



Cognitive Behavioural Therapy

Toolkit technical report

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This report is produced in collaboration with staff from the Campbell Collaboration Secretariat. It is a derivative product, which summarises information from Campbell systematic reviews, and other reviews, to support evidence-informed decision making’.

Abstract/Plain Language summary

The objective of this technical report is to review the evidence on the effect of cognitive-behavioural therapy (CBT) on the prevention of crime and violence. The report is based on three systematic reviews. Koehler et al. (2013) report a meta-analysis on the effectiveness of CBT on the reoffending rates of young people in European countries. Lipsey et al. (2007) examine the effect of CBT programmes on recidivism. Riise et al. (2021) report the effectiveness of CBT on externalizing behaviours in children and adolescents in routine clinical care.

CBT is a widely used treatment for various psychological and behavioural issues, with children, adolescents and youth. One of the fundamental components of CBT programmes, that distinguishes these interventions from other approaches such as social skills training, is the inclusion of cognitive restructuring training. This involves activities and practical exercises that help individuals to recognise cognitive distortions and thinking patterns and apply techniques to modify these distortions. These activities aim to improve the recipients' general thinking and decision-making skills, such as how to stop and think before acting and implement alternative more desirable responses (Lipsey et al., 2007).

There are a range of different intervention programmes that use CBT techniques or components and the current report includes any intervention that has been described as a cognitive-behavioural therapy intervention. Different treatment types that fall under the label of CBT include reasoning and rehabilitation, moral reconnection therapy, aggression replacement therapy, interpersonal problem-solving therapy and thinking for a change. Many other intervention approaches may use CBT principles to guide intervention activities (e.g., mentoring, parenting, or anti-bullying programmes) but the current report refers to interventions that were predominantly cognitive-behavioural in nature.

CBT is typically an intensive intervention that takes place over a short period of time. Riise et al. (2021) reported that CBT programmes took place over an average of 15 weeks and the mean number of sessions was 17.3, with a mean intensity of 2.8 hours a week.

CBT is a form of psychological intervention intended to be implemented by psychologists, usually with post-graduate training or professional certification in cognitive-behavioural therapy. Despite this, Lipsey et al. (2007) found that most CBT programmes that were implemented to reduce reoffending involved minimal training for those who implemented the intervention (53% of studies).

CBT is an effective intervention approach to reduce youth reoffending, although the results are mixed. The headline estimate is informed by Koehler et al. (2013) and the observed effect size of 0.302 corresponds to an approximate reduction in youth reoffending of 27%. The evidence rating is 3. These findings came from 11 evaluations of CBT in European countries, including the UK.

The effect sizes of Riise et al. (2021) are very large corresponding to reductions in externalizing behaviour from 62-74% across the range of behaviours. However, similar reductions in offending would not be expected, because these results were based on rating scales and most assessors (71%) were not blind to conditions.

The most important moderators of the effect size are the quality of implementation (beta = 0.45), the recidivism risk rating of the person receiving therapy (beta = 0.26), and the number of sessions of CBT per week (beta = 0.22) (Lipsey et al., 2007). The most successful type of programme was Moral Reconciliation Therapy, MRT (beta = 0.15). The review of European studies by Koehler et al. (2013) confirms greater effectiveness with young people with greater needs and that fidelity of implementation matters. It also finds that interventions are more effective in community than custodial settings.

Meta-regression analyses also found a significant association between various variables and externalising behaviours (Riise et al., 2021). The largest effects are that programmes are more effective for participants with more severe symptoms before treatment ($b = 0.643, p = .002$). There are also small but significant differences showing greater effectiveness with younger participants ($b = -0.053, p < .001$), and the intensity of treatment ($b = -0.009, p = .006$). The

interventions have the largest effects in Australia and the smallest effects in Europe, with North America in between.

Koehler et al. (2013) report a much larger overall effect of programmes (not specifically only CBT programmes) in the non-UK studies than in the UK studies (OR 2.17 versus 1.11, the latter being statistically insignificant). However, this difference is removed when controlling for type of CBT, community versus custodial settings, and whether it was a 'demonstration study' or part of routine practice. Koehler et al. (2013) do not provide further information on what classifies as a demonstration study, but we assume that this refers to an intervention implemented on a small scale and evaluated by the developer as a means to demonstrate how the programme would work in a particular context.

Objective and approach

The objective of this technical report is to review the evidence on the effect of cognitive-behavioural therapy (CBT) on protecting young people from involvement in crime or violence.

This technical report is based on three systematic reviews: Koehler et al. (2013), Lipsey et al. (2007) and Riise et al. (2021). Koehler et al. (2013) reported a meta-analysis on the effectiveness of CBT on the reoffending rates of young people in Europe. Lipsey et al. (2007) published a systematic review of the effects of CBT programmes on recidivism. Riise et al. (2021) reported the effectiveness of CBT on ratings of externalising behaviours in children and adolescents in routine clinical care.

The following inclusion and exclusion criteria were used to inform selection of systematic reviews.

Inclusion criteria

To be included in this report, a systematic review must include evaluations of the effects of CBT on a crime or violence outcome or externalising disorder in youth aged up to 18 years old and must conduct a meta-analysis.

Exclusion criteria

Reviews were excluded if they were not specifically on CBT or were more restricted in their coverage (e.g., for sex offenders).

Outcomes

Riise et al. (2021) included studies with youth diagnosed with attention deficit hyperactivity disorder (ADHD), conduct disorder (CD), and oppositional defiant disorder (ODD). This meta-analysis evaluated the effectiveness of CBT in reducing these conditions in children and adolescents. Koehler et al. (2013) evaluated the effect of CBT on reoffending and Lipsey et al. (2007, p. 7) evaluated the effect on “criminal offending subsequent to treatment”. Of course, CBT is also used for internalising problems such as anxiety and depression, but the criminological literature has focused on externalising problems and offending.

Description of interventions

CBT is a widely used treatment for various psychological and behavioural issues, with children, adolescents and youth. When applied to address behavioural problems in young people, there are a range of different intervention programmes that use CBT techniques or components. One of the fundamental components of CBT programmes, that distinguishes these interventions from other approaches such as social skills training, is the inclusion of cognitive restructuring training. This involves activities and practical exercises that help individuals to recognise cognitive distortions and thinking patterns and apply techniques to modify these distortions (Lipsey et al., 2007).

Riise et al. (2021) included primary evaluations of a range of different interventions to reduce ADHD, CD and ODD in young people that targeted both parents (e.g., New Forrest Parenting Package; Defiant Children; Parent-Child Interaction Therapy) and children (e.g., “THAV”; Social Cognitive Intervention Program). This review also outlined how the majority of CBT interventions to reduce child externalising behaviour will include a mixture of parent behaviour therapy and child behaviour therapy (e.g., Stop Now and Plan), and can also include teacher training (e.g., Collaborative Life Skills Program).

In searching for evaluations of treatment programmes for youth reoffending, Koehler et al. (2013) found a wide variety of interventions. This review categorised cognitive-behavioural therapy and behavioural therapy as programmes that involved thinking skills programmes, social skills, problem solving approaches, and reinforcement of behavioural change (Koehler et al., 2013, p. 24).

Lipsey et al. (2007) described several different treatment types that fell under the label of CBT. These included reasoning and rehabilitation, moral reconditioning therapy, aggression replacement therapy, interpersonal problem-solving therapy, thinking for a change and substance abuse focus, amongst other manualised intervention components. A number of different treatment elements are included in CBT programmes. For example, CBT programmes will aim to improve the recipients' general thinking and decision-making skills, such as how to stop and think before acting, and help them to implement alternative responses (Lipsey et al., 2007, p. 18). Recipients in this case refers to the individuals that the intervention is aiming to help; in most cases the child or young person experiencing behavioural difficulties.

Cognitive skills also teach participants to consider the consequences of their actions and make decisions about appropriate behaviour. Programmes may also involve components of interpersonal problem solving, such as dealing with interpersonal conflict and peer pressure, and social skills, such as prosocial behaviours, interpreting social cues and considering others' feelings and emotions.

Targeted or Universal

The application of CBT programmes for behaviours in youth such as offending, reoffending, or general externalising behaviour, is a targeted intervention. In these programmes, young people and their families are the sole recipients of the therapy. The wider community, school, or peer group are not involved, so it is never a universal intervention.

Riise et al. (2021) reported that in 49% of included studies parents were the target of treatment and in a further 41% of studies, parents and children were the targets of treatment. In only 9.8% of studies was the child the direct target of CBT treatment.

Implementation setting and personnel

CBT is a form of psychological intervention and, to deliver such treatment, an individual must be trained. CBT is most commonly implemented by psychologists, usually with post-graduate training or professional certification in cognitive-behavioural therapy.

Despite this, Lipsey et al. (2007) found that most evaluations of CBT programmes that were implemented to reduce reoffending involved minimal training for those who implemented the intervention (53% of studies). A further 24% and 22% of studies, respectively, included moderate or high levels of training for providers. The majority (69%) of providers had no background, or a minimal background, in mental health.

Duration and Scale

CBT is typically an intensive intervention that takes place over a short period of time. Riise et al. (2021) reported that CBT programmes took place over an average of 15 weeks and the mean number of sessions was 17.3. Moreover, the mean intensity (estimated as the number of hours divided by the number of weeks) was 2.8.

Theory of change/presumed causal mechanisms

The theory of change in CBT programmes is that problem behaviours or offending arise out of distorted cognitions, or patterns of thinking. Through cognitive-behavioural therapy, these cognitive distortions are targeted and changed in order to prevent problem behaviours.

Evidence base

Descriptive overview

Riise et al. (2021) reported the effects of CBT on externalising behaviour based on 51 primary studies, representing data from 5,295 participants. Studies were published between 1991 and 2019 and used a randomised controlled trial design ($n = 35$) or an 'open trial' design ($n = 16$).

For both ADHD and CD/ODD outcomes, the majority of participants were male (78% and 77.3% respectively). The mean age was 8.2 years old. Most of the 51 studies were conducted in North America ($n = 25$) or Europe ($n = 23$). Some studies reported co-occurring disorders present in participants ($n = 24$) and, of these, 53% of participants had at least one co-occurring disorder such as anxiety or depression. Of participants who had ADHD, 46.7% had at least one of these co-occurring disorders, while 63.2% of participants with CD/ODD had at least one co-occurring disorder. No further information about the prevalence or symptomology of these comorbid disorders is provided.

Thirty-three studies reported the proportion of participants who were taking medication for their disorder, and the mean proportion was 33%. There was a significant difference between the types of conditions; youth with ADHD were significantly more likely to be taking psychotropic medication than youth with CD/ODD (Riise et al., 2021). No information on participants' ethnicities is provided. There was great variation in the attrition rate reported by primary studies. Some reported no attrition, and others reported attrition rates up to 50%. One study reported an attrition rate of 91% (Breider, 2019). The majority of interventions included in the Riise et al. (2021) review included high ($n = 33$ studies) or moderate ($n = 27$) parental involvement.

Koehler et al. (2013) included 25 evaluations of treatment programmes to prevent youth reoffending, of which 11 were evaluations of CBT and behaviour therapy programmes. Overall, 68% of programmes were implemented in the community and the majority of programmes included mostly male participants aged 16-20 years old. However, Koehler et al. (2013) did not provide demographic information about participants or characteristics of programmes for CBT interventions specifically. Also, Koehler et al. (2013) did not provide information on parental involvement, and we assume that, in all interventions, the child or young person was the target of the intervention.

The earlier review by Lipsey et al. (2007) included 58 studies that evaluated the effect of CBT programmes on reoffending, but only 17 of these studies reported effects for young people. Lipsey et al. (2007) did not provide details about the characteristics of the sample or

intervention programme separately for evaluations with young people. The majority of programmes implemented CBT only ($n = 36$; 62%); others implemented CBT with other services ($n = 11$) or CBT and other treatment ($n = 11$). Most of the studies included all male samples ($n = 36$, 62%). Of the studies that reported data on the ethnicity of participants ($n = 37$), 21% of these included 51-75% of minority ethnicities and 21% included between 0-25% minority ethnicity. Lipsey et al. (2007) did not provide information on parental involvement, but we assume that, in all interventions, the child or young person was the target of the intervention.

Assessment of the evidence rating

We have confidence that, at the time of writing, the reviews by Koehler et al. (2013), Lipsey et al. (2007) and Riise et al. (2021) are the best available evidence on the effectiveness of CBT interventions. Our decision rule for determining the evidence rating is summarised in the technical guide.

Two independent coders used a modified version of the AMSTAR2 critical appraisal tool was used to appraise the reviews by Koehler et al. (2013), Lipsey et al. (2007), and Riise et al. (2021). According to this tool, the review by Riise et al. (2021) was rated as 'high', and the reviews by Koehler et al. (2013) and Lipsey et al. (2007) were rated low. The results of this assessment are summarised in Annex 3.

All reviews adequately specified the research questions and the inclusion/exclusion criteria. The inclusion criteria included components relating to the population, intervention, comparison group and outcome of interest.

Riise et al. (2021) specified that they created a review protocol, and it was registered in PROSPERO. Lipsey et al. (2007) created a protocol for coding and data extraction, while Koehler et al. (2013) do not refer to any protocol for their review.

Koehler et al. (2013) included experimental and quasi-experimental evaluations that measured outcomes in an intervention group and a comparison group that involved no

treatment, treatment as usual, or alternative treatment. Included studies were rated on methodological rigour, and the categories were: randomised experiments, strong statistical control due to baseline matching of groups, and those with moderate control that compared groups post-hoc. Riise et al. (2021) also rated the methodological rigor of studies and assessed how this may influence the effect size. Evaluations included in this review were conducted using RCT designs or were described as open trials. Lipsey et al. (2007) specified that included evaluations must be conducted using a randomised controlled trial design or a quasi-experimental design that included a control group who did not receive the CBT programme.

All reviews reported a comprehensive literature search strategy including a number of different databases, designated keywords and search strategies. Lipsey et al. (2007) did not restrict inclusion criteria to only peer-reviewed publications or only reports in English. Koehler et al. (2013) specified that they searched for reports published or unpublished in any European language. Riise et al. (2021) only included evaluations published (or in press) in English.

Riise et al. (2021) stated that evaluations that met inclusion criteria for the review were coded and assessed for risk of bias by multiple authors and searches were conducted by two authors with assistance from a librarian. Koehler et al. (2013) and Lipsey et al. (2007) do not report on the coding procedure of studies or whether more than one person coded eligible studies.

Riise et al. (2021) evaluated risk of bias analysis using the EPOC risk of bias tool, as suggested by the Cochrane Collaboration, and conducted a series of analyses to evaluate the impact of possible risk of bias on outcomes. Koehler et al. (2013) and Lipsey et al. (2007) did not conduct any risk of bias analyses, beyond normal publication bias analysis.

Lipsey et al. (2007) and Riise et al. (2021) state that no funding was received for their review and Koehler et al. (2013) do not provide information about funding.

Each of the reviews conducted a meta-analysis and reported detailed information on the synthesis and estimation of weighted effect sizes and adequately reported the heterogeneity

between primary effects. Each of the meta-analyses reported separate weighted effect sizes for independent outcomes and assessed multiple moderators as possible explanations for heterogeneity among primary effect sizes.

Koehler et al. (2013) provide a direct estimate of the effect on reoffending based on 15 studies. However, the results are heterogeneous ($I^2 = 63\%$) and rated 'low' as per the AMSTAR tool, so the overall evidence rating is 3. Because it is more recent than Lipsey et al. (2007), this is the estimate we use to inform the headline impact metric in the Toolkit.

Lipsey et al. (2007) provide a direct estimate of the effect on reoffending based on 58 studies. However, the results are highly heterogeneous ($I^2 = 73\%$), so the overall evidence rating is 3.

Riise et al. (2021) present an indirect estimate based on 65 treatment-control comparisons, with high heterogeneity ($I^2 = 69.4\%$), so the overall evidence rating for externalising behaviour outcomes is 4. No direct estimate of the effect on outcomes of crime or violence are included in the review by Riise et al. (2021) and so the evidence rating is 2 for these outcomes.

Impact

Summary impact measure

Overall, the meta-analyses that inform this technical report suggest that CBT can be an effective intervention approach to reduce youth reoffending. Koehler et al. (2013) found a large statistically significant effect of CBT interventions on youth reoffending. Lipsey et al. (2007) reported an overall significant effect of CBT on recidivism (OR = 1.53) and that the effect did not differ significantly between juveniles and adults (beta = -.03, n.s.). These weighted mean effect sizes for reoffending outcomes are summarised in Table 1.

Table 1

Mean effect sizes for reoffending outcomes.

Review	ES (<i>d</i> and OR)	CI (ES)	<i>p</i>	% reduction	Evidence rating for reoffending
Koehler et al. (2013), CBT and behavioural therapy	OR = 1.73 <i>d</i> = 0.302	1.26 – 2.36	< .001	27%	3
Lipsey et al. (2007)	OR = 1.53 <i>d</i> = 0.234		< .001	21%	3

Note: ES = the weighted mean effect size; CI = 95% confidence intervals for the mean ES; *p* = the statistical significance of the mean ES; OR = odds ratio (greater than 1 = desirable effect).

In estimating % reduction, we assumed that there were equal numbers (each $n = 100$) in the experimental and control conditions, and that 50% of persons in the control condition reoffended. With these assumptions, the OR of 1.73 for Koehler et al. (2013) translated to 36.6% of experimental persons reoffending, which is a 27% decrease. For Lipsey et al. (2007) the OR of 1.53 can be transformed to 39.5% of the experimental persons reoffending, a 21% reduction. This transformation is explained in further detail in Annex 1.

It is plausible to assume a 50% overall reoffending rate; for example, in England and Wales, 37% of juvenile offenders in the period October to December 2018 had proven (recorded) reoffending only one year later (Ministry of Justice, 2020). It would be expected that their reoffending rate would soon reach 50% within another two years or so.

CBT is also often used as a treatment programme for problem behaviours in children and adolescents. Riise et al. (2021) found that CBT is an effective approach to reduce these problem behaviours, such as ADHD, CD or ODD. The mean effect sizes for these outcomes are summarised in Table 2.

Table 2

Mean effect sizes for externalising behaviour outcomes.

Review	ES (<i>g</i> and OR)	CI (ES)	<i>p</i>	% reduction	Evidence rating for externalising behaviours	Evidence rating for reoffending
Riise et al. (2021); ADHD; post-treatment	<i>g</i> = 0.80 OR = 4.27	0.67 – 0.93	< .001	62%	4	2
Riise et al. (2021); CD/ODD; post-treatment	<i>g</i> = 0.98 OR = 5.92	0.85 – 1.12	< .001	71%	4	2
Riise et al. (2021); ADHD; follow-up	<i>g</i> = 0.88 OR = 4.93	0.87 – 1.14	< .001	66%	4	2
Riise et al. (2021); CD/ODD; follow-up	<i>g</i> = 1.06 OR = 6.84	0.70 – 1.07	< .001	74%	4	2

Note. ES = weighted mean effect size under a random effects meta-analysis; OR = odds ratio; *g* = Hedges' *g*; *p* = statistical significance; ADHD = Attention Deficit Hyperactivity Disorder; CD = Conduct Disorder; ODD = Oppositional Defiant Disorder

The effect sizes of Riise et al. (2021) are very large. They reflect differences between pre- and post-measures of ADHD, CD and ODD. The follow-up measure was, on average, 10.8 months after the treatment. For ease of comparison with our other analyses, problems were assumed to be dichotomous (present or absent). The remission rates averaged 44% post-treatment and 51% at follow-up. Therefore, in estimating the % reduction, we assumed that 50% of the control group continued to display the problem behaviour, and that there were equal

numbers (each $n = 100$) in experimental and control conditions. We used the equation $\text{Ln}(\text{OR}) = g / .5513$ to transform reported effect sizes to odds ratios (Lipsey & Wilson, 2001). With these assumptions, the % of the experimental group continuing to display the problem behaviour was 19% (ADHD, post-treatment), 14.5% (CD/ODD, post-treatment), 16.9% (ADHD, follow-up) and 12.8% (CD/ODD, follow-up), corresponding to reductions in externalizing behaviour from 62-74%. However, similar reductions in offending would not be expected, because these results were based on rating scales and most assessors (71%) were not blind to conditions.

Moderators and mediators

Lipsey et al. (2007) included a range of different moderators that could be useful in furthering understanding of how CBT works to reduce reoffending in youth. However, Lipsey et al. (2007) did not report results separately for children versus adults, but previously they showed that the results did not differ between these categories. In a regression analysis, the most important moderators of the effect size were the quality of implementation (beta = 0.45), the recidivism risk rating of the offender (beta = 0.26), and the number of sessions of CBT per week (beta = 0.22). The most successful type of programme was Moral Reconciliation Therapy or MRT (beta = 0.15).

Riise et al. (2021) conducted a series of subgroup analysis with several moderator variables, such as the study design and the type of analysis (i.e., intention to treat or based on participants who completed the programme). The results showed no significant differences between any of these subgroups. There was a significant difference ($p = .04$) between studies conducted in Australia ($g = 1.37$, 95% CI 0.99 – 1.75, $n = 5$), North America ($g = 0.91$, 95% CI 0.77 – 1.05, $n = 28$), and Europe ($g = 0.83$, 95% CI 0.69 – 0.97, $n = 32$).

Riise et al. (2021) also compared the effect sizes of evaluations depending on the level of parental involvement in the intervention. Studies with a high level of parental involvement were associated with the greatest reduction in externalising behaviours ($g = 0.97$, 95% CI 0.82 – 1.12, $n = 33$). Studies with a moderate level of parental involvement were also associated with a large reduction in externalising behaviours ($g = 0.86$, 95% CI 0.72 – 1.00, $n = 27$). The difference between these was not statistically significant ($p = 0.54$). Very few programmes

were categorised as having a low level of parental involvement ($g = 0.84$, 95% CI 0.46 – 1.22, $n = 5$).

Meta-regression analyses also found a significant association between various variables and externalising behaviours (Riise et al., 2021). For example, analyses suggested that programmes were more effective with younger participants ($b = -0.053$, $p < .001$), participants with more severe symptoms before treatment ($b = 0.643$, $p = .002$), and low intensity of treatment ($b = -0.009$, $p = .006$).

Koehler et al. (2013) did not carry out moderator analyses for CBT programmes separately.

Implementation and Cost analysis

None of the reviews used to inform the current technical report included information on the implementation of CBT programmes or on cost analyses.

We can present implementation evidence from one study included by Koehler et al. (2013): the adaptation of the Canadian Reasoning and Rehabilitation programme by the probation service in mid-Glamorgan, Wales (Rayner & Vanstone, 1994). The programme consisted of 35 two-hour sessions implemented by probation staff with prior experience of running group interventions. Whilst the programme was generally positively viewed by participants, some mentioned repetition and boredom with it.

The study shows that the programme was largely successfully adapted, with changes made to the programme mostly improving its focus. The challenges were a lack of time and resources, and sometimes a lack of cooperation from other probation staff. Staff who were not directly involved in the programme did not all view it positively, implying that better internal communication may help.

Findings from UK/Ireland

The reviews by Lipsey et al. (2007) and Riise et al. (2021) did not specify whether any evaluations were conducted in the United Kingdom or Ireland.

Koehler et al. (2013) state that 16 of their 25 effect estimates (not all involving CBT) are from the United Kingdom. The most relevant of their references is the study by Cann et al. (2005) of a prison-based cognitive skills programme for young people in England and Wales. This was not exactly a CBT intervention and expert opinion might categorise this as a structured psycho-educational course rather than a psychological therapy¹. However, it was the only CBT evaluation conducted in England and Wales and it was included by Koehler et al. (2013).

Cognitive-behavioural treatment for people held in custody in England and Wales in the early 1990s used two approaches: Reasoning & Rehabilitation and Enhanced Thinking Skills, used with youth with a high and low risk of reoffending respectively. Enhanced Thinking Skills was based on the same cognitive model as Reasoning & Rehabilitation, but Reasoning & Rehabilitation was a more intensive programme, with more modules, and 38 sessions, as opposed to 21 sessions for Enhanced Thinking Skills. Cann et al. (2005) compared reconviction rates between about 1,500 people who voluntarily started one of these CBT-based programmes and a matched comparison group of the same size of people who did not. Matching was done using data from the Inmate Information System (IIS) using five characteristics: risk of reconviction, ethnicity, sentence length, year of discharge and offence type. There was no significant difference in reoffending between those in the programme and the comparison group (33.6% and 35.5% respectively). However, when the treatment group was restricted to those completing the programme, there was a small significant effect (31.4% versus 35.5%). As this was not an RCT, there could have been unmeasured pre-existing differences between the groups. Also, seven UK evaluations of Reasoning & Rehabilitation, based in prison and probation, were included in the review by Tong and Farrington (2008), who concluded that this programme was effective in reducing recidivism.

¹ We are grateful to Professor David Crighton for providing expert opinion on this matter. The study is included by Koehler et al. (2013) as a cognitive-behavioural intervention.

What do we need to know? What don't we know?

Reviews show that CBT-based interventions can have a large effect on externalizing behaviour and offending. Primary RCT evaluations of CBT in UK practice settings are needed to improve our understanding of the conditions for effectiveness.

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Annex 1: Effect size calculation

This annex shows the calculation based on the results and assumptions given in the text. We assume 200 youth, evenly divided between treatment and comparison groups. That means there are 100 youth in the control group and 100 youth in the treatment group. Assuming that 50% of youth in the control group reoffended, the mean effect sizes for the reviews by Koehler et al. (2013) and Lipsey et al. (2007) can be easily transformed to a percentage reduction in reoffending. The process is similar for externalising behaviour outcomes reported by Riise et al. (2021).

If the odds ratio for the incidence of reoffending is 1.73 for the Koehler et al. (2013) review, then using the table below and the formula for an OR, we can estimate the value of X. The odds ratio is estimated as: $A \cdot D / B \cdot C$, where A is the number of participants in the treatment group who do not reoffend, B is the number of participants in the treatment group who reoffend, C is the number of participants in the control group who do not reoffend, and D is the number of participants in the control group who reoffend. Therefore, the value of X is 36.63 in the case of Koehler et al. (2013).

	Do not reoffend	Reoffend	Total
Treatment	100-x	x	100
Control	50	50	100

Therefore, the relative reduction in reoffending is $(50 - 36.63)/50 = 26.74\%$. In relation to the review by Lipsey et al. (2007) the value of X is 39.53 and the relative reduction in reoffending is 20.95%.

The prevalence of reoffending is likely to vary between study and can be influenced greatly by the type of report (e.g., self-report or official records), the length of follow-up (e.g., one-year reconviction data or five-year reconviction data), and the type of crime included (e.g., violent crime, burglary offences, or other crime). If we were to adjust our assumption that 50% of the control group reoffend, the overall % reduction in the intervention group is not greatly affected.

For example, if we assume that 40% of the control group reoffend, the 2x2 table would be as follows and the value of X is 27.82 (for Koehler et al., 2013). Therefore, the relative reduction is 30.45% (i.e., $(40 - 27.82)/40 \times 100$).

	Do not reoffend	Reoffend	Total
Treatment	100-x	x	100
Control	60	40	100

Similarly, if we assume that 60% of the control group reoffend, the value of X is 46.44 (Koehler et al., 2013) and the relative reduction in reoffending is 22.6%. Given the significant difference in the assumed prevalence of reoffending, the percentage relative reduction does not vary in a similar fashion. Table 3 shows this further.

Table 3

Variation in the relative reduction in reoffending depending on various estimates.

	Koehler et al. (2013) OR = 1.73	Lipsey et al. (2007) OR = 1.53
Assumed prevalence	Relative reduction	
40%	30.45%	24.12%
50%	26.74%	20.95%
60%	22.6%	17.49%

Annex 2: AMSTAR Rating

Modified AMSTAR item		Scoring guide	CBT		
			Koehler 2013	Riise 2021	Lipsey 2007
1	Did the research questions and inclusion criteria for the review include the components of the PICOS?	To score 'Yes' appraisers should be confident that the 5 elements of PICO are described somewhere in the report	Yes	Yes	Yes
2	Did the review authors use a comprehensive literature search strategy?	At least two bibliographic databases should be searched (partial yes) plus at least one of website searches or snowballing (yes).	Yes	Yes	Yes
3	Did the review authors perform study selection in duplicate?	Score yes if double screening or single screening with independent check on at least 5-10%	No	Yes	Partial Yes
4	Did the review authors perform data extraction in duplicate?	Score yes if double coding	No	Yes	No
5	Did the review authors describe the included studies in adequate detail?	Score yes if a tabular or narrative summary of included studies is provided.	No	Yes	No

6	Did the review authors use a satisfactory technique for assessing the risk of bias (RoB) in individual studies that were included in the review?	Score yes if there is any discussion of any source of bias such as attrition, and including publication bias.	Partial Yes	Yes	Partial Yes
7	Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review?	Yes if the authors report heterogeneity statistic. Partial yes if there is some discussion of heterogeneity.	Yes	Yes	Partial Yes
8	Did the review authors report any potential sources of conflict of interest, including any funding they received for conducting the review?	Yes if authors report funding and mention any conflict of interest	No Low	Yes High	Yes Low



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