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Review

Efficacy of focused social and communication intervention practices for young children with autism spectrum disorder: A meta-analysis

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ABSTRACT

Focused intervention practices (FIPs) are widely used to improve social communication skills, as they are specifically aimed at enhancing skills identified as being problematic in children with autism spectrum disorder ASD, such as imitation, eye contact, gestures, joint attention and play. This meta-analysis was performed to ascertain the overall effectiveness of FIPs in children with ASD 6 years of age and younger. Five electronic searches were conducted, 1828 references were retrieved, and 43 studies 59 outcome measures were included in the meta-analysis. Studies included 785 participants 41.6 months with ASD. The overall socio-communicative effect size for each specific skill imitation, joint attention, and play was calculated using the Hedges' g (*g*) for group design studies, and the Nonoverlap of All Pairs (NAP) for single case design studies. Random-effects metaregression models and correlations were also used to assess whether the results were different according to population and intervention characteristics. The impact of possible publication bias was analysed. The results suggest that, whereas FIPs have medium to large positive effects (*g* = 0.51; NAP = 0.86), those where caregivers or teachers play an active role (*g* = 0.50; NAP = 0.89) have medium effect sizes. All social and communicative skills outcomes of FIPs have medium effect sizes (Imitation: g = 0.42, NAP = 0.90; Joint attention: g = 0.54, NAP = 0.86; Play: g = 0.47, NAP = 0.81). Effect sizes were greater when participants' preintervention ages were lower and treatment dosage was higher. When it comes to achieving substantial improvements, factors to be highlighted are the role of caregivers and adaptation of the programme to the characteristics of the child. Implementation of early intervention programmes should be substantiated by a sufficient amount of information about the characteristics of each participant. Professionals should take this information into account in order to select as accurately as possible those procedures that are most effective and feasible.

Contents

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1. Introduction

Impairment in social communication skills has been recognised as one of the key problems in children with autism spectrum disorder (ASD) (Watkins, Kuhn, Ledbetter-Cho, Gevarter, & O'Reilly, 2017; Zwaigenbaum et al., 2015), and is given as one of the criteria for diagnosis of ASD in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) (American Psychiatric Association, 2013). Furthermore, social communication skills are fundamental for the development of more complex abilities, such as language (Bradshaw, Koegel, & Koegel, 2017; Hampton & Kaiser, 2016), but impairments in these skills do not seem to ameliorate with time in children with ASD (Gates, Kang, & Lerner, 2017). Consequently, intervention models should help children with ASD to increase their social communication skills and reduce the greatest number of severe symptoms in this area (Gates et al., 2017; Murza, Schwartz, Hahs-Vaughn & Nye, 2016; Schreibman et al., 2015; Zwaigenbaum et al., 2015. The overall ASD prevalence was 17 per 1000 children aged 4 years in 2014 for Early Autism and Developmental Disabilities Monitoring Early ADDM sites Christensen, 2019).

Focused intervention practices (FIPs) are individual instructional practices or strategies used to teach specific skills to children with ASD in a relatively short period of time (e.g., 0–3 months) (Odom, Boyd, Hall, & Hume, 2010; Odom, Collet-Klingenberg, Rogers, & Hatton, 2010; Wong et al., 2015). They are frequently used to improve social and communication skills and have become the focus of most therapies for young children (6 years and younger) with ASD to meet society's demands (Schreibman et al., 2015; Wang, Parrila, & Cui, 2013; Zwaigenbaum et al., 2015). Behavioural strategies, naturalistic interventions, picture exchange communication systems, pivotal response training and visual supports are all examples of FIPs (Boyd, Odom, Humphreys, & Sam, 2010). In recent years, there have been empirical research reviews covering both single-case and group-design studies of FIPs aimed at improving social and communication skills (Bradshaw, Steiner, Gengoux, & Koegel, 2015; French & Kennedy, 2018; Reichow, Barton, Boyd, & Hume, 2012; Waddington, van der Meer, & Sigafoos, 2016). However, these reviews do not always include an evaluation of study quality. Despite the extensive use of FIPs, little research has thus been done to examine their overall efficacy (Kasari, Shire, Factor, & McCracken, 2014).

1.1. Current evidence in support of FIPs in ASD

There are some meta-analytical studies that have rigorously assessed and corroborated the effectiveness of FIPs, and reported a medium effect. Reichow et al. (2012) reported outcomes that support these types of programmes with behavioural approaches (g = 0.47). Similarly, Murza et al. (2016) reviewed the efficacy of FIPs, specifically in the case of joint attention, and their results substantiate the efficacy of this type of intervention (g = 0.66), as do those of Gates et al. (2017), who also provide substantial supporting evidence (g = 0.51). Despite these promising results, these studies focused exclusively on behavioural approaches (Reichow et al., 2012), in youth individuals with ASD (>5 years) (Gates et al., 2017), or on a specific targeted skill (Murza et al., 2016), thereby underscoring the limited nature of the literature on the effectiveness of different FIPs (not only behavioural approaches) in young children with ASD (under 6 years) on a wide range of targeted skills.

1.2. FIPs in targeted social and communication skills

Although there is evidence to show that FIPs are effective for the development of socio-communicative skills in young children with ASD, outcomes vary depending on the skill being targeted (Zwaigenbaum et al., 2015). These differences highlight the complexity of social-communication skills, including behaviours such as imitation, eye contact, joint attention, gestures and play, which are also skills evaluated for diagnosis of ASD via the ADOS-2 (Autism Diagnostic Observation Schedule, Second Edition) "gold standard" tool (Lord, Rutter, DiLavore, Risi, Gotham & Bishop, 2012).

Imitation plays a fundamental role in the development of social skills, social-emotional communicative functions, and theory of the mind, as well as language and play skills (Contaldo, Colombi, Narzisi, & Muratori, 2016; Cooley, 2017; Dohmen, Bishop, Chiat, & Roy, 2016). Imitation promotes a social orientation toward others (Contaldo et al., 2016), and children improve attention to adults instead of objects, and smile more as they perform their actions (Carpenter et al., 2002). They recognise this "imitation play" from the age of 9 months (Agnetta & Rochat, 2004). Therefore, imitation has become a critical ability to work on different intervention therapies, both to reduce the symptoms of ASD and to increase the skills that are associated (Ingersoll, 2010; Landa, 2018; McDuffie et al., 2007).

For example, eye contact, which is impaired in children with ASD (Jones & Klin, 2013), is an essential component of daily social relations and provides the basis for the development of more complex skills, such as social engagement (Franchini et al., 2017). Children of 1–2 months of age who were later diagnosed with ASD showed a level of visual contact equivalent to children with typical development (Jones & Klin, 2013), decreasing the frequency as they grew. This decline in eye contact, rather than an absence, offers a promising opportunity for early intervention.

Joint attention is another significant deficit in children with ASD (Mundy, 2018) and is one of the key FIP components (Kasari, Gulsrud, Paparella, Hellemann, & Berry, 2015; Murza et al., 2016). Joint attention correlates with language development and other social communication skills (e. g., play, imitation) (Adamson, Bakeman, Suma, & Robins, 2019; Bottema-Beutel, 2016; Kasari et al., 2015; Pickard & Ingersoll, 2015). This robust correlation improve many aspects of language development, such as expressive and receptive language, vocabulary, and gestures. More importantly, by teaching joint attention skills to children with ASD they could learn to pay more attention to the social behaviour of others and incorporate into their repertoire the use of social skills such as gestures, vocalizations or emotional expressions, which promotes their social involvement in daily routines (Meindl & Cannella-Malone, 2011). In this way, children with ASD would begin to take others into account and their social engagement would increase by being able to share attention on objects or events and people.

In addition, children with ASD have difficulties using gestures to acknowledge an object or its properties (Gordon & Watson, 2015; Mastrogiuseppe, Capirci, Cuva, & Venuti, 2015), and these nonverbal communication movements have been included in intervention programmes to improve the development of skills such as joint attention (pointing), imitation, play, as well as language (Ingersoll & Lalonde, 2010; Özçalışkan, Adamson, & Dimitrova, 2016; Paparella & Freeman, 2015).

Children with ASD encounter many difficulties in play, especially when it comes to performing sequences of symbolic and pretend play (Wilson et al., 2017). Play skills are important predictors of later language, social, and communication skills (Kasari, Paparella, Freeman, & Jahromi, 2008) and of the development of theory of mind (Lin, Tsai, Li, Huang, & Chen, 2017). Moreover, play has a reciprocal relationship with the development of skills such as language. Children who improve their play skills also improve the development of other skills (Pierucci, Barber, Gilpin, Crisler, & Klinger, 2015), therefore, it is justified that intervention programmes promote the development of play skills.

Hence, examining change in these targeted skills as intervention outcomes, in order to compare them, both separately and overall, may be useful for the purpose of understanding FIP outcomes according to the specific skills targeted.

1.3. Plausible moderators of FIP effects

In general, there is a wide heterogeneity in the results obtained by different studies. This heterogeneity may be due to the effect of certain factors, such as the characteristics of the participants (chronological age, sex, level of symptom severity) or of the intervention (individual/group) that could be acting as moderating variables that influence the strength and/or direction of the relationship between treatment and outcomes (Kazdin, 2007; Lerner, White, & McPartland, 2012; Spielmans & Flückiger, 2018).

Examining the potential moderator variables may help explain the heterogeneous results within meta-analysis studies about treatment efficacy and may help identify and explain mediating variables and mechanisms involved in treatment outcome. Efficacy studies should take these mediators and mechanisms into account as they intervene in treatment outcome, either to explain, at least theoretically, how mediators relate to outcome variables, or to consider how treatment variables influence mediators (Gottfredson et al., 2015). The authors of the studies are therefore expected to identify and describe, within the approach underpinning the treatment they propose, the role of possible mediators. Alternatively, the description of treatment characteristics and the type of measures used in the studies should include data on mediating variables, as well as information on the moderating effect of other variables and the possible effect that the treatment might have on the identified mediators (i.e. indirect effects of socio-communicative programs on variables such as symptomatology level, language, IQ, adaptive behavior). This would make it possible to identify the characteristics of the intervention that are most central in explaining the observed change.

Taking into consideration these elements, the study on the efficacy of a given treatment could allow some kind of proposal to be made about the mechanism that produces the result of the treatment. On the other hand, a meta-analysis study could analyse the specific influence of different moderating variables, since it would combine the results of several studies, in which there will be certain heterogeneity with respect to the characteristics of the participants, as well as variations in the characteristics of the treatment. Thus, by means of a meta-analysis, it would be possible to obtain conclusions on the generability of the treatment.

Participants and FIPs' characteristics (e. g. age or treatment dosage) were chosen as moderators of the effect. These moderating variables have been studied extensively as they are the ones that most influence the intervention outcome. (Kazdin, 2007). Another characteristic that has been studied lately is the active participation of parents in the intervention, increasing the effect of the intervention and reducing parental stress and family burden, suggesting that family participation should be taken into account when studying the effect of a treatment. (de Veld et al., 2017; McIntyre & Zemantic, 2017; Stadnick, Drahota, & Brookman-Frazee, 2013).

1.4. Participant characteristics

The age that FIPs are implemented can vary widely. Although Gates et al. (2017) have shown how these interventions are effective for youth (5–21 years) with ASD (g = 0.51), no study has investigated whether these results would be consistently main-

tained in children with ASD from very early ages until they reach the age of 6 years. Significant progress in reducing ASD identification age has been observed in recent years (Mazurek et al., 2014), as it is now possible to detect signs of risk in children aged 12–14 months (see Jones et al., 2014), as a result, the demand for effective strategies designed to be implemented in early intervention programmes is increasing (Zwaigenbaum et al., 2015). The aim of early detection is to identify signs of risk or early symptoms of ASD in the child's development, in order to initiate earlier treatment, even before the child receives a formal diagnosis. Thus, early detection only makes sense if there is early treatment available that has proven its efficacy.

Systematic early detection actions associated with the initiation of early intervention activities are linked to positive outcomes for children at risk for ASD, as children who begin treatment earlier have better outcomes (MacDonald, Parry-Cruwys, Dupere, & Ahearn, 2014; Orinstein et al., 2014). Hence, the ultimate goal is for intervention to occur during the child's critical period of development, when neuronal plasticity is greater and long-term positive results can be achieved (Crais & Watson, 2014). In addition, the initiation of early intervention activities could also have positive consequences for the family, who may find answers to their concerns and learn strategies to cope with the developmental difficulties of their child (Ingersoll, Shannon, Berger, Pickard, & Holtz, 2017; Kasari et al., 2015).

Participants' cognitive development, verbal ability, and IQ may change the effect of FIPs' efficacy. Studies report significant differences in social communication skills in those cases where participants' IQ or verbal ability is higher at baseline (Virués-Ortega, 2010). Improvement in such abilities at baseline seems to be a predictor of a reduction in ASD severity and an increase in adaptive abilities (Zachor & Ben-Itzchak, 2017). This means that the role of IQ and verbal ability in the effect of FIPs must be studied, in order to recommend suitable intervention programmes taking into account these characteristics in the participants.

1.5. FIP characteristics

One of the most controversial variables is the dosage of the intervention. Numerous studies recommend that in order to yield positive effects on the targeted skills, treatment should be as long (duration of the intervention in weeks/months/years) and intense (hours per week) as possible (Granpeesheh, Dixon, Tarbox, Kaplan, & Wilke, 2009; Klintwall, Eldevik, & Eikeseth, 2015; Linstead, Dixon, French et al., 2017; Zwaigenbaum et al., 2015). However, the use of programmes that can be taught in a short period of time (FIPs) reduce costs and waiting time delays (Ingersoll et al., 2017; Kasari et al., 2015). The findings are mixed: whereas one meta-analysis reported that the intensity (hours per week, ranged from 6 to 45) seemed to partially influence the outcome of the intervention (Virués-Ortega, 2010), other studies reported that this had a strong influence on the outcome (hours per month, ranged from 20 to 198) (Eldevik et al., 2010; Linstead, Dixon, French et al., 2017, Linstead, Dixon, Hong et al., 2017). It is therefore necessary to study whether there is a significant variation in the effect of FIPs depending on the dosage of the intervention.

Another aspect that must be taken into account is the fidelity of the intervention, which is the extent to which the intervention is delivered as it was intended (Gearing et al., 2011). Reporting the intervention fidelity in the published product is crucial in order to assess the quality of the study and to understand how different factors may have influenced the outcome of the study (Murphy & Gutman, 2012). If treatment fidelity is not sufficiently assured, significant uncontrolled variability in effect sizes may appear. (Mandell et al., 2013)

The people involved in the intervention program must be considered because they too influence the effectiveness of the FIPs. Several reviews suggest that the active participation of parents is an aspect that must be taken into account when evaluating the effectiveness of intervention outcomes (Bradshaw et al., 2015; Debodinance, Maljaars, Noens, & Van den Noortgate, 2017; Reichow, 2012; Zwaigenbaum et al., 2015). Several studies have shown the effectiveness of intervention programmes where parents and/or teachers actively participate with the main therapist, after receiving specific training (Lawton & Kasari, 2012; Schertz, Odom, Baggett & Sideris, 2013; Wong, 2014).

Finally, parental involvement is also fundamental for considering the satisfaction with intervention programme (McIntyre & Zemantic, 2017; Stadnick et al., 2013). In addition, involving parents reduces intervention costs by decreasing the number of treatment hours with professionals and increasing skill development in natural contexts (Ingersoll et al., 2017; Pickles et al., 2016). All these aspects mean that parental involvement in interventions could significantly reduce the economic burden for the family, health-care system, and society, and it could also decrease the stress associated with raising a child with ASD (Kasari et al., 2015). Despite showing positive effects in some studies, it is not clear whether or not parental involvement in intervention programmes increases the effect of FIPs, and thus, it is important to identify the characteristics of parent participation procedures that achieve significantly positive outcomes.

1.6. Measuring FIPs

A key concept when examining the effectiveness of interventions such as FIPS is whether the comparison measures are adequate and accurate. Within the group-design studies, Randomised Control Trials (RCTs) and Quasi-Experimental Designs studies (QEDs) use posttest measures to calculate standardised mean difference. RCTs are considered a Ġold Standardänd the ideal option in research on treatment efficacy because the randomization of RCTs increases the probability that the groups are equivalent and comparable in terms of the variables of interest (e.g., participant characteristics), allow better control of possible biases, and provide greater security in the determination of causality. However, for practical or ethical reasons, it is not always possible to carry out RCTs and some researchers opt for QEDs or Single Case Design studies (SCDs) when there are few participants. In QEDs and SCDs, as they do not include randomisation procedures, there may be a selection bias that can interact with independent variables and a priori the equivalence of the groups (QEDs) is not guaranteed or there are no groups to compare (SCDs), which poses a threat to the internal validity of the study. Therefore, since in QEDs and SCDs the effect of the intervention could be due to uncontrolled variables, rather than to variables considered independent, it is critical to make an analysis of the quality of the QEDs and SCDs that includes, among other aspects (experimental mortality, testing effects, etc.), information on the groups selection process, type of measures, etc. In QEDs, only those studies that have proved that there are no significant differences between the comparison groups at baseline would be incorporated into the meta-analysis. That is to say, we will select those QEDs where quality analysis establishes that the study method includes procedures to ensure the equivalence of the different groups in terms of general and specific criteria (age, sex, symptoms, IQ, etc.), which may lead to biases in the effects of the intervention (French & Kennedy, 2018; Wong et al., 2015). In SCDs, only studies that have proved to meet quality standards (See Kratochwill et al., 2010), such as interobserver agreement (IOA) of at least 80%, a second observer measured the variable 20% of all phases, and provided repeated measures across different conditions. Hence, we will select those SCDs whose quality analysis

establishes that the study method includes procedures to ensure that the effect of the intervention is produced exclusively by the FIPs, and allow the replicability of the study.

1.7. Current study

The first aim of this study was to examine FIPs for young children with ASD in terms of: their effectiveness in relation to basic social-communication skills; and their benefits according to selected participant and programme characteristics. The second objective was to examine whether different aspects, such as participant and FIP characteristics (e.g., age, IQ, language level, dosage of intervention, and family and/or teacher actively participation in the intervention) will moderate treatment outcomes. In addition, the methodological rigor on the final set of studies selected for the meta-analysis was also measured.

2. Methods

2.1. Identification and selection of studies

An electronic search was conducted in the following databases: PsycINFO; PUBMED; Educational Resource Information Centre; and Cumulative Index to Nursing and Allied Health Literature. Five different searches were made, one for each targeted skill, using the following search criteria: (autism OR autism spectrum disorder OR ASD OR autistic disorder OR Pervasive Developmental Disorder OR Asperger) AND (imitation; eye contact; joint attention; gestures; play) AND (training OR treatment OR intervention OR teach OR teaching OR development OR improving OR therapy).

2.2. Study-selection and literature search

The design and development of the meta-analysis was carried out in two phases. The first phase consisted in the screening of references (selection of the studies by eligibility criteria) retrieved from the electronic search. In this phase, the studies were first screened by title, then by abstract and finally by full text, according to the eligibility criteria (Appendix A). The second phase focused on the methodological quality of the studies selected in the first phase. Eligibility criteria for this phase were different for studies with group and single case design.

2.2.1. First stage of literature search

The systematic literature search was conducted from January 2000 to July 2018. Fig. 1 gives a detailed layout of the study-identification and selection process. The search goals were established according to the recommendations provided by the Cochrane Collaboration (Higgins & Green, 2011), based on the PICOS structure (Participants, Interventions, Comparison, Outcomes, Study design).

2.2.2. Inclusion and exclusion criteria

The study was selected and reviewed if: (a) was empirical; (b) was published in a peer-reviewed journal; (c) written in English; ; (d) participants were six years of age or younger; (e) participants were diagnosed with ASD, according to the criteria of DSM-5 (American Psychiatric Association, 2013) or DSM-IV-TR (APA, 2000); and (f) used FIPs involving behavioural, developmental, or educational interventions to improve communication and social interaction skills (imitation, eye contact, joint attention, gestures, and play). The exclusion criteria were defined as studies that: (a) did not use "gold standard" measures, such as ADOS (Lord et al., 2000, 2012) in their diagnostic assessment; and, (b) included medical or pharmacological interventions.

2.2.3. Study-selection procedure

A total of six reviewers participated in all selection phases (from title review to full text) independently applying the eligibility criteria (inclusion/exclusion). The criteria were formulated as specific questions for each phase of the selection process, where the reviewers had to code "Yes" or "No". The intercoder agreement focused on the proportion of observed concordance between reviewers in relation to the eligibility criteria. Studies had to meet all the inclusion and exclusion criteria to move on to the next review phase (See Appendix A). All the studies were screened by two independent reviewers who belonged to the research group associated with the ASDEU project (Autism Spectrum Disorder in the European Union, 2015–2018ASDEU, 2020Autism Spectrum Disorder in the European Union, 2015–2018). A third reviewer was consulted to settle any disagreements between reviewers during the various selection stages.

Taking into account the above search criteria, 2894 studies were identified once duplicates had been removed. The title and abstract screening were completed with the mentioned eligibility criteria with excellent reliability *Kappa*: 1.00, 0.96 respectively; Cohen, 1968).

The full texts were screened again applying the following additional criteria (see Appendix A): (a) studies that included quantitative data outcomes in respect of the targeted skills analysed; (b) studies that included pre and postquantitative data; and (c) original studies with group (RCT or QED) or single-case designs (withdrawal of treatment (e.g., ABAB), multiple baseline, multiple probe, alternating treatment, and the changing-criterion design) with excellent reliability (*Kappa* = 0.92). This process yielded 116 studies eligible for the second stage of the review.

2.2.4. Quality-selection procedure

In the second phase, a review of the quality of the studies selected in the first phase (116 studies) was conducted. Single case and group design studies were screened. To include a study in the final meta-analysis, it had to meet the quality criteria of the second phase. The purpose of this revision was to ensure the methodological quality and rigor of intervention studies (single case and group design) and that they complied with specific standards that would ensure that the size of the effect would have been produced by the use of the FIPs. We conducted this quality review of all full-text studies selected in the first phase using the EBP Update Workgroup Reviewer Training criteria (Wong et al., 2015) of the National Professional Development Centre on Autism Spectrum Disorders. The EBP Inclusion Criteria Checklist (https://autismpdc.fpg.unc.edu/sites/autismpdc.fpg.unc.edu/files/imce/documents/EBP-InclusionCriteriaDesignChecklists.pdf) consist of 10 items for group design and 9 items for single case design studies. For a study to be included with this criterion, all items must be answered with a "yes". Examples for the Group design EBP Inclusion Criteria Checklist are: Does the study have experimental and control/comparative groups? Was the control/comparison condition(s) described? Was attrition NOT a significant threat to internal validity? Examples of Single Case Design EBP Inclusion Criteria Checklist are: Did a secondary observer collect data on the dependent variable for at least 20% of sessions across conditions? Was mean interobserver agreement (IOA) 80% or greater OR *kappa* of 0.60 or greater?

In this second stage 43 studies were selected for quantitative synthesis. Some of these studies measured outcomes from more than one skill. For example, a study could present results from two skills, one on imitation and one on joint attention, using the same FIP. Thus, 59 outcome measures were identified from all of the 43 studies for all the different skills analysed in this research (see Appendix C. Table 1 for details). Each of these 59 outcome measures only reported results in one of the social communication

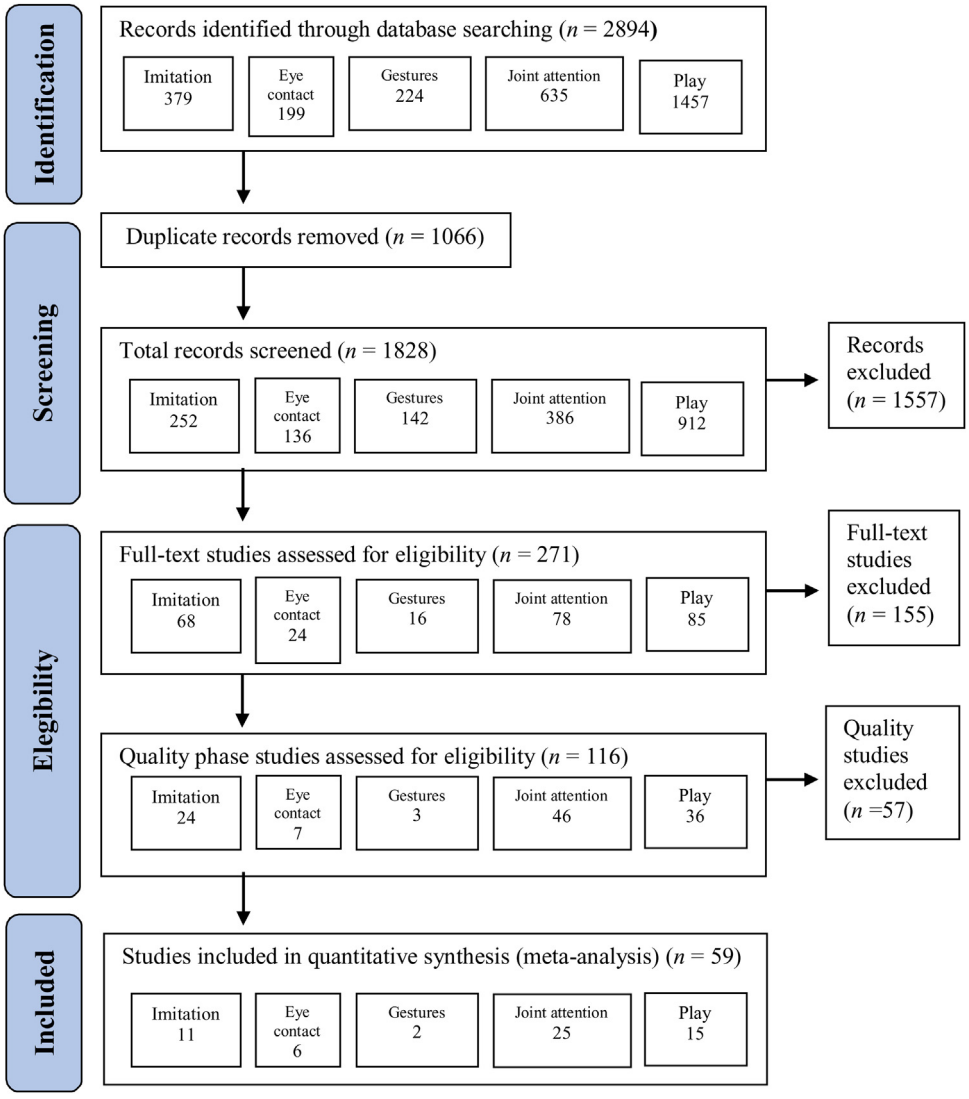

Fig. 1. PRISMA flowchart representing the identification and selection of the studies.

skills analysed in our study. The mean Cohen's *Kappa* coefficient for quality reviews was excellent (>0.98).

2.2.5. Data extraction

The 43 studies were double-coded by two independent reviewers (see Appendix B on Supplemental material). For this stage, a variable extraction protocol was created with the corresponding operational definitions and coding values. This protocol had four sections with different variables to complete according to the information from the study. These sections were the following: (a) participant characteristics at the time of inclusion in the corresponding study (e. g., age, gender, race, diagnosis, cognitive development, language level); (b) intervention characteristics (treatment dosage, parents' participation, specific FIP, professional profile); (c) study design (Randomized Control Trial (RCT), Quasi-experimental design (QED), Multiple baseline (MB), Alternating treatment (AT), etc.); and (d) outcomes based on specific social-communication skills were collected in at least one of the following two ways: (a) through general standardised measures of development, such as communication and social skill scales; and/or (b) through quantitative data on the various behaviours targeted by the intervention, as observed by two or more therapists via video recordings (frequency/percentage/steps of acts). In addition, we included data gathered throughout the different intervention stages: (a) baseline; (b) intervention; and, (c) postintervention/follow-up. The results of the studies were subcategories of the dependent variables under study (e.g., motor imitation, symbolic play) (for further details see Appendix K on Supplemental material). To settle any disagreements during the reviewing process, a third reviewer was consulted. Agreement among coders was excellent, *Kappa* > 0.89.

The specific outcome measures for each social and communicative skills in the studies (see Appendix C, Tables 1 and 2 in Supplementary material) was used to obtain the effect sizes, both total and of each studied ability. However, the different articles did not rely on the same research study dataset, so that each article represented a different study. Variables related to the characteristics of the participants (age, IQ, language level), as well as the treatment dosage, were also key analytic variables used in the meta-analysis.

This study did not describe the models that support each FIP, but the interested reader can review the following references: Odom, Boyd et al., 2010, Odom, Collet-Klingenberg et al., 2010; Wong et al., 2015; and see the Table 1 - Appendix D on Supplemental material for further information.

2.3. Meta-analytical procedure

The meta-analytical procedures used in this study adhered to the guidelines contained in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (Moher, Liberati, Tetzlaff, Altman, & Group, 2009). PRISMA is an evidence-based minimum set of items for reporting in meta-analyses. PRISMA focuses on the reporting of reviews evaluating randomized trials, but can also be used as a basis for reporting of other types of research, particularly evaluations of interventions (PRISMA, 2019; http://www.prisma-statement.org/).

The current study included five separate meta-analyses: the first included social and communication overall measures from each study (group design, n = 18; single case design, n = 25); and the second explored the intervention programmes where caregivers and/or teachers played an active role (group design, n = 9; single case design, n = 7), whether individually after receiving training, or jointly along with the main therapist. In order to examine the different social and communication skills separately, the other meta-analyses consisted of the different outcome measures reported for each social and communication skill, i.e., imitation (group design, n = 4; single case design, n = 7), joint attention (group design, n = 14; single case design, n = 10), and play (group design, n = 7; single case design, n = 9). The meta-analysis for gestures and eye-contact abilities was not included, due to the limited number of studies obtained from both group and single-case designs.

2.4. Statistical analyses

To calculate the effect size of the different interventions, the studies were separated as follows: (a) group design; and, (b) single-case design.

The random effect model was used for the point estimate of effect size in the group-design studies, due to the difference in the progression of results (pre — posttest, pretest — follow-up) among the experimental and the control/comparison groups. The effect size (g), was calculated using the difference between means of the treatment group and the control group, divided by the standard deviation, and weighted for sample size to correct for small sample bias (Hedges & Olkin, 1985) (95% CI). The Cohen convention Cohen (1988) was used to interpret the results, since these two statistical variables are extremely similar and comparable (e.g., 0 < g < 0.30 = small; 0.30 < g < 0.80 = moderate; g > 0.80 = large). Effect sizes were calculated for each outcome measure, and then averaged together to make an overall effect size for each study. Some studies measured the effect of treatment on more than one skill (e.g., Van der Paelt et al. (2014) analysed the effect of a FIP on imitation, joint attention and play skills). In our study we have differentiated the overall effect and the specific effect of the outcome measures. The overall effect has been obtained by aggregating all treatment effects on all outcome measures in the study. The specific effect of the outcome measures is the effect of the treatment on each skill measured in the studies. However, each article represented a different study. The standardised mean difference using Hedges' g for small sample correction was calculated using Comprehensive Meta-Analysis software (CMA) version 3 (Borenstein, Hedges, Higgins, & Rothstein, 2005).

Random-effects meta-regression models (Thompson & Sharp, 1999) were also used to assess whether the results were different according to population and intervention characteristics, such as age, cognitive development, language preintervention, and treatment dosage. In every case where heterogeneity was detected (Q: I^2), a moderator analysis was conducted. The Q test inspects for heterogeneity by adding the squared deviation of the effect size for each study of the overall effect size and weighting each study by variance (Higgins & Green, 2011). The I^2 statistic describes the percentage of variation across studies caused by heterogeneity rather than chance, regardless of the treatment effect metric (Higgins & Thompson, 2002). Values of around 25%, 50% and 75% refer to low, medium and high heterogeneity respectively. Although I^2 was developed to be independent of the number of studies, it should be interpreted with caution in cases where few studies are meta-analysed (Huedo-Medina, Sánchez-Meca, Marín-Martínez, & Botella, 2006). To evaluate whether it would be appropriate to conduct a moderator analysis on any given effect, the following criteria were established (from Gates et al., 2017): (a) at least 10 studies had to be included in the analysis; and, (b) in the absence of significant Q statistics, there had to be evidence of at least a nontrivial amount of heterogeneity according to the I^2 statistic ($\geq$20%). The moderators of interest were age, treatment dosage, overall cognitive ability and language. In addition, correlation analyses were performed among those moderating variables that were significant in the effect of the intervention.

For single-case-design studies, the nonoverlap of all pairs (NAP) index was used (Parker & Vannest, 2009). Nonoverlapping data were analysed as an indicator of the performance differences between the different stages of visual analysis during single-case research (SCR) (Sidman, 1960). The NAP index has been included in recently proposed standards for evaluating SCR (Horner et al., 2005) and summarises all overlapping points within each stage (baseline-intervention, baseline-follow-up). It is equivalent to the number of comparison pairs showing no overlap, divided by the total number of comparisons. Moreover, the index can be calculated manually from an SCR graph, where individual graphs of each study can be extracted. These graphs were introduced into a software programme (Digitizelt, version 2.2.2), which extracts all points of the graph numerically. After extracting these numbers, we calculated the NAP index using the NAP calculator (http://www.singlecaseresearch.org/calculators/nap). For single-case studies, correlations were made between the effect size of the programmes and the respective study characteristics, such as age, cognitive development, language preintervention and treatment dosage.

Group and single case design studies with larger effect sizes were selected to see what commonalities they shared in terms of moderators. To do this, studies whose effect size were higher than the overall effect size calculated later were selected. Descriptive analyses of these variables were conducted (*mean*; *SD*). In addition, the Coefficient of Variation (*CV*) of the mean was calculated. The *CV* inform about the homogeneity of the data (if a set of data shares similarities). A *CV* below 20% indicates that those set of data is homogeneous and does not deviate from the mean.

2.5. Test for publication bias

The impact of possible publication bias was also analysed in cases where the number of studies was appropriate (k > 10), using funnel plots and a combined tandem method, as suggested by Ferguson and Brannick (2012) and used by Gates et al. (2017). This method includes Egger's regression test, in which significant findings suggest publication bias (Egger & Davey Smith, 1998), the trim-and-fill method (Duval & Tweedie, 2000), and Orwin's Fail Safe N (Ferguson & Brannick, 2012). When all three criteria were met, indicating the presence of bias, publication bias was deemed "probable"; when one or two criteria were met, bias was deemed "possible"; and when no evidence of bias was found, publication bias was deemed "unlikely".

To investigate publication bias for single-case studies, the correlation between standard error and observed effect size was calculated. We performed this analysis because in small studies (with a large standard error), only very large observed effect sizes are statistically significant and thus more likely to be published,

resulting in a positive correlation between standard error and effect size (Egger & Davey Smith, 1998)

3. Results

3.1. Descriptive characteristics

43 of the studies met the inclusion criteria. Several studies were selected by two or more screening reviews of the specific social-communication skills, since the same study could have measured the effect on more than one outcome measure (Fig. 1). A description of the studies included in the meta-analysis can be found in Appendix C (see Supplemental material). In the group-design studies, a total of 669 participants, mean age 41.2 months (range 24.6–56.2), were included in the experimental intervention groups, and a total of 617 participants, mean age 41.5 months (range 27.5–59.7), were included in the control groups; the percentage of male participants ranged from 75.0–91.7%. The single-case design studies included a total of 116 participants (range 1–16) with a mean age of 43.2 months (range 30–72); the percentage of male participants ranged from 50 to 100%. Total treatment dosage ranged from 8 to 259 h in the group-design studies and from 5.0–40.2 h in the single-case design studies.

3.2. Overall analysis

Interventions on social communication skills showed positive outcomes in the 18 group-design studies reviewed. The individual effect sizes, covering a total of 669 participants, ranged from g = 0.10 to g = 1.54, with positive effects indicating increases in ratings of social and communicative competence (see Table 1). Fig. 2 shows the individual effect size for this analysis (g = 0.51, K = 18, 95% [CI 0.37, 0.65], Z = 7.22, p < 0.001). This was a medium effect. The I^2 (23.01) value was nontrivial, and there were at least 10 studies included. Exploratory moderator analyses were conducted (see Moderator analysis section).

Interventions on social communication skills showed positive outcomes in the 25 single-case design studies reviewed. The individual effect sizes, covering a total of 116 participants, ranged from NAP = 0.58 to NAP = 1.00, with positive effects indicating increases in ratings of social and communicative competence. Fig. 3 shows the individual effect size for this analysis. Participants who received treatment made significant improvements in social and communicative abilities (NAP = 0.86, K = 25, 90% [CI 0.59, 0.98], Z = 62.12, p < 0.001). This was a medium effect.

3.3. Publication bias analysis

Evidence of publication bias was found by Egger's regression test (b = 2.07, p < 0.01), showing asymmetry in the funnel plot graph (see Appendix E on Supplemental material). Publication bias was not evident according to the trim-and-fill analysis, where six studies were moved to the right of the mean, making the adjusted effect of intervention smaller (g = 0.42, 95% [CI 0.29, 0.54]), though still significantly different from zero. In contrast, no evidence of publication bias was found according to the Fail-Safe N (99 studies) method. The combined tandem criteria suggested that there was a possibility of publication bias.

For single-case designs, no significant correlation was found between standard error and effect size, indicating the absence of publication bias (r = 0.07, p = 0.72).

3.4. Targeted skills analysis

The effect size (g) for imitation group-design studies ranged from g = 0.11 to g = 0.91, and the effect size for single-case design studies ranged from NAP = 0.79 to NAP = 1.00 (see Table 1 and Appendix F and G on Supplemental material). The sample of studies was not sufficiently large and I^2 statistic (6.62) did not meet the criteria to proceed with moderator or publication bias analyses.

The effect size (g) for joint attention group-design studies ranged from g = 0.21 to g = 1.26, and the effect size for joint attention single-case design studies ranged from NAP = 0.67 to NAP = 1.00 (see Table 1 and Appendix F and G). While the number of studies included in the analysis was sufficient, the I^2 statistic (19.83) was not large enough to proceed with moderator analyses. No evidence for publication bias was found using the tandem method, suggesting that such bias was unlikely.

The effect size (g) for play group-design studies ranged from g = 0.01 to g = 2.12, and the effect size for play single-case design studies ranged from NAP = 0.72 to NAP = 1.00 (see Table 1 and Appendix F and G). The I^2 statistic (73.56) was sufficient to support exploratory moderator analyses but the sample of studies was too small to allow for this. As a result, neither publication bias nor moderator analyses were conducted.

3.5. Caregivers/teachers included in the treatment programme analysis

Nine studies with group design included caregivers or teachers as active components in treatment programmes. The effect sizes for programmes where, in addition to the main therapist, the caregivers or teachers had an active role in the intervention, ranged from g = 0.11 to g = 1.02. Fig. 4 shows the individual effect size for this analysis (g = 0.50, K = 9, 95% [CI 0.32, 0.68], Z = 5.39, p < 0.001). This was a medium effect. The sample of studies was not sufficiently large and the I^2 statistic (0.00) did not meet the criteria to proceed with moderator or publication bias analyses.

Seven studies with single-case design included caregivers or teachers in treatment programmes. The effect sizes for these programmes ranged from NAP = 0.75 to NAP = 0.99. Fig. 4 shows the individual effect size for this analysis (NAP = 0.89, K = 7, 90% [CI 0.66, 0.99], Z = 62.83, p < 0.001). This was a medium effect. The sample of studies was not sufficiently large to proceed with publication bias analyses.

3.6. Moderator analysis

Metaregression analyses of moderators were conducted for the study as a whole. All the descriptive moderators (overall cognitive ability, verbal ability, and treatment dosage) were nonsignificant, except preintervention age (Table 2), which did prove to be significant, Q (1) = 6.95, p = 0.008. Effect sizes were greater when participants' preintervention ages were lower (see Appendix H for more information). Treatment dosage increased with increasing participants' age, although this relationship was not significant (r = 0.271, p = 0.076). In addition, when we eliminated the two studies where treatment dosage was much higher than the rest of the studies, the relationship between the dosage and the effect was significantly positive (see Fig. 6 in Appendix I).

The correlation analyses for single-case studies showed significant effects according to the treatment dosage moderator (Table 2), with the effect being greater when the treatment dosage was increased (number of sessions X hours). The correlations did not show effects in terms of age, IQ or language (see Appendix I for more information).

Correlation analyses were performed with treatment dosage and age of intervention (significant moderating variables of the effect of the intervention). The correlation was positive, but not significant. In addition, when eliminating the two outlier studies, the significance of the model was reduced (r Pearson = 0.199, p = 0.206).

Table 1
Aggregate effect for all analysis.

Meta-Analysis	*k*		Total *N*		Effect size		*Q*	I^2
	GD	SCD	GD	SCD	GD	SCD		
Overall	18	25	669	116	0.51**	0.86**	21.11	23.01
Caregiver/teacher	9	7	253	29	0.50**	0.89**	5.15	0.00
Imitation	4	7	77	27	0.43**	0.89*	3.21	6.62
Joint Attention	14	10	396	44	0.55**	0.85*	16.14	19.83
Play	7	9	160	25	0.47**	0.81**	28.08	73.56

Note. *Q* and I^2 were only calculated for group design studies.
GD: group design; SCD: single case design.
* $p < 0.05$.
** $p < 0.001$.

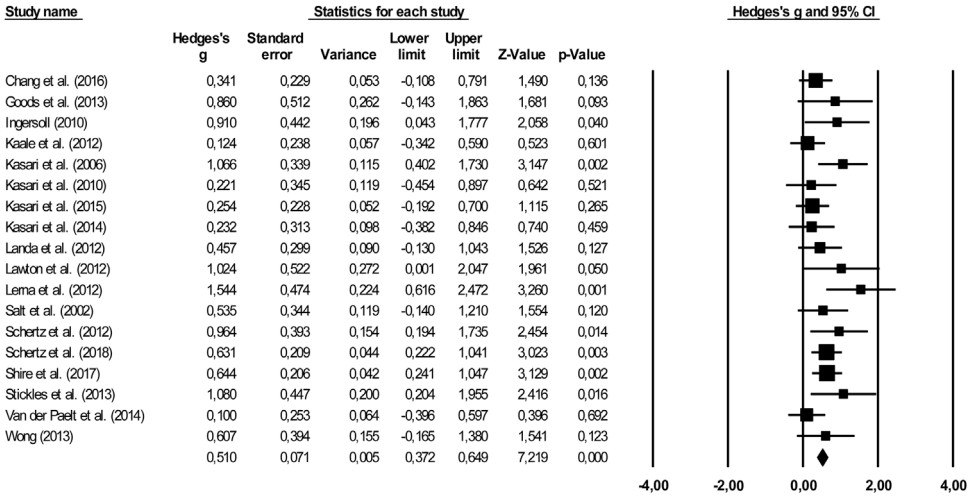

Fig. 2. Overall effect sizes for all measures of social and communicative skills from group design studies. All effect sizes are Hedges' g. 2b.
* The size of the icons represented by the Hedge's g values represent the weight of the study within the meta-analysis
In some studies, the effect outcome measures of the different skills were aggregated to obtain an overall effect of the studies. To see the analysis of the specific outcome measure in each study, see Appendix F.

Table 2
Meta-regression for group design studies and correlations for single case design studies according to the intervention features used in the social-communicative studies.[a]

Intervention feature	Meta-regressions for group design studies in the overall analysis			Correlations for single case design studies in the overall analysis		
	No. Studies	Effect size (95% CI)	*p* value	No. Studies	rPearson	Sig.
Pre-intervention age	24	**−0.02 (−0.03-0.00)**	**0.008**	31	−0.268	0.144
Pre-intervention IQ	14	0.00 (−0.02–0.03)	0.678	17	0.062	0.813
Pre-intervention exp. language	11	0.00 (−0.02–0.02)	0.946	7	0.228	0.712
Pre-intervention rec. language	11	0.00 (−0.01–0.02)	0.620	5	0.219	0.705
Treatment dosage (total hours)	16	0.00 (−0.00–0.01)	0.366	27	**0.380**	**0.050**

CI: confidence Interval. Exp.: expressive. Rec.: receptive.
[a] Pooled effect sizes were estimated from random-effects meta-regression models including the indicator variables for each intervention feature category for group design studies. Significance was estimated using correlation models that included the indicator variables of each intervention feature category for single case design studies.

In studies with larger effect sizes, the mean age of the participants was 45.6 months (*SD* = 13.4, *CV* = 29.5%). The mean IQ of the participants was 22.1 months (*SD* = 9.53, *CV* = 43.07%). The mean of expressive and receptive language was 19.7 and 19.8 months respectively (*SD* = 7.1, *CV* = 35.8%, *SD* = 8.6, *CV* = 43.4%). Finally, the total average of intervention hours was 33.2 (*SD* = 44.0, *CV* = 132.5%) (See Appendix J for more information). In 45.5% of these studies, parents and teachers played an active role in the intervention programmes.

4. Discussion

This study sought to contribute to the literature that evaluates the effectiveness of FIPs in terms of enhancing specific social and communication skills among young children with ASD. The results suggest that intervention programmes in experimental studies, having a group- or a single-case design, which focus on improving social-communication skills, produce medium positive effects. Specifically, such medium positive effects are encountered in FIPs where parents and/or teachers participate actively alongside the main therapist. Furthermore, the effect of the intervention is increased among participants who start participating in FIP programmes at an early age. FIPs have shown a positive effect on the development of communication skills. Therefore, the use of FIPs would allow professionals and parents to choose these types of programmes for the development of skills of children with ASD, since they produce positive effects, reducing costs and waiting times, two fundamental aspects in the satisfaction of parents and professionals of children with ASD (Bejarano-Martín et al., 2019). The results obtained of the overall effect size of FIPs are similar to other

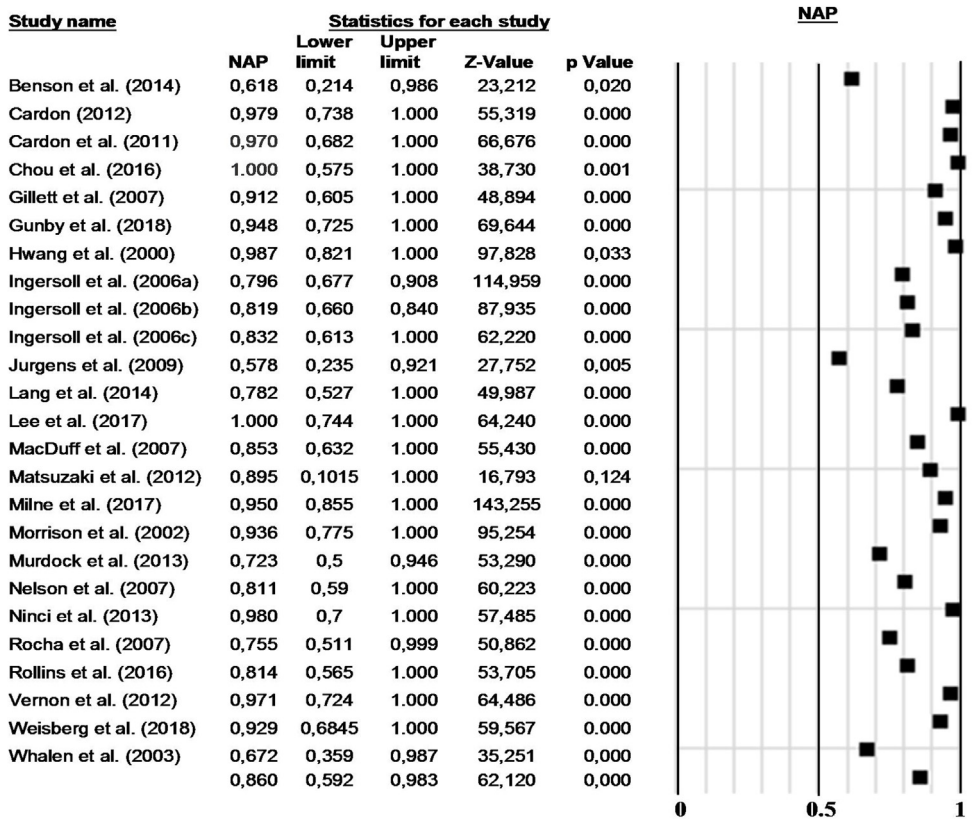

Fig. 3. Overall effect sizes for all measures of social and communicative skills from single case design studies. All effect sizes are NAP.
* In some studies, the effect outcome measures of the different skills were aggregated to obtain an overall effect of the studies. To see the analysis of the specific outcome measure in each study, see Appendix G.

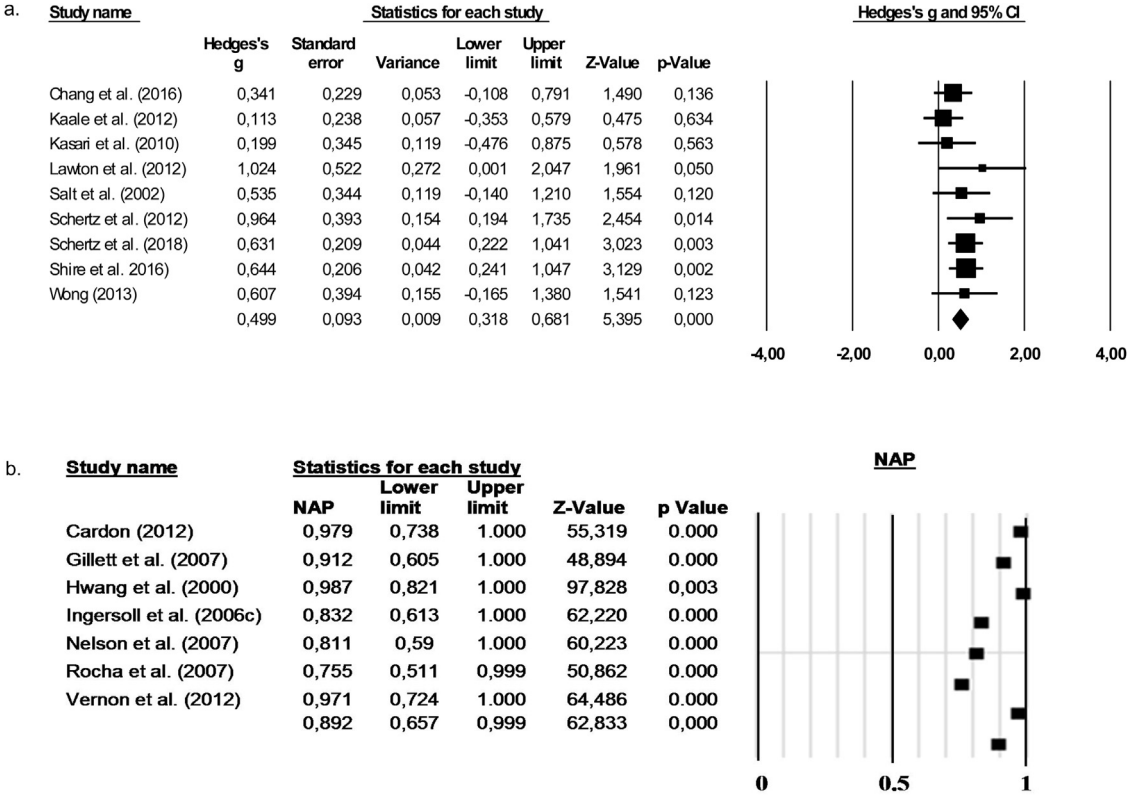

Fig. 4. (a) Effect sizes for programs in which caregivers play an active role from group design studies. All effect sizes are Hedges' g. (b) Effect sizes for programs in which caregivers play an active role from single design studies. All effect sizes are NAP.
* The size of the icons represented by the Hedge's g values represent the weight of the study within the meta-analysis.

intervention programmes studied extensively in the literature (e.g. Applied Behavior Analysis (ABA), Denver Model, PECS).

4.1. FIPs' efficacy to improve social and communication skills in children with ASD

The effect size found in the overall meta-analysis of FIPs (*g*= 0.52) was comparable to that of other meta-analyses of social and communicative interventions to date (*g*= 0.51, Gates et al., 2017; *g*= 0.47, Reichow et al., 2012). Gates et al. (2017) analysed the effectiveness of social communicative interventions from ages 5–20 years. This study examined the effectiveness of interventions for children 6 years of age and younger and obtained similar results. The effectiveness of social communicative interventions has thus been demonstrated from the first stages of development to the beginning of adulthood.

In single case design studies, the overall effect of FIPs was a medium effect (NAP = 0.86). These results were similar to those obtained by Schneider, Goldstein, and Parker, (2008) (percentage of all nonoverlapping data (PAND) = 0.91). NAP and PAND are similar and they can be directly compared (Parker et al., 2009; Rakap, Snyder, & Pasia, 2014). These results could not be compared with the results obtained in the group design studies, since the NAP and Hedge's measurements are not directly comparable. Future studies should analyse both designs with comparable measures to know which type of FIPs designs obtain better results.

In addition to finding an overall effect of FIPs on social-communication skills, it is possible that, by aggregating the data, important information about each specific skill in the studies could be lost. Therefore, an individualized analysis of each skill was carried out by calculating the effect sizes for each of the different types of social-communication skills. Although the effects were positive for all social-communication skills, the results for joint attention in the group-design studies were higher than those obtained for play and imitation skills, with medium effect sizes. In single case studies, the results of joint attention and imitation were higher than those obtained for play skills. These joint attention results are consistent with those reported by Murza et al. (2016). This is particularly noteworthy because joint attention is one of the main deficits in children with ASD, and is one of the skills which have the strongest relationship with the development of communication and cognitive development at later ages (Charman et al., 2003; Mundy et al., 2007; Poon, Watson, Baranek, & Poe, 2012). In play skill there were two studies with higher effect size. We found that the dependent variable in these studies (Cooperative play) is less specific than those specified in the other studies (functional play, symbolic play). Also, the authors measure it as the seconds that the child plays with the adult. By having such a general variable and measuring it as seconds instead of frequencies, the authors could get very good results. Therefore, the results of this meta-analysis should be interpreted with caution because there was significant variation among the FIPs used across the different studies.

Randomised group assignment was possible in the majority of group-design studies (19). Further, the general quality standards of clinical studies that included randomisation (or group equivalence in QEDs), blindness, intention-to-treat analysis, and the use of prospective -as opposed to retrospective- designs, were consistently observed in all the group design studies through the quality selection procedure (EBP inclusion criteria). Therefore, all the group design studies included in the analyses met the standards of methodological quality. Similarly, all single case design studies included in the analysis met the methodological quality standards (EBP inclusion criteria) based on Wong et al. (2015). These quality standards are similar to those proposed by Romeiser Logan, Hickman, Harris, and Heriza, (2008). However, several studies, both group and single case designs, did not carry out a post evaluation of measures, such as cognitive development, language level, or level of symptomatology, which were only recorded at baseline. Despite this, it was possible to perform a meta-analysis of the random effects by partially compensating for the effect sizes, which were calculated only for the social communication skills.

The level at which the intervention was implemented was not considered as a moderator in this meta-analysis. However, one of the inclusion criteria for the selection of studies in phase two had to ensure the description of the control group. This guaranteed that this group did not follow any specific programme or follow a "treatment as usual". However, the "treatment as usual" conducted in some studies could not be controlled, since some studies did not report this information. Despite this, most studies reported that in these types of programmes followed in the control group, the same principles of intervention group were not followed.

Although presenting a measure of treatment fidelity was not a criterion for inclusion in the selection of studies, all intervention programmes presented optimal fidelity measures (>80% or Inter Correlation Coefficient (ICC) >0.80) (See Appendix C). Only two studies with group design and two studies with single case design did not report the specific data of treatment fidelity in their studies, although they reported having complied with the programme's fidelity standards. Therefore, we can attest that the therapists collaborating in the studies conducted the intervention programmes as they were designed.

4.2. Effects of participant and FIP characteristics

Metaregression of moderator analyses of group-design studies has afforded evidence of the importance of considering participants' characteristics in order to improve the effect of the programmes implemented. These results support the suggestions of other studies (see Siu et al., 2016) that interventions should be implemented as soon as possible. However, these data show that, while the increase in treatment dosage had a positive impact on the effect of the intervention, the results were not statistically significant. These results are consistent with Virués-Ortega (2010). In addition, when considering the range of treatment dosage (10–259 h), it is still unclear what the most appropriate number of sessions or hours should be for the respective interventions that focused on the development of specific social-communication skills. By eliminating studies with higher standard deviation, the relationship between dosage and effect was significantly positive, consistent with other studies (Eldevik et al., 2010; Linstead, Dixon, French et al., 2017, Linstead, Dixon, Hong et al., 2017). These results should be interpreted cautiously, bearing in mind that the number of hours that children may have received outside the intervention-programme studies is not known.

The correlation analyses of the single-case design studies showed that increases in treatment dosage also led to more effective programme outcomes. However, the lack of a statistically significant relationship between the effect of the programme outcomes in the group-design studies and the duration of the intervention may be due to the great variability in the number of hours employed. In addition, a significant relationship was observed in single-case design studies because the range in the number of intervention hours was narrower.

As indicated above, we have performed a correlation analysis of the treatment dosage with the age of the intervention as these two variables probably have a significant moderating role on the effect of the intervention). These variables correlated positively, as the age of the participants increased, the treatment dosage increased, but not significantly, and the significance of the model decreased when we eliminated two studies with outliers (disproportionately high).

The descriptive analyses of the moderators in the selected studies with larger effect sizes showed CVs greater than 20%. This shows us that in these studies no similarities were found in terms of age, IQ, and language of the participants, or in treatment dosage, that is, no homogeneity was found in the studies. Future studies should analyse possible similarities of different FIPs, in order to find those characteristics of the participants or programmes that produce the greatest effects.

Although it has been found that these variables influenced the effect of the intervention, it was not possible to verify whether FIPs produced indirect effects on the language, level of symptomatology, adaptive behavior and / or IQ because the studies did not provide information on these aspects in the postintervention phase. In these studies, FIPs focused on the improvement of communication and social skills, so it appears that they did not consider it necessary to report information on measures about the characteristics of participants postintervention. Therefore, it was not possible to evaluate whether the intervention programmes had an indirect impact on these variables. Future studies should analyse the indirect effect of FIPs on this type of variables, so that they are taken into account when selecting the type of programme.

4.3. Effectiveness of FIPs when families and/or teachers actively participate in the intervention

Pooled effect sizes of FIPs were significant where, in addition to the therapist, parents, caregivers or teachers participated in the intervention. These results are in line with the results of other studies where parents' or caregivers' role in the intervention was evaluated (Estes et al., 2014; Pickles et al., 2016), and which also provide evidence of a reduction in family stress levels (Keen, Couzens, Muspratt, & Rodger, 2010). The participation of parents or caregivers has been proposed as one of the key intervention components by numerous studies (Casagrande & Ingersoll, 2017; Zwaigenbaum et al., 2015), since these are the persons with whom children with ASD spend most of their time. Considering the priorities and preferences of caregivers produces positive results (Leadbitter et al., 2017), as they have a better understanding of the challenges that the child faces in his/her daily life. In addition, the inclusion of caregivers would most likely lower the costs incurred by public services, by reducing the number of intervention hours that therapists devote each child. Accordingly, giving caregivers an active role would not only help the child with ASD, but also lead to a reduction in long-term parental stress and the other ASD-related burdens (Keen et al., 2010). Programmes that included caregivers in the intervention were selected for this study, regardless of the number of hours devoted by parents/caregivers to the task or the way where they participated in the intervention.

4.4. Implications for research and clinical practice

The following are some of the implications of this work for professional practice, as this study is part of a European Union project (ASDEU, 2020) on Autism Spectrum Disorders, which one of the main objectives was to promote the improvement of early intervention programmes in the European context.

Firstly, the use of FIPs in early socio-communication skills interventions has resulted in a medium positive effect. Therefore, the use of FIPs has proven its effectiveness. An average positive effect is an indicator of sufficient quality to recommend the use of a programme. FIPs are not only based on scientific evidence (Odom, Boyd et al., 2010, Odom, Collet-Klingenberg et al., 2010), but they have also shown to be effective in the development of socio-communication skills. Professionals and service providers should take into account the use of these programmes in a clinical context, as they have demonstrated positive effectiveness for children between 0 and 6 years.

Second, we suggest that the implementation of early intervention programmes be based on a sufficient amount of information about the characteristics of each participant and that this information be taken into account in the publication of results. This information should include pre - post measures of behaviour, cognition, communication and social functioning that would allow the effectiveness of the intervention, and its applicability to different groups of children, to be evaluated that subsequently would allow to compare the results with other programmes that pursue similar objectives and/or replicate the same methodology. Likewise, the professionals directly involved must take into account the characteristics of the children for whom they are going to develop an intervention programme in relation to the children who have participated in studies that prove the effectiveness of the programme. In this way, they would be able to select with greater precision the most potentially effective and feasible procedures.

Third, in relation to the context of the intervention, assuming that: (a) the effect of the intervention is significantly positive when parents are actively involved in well-structured activities, and (b) that it may be more effective if carried out in the child's natural environment, it is desirable that both intervention programmes and studies on treatment effectiveness clearly define the role of caregivers as active agents with interests in the process (Webb, Jones, Kelly, & Dawson, 2014). In addition, according to Leadbitter et al. (2017), intervention programmes and effectiveness studies should specify the type of relevant information or training that parents should receive, considering both the total number of hours that family members should devote to learning the techniques they must use to teach specific skills, and the time they should devote to conducting teaching activities themselves. In addition, it is important to keep in mind the fidelity of the intervention, something that few studies provide with concrete measures to achieve such fidelity specifically in relation to the application of the procedures by the parents (most studies only provided information on how they ensured the fidelity of treatment for therapists). It is also expected that assigning an active role to parents will also help reduce their long-term stress levels (Keen et al., 2010).

Forth, since various targeted interventions have provided evidence of efficacy, efforts can be made to make these techniques complementary to early detection programmes for signs of ASD risk. If screening programmes identify delays or deviations in skills such as eye contact, play, imitation, or joint attention, it is possible to implement FIPs aimed at those hindered skills, actively involving families to begin working with their children, even before they receive a formal diagnosis of ASD. This would make early detection programmes more useful and socially valid. FIPs will increase the success of screening programmes and reduce the symptoms of ASD (MacDonald et al., 2014; Orinstein et al., 2014).

Finally, increasing the dose of treatment may heighten the effect of the intervention. Therefore, policy makers, as well as intervention services, should seek ways to provide resources to families and professionals so that they can initiate and sustain treatments for as long as possible (duration of intervention in weeks/months/years) and as intense (hours per week) as possible.

4.5. Limitations and future research

Evidence of possible publication bias was found in the overall analysis of the studies, suggesting that the "true" effects may be smaller than what has been reported in the literature to date. There is the possibility that studies with a small effect size are not published, which, if true, would support the contention that the most relevant aspect of the study is to demonstrate that the particular FIP was studied in a sufficiently large sample. This evidence of pos-

sible publication bias was shown with a combined tandem method as this makes it easier to visually identify publication bias (Terrin, Schmid & Lau, 2005). Even so, the limited sample size of most studies suggests that evidence of publication bias may simply be the by-product of small-sample-size studies rather than genuine publication bias (Whitehead, 2002). No evidence of publication bias was found in correlation analyses of single case design studies. However, given the nature of these small studies, with subsequently high standard errors, in which multiple subjects participated with varying time intervals before and after the intervention, these results should be taken with caution. Consequently, more studies with larger number of participants are needed to increase their practical relevance.

In those studies that reported results in more than one outcome measure, the effect size was calculated by aggregating these measures to obtain a global effect in each study. These analyses allowed to obtain an overall effect. However, adding the individual effects to a global effect could lead to a loss of information from the data. Therefore, individual analyses of each of the outcome measures were conducted, and it was possible to conduct an analysis of the effect of the FIPs for imitation (n = 11), joint attention (n = 25) and play (n = 15) skills. The total number of studies found for skills such as eye contact (n = 6) and gestures (n = 2) was low. The outcomes of specific skills must thus be interpreted with caution. As a consequence, a meta-analysis could not be performed to determine the effect size in the case of the above skills.

In addition to the relatively small number of studies, analysis of the outcomes of the interventions reviewed was also limited, due to the diverse number of methods and designs used in the different papers. This limitation was further exacerbated by the degree of variability in the characteristics of each intervention programme and the characteristics of the children reported by each study (French & Kennedy, 2018; Spreckley & Boyd, 2009). In order to study the moderating effect of contextual factors, additional research studies are required to better describe the characteristics of the participants and the intervention settings.

Future research should examine whether parents' participation is equally important for teaching different types of skills or whether such active participation is more relevant for developing and/or evaluating the acquisition of specific skills. A further area to be addressed is the possible influence that parents' involvement in the intervention may have on their degree of satisfaction with the programme, as suggested by some studies (Bearss, Burrell, Stewart, & Scahill, 2015; Gulsrud, Hellemann, Shire, & Kasari, 2016). Research should be undertaken to define the best procedure to be implemented for the purpose of fostering the active participation of the various stakeholders involved. In this regard, an evaluation of the reproducibility of both the teaching methods and the support and reinforcement required, would facilitate learning and the generalisation of the procedures by such stakeholders (Debodinance et al., 2017).

5. Conclusion

This study provides information that may prove useful for debating whether currently available Focused Intervention Practices (FIPs) aimed at improving the social communicative skills generally affected in young children with ASD (imitation, joint attention and play), are effective, adequate, and suitable enough to be used as treatment in early-intervention services. Our research confirms that studies using FIPs to improve social-communication skills show promising results, and therefore supports the contention that caregivers and/or teachers could play an active role in FIPs when it comes to obtaining positive effects. Moreover, active participation by caregivers or teachers could reduce the costs incurred by public services, by reducing the number of intervention hours that therapists devote to each child. In addition, since these FIPs focus on specific skills, application time would become shorter, something that could, in turn, lead to lowering the cost of treatment and thus rendering it more affordable. Future research should provide results that would allow for their inclusion in services aimed at the identification, diagnosis and treatment of early neurodevelopmental disorders, by identifying the characteristics, which increase the intervention's chances of success.

Author contribution

ABM, RCB, MMM y CFA designed the study; ABM y RCB wrote the manuscript; ABM, SLJ, ES, AV, CR, CC conducted the literature review and executed the quality review process; ABM and MMM extracted the data from the selected articles; ABM, MMM and RCB carried out statistical analyses and interpreted the results; MMM, CFA, PGP and MP collaborated in writing the manuscript. All authors have read and approved the final manuscript.

Declarations of interest

All authors declare they have no conflicts of interest.

Ethical approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.ecresq.2020.01.004.

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