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Interventions for toddlers with autism spectrum disorder: A meta-analysis of single-subject experimental studies

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ABSTRACT

Background: Progress in diagnostic assessment made it possible to diagnose ASD at a young age. Concurrently, intervention research for toddlers with ASD has increased since the past decade.
Method: In this study, we report on a five-level meta-analysis of 34 single-subject experimental studies, intended to offer a better insight into what types of interventions are effective for toddlers under the age of three with or at risk for ASD.
Results: The analysis revealed a significant positive overall effect size. We found that interventions at home were significantly more effective compared to those in other settings. Other significant moderators regarding intervention characteristics were the agent of intervention and duration in weeks. No moderator effects of study and child characteristics were found.
Conclusions: On average, interventions for toddlers with or at risk for ASD are successful.

1. Introduction

An early diagnosis of autism spectrum disorder (ASD) creates opportunities for early intervention. Previous research suggests that a reliable and stable diagnosis can be made from three years on (Woolfenden, Sarkozy, Ridley, & Williams, 2012), but early behavioral markers of ASD, such as reduced social attention and communication, become already visible between 12 and 24 months of age (Zwaigenbaum et al., 2015a). However, research demonstrates an extensive delay and variation in age at diagnosis. Most children with ASD are diagnosed after their third birthday. The mean age at diagnosis ranges from 38 to 120 months and early diagnosis is positively related to symptom severity, parental concern about

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symptoms and socioeconomic status (Daniels & Mandell, 2014). However, early identification and diagnosis of ASD are necessary for timely access to early interventions in order to achieve optimal outcomes (Boyd, Odom, Humphreys & Sam, 2010) and nowadays there is a trend towards an earlier identification and diagnosis of ASD (Daniels & Mandell, 2014).

Many studies target interventions with children older than 3 years. As a consequence, relatively little is known about the effect of interventions started at a very young age (Jang et al., 2014; Makrygianni & Reed, 2010). The first years of life are characterized by a rapid development, in particular in the domains of cognition, social-communication, and language skills (Bradshaw, Steiner, Gengoux, & Koegel, 2015). Therefore, very early intervention could benefit the child with ASD, its family and the community. The rationale for early intervention is twofold. The first reason is that early interventions can move children with ASD towards a more typical developmental trajectory, due to plasticity of the brain in early development, reducing cumulative effects of secondary neurological disturbance. Secondly, psycho-education and early treatment may prevent or minimize the onset of secondary (compensatory) behavior problems, which can lead to additional impairments or aggravation of ASD symptoms (Barbaro & Dissanayake, 2009; Koegel, Koegel, Ashbaugh, & Bradshaw, 2014; Rogers & Vismara, 2008; Webb, Jones, Kelly, & Dawson, 2014).

Due to the individual differences between children with ASD, choosing a specific intervention can be a complex task. Many psychosocial interventions can be placed on a continuum from highly structured, behavioral approaches to more social developmental approaches (Ospina et al., 2008; Schertz, Baker, Hurwitz, & Benner, 2011). The traditional applied behavior analytic (ABA) interventions are based on principles of operant learning to teach children different skills in a highly structured setting. The more recent naturalistic developmental behavioral interventions integrate developmental and ABA principles embedded in a natural environment, such as play or daily routines (Schreibman et al., 2015). Next to these broader interventions, there are also interventions with a more specific target, such as augmentative and alternative communication and sensory regulation interventions.

Intervention research for toddlers with ASD has increased since the past decade. Therefore, it is important to combine, compare and analyze the results from these studies. In this study, we report on a meta-analysis intended to offer a better insight into what types of interventions are effective for toddlers with ASD by combining different single-subject experimental studies (SSEDs) (Boyd et al., 2010; Dawson, 2008; Jang et al., 2014; Zwaigenbaum, 2010). Several participant, family and intervention characteristics can be expected to influence outcome of early intervention in young children with ASD, but knowledge on this topic is still mixed and limited. A number of child factors are sometimes mentioned as predictors of outcome, such as level of functioning, severity of ASD symptoms, and age at start of intervention (Kasari, Gulsrud, Freeman, Paparella, & Helleman, 2012; Perry, Blacklock, & Dunn Geier, 2013; Vivanti, Prior, Williams, & Dissanayake, 2014). Recent studies suggest that the earlier an intervention starts, the better the outcome (Guthrie et al., 2016; Orinstein et al., 2014; Zwaigenbaum et al., 2015b). Higher initial levels of cognitive, adaptive or communication and language abilities and less severe ASD symptoms sometimes predict better outcomes (e.g., Flanagan, Landa, Bhat, & Bauman, 2012; Itzchak & Zachor, 2011; Perry et al., 2011). However, other studies failed to find significant effects for the above mentioned predictors (e.g., Reichow, 2012). Family characteristics, such as maternal age or level of education and parental stress, are seldom included (Vivanti et al., 2014) and therefore cannot be analyzed in this study. Intervention characteristics, such as type of intervention, duration, intensity, setting and agent of intervention, may play a role as well. A higher treatment intensity, a longer duration and inclusion of parents in the intervention have been found to be related to a better treatment outcome (Reichow, 2012).

The purpose of the meta-analysis is to answer the following questions: (1) What is the overall effect of interventions for toddlers with or at risk for ASD? (2) Does the effect vary over studies? (3) Does the effect vary over participants? (4) Which characteristics of the intervention, the study, and the participants have a moderating impact on the effect of treatment?

Existing reviews and meta-analyses on interventions for ASD are often restricted in analyzing a specific kind of intervention (Morgan et al., 2014), a specific age group (Bradshaw et al., 2015), or using a specific outcome measurement (Kwok, Brown, Smyth, & Cardy, 2015; Tonge, Bull, Brerton, & Wilson, 2014). The current study is also restricted to a specific age group but not to a specific kind of intervention. We exclusively included SSEDs, because by combining this kind of studies, we do not only get a better insight into the mean effect of the intervention and how much and why the treatment effect varies over studies, but also in how much and why the treatment effect varies over participants. Traditionally, meta-analyses only include studies implementing a group-design, but the last decade methodology for meta-analysis of SSEDs has developed considerably. These new techniques are applied in this article, only selecting SSEDs focusing on early intervention programs for ASD.

Besides the investigation on the effects of interventions in general, an investigation of moderator effects is undertaken. We hypothesize that types of interventions differ in the degree of effectiveness (Koegel et al., 2014a; Schertz, Reichow, Tan, Vaiouli, & Yildirim, 2012). Based on the conclusions of Vivanti et al. (2014), we expect that both individual and intervention characteristics moderate the effect of treatment. In line with several studies (e.g., Guthrie et al., 2016; Orinstein et al., 2014), younger children are expected to benefit more from intervention than older children. Interventions with parent as agents (co-)implementing the intervention, are expected to have a positive impact on intervention outcome, as in particular young children spend a lot of time at home with their parents (Zwaigenbaum et al., 2015b). Other factors may play a role as well, but have not been systematically studied before or mainly yielded mixed results.