



Effects of a responsiveness–focused intervention in family child care homes on children’s executive function

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ABSTRACT

Caregiver responsiveness has been theorized and found to support children’s early executive function (EF) development. This study examined the effects of an intervention that targeted family child care provider responsiveness on children’s EF. Family child care providers were randomly assigned to one of two intervention groups or a control group. An intervention group that received a responsiveness–focused online professional development course and another intervention group that received this online course plus weekly mentoring were collapsed into one group because they did not differ on any of the outcome variables. Children ($N=141$) ranged in age from 2.5 to 5 years (mean age = 3.58 years; 52% female). At pretest and posttest, children completed delay inhibition tasks (gift delay–wrap, gift delay–bow) and conflict EF tasks (bear/dragon, dimensional change card sort), and parents reported on the children’s level of attention problems. Although there were no main effects of the intervention on children’s EF, there were significant interactions between intervention status and child age for delay inhibition and attention problems. The youngest children improved in delay inhibition and attention problems if they were in the intervention rather than the control group, whereas older children did not. These results suggest that improving family child care provider responsive behaviors may facilitate the development of certain EF skills in young preschool–age children.

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1. Introduction

Executive function (EF) refers to a set of cognitive processes that are linked with the prefrontal cortex and support flexible, goal-directed behavior (Jones, Rothbart, & Posner, 2003; Kane & Engle, 2002; Osaka et al., 2003; Peake, Hebl, & Mischel, 2002). EF skills, such as inhibiting an automatic response, updating information in working memory, and shifting between rules or behaviors, are robust predictors of school readiness, academic achievement, and social-emotional competence (Duncan et al., 2007; Espy, Sheffield, Wiebe, Clark, & Moehr, 2011; Welsh, Nix, Blair, Bierman, & Nelson, 2010). Given that early childhood is a period of rapid growth and considerable plasticity in EF processes (Garon, Bryson, & Smith, 2008; Rueda, Posner, & Rothbart, 2005), early experience may play an important role in shaping children’s EF development.

Supporting the development of EF skills early in life increases children’s chances of positive academic and social-emotional out-

comes. Interventions in prekindergarten and Head Start settings have been shown to improve children’s EF development (Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Diamond, Barnett, Thomas, & Munro, 2007; Raver et al., 2011; Weiland & Yoshikawa, 2013). However, little is known about the effects of interventions conducted in child care settings on EF. Furthermore, caregiver responsiveness, a broad construct emphasizing sensitive and contingent responding to children’s cues, has been identified as a robust predictor of children’s EF development (Bernier, Carlson, & Whipple, 2010; Conway & Stifter, 2012; Hamre, Hatfield, Pianta, & Jamil, 2014), suggesting that improving responsiveness may be a crucial component of an effective child care intervention.

As such, the purpose of the current study was to investigate the effects of an intervention that targeted family child care provider responsiveness on children’s EF skills. Child care providers in the intervention group received training that emphasized responsiveness primarily via an online professional development course, and children completed EF assessments at pretest and posttest. The results of this study were expected to shed light on the ways in

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which family child care might be improved to enhance children's early EF skills.

1.1. Executive function processes

Two EF processes that have been highlighted in the developmental literature are *delay inhibition* and *conflict EF* (Bernier et al., 2010; Bernier, Carlson, Deschênes, & Matte-Gagné, 2012; Carlson, Mandell, & Williams, 2004; Conway & Stifter, 2012). Delay inhibition tasks (e.g., delay of gratification tasks) require children to control impulses or inhibit an automatic response in the context of a reward. Conflict EF tasks require children to suppress a dominant response while executing a novel, conflicting response and holding information in working memory (Carlson & Moses, 2001; Carlson, White, & Davis-Unger, 2014). Conflict EF tasks include Stroop-like inhibition tasks (e.g., day/night, bear/dragon) and attention shifting tasks (e.g., dimensional change card sort [DCCS]; Bernier et al., 2010; Carlson & Moses, 2001; Carlson et al., 2004; Matte-Gagné & Bernier, 2011). Factor analytic studies of preschool-age children have yielded empirical support for separate delay inhibition and conflict EF dimensions (Bernier et al., 2010; Bernier et al., 2012; Carlson & Moses, 2001; Carlson et al., 2004; Conway & Stifter, 2012; Matte-Gagné & Bernier, 2011) and, similarly, separate “hot” (affectively salient) and “cool” (affectively neutral) EF dimensions (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009; Kim, Nordling, Yoon, Boldt, & Kochanska, 2013; Willoughby, Kupersmidt, Voegler-Lee, & Bryant, 2011; Zelazo & Carlson, 2012), although not all findings are consistent (Allan & Lonigan, 2011; Sulik et al., 2010).

There is also evidence that delay inhibition and conflict EF differ in their developmental course, predictors, and associations with social-emotional and academic outcomes (Allan, Hume, Allan, Farrington, & Lonigan, 2014; Carlson, 2005; Lengua et al., 2014; Li-Grining, 2007). For instance, preschoolers' delay inhibition but not conflict EF accounted for unique variance in later internalizing and externalizing problems (Kim et al., 2013; Smith-Donald, Raver, Hayes, & Richardson, 2007), whereas conflict EF but not delay inhibition made unique contributions to growth in emergent literacy and mathematics (Brock et al., 2009; Bull, Espy, & Wiebe, 2008; Clark, Pritchard, & Woodward, 2010; McClelland et al., 2007; Welsh et al., 2010; Willoughby et al., 2011).

The construct of executive attention, which refers to attention processes under cognitive control, overlaps considerably with the construct of EF (Rueda et al., 2005; Zhou, Chen, & Main, 2012). For instance, some EF skills and tasks, such as inhibitory control skills measured using Stroop-like tasks, have also been studied as executive attention skills and tasks (Zelazo et al., 2013), illustrating the close association between attention regulation and EF (Cuevas & Bell, 2014). Although these skills are typically measured using performance-based tasks, rating scales have been used to understand children's EF and attention regulatory behavior in everyday contexts (Bierman et al., 2008; Clark et al., 2010; Raver et al., 2011). Measures of EF using rating scales have also been found to predict later academic achievement (Clark et al., 2010).

1.2. Early experience and executive function development

Children's early experiences are linked with variability in their EF skills. Although the home environment is a central context for early development, many children spend a significant amount of time in child care and preschool settings during their early years (Laughlin, 2013). The quality of child care and preschool contexts has been associated with children's EF and attention skills (NICHD Early Child Care Research Network, 2005; Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009). For example, teacher responsiveness and positive classroom management and routines

are associated with growth in EF skills across the preschool year (Hamre et al., 2014).

Interventions improving prekindergarten or Head Start quality have been found to enhance children's EF outcomes (Diamond et al., 2007; Weiland & Yoshikawa, 2013). For instance, the Head Start REDI intervention improved 3–5-year-old children's attention shifting (DCCS task) and interviewer-rated attention and self-regulatory skills (Bierman et al., 2008). Also, Head Start children in the Chicago School Readiness Project (CSRP) intervention outperformed control children in terms of their conflict EF and interviewer-rated attention and impulsivity but not their delay of gratification skills (Raver et al., 2011). However, few studies have examined the effects of interventions conducted in child care settings on EF.

Family or home-based child care, defined as care that takes place in the provider's home, is one of the most common non-parental child care arrangements for young children in the United States (Laughlin, 2013). In particular, low-income families frequently use family child care (Burchinal, Howes, & Kontos, 2002; Dowsett, Huston, Imes, & Gennetian, 2008; NICHD Early Child Care Research Network, 2004). Some evidence suggests that family child care homes are often lower in quality than center-based care, although both types of care vary widely in their quality (NICHD Early Child Care Research Network, 2004; Votruba-Drzal, Coley, & Chase-Lansdale, 2004; Fuller, Kagan, Loeb, & Chang, 2004; Loeb, Fuller, Kagan, & Carrol, 2004; Ruzek, Burchinal, Farkas, & Duncan, 2014). In addition, children in family child care settings show lower school readiness skills compared to children in center-based child care (Ansari & Winsler, 2013; Burchinal, Roberts, Riggins, Zeisel, Neebe, & Bryant, 2000; Gordon, Colaner, Usdansky, & Melgar, 2013; Loeb et al., 2004; NICHD Early Child Care Research Network, 2006; NICHD Early Child Care Research Network and Duncan, 2003).

Some previous studies have examined the effects of interventions conducted in family child care homes, with several targeting the linguistic stimulation caregivers provided to the children (Koh & Neuman, 2009). For example, family child care providers who received a 10-h in-service training focused on supporting children's early language development provided greater language stimulation to children compared to providers in the control group (Ota & Austin, 2013). Other interventions have targeted family child care provider sensitivity and support for children's social development (Howes, Galinsky, & Kontos, 1998). For example, a 6-session video-feedback intervention targeting child care provider sensitivity and behavior management improved global child care quality, but not provider sensitivity, in the Netherlands (Groeneveld, Vermeer, van Ijzendoorn, & Linting, 2011). Also, family child care providers who completed a 9-h video-based training program on promoting children's social development increased their use of effective behavior management practices compared to the control group, and more effective behavior management was associated with decreased externalizing behavior across children in care (Rusby, Smolkowski, Marquez, & Taylor, 2008). Given the lack of studies examining children's EF outcomes, studies are needed that investigate the effects of interventions conducted in family child care homes on children's EF development.

1.3. Caregiver responsiveness and executive function development

Caregiver responsiveness is thought to be crucial to early EF development. As conceptualized across theoretical frameworks including attachment theory and socio-cultural theory, responsiveness encompasses a broad set of behaviors emphasizing warm acceptance of the child's needs and interests, sensitive and contingent responses to child signals (Ainsworth, Blehar, Waters, & Wall, 1978), scaffolding the child's ability to maintain attention

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