Comparing instructional approaches in caregiver-implemented intervention: An interdisciplinary systematic review and meta-analysis

Bailey J. Sone, MA, CCC-SLP[1]; Jordan Lee, MS, CCC-SLP[1]; and

Megan Y. Roberts, PhD, CCC-SLP[1]

[1]Department of Communication Sciences and Disorders, Northwestern University

Author Note

Bailey Sone ORCID iD https://orcid.org/0000-0002-6130-9250

Megan Roberts ORCID iD: https://orcid.org/0000-0002-4699-0236

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Correspondence regarding this article should be addressed to Bailey Sone, 2240 Campus Drive, Evanston, IL 60208. Email: bailey.sone@u.northwestern.edu

Abstract

Family involvement is a cornerstone of early intervention (EI). Therefore, positive caregiver outcomes are vital, particularly in caregiver-implemented interventions. As such, caregiver instructional approaches should optimize adult learning. This study investigated the comparative efficacy of coaching and traditional caregiver instruction on caregiver outcomes across EI disciplines. A systematic search for articles was conducted using PRISMA guidelines. Meta-analysis methodology was used to analyze caregiver outcomes, and a robust variance estimate model was used to control for within-study effect size correlations. Seven relevant studies were ultimately included in the analysis. A significant, large effect of coaching on caregiver outcomes was observed compared to other models of instruction (g = 0.745, SE = 0.125, p = 0.0013). These results support the adoption of a coaching framework to optimize caregiver outcomes in EI. Future research should examine how coaching and traditional instruction can be used in tiered intervention models with a variety of populations.

Keywords: coaching, parents, caregivers, early intervention, meta-analysis

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The Individuals with Disabilities Education Act mandates provider-family partnerships in early intervention (EI) service delivery (IDEA, 2004). Caregiver involvement in all components of service is encouraged, including goal development, progress monitoring, and intervention. As such, EI should also take place in the child's natural environment to the greatest extent possible. These service mandates highlight the importance of the caregiver-child relationship in child development and acknowledge caregivers as the primary teachers and language models for their infants and toddlers. The theoretical foundation for these service mandates is based on the transactional model of development (Sameroff & Chandler, 1975). Within this model, not only does caregiver behavior shape child behavior, but child behavior is also thought to affect caregiver behavior. To this end, the involvement of the caregiver and family in EI is essential. However, the concept of caregiver involvement in such services has evolved since the conception of EI (Woods et al., 2011), demonstrating the need to examine different service delivery models that incorporate the caregiver as well as caregiver outcomes as a result of these models. This is particularly true in caregiver-implemented interventions, in which caregivers are taught to deliver intervention and learn to be a force of change in their child's developmental trajectory. Caregiver learning is critical to the success of such interventions, highlighting an immediate need to examine instructional strategies that promote positive caregiver outcomes.

Benefits of Caregiver-Implemented Interventions

Caregiver involvement can be maximized through caregiver-implemented interventions, which have garnered increased attention in recent years (Kemp & Turnbull, 2014; Roberts et al., 2019; Wyatt Kaminski et al., 2008). Within this framework, emphasis is placed on the active role

of caregivers in the service provision of their infants and toddlers in order for caregivers to learn to use specialized intervention techniques. While there are multiple benefits of teaching caregivers to become skilled intervention implementers, an increase in intervention dosage is a noteworthy advantage. In fact, children receive 18 more hours of weekly intervention when participating in a caregiver-implemented intervention program compared to services-as-usual (Roberts & Kaiser, 2015). This increase in dosage is not to be underestimated, as it has been shown that an increase in monthly EI is associated with functional improvements for children receiving services (McManus, 2009). Functional improvements are important because it has been suggested that early developmental deficits reduce long-term outcomes and increase cost for families and communities (Heckman, 2008). Taken together, these findings highlight the critical need to provide high-dosage intervention at an early age, and caregiver-implemented intervention is likely the most feasible and cost-effective solution.

In addition to increasing intervention dosage, caregiver-implemented intervention is a viable solution to multiple barriers to service delivery. For example, clinician-implemented interventions require resources from the caregiver and family including appointments during working hours and payment or insurance. These resources may limit high-dosage clinician-implemented services to families who are of higher socioeconomic status (Karpur et al., 2018). Although EI is federally mandated, children from families of higher socioeconomic status get more supplementary services than children from families of lower socioeconomic status (McManus, 2009). Caregiver-implemented intervention in the context of federally funded EI may be especially helpful for families of children who require high-dosage intervention even when the family is unable to access private services outside of EI. In addition, caregiver-implemented intervention is a means to provide services to families and children from rural or

underserved areas. With the advent of telepractice and remote therapy options, caregiver-implemented interventions can extend the reach of EI to more children than ever before (Ingersoll et al., 2016). However, the success of caregiver-implemented intervention relies on the caregiver's ability to learn the intervention techniques, thus there is a critical need to investigate instructional strategies that promote adult learning.

Caregiver Instructional Strategies

Coaching is a strategy for caregiver instruction that is informed by adult learning theory. In fact, coaching is one of the most effective strategies to optimize adult learning, with applications in professional training and skill improvement alike (Trivette et al., 2009). An essential component of coaching is that the caregiver practices with their child with collaboration from an intervention provider. This teaching procedure allows caregivers to be self-directed, to engage in real-life contexts, and to incorporate problem solving and reflection (Brown & Woods, 2016). Some caregiver teaching programs attempt to simulate this type of learning through role-play, but previous research suggests that hands-on practice with the child is a key component (Wyatt Kaminski et al., 2008). As a result, caregiver-implemented interventions that use coaching are often described as triadic, with an emphasis on the partnership between the caregiver and the intervention provider paired with active engagement of the child (Brown & Woods, 2016).

While it has been widely acknowledged that coaching is often used as an all-encompassing term to describe parent instruction with limited consensus on its components (Artman-Meeker et al., 2015; Haring Biel et al., 2018; Kemp & Turnbull, 2014), the operational definitions proposed by Friedman, Woods, & Salisbury (2012) guided the instructional framework in the present study (Table 1). These operational definitions include instructional

strategies that could be used to teach caregivers, as well as strategies used in other components of EI. In fact, the defined strategies are not all used for the same purpose during intervention or during the same stage of intervention (Friedman et al., 2012). However, it is critical to the goal of the present study to limit the definition of coaching to teaching strategies that promote triadic intervention and caregiver application opportunities. As such, only instructional strategies that include caregiver-child practice with provider feedback or collaboration meet these criteria for coaching. For example, the caregiver may lead the interaction with their child and receive real-time feedback from the intervention provider (e.g., caregiver practice with feedback in Table 1). Alternatively, the intervention provider may provide specific, real-time recommendations for the caregiver to try techniques during an interaction with their child (e.g., guided practice with feedback in Table 1). Coaching can also include the parent and intervention provider working together as a team to support the child, giving the caregiver opporunities to practice the intervention techniques with support (e.g., joint interaction in Table 1; Friedman et al., 2012).

In contrast, other models of traditional caregiver instruction differ from coaching in that they do not include caregiver-child interaction. In other words, they are not triadic and do not include a structured component in which caregivers have the opportunity to practice the intervention with their child while working with the provider. Often, teaching strategies in traditional caregiver instruction are didactic with the purpose of transferring knowledge from the intervention provider to the caregiver (Kemp & Turnbull, 2014). These instructional strategies are meant to provide active adult learning; for example, providing a caregiver a definition of an intervention technique and using detailed, personalized examples of how that technique is done (e.g., direct teaching in Table 1). There is notable variation in how interventions that use traditional instruction are delivered. Some use group training to instruct caregivers (Kasari et al.,

2014), some use primarily clinician-implemented intervention with didactic components (Dirks & Hadders-Algra, 2011), and others use self-guided training portals (Ingersoll et al., 2016).

There are benefits to both caregiver coaching and traditional caregiver instruction. For example, coaching provides caregivers with hands-on practice and feedback that may be necessary to learn complex intervention techniques. However, group caregiver training and self-guided training portals require less provider time per family and thus are more cost effective options. Understanding the extent to which each caregiver instuctional approach affects caregiver outcomes is a necessary first step in optimizing caregiver-implemented interventions across settings and EI disciplines.

Child Outcomes Following Caregiver-Implemented Interventions

Positive effects of caregiver-implemented interventions on child outcomes have been demonstrated in multiple disciplines. Roberts and Kaiser (2011) found positive, significant effects on child language outcomes in a meta-analysis comparing caregiver-implemented communication interventions to both services-as-usual and clinician-implemented interventions. More recently, a meta-analysis extended these findings by including at-risk children, demonstrating a positive effect of caregiver instruction on both child language outcomes and caregiver outcomes (Roberts et al., 2019). Both of these meta-analyses acknowledge that caregiver instructional strategies were not consistently described across studies. As such, it is not surprising that intervention characteristics did not moderate treatment outcomes in either meta-analysis.

Caregiver-implemented interventions are also well-established in the field of child behavior intervention (O'Brien, 2011). A meta-analysis investigating programs for families of children with disruptive behavior found positive effects of caregiver instruction on both

caregiver and child outcomes. Notably, the study showed that caregiver programs that included a coaching component were associated with higher effect sizes (Wyatt Kaminski et al., 2008). Other disciplines serving children enrolled in EI also demonstrate positive effects of caregiver-implemented interventions. For example, children who participated in the physical therapy program, *Coping With and Caring for Infants With Special Needs*, improved motor outcomes (Dirks & Hadders-Algra, 2011), and children demonstrated improvements in occupational therapy goals following occupational therapy caregiver coaching (Hanna & Rodger, 2002).

Caregiver Outcomes in Caregiver-Implemented Interventions

In order for caregiver-implemented interventions to result in positive child outcomes, the caregiver must implement the intervention with fidelity (Barton & Fettig, 2013; Haring Biel et al., 2019). In other words, the extent to which children make progress may be dependent on the caregiver's ability to implement the intervention as it was intended. Given the importance of caregiver outcomes, it is surprising that one meta-analysis showed that such outcomes were reported in less than half of the studies on caregiver-implemented interventions (Roberts et al., 2019). When caregiver outcomes are underreported, the extent to which coaching and other instructional strategies impact caregiver learning cannot be examined. While individual studies suggest a positive effect of coaching on caregiver outcomes in speech-language pathology (Roberts & Kaiser, 2015), physical therapy (Dirks & Hadders-Algra, 2011), and occupational therapy (Foster et al., 2013), it is unclear whether coaching results in better caregiver outcomes than other caregiver instructional models.

Purpose

The purpose of this meta-analysis is to compare instructional procedures used to teach parents EI techniques with a focus on outcomes related to caregiver learning. Various

methodologically rigorous meta-analyses have shown positive effects of caregiver-implemented interventions to support families and children (Roberts & Kaiser, 2011; Roberts et al., 2019; Wyatt Kaminski et al., 2008). However, these studies do not directly contrast coaching with traditional caregiver instruction. Further, these studies are often limited to a specific child outcome (e.g., communication) and as such do not take a interdisciplinary perspective. Although such child outcomes are the ultimate goal of EI programs, caregiver outcomes were of particular interest in the present meta-analysis because they are a proximal result of the instructional strategy. As such, a focus on caregiver outcomes is a critical first step in understanding and implementing high-quality caregiver teaching methods in EI. The following research question guided this study: What is the comparative efficacy of a coaching model of caregiver-implemented intervention versus traditional caregiver instructional procedures on caregiver outcomes across all EI disciplines?

Method

Guidelines from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) were used in this study (Moher et al., 2009). These evidence-based guidelines were created to improve reporting and quality in systematic reviews and meta-analyses. PRISMA guidelines can apply to various types of research and are particularly ideal in the evaluation of interventions. The PRISMA checklist is available in the supplemental materials.

Eligibility Criteria

Studies eligible for the present review were randomized or non-randomized between-group designs comparing a coaching model to another caregiver instructional method. To be included, studies were required to report caregiver outcomes related to the skills caregivers were

taught to use in the intervention program. In order to focus on EI, services provided by any discipline that typically serves families of children with disabilities or children at-risk from birth to age five were included. As such, studies were only included if the mean age of the children was less than six years old. Studies were excluded if the comparison condition was not designed to teach caregivers similar skills to those taught in coaching condition (e.g., general counseling) or if the study did not measure caregiver use of an intervention strategy that the caregivers were taught to use with their children. A review protocol was not preregistered for the present study.

Search and Study Selection

Search Methods

The original systematic search for articles was conducted on October 12, 2018 and has since been updated through June 16, 2020, using Academic Search Complete, Communication Source, ERIC, ProQuest Dissertations and Theses Global, PsychInfo, and PubMed. All levels other than full-text were searched where possible, though the search options available varied depending on the database. The PICOS framework (Participants, Intervention, Comparison, Outcomes, and Study Design; Impellizzeri & Bizzini, 2012) was used to guide search term selection and study criteria (Table 2). Broad search terms were selected in order to locate as many articles as possible. However, a previous research synthesis noted heterogeneity in the terminology used to describe caregiver coaching and instruction frameworks across the literature (Kemp & Turnbull, 2014). Kemp & Turnbull (2014) reported accounting for that heterogeneity by using various combinations of search terms. In order to account for this heterogeneity while keeping search terms both consistent and systematic, references from related meta-analyses yielded from the search were reviewed for relevant studies (no unique references were identified). Additionally, ancestral searching and forward searching was used on each included

study to identify grey literature and additional relevant studies (10 unique references were identified; see Figure 1).

Data Collection

Following the search, the first author screened all titles for possible inclusion. All titles considered relevant were imported into Research Electronic Data Capture (REDCap) for data management and further screening (Harris et al., 2009). The first and second author independently screened each abstract and subsequently screened the full text of all initially identified articles, thus screening of all abstracts was completed by two independent individuals. The authors demonstrated 99% agreement for full-text inclusion. All disagreements were resolved via consensus coding to make a final inclusion decision, resulting in 100% agreement following this consensus decision.

Data Extraction

All included studies were coded by two independent coders and verified through consensus coding to ensure accuracy of the data. Any disagreements on descriptive variables, effect sizes, or risk of bias were resolved through this process between the two trained coders. During training, we noted the majority of initial disagreements were due to inconsistency in reported definitions of instructional strategies between studies. Therefore, exact author verbiage was used to define instructional techniques, as opposed to defining each technique using the coaching framework in Table 1. As such, all instructional strategies presented in the present study have been verified by each coder, but these items were not traditionally coded using a manual and item bank. In contrast, all other variables were extracted based on predetermined criteria using a coding manual. Agreement on descriptive variables, including risk of bias, was initially 80%, reaching 100% after the consensus coding process. Initial agreement on effect size

calculations was 100% and did not require consensus coding. The full coding manual is available from the first author upon request.

Descriptive Variables

Coders extracted descriptive variables from all included studies using the definitions in Table 3. Due to the comparative nature of the present review, details about each intervention were a primary focus of coding. Descriptions of the coaching or instructional strategies, weekly time spent engaged in coaching or traditional instruction, materials used for coaching or traditional instruction, and total length of the intervention were of critical interest. Participant data, such as age of the child, age of the adult, socioeconomic status, and caregiver education, were also collected. Further, coders determined the discipline within EI in which the study applied (speech-language therapy, physical therapy, etc.) and the type of caregiver outcome measure that was used.

Effect Sizes

Coders also calculated effect sizes for all caregiver outcomes in each study. The standardized Hedges's *g* was used to estimate effect sizes because it is a conservative approach appropriate for small sample sizes (Cooper et al., 2009). Means and standard deviations of post-intervention outcome variables were used for this estimation. When means and standard deviations were not available, chi-square tests were used (Lipsey & Wilson, 2001). Effect sizes were calculated using the Practical Meta-Analysis Effect Size Calculator during initial coding to promote ease and consistency between coders (Lipsey & Wilson, 2001). Following online effect size calculations, all effect sizes were transformed from Cohen's *d* to Hedges's *g* using RStudio (RStudio Team, 2015). One study did not present the data necessary to calculate an effect size. The author was emailed for additional data but failed to respond. This resulted in the exclusion

of the study from the analysis. In the event that a study had some data that were conducive to calculating an effect size and some data that were not, only the available data were used.

Risk of Bias

All included studies were rated for risk of bias by the two primary coders. The present review used a risk of bias measure adapted from a previous meta-analysis on caregiver-implemented interventions to assess the quality of the included studies (Roberts et al., 2019). This measure evaluated studies on qualities that impact their internal validity (e.g., randomization, measuring fidelity of intervention, blinding of assessors). Studies were assigned risk scores for each item on a two-point scale, receiving a score of zero for low risk, one for unclear risk, and two for high risk. This resulted in a total potential bias scores ranging from zero to fourteen, such that higher scores indicated lower quality and greater risk. Risk of bias indicators and associated scores are available in Table 4.

Analytic Strategies

A meta-analytic methodology was applied to this systematic review in order to compare studies from different disciplines with different outcome measures in a standardized manner. Specifically, a random effects model with robust variance estimation was used to control for within-study effect size correlations by creating random weights (Hedges et al., 2010). The rationale for this method is twofold: it permits the inclusion of multiple effect sizes from a single study, and it permits the inclusion of effect-sizes from secondary studies that use a common participant pool. As such, this method allows for the use of all available data related to our research question, since studies of caregiver-implemented interventions likely measure more than one caregiver skill. Further, the data structure supported this method, as multiple studies used the same participant pools. This is often the case in clinical trials, since primary and

secondary outcomes may not be reported in the same manuscript. When this occurred, these manuscripts were manually grouped and all study outcomes were included as part of the primary aims study, as determined through in-text citations and funding documentation. In addition, sensitivity analysis was conducted to evaluate the stability of the estimates across covariance structures (Hedges et al., 2010). The robumeta package version 2.0 in RStudio version 4.0.2 was used for both the random effects model with robust variance estimation and the sensitivity analysis (Fisher & Tipton, 2015).

Publication bias was assessed using funnel plot analysis as well as an Egger's regression test to examine small study bias. The metafor package version 2.4 in RStudio version 4.0.2 was used for these analyses of publication bias (Viechtbauer, 2010). Publication bias was determined by averaging within-study effect sizes, resulting in a single effect size for each study. As such, single effect sizes for each study were analyzed using a funnel plot as a random effects model (without robust variance estimation).This method was chosen because to our knowledge, there is not yet a method of calculating publication bias that complements the robust variance meta-analysis such that it accounts for within-study correlations between effect sizes.

Results

Study Selection

The systematic search procedure yielded 3,609 unique articles, comprised of 3,599 articles from the databases and 10 articles from the ancestral search. Of these articles, 989 were screened for inclusion with 886 excluded using the abstract and 93 excluded following full-text review, resulting in 10 total included articles (Figure 1). A subset of studies were secondary analyses of larger clinical trials, and as such shared common participants with another included study (n = 3). Two of these studies were peer-reviewed publications and shared a participant

group with one larger clinical trial (Kasari et al., 2015). The remaining study was a dissertation and shared a participant group with another larger clinical trial (Kasari et al., 2014). All relevant effect sizes for these studies were included in the analysis. However, these studies were not coded separately and effect sizes were manually added to relevant primary studies per the study methods. Therefore, there are seven unique studies in the present review.

Study Characteristics

All studies were published within the past ten years (range = 2011–2017), with the exception of one study (1983). Of these studies, 85.7% were published in peer-reviewed journals (n = 6) and one was an unpublished dissertation. Randomized controlled trials comprised 100% of the work, and all but one study was conducted in the United States. Only a few EI disciplines were represented. Speech-language therapy comprised 42.9% of studies (n = 3), behavioral parenting intervention comprised 42.9% of studies (n = 3), and physical therapy comprised 14.3% of studies (n = 1). No studies including occupational therapy, general developmental therapy, or educational intervention were identified (Table 5).

Sample Characteristics

Caregiver characteristics were described with varying detail. No study reported all six demographic caregiver characteristics (caregiver participant, age, education, socioeconomic status, percent minority, and language). All but one study included information about which caregiver was the participant. Mothers participated in 85.7% of studies (n = 6), fathers participated in 42.9% of studies (n = 3), grandparents or other familial caregivers participated in 28.6% of studies (n = 2), and foster parents only participated in one study. Additionally, all studies included information about caregiver education. Average caregiver education was relatively evenly distributed with two studies including participants primarily with a high school

education, three studies including participants primarily with some college education, and two studies including participants primarily with a college education. Caregiver age was only reported in 50% of studies, with an average of 32.37 years (average range = 28.2–35.9 years). Caregiver risk factors were identified in 42.9% of studies, with two studies that included low-resourced families and one study that included families living in underserved areas (Table 6). Of the 7 total studies, 57% (*n* = 4) of studies reported an outcome or multiple outcomes that broadly reflected the caregivers' qualitative assessment of, acceptance of, or reaction to the intervention. However, vastly different constructs were used to measure these additional parent outcomes across studies. These constructs included caregiver satisfaction (*n* = 2), stress (*n* = 2), depressive symptoms (*n* = 2), and self-efficacy (*n* = 1). Additional parent outcomes (i.e., not related to main effects) reported across studies are shown in Table 7.

All studies described child characteristics. Due to the primary focus on caregiver outcomes in the present review, fewer child variables were coded. All of the studies reported the age of the child participants, revealing that children in the studies were, on average, 36.4 months old (range = 3–50.72 months). Less than half of the studies included children with autism spectrum disorder (ASD) as primary participants (*n* = 3). Six of the seven total studies reported child outcomes, and child outcomes were related to the discipline (i.e., movement/care outcomes for physical therapy, communication outcomes for speech-language therapy, and behavior outcomes for parenting or behavior interventions). Interestingly, all speech-language therapy studies included children with ASD (42.9% of all studies). Child characteristics are presented in Table 8.

Descriptions of Interventions

Coaching Interventions

About half of the studies reported that coaching interventions were provided in the home (n = 3) while the other four studies occurred in either a community setting (n = 1), a research laboratory (n = 2), or via telepractice (n = 1). All studies used a triadic service delivery model, with the interventionists, caregiver, and child all actively participating in the session. Three studies (42.9%) added an additional caregiver instruction component. Caregivers and interventionists were participants in these caregiver instruction components, but children were not present. No coaching strategy (e.g., live feedback, problem solving) was common to all coaching interventions. In fact, specific coaching procedures were not described in great detail in most of the studies. However, all coaching interventions differed from the traditional caregiver instruction conditions in that real-time coaching during triadic engagement was used (Table 9).

Comparative Instructional Interventions

Traditional caregiver instruction provided in the comparison conditions was even more diverse than caregiver coaching models. In all but one study, caregiver instruction was provided to the comparison group in the same location as the coaching group (i.e., home, telepractice). Two studies (28.6%) used group caregiver training as the service delivery model, and the others used traditional clinician-implemented intervention with integrated caregiver instruction, a self-directed online training portal, individual caregiver education, or an instructional video or manual. Similar to the coaching intervention conditions, no instructional techniques (e.g., lectures, handouts, group discussion) were common to all comparative instructional interventions (Table 9).

Risk of bias

Risk of bias was moderate across studies (M = 4.71, SD = 2.29). The overall risk of bias scores ranged from zero to seven out of a total 14. Most common indicators of bias were not

reporting blinding of coders, removal of missing data, and not reporting or having inadequate intervention fidelity in one or both of the intervention conditions (Table 10).

Data Synthesis

Main Effects

A significant, large effect of caregiver coaching on caregiver outcomes compared to other models of caregiver instruction was found (g = 0.745, SE = 0.125, p = 0.0013, 95% CI [0.43 – 1.06]). Between study variance was present but not large (τ^2 = 0.17). The sensitivity analysis yielded stable outcomes across all rho-values. No additional moderators were analyzed due to the small sample size and variability in descriptive variables in each study. Figure 2 presents a forest plot of caregiver outcomes, controlling for within-study effect size correlations. Of note, outcomes were measured in a variety of ways across all effect sizes included in the analysis (n = 17). The most common type of outcome measure was an observational coding system (n = 11). Other measurement types included, but were not limited to, caregiver report (n = 1) and clinician-reported global parent ratings (n = 2). Details on measurement are presented in Table 11.

Publication Bias

A funnel plot revealed symmetry in study outcomes (Figure 3). Egger's test for asymmetry confirmed this visual inspection, such that it demonstrated nonsignificant effects (z = 0.14, p = 0.89).

Discussion

The results of this systematic review and meta-analysis demonstrate significant, positive effects of coaching to teach caregivers in EI as compared to other instructional approaches. All of the coaching interventions were triadic and involved real-time coaching of caregivers as they

interacted with their child. In contrast, traditional caregiver instruction generally occurred between the caregiver and the interventionist without the child present. While caregiver-implemented interventions are designed based on the premise that caregivers can learn and effectively use EI techniques with their children, the findings of this meta-analysis suggest that coaching caregivers is the most efficient way to promote adult learning. This result has clear implications for clinical practice in EI, supporting the adoption of a coaching framework to teach caregivers intervention techniques across disciplines.

This study adds to previous meta-analytic work on caregiver-implemented interventions by focusing on caregiver outcomes to determine the comparative efficacy of frameworks used to teach caregivers. To our knowledge, this is the first meta-analysis that has used caregiver outcomes to determine effective instructional strategies. As a whole, caregiver-implemented interventions are known to increase the dosage of intervention that children receive; the findings of this study demonstrate that coaching caregivers increases the quality of intervention as measured by caregiver intervention skills in addition to the quantity of intervention.

The results of this study should be considered in context of its limitations. Like previous meta-analyses and research syntheses on caregiver-implemented interventions, the procedures used to coach and teach caregivers were not adequately described (Kemp & Turnbull, 2014; Roberts et al., 2019; Roberts & Kaiser, 2011). Although the results of this study demonstrate that coaching is an active ingredient to increase caregiver success, the ambiguity in coaching strategies limits the recommendations that can be made as a result of these findings. Consequently, reproducibility of the coaching strategies used across studies is difficult for future research and, moreover, clinical practice. Consistent with unclear intervention descriptions, the lack of consistent terminology may have impacted the systematic search conducted to select

studies for analysis. Given prior knowledge of this potential limitation, caregiver coaching was the focus of the present study, but comparisons of other adult instructional strategies that occur in different training contexts (e.g., professional development) may have been missed. Taken together, these limitations support the adoption of operational definitions as suggested by Friedman, Woods, and Salisbury (2012).

Additionally, this meta-analysis only included seven primary studies. The small sample size precluded the analysis of additional caregiver variables of interest because they were not reported across studies. While it is clear that coaching is more effective in increasing caregiver skill use than traditional caregiver instruction, the inability to analyze other outcomes, such as caregiver stress or perceived competency, may obscure any potential benefits of traditional caregiver instruction. Moreover, further statistical procedures using moderator analysis were not possible. While the results suggest that coaching is indeed an important component of caregiver instruction, analysis could not determine how much, for whom, and for what child intervention techniques coaching has the greatest effect. Future work should investigate response to coaching based on caregiver characteristics and the relationship between intervention strategy type and coaching.

Similarly, low statistical power made it impossible to analyze the impact that risk of bias rating or type of measure had on outcomes. This limitation may have prevented a true estimate of the magnitude of the difference between groups with an effect size, given the impact both bias and measurement can have on study results. For example, the study with the lowest risk of bias score (0 out of 14) yielded the highest average effect size across all caregiver outcomes (g = 1.16; Kasari et al., 2015). However, this study also used a single, consistent measure type across outcomes (behavioral coding by trained coders) that may be more precise in detecting group

differences than a potentially less robust measure (e.g., parent report). Ultimately, more work is needed before these factors can be examined meta-analytically.

Child outcomes were not analyzed in the present study due to its focus on parent outcomes and its small sample size. Not all included studies reported child outcomes, further decreasing the sample size of studies to be analyzed for such outcomes. The variability in child outcomes further limited the statistical power, and thus, the appropriateness of meta-analytic techniques. Additionally, the primary hypothesis that prompted the development of this study was that child outcomes are mediated by parent outcomes (Beauchaine et al., 2005; Hanisch et al., 2014); as previously mentioned, the sample size did not allow for a model with multiple predictors (i.e., a mediation model), barring this relationship from being explored in the current study. Although improved child outcomes are the ultimate goal of EI services, the results of this study are an important initial step in determining how to deliver caregiver-implemented intervention with fidelity. A necessary next step will be to determine whether the type of parent instructional strategy mediates child outcomes.

A further limitation is that the participants in this study are not representative of all children and families who are eligible for EI services. For one, despite the interdisciplinary aims of this meta-analysis, only three EI disciplines were represented in the included studies. It is not surprising that most of the studies were conducted in the fields of speech-language pathology and behavior intervention given the existing high-level meta-analytic evidence demonstrating positive effects of caregiver-implemented interventions in those disciplines. Homogeneity is also noted in the clinical groups represented in this analysis. Children with ASD represented many of the effect sizes used in the analysis. Caregiver-implemented intervention research is perhaps especially critical for this population because studies recommend that children with ASD receive

a high dosage of EI (Virués-Ortega, 2010). Similarly, half the studies included caregivers with a relevant risk factor (e.g., low resourced, living in underserved communities). Because children and families with these characteristics are ideal candidates for caregiver-implemented intervention, it is not clear whether the large, positive effects of a coaching framework will generalize to all children and families who qualify for EI.

Future work should include a greater variety of participants in coaching interventions. This is especially important in the context of a tiered intervention model because coaching is not feasible or cost effective for all tiers of service. For example, a self-guided portal is likely cost effective and feasible in tier one primary prevention, group caregiver training could provide tier two support, and coaching might be most critical for children and families that need the greatest level of support. Including a wider variety of participants and tiers of service in research on caregiver coaching and instruction may create more opportunities to explore some of the future directions prompted by these study results. Analyzing the relationship between instructional strategy and intervention strategy type could elucidate the type of caregiver instruction and level of caregiver fidelity necessary to teach strategies of varying complexity. For example, it may be the case that caregivers learn general strategies sufficiently in tier one primary prevention with traditional instruction but require coaching to learn specialized strategies in tier three intervention due to their complexity. Further, it could be that high levels of caregiver fidelity mediate child outcomes in tier three intervention, while only moderate levels of fidelity mediate child outcomes in the other service tiers, such that coaching is only necessary for robust child outcomes in tier three intervention. Addressing these nuances could allow for efficient implementation of coaching frameworks for families who need it most. These complex questions could be studied by using experimental designs that allow researchers to test how to tailor

interventions based on individual characteristics, such as sequential multiple-assignment randomized trials (SMART; Chow & Hampton, 2019). Such adaptive designs are likely critical to understanding best practices for caregiver instruction.

Finally, the interdisciplinary approach in this systematic review and meta-analysis is an exciting future direction for continued work in EI. An interdisciplinary focus may help to develop a common framework of instructional approaches, allowing for the investigation and comparison of these instructional approaches in EI. Such efforts can grow this important of body of work in order for future meta-analyses to include additional critical variables, such as child outcomes and active ingredients in caregiver coaching. Not only that, an interdisciplinary framework for parent instruction would allow for successful implementation in real-world settings and would delineate when coaching compared to other instructional approaches has the greatest reach in EI. In sum, the results of this meta-analysis are a vital stepping-stone toward the improvement of EI service delivery in caregiver-implemented interventions.

References

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Table 1. A Coaching Framework

Instructional Strategy	Description	Practice and Coaching[a]	Active Adult Learning[b]
Conversation	Caregiver and interventionist make comments and/or ask and respond to questions about the early intervention program in general.		
Information sharing	Caregiver and interventionist share information, make comments, and ask and respond to questions relevant to the child's and family's outcomes.		
Observing, data collection	Caregiver works with child while interventionist observes without feedback.		
Problem solving, planning, reflection	Caregiver and interventionists discuss strategies to improve outcomes by jointly describing the child or routine status from their perspectives, seeking a variety of ideas and input from family members.		X
Joint interaction	Interventionist and caregiver work as partners with child.	X	
Demonstration	Interventionist narrates her own actions while simultaneously modeling the strategy with the child and describes what she is doing while the caregiver observes.		X
Caregiver practice with feedback (CPF)	Caregiver leads and interventionist supports with feedback, encouragement, indirect prompts. CPF reduces the hands-on role of the provider and emphasizes the independence of the caregiver.	X	
Guided practice with feedback	Interventionist guides caregiver as they work with the child, practicing strategies, using or adapting materials, or increasing opportunities. The interventionist offers specific recommendations or suggestions in the context of the routine to help the caregiver implement the strategy or maintain the child's engagement and participation.	X	
Direct teaching	How-to content presented by the interventionist to increase caregiver knowledge or capacity.		X
Child focused	Interventionist works directly with child while caregiver is not present or engaged; provider makes no attempt to involve caregiver.		
Other	The interventionist and caregiver talk about topics unrelated to the child or family outcomes or early intervention program.		

Note. [a]To use a coaching framework, instructional strategies needed to include practice; [b]additional strategies that provide active adult learning may be also be included in coaching interventions; conceptual framework adapted from Friedman, Woods, & Salisbury (2012)

Table 2. PICOS Framework and Search

PICOS Category	Criteria	Search terms
Participants	Caregivers of children younger than 6	(caregiver* OR parent* OR mother* OR father*) AND (infant* OR child* OR toddler*)
Intervention	Coaching model used to teach caregivers, children present during coaching sessions	coach*
Comparison	Alternative invention that includes a non-coaching method to teach caregivers	
Outcomes	Caregiver use of strategy taught or metric of therapy involvement	

Note. Search was conducted at all levels outside of full text, though available levels varied based on database; search terms in each separate rows were connected by "AND"

Table 3. Study Variables

Item	Definition
Intervention type	Coaching (described a practice and coaching component as described in Table 1 or stated that it used a coaching model) or traditional caregiver instruction (group format, individual, or any other instruction format that did not include interaction with the child)
Triadic	Sessions involved the caregiver, child, and intervention provider
Caregiver education	Any education components that occurred as part of a coaching intervention but were between caregiver and intervention provider
Group training	Caregivers were trained in a group setting alone without any 1-1 instruction
Individual caregiver instruction	Caregivers received individualized education regarding their child
Telepractice	The intervention was provided from a distance using telecommunication
Caregiver outcomes	
Participation	A measure of routine participation
Quality of involvement	A measure of caregiver involvement including quality ratings
All strategy use	A measure of caregiver fidelity or global strategy use
Responsiveness	A measure of caregiver responding to child communication
Directive intervention strategies	A measure of caregiver directedness including asking questions, placing demands, or giving directions
Positive parenting	A measure of overall positivity including smiling, affect, or praise or a measure in decrease in negative parenting
Communication	A general measure of caregiver-child communication
Joint engagement	A measure of shared attention during play

Table 4. Risk of Bias Scoring

Item	Low risk (score 0)	Unclear risk (score 1)	High risk (score 2)
Attrition bias	Missing data were less than 20% and balanced across groups	Unclear how missing data were handled	Great than 20% missing data, unbalanced across groups, and missing data
Selection	Description of a randomization component (e.g., random number generator, coin flip)	No description of how randomization was decided	Description of a non-random component (e.g., birthdate, distance)
Allocation concealment	The sequence of randomization was concealed from research staff	Insufficient information to assess risk of bias	The sequence of randomization was not concealed from research staff
Detection bias: Blind assessor	Assessors of the outcome were blind to randomization	Insufficient information to assess if assessors were maintained as blind raters of the outcome	Assessors were aware of the randomization of participants
Performance bias: Blind coder	Coders of the outcome were blind to randomization	Insufficient information to assess if coders were maintained as blind raters of the outcome	Coders were aware of the randomization of participants
Fidelity	Fidelity of intervention was measured in both interventions and acceptable (or in one intervention if the other intervention does not include a provider such as self-guided portals)	Fidelity was not measured in one or both of the interventions or the extent to which fidelity was measured or achieved is unclear	Fidelity was inadequate (<80% or measured in less than <15% of sessions) in one or both interventions or significantly unequal between the two intervention conditions
Other	Any baseline differences were correctly adjusted for and contamination of intervention effect is not evident	Insufficient information to assess other risk of bias present	Significant baseline differences that were not adjusted for, contamination of intervention, unit of analysis errors, statistical analysis errors, low reliability or validity, conflict of interest, non-equivalent comparison group, clearly unreported outcomes, or some other problem
Total	**0**	**7**	**14**

Table 5. Study Characteristics

Study	Title	Publication Type	Location	Design	Number of Dvads	EI Discipline
Dirks et al., 2011	Differences between the family-centered "COPCA" program and traditional infant physical therapy based on neurodevelopmental treatment principles	Peer Reviewed	Europe	RCT	46	Physical Therapy
Gross, Belcher, Budhathoki, Ofonedu, & Uveges, 2017	Does parent training format affect treatment engagement? A randomized study of families at social risk	Peer Reviewed	USA	RCT	159	Behavior, Parenting
Ingersoll, Wainer, Berger, Pickard, & Bonter, 2016	Comparison of a self-directed and therapist-assisted telehealth parent-mediated intervention for children with ASD: A pilot RCT	Peer Reviewed	USA	RCT	29	SLT
Kasari et al., 2014; Pizzano, 2018	Caregiver-mediated intervention for low-resourced preschoolers with autism: An RCT	Peer Reviewed	USA	RCT	147	SLT
Kasari, Gulsrud, Paparella, Helleman, & Berry, 2015; Gulsrud, Helleman, Shire, & Kasari, 2015; Shire, Gulsrud, & Kasari, 2016	Randomized comparative efficacy study of parent-mediated interventions for toddlers with autism	Peer Reviewed	USA	RCT	86	SLT
O'Brien, 2011	Training methods for the child directed interaction (CDI) in parent-child interaction therapy (PCIT) and parenting skill acquisition	Dissertation	USA	RCT	28	Behavior, Parenting
Packard, Robinson, & Grove, 1983	The effect of training procedures on the maintenance of parental relationship building skills	Peer Reviewed	USA	RCT	11	Behavior, Parenting

Note. Primary and secondary studies are grouped together, with primary studies listed first; RCT = Randomized controlled trial; SLT = speech-language therapy

Table 6. Caregiver Characteristics

Study	Caregivers	Caregiver Age Mean (*SD*)	Caregiver Education	SES	% Minority	Language	Caregiver Risk Factors
Dirks et al., 2011	Mothers, fathers, grandparents or other familial caregiver	31.21 (*5.25*)	High school or vocational school			Dutch	
Gross, Belcher, Budhathoki, Ofonedu, & Uveges, 2017	Mothers, fathers, grandparents or other familial caregiver, foster parents		High school	Primarily low		English	Low resourced
Ingersoll, Wainer, Berger, Pickard, & Bonter, 2016	Mothers, fathers		College		78		Living in underserved area
Kasari et al., 2014; Pizzano, 2018			Some college or college	Primarily low		English, Other	Low resourced
Kasari, Gulsrud, Paparella, Helleman, & Berry, 2015; Gulsrud, Helleman, Shire, & Kasari, 2015; Shire, Gulsrud, & Kasari, 2016	Mothers	35.9 (*4.6*)	College				
O'Brien, 2011	Mothers	34.16 (*5.88*)	Some college	Low-middle	33		
Packard, Robinson, & Grove, 1983	Mothers	28.2	Some college				

Note. Primary and secondary studies are grouped together, with primary studies listed first; all blank fields were unreported

Table 7. Caregiver Qualitative Assessment of Intervention

Study	Satisfaction	Stress	Depressive Symptoms	Self-Efficacy
Dirks et al., 2011				
Gross, Belcher, Budhathoki, Ofonedu, & Uveges, 2017	X		X	
Ingersoll, Wainer, Berger, Pickard, & Bonter, 2016		X		X
Kasari et al., 2014; Pizzano, 2018				
Kasari, Gulsrud, Paparella, Helleman, & Berry, 2015; Gulsrud, Helleman, Shire, & Kasari, 2015; Shire, Gulsrud, & Kasari, 2016		X		
O'Brien, 2011	X		X	
Packard, Robinson, & Grove, 1983				

Note. Primary and secondary studies are grouped together, with primary studies listed first

Table 8. Child Characteristics

Study	Age in Months Mean (*SD*)	Child diagnoses	Report of child outcomes?
Dirks et al., 2011	3 (NA)	Preterm infants, abnormal general movements	Yes
Gross, Belcher, Budhathoki, Ofonedu, & Uveges, 2017	43.8 (*12.36*)	ADHD, disruptive behavior, ODD, PTSD, separation anxiety	Yes
Ingersoll, Wainer, Berger, Pickard, & Bonter, 2016	43.74 (*12.69*)	ASD	Yes
Kasari et al., 2014; Pizzano, 2018	42.32 (*10.1*)	ASD	Yes
Kasari, Gulsrud, Paparella, Helleman, & Berry, 2015; Gulsrud, Helleman, Shire, & Kasari, 2015; Shire, Gulsrud, & Kasari, 2016	31.5 (*3.2*)	ASD	Yes
O'Brien, 2011	50.72 (*11.44*)	Non-clinical	No
Packard, Robinson, & Grove, 1983	39.7 (NA)	NA	Yes

Note. Primary and secondary studies are grouped together, with primary studies listed first; ADHD = attention deficit hyperactivity disorder, ASD = autism spectrum disorder, ODD = oppositional defiant disorder, PTSD = post-traumatic stress disorder

Table 9. Intervention Description

Coaching Intervention							*Comparison Caregiver Instruction Intervention*				
Study	**Location**	**Service Delivery Model**	**Coaching Techniques**	**Additional Instructional Techniques**	**Weeks**	**Hours/week**	**Location**	**Service Delivery Model**	**Instructional Techniques**	**Weeks**	**Hours/week**
Dirks	H	Triadic	Coaching, observations, detailed conversations		12	2	H	Clinician-implemented with instructional component	Modeling, caregiver education, suggestions for home integration	12	.5
Gross	C	Triadic	Information sharing, bug-in ear coaching, problem solving	Systematic evaluation of interactions, weekly homework	17.3	1	C	Group training	Video vignettes, group discussion, weekly homework	12	2
Ingersoll	T	Triadic, Caregiver education	Clarify lesson content, apply information to child, live feedback	Slideshow, manual, self-check, exercises, homework, reflection questions, video library, forum, resources, tip emails	12	2.25	T	Self-directed training portal	Slideshow, manual, self-check, exercises, homework, reflection questions, video library, forum, resources, tip emails	12	1.5

Kasari 2014	H	Triadic	Active coaching		12	2	C	Group training	Didactic sessions, handouts	12	2
Kasari 2015	H	Triadic	Active coaching		20	2	H	Individual caregiver education	Informational sessions	10	1
O'Brien	L	Triadic, Caregiver education	Performance feedback, bug-in-ear coaching	Didactic presentation	1	.92	L	Instructional video	Independent practice	1	.5
Packard	L	Triadic, Caregiver education	Practice with feedback	Manual	2	1.75	L	Instructional manual	Independent practice	2	1.75

Note. Studies identified by first author last name only; C = community setting, H = home, L = research lab, T = telepractice; all blank fields were unreported

Table 10. Risk of Bias Score

Study	Selection Bias: Sequence Generation	Selection Bias: Allocation Concealment	Attrition Bias	Detection Bias	Performance Bias	Fidelity	Other	Total Risk of Bias
Dirks et al., 2011	1	1	2	0	0	1	0	5
Gross, Belcher, Budhathoki, Ofonedu, & Uveges, 2017	0	0	2	2	1	0	1	6
Ingersoll, Wainer, Berger, Pickard, & Bonter, 2016	0	0	0	1	1	2	0	4
Kasari et al., 2014; Pizzano, 2018	0	0	0	0	1	2	2	5
Kasari, Gulsrud, Paparella, Helleman, & Berry, 2015; Gulsrud, Helleman, Shire, & Kasari, 2015; Shire, Gulsrud, & Kasari, 2016	0	0	0	0	0	0	0	0
O'Brien, 2011	1	1	0	1	2	1	0	6
Packard, Robinson, & Grove, 1983	2	1	2	0	0	1	1	7

Note. Primary and secondary studies are grouped together, with primary studies listed first; score definitions are available in Table 4

Table 11. Outcome Measures

Study	Outcome	Measurement type	Rater	Context
Dirks	Routine participation	Outcome present/absent	Study coders	Video
Gross	Quality of parent involvement	Engagement form (global rating scale)	Clinicians	Live
Ingersoll	Overall strategy use	Project ImPACT fidelity checklist	Study coders	Video
Kasari 2014	(a) Overall strategy use (b) Quality of parent involvement (c) Joint engagement (d) Overall strategy use	(a) Caregiver diary (b) Caregiver quality of involvement scales (c) Behavioral coding (d) Global rating scale	(a) Caregivers (b) Clinicians (c) Study coders (d) Study coders	(a) Ongoing (b) Ongoing (c) Video (d) Video
Kasari 2015	(a) Joint engagement (b) Directive strategy use (environmental arrangement) (c) Responsive strategy use (mirrored pacing) (d) Directive strategy use (prompting) (e) Communication (f) Parental responsiveness	(a–f) Behavioral coding	(a–f) Study coders	(a–f) Video
O'Brien	(a) Positive parenting (b) Negative parenting	(a–b) Dyadic Parent-Child Interaction Coding System (Third Edition)	(a–b) Study coders	(a–b) Video
Packard	(a) Positive parenting (b) Negative parenting	(a–b) Dyadic Parent-Child Interaction Coding System	(a–b) Study coders	(a–b) Video

Note. Studies identified by first author last name only

Supplement: PRIMSA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Title Page (1), 3
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3-8
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	8-9
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	10
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	9-10; Table 1, 2
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	10-11
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	10-11; Table 2
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	11
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	11-12
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	12; Table 3

Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	13, Table 4
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	12
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	13-14

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	14
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	14
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	14-15; Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	15-17, Tables 5-9, 11
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	17-18; Table 10
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Figure 2
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	18
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	18
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	18
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	18-19
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	19-22
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	22-23
FUNDING			

Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	NA

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