision was assessed qualitatively during committee discussions. Other than this modification, GRADE was used to assess the quality of evidence for the selected outcomes and this evidence review developed using the methods and process described in Developing NICE guidelines: the manual. Methods specific to this review question are described in the review protocol in appendix A and the methods document (supplementary document 1).

Declarations of interest were recorded according to NICE's conflicts of interest policy.

Effectiveness evidence

Included studies

Two studies were included in this review. Both were non-randomised prospective cohort studies (Kapur 2005, Murphy 2011).

These included studies are summarised in Table 2.

Both studies were conducted in a UK setting and included individuals presenting with an episode of self-harm (Kapur 2005, Murphy 2011).

One study compared emergency department staff assessment with mental health staff assessment (Kapur 2005). One study compared mental health nurse assessment with psychiatrist assessment (Murphy 2011).

Please note that the included studies do not meet the inclusion criteria, in the sense that there were no studies that compared risk assessment (RA) plus risk formulation with RA

alone or no RA, and no studies comparing RA alone with no RA. Instead, the evidence included were from studies comparing RAs conducted by different professionals, which may have resulted in differences in risk formulation. These studies were included because they were the best evidence available.

See the literature search strategy in appendix B and study selection flow chart in appendix C.

Excluded studies

Studies not included in this review are listed, and reasons for their exclusion are provided, in appendix J.

Summary of included studies

Summaries of the studies that were included in this review are presented in Table 2.

Table 2: Summary of included studies

Study	Population	Intervention	Comparison	Outcomes
Kapur 2005 Cohort study UK	N=7612 people aged ≥16 years who presented with self-harm in 1997-2001 at one of four hospitals in Manchester and Salford. • **Emergency department staff assessments:** n=4879 No demographic details reported by study group • **Mental health staff assessments:** n=3828 No demographic details reported by study group	Emergency department staff assessments. Staff completed comprehensive assessment forms (which included demographic items as well as details of the self-harm episode, past history, and current mental state).	Mental health staff assessment, no detail reported. Staff completed comprehensive assessment forms (which included demographic items as well as details of the self-harm episode, past history, and current mental state).	• Repeat self-harm (12 months)
Murphy 2011 Prospective cohort study UK	N=3491 consecutive hospital presentations of self-harm 2002 to 2006 by individuals aged ≥16 years. Study sample: • Median age	Mental Health Nurse assessment. Psychosocial assessment was a comprehensive assessment carried out following self-harm, of which risk assessment is a key component	Psychiatrist assessment. Psychosocial assessment was a comprehensive assessment carried out following self-harm, of which risk assessment is a key component	• Repeat self-harm (12 months)

Study	Population	Intervention	Comparison	Outcomes
	(IQR): 31 (22-41) years • Sex (female/ male): 2060/ 1431 • Ethnicity: Not reported • Co-morbidities: Not reported • Mean duration of self-harm (SD): Not reported • Method of self-harm: self-poisoning n=2997; cutting n=322; combined methods of injury and poisoning n=123; other injuries including asphyxiation n=49 • **Mental health nurse assessment:** N=2626 No demographic details reported by study group • **Psychiatrist assessment:** N=865 No demographic details reported by study group			

MSHR, Manchester Self-Harm Rule; MSPS, modified SAD PERSONS Scale; NA, not applicable; SD, standard deviation; SPS, SAD PERSONS Scale; UK, United Kingdom

See the full evidence tables in appendix D.

Summary of the evidence

One study (Kapur 2015) compared emergency department staff risk assessment with mental health staff risk assessment in people aged ≥16 years who presented to an emergency department with self-harm. The study reported repeat self-harm within 12 months. Overall, risk assessment conducted by mental health staff was no more likely to identify repeat self-harm than risk assessment conducted by emergency department staff (low quality). This was also the case for people categorised as high risk (low quality). People categorised as low or

moderate risk, respectively, by mental health staff were more likely to repeat self-harm within 12 months' follow-up than people categorised as low or moderate risk, respectively, by emergency department staff (low quality).

One study (Murphy 2011) compared risk assessments by psychiatrists and mental health nurses following an episode of self-harm. The study reported repeat self-harm within 12 months. Overall, risk assessment conducted by a psychiatrist was no more likely to identify repeat self-harm than risk assessment conducted by a mental health nurse (moderate quality). This was also the case for people categorised as low or high risk by a psychiatrist or mental health nurse, respectively (moderate quality).

None of the included studies reported the following outcomes: service user satisfaction, suicide, quality of life, distress, or service utilisation.

See appendix F for full GRADE tables.

Economic evidence

Included studies

A single economic search was undertaken for all topics included in the scope of this guideline but no economic studies were identified which were applicable to this review question. See the literature search strategy in appendix B and economic study selection flow chart in appendix G.

Excluded studies

Economic studies not included in the guideline economic literature review are listed, and reasons for their exclusion are provided in appendix J.

Economic model

No economic studies were identified which were applicable to this review question.

Evidence statements

Economic

No economic modelling was undertaken for this review because the committee agreed that other topics were higher priorities for economic evaluation.

The committee's discussion and interpretation of the evidence

The outcomes that matter most

Self-harm repetition, suicide and service user satisfaction were prioritised as critical outcomes by the committee. Self-harm repetition and suicide were prioritised as critical outcomes because they are direct measures of any differential effectiveness associated with the types of risk assessment and captures both fatal and non-fatal self-harm. Service user satisfaction was chosen as a critical outcome due to the importance of delivering services which are centred on the patients' experiences and because patient satisfaction is likely to influence whether the patient engages with the intervention.

Distress, quality of life, and service utilisation (voluntary/compulsory) were considered important outcomes by the committee. Distress was chosen as an important outcome as, given that self-harm is an expression of personal distress, different risk assessment strategies may impact on an individual distress levels in different ways. Quality of life was chosen as an important outcome as it is a multidimensional concept encompassing health-related outcomes beyond those of repeat self-harm or survival. Service utilisation (voluntary/compulsory) was chosen as an important outcome to assess the uptake of services and healthcare resource use during the follow-up period.

The quality of the evidence

When assessed using GRADE methodology the evidence was found to range in quality from low to moderate quality. In all cases, the evidence was downgraded due to risk of bias as per ROBINS-I (for example, due to missing data or lack of blinding or lack of information), and in one study due to indirectness of the population and intervention as well.

There was no evidence identified for the following comparisons: risk assessment + formulation; no risk assessment or formulation. Only different types of risk assessment were compared to each other in the available evidence. Additionally, no evidence was identified for the following outcomes: service user satisfaction, suicide, quality of life, distress, or service utilisation.

Imprecision and clinical importance of effects

The committee discussed the available evidence, which mostly found no benefit when risk assessments were carried out by specific staff. Where findings showed people identified as low or moderate risk by mental health staff were more likely to repeat self-harm within 12 months' follow-up than those identified by emergency department staff, the committee qualitatively discussed the imprecision of the findings and agreed that the 95% confidence intervals were too wide and too close to the line of no effect to give confidence in the effect estimate. The rest of the evidence was already of low quality even before discussions regarding the imprecision. As a result, the recommendations were drafted based on the evidence where possible, but due to concerns over the quality and paucity of evidence, most of the recommendations were drafted using the committee's own experience and expertise.

The committee discussed whether there was a need to develop a research recommendation due to the paucity of the evidence, specifically considering the lack of evidence about machine learning. However, the committee agreed that while new evidence may aid decision-making, it would be unlikely to affect practice, and that the committee's knowledge and experience already allowed recommendations to be made that improved the quality of care. As a result, other review questions were prioritised for research recommendations.

Benefits and harms

There was no evidence on the effectiveness of risk assessment tools and scales, however, the committee discussed benefits and harms based on their extensive experience and knowledge. The committee agreed that the lack of evidence about the efficacy of risk assessment tools as well as the committee's knowledge of the limited validity of tools regarding their ability to accurately predict risk of self-harm meant they should not be used to predict risk of self-harm or suicide. Additionally, the committee discussed the potential harms of using risk assessment tools, based on their experience that tools and scales may enable the withholding of care based on the level of risk of self-harm identified, even if the tool is not accurate in its assessment. The committee agreed based on their experience that denying care on this basis could lead to repeat self-harm, distress, and lower service user

satisfaction, and therefore tools and scales should not be used for this purpose either. Although the committee acknowledged that risk assessment tools can be seen as useful as an adjunct to clinical assessment, they agreed their potential benefit as a guide for performing assessment was outweighed by the harms associated with using them.

The committee also acknowledged the potential harms of risk stratification, such as implying that risk was static instead of dynamic, which could lead to the development of new safety concerns for the person being missed. They also discussed their experience of some treatments not being offered to people who self-harm unless they were identified as being 'high' risk. This could also lead to people not receiving the most appropriate care so the committee agreed that risk stratification should not be used to predict repeat self-harm or suicide, or determine access to treatment and care.

The evidence showed there was no significant difference in repeat self-harm regardless of which health professional carried out the risk assessment. Therefore, the committee agreed there was not enough evidence to specify who should complete a risk assessment. Additionally, the committee had a wider discussion about the utility of risk assessment and agreed that its use by non-specialist staff in particular tended to result in the assessment of 'risk' in isolation of other factors, due to the fact that non-specialist staff do not usually conduct a full psychosocial assessment that takes into account other factors influencing the functions of self-harm for the person. The committee agreed this approach does not allow for nuances related to the person's individual situation to be assessed, potentially leading to provision of inappropriate care. Assessment and care by all staff should therefore be based on a person's needs, vulnerabilities, and safety instead of a generic risk assessment. The committee used their knowledge and experience to outline a number of principles and considerations in the recommendations on assessment and care, to help staff identify pertinent questions to ask in order to assess the person's needs as well as how to support their immediate and long-term psychological and physical safety. The committee discussed what non-specialist staff in particular should do in place of risk assessment, and agreed that they should use their clinical judgment when assessing someone who has self-harmed and refer to the non-specialist assessment recommendations for what to do in the event they are concerned about the person and their safety.

The committee agreed that identifying the safety needs of a person who has self-harmed in isolation of other factors was insufficient to accurately create a comprehensive picture of the person's experience. They agreed that mental health professionals should conduct a risk formulation as part of every psychosocial assessment to place the person's safety considerations in context with their strengths, difficulties, and any coexisting conditions, to develop a meaningful narrative that would inform the care plan. The committee agreed this would specialist staff to provide a higher quality of care.

Cost effectiveness and resource use

The committee noted that no relevant published economic evaluations had been identified and no additional economic analysis had been undertaken on using risk assessment tools and scales to predict future risk of self-harm repetition. They made recommendations to include consideration for the person's needs and safety as standard and reduce reliance on assessment of a person's 'risk' in isolation of other factors. This should result in a reduction in the occurrence of arbitrary thresholds being used to determine access to care. The committee expressed the opinion that there should be no significant resource impact from removing risk stratification because access to services should already be determined by patient needs, not arbitrary risk thresholds. However, the committee acknowledged that risk assessment tools and scales are still used in some settings to determine access to treatment and care. The recommendations might have an initial effect on costs, depending on how services currently assess people who have self-harmed. Changes in practice should result in

lower costs over time because people will receive the care they need rather than have it determined by unreliable risk tools and scales, potentially reducing repeat self-harm.

Recommendations supported by this evidence review

This evidence review supports recommendations 1.6.1-1.6.6. Other evidence supporting these recommendations can be found in the evidence reviews on specialist psychosocial assessment (Evidence report F), non-specialist assessment (Evidence report E), and specialist and non-specialist staff skills (Evidence reports P and R).

References – included studies

Effectiveness

Study
Kapur, Navneet, Cooper, Jayne, Rodway, Cathryn et al. (2005) Predicting the risk of repetition after self harm: Cohort study. BMJ: British Medical Journal 330: 394-395
Murphy, E., Kapur, N., Webb, R. et al. (2011) Risk assessment following self-harm: Comparison of mental health nurses and psychiatrists. Journal of Advanced Nursing 67: 127-139

Economic

No studies were identified that met the inclusion criteria.

Other

Quinlivan L, Cooper J, Meehan D, et al. (2017). Predictive accuracy of risk scales following self-harm: multicentre, prospective cohort study. Br J Psychiatry.210(6):429-436.

Appendices

Appendix A Review protocols

Review protocol for review question: What are the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed?

Table 3: Review protocol

Field	Content
PROSPERO registration number	CRD42020215430
Review title	Risk assessment and formulation
Review question	What are the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed?
Objective	To identify the benefits and harms of a risk assessment and formulation, including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed.
Searches	The following databases will be searched: • Cochrane Central Register of Controlled Trials (CENTRAL) • Cochrane Database of Systematic Reviews (CDSR) • Database of Abstracts of Reviews of Effects (DARE) • Embase • Emcare • International Health Technology Assessment (IHTA) database • MEDLINE & MEDLINE In-Process • PsycINFO Searches will be restricted by: • English language studies • Human studies • Date: 2000 onwards as the current service context is different from pre-2000. Other searches: • Inclusion lists of systematic reviews • Reference lists of included studies

Field	Content
	The full search strategies will be published in the final review.
Condition or domain being studied	All people who have self-harmed, including those with a mental health problem, neurodevelopmental disorder or a learning disability. 'Self-harm' is defined as intentional self-poisoning or injury irrespective of the apparent purpose of the act. This does not include repetitive stereotypical self-injurious behaviour, for example head-banging in people with a significant learning disability.
Population	Inclusion: All people who have self-harmed, including those with a mental health problem, neurodevelopmental disorder or a learning disability, who have presented to a non-specialist or specialist setting. Exclusion: • People displaying repetitive stereotypical self-injurious behaviour, for example head-banging in people with a significant learning disability
Intervention	• Risk assessment (label people as low/medium/high risk; e.g., using check lists, structured clinical judgement, risk scoring, computer-aided risk assessment) + risk formulation (take into account all different risks in person when formulating a management plan) • Risk assessment (label people as low/medium/high risk; e.g., using check lists, structured clinical judgement, risk scoring, computer-aided risk assessment) alone • No risk assessment (or formulation)
Comparator/Reference standard/Confounding factors	Each other
Types of study to be included	• Systematic review of randomised controlled trials (RCTs) or non-randomised comparative prospective and retrospective cohort studies • RCTs • Non-randomised comparative prospective cohort studies with N≥100 per treatment arm • Non-randomised comparative retrospective cohort studies with N≥100 per treatment arm Conference abstracts will not be included. Non-randomised studies should adjust for the following covariates in their analysis when there are differences between groups at baseline: age, gender, previous self-harm, comorbidities (e.g. alcohol and drug misuse, psychiatric illness, physical illness), and current psychiatric treatment. Studies will be downgraded for risk of bias if important covariates are not adequately adjusted for, but will not be excluded for this reason.
Other exclusion criteria	Studies will not be included for the following reasons: Language: • Non-English Publication status: • Abstract only Studies published in languages other than English will not be considered due to time and resource constraints with translation.
Context	Settings: Inclusion:

Field	Content
	• Primary, secondary and tertiary healthcare settings (including pre-hospital care, accident and emergency departments, community pharmacies, inpatient care, and transitions between departments and services) • Home, residential and community settings, such as supported accommodation • Supported care settings • Education and childcare settings • Criminal justice system • Immigration removal centres. • Community mental health services • Inpatient mental health services
Primary outcomes (critical outcomes)	Critical: • Self-harm repetition (for example, self-poisoning or self-cutting) • Service user satisfaction (dignity, respect, compassion) • Suicide
Secondary outcomes (important outcomes)	Important: • Quality of life • Distress • Service utilisation (voluntary/compulsory)
Data extraction (selection and coding)	All references identified by the searches and from other sources will be uploaded into EPPI and de-duplicated. Titles and abstracts of the retrieved citations will be screened to identify studies that potentially meet the inclusion criteria outlined in the review protocol. Dual sifting will be performed on 10% of records; 90% agreement is required. Disagreements will be resolved via discussion between the two reviewers, and consultation with senior staff if necessary. Full versions of the selected studies will be obtained for assessment. Studies that fail to meet the inclusion criteria once the full version has been checked will be excluded at this stage. Each study excluded after checking the full version will be listed, along with the reason for its exclusion. A standardised form will be used to extract data from studies. The following data will be extracted: study details (reference, country where study was carried out, type and dates), participant characteristics, inclusion and exclusion criteria, details of the interventions, setting and follow-up, relevant outcome data, risk of bias and source of funding. One reviewer will extract relevant data into a standardised form, and this will be quality assessed by a senior reviewer.
Risk of bias (quality) assessment	Quality assessment of individual studies will be performed using the following checklists: • ROBIS tool for systematic reviews • Cochrane RoB tool v.2 for RCTs and quasi-RCTs • Cochrane ROBINS-I tool for non-randomised (clinical) controlled trials and cohort studies The quality assessment will be performed by one reviewer and this will be quality assessed by a senior reviewer.
Strategy for data synthesis	Quantitative findings will be formally summarised in the review. Where multiple studies report on the same outcome for the same comparison, meta-analyses will be conducted using Cochrane Review Manager software. A fixed effect meta-analysis will be conducted and data will be presented as risk ratios if possible or odds ratios when required (for example if only available in this form in included studies) for dichotomous

Field	Content
	outcomes, and mean differences or standardised mean differences for continuous outcomes. Heterogeneity in the effect estimates of the individual studies will be assessed using the I^2 statistic. I^2 values of greater than 50% and 80% will be considered as significant and very significant heterogeneity, respectively. Heterogeneity will be explored as appropriate using sensitivity analyses and subgroup analyses based on identified covariates if they have not been adjusted for. If heterogeneity cannot be explained through subgroup analysis then a random effects model will be used for meta-analysis, or the data will not be pooled if the random effects model does not adequately address heterogeneity. The confidence in the findings across all available evidence will be evaluated for each outcome using an adaptation of the 'Grading of Recommendations Assessment, Development and Evaluation (GRADE) toolbox' developed by the international GRADE working group: http://www.gradeworkinggroup.org/
Analysis of sub-groups	Evidence (if data allows) will be stratified by: • Age group: ≥65 years, 18-64 years, 16-17 years, <16 • Type of risk assessment method used: E.g., check lists, structured clinical judgement, risk scoring, computer-aided risk assessment
Type and method of review	Intervention
Language	English
Country	England
Anticipated or actual start date	02/10/2020
Anticipated completion date	26/01/2022
Stage of review at time of this submission	**Review stage** / **Started** / **Completed** Preliminary searches ☐ ☐ Piloting of the study selection process ☐ ☐ Formal screening of search results against eligibility criteria ☐ ☐ Data extraction ☐ ☐ Risk of bias (quality) assessment ☐ ☐ Data analysis ☐ ☐
Named contact	5a. Named contact: National Guideline Alliance 5b Named contact e-mail: selfharm@nice.org.uk 5e Organisational affiliation of the review: National Institute for Health and Care Excellence (NICE) and National Guideline Alliance
Review team members	National Guideline Alliance
Funding sources/sponsor	This systematic review is being completed by the National Guideline Alliance which receives funding from NICE.

Field	Content
Conflicts of interest	All guideline committee members and anyone who has direct input into NICE guidelines (including the evidence review team and expert witnesses) must declare any potential conflicts of interest in line with NICE's code of practice for declaring and dealing with conflicts of interest. Any relevant interests, or changes to interests, will also be declared publicly at the start of each guideline committee meeting. Before each meeting, any potential conflicts of interest will be considered by the guideline committee Chair and a senior member of the development team. Any decisions to exclude a person from all or part of a meeting will be documented. Any changes to a member's declaration of interests will be recorded in the minutes of the meeting. Declarations of interests will be published with the final guideline.
Collaborators	Development of this systematic review will be overseen by an advisory committee who will use the review to inform the development of evidence-based recommendations in line with section 3 of Developing NICE guidelines: the manual. Members of the guideline committee are available on the NICE website: https://www.nice.org.uk/guidance/indevelopment/gid-ng10148.
Other registration details	None
URL for published protocol	https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=215430
Dissemination plans	NICE may use a range of different methods to raise awareness of the guideline. These include standard approaches such as: • notifying registered stakeholders of publication • publicising the guideline through NICE's newsletter and alerts • issuing a press release or briefing as appropriate, posting news articles on the NICE website, using social media channels, and publicising the guideline within NICE.
Keywords	Self-harm, assessment, management, prevention, health care
Details of existing review of same topic by same authors	None
Current review status	Ongoing
Additional information	Not applicable
Details of final publication	www.nice.org.uk

CDSR: Cochrane Database of Systematic Reviews; CENTRAL: Cochrane Central Register of Controlled Trials; GRADE: Grading of Recommendations Assessment, Development and Evaluation; NGA: National Guideline Alliance; NICE: National Institute for Health and Care Excellence; RCT(s): randomised controlled trial(s); RevMan: review manager; RoB: risk of bias; ROBINS-I: Risk Of Bias In Non-randomized Studies - of Interventions

Appendix B Literature search strategies

Literature search strategies for review question: What are the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed?

Clinical

Database(s): MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily – OVID interface
Date of last search: 23rd November 2020

#	searches
1	drug overdose/ or self mutilation/ or self-injurious behavior/ or suicidal ideation/ or suicide, attempted/ or suicide, completed/ or suicide/
2	(auto mutilat* or automutilat* or self cut* or selfcut* or self destruct* or selfdestruct* or self harm* or selfharm* or self immolat* or selfimmolat* or self inflict* or selfinflict* or self injur* or selfinjur* or self mutilat* or selfmutilat* or self poison* or selfpoison* or suicid*).ti,ab.
3	or/1-2
4	((formulation* or risk*) adj2 (assess* or reassess*)).sh,ti,ab. or (risk* adj2 manag*).ti,ab.
5	(risk* adj5 (apprais* or assess* or evaluat* or reassess*) adj7 (checklist* or check list* or index or instrument* or interview* or inventor* or item* or measure*1 or questionnaire* or rate* or rating or scale* or score* or scoring or screen* or subscale* or survey* or test* or tool* or judgement or computer* or artificial intelligence or facebook or machine learning or social media or technolog* or twitter)).ti,ab.
6	(risk* adj2 (checklist* or check list* or index or instrument* or interview* or inventor* or item* or measure*1 or questionnaire* or rate* or rating or scale* or score* or scoring or screen*)).ti,ab.
7	((checklist* or check list* or clinical or index or instrument* or interview* or inventor* or item* or measure*1 or questionnaire* or rate* or rating or scale* or score* or scoring or screen* or subscale* or survey* or test* or tool* or judgement or computer* or artificial intelligence or facebook or machine learning or social media or technolog* or twitter) adj4 (identif* or predict*) adj5 risk*).ti,ab.
8	(clinical adj2 (apprais* or assess* or evaluat* or reassess*) adj5 risk adj5 (harm* or self harm* or suicid*)).ti,ab.
9	(artificial intelligence or machine learning or screening technolog* or (assess* adj3 (facebook or social media or twitter) adj3 account*)).ti,ab.
10	((formulat* or synthes* or summari*) adj2 risk*).ti,ab.
11	(((biopsychosocial or bio psychosocial) adj assess*) or ((historical adj2 clinical adj2 risk management scale*) or hcr 20 or hcr20) or (violence risk appraisal guide or vrag)).ti,ab.
12	or/4-11
13	3 and 12

#	searches
14	limit 13 to yr="2000 -current"
15	limit 14 to english language

Database(s): Embase and Emcare – OVID interface
Date of last search: 23rd November 2020

#	searches
1	automutilation/ or exp suicidal behavior/
2	(auto mutilat* or automutilat* or self cut* or selfcut* or self destruct* or selfdestruct* or self harm* or selfharm* or self immolat* or selfimmolat* or self inflict* or selfinflict* or self injur* or selfinjur* or self mutilat* or selfmutilat* or self poison* or selfpoison* or suicid*).ti,ab.
3	or/1-2
4	((formulation* or risk*) adj2 (assess* or reassess*)).sh,ti,ab. or (risk* adj2 manag*).ti,ab.
5	(risk* adj5 (apprais* or assess* or evaluat* or reassess*) adj7 (checklist* or check list* or index or instrument* or interview* or inventor* or item* or measure*1 or questionnaire* or rate* or rating or scale* or score* or scoring or screen* or subscale* or survey* or test* or tool* or judgement or computer* or artificial intelligence or facebook or machine learning or social media or technolog* or twitter)).ti,ab.
6	(risk* adj2 (checklist* or check list* or index or instrument* or interview* or inventor* or item* or measure*1 or questionnaire* or rate* or rating or scale* or score* or scoring or screen*)).ti,ab.
7	((checklist* or check list* or clinical or index or instrument* or interview* or inventor* or item* or measure*1 or questionnaire* or rate* or rating or scale* or score* or scoring or screen* or subscale* or survey* or test* or tool* or judgement or computer* or artificial intelligence or facebook or machine learning or social media or technolog* or twitter) adj4 (identif* or predict*) adj5 risk*).ti,ab.
8	(clinical adj2 (apprais* or assess* or evaluat* or reassess*) adj5 risk adj5 (harm* or self harm* or suicid*)).ti,ab.
9	(artificial intelligence or machine learning or screening technolog* or (assess* adj3 (facebook or social media or twitter) adj3 account*)).ti,ab.
10	((formulat* or synthes* or summari*) adj2 risk*).ti,ab.
11	(((biopsychosocial or bio psychosocial) adj assess*) or ((historical adj2 clinical adj2 risk management scale*) or hcr 20 or hcr20) or (violence risk appraisal guide or vrag)).ti,ab.
12	or/4-11
13	3 and 12
14	limit 13 to yr="2000 -current"
15	limit 14 to english language

Database(s): PsycINFO – OVID interface
Date of last search: 23rd November 2020

#	searches
1	self-injurious behavior/ or self-destructive behavior/ or self-inflicted wounds/ or self-mutilation/ or self-poisoning/ or exp suicide/ or suicidal ideation/
2	(auto mutilat* or automutilat* or self cut* or selfcut* or self destruct* or selfdestruct* or self harm* or selfharm* or self immolat* or selfimmolat* or self inflict* or selfinflict* or self injur* or selfinjur* or self mutilat* or selfmutilat* or self poison* or selfpoison* or suicid*).ti,ab.
3	or/1-2
4	((formulation* or risk*) adj2 (assess* or reassess*)).sh,ti,ab. or (risk* adj2 manag*).ti,ab.
5	(risk* adj5 (apprais* or assess* or evaluat* or reassess*) adj7 (checklist* or check list* or index or instrument* or interview* or inventor* or item* or measure*1 or questionnaire* or rate* or rating or scale* or score* or scoring or screen* or subscale* or survey* or test* or tool* or judgement or computer* or artificial intelligence or facebook or machine learning or social media or technolog* or twitter)).ti,ab.
6	(risk* adj2 (checklist* or check list* or index or instrument* or interview* or inventor* or item* or measure*1 or questionnaire* or rate* or rating or scale* or score* or scoring or screen*)).ti,ab.
7	((checklist* or check list* or clinical or index or instrument* or interview* or inventor* or item* or measure*1 or questionnaire* or rate* or rating or scale* or score* or scoring or screen* or subscale* or survey* or test* or tool* or judgement or computer* or artificial intelligence or facebook or machine learning or social media or technolog* or twitter) adj4 (identif* or predict*) adj5 risk*).ti,ab.
8	(clinical adj2 (apprais* or assess* or evaluat* or reassess*) adj5 risk adj5 (harm* or self harm* or suicid*)).ti,ab.
9	(artificial intelligence or machine learning or screening technolog* or (assess* adj3 (facebook or social media or twitter) adj3 account*)).ti,ab.
10	((formulat* or synthes* or summari*) adj2 risk*).ti,ab.
11	(((biopsychosocial or bio psychosocial) adj assess*) or ((historical adj2 clinical adj2 risk management scale*) or hcr 20 or hcr20) or (violence risk appraisal guide or vrag)).ti,ab.
12	or/4-11
13	3 and 12
14	limit 13 to yr="2000 -current"
15	limit 14 to english language

Database(s): Cochrane Library – Wiley interface
Cochrane Database of Systematic Reviews, Issue 11 of 12, November 2020; Cochrane Central Register of Controlled Trials, Issue 11 of 12, November 2020
Date of last search: 23rd November 2020

#	searches
1	MeSH descriptor: [poisoning] this term only
2	MeSH descriptor: [self-injurious behavior] explode all trees
3	MeSH descriptor: [self mutilation] this term only

#	searches
4	MeSH descriptor: [suicide] this term only
5	MeSH descriptor: [suicidal ideation] this term only
6	MeSH descriptor: [suicide, attempted] this term only
7	MeSH descriptor: [suicide, completed] this term only
8	(automutilat* or "auto mutilat*" or cutt* or (self near/2 cut*) or selfdestruct* or "self destruct*" or selfharm* or "self harm*" or selfimmolat* or "self immolat*" or selfinflict* or "self inflict*" or selfinjur* or "self injur*" or selfmutilat* or "self mutilat*" or selfpoison* or "self poison*" or selfwound* or "self wound*" or suicid*):ti,ab.
9	{or #1-#8}
10	((formulation* or risk*) near/2 (assess* or reassess*)):kw,ti,ab.
11	(risk* near/2 manag*):ti,ab.
12	(risk* near/5 (apprais* or assess* or evaluat* or reassess*) near/7 (checklist* or "check list*" or index or instrument* or interview* or inventor* or item* or measure* or questionnaire* or rate* or rating or scale* or score* or scoring or screen* or subscale* or survey* or test* or tool* or judgement or computer* or "artificial intelligence" or facebook or "machine learning" or "social media" or technolog* or twitter)):ti,ab.
13	(risk* near/2 (checklist* or check list* or index or instrument* or interview* or inventor* or item* or measure* or questionnaire* or rate* or rating or scale* or score* or scoring or screen*)):ti,ab.
14	((checklist* or "check list*" or clinical or index or instrument* or interview* or inventor* or item* or measure* or questionnaire* or rate* or rating or scale* or score* or scoring or screen* or subscale* or survey* or test* or tool* or judgement or computer* or "artificial intelligence" or facebook or "machine learning" or social media or technolog* or twitter) near/4 (identif* or predict*) near/5 risk*):ti,ab.
15	(clinical near/2 (apprais* or assess* or evaluat* or reassess*) near/5 risk near/5 (harm* or self harm* or suicid*)):ti,ab.
16	("artificial intelligence" or "machine learning" or "screening technolog*" or (assess* near/3 (facebook or social media or twitter) near/3 account*)):ti,ab.
17	((formulat* or synthes* or summari*) near/2 risk*):ti,ab.
18	(((biopsychosocial or "bio psychosocial") next assess*) or ((historical near/2 clinical near/2 "risk management scale*") or hcr 20 or hcr20) or ("violence risk appraisal guide" or vrag)):ti,ab.
19	{OR #10-#18}
20	(#9 and #19) with Cochrane Library publication date Between Jan 2000 and Nov 2020

Database(s): CDSR and HTA – CRD interface

Date of last search: 23rd November 2020

#	Searches
1	MeSH descriptor: poisoning IN CDSR, HTA
2	MeSH descriptor: self-injurious behavior EXPLODE ALL TREES IN CDSR, HTA

#	Searches
3	MeSH descriptor: self mutilation IN CDSR, HTA
4	MeSH descriptor: suicide IN CDSR, HTA
5	MeSH descriptor: suicidal ideation IN CDSR, HTA
6	MeSH descriptor: suicide, attempted IN CDSR, HTA
7	MeSH descriptor: suicide, completed IN CDSR, HTA
8	(automutilat* or "auto mutilat*" or cutt* or (self near2 cut*) or selfdestruct* or "self destruct*" or selfharm* or "self harm*" or selfimmolat* or "self immolat*" or selfinflict* or "self inflict*" or selfinjur* or "self injur*" or selfmutilat* or "self mutilat*" or selfpoison* or "self poison*" or selfwound* or "self wound*" or suicid*) IN CDSR, HTA
9	(#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8) from 2000 to 2020

Economic

A global, population based search was undertaken to find for economic evidence covering all parts of the guideline.

Database(s): MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily – OVID interface
Date of last search: 12th August 2021

#	Searches
1	poisoning/ or exp self-injurious behavior/ or self mutilation/ or suicide/ or suicidal ideation/ or suicide, attempted/ or suicide, completed/
2	(automutilat* or auto mutilat* or cutt* or (self adj2 cut*) or selfdestruct* or self destruct* or selfharm* or self harm* or selfimmolat* or self immolat* or selfinflict* or self inflict* or selfinjur* or self injur* or selfmutilat* or self mutilat* or selfpoison* or self poison* or selfwound* or self wound* or suicid*).ti,ab.
3	or/1-2
4	Economics/
5	Value of life/
6	exp "Costs and Cost Analysis"/
7	exp Economics, Hospital/
8	exp Economics, Medical/
9	Economics, Nursing/
10	Economics, Pharmaceutical/
11	exp "Fees and Charges"/
12	exp Budgets/
13	budget*.ti,ab.
14	cost*.ti.
15	(economic* or pharmaco?economic*).ti.
16	(price* or pricing*).ti,ab.
17	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
18	(financ* or fee or fees).ti,ab.
19	(value adj2 (money or monetary)).ti,ab.
20	Quality-Adjusted Life Years/

#	Searches
21	Or/4-20
22	3 and 21
23	limit 22 to yr="2000 -current"

Database(s): Embase and Emcare – OVID interface
Date of last search: 12th August 2021

#	searches
1	automutilation/ or exp suicidal behavior/
2	(auto mutilat* or automutilat* or self cut* or selfcut* or self destruct* or selfdestruct* or self harm* or selfharm* or self immolat* or selfimmolat* or self inflict* or selfinflict* or self injur* or selfinjur* or self mutilat* or selfmutilat* or self poison* or selfpoison* or suicid*).ti,ab.
3	or/1-2
4	health economics/
5	exp economic evaluation/
6	exp health care cost/
7	exp fee/
8	budget/
9	funding/
10	budget*.ti,ab.
11	cost*.ti.
12	(economic* or pharmaco?economic*).ti.
13	(price* or pricing*).ti,ab.
14	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
15	(financ* or fee or fees).ti,ab.
16	(value adj2 (money or monetary)).ti,ab.
17	Quality-Adjusted Life Year/
18	Or/4-17
19	3 and 18
20	limit 19 to yr="2000 -current"

Database(s): Cochrane Library - Wiley interface
Cochrane Central Register of Controlled Trials, Issue 8 of 12, August 2021
Date of last search: 12th August 2021

#	Searches
1	MeSH descriptor: [poisoning] this term only
2	MeSH descriptor: [self-injurious behavior] explode all trees
3	MeSH descriptor: [self mutilation] this term only
4	MeSH descriptor: [suicide] this term only
5	MeSH descriptor: [suicidal ideation] this term only
6	MeSH descriptor: [suicide, attempted] this term only

#	Searches
7	MeSH descriptor: [suicide, completed] this term only
8	(automutilat* or "auto mutilat*" or cutt* or (self near/2 cut*) or selfdestruct* or "self destruct*" or selfharm* or "self harm*" or selfimmolat* or "self immolat*" or selfinflict* or "self inflict*" or selfinjur* or "self injur*" or selfmutilat* or "self mutilat*" or selfpoison* or "self poison*" or selfwound* or "self wound*" or suicid*):ti,ab.
9	{or #1-#8}
10	MeSH descriptor: [Economics] this term only
11	MeSH descriptor: [Value of life] this term only
12	MeSH descriptor: [Costs and Cost Analysis] explode all trees
13	MeSH descriptor: [Economics, Hospital] explode all trees
14	MeSH descriptor: [Economics, Medical] explode all trees
15	MeSH descriptor: [Economics, Nursing] this term only
16	MeSH descriptor: [Economics, Pharmaceutical] this term only
17	MeSH descriptor: [Fees and Charges"]
18	MeSH descriptor: [Budgets] this term only
19	budget*:ti,ab.
20	cost*.ti.
21	(economic* or pharmaco?economic*):ti.
22	(price* or pricing*):ti,ab.
23	(cost* near/2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)):ab.
24	(financ* or fee or fees):ti,ab.
25	(value near/2 (money or monetary)):ti,ab.
26	MeSH descriptor: [Quality-Adjusted Life Years] this term only
27	{OR #10-#26}
28	(#9 and #27) with Cochrane Library publication date Between Jan 2000 and Aug 2021

Database(s): NHS EED and HTA interface

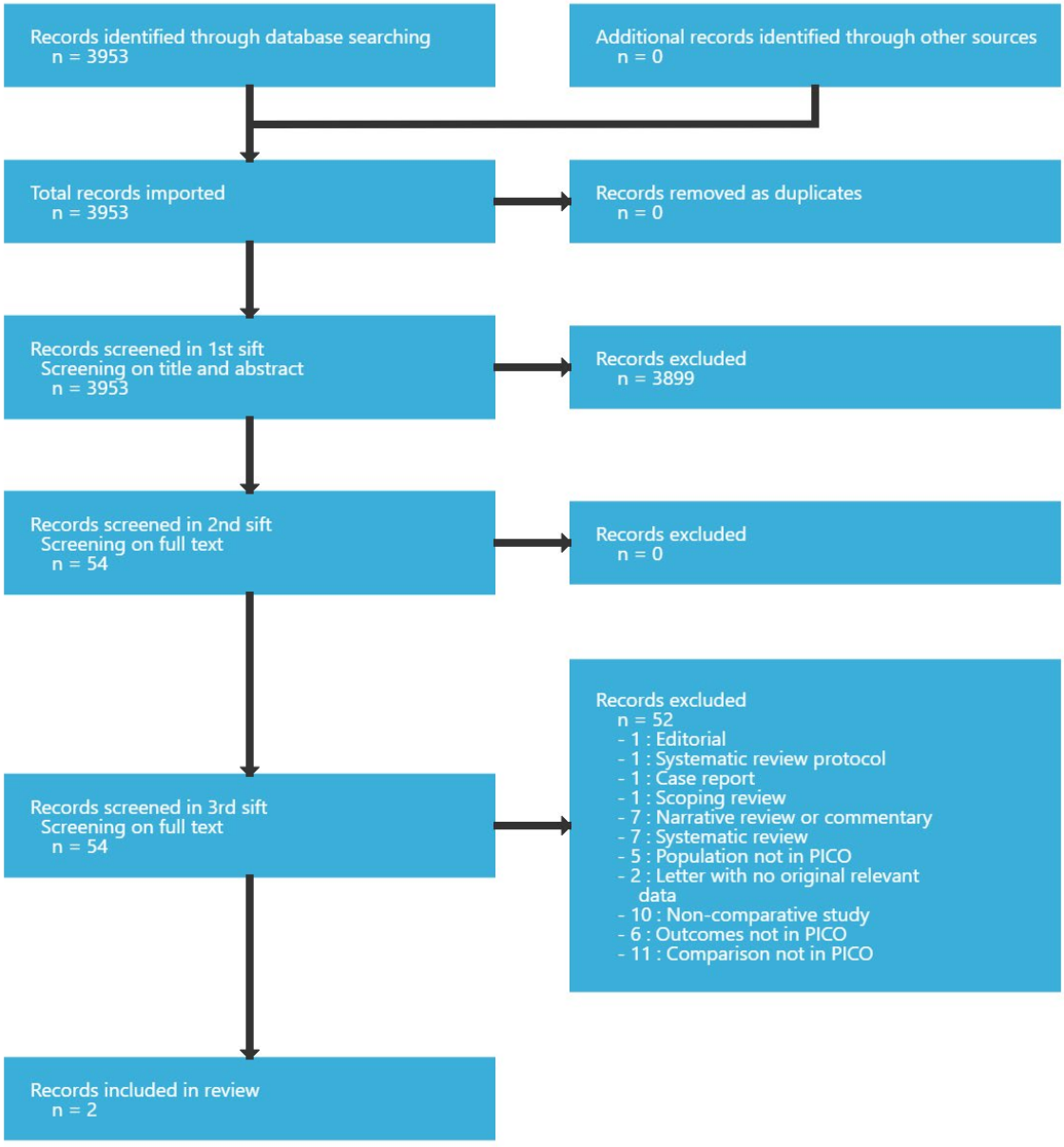
Date of last search: 12th August 2021

#	Searches
1	MeSH descriptor: poisoning IN NHSEED, HTA
2	MeSH descriptor: self-injurious behavior EXPLODE ALL TREES IN NHSEED, HTA
3	MeSH descriptor: self mutilation IN NHSEED, HTA
4	MeSH descriptor: suicide IN NHSEED, HTA
5	MeSH descriptor: suicidal ideation IN NHSEED, HTA
6	MeSH descriptor: suicide, attempted IN NHSEED, HTA
7	MeSH descriptor: suicide, completed IN NHSEED, HTA
8	(automutilat* or "auto mutilat*" or cutt* or (self near2 cut*) or selfdestruct* or "self destruct*" or selfharm* or "self harm*" or selfimmolat* or "self immolat*" or selfinflict* or "self inflict*" or selfinjur* or "self injur*" or selfmutilat* or "self mutilat*" or selfpoison* or "self poison*" or selfwound* or "self wound*" or suicid*) IN NHSEED, HTA
9	(#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8) from 2000 to 2021

Appendix C Clinical evidence study selection

Study selection for review question: What are the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed?

Figure 1: Study selection flow chart



Appendix D Evidence tables

Evidence tables for review question: What are the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed?

Table 4: Evidence tables

Kapur, 2005

Bibliographic Reference	Kapur, Navneet; Cooper, Jayne; Rodway, Cathryn; Kelly, Joanne; Guthrie, Else; Mackway-Jones, Kevin; Predicting the risk of repetition after self harm: Cohort study; BMJ: British Medical Journal; 2005; vol. 330; 394-395

Study details	
Country/ies where study was carried out	UK
Study type	Prospective cohort study
Study dates	1997 to 2001
Inclusion criteria	People aged at least 16 who presented with self-harm in 1997-2001 at one of four hospitals providing emergency care in Manchester and Salford
Exclusion criteria	Not reported
Patient characteristics	**Emergency department staff assessment** • n=4879 • Mean age (SD): Not reported • Sex (female/ male): Not reported • Ethnicity: Not reported • Comorbidities: Not reported • Duration of self-harm: Not reported • Method of self-harm: Not reported • Previous self-harm: Not reported **Mental health staff assessment** • n=3828 • Mean age (SD): Not reported • Sex (female/ male): Not reported • Ethnicity: Not reported • Comorbidities: Not reported • Duration of self-harm: Not reported • Method of self-harm: Not reported • Previous self-harm: Not reported
Intervention(s)/control	• Emergency department staff assessment (no detail reported) • Mental health staff assessment (no detail reported)
Duration of follow-up	12 months

Sources of funding	Manchester Mental Health and Social Care Trust
Sample size	N=7612
Results	Risk of repetition of self-harm within 12 months (repeats/total) Emergency department staff assessments • Total 646/ 4879 • Low 113/ 1624 • Moderate 326/ 2284 • High 207/ 971 Mental health staff assessments • Total 549/ 3828 • Low 165/ 1721 • Moderate 289/ 1738 • High 95/ 369

Critical appraisal

Section	Question	Answer
1. Bias due to confounding	Risk of bias judgement for confounding	Moderate *(Potential for confounding and no information provided on analysis method to control for confounding)*
2. Bias in selection of participants into the study	Risk of bias judgement for selection of participants into the study	Low *(All participants who would have been eligible for the target trial were included in the study and start of follow up and start of intervention coincided)*
3. Bias in classification of interventions	Risk of bias judgement for classification of interventions	Moderate *(Intervention status is well defined, but unclear whether some aspects of intervention assignment were determined retrospectively)*
4. Bias due to deviations from intended interventions	Risk of bias judgement for deviations from intended interventions	Low *(Any deviations from usual practice were unlikely to impact on the outcome)*
5. Bias due to missing data	Risk of bias judgement for missing data	No information
6. Bias in measurement of outcomes	Risk of bias judgement for measurement of outcomes	Moderate *(The outcome measure is only minimally influenced by knowledge of the intervention received by study participants)*

Section	Question	Answer
7. Bias in selection of the reported result	Risk of bias judgement for selection of the reported result	Moderate *(There is no clear evidence of a pre-registered protocol, but outcomes and analyses are consistent with an a priori plan)*
Overall bias	Risk of bias judgement	Moderate *(Moderate risk of bias due to confounding, classification of intervention, measurement of outcomes and selection of the report result)*
	Risk of bias variation across outcomes	None
	Directness	Directly applicable

Murphy, 2011

Bibliographic Reference	Murphy, E.; Kapur, N.; Webb, R.; Cooper, J.; Risk assessment following self-harm: Comparison of mental health nurses and psychiatrists; Journal of Advanced Nursing; 2011; vol. 67; 127-139

Study details	
Country/ies where study was carried out	UK
Study type	Prospective cohort study
Study dates	1 September 2002 to 31 August 2006
Inclusion criteria	All episodes of self-harm by individuals aged 16 years and over that met the case definition: "an act of intentional self-injury or poisoning irrespective of the apparent purpose of the act" including attempts regardless of suicidal intent or medical seriousness, and who had received a psychosocial assessment during the 4-year period
Exclusion criteria	Not reported
Patient characteristics	Total sample • N=3491 • Median age (IQR): 31 (22-41) years • Sex (female/male): 2060/ 1431 • Ethnicity: Not reported • Co-morbidities: Not reported • Mean duration of self-harm (SD): Not reported • Method of self-harm: self-poisoning n=2997; cutting n=322; combined methods of injury and poisoning n=123; other injuries including asphyxiation n=49 Mental health nurse assessment: n=2626 Demographic and clinical characteristics not reported by study group

	Psychiatrist assessment: n=865 Demographic and clinical characteristics not reported by study group
Intervention(s)/control	• Mental health nurse assessment: Psychosocial assessment used is a comprehensive assessment carried out following self-harm, of which risk assessment is a key component • Psychiatrist assessment: Psychosocial assessment used is a comprehensive assessment carried out following self-harm, of which risk assessment is a key component
Duration of follow-up	12 months
Sources of funding	Department of Health
Sample size	N=3491
Results	Repeat self-harm within 12 months Psychiatrist Assessment • Total cases: 93/ 629 • High risk assessment: 11/ 48 • Lower risk assessment: 82/ 581 Mental Health Nurse Assessment • Total cases: 320/ 2087 • High risk assessment: 56/ 227 • Lower risk assessment: 264/ 1860

Critical appraisal

Section	Question	Answer
1. Bias due to confounding	Risk of bias judgement for confounding	Moderate *(Confounding expected and all important confounding domains appropriately measured and controlled for)*
2. Bias in selection of participants into the study	Risk of bias judgement for selection of participants into the study	Low
3. Bias in classification of interventions	Risk of bias judgement for classification of interventions	Low
4. Bias due to deviations from intended interventions	Risk of bias judgement for deviations from intended interventions	Low
5. Bias due to missing data	Risk of bias judgement for missing data	Low
6. Bias in measurement of	Risk of bias judgement for measurement of	Moderate

Section	Question	Answer
outcomes	outcomes	*(Likely that methods of outcome assessment were comparable across groups and measurement of outcome only minimally affected by knowledge of intervention)*
7. Bias in selection of the reported result	Risk of bias judgement for selection of the reported result	Moderate *(Reported outcomes and analysis are clearly defined within the study and no indication of selection of analysis from multiple analyses or subgroups)*
Overall bias	Risk of bias judgement	Moderate *(Moderate risk of bias due to possible bias in measurement of outcomes and selection of reported results)*
	Risk of bias variation across outcomes	None
	Directness	Directly applicable

Appendix E Forest plots

Forest plots for review question: What are the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed?

There are no forest plots for this review as no meta-analyses were conducted.

Appendix F Modified GRADE tables

Modified GRADE tables for review question: What are the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed?

Table 5: Evidence profile for comparison between risk assessment by emergency department staff and risk assessment by mental health staff

Quality assessment						No of patients		Effect			
Number of studies	Design	Risk of bias	Inconsistency	Indirectness	Other considerations	Emergency Department Staff Assessment	Mental Health Staff Assessment	Relative (95% CI)	Absolute	Quality	Importance
Repeat self-harm (follow-up: 12 months)											
1 (Kapur 2005)	observational study	serious[1]	no serious inconsistency	serious indirectness[2]	none	646/4879 (13.2%)	549/3828 (14.3%)	0.92 (0.83, 1.03)	11 fewer per 1,000 (from 24 fewer to 4 more)	LOW	CRITICAL
Repeat self-harm (low[3] risk assessment) (follow-up: 12 months)											
1 (Kapur 2005)	observational study	serious[1]	no serious inconsistency	serious indirectness[2]	none	113/1624 (7.0%)	165/1721 (9.6%)	0.73 (0.58, 0.91)	26 fewer per 1,000 (from 40 fewer to 9 fewer)	LOW	CRITICAL
Repeat self-harm (moderate[3] risk assessment) (follow-up: 12 months)											
1 (Kapur 2005)	observational study	serious[1]	no serious inconsistency	serious indirectness[2]	none	326/2284 (14.3%)	289/1738 (16.6%)	0.86 (0.74, 0.99)	23 fewer per 1,000 (from 43 fewer to 2 fewer)	LOW	CRITICAL
Repeat self-harm (high risk[3] assessment) (follow-up: 12 months)											
1 (Kapur	observational	serious[1]	no serious	serious	none	207/971	95/369	0.83 (0.67,	44 fewer per	LOW	CRITICAL

Quality assessment						No of patients		Effect			
Number of studies	Design	Risk of bias	Inconsistency	Indirectness	Other considerations	Emergency Department Staff Assessment	Mental Health Staff Assessment	Relative (95% CI)	Absolute	Quality	Importance
2005)	study		inconsistency	indirectness[2]		(21.3%)	(25.7%)	1.02)	1,000 (from 85 fewer to 5 more)		

CI = confidence interval; ROBINS-I = Risk Of Bias In Non-randomised Studies - of Interventions; RR = Risk Ratio
1 Serious risk of bias in the evidence contributing to the outcomes
2 Population and intervention is indirect due to dates of recruitment/treatment/presentation (1997-2001).
3 Risk of repeat self-harm within 12 months of index presentation assessed as low, moderate or high risk as assessed by emergency department staff or mental health staff.

Table 6: Evidence profile for comparison between risk assessment by psychiatrist and risk assessment by mental health nurse

Quality assessment						No of patients		Effect			
Number of studies	Design	Risk of bias	Inconsistency	Indirectness	Other consideration	Psychiatrist Assessment	Mental Health Nurse Assessment	Relative (95% CI)	Absolute	Quality	Importance
Repeat self-harm (follow-up: 12 months)											
1 (Murphy 2011)	observational study	serious[1]	no serious inconsistency	no serious indirectness	none	93/629	320/2087	0.96 (0.78, 1.19)	6 fewer per 1,000 (from 34 fewer to 29 more)	MODERATE	CRITICAL
Repeat self-harm (high risk assessment) (follow-up: 12 months)											
1 (Murphy 2011)	observational study	serious[1]	no serious inconsistency	no serious indirectness	none	11/48	56/227	0.93 (0.53, 1.64)	17 fewer per 1,000 (from 116 fewer to 158 more)	MODERATE	CRITICAL
Repeat self-harm (low risk assessment) (follow-up: 12 months)											

Quality assessment						No of patients		Effect			
Number of studies	Design	Risk of bias	Inconsistency	Indirectness	Other consideration	Psychiatrist Assessment	Mental Health Nurse Assessment	Relative (95% CI)	Absolute	Quality	Importance
1 (Murphy 2011)	observational study	serious[1]	no serious inconsistency	no serious indirectness	none	52/581	264/1860	0.99 (0.79, 1.25)	1 fewer per 1,000 (from 30 fewer to 35 more)	MODERATE	CRITICAL

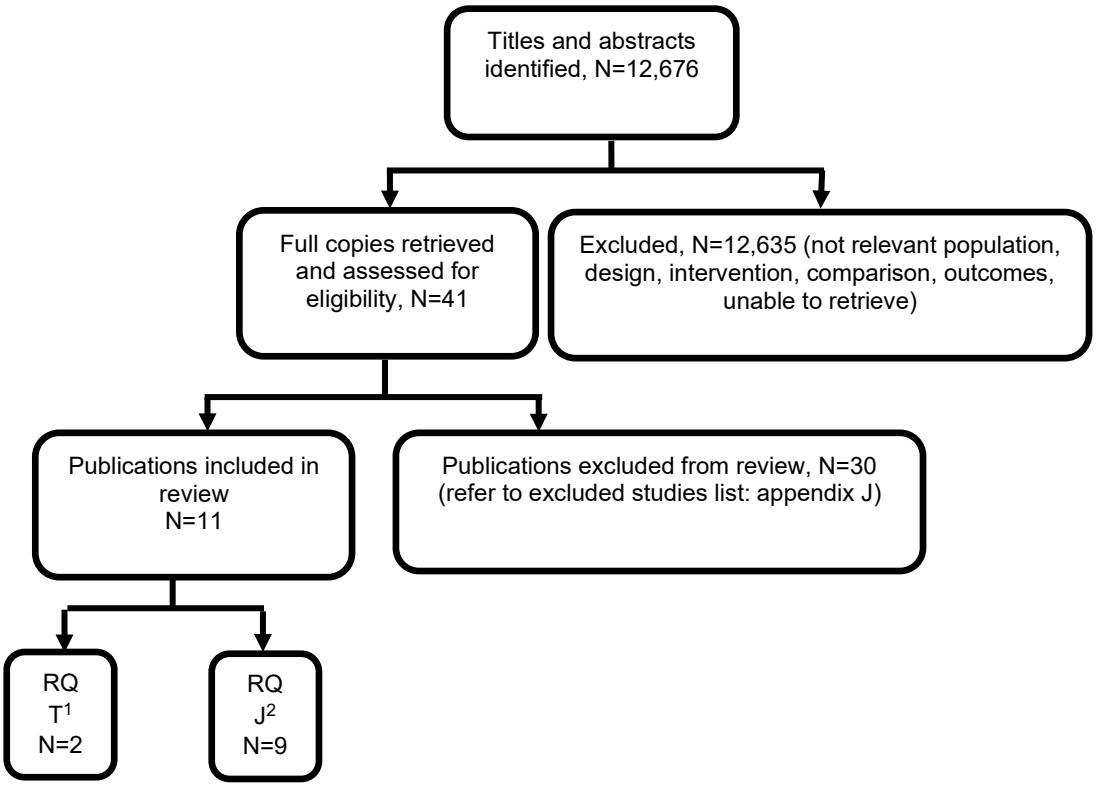
CI = confidence interval; ROBINS-I = Risk Of Bias In Non-randomised Studies - of Interventions; RR = risk ratio
1 Serious risk of bias in the evidence contributing to the outcomes

Appendix G Economic evidence study selection

Study selection for review question: What are the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed?

A global health economics search was undertaken for all areas covered in the guideline. Figure 2 shows the flow diagram of the selection process for economic evaluations of interventions and strategies associated with the care of people who have self-harmed.

Figure 2: Flow diagram of economic article selection for global health economic search



Abbreviations: RQ: Research question
Notes:
1 What are the most effective models of care for people who have self-harmed?
2 What psychological and psychosocial interventions (including safety plans and electronic health-based interventions) are effective for people who have self-harmed?

Appendix H Economic evidence tables

Economic evidence tables for review question: What are the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed?

No evidence was identified which was applicable to this review question.

Appendix I Economic model

Economic model for review question: What are the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed?

No economic analysis was conducted for this review question.

Appendix J Excluded studies

Excluded studies for review question: What are the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed?

Excluded effectiveness studies

Table 7: Excluded studies and reasons for their exclusion

Study	Code [Reason]
Abarca, C., Gheza, C., Coda, C. et al. (2018) Literature review to identify standardized scales for assessing adult suicide risk in the primary health care setting. Medwave 18: e7246	- Systematic review *Included studies assessed for relevance*
Ali, A. and Hassiotis, A. (2006) Deliberate self harm and assessing suicidal risk. British Journal of Hospital Medicine 67: M212-M213	- Non-comparative study
Anonymous (2018) Suicide risk assessment and prevention. Nursing management 49: 1	- Non-comparative study
Asarnow, J. R., Baraff, L. J., Berk, M. et al. (2008) Pediatric emergency department suicidal patients: Two-site evaluation of suicide ideators, single attempters, and repeat attempters. Journal of the American Academy of Child and Adolescent Psychiatry 47: 958-966	- Comparison not in PICO *Study compared suicidal youth emergency department (ED) patients across 2 ED sites by sociodemographic and background characteristics*
Ballard, E. D., Cwik, M., Van Eck, K. et al. (2017) Identification of At-Risk Youth by Suicide Screening in a Pediatric Emergency Department. Prevention science : the official journal of the Society for Prevention Research 18: 174-182	- Population not in PICO *Population included paediatric patients with psychiatric complaints: 26% participants reported suicidal ideation or attempt, and results were not reported separately*
Barzilay, S., Yaseen, Z. S., Hawes, M. et al. (2019) Determinants and Predictive Value of Clinician Assessment of Short-Term Suicide Risk. Suicide & life-threatening behavior 49: 614-626	- Outcomes not in PICO *Although the study has used different risk assessment tools, the target outcomes are only reported collapsed across the different risk assessment tools, not presented for each tool separately.*
Bergen, H., Hawton, K., Waters, K. et al. (2010) Psychosocial assessment and repetition of self-harm: The significance of single and multiple repeat episode analyses. Journal of Affective Disorders 127: 257-265	- Comparison not in PICO *Study compared psychosocial assessment vs no psychosocial assessment, not risk assessment to no risk assessment*
Bittar, A., Velupillai, S., Roberts, A. et al. (2019) Text Classification to Inform Suicide Risk Assessment in Electronic Health Records. Studies in health technology and informatics 264:	- Population not in PICO *Population included suicide-related (case) and non-suicide related (control) admissions*

Study	Code [Reason]
40-44	
Boudreaux, E. D., Larkin, C., Camargo, C. A. et al. (2020) Validation of a Secondary Screener for Suicide Risk: Results from the Emergency Department Safety Assessment and Follow-up Evaluation (ED-SAFE). Joint Commission Journal on Quality and Patient Safety 46: 342-352	- Non-comparative study
Carroll, A. (2008) Risk assessment and management in practice: The Forensicare risk assessment and management exercise. Australasian Psychiatry 16: 412-417	- Narrative review or commentary
Carroll, R., Metcalfe, C., Steeg, S. et al. (2016) Psychosocial assessment of self-harm patients and risk of repeat presentation: An instrumental variable analysis using time of hospital presentation. PLoS ONE 11 (2)	- Comparison not in PICO *Study did not compare risk assessment methods. Study assessed whether time of day of hospital presentation was a valid instrument for identifying the effects of psychosocial assessment on risk of repeat self-harm*
Carter, G. and Spittal, M. J. (2018) Suicide Risk Assessment. Crisis 39: 229-234	- Editorial
Carter, T., Walker, G. M., Aubeeluck, A. et al. (2019) Assessment tools of immediate risk of self-harm and suicide in children and young people: A scoping review. Journal of child health care : for professionals working with children in the hospital and community 23: 178-199	- Scoping review *Included studies were assessed for relevance*
Cha, C. B., Augenstein, T. M., Frost, K. H. et al. (2016) Using implicit and explicit measures to predict nonsuicidal self-injury among adolescent inpatients. Journal of the American Academy of Child and Adolescent Psychiatry 55: 62-68	- Comparison not in PICO *Although the study compares different risk assessment tools, all included participants received all the tools, which means the outcomes cannot be assigned to assessment by one tool or another (the rates of repeat self-harm would be the same for each tool given that it is the same population)*
Cooper, J. B., Lawlor, M. P., Hiroeh, U. et al. (2003) Factors that influence emergency department doctors' assessment of suicide risk in deliberate self-harm patients. European journal of emergency medicine : official journal of the European Society for Emergency Medicine 10: 283-287	- Non-comparative study
Cwik, M. F.; O'Keefe, V. M.; Haroz, E. E. (2020) Suicide in the pediatric population: screening, risk assessment and treatment. International Review of Psychiatry 32: 254-264	- Narrative review or commentary
Desjardins, I., Cats-Baril, W., Maruti, S. et al. (2016) Suicide risk assessment in hospitals: An expert system-based triage tool. Journal of Clinical Psychiatry 77: e874-e882	- Population not in PICO *"Individuals 18 years or older and able to provide informed consent were approached for participation regardless of their chief complaint"*

Study	Code [Reason]
	(p. e875)
Dickens, G. L. and O'Shea, L. E. (2015) How short should short-term risk assessment be? Determining the optimum interval for START reassessment in a secure mental health service. Journal of Psychiatric & Mental Health Nursing 22: 397-406	- Non-comparative study
Feeney, L.; Ryan, J.; Moran, P. (2005) Parasuicide assessment in the emergency department. Irish Medical Journal 98: 111-113	- Outcomes not in PICO *Study assessed emergency department detection and classification of parasuicide and compared agreement in risk assessment undertaken by emergency department staff with that of the liaison psychiatry team, but the patients were not followed up so whether the risk assessments were associated with differences in outcomes was not reported*
Friedmann, H. and Kohn, R. (2004) Exponential lethality: upper limits on suicide risk assessments. Medicine and health, Rhode Island 87: 146-148	- Non-comparative study
Gale, C. and Glue, P. (2018) How comprehensive is suicide risk assessment in the emergency department?. New Zealand Medical Journal 131: 11-13	- Non-comparative study
Ganeshalingam, Y. (2008) Assessing risk and managing patients who deliberately self harm. British Journal of Hospital Medicine 69: M156-M157	- Narrative review or commentary
Haglund, A., Lindh, A. U., Lysell, H. et al. (2016) Interpersonal violence and the prediction of short-term risk of repeat suicide attempt. Scientific reports 6: 36892	- Non-comparative study
Harris, I. M.; Beese, S.; Moore, D. (2019) Predicting repeated self-harm or suicide in adolescents and young adults using risk assessment scales/tools: A systematic review protocol. Systematic Reviews 8 (1)	- Systematic review protocol
Harris, I. M.; Beese, S.; Moore, D. (2019) Predicting future self-harm or suicide in adolescents: A systematic review of risk assessment scales/tools. BMJ Open 9 (9)	- Systematic review *Included studies assessed for relevance*
Harris, K. M.; Lello, O. D.; Willcox, C. H. (2017) Reevaluating Suicidal Behaviors: Comparing Assessment Methods to Improve Risk Evaluations. Journal of Psychopathology and Behavioral Assessment 39: 128-139	- Population not in PICO *"Data came from three independent, non-concurrent, surveys on suicidality and related factors. Inclusion criteria were age 18+ years and adequate English language skills. There were no additional exclusion criteria" (p. 131)*
Harrison, D. P., Stritzke, W. G. K., Fay, N. et al.	- Outcomes not in PICO

Study	Code [Reason]
(2018) Suicide risk assessment: Trust an implicit probe or listen to the patient?. Psychological Assessment 30: 1317-1329	*Although the study has used different risk assessment tools, the target outcomes are only reported collapsed across the different risk assessment tools, not presented for each tool separately*
Hom, M. A.; Joiner, T. E.; Bernert, R. A. (2016) Limitations of a single-item assessment of suicide attempt history: Implications for standardized suicide risk assessment. Psychological Assessment 28: 1026-1030	- Outcomes not in PICO *Study compared the proportions of participants reporting prior suicide attempt as determined by different screening methods*
Horton, M., Wright, N., Dyer, W. et al. (2014) Assessing the risk of self-harm in an adult offender population: An incidence cohort study. Health Technology Assessment 18: i-xxv+1	- Outcomes not in PICO *Although the study has used different risk assessment tools, the target outcomes are only reported collapsed across the different risk assessment tools, not presented for each tool separately*
Khan, S. S. (2011) Sadpersons scale in assessing self harm risk. Emergency Medicine Journal 28: 335-336	- Narrative review or commentary
Large, M., Myles, N., Myles, H. et al. (2018) Suicide risk assessment among psychiatric inpatients: a systematic review and meta-analysis of high-risk categories. Psychological medicine 48: 1119-1127	- Systematic review *Included studies checked for relevance*
Lindh, A. U., Dahlin, M., Beckman, K. et al. (2019) A comparison of suicide risk scales in predicting repeat suicide attempt and suicide: A clinical cohort study. Journal of Clinical Psychiatry 80 (6)	- Outcomes not in PICO *Although the study has used different risk assessment tools, the target outcomes are only reported collapsed across the different risk assessment tools, not presented for each tool separately*
Lopez-Morinigo, J. D., Fernandes, A. C., Shetty, H. et al. (2018) Can risk assessment predict suicide in secondary mental healthcare? Findings from the South London and Maudsley NHS Foundation Trust Biomedical Research Centre (SLaM BRC) Case Register. Social Psychiatry & Psychiatric Epidemiology 53: 1161-1171	- Comparison not in PICO *Study compared the sensitivity, specificity, and predictive accuracy of risk assessment total scores from the same tool in people who had died by suicide compared with non-suicides*
Marfe, E. (2003) Assessing risk following deliberate self harm. Paediatric nursing 15: 32-34	- Narrative review or commentary
Mayes, T. L., Killian, M., Rush, A. J. et al. (2020) Predicting future suicidal events in adolescents using the Concise Health Risk Tracking Self-Report (CHRT-SR). Journal of Psychiatric Research 126: 19-25	- Non-comparative study
Modai, I., Ritsner, M., Kurs, R. et al. (2002) Validation of the Computerized Suicide Risk Scale - A backpropagation neural network instrument (CSRS-BP). European Psychiatry 17:	- Non-comparative study

Study	Code [Reason]
75-81	
Nelson, H. D., Denneson, L. M., Low, A. R. et al. (2017) Suicide risk assessment and prevention: A systematic review focusing on veterans. Psychiatric Services 68: 1003-1015	- Systematic review *Included studies assessed for relevance*
Nielssen, O.; Ryan, C.; Large, M. (2011) Risk assessment and resource allocation. Australasian Psychiatry 19: 270	- Letter with no original relevant data
Quinlivan, L., Cooper, J., Davies, L. et al. (2016) Which are the most useful scales for predicting repeat self-harm? A systematic review evaluating risk scales using measures of diagnostic accuracy. BMJ Open 6 (2)	- Comparison not in PICO *Study included data from 32 hospitals, investigated the extent to which risk scales were used for the assessment of self-harm by emergency department clinicians and mental health staff in these hospitals, and compared repeat self-harm within 6 months between hospitals that used published risk assessment scales as a component of their risk assessments and hospitals that did not use published scales as a component of their risk assessments. The actual risk assessment methods undertaken by the 32 hospitals varied widely*
Quinlivan, L., Cooper, J., Steeg, S. et al. (2014) Scales for predicting risk following self-harm: An observational study in 32 hospitals in England. BMJ Open 4 (5)	- Systematic review *Included studies assessed for relevance*
Randall, J. R., Sareen, J., Chateau, D. et al. (2019) Predicting Future Suicide: Clinician Opinion versus a Standardized Assessment Tool. Suicide & life-threatening behavior 49: 941-951	- Comparison not in PICO *Although the study compares different risk assessment tools, all included participants received all the tools, which means the outcomes cannot be assigned to assessment by one tool or another (the rates of repeat self-harm would be the same for each tool given that it is the same population)*
Reshetukha, T. R., Alavi, N., Prost, E. et al. (2018) Improving suicide risk assessment in the emergency department through physician education and a suicide risk assessment prompt. General Hospital Psychiatry 52: 34-40	- Comparison not in PICO *Study evaluated the impact of a suicide risk assessment prompt on the documentation of suicide risk by emergency medicine and psychiatric physicians (pre- versus post-intervention)*
Ronquillo, L., Minassian, A., Vilke, G. M. et al. (2012) Literature-based recommendations for suicide assessment in the emergency department: a review. Journal of Emergency Medicine 43: 836-42	- Narrative review or commentary
Runeson, B., Odeberg, J., Pettersson, A. et al. (2017) Instruments for the assessment of suicide risk: A systematic review evaluating the certainty of the evidence. PLoS ONE 12 (7)	- Systematic review *Included studies assessed for relevance*

Study	Code [Reason]
Ryan, C. J.; Large, M. M.; Callaghan, S. (2013) Suicide risk assessment: where are we now?. The Medical journal of Australia 199: 534	- Letter with no original relevant data
Smith, E. M. (2018) Suicide risk assessment and prevention. Nursing management 49: 22-30	- Narrative review or commentary
Steeg, S., Quinlivan, L., Nowland, R. et al. (2018) Accuracy of risk scales for predicting repeat self-harm and suicide: A multicentre, population-level cohort study using routine clinical data. BMC Psychiatry 18 (1)	- Comparison not in PICO *Although the study compares different risk assessment tools, all included participants received all the tools, which means the outcomes cannot be assigned to assessment by one tool or another (the rates of repeat self-harm would be the same for each tool given that it is the same population)*
Tran, T., Luo, W., Phung, D. et al. (2014) Risk stratification using data from electronic medical records better predicts suicide risks than clinician assessments. BMC Psychiatry 14 (1)	- Comparison not in PICO *Although the study compares different risk assessment tools, all included participants received all the tools, which means the outcomes cannot be assigned to assessment by one tool or another (the rates of repeat self-harm would be the same for each tool given that it is the same population)*
Viguera, A. C., Milano, N., Laurel, R. et al. (2015) Comparison of Electronic Screening for Suicidal Risk With the Patient Health Questionnaire Item 9 and the Columbia Suicide Severity Rating Scale in an Outpatient Psychiatric Clinic. Psychosomatics 56: 460-469	- Population not in PICO *Unclear whether population included people with self-harm "any adult mental health outpatient visits in people added 18 years or older" (p. 462)*
Wang, Y., Bhaskaran, J., Sareen, J. et al. (2016) Clinician prediction of future suicide attempts: A longitudinal study. Canadian Journal of Psychiatry 61: 428-432	- Comparison not in PICO *Although the study compares different risk assessment tools, all included participants received all the tools, which means the outcomes cannot be assigned to assessment by one tool or another (the rates of repeat self-harm would be the same for each tool given that it is the same population)*
Wilfond, B. S.; Zabrowski, J.; Johnson, L. M. (2019) A Pragmatic Trial of Suicide Risk Assessment and Ambulance Transport Decision Making Among Emergency Medical Services Providers: Implications for Patient Consent. The American journal of bioethics : AJOB 19: 97-98	- Case report
Woodford, R., Spittal, M. J., Milner, A. et al. (2019) Accuracy of Clinician Predictions of Future Self-Harm: A Systematic Review and Meta-Analysis of Predictive Studies. Suicide & life-threatening behavior 49: 23-40	- Systematic review *Included studies assessed for relevance*

Excluded economic studies

Table 8: Excluded studies from the guideline economic review

Study	Reason for Exclusion
Adrian, M., Lyon, A. R., Nicodimos, S., Pullmann, M. D., McCauley, E., Enhanced "Train and Hope" for Scalable, Cost-Effective Professional Development in Youth Suicide Prevention, Crisis, 39, 235-246, 2018	Not relevant to any of the review questions in the guideline - this study examined the impact of an educational training ongoing intervention, and the effect of the post-training reminder system, on mental health practitioners' knowledge, attitudes, and behaviour surrounding suicide assessment and intervention. As well, this study was not a full health economic evaluation
Borschmann R, Barrett B, Hellier JM, et al. Joint crisis plans for people with borderline personality disorder: feasibility and outcomes in a randomised controlled trial. Br J Psychiatry. 2013;202(5):357-364.	Not relevant to any of the review questions in the guideline - this study examined the feasibility of recruiting and retaining adults with borderline personality disorder to a pilot randomised controlled trial investigating the potential efficacy and cost-effectiveness of using a joint crisis plan
Bustamante Madsen, L., Eddleston, M., Schultz Hansen, K., Konradsen, F., Quality Assessment of Economic Evaluations of Suicide and Self-Harm Interventions, Crisis, 39, 82-95, 2018	Study design - this review of health economics studies has been excluded for this guideline, but its references have been hand-searched for any relevant health economic study
Byford, S., Barrett, B., Aglan, A., Harrington, V., Burroughs, H., Kerfoot, M., Harrington, R. C., Lifetime and current costs of supporting young adults who deliberately poisoned themselves in childhood and adolescence, Journal of Mental Health, 18, 297-306, 2009	Study design – no comparative cost analysis
Byford, S., Leese, M., Knapp, M., Seivewright, H., Cameron, S., Jones, V., Davidson, K., Tyrer, P., Comparison of alternative methods of collection of service use data for the economic evaluation health care interventions, Health Economics, 16, 531-536, 2007	Study design – no comparative cost analysis
Byford, Sarah, Barber, Julie A., Harrington, Richard, Barber, Baruch Beautrais Blough Brent Brodie Byford Carlson Chernoff Collett Fergusson Garland Goldberg Harman Harrington Hawton Huber Kazdin Kerfoot Knapp Lindsey McCullagh Miller Netten Reynolds Sadowski Shaffer Simms Wu, Factors that influence the cost of deliberate self-poisoning in children and adolescents, Journal of Mental Health Policy and Economics, 4, 113-121, 2001	Study design – no comparative cost analysis
Denchev, P., Pearson, J. L., Allen, M. H., Claassen, C. A., Currier, G. W., Zatzick, D. F., Schoenbaum, M., Modeling the cost-effectiveness of interventions to reduce suicide risk among hospital emergency department patients, Psychiatric Services, 69, 23-31, 2018	Not relevant to any of the review questions in the guideline - this study estimated the cost-effectiveness of outpatient interventions (Postcards, Telephone outreach, Cognitive Behaviour Therapy) to reduce suicide risk among patients presenting to general hospital emergency departments
Dunlap, L. J., Orme, S., Zarkin, G. A., Arias, S. A., Miller, I. W., Camargo, C. A., Sullivan, A. F., Allen, M. H., Goldstein, A. B., Manton, A. P., Clark, R., Boudreaux, E. D., Screening and Intervention for Suicide Prevention: A Cost-	Not relevant to any of the review questions in the guideline - this study estimated the cost-effectiveness of suicide screening followed by an intervention to identify suicidal individuals and prevent recurring self-harm

Study	Reason for Exclusion
Effectiveness Analysis of the ED-SAFE Interventions, Psychiatric services (Washington, D.C.), appips201800445, 2019	
Fernando, S. M., Reardon, P. M., Ball, I. M., van Katwyk, S., Thavorn, K., Tanuseputro, P., Rosenberg, E., Kyeremanteng, K., Outcomes and Costs of Patients Admitted to the Intensive Care Unit Due to Accidental or Intentional Poisoning, Journal of Intensive Care Medicine, 35, 386-393, 2020	Study design – no comparative cost analysis
Flood, C., Bowers, L., Parkin, D., Estimating the costs of conflict and containment on adult acute inpatient psychiatric wards, Nursing economic$, 26, 325-330, 324, 2008	Study design – no comparative cost analysis
Fortune, Z., Barrett, B., Armstrong, D., Coid, J., Crawford, M., Mudd, D., Rose, D., Slade, M., Spence, R., Tyrer, P., Moran, P., Clinical and economic outcomes from the UK pilot psychiatric services for personality-disordered offenders, International Review of Psychiatry, 23, 61-9, 2011	Not relevant to any of the review questions in the guideline
George, S., Javed, M., Hemington-Gorse, S., Wilson-Jones, N., Epidemiology and financial implications of self-inflicted burns, Burns, 42, 196-201, 2016	Study design – no comparative cost analysis
Gunnell, D., Shepherd, M., Evans, M., Are recent increases in deliberate self-harm associated with changes in socio-economic conditions? An ecological analysis of patterns of deliberate self-harm in Bristol 1972-3 and 1995-6, Psychological medicine, 30, 1197-1203, 2000	Study design - cost-of-illness study
Kapur, N., House, A., Dodgson, K., Chris, M., Marshall, S., Tomenson, B., Creed, F., Management and costs of deliberate self-poisoning in the general hospital: A multi-centre study, Journal of Mental Health, 11, 223-230, 2002	Study design – no comparative cost analysis
Kapur, N., House, A., May, C., Creed, F., Service provision and outcome for deliberate self-poisoning in adults - Results from a six centre descriptive study, Social Psychiatry and Psychiatric Epidemiology, 38, 390-395, 2003	Study design – no comparative cost analysis
Kinchin, I., Russell, A. M. T., Byrnes, J., McCalman, J., Doran, C. M., Hunter, E., The cost of hospitalisation for youth self-harm: differences across age groups, sex, Indigenous and non-Indigenous populations, Social Psychiatry and Psychiatric Epidemiology, 55, 425-434, 2020	Study design – no comparative cost analysis
O'Leary, F. M., Lo, M. C. I., Schreuder, F. B., "Cuts are costly": A review of deliberate self-harm admissions to a district general hospital plastic surgery department over a 12-month period, Journal of Plastic, Reconstructive and Aesthetic Surgery, 67, e109-e110, 2014	Study design – no comparative cost analysis

Study	Reason for Exclusion
Olfson, M., Gameroff, M. J., Marcus, S. C., Greenberg, T., Shaffer, D., National trends in hospitalization of youth with intentional self-inflicted injuries, American Journal of Psychiatry, 162, 1328-1335, 2005	Study design – no comparative cost analysis
Ostertag, L., Golay, P., Dorogi, Y., Brovelli, S., Cromec, I., Edan, A., Barbe, R., Saillant, S., Michaud, L., Self-harm in French-speaking Switzerland: A socio-economic analysis (7316), Swiss Archives of Neurology, Psychiatry and Psychotherapy, 70 (Supplement 8), 48S, 2019	Conference abstract
Ougrin, D., Corrigall, R., Poole, J., Zundel, T., Sarhane, M., Slater, V., Stahl, D., Reavey, P., Byford, S., Heslin, M., Ivens, J., Crommelin, M., Abdulla, Z., Hayes, D., Middleton, K., Nnadi, B., Taylor, E., Comparison of effectiveness and cost-effectiveness of an intensive community supported discharge service versus treatment as usual for adolescents with psychiatric emergencies: a randomised controlled trial, The Lancet Psychiatry, 5, 477-485, 2018	Not self-harm. In addition, the interventions evaluated in this economic analysis (a supported discharge service provided by an intensive community treatment team compared to usual care) were not relevant to any review questions
Palmer, S., Davidson, K., Tyrer, P., Gumley, A., Tata, P., Norrie, J., Murray, H., Seivewright, H., The cost-effectiveness of cognitive behavior therapy for borderline personality disorder: results from the BOSCOT trial, Journal of Personality Disorders, 20, 466-481, 2006	Not self-harm
Quinlivan L, Steeg S, Elvidge J, et al. Risk assessment scales to predict risk of hospital treated repeat self-harm: A cost-effectiveness modelling analysis. J Affect Disord. 2019;249:208-215.	Not relevant to any of the review questions in the guideline - this study estimated the cost-effectiveness of of risk assessment scales versus clinical assessment for adults attending an emergency department following self-harm
Richardson JS, Mark TL, McKeon R. The return on investment of postdischarge follow-up calls for suicidal ideation or deliberate self-harm. Psychiatr Serv. 2014;65(8):1012-1019.	Not enough data reporting on cost-effectiveness findings
Smits, M. L., Feenstra, D. J., Eeren, H. V., Bales, D. L., Laurenssen, E. M. P., Blankers, M., Soons, M. B. J., Dekker, J. J. M., Lucas, Z., Verheul, R., Luyten, P., Day hospital versus intensive out-patient mentalisation-based treatment for borderline personality disorder: Multicentre randomised clinical trial, British Journal of Psychiatry, 216, 79-84, 2020	Not self-harm
Tsiachristas, A., Geulayov, G., Casey, D., Ness, J., Waters, K., Clements, C., Kapur, N., McDaid, D., Brand, F., Hawton, K., Incidence and general hospital costs of self-harm across England: estimates based on the multicentre study of self-harm, Epidemiology & Psychiatric Science, 29, e108, 2020	Study design – no comparative cost analysis
Tsiachristas, A., McDaid, D., Casey, D., Brand, F., Leal, J., Park, A. L., Geulayov, G., Hawton, K., General hospital costs in England of medical and psychiatric care for patients who self-harm:	Study design – no comparative cost analysis

Study	Reason for Exclusion
a retrospective analysis, The Lancet Psychiatry, 4, 759-767, 2017	
Tubeuf, S., Saloniki, E. C., Cottrell, D., Parental Health Spillover in Cost-Effectiveness Analysis: Evidence from Self-Harming Adolescents in England, PharmacoEconomics, 37, 513-530, 2019	This study is not a separate study from one already included in the guideline for topic 5.2 (Cottrel 2018). This secondary analysis presents alternative parental health spillover quantification methods in the context of a randomised controlled trial comparing family therapy with treatment as usual as an intervention for self-harming adolescents of (Cottrel 2018), and discusses the practical limitations of those methods
Tyrer, P., Thompson, S., Schmidt, U., Jones, V., Knapp, M., Davidson, K., Catalan, J., Airlie, J., Baxter, S., Byford, S., Byrne, G., Cameron, S., Caplan, R., Cooper, S., Ferguson, B., Freeman, C., Frost, S., Godley, J., Greenshields, J., Henderson, J., Holden, N., Keech, P., Kim, L., Logan, K., Manley, C., MacLeod, A., Murphy, R., Patience, L., Ramsay, L., De Munroz, S., Scott, J., Seivewright, H., Sivakumar, K., Tata, P., Thornton, S., Ukoumunne, O. C., Wessely, S., Randomized controlled trial of brief cognitive behaviour therapy versus treatment as usual in recurrent deliberate self-harm: The POPMACT study, Psychological medicine, 33, 969-976, 2003	Study design - no economic evaluation
Van Roijen, L. H., Sinnaeve, R., Bouwmans, C., Van Den Bosch, L., Cost-effectiveness and Cost-utility of Shortterm Inpatient Dialectical Behavior Therapy for Chronically Parasuicidal BPD (Young) Adults, Journal of Mental Health Policy and Economics, 18, S19-S20, 2015	Conference abstract
van Spijker, B. A., Majo, M. C., Smit, F., van Straten, A., Kerkhof, A. J., Reducing suicidal ideation: cost-effectiveness analysis of a randomized controlled trial of unguided web-based self-help, Journal of medical Internet research, 14, e141, 2012	Not self-harm

Appendix K Research recommendations – full details

Research recommendations for review question: What are the benefits and harms of a risk assessment and formulation including those models or tools that combine elements of machine learning and artificial intelligence for people who have self-harmed?

No research recommendations were made for this review question