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Identifying Effective Components in Preventive Parenting Behaviour Change Interventions: A Meta-Analysis

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Abstract

This meta-analysis looks at the effect of preventive parenting interventions and which categories of behaviour change techniques are effective in preventing adverse parenting behaviour and child psychosocial development outcomes. A three-level meta-analysis was conducted on studies with a randomised controlled trial or controlled trial design reporting a post-intervention assessment of a parenting behaviour measure for a preventive parenting intervention for parents who are expecting a child or who have a child aged 0 to 4. We included 79 studies reporting 86 interventions (N = 14,877 participants) on primarily American (33%) and European (29%) populations with a mean parent age of 30.4 and a mean child age of 1.6 years. We found a moderate positive effect both for parenting ($g = 0.28$) and child ($g = 0.25$) outcomes. Effect sizes were significantly larger for interventions targeting parents with lower socioeconomic status and for indicated prevention interventions. Interventions providing information on the consequences of specific behaviour yielded smaller effect sizes for both outcomes, whereas interventions aimed at parental involvement resulted in better child outcomes. Some behaviour change technique categories were often applied in interventions and had moderate effect sizes. We recommend continuing the use of these techniques.

Keywords Parenting · Intervention · Prevention · Behaviour change techniques · Meta-analysis

Highlights

- Parenting plays a significant role in child psychosocial development and preventive parenting interventions seem to be effective.
- In this meta-analysis, we study what intervention components are effective in improving parenting behaviour and child psychosocial development, analysing 86 interventions from 79 studies with a total of 14,877 participants.
- Effects are larger for indicated prevention interventions and for interventions in which mainly parents with a lower socioeconomic status participated.
- Interventions aiming to improve parental involvement had a moderate positive effect on child outcomes.
- Interventions often apply similar combinations of techniques. Providing information on consequences of specific behaviour is not a particularly effective behaviour change technique.

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Introduction

Parents and primary caregivers play a substantial role during someone's life, especially during childhood, a critical period of development that shapes individual lives and even those of future generations (Linnér & Almgren, 2020; Walker et al., 2011). We know that parenting is associated with child cognitive, social and emotional development, including externalising and internalising problems (Lanje-kar et al., 2022). Distinct parenting styles affect a child differently, with positive effects for sensitive, responsive, and warm parenting and negative effects for harsh, authoritarian, and overinvolved parenting and parental rejection (Black et al., 2017; Neel et al., 2018; Pinquart, 2017; Rose et al., 2018). Both mothers and fathers play a complementary, important role in raising children through different parenting styles, although fathers have often been neglected in research on parenting interventions (Bögels & Phares, 2008; Pakaluk & Price, 2020; Wittig & Rodriguez, 2019). There are also some groups that are more at risk of experiencing parenting problems, such as teenage parents, parents of low socioeconomic status, and ethnic minority parents (Savio Beers & Hollo, 2009; Van Mourik et al., 2016; Zilberstein, 2016).

Considering the impact of parenting, it is not surprising that interventions aimed at parenting, and especially prevention of parenting problems, have been shown to be effective in promoting child development (Anderson et al., 2003; Jeong et al., 2021). Preventive parenting interventions even have the potential to have a positive public and societal impact. In spite of this, we still see limited implementation and uptake in the Netherlands (Hosman & Jonkman, 2020). In the current meta-analysis, we look at different prevention levels using the framework from the National Research Council and Institute of Medicine (2009) in which prevention is considered universal when it is aimed at the general not at-risk population, selective when it is aimed at risk groups, and indicated when it is aimed at a population with high risk and early symptoms. In this paper, we look at interventions aimed at people who have no issues around parenting yet (universal or selective prevention) and at people who have concerns with regards to parenting (indicated prevention).

Existing systematic reviews and meta-analyses on such preventive parenting interventions usually focus on their overall effectiveness (Barlow et al., 2016; Flujas-Contreras et al., 2019; Moon et al., 2020; Van Aar et al., 2017). The results of these studies seem to indicate that parenting interventions improve parental and child wellbeing, decrease child emotional and behavioural issues, increase parental knowledge and parent-child interaction, and decrease negative disciplining (Barlow et al., 2016; Flujas-Contreras et al., 2019; Moon et al., 2020). In addition, the

effect of parenting interventions in reducing disruptive child behaviour appears to be sustained over time (Van Aar et al., 2017).

Little systematic scientific knowledge is available on which specific type of preventive parenting interventions and which intervention components are most effective in changing parenting behaviour and improving child well-being. This is, however, essential for successful selection and implementation of tailored interventions based on the targeted group of parents and the interventions' core ingredients. The importance of this is illustrated by the meta-analysis of Wyatt Kaminski, and colleagues (2008) who investigated to what extent specific components of parent skills training can improve behaviour and adjustment of children aged 0 to 7. They found large positive results for components focused at 1) positive parent-child interaction and communication, 2) parenting consistency and using the disciplinary technique of a time-out with their child, and 3) practicing of new skills during sessions. Components directed at improving parental problem solving abilities and suggesting how to encourage their child's cognitive skills were also associated with small positive effects on parenting behaviour, and on child behaviour for improving their child's social skills (Wyatt Kaminski et al., 2008). In other meta-analyses, on the prevention of child abuse, overall positive effects of interventions were found, especially when aimed at parental expectations, parental responsiveness and sensitivity, and when applying home visiting and parent training (Van der Put et al., 2018). When it comes to specific components of interventions, no differences or small negative differences were observed, specifically for direct feedback, skills practice, improving parents' personal skills and problem-solving, or encouraging prosocial behaviour of children (Gubbels et al., 2019). In summary, there is evidence that preventive parenting interventions can be effective, however evidence on whether some components are more effective than others is still insufficient, especially since it is centred around the prevention of child abuse rather than prevention of parenting and child problems more generally.

The aims of this meta-analysis are 1) to investigate the effects of preventive parenting interventions for parents/primary caregivers who are expecting a baby or have a child aged 0 to 4 years (preschool years in the Netherlands) as shown by RCTs and controlled trials using a control or comparison group on a) parenting behaviour and b) child (psychosocial) development, and 2) to study to what extent the structural, contextual, and content components may influence the effectiveness of these interventions.

To determine which intervention strategies were used to change parenting behaviour in each of the interventions included in our meta-analysis, we employed the behaviour change technique (BCTs) taxonomy as defined by Michie

Table 1 Behaviour change technique (BCT) categories with examples

BCT category	Examples of BCTs
Goals and planning	Goal setting, problem solving, action planning, reviewing outcome goals
Feedback and monitoring	Monitoring by others, self-monitoring, feedback on behaviour
Social support	Practical social support, emotional social support
Shaping knowledge	Instruction on how to perform a behaviour, information about antecedents
Natural consequences	Information about health, social, emotional, or environmental consequences
Comparison of behaviour	Demonstration of behaviour, social comparison
Associations	Introducing or reducing prompts/cues, satiation, associative learning
Repetition and substitution	Behavioural practice or substitution, habit formation
Comparison of outcomes	Pros and cons, comparative imagining of future outcomes
Reward and threat	Material or social incentives or rewards
Regulation	Reducing negative emotions, conserving mental resources
Antecedents	Restructuring the physical or social environment, distraction
Identity	Identification of self as role model, framing, incompatible beliefs
Scheduled consequences	Behaviour cost, punishment, removing reward, removing punishment
Self-belief	Verbal persuasion about capability, mental rehearsal of successful performance
Covert learning	Imaginary punishment or reward, vicarious consequences

et al. (2013). This taxonomy exists of 93 techniques divided over 16 categories of BCTs, presented in Table 1 along with examples of BCTs falling under each category. It is widely used to report on the different techniques used in behaviour change interventions and it is a useful tool to help with the development of new or improvement of existing interventions (Hornstra et al., 2023; Ntoumanis et al., 2021).

Methods

Eligibility Criteria

Studies were included for analysis if 1) the study was a randomised controlled trial (RCT) or a controlled trial; 2) the study reported on at least one intervention for preventing or reducing parenting problems in the general population (universal/selective prevention) or in the population at risk for developing parenting problems (indicated prevention); 3) the study reported on a measure of parenting skills or parenting behaviour, for example parent-child interaction or parenting self-efficacy, and related terms, such as parenting practices and parenting style; 4) the study reported post-intervention assessments or assessments within six months of follow-up; and 5) the intervention targeted caregivers with a child aged –9 months (during pregnancy) until 4 years old.

Studies were excluded if 1) study outcomes only related to lifestyle behaviour (e.g. physical activity, diet and substance), literacy behaviour, breastfeeding practices, academic achievement, and knowledge, attitudes and practices regarding feeding; 2) the study lacked a control group or the

intervention group and comparison group both receiving a completely different intervention; 3) the intervention targeted people who were already experiencing parenting problems; 4) the intervention only supported children or teachers; 5) the intervention was provided to foster parents or incarcerated parents (high risk of already having problems); 6) the intervention was aimed at children or parents who displayed clinically apparent or diagnosed (mental) health problem behaviour; 7) the intervention focused only on children or parents with health problems (e.g. asthma, eczema, preterm births), parents with HIV or when families are known by social services for child maltreatment, homeless parents (not own setting); 8) the intervention was prenatal and only focused on health-related and physical development outcomes in mother and child.

Information Sources

The electronic databases PubMed, Embase, Web of Science, PsycINFO, Cochrane Library/CENTRAL, Emcare, and ProQuest Dissertations were searched for articles, dissertations, and reports until June 12, 2024.

Search Strategy

The search strategy was set up in collaboration with a librarian from the Leiden University Medical Center Walaeus library and included keywords related to study design, intervention characteristics, outcomes, and study population: ‘randomized control,’ ‘random,’ ‘parent program,’ ‘parenting intervention,’ ‘video feedback,’ ‘parenting,’ ‘child rearing,’ ‘parent.’ The complete search strategy

can be found in Appendix A. Two reviewers independently screened all titles and abstracts based on our inclusion criteria. The full-text selection was conducted by three authors (MS, KM, EJ) and three research assistants. In case of studies reporting secondary analyses, studies reporting primary analyses were searched for too. Disagreements were solved by consensus and one of the authors (MC) was consulted in case of uncertainty about inclusion. Two reviewers performed a final check. The random percentage agreement was 85.9% for full-text screening. For title and abstract screening, no agreement scores are available as this was not noted. In case of any incomplete study data, study authors were contacted to obtain all data needed for the current analysis.

Data Extraction

Data extraction was done by three authors (MS, KM, EJ) and four research assistants. Before coding independently, data extractors were trained by coding five studies on the variables of interest. During data extraction any disagreements were resolved by consensus and MC was consulted in case of uncertainty about extraction. Random percentage agreement was 83.8% for data extraction. In addition, 100% of the contextual factors, structural components, specific intervention practices, outcome and sample size data used to compute effect sizes were verified for accuracy by the first or second author. Our codebook can be found in Appendix B.

All data on study design and intervention characteristics that could moderate the effect of parenting interventions was extracted and coded following a coding system as described in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2019). For our determinants, we extracted data on study characteristics, and structural, contextual, and content intervention characteristics. Regarding study characteristics, we extracted information on publication year, research design, study country, gender of parents and percentages of ethnic minorities in the sample, measurement method, and type of control. With regards to intervention characteristics, we extracted structural information on prevention level (universal/selective and indicated), intervention type (mode of delivery), intervention duration, frequency, contextual information on the intervention's target parent group and child age, and content information about the behaviour change techniques and intervention goals. We applied Michie's Behavior Change Technique (BCT) Taxonomy (v1) to code the techniques used. We have coded the 93 BCTs, but in the current study we only used the 16 categories as there was not enough data to perform analyses the 93 unique techniques (Michie et al., 2013). The coding of the techniques was based on information found in the study and additional information from intervention manuals, if

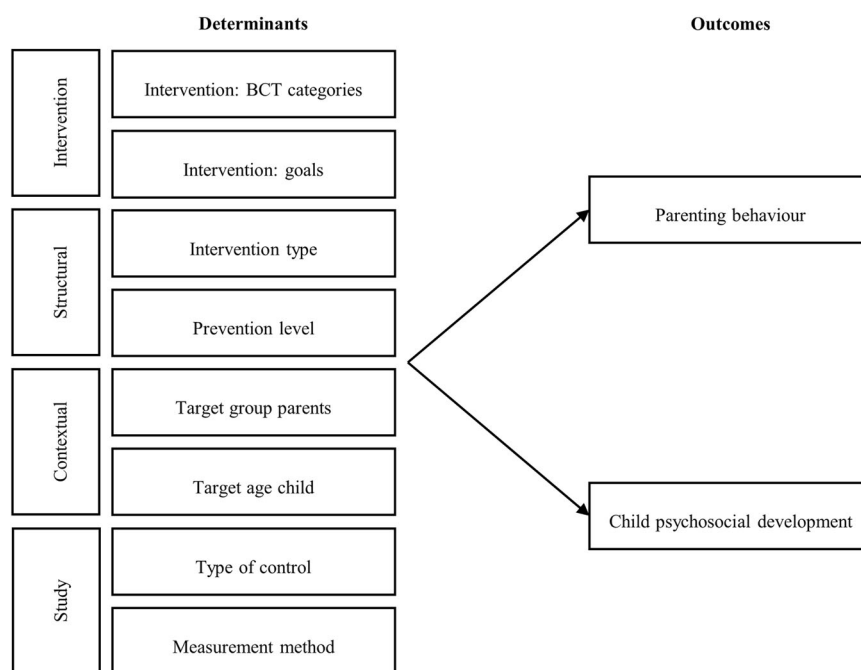
available. In intervention descriptions, we also noted if the intervention worked towards one or more of these 13 goals that were identified in our expert project group: child development, child wellbeing, sensitive parenting, positive parenting, promoting disciplining, communication, parental involvement, parental self-efficacy, parenting attitudes, parental wellbeing, relationship with partner, social network, emotional support, or practical support.

We had two outcome variables: parenting behaviour and child psychosocial development. As the included studies measured different outcomes using different measures, we first classified the measures into measurements of parenting behaviour or child psychosocial development. Parenting behaviour measures included for example parental sensitivity (measured by e.g., Emotional Availability Scales, Ainsworth Sensitivity Scale), parental self-efficacy (measured by e.g., Parent Self-Efficacy, Parenting Sense of Competence Scale, and Self-Efficacy in Infant Care Scale), and positive parenting (measured by e.g., Parent Play Questionnaire and the Dyadic Parent-Child Interaction Coding System). Child psychosocial development measures included amongst others Dyadic Parent-Child Interaction Coding System, Child Behavior Checklist, Brief Infant-Toddler Social and Emotional Assessment, Strengths and Difficulties Questionnaire, Eyberg Child Behavior Inventory, and Child Behavior Development Scale.

Data Analyses

A theoretical model of our analyses can be found in Fig. 1. We applied a three-level meta-analysis which deals with dependencies of effect sizes within individual studies in a different manner. It considers three sources or levels of variance: variance between intervention participants (level 1), variance between different outcome measures within a study (level 2), and variance between studies (level 3). As most, but not all, studies presented multiple outcome measures (level 2), we aggregated the outcomes on study level (level 3) by our two main outcomes of interest as described above: parenting behaviour and child psychosocial development. We used the metafor package in R with the function `rma.mv` to carry out our analyses applying a Correlated and Hierarchical Effects model with a Robust Variance Estimation method (Pustejovsky & Tipton, 2022). Hedges' g , a corrected standardised mean difference, was used to calculate effect sizes for each outcome measure. To make sure that all effect sizes represented an effect in the correct direction, negative signs were given to effect sizes representing outcomes for which higher scores should be interpreted as a negative effect, e.g., measures for depression. The outcomes were visualised using forest plots, considering each study's weight.

After performing overall analyses for both primary outcomes, we conducted moderator analyses. For both

Fig. 1 Theoretical model of analyses

parenting behaviour and child psychosocial development, we performed meta-analyses on a subset of studies containing each intervention or study characteristic. Then, we performed individual meta-regression analyses comparing the studies in which each characteristic was present to those in which it was absent. We also ran subgroup analyses on interventions designed for people with children aged 0 to 4 and people with a lower socioeconomic status (SES). We planned to conduct subgroup analyses on interventions designed for pregnant, teenage, and ethnic minority parents too, but there were insufficient studies to perform these analyses. Additionally, we performed a meta regression to investigate whether it was more effective to use more BCTs from various categories. Since all variables in moderator analyses are categorical, analyses were only performed for variables present in four or more studies (Fu et al., 2010). To assess heterogeneity between studies, we computed the prediction interval (PI) and used the Cochran's Q χ^2 test and the I^2 statistic. An I^2 up to 40% might not be important, an I^2 of 30 to 60% is considered to represent moderate heterogeneity, an I^2 of 50 to 90% may point to substantial heterogeneity, and an I^2 of 75 to 100% represents considerable heterogeneity (Higgins et al., 2019).

Bias and Certainty Assessment

Presence of publication bias was assessed using a funnel plot, testing for asymmetry with the Egger's regression test, and adjusting for asymmetry in the funnel plot using the Duval & Tweedie trim and fill method. Additionally, we applied the PET-PEESE method (precision-effect test-

precision effect estimate with standard error) (Stanley & Doucouliagos, 2014). We planned to perform additional sensitivity analyses if the between-study heterogeneity was high.

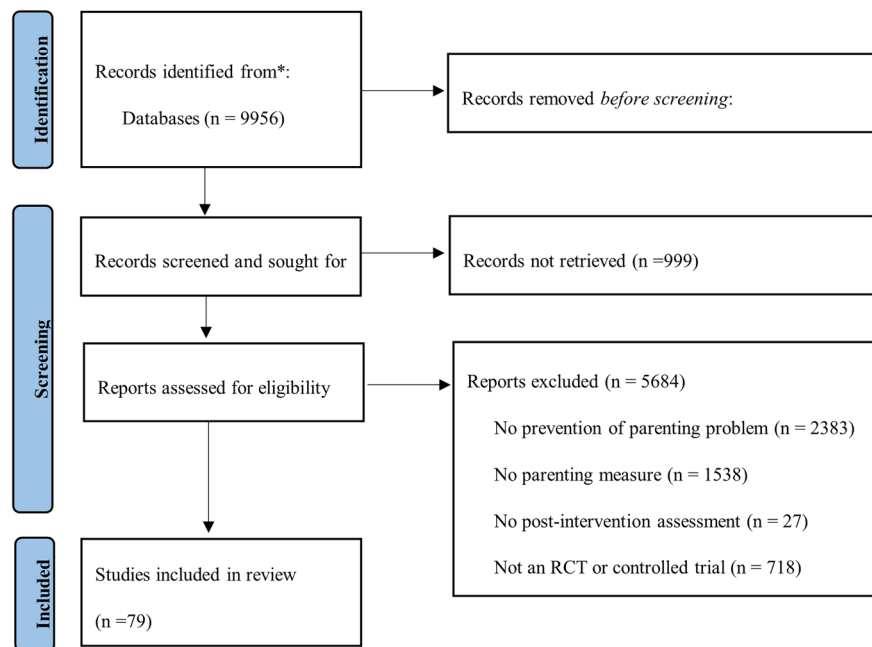
The Cochrane Collaboration tool was used to assess the risk of bias in the included studies (Higgins et al., 2019; Sterne et al., 2019). Studies were coded on six items: allocation sequence, allocation concealment, report of baseline characteristics, report of incomplete outcome data, knowledge of allocated intervention group (blinding), and presence of selective outcome reporting. Following the Cochrane Handbook's standardized guidance each item was coded as high, unclear, or low bias (Higgins et al., 2019). Risk of bias assessments were done by one reviewer and verified by a second reviewer. After performing all analyses, the two overall meta-analyses on parenting behaviour and child psychosocial development were repeated to examine whether potential bias in studies influenced the results in our meta-analysis. For these analyses, we excluded studies with high risk of bias for one or more of the risk of bias items, except for the variable on knowledge of allocation intervention since studies on these types of interventions usually have high risk of bias for this variable.

Results

Study Selection

We included 79 studies (total $N = 14,877$ participants) evaluating a total of 86 preventive parenting interventions in

Fig. 2 PRISMA flow chart



the general population (universal/selective prevention) or in an at-risk population (indicated prevention). A list of included studies can be found in Appendix C. Our search (see the flowchart in Fig. 2) of the databases PubMed, Embase, Web of Science, PsycINFO, Cochrane Library/CENTRAL, Emcare, and ProQuest Dissertations yielded a total of 9956 citations. After title and abstract screening, the full text of 5763 studies was screened on the inclusion criteria, of which 5684 studies were excluded. Exclusion was most often done because the intervention was not designed for prevention of a parenting problem ($n = 2383$) or because no outcome measure of parenting was available in the dataset ($n = 1538$). Twenty-eight authors were contacted to provide missing data, eleven authors responded, and eight authors provided the data requested. The studies for which data was not provided were excluded.

Study Characteristics

Table 1 in Appendix D provides an overview of the studies included. Studies were conducted in North America (33%) and Europe (29%), followed by Australia and South America (both 11%), Middle East (5%), Africa (4%), and Asia (6%). Most (76) studies had an RCT design, three had a controlled trial design, and 63% of the studies applied no other intervention or a waiting list as control. Mean age of parents participating in the interventions was 30.4 years (range: 16–62) and mean age of the children was 1.6 years (range: 0–4). Most parents in the studies were female (90%) and 44% were part of a cultural minority group. 28% of studies focused specifically on families with lower SES.

Intervention Characteristics

Table 2 in Appendix D gives more details on the interventions studied. Most (69%) interventions were individual-based, while 16% of interventions were group-based, and 15% of interventions applied a combination of these two forms. The individual interventions most frequently consisted of home-visitation programmes, followed by video-feedback interventions. Studies less often evaluated independent online interventions. Some intervention programmes were evaluated in multiple studies, such as Triple P – Positive Parenting Program (10) (Adamson et al., 2013; Dittman et al., 2016; Hahlweg et al., 2008; Markie-Dadds & Sanders, 2006; Morawska & Sanders, 2006; Smallegange et al., 2016; Tully & Hunt, 2017; Turner & Sanders, 2006), Video-feedback Intervention to promote Positive Parenting (VIPP) (9) (Alsancak-Akbulut et al., 2021; Barone et al., 2021; Euser et al., 2021; Green et al., 2017; Juffer et al., 2005; Kalinauskiene et al., 2009; Negrao et al., 2014; Van Zeijl et al., 2006; Yagmur et al., 2014), Incredible Years (3) (Hutchings et al., 2016; Pontoppidan et al., 2022; Reedtz et al., 2011), and Home-Start (2) (Hermanns et al., 2013; Smallegange et al., 2016). In total 53% of the interventions had a universal/selective prevention goal and 47% an indicated prevention goal. Most interventions lasted 0 to 6 months (77%), some lasted 7 to 12 months (12%) and only a small number of interventions were implemented for 13 to 24 (8%) or more than 24 (3%) months. The frequency of intervention sessions was most often weekly (41%), followed by every other week or monthly (26%), and multiple sessions per week (14%). As for BCTs, several categories were often applied in interventions, such as

shaping knowledge ($n = 74$, 86%), repetition and substitution ($n = 60$, 70%), comparison of behaviour ($n = 55$, 64%), feedback and monitoring ($n = 48$, 56%), goalsetting and planning ($n = 42$, 49%), and natural consequences ($n = 36$, 42%). Finally, interventions were often aimed at improving child development ($n = 63$, 73%), sensitive parenting ($n = 42$, 49%), communication ($n = 40$, 47%), and positive parenting ($n = 36$, 42%).

Overall Effect and Risk of Bias

As for parenting behaviour, the effect size was 0.28 (95% CI = 0.23–0.33, p -value = <0.001) for all interventions ($n = 86$) and 0.28 ($n = 44$, 95% CI = 0.21–0.35, p -value = <0.001) after excluding studies with high risk of bias. Figure 3 visualises results for parenting behaviour. Parenting behaviour effect sizes ranged from -0.25 to 1.27 , with a significantly positive effect size for seventeen out of 86 interventions (range 0.52–1.27). For child psychosocial development, the effect size for all interventions ($n = 56$) was 0.25 (95% CI = 0.19–0.32, p -value = <0.001) and 0.26 ($n = 30$, 95% CI = 0.17–0.35, p -value = <0.001) after excluding studies with high risk of bias. Figure 4 visualises intervention effects on child psychosocial development. Effect sizes for child psychosocial development ranged from -0.13 to 0.86 , nine interventions had a significant positive effect size (range 0.59–0.86).

Results of Moderator Analyses

Table 2 presents moderator analyses for parenting behaviour and child psychosocial development. Note that statistics presented are based on analyses of subsets, i.e., effect sizes of interventions with a certain characteristic, and indication of significance results from comparison of intervention with and without this characteristic. When comparing target groups to interventions not focusing on this group, increased significant effects results were found for interventions focusing on families with lower SES (parenting behaviour: $g = 0.37$, 95% CI [0.27–0.48], child psychosocial development: $g = 0.40$, 95% CI [0.23–0.57]). As for other programme characteristics no significant differences in effect sizes were found for parenting behaviour. For child psychosocial development, universal/selective prevention programmes yielded a lower overall effect size ($g = 0.17$, 95% CI [0.09–0.24]) than indicated prevention programmes ($g = 0.34$, 95% CI [0.22–0.45]), and interventions that were only group-based yielded a lower effect size ($g = 0.10$, 95% CI [-0.01 –0.20]) compared to other intervention types. Furthermore, interventions aimed at parental involvement had a higher effect size for child psychosocial development compared to interventions that did not focus on this ($g = 0.44$, 95% CI [0.24–0.64]). As for BCT

categories, we found 58 different combinations of BCT categories in the interventions. Shaping knowledge, repetition and substitution, comparison of behaviour, feedback and monitoring, and goalsetting and planning were most often applied. Natural consequences yielded lower effect sizes both for parenting behaviour ($g = 0.21$, 95% CI [0.14–0.29]) and child psychosocial development ($g = 0.15$, 95% CI [0.06–0.23]). In our meta regression on the number of BCT categories applied in the interventions, we did not find evidence for an effect with an estimate of -0.007 (p -value = 0.608) for parenting and -0.007 (p -value = 0.730) for child psychosocial development, hence there is no larger effect when several different types of BCTs are applied in intervention.

When looking closer at the three interventions with the highest significant effect sizes separately for parenting behaviour and child psychosocial development, it stands out that five of the six interventions apply techniques from the shaping knowledge BCT category. The BCT categories of feedback and monitoring and repetition and substitution were implemented in four of these top interventions, and goalsetting and planning in half of them. One intervention was group-based online and five of these interventions were individual, two home-based, and one with video-feedback, online, or in practice (Day & Sanders, 2018; Fung & Fox, 2014; Huang et al., 2021; Lagges & Gordon, 1999; Markie-Dadds & Sanders, 2006; Turk Dudukcu & Tas Arslan, 2022).

Subgroup Analyses

The pregnancy subgroup had an overall significant effect size both for parenting ($g = 0.26$) and child psychosocial development ($g = 0.29$). The teenage subgroup had an overall significant effect size both for parenting ($g = 0.28$) and child psychosocial development ($g = 0.27$). The ethnic minority subgroup had an overall significant effect size both for parenting ($g = 0.24$) and child psychosocial development ($g = 0.34$).

For the subgroup of families with children aged 0 to 4 (Table 1 in Appendix E), only the overall effect size was significant for parenting behaviour ($g = 0.30$). For child psychosocial development, we found a significant overall effect size ($g = 0.25$) and, like our analyses of all studies, higher effect size for interventions aimed at parental involvement and lower effect sizes for group-based interventions and interventions applying the BCTs from the natural consequences category.

The interventions aimed at families with lower SES had a higher effect size both for parenting ($g = 0.37$) outcomes and for child psychosocial development ($g = 0.40$) compared to studies not focused on this group (Table 2 in Appendix E). The BCT category of goalsetting and

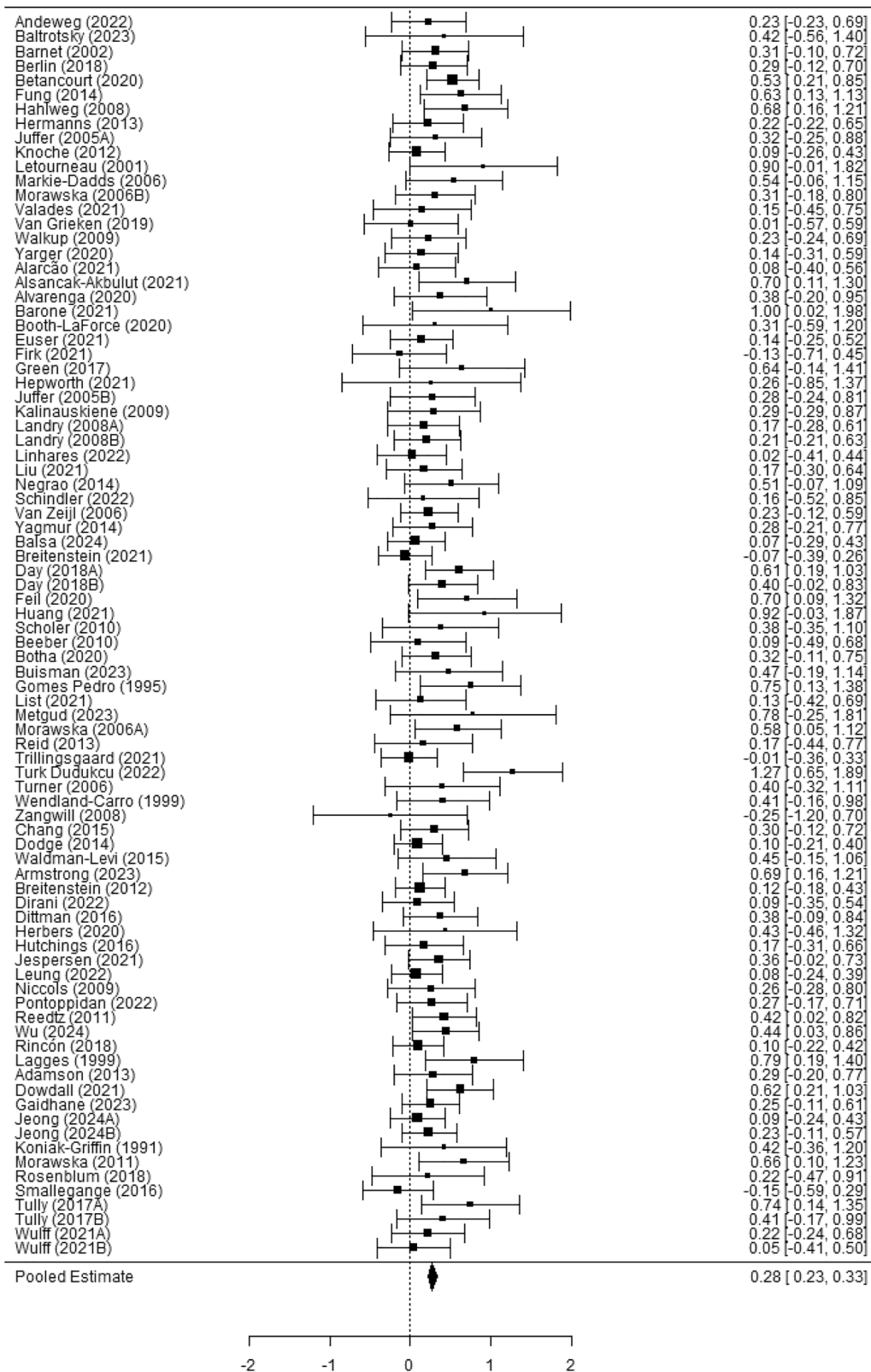
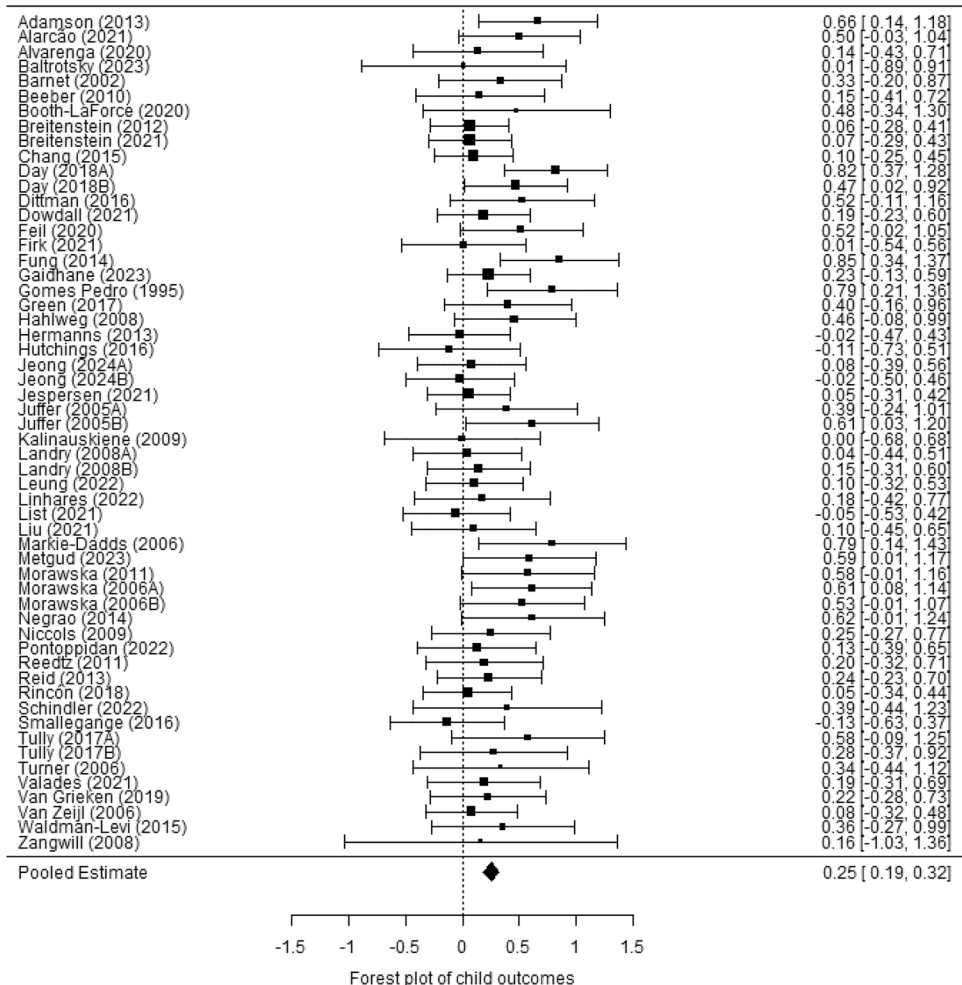


Fig. 3 Forest plot visualising study effects on parenting behaviour (n = 66)

Fig. 4 Forest plot visualising study effects on child psychosocial development (n=44)



planning yielded a significantly positive effect size at 0.65. As for intervention goals, parental involvement resulted in a significantly larger effect size of 0.72.

Bias and Certainty of Evidence

Figure 5 shows the risk of bias distribution of the included studies for each of the factors considered to assess risk of bias. Generally, low risk of bias was found except for one factor: knowledge of allocated intervention. This is unsurprising, as in the studies included, it is difficult to blind participants to intervention assignment, as most often no intervention or a waiting list is used as control. All study scores for each risk of bias question can be found in Appendix F.

The Cochran's Q χ^2 test for both parenting and child psychosocial development returned a p-value of <0.0001 , indicating heterogeneity between studies. For parenting behaviour, there was low to moderate heterogeneity between studies with 29.3% of the total variance distributed at level 1, 61.3% at level 2, and 9.4% at level 3.

For child psychosocial development, the same level of heterogeneity was found with 44.3% of the total variance distributed at level 1, 33.0% at level 2, and 22.7% at level 3. Correspondingly, PIs included 0 both for parenting behaviour (-0.24 – 0.79) and child psychosocial development (-0.18 – 0.69), indicating presence of heterogeneity as well. As there was no high heterogeneity, we did not perform additional sensitivity analyses.

The funnel plot of the trim-and-fill analysis in Fig. 1 in Appendix G, shows that the distribution of effect sizes included in this meta-analysis is asymmetrical, which was confirmed by the Egger's regression test ($p < 0.0001$) and in the trim-and-fill analysis, imputation of several effect sizes was needed to create a symmetrical funnel plot. It is also apparent that some of the effect sizes of included studies are outliers. Results from the PET-PEESE analyses yielded adjusted estimates of 0.03 (PET) and 0.18 (PEESE) for parenting behaviour and -0.01 (PET) and 0.11 (PEESE) for child psychosocial development. PET results are not significant for both outcomes, indicating that the PET estimate must be used. However, since the PET estimate for child

Table 2 Results for the moderator analyses

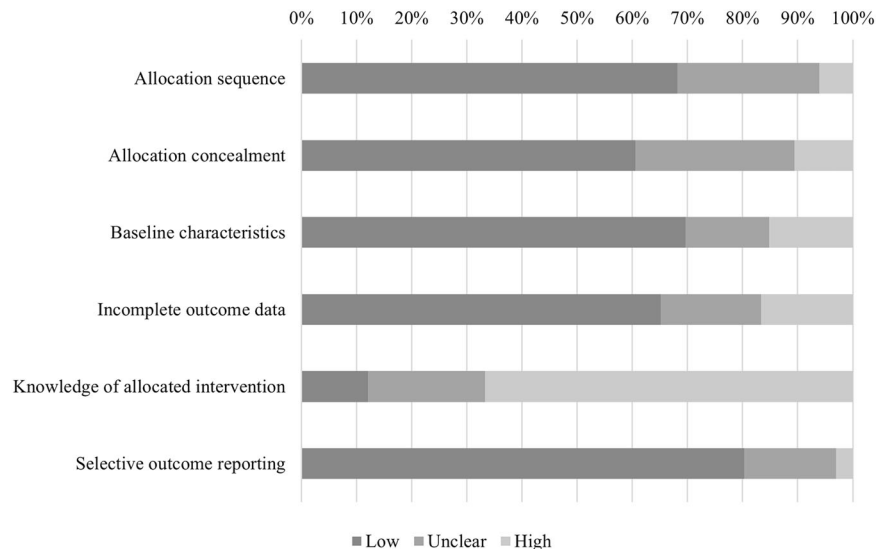
Variable	Parenting behaviour				Child psychosocial development			
	N	<i>g</i>	CI 95%	SE	N	<i>g</i>	CI 95%	SE
Overall	86	0.28*	(0.23–0.33)	0.03	56	0.25*	(0.19–0.32)	0.03
Characteristics								
Target age child								
Pregnancy	11	0.26	(0.09–0.44)	0.09	4	0.29	(0.05–0.52)	0.12
Child 0 to 4 years	75	0.30	(0.24–0.36)	0.03	53	0.25	(0.18–0.32)	0.04
Target group parents								
Ethnic minority	10	0.24	(0.1–0.38)	0.07	6	0.34	(0.06–0.62)	0.14
Lower SES	23	0.37*	(0.27–0.48)	0.05	13	0.40*	(0.23–0.57)	0.09
Teenage parents	6	0.28	(0.02–0.53)	0.13	4	0.27	(0.05–0.48)	0.11
Intervention type								
Individual: home-based	18	0.31	(0.2–0.41)	0.05	11	0.38	(0.21–0.55)	0.09
Individual: video feedback	18	0.24	(0.13–0.35)	0.05	13	0.19	(0.06–0.32)	0.07
Individual: online	7	0.35	(0.1–0.61)	0.13	4	0.45	(0.11–0.79)	0.17
Individual: in practice	16	0.34	(0.18–0.51)	0.08	10	0.30	(0.11–0.48)	0.09
Group-based	13	0.25	(0.15–0.35)	0.05	9	0.10*	(–0.01–0.2)	0.05
Group combined with individual	13	0.28	(0.14–0.42)	0.07	9	0.23	(0.08–0.39)	0.08
Prevention level								
Universal/selective prevention	46	0.24	(0.18–0.3)	0.03	26	0.17*	(0.09–0.24)	0.04
Indicated prevention	40	0.31	(0.23–0.4)	0.04	30	0.34*	(0.22–0.45)	0.06
Type of control								
No intervention/waitlist control	54	0.27	(0.21–0.33)	0.03	40	0.25	(0.17–0.32)	0.04
Other intervention	32	0.30	(0.2–0.39)	0.05	16	0.26	(0.11–0.41)	0.08
Method of measurement								
Parent self-report	53	0.29	(0.22–0.36)	0.04	38	0.25	(0.16–0.33)	0.04
Observation	56	0.26	(0.19–0.33)	0.04	31	0.29	(0.19–0.39)	0.05
Techniques								
Goalsetting and planning	42	0.28	(0.21–0.35)	0.04	32	0.30	(0.2–0.4)	0.05
Feedback and monitoring	48	0.30	(0.23–0.37)	0.04	33	0.23	(0.14–0.32)	0.05
Social support	29	0.27	(0.17–0.36)	0.05	20	0.22	(0.13–0.32)	0.05
Shaping knowledge	74	0.29	(0.23–0.35)	0.03	48	0.27	(0.19–0.34)	0.04
Natural consequences	36	0.21*	(0.14–0.29)	0.04	23	0.15*	(0.06–0.23)	0.04
Comparison of behaviour	55	0.26	(0.2–0.32)	0.03	42	0.23	(0.16–0.3)	0.04
Associations	10	0.27	(0.16–0.38)	0.05	5	0.34	(0.08–0.61)	0.13
Repetition and substitution	60	0.29	(0.23–0.35)	0.03	43	0.25	(0.17–0.33)	0.04
Comparison of outcome	9	0.38	(0.17–0.58)	0.10	7	0.35	(0.07–0.62)	0.14
Reward and threat	22	0.22	(0.13–0.32)	0.05	17	0.20	(0.08–0.32)	0.06
Regulation	2				1			
Antecedents	7	0.24	(0.07–0.42)	0.09	4	0.28	(0.06–0.51)	0.11
Identity	5	0.18	(0.04–0.33)	0.07	2			
Scheduled consequences	2				1			
Self-belief	15	0.23	(0.11–0.35)	0.06	7	0.28	(0.08–0.48)	0.1
Covert learning	2				1			
Intervention goals								
Child development	63	0.27	(0.21–0.33)	0.03	45	0.25	(0.18–0.33)	0.04
Child wellbeing	24	0.31	(0.21–0.41)	0.05	12	0.24	(0.11–0.37)	0.07
Sensitive parenting	42	0.26	(0.19–0.32)	0.04	27	0.17	(0.1–0.25)	0.04

Table 2 (continued)

Variable	Parenting behaviour				Child psychosocial development			
	N	<i>g</i>	CI 95%	SE	N	<i>g</i>	CI 95%	SE
Positive parenting	36	0.32	(0.24–0.39)	0.04	24	0.33	(0.21–0.45)	0.06
Disciplining	30	0.28	(0.2–0.37)	0.04	22	0.28	(0.16–0.39)	0.06
Communication	40	0.26	(0.19–0.34)	0.04	31	0.20	(0.12–0.28)	0.04
Parental involvement	16	0.32	(0.19–0.44)	0.06	11	0.44*	(0.24–0.64)	0.10
Parental self-efficacy	21	0.31	(0.17–0.45)	0.07	15	0.28	(0.12–0.44)	0.08
Parenting attitudes	10	0.40	(0.22–0.57)	0.09	8	0.37	(0.16–0.58)	0.11
Parental wellbeing	16	0.26	(0.13–0.39)	0.07	8	0.14	(0.01–0.26)	0.06
Relationship partner	4	0.16	(–0.03–0.35)	0.10				
Social network	7	0.20	(0–0.41)	0.10	4	0.12	(–0.03–0.26)	0.07
Emotional support	6	0.25	(0.04–0.46)	0.11	3			
Practical support	2				2			

Statistics presented are based on analyses of subsets and thus present effect sizes for a group of interventions with a certain characteristic. Indication of significance results from comparison of interventions with and without this characteristic.

N number of studies; *g* Hedges' *g* effect size; *CI* confidence interval; *SE* standard error; * *p*-value < 0.05

Fig. 5 Risk of bias distribution

psychosocial development is negative, we must use the PEESE estimate for this outcome (Stanley & Doucouliagos, 2014). Results from the trim-and-fill funnel plot, Egger's regression test, and PET-PEESE indicate that it is likely that publication bias was present.

Discussion

We found that preventive parenting interventions in general have a positive effect on both parenting behaviour and child psychosocial development. Most behaviour change techniques that were used in the interventions related to the BCT categories of shaping knowledge, repetition and substitution, and comparison of behaviour. Parenting behavioural

change was somewhat more successful when interventions focused at parents with a lower SES compared to interventions that did not. For child psychosocial development, interventions had larger effect sizes when they included lower SES parents and were directed at indicated prevention and improving parental involvement, but lower effect sizes when interventions were group-based compared to individual or combined interventions. Although indicated prevention was more effective for child psychosocial development, which is an expected effect, we must keep in mind that through universal/selective prevention we can reach a larger population. Hence, a small but positive effect through universal/selective prevention for more people may result in an equally large, or even more substantial effect on society compared to the smaller interventions with bigger

effects through indicated prevention. For both outcomes, we found that the BCT category on providing information on the consequences of performing a specific behaviour (natural consequences) yielded lower effect sizes, while the BCT category on goalsetting and planning yielded larger effect sizes for child psychosocial development in interventions aimed at lower SES parents.

We found that some categories of BCTs are prevalent across interventions which resulted in effect sizes that were very similar to the overall effect size and subsequently rarely resulted in a unique significant effect. This applies to goalsetting and planning, feedback and monitoring, shaping knowledge, comparison of behaviour, and repetition and substitution. These categories of techniques were often implemented in interventions. Because the overall effect size was significant, we can say that on average, these techniques do have a positive effect. Several BCT categories were not widely implemented: association, comparison of outcome, regulation, antecedents, identity, scheduled consequences, and covert learning. Moreover, interventions did not often aim to improve the relationship of the parents, their social network, and practical or emotional support. Consequently, there are still many opportunities for evaluating a wider array of BCTs. We did not find evidence for an effect based on the number of different BCT categories applied.

In short, interventions seem to be specifically effective when they aim to promote parental involvement and apply BCTs from categories such as shaping knowledge (giving information about how to perform the behaviour, antecedents, and re-attribution) or repetition and substitution (e.g., replacing of old, rehearsal of new behaviour). In the shaping knowledge category, information is given on how to perform the behaviour and how antecedents and re-attribution may play a role (Michie et al., 2013). These results are in line with earlier findings (Black et al., 2017; Rose et al., 2018; Walker et al., 2007; Wyatt Kaminski et al., 2008). In addition, we observed that information about natural consequences is a less effective method for child psychosocial development, which has not been found in prior meta-analyses. For problem solving, part of the goals and planning BCT category, we found a positive effect for interventions aimed at lower SES parents. This meta-analysis therefore confirms the positive effects found for problem-solving in the meta-analysis of Wyatt Kaminski et al. (2008) for this subgroup, but opposes the negative effects found by Gubbels et al. on child maltreatment (2019). However, unlike Van der Put et al. (2018), we did not find that promoting parental self-confidence, such as is done in the BCT category of self-belief, is particularly effective. We also did not find that interventions aimed at promoting sensitive parenting are more effective, or that video-feedback was especially effective, as suggested by

the meta-analysis of Gubbels et al. (2021). This may be related to our meta-analysis studying preventive parenting interventions more generally, while they focused on child maltreatment interventions (Gubbels et al., 2019; Gubbels et al., 2021; Van der Put et al., 2018).

Strengths and Limitations

Our meta-analysis included a wide range of studies that evaluated various aspects of parenting behaviour and child psychosocial development after implementing interventions in a randomised controlled or controlled trial design. We not only looked at the overall effectiveness of interventions, but we also investigated the behavioural change techniques and researched it in a structured way using the BCT Taxonomy (v1) from Michie et al. (2013). We looked both at parenting and child outcomes rather than just one and we studied these outcomes based on a variety of measures that were applied in the included studies. Although this method neutralises information on which specific aspects of parenting behaviour or child psychosocial development are impacted by intervention components, it does provide us with information that is more applicable for preventive interventions: whether there is an effect on parenting behaviour and child psychosocial development in general. Additionally, results from our overall analyses and results from our analyses in which we excluded studies with high risk of bias were incredibly similar.

Several limitations of our meta-analysis should be considered. First, it is very likely that publication bias was present in our selection of studies. Additionally, our focus on universal/selective and indicated prevention has led to the exclusion of populations who are at a much higher risk of problems in parenting or child psychosocial development (Engler et al., 2022; Murray et al., 2012; Turney, 2014). Hence, results from this meta-analysis cannot be generalised to these populations. With regards to our screening, it is a limitation that no agreement scores are available for title and abstract screening. Another limitation is that we were not able to perform analyses on the subgroups of pregnant, teenage, and ethnic minority parents. We could also not look at differences between mothers and fathers, since included study samples rarely included fathers. In addition, we could not evaluate which combination of BCTs is especially effective, due to the high number of different combinations of BCT. Finally, future studies and intervention protocols should improve their description of interventions, particularly the theoretical foundation when it comes to behaviour change. Now, we may have missed BCTs that might have been applied in interventions, because the behaviour change methods were only broadly described. To deal with this, we contacted authors for their intervention protocols and, although there was a low

response, from those that responded, the protocols did not lead to the discovery of other BCT categories than previously identified in the studies.

Implications

For practice, we recommend a focus on parental involvement and application of the following BCT categories: feedback and monitoring, shaping knowledge, comparison of behaviour, repetition and substitution, and goalsetting and planning. Providing information on consequences of behaviour might not be an important focus. Future research should make an effort to include fathers in their intervention evaluations and parenting research in general. It is underlined once more by our meta-analysis that fathers are rarely included in (evaluations of) parenting interventions, although it is known that paternal and maternal parenting are equally important (Van der Sluis et al., 2015; Wittig & Rodriguez, 2019).

Conclusion

This meta-analysis shows that preventive parenting interventions are effective in improving both parenting behaviour and child psychosocial development, especially when they are aimed at parental involvement and at parents with lower SES. To conclude, it is worth investing in preventive parenting interventions, both for parents and the wellbeing and future of children.

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Compliance with Ethical Standards

Conflict of Interest This work was supported by ZonMw under Grant number 554002006 and under Grant number 729300015. The authors report there are no competing interests to declare. PROSPERO registration number and name: CRD42021253462, Identifying Effective Elements in Preventive Parenting Behaviour Change Interventions: A Meta-Analysis. A separate review protocol was not prepared. Changes compared to registration: change of wording (controlled trial instead of semi-RCT), use of Hedges' g for all measures of effect (no risk ratio), use of Cochran's Q χ^2 test and the I^2 statistic only for heterogeneity assessments (not τ^2), only forest plots and no drapery plots, no subgroup analysis by ethnicity and teenage parents due to lack of data, and one additional collaborator (EJ). Extracted data and R codes can be obtained by contacting the first author. Mathilde R

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