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# Does attending preschool in an economically advantaged or disadvantaged neighborhood moderate the effects of the preschool edition of promoting alternative thinking strategies®?

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Early interventions that foster the participation, engagement, and development of children attending preschools, including those in economically disadvantaged (low-income) neighborhoods, are of high priority. One such intervention is a universal socioemotional learning (SEL) program called Promoting Alternative Thinking Strategies (PATHS®) which aims to promote social emotional competence and positive adjustment in children, in general, and may have unique benefits for children attending preschool in low incomes areas. In the SEL field, areas in need of exploration include the possible role that neighborhood income level (i.e., all residents' income in a postal code that a preschool is located in) could have for children's social emotional competence and positive adjustment and how neighborhood income level may relate to benefits of an intervention such as PATHS. The study aims were to investigate 1) the baseline group differences in social emotional competence and adjustment depending on the neighborhood income level and 2) to determine if neighborhood income level moderated the effects of PATHS on children's social emotional competence and adjustment from pre to posttest. Participants were 275 children aged four to five years old, from the preschools randomized into an immediate intervention ($n$ = 145 children) or a wait-list control group ($n$ = 130 children). Overall, 42.9% ($n$ = 118) of the children attended preschools in economically disadvantaged neighborhoods and 57.1% ($n$ = 157) of the children attended preschools in economically advantaged neighborhoods. Children's social emotional competence and adjustment were assessed through child tasks, child observations and teacher reports. The moderation of intervention effects by the preschools' neighborhood income was tested in a series of just-identified structural equation models (SEM) that explored interaction effects

(income*PATHS interactions). At baseline, relative to children attending preschool in economically advantaged preschools, children attending preschool in economically disadvantaged neighborhoods showed lower levels of inhibitory control, working memory, task orientation and higher levels of inattention. Children attending preschools in economically disadvantaged neighborhoods participating in PATHS also showed reductions in inattention, social withdrawal and anxiety compared to control group children also attending preschool in disadvantaged neighborhoods. Additionally, PATHS children from advantaged neighborhoods improved their prosocial behavior, but not their social independence, relative to control group children who also attended preschool in advantaged neighborhoods. Offering PATHS as an SEL intervention in early childhood education and care settings could help to reduce disparities among children in a number of key outcomes.

KEYWORDS

**PATHS, intervention, children, preschool, social emotional competence, adjustment**

## Introduction

Universal school-based interventions that promote social emotional learning (SEL) are increasingly implemented to promote healthy development among young children (Taylor et al., 2017). The idea is that such an intervention would provide an added boost to naturally occurring efforts within preschools to help children develop competencies such as positive socialization and emotional regulation (e.g., Domitrovich et al., 2007), which in turn would be of importance to children's engagement and participation in early childhood education and care settings (ECEC), such as in preschool. In the United States (U.S.), SEL-interventions are often implemented in neighborhoods and schools that are in neighborhoods in which economic disadvantage is widespread (e.g., Fishbein et al., 2016) and ECEC quality can be variable. One rationale for such an effort is to provide additional resources that can boost competencies among children with access to few resources (e.g., material, experiential, relational resources). The role that neighborhood economic level (i.e., economic disadvantage or advantage of residents living in the particular locality) has on the effects of an SEL-intervention's ability to foster children's social emotional competence is however rarely explored in the research literature. In this study, we investigated whether a SEL preschool intervention entitled: Promoting Alternative THinking Strategies (PATHS® Kusché and Greenberg, 1994) had differential intervention-related effects on social emotional competence and indicators of adjustment in children attending preschool in economically disadvantaged and advantaged Swedish urban and suburban neighborhoods.

Inclusive education in ECEC provides opportunities to improve achievement and positive development for each child (European Agency for Special Needs and Inclusive Education, 2014). In educational settings, one of the key aspects for quality of inclusion is child engagement in learning and school activities, defined as the amount of time a child interacts with the environment in a way that is developmentally and contextually adequate (McWilliam and Bailey, 1995; McWilliam and Casey, 2008). Indeed, child engagement is considered an indicator of positive functioning in the early years and is thus central for the study of early childhood education (Castro et al., 2017). In that sense, child engagement plays an important role for supporting children's school readiness (e.g., Williford et al., 2013; Aydoğan et al., 2015).

From the perspective of ECEC and inclusive education as suggested by the European Agency for Special Needs and Inclusive Education (2014), interventions that promote participation and engagement of children could be highly relevant in terms of school readiness (Morrissey and Vinopal, 2018). Skills such as positive socialization, social support and equitable social status can be regarded as critical for positive engagement and optimal development. These are all skills (also in some cases referred to as competencies) that are facilitated by SEL interventions and practices (Ryan et al., 2019), which focus on building internal and external assets in terms of enhancing social emotional competence as a goal in its own right, rather than having a sole or primary focus on reducing risk by targeting problems directly as a part of an intervention (Brackett and Rivers, 2014).

According to the Affective-Behavioral-Cognitive-Dynamic Model of Development (ABCD-model; Greenberg and Kusche, 1993), social emotional competence includes the developmental integration of affective, cognitive, and behavioral systems and can be further conceptualized as two interrelated domains:

intrapersonal and interpersonal (Collaborative for Academic, Social, and Emotional Learning [CASEL], 2013; Domitrovich et al., 2017). Intrapersonal competence includes skills such as self-control and emotional regulation, as well as being able to shift attention from one task to another, plan tasks, and utilize working memory (Collaborative for Academic, Social, and Emotional Learning [CASEL], 2013). Such intrapersonal skills are also encompassed with the concept of executive functioning (EF). EF is the ability necessary for goal-directed activity which may involve (a) an intention to inhibit a response (i.e., inhibition control), (b) ability to resist distracting stimuli (i.e., interference control), and (c) temporary mental representation of the task (i.e., working memory) (Pennington and Ozonoff, 1996; Collaborative for Academic, Social, and Emotional Learning [CASEL], 2013). The interpersonal competence domain includes skills that are needed to interact with others, such as communication, perspective taking, and social problem solving (Collaborative for Academic, Social, and Emotional Learning [CASEL], 2013; Domitrovich et al., 2017).

The early social emotional skills encompassed within the intrapersonal and interpersonal competence domains are regarded as fundamental for healthy development, including mental health (Greenberg et al., 2001; Taylor et al., 2017), lower risk for criminal violence, and drug use (Durlak et al., 2010), as well as success in the labor market (Heckman and Kautz, 2012). Given the critical role that social emotional competence plays in terms of life expectancies, investing in SEL interventions is key (Taylor et al., 2017). Indeed, SEL interventions seem to have long-term beneficial impact on child aggressive behaviors and aggressive problem solving (Crean and Johnson, 2013), executive functioning and grades (Watts et al., 2018), social emotional and self-regulation skills (Welsh et al., 2020), adolescent conduct problems, emotional symptoms, and peer problems (Bierman et al., 2021), as well as overall, social emotional difficulties (McCoy et al., 2018).

Moreover, recent meta-analysis based on 82 intervention studies showed significant positive impacts of SEL interventions on children's social emotional competence, attitudes, and academic performance compared with children in control conditions (Taylor et al., 2017). These effects were sustained on average 3.75 years following program participation, with the strongest follow-up effects among children who received the intervention during early childhood (ages five to 10 years old). In other words, children's social emotional learning and development is well suited to intervention efforts as early as preschool age. Preschool also represents an important opportunity for SEL interventions given the whole child ethos and mission of many ECEC settings in various parts of the world (e.g., Ferrer-Wreder et al., 2021).

Child engagement includes at least three components, i.e., behavioral, emotional, and cognitive engagement components (Fredricks et al., 2004) which is why these processes could be intrinsically linked. Indeed, the association between social emotional competencies and engagement has been evidenced in several studies (Durlak et al., 2011; Korpershoek et al., 2016; Yang et al., 2018; Salmela-Aro and Upadyaya, 2020) suggesting that SEL interventions and practices can be linked to higher child and student engagement across different levels of educational contexts. For example, teaching of intrapersonal skills (such as moral reasoning and self-discipline) and interpersonal skills (such as resolving conflicts, considering others' perspectives) has been associated with higher levels of engagement, including cognitive-behavioral as well as emotional engagement, particularly in young children (Yang et al., 2018). In that sense, providing children with opportunities to enhance their social emotional skills could pave the path for enhanced engagement and possibilities for developmental growth.

Promoting Alternative Thinking Strategies (PATHS®) is a universal SEL intervention that is designed to promote children's social emotional competence (Domitrovich et al., 2007). Goals within the PATHS conceptual model are, for example, to support children's ability to self-regulate, understand emotions and behaviors, as well as to prevent or reduce behavioral and emotional problems. PATHS has a significant focus on aspects of the child's daily context, namely the preschool and classroom contexts, which on a microsystem level, along with the home context, play a large role in shaping children's development. There are different PATHS editions for preschool, primary and secondary school. The preschool version is designed for weekly or bi- weekly implementation across the school year by trained classroom teachers (Domitrovich et al., 2007). The program modalities are guided by a curriculum containing 33 lessons, which are interactive and consist of activities such as self-calming techniques, giving and receiving compliments, and take-home activities. Each lesson lasts 10–15 min and can take place during circle-time. In addition to the lessons, PATHS is also integrated in everyday practice. For a description of the PATHS logic model, see the EPISCenter (2011). Indeed, the recent effectiveness trial of PATHS® among Swedish preschool children (Eninger et al., 2021) showed several benefits in children's social emotional competencies (emotional knowledge, working memory and prosocial play) and an unexpected intervention-related increase in hyperactive/impulsive behavior from pre to posttest. This trial (Eninger et al., 2021) utilized the same dataset that is analyzed in this article. The original intervention trial (Eninger et al., 2021) focused primarily on intervention-related main effects and moderated intervention effects by children's gender. This study demonstrated largely consistent findings with the wider intervention efficacy and effectiveness research literature on preschool PATHS in the U.S. and other nations.

More specifically, other U.S. based studies have shown intervention-related benefits in child emotional knowledge skills, social interactions, and reductions in social withdrawal (Domitrovich et al., 2007), as well as indicators of executive functioning, such as improvements in inhibitory control and

task orientation one year later (Bierman et al., 2008). However, as the preschool is a part of and interacts with the neighborhood where it is situated, the economic resources offered in the neighborhood context could be critical in terms of the effect of such an intervention has on children's social emotional development. Indeed, an evaluation of preschool PATHS in high-poverty U.S. neighborhoods revealed that children who received PATHS showed improvements in various aspects of social competence and behavioral problems one year later (Fishbein et al., 2016). These effects were sustained over time (Calhoun et al., 2020). To date, no prior preschool PATHS intervention study has investigated whether or not the neighborhood income level in which preschools are located as a potential moderating factor on the effects that preschool PATHS possibly confers on children's social emotional competence and behavior/adjustment. This is the knowledge gap addressed in the current study.

Neighborhood income level plays an important, but less explored role in children's development (Vinopal and Morrissey, 2020). Neighborhoods are defined in various ways in a global research context (e.g., from a registry data standpoint, census tract in the U.S., postal code in Sweden). In addition, the aspects/facets of the neighborhood that are important to child development and behavior are also examined from a number of different standpoints in the international research literature (e.g., built environmental features, green spaces, residents' income and educational background). This study focused on all residents' income at the postal code level, which represents the respective neighborhoods in which preschools, in this trial of preschool PATHS were located.

For the sake of brevity, in the remainder of this article, all residents' income at the postal code/neighborhood/preschool level is referred to as neighborhood income level. Neighborhood income level is notably connected to where a cohort of children attend preschool, although their homes may or may not be located in this neighborhood. Indeed, the neighborhood income level in which schools are located could be critical in terms of the quality of ECEC as reflected in preschools (Leventhal and Brooks-Gunn, 2000; Cloney et al., 2016) as well as have direct bearing on children's social emotional competence and behavior/adjustment, due to daily exposure to people and resources within the immediate context around children's preschool. Thus, more attention to the role of neighborhood income level as a contextual feature of possible importance for the development of children in ECEC is warranted (Vinopal and Morrissey, 2020). Moreover, universal school based SEL interventions are increasingly implemented to promote healthy development among young children (Taylor et al., 2017); and what role the neighborhood income that schools are located in and how that relates to intervention benefits of SEL interventions is however yet to be widely explored. In this article, we investigated whether a SEL preschool intervention (i.e., PATHS; Domitrovich et al., 2007) had differential intervention-related effects on social emotional competence and indicators of child behavior/adjustment among children attending preschools in economically disadvantaged and advantaged Swedish neighborhoods (urban and suburban areas).

According to ecological systems theory (Bronfenbrenner, 1979; Bronfenbrenner and Morris, 2006) children are co-influential actors with dynamic interrelated proximal contexts of development. In that sense, child development is in part inherently rooted in the social contexts that children live in on a daily basis. Accordingly, these contexts include immediate settings, called microsystems, which include for example a child's direct interactions with parents, peers, schools, and neighborhoods. These microsystems are in turn rooted and connected to several distal systems and processes, which are important to child development. The economic status of a neighborhood (i.e., neighborhood income level) plays a role both in terms of resident norms and collective efficacy (e.g., to address crime, disobedience) and institutional resources such as availability of schools and health care (e.g., Leventhal and Brooks-Gunn, 2000) which may be important to child development. Indeed, children living in economically disadvantaged (i.e., low-income) neighborhoods have evidenced poorer mental health (Riina et al., 2014) and cognitive development (Dean et al., 2018) including development of skills such as verbal and language proficiency (Kohen et al., 2009) and other skills critical for emotional and stress regulation (e.g., Lipina and Evers, 2017) relative to children living in economically advantaged (i.e., high-income) neighborhoods. Also, children in more economically advantaged neighborhoods in some cases have evidenced elevated positive development of cognitive skills such as reading and mathematics achievement in comparison to children living in economically disadvantaged neighborhoods (e.g., Sastry and Pebley, 2010).

The links between neighborhood context and aspects of child development could be explained through the impact of different structural or social mechanisms. Lack of safety, poor social cohesion, and the quality and structure of the family environment play an important role for development of cognitive, emotional, and behavioral skills (Minh et al., 2017). Often, these mechanisms accumulate which may overwhelm child physiological stress response systems and their physiological, emotional and attentional reactivity to stimulation (Brown and Ackerman, 2011). For example, in the context of unpredictability and absence of promotive resources that could be found in the neighborhood and/or family environment, stress exposure seems to shape brain development in ways that impedes development of executive function, including attention and emotional regulation skills (Blair et al., 2011). In that sense, instead of engaging in reflective and problem-oriented responses to stimulation, children exposed to disadvantageous environments rather can engage in defensive and reactive responses to stimulation (Blair and Raver, 2016).

In addition, the link between neighborhood context and child development may at least partially be explained by the quality of childcare institutions (Minh et al., 2017).

For example, a Swedish cross-sectional study with children four to six years old (a subset of children in the present study) showed that those children attending preschools in economically advantaged areas had elevated letter recognition and more rapid naming of objects (i.e., indicators of linguistic and reading development), in comparison to children attending preschool in disadvantaged areas (Herkner et al., 2021). In addition, a recent Swedish report suggests that the proportion of children who are eligible for high school at 16 years of age, as well as those who complete a high school education with a degree are higher among children who live in economically advantaged neighborhoods relative to children living in economically disadvantaged areas (Delegationen mot segregation, 2022). In that sense, high-quality ECEC settings could particularly be beneficial for children living in economically disadvantaged neighborhoods (e.g., Duncan and Sojourner, 2013).

Given the need to examine neighborhood income level and children's social emotional competence and behavior/adjustment, the following hypotheses were posed and guided this study:

H1. At baseline (or pretest), the level of social emotional competence and behavior/adjustment will significantly differ between children attending preschools in economically advantaged relative to economically disadvantaged neighborhoods. Guided by theory (e.g., Bronfenbrenner, 1979) and earlier research (e.g., Morrissey and Vinopal, 2018; Vinopal and Morrissey, 2020), we expected that children attending preschool in economically disadvantaged neighborhoods, would have significantly lower emotional knowledge/awareness, social problem solving and executive functioning (indexed by inhibitory control and working memory) (also referred to as primary outcomes, based on distinction between primary, secondary and distal outcomes in other PATHS intervention trials, e.g., Domitrovich et al., 2007), than children attending preschool in economically advantaged neighborhoods. For secondary outcomes, i.e., prosocial skills, task orientation, social cooperation, social interactions and social independence, we also expected children attending preschool in economically disadvantaged neighborhoods to score significantly lower relative to children attending preschool in economically advantaged neighborhoods. Children attending preschool in economically disadvantaged, relative to economically advantaged neighborhoods, would show higher levels of internalizing (social withdrawal and anxiety) and externalizing behaviors (aggression), inattention and hyperactivity (distal outcomes).

H2. Neighborhood income level will moderate the effects of PATHS on children's social emotional competence and indicators of behavior/adjustment from pre to posttest (please see **Figure 1** for a conceptual model). Based on the earlier research on the substantial value added to implementing preschool PATHS with children living in poor neighborhoods (e.g., Fishbein et al., 2016), we expected that, relative to children in the control condition who attended preschool in an economically disadvantaged neighborhood, those children attending preschools in economically disadvantaged neighborhoods who participated in PATHS would show unique intervention-related benefits in several aspects of social emotional competence and behavior/adjustment.

# Materials and methods

## Sample

Participants were 275 children aged four to five years old at baseline ($M$ = 4.44 years old, $SD$ = 6 months; 50.9% girls) attending 26 preschools in three municipalities in the Stockholm area. Preschools were randomly assigned to PATHS intervention ($n$ = 145 children) or a wait-list control condition ($n$ = 130 children) with normal classroom activities during the study. Overall, 42.9% ($n$ = 118) children attended preschools in economically disadvantaged neighborhoods and 57.1% ($n$ = 157) children attended preschools in economically advantaged neighborhoods (see **Table 1** for further description of the groups).

## Procedure

Prior to the intervention study described here, two years of formative studies were carried out in order to culturally adapt PATHS to a Swedish preschool context. This was done according to a cultural adaptation process called the Planned Intervention Adaptation (PIA) protocol (Ferrer-Wreder et al., 2021). After the cultural adaptation process, a two-wave pre-posttest cluster randomized controlled trial of PATHS was conducted. Preschools from three municipalities, representing a broad variation in average household income were included in the trial. The recruitment process involved receiving assent from education administrators to recruit schools at the municipal level, and thereafter recruiting school principals and teachers with pupils aged four to five years old. Recruited schools were then randomly assigned to study condition (intervention or wait-list control) within the three municipalities, with intervention teachers taking part in a two-day training by a certified PATHS trainer, followed by a 1-day booster training. Members from the research group regularly visited the intervention teachers during the school year to support them in their progress with the curriculum. PATHS was implemented over the course of a school year, i.e., August-May. During this period of time the participating preschools aimed to complete

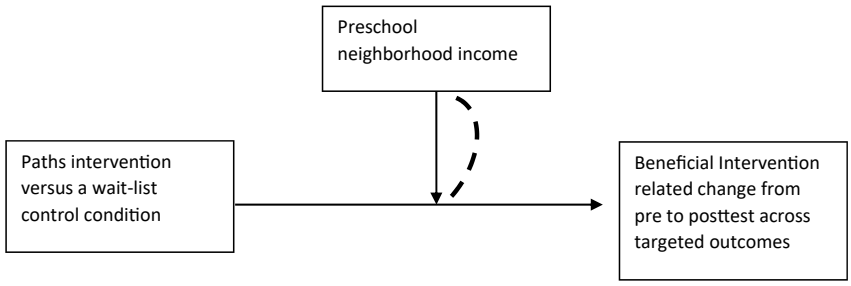


FIGURE 1
Conceptual model with neighborhood income as a moderator of the effects of PATHS. This figure is an adaptation of Howe's (2019) figure to display an effect moderation conceptually. Dashed line represents possible confounding variables for a moderated effect (Howe, 2019). Hypothesis 2 in this study examines this conceptual model. In practical terms, this conceptual model was examined one outcome at a time and the dashed line which represents possible confounding variables that were included as control variables in the analyses were: children's age at pretest, wave/cohort (data collection in the trial is spread out across two data collection waves) and preschool neighborhood income level.

TABLE 1 Allocation of preschools and children divided by economically disadvantaged and advantaged neighborhood groups.

| | EDN | | | EAN | | |
|---|---|---|---|---|---|---|
| | **Paths% (*n*)** | **Control% (*n*)** | **Total% (*n*)** | **Paths% (*n*)** | **Control% (*n*)** | **Total% (*n*)** |
| Preschools | 8 | 3 | 11 | 6 | 9 | 15 |
| Children | 94 | 24 | 118 | 157 | 51 | 157 |

EDN, economically disadvantaged neighborhood; EAN, economically advantaged neighborhood.

the 33-lesson curriculum. Both lessons and extension activities (e.g., PATHS game or project) were implemented once a week and lessons took place during circle-time for about 15–20 min. Attendance for individual children was not monitored. Instead, dosage on classroom level was estimated based on the teachers report of how many lessons they had implemented. Pretest assessments were carried out at the beginning of the school year and posttest assessments were conducted at the end of the school year. This was done similarly in both intervention and wait-list control schools.

Children individually participated in the child tasks administered by trained research assistants during preschool visits. Teacher ratings of participating children were collected, and teachers and participating classroom received incentives for study participation such as movie vouchers/gift card of a nominal amount. Parents provided written consent for child participation and children provided verbal assent regarding their study participation. Implementation data were collected, and observer ratings of fidelity were carried out during the school year for intervention schools. This study was approved by a regional ethics review panel (dnr. 2012/1714-31/5). The protocol was registered at ClinicalTrials.gov (NCT04512157) after the trial was completed. As noted, the overview of the PATHS program including details concerning the topics and dosage, as well as the results of the main outcome evaluation for this trial of PATHS and moderation analyses by gender has been reported elsewhere (Eninger et al., 2021; Ferrer-Wreder et al., 2021).

## Materials

The measures are described in the order of the hypothesized outcomes (primary, secondary, and distal) for this intervention trial that were based on the results of prior studies of preschool PATHS in the U.S. (i.e., Domitrovich et al., 2007; Bierman et al., 2008) at the time this trial was conducted.

Primary outcome measures were all child tasks and included: The Assessment of Children's Emotional Skills (ACES; Schultz et al., 2004) measuring emotional knowledge, the Challenging Situations Task (CST; Denham et al., 1994) measuring emotional awareness and social problem solving, as well as three indicators of children's executive functioning, namely motor inhibitory control (Knock and Tap task; Korkman et al., 1998), interference control (adapted Day-Night task; Gerstadt et al., 1994), and working memory (Word Span Task; Tillman et al., 2008).

For the ACES (Schultz et al., 2004) a standard protocol was followed in which children were shown a series of 14 pictures (one at a time). Each picture was of a child showing one of one of basic emotions (happy, sad, angry, sacred) or a mixed emotional expression. For those 10 faces with only one of the basic emotions, children's responses that correctly identified the facial expression were scored one for correct and zero for incorrect. After viewing each face, children were read in a fixed response format the names of the four basic emotions and also had the option to say that the face they saw showed no feeling. The ACES scale score (ACES-emotional knowledge) represents

the sum of the 10 faces that were correctly identified, and scores on this scale could range from 0 to 10. The internal consistency of the items was very good and evidenced Cronbach's alpha of 0.87.

For the Challenging Situations Task (CST; Denham et al., 1994) children were read four stories about a child who had an interaction with a peer who was not behaving in a prosocial manner and children were asked after each story (in an open-ended format, with standardized prompts) about how they would handle such a situation. For the CST scores, raters scored children's responses to the CST stories/prompts into four possible categories: CST-emotional awareness, CST-competent, CST-aggressive, and CST-inept. The CST scale scores are the sum of the responses across all four stories in each of these four types of responses. A child's response to a story could contain a score in more than one of these categories. The scale scores for the CST ranged from good [0.73 (Inept) 0.77 (Competent)] to excellent [0.91 (Emotional awareness) 0.97 (Aggressive)] interrater reliability using Intraclass Correlation Coefficients.

The three other child tasks in the primary outcomes are indicators of different aspects of executive functioning. All tasks followed a standardized protocol. For the Knock and Tap task (Korkman et al., 1998; IC1) and the adapted Day Night task (Gerstadt et al., 1994; IC2) the main interest was to provide different indicators of inhibitory control. Knock and Tap concerns motor inhibition and children are instructed to either knock or tap with their hand depending on the researcher's movement. Correct responses in which the directions are followed, and a dominant response is inhibited by the child yields a score of one. The Knock and Tap score was the sum of all correct responses and the possible score for a child ranged from zero to 30. Children's performance on the first and second subtasks are significantly associated with one another ($r$ = 0.22; $p$ = 0.002). The adapted Day-Night task (Gerstadt et al., 1994) provides an indicator of interference control. The task in this case is presented to the child as a series of images on a computer tablet and the images are timed with a presentation that becomes faster from the first to the last part of the task (from 1,500 to 1,000 milliseconds in subtest 1 and 2 of this task). When presented with an image, children are instructed to say the opposite of the image that they see in the picture. For example, if the child is shown a downward pointing arrow, the correct response from the child would be to say up. Correct responses were scored as one, and the possible scores for this task across two subtasks ranged from zero to 48. In a prior study with Swedish children, this task evidenced very good test-retest reliability with scores over time positively and significantly associated with one another (Thorell and Wåhlstedt, 2006).

The final indicator of executive functioning was a standardized Word Span task which was designed to provide an indicator of working memory (WM; Tillman et al., 2008). In this task, the protocol involves children hearing a series of words (could be two in a row and up to six in row in some trials) and children are asked to repeat back the words. The words are either one or two syllable words and when children repeat them back, they should be in the same order in which they were spoken. The Word Span task score represents the sum of the number of correct responses, which would be the number of correctly spoken words repeated back from the child across a series of trials. The possible score on this task can range from zero to 30 and for this sample the internal consistency reliability was acceptable at 0.63.

The remainder of the outcome measures were either observer (researcher) or teacher reports of children's social competence (secondary outcomes) or behavior/adjustment (distal outcomes). For the secondary outcomes, teacher reported scales included the Social Competence Scale (SCS; Sorensen and Dodge, 2016). Twenty-three items (rated on a 4-point scale) of the SCS were used in the present study. The SCS provides an indicator of children's teacher's view of their ability to be prosocial and communicate with others, as well ability to self-regulate emotions and the child's academic ability. The 23 items can be averaged into three scale scores namely, prosocial/communication skills, emotional self-regulation, and academic skills. The internal consistency of the scale scores, in this study were excellent and ranged from 0.92 (academic skills) and 0.93 prosocial/communication skills to 0.94 (emotional self-regulation).

The other teacher reported hypothesized secondary outcomes were three scale scores from the Preschool and Kindergarten Behavior Scales (PKBS; Merrell, 1996) which were designed to provide an indication of children's ability to cooperate, interact, and show independence in social situations. Across these scale scores (which are averaged scores), there are a total of 31 items that are rated by teachers on a four-point scale. These scale score's internal consistency reliability was very good [(0.86 social independence) (0.89 social interaction)] to excellent (0.90 social cooperation).

For observer reported scales among the hypothesized secondary outcomes, a scale of the SCS (Sorensen and Dodge, 2016) was used as well as a Task Orientation scale (Smith-Donald et al., 2007). The SCS was rated by two observers of participating children in a play situation and the Task Orientation scale was the rating of a single observer who was the interviewer of the child during the child tasks (described in the primary outcomes). At the end of the child tasks, the interviewer then made a rating of how the child performed while completing these tasks.

For the SCS items used in the play observation, in this case, only the scale score on prosocial/communication skills was used (and not all three scales within the SCS) and seven items (and not six items as in the teacher report for this scale) were used. Further, the response options also differed from the teacher reported SCS and for the play observation ratings, the SCS (prosocial/communication skills item) response options were added to in number of responses possible and were from

1 = Not at All to 5 = Very Well, with an added response option called did not observe, which was scored as missing). This modified SCS prosocial/communication scale was used by two observers who rated children's behavior in two standardized play situations with a large toy to be shared and played with by three children participating in the study (i.e., the Mobile Country Farm and the Marble Run Play Set). Observers made a separate rating for each of the three children during the play situation. The observers' inter-rater reliability was excellent and ranged from 0.92 to 0.93 (across toys; intraclass correlation coefficients). For the Task Orientation scale (Smith-Donald et al., 2007), the nine items of this scale concerned children's level and quality of attention during the child tasks and were rated by observers from 0 = Not True At All to 4 = Very True, and the internal consistency reliability (Cronbach alpha) of this scale was excellent at 0.94.

For the distal outcomes, all scales were teacher rating of children's behavior and adjustment. In this case, additional scales from the PKBS (Merrell, 1996) were used to provide an indicator of internalizing and externalizing behavior. Specifically, three scales from the PKBS were used to provide a teacher rating of children's social withdrawal, anxiety/somatic symptoms, and aggression (total of 22 items across these three scales) rated on four-point scale. Internal consistency reliability of these scales was very good [(0.86 social withdrawal) (0.87 anxiety/somatic)] to excellent (0.94 aggression).

The other teacher rated scales measuring distal outcomes were from the ADHD Rating Scale–IV (DuPaul et al., 1998). In this case, this instrument provided two scale scores (rated on a four-point scale and 16 items in total) that were indicators of children's inattentive and hyperactive/impulsive behaviors. The two scale scores were average scores across seven (inattention scale) and nine items (hyperactivity/impulsivity scale). The internal consistency reliability of these two scales were excellent, both scales at 0.93 (Cronbach's alpha).

### Neighborhood level income indicator

First, we categorized preschools in economically disadvantaged and advantaged neighborhoods by comparing all resident incomes (e.g., monthly average income before taxes) for the postal code in which participating preschools were situated in during the intervention trial. This information came from registry data collected by Statistics Sweden. This amount was then compared against the average income for the entire region in which these postal codes were located during the time period of the intervention trial, which was 533, 475 Swedish crowns in year 2014, and 580, 675 Swedish crowns in year 2016. This comparison resulted in a categorization of either advantaged (above the regional average income) or disadvantaged (below the regional average income) resident income that was dummy coded into one of two possible categories and this represents the neighborhood income level that was then used in the hypothesis related analyses.

## Data analysis

The H1 analyses involved an examination of possible average group differences in baseline level of social emotional competence and behavior/adjustment between children attending schools in economically disadvantaged neighborhoods in comparison to children attending schools in economically advantaged neighborhoods with a series of independent sample t-tests. We controlled family wise (primary, secondary, distal outcomes) error with a correction for the interpretation of a significant group difference by using a modified Holm-Bonferroni method which address the increased risk of Type I error due to multiple t-tests conducted.

The H2 related analyses consisted of a series of just-identified two-wave structural equation models (SEM) to test the possibility of the moderation of intervention effects on child level outcomes, by neighborhood income level. We used one model for each outcome variable. Each model included the posttest (called T2) outcome as the response variable and the same set of predictor variables. The predictors of the T2 outcome were PATHS (1 = intervention, 0 = comparison), age, cohort (1 = cohort 1, 2 = cohort 2), income (1 = above average, 0 = below average), and an interaction term (PATHS*income; Jaccard and Turrisi, 2003). The path coefficients (b) for the interaction terms provided estimates of the interaction between PATHS and income, holding constant the predictors. The significance tests for these path coefficients were tests of the null hypothesis that there was no interaction between PATHS and neighborhood income level.

Mplus 8.6 (Muthén and Muthén, 1998–2021) was the statistical software used to conduct the SEM models. Data across primary, secondary, and distal outcomes (child task, child observation, teacher reports) evidenced missing data from a low of 12–36%. Missing data were addressed in several steps such as the generation of 50 imputed data sets (which were pooled and provide the basis of the results reported here) with a Bayesian approach (Asparouhov and Muthén, 2021). Further, nesting of data by school building were addressed with the TYPE = COMPLEX command in Mplus (i.e., the use of Huber-White adjustment).

# Results

## H1: Possible differences in child outcomes by neighborhood income level, at baseline

**Table 2** shows means and standard deviations in the child level outcomes at baseline. In terms of primary outcomes, children attending preschool in economically disadvantaged neighborhoods showed lower levels of inhibitory control ($t = 4.79$ $p < 0.001$), interference control ($t = 3.03$, $p = 0.002$) and

working memory ($t$ = 2.70, $p$ = 0.007) than children attending schools in economically advantaged neighborhoods. In terms of secondary outcomes there were no significant group differences. In terms of distal outcomes, children attending preschool in economically disadvantaged neighborhoods showed greater teacher-rated inattention ($t$ = 3.12, $p$ = 0.002) in comparison to children attending preschools in economically advantaged neighborhoods.

## H2: Intervention moderation analysis

To examine H2 (i.e., did children attending preschools in economically disadvantaged neighborhoods differentially benefit from the intervention in terms of improvements in their social emotional competence and behavior/adjustment), we conducted a series of covariate adjusted SEM models with the interaction term (PATHS*income) predicting post-test outcomes. This creates a comparison between four subgroups of children, those in the intervention condition attending preschools in advantaged or disadvantaged neighborhoods, as well as those in the control condition attending preschools in advantaged and disadvantaged neighborhoods. Table 3 shows the standardized interaction parameter estimates from the tested SEM models, and Table 4 shows the observed subgroup mean and standard deviations. The cut off for the interpretation of a substantive difference between subgroups was set as: (1) a standardized parameter estimate of an absolute value of ±0.20 or higher based on the benchmarks developed earlier intervention studies (e.g., Taylor et al., 2017; Eninger et al., 2021) and (2) the interaction effect should be within the range of the confidence intervals. Using this criterion and analysis approach, we found three interaction effects between PATHS (intervention/control) and preschool neighborhood income (advantaged/disadvantaged) with significant differences between the subgroups. Results indicated that for hypothesis 2 (moderation of intervention effects by subgroups with unique intervention related benefits for children attending preschool in disadvantaged neighborhoods), there were no significant subgroup differences for the primary outcome measures.

TABLE 2 Means and standard deviations at baseline.

| | Pre-test | EDN | | EAN | |
|---|---|---|---|---|---|
| | Min-max | M | SD | M | SD |
| **Primary outcomes** | | | | | |
| ACES-emotional knowledge | 1–10 | 6.83 | 1.95 | 7.05 | 1.64 |
| CST-emotional awareness | 0–11 | 4.31 | 1.51 | 4.21 | 1.81 |
| CST-SPS: competent | 0–8 | 2.32 | 2.31 | 2.61 | 2.21 |
| CST-SPS: aggressive | 0–9 | 0.94 | 1.56 | 0.62 | 1.27 |
| CST-SPS: inept | 0–7 | 0.57 | 1.03 | 0.55 | 1.14 |
| IC1: knock and tap task | 6–30 | 22.37 | 6.95 | 26.01 | 4.60 |
| IC2: day-night task | 0–47 | 24.90 | 14.56 | 30.56 | 12.70 |
| WM: word span task | 0–23 | 10.02 | 4.51 | 11.56 | 4.38 |
| **Secondary outcomes** | | | | | |
| Prosoc/communication | 0.67–4 | 2.85 | 0.81 | 3.00 | 0.94 |
| Prosocial skills (observer) | 1–5 | 3.55 | 0.73 | 3.65 | 0.72 |
| Task orientation | 0.44–4 | 2.76 | 0.90 | 3.03 | 0.82 |
| Social cooperation | 1.18–3 | 2.60 | 0.43 | 2.65 | 0.44 |
| Social interaction | 0.10–3 | 2.32 | 0.58 | 2.44 | 0.53 |
| Social independence | 0.50–3 | 2.63 | 0.44 | 2.68 | 0.38 |
| **Distal outcomes** | | | | | |
| Social withdrawal | 0–2.29 | 0.61 | 0.60 | 0.61 | 0.61 |
| Anxiety/somatic symptoms | 0–2.71 | 0.45 | 0.59 | 0.48 | 0.54 |
| Aggression | 0–2.88 | 0.43 | 0.62 | 0.47 | 0.71 |
| Inattention | 0–3 | 0.92 | 0.80 | 0.60 | 0.72 |
| Hyperactivity/impulsivity | 0–3 | 0.81 | 0.80 | 0.60 | 0.65 |

EDA, economically disadvantaged neighborhood; EAA, economically advantaged neighborhood.

However, there were two significant interaction effects for the secondary outcomes, and three significant interaction effects for the distal outcomes.

First, there was a PATHS*income interaction effect on observer rated prosocial skills (a hypothesized secondary outcome), $b$ = 0.615 [0.006, 1.225], $p$ = 0.097. The difference between the intervention and control group was positive among children attending preschool in economically advantaged neighborhoods, $b$ = 0.751 [0.244, 0.772], $p$ = 0.002. Examination of the subgroup means and standard deviations showed that children in economically advantaged neighborhoods who were in PATHS increased in prosocial skills from pre-test ($M$ = 3.43, $SD$ = 0.72) to post-test ($M$ = 4.20, $SD$ = 0.55) while children in economically advantaged neighborhoods who were in control group decreased in prosocial skills from pre-test ($M$ = 3.74, $SD$ = 0.70) to post-test ($M$ = 3.60, $SD$ = 0.59). For this analysis, the difference between PATHS and control group children attending preschool in economically disadvantaged neighborhoods was negligible (thus below 0.20). Thus, there were unique benefits among children attending preschool in advantaged neighborhoods on this secondary outcome (observer rated prosocial/communication skills as measured by during a play observation; SCS-observer). This result was not hypothesized.

Next, we found a PATHS*income interaction on teacher rated social independence (secondary outcome), $b$ = –0.491 [–0.934, –0.049], $p$ = 0.068. The estimate was negative in children attending schools in economically advantaged areas, $b$ = –0.298 [–0.245, 0.008], $p$ = 0.110. The difference between the PATHS children and children in control group in economically disadvantaged neighborhoods was negligible (thus below 0.20). PATHS children in economically advantaged neighborhoods showed a slight increase in social independence from pre-test ($M$ = 2.65, $SD$ = 0.38) to post-test ($M$ = 2.66, $SD$ = 0.42), while children in economically advantaged neighborhoods who were in control group showed more of an increase in social independence from pre-test ($M$ = 2.71, $SD$ = 0.28) to post-test

TABLE 3 Standardized interaction parameter estimates, $N = 275$.

| Outcomes | Predictors | St. estimate | *P* | 95% CI | St. errors |
|---|---|---|---|---|---|
| **Primary outcomes** | | | | | |
| ACES-emotional knowledge | Paths*income | −0.164 | 0.542 | [−0.607,0.279] | 0.269 |
| | Paths low income | 0.489 | 0.012 | [0.170,0.807] | 0.193 |
| | Paths high income | 0.324 | 0.098 | [0.002,0.647] | 0.196 |
| CST-emotional awareness | Paths*income | 0.440 | 0.103 | [−0.004,0.884] | 0.270 |
| | Paths low income | −0.293 | 0.091 | [−0.579, −0.008] | 0.174 |
| | Paths high income | 0.147 | 0.573 | [−0.282,0.575] | 0.260 |
| CST-SPS: competent | Paths*income | 0.196 | 0.622 | [−0.458,0.849] | 0.397 |
| | Paths low income | 0.060 | 0.866 | [−0.524,0.643] | 0.355 |
| | Paths high income | 0.256 | 0.178 | [−0.057,0.568] | 0.190 |
| CST-SPS: aggressive | Paths*income | 0.438 | 0.166 | [−0.082,0.958] | 0.316 |
| | Paths low income | −0.309 | 0.283 | [−0.783,0.164] | 0.288 |
| | Paths high income | 0.128 | 0.500 | [−0.184,0.441] | 0.190 |
| CST-SPS: inept | Paths*income | −0.146 | 0.728 | [−0.837,0.545] | 0.420 |
| | Paths low income | 0.402 | 0.218 | [−0.135,0.939] | 0.326 |
| | Paths high income | 0.256 | 0.290 | [−0.142,0.654] | 0.242 |
| IC1: knock and tap task | Paths*income | −0.455 | 0.147 | [−0.972,0.061] | 0.314 |
| | Paths low income | 0.418 | 0.149 | [−0.059,0.894] | 0.290 |
| | Paths high income | −0.038 | 0.840 | [−0.345,0.269] | 0.187 |
| IC2: day-night task | Paths*income | 0.271 | 0.238 | [−0.107,0.650] | 0.230 |
| | Paths low income | −0.251 | 0.186 | [−0.564,0.061] | 0.190 |
| | Paths high income | 0.020 | 0.896 | [−0.229,0.269] | 0.151 |
| WM: word span task | Paths*income | 0.085 | 0.771 | [−0.394,0.564] | 0.291 |
| | Paths low income | 0.322 | 0.134 | [−0.031,0.675] | 0.215 |
| | Paths high income | 0.406 | 0.070 | [0.037,0.776] | 0.225 |
| **Secondary outcomes** | | | | | |
| Prosocial/communication skills | Paths*income | −0.113 | 0.684 | [−0.571,0.344] | 0.278 |
| | Paths low income | −0.219 | 0.389 | [−0.638,0.199] | 0.255 |
| | Paths high income | −0.332 | 0.052 | [−0.773, −0.051] | 0.171 |
| Prosocial skills (observer | Paths*income | 0.615 | 0.097 | [0.006, 1.225] | 0.371 |
| | Paths low income | 0.136 | 0.675 | [−0.398,0.670] | 0.324 |
| | Paths high income | 0.751 | 0.002 | [0.244,0.772] | 0.241 |
| Task orientation | Paths*income | 0.268 | 0.374 | [−0.229,0.766] | 0.302 |
| | Paths low income | −0.015 | 0.950 | [−0.399,0.370] | 0.234 |
| | Paths high income | 0.254 | 0.221 | [−0.087,0.594] | 0.207 |
| Social cooperation | Paths*income | −0.355 | 0.128 | [−0.738,0.029] | 0.233 |
| | Paths low income | 0.190 | 0.364 | [−0.154,0.534] | 0.209 |
| | Paths high income | −0.165 | 0.244 | [−0.399,0.068] | 0.142 |
| Social interaction | Paths*income | −0.452 | 0.122 | [−0.471,0.018] | 0.292 |
| | Paths low income | 0.214 | 0.440 | [−0.123,0.337] | 0.277 |
| | Paths high income | −0.238 | 0.123 | [−0.249,0.009] | 0.155 |
| Social independence | Paths*income | −0.491 | 0.068 | [−0.934, −0.049] | 0.269 |
| | Paths low income | 0.193 | 0.387 | [−0.174,0.561] | 0.224 |
| | Paths high income | −0.298 | 0.110 | [−0.245,0.008] | 0.187 |
| **Distal outcomes** | | | | | |
| Social withdrawal anxiety/somatic symptoms | Paths*income | 0.549 | 0.047 | [0.094, 1.00] | 0.276 |
| | Paths low income | −0.389 | 0.079 | [−0.750, −0.028] | 0.219 |
| | Paths high income | 0.160 | 0.484 | [0.216,0.536] | 0.229 |
| | Paths*income | 0.618 | 0.089 | [0.020, 1.216] | 0.363 |

*(Continued)*

TABLE 3 (Continued)

| Outcomes | Predictors | St. estimate | *P* | 95% CI | St. errors |
|---|---|---|---|---|---|
| | Paths low income | −0.566 | 0.082 | [−1.101, −0.031] | 0.325 |
| | Paths high income | 0.052 | 0.813 | [−0.309,0.413] | 0.219 |
| Aggression | Paths*income | −0.336 | 0.153 | [−0.722,0.051] | 0.235 |
| | Paths low income | −0.136 | 0.503 | [−0.470,0.198] | 0.203 |
| | Paths high income | 0.200 | 0.213 | [−0.064,0.463] | 0.160 |
| Inattention | Paths*income | 0.619 | 0.068 | [0.062, 1.176] | 0.339 |
| | Paths low income | −0.367 | 0.242 | [−0.882,0.149] | 0.313 |
| | Paths high income | 0.252 | 0.159 | [−0.043,0.547] | 0.179 |
| Hyperactivity/impulsivity | Paths*income | −0.103 | 0.722 | [−0.579,0.373] | 0.289 |
| | Paths low income | 0.234 | 0.373 | [−0.198,0.666] | 0.262 |
| | Paths high income | 0.131 | 0.405 | [−0.128,0.390] | 0.157 |

*Connotes interaction term.

TABLE 4 Subgroup means and standard deviations.

| | EDN | | | | | | | | EAN | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Paths | | | | Control | | | | Paths | | | | Control | | | |
| | Pre-test | | Post-test | | Pre-test | | Post-test | | Pre-test | | Post-test | | Pre-test | | Post-test | |
| | M | SD | M | SD | M | SD | M | SD | M | SD | M | SD | M | SD | M | SD |
| **Primary outcomes** | | | | | | | | | | | | | | | | |
| ACES-emotional knowledge | 7.06 | 1.89 | 7.81 | 1.29 | 5.95 | 1.96 | 7.13 | 1.24 | 6.80 | 1.85 | 7.66 | 1.42 | 7.16 | 1.52 | 7.48 | 1.42 |
| CST-emotional awareness | 4.24 | 1.45 | 4.42 | 1.37 | 4.54 | 1.74 | 5.00 | 1.66 | 3.74 | 1.40 | 4.29 | 1.19 | 4.41 | 1.93 | 4.29 | 1.34 |
| CST-SPS: competent | 2.52 | 2.35 | 2.93 | 2.35 | 1.54 | 2.04 | 2.23 | 2.40 | 2.40 | 2.31 | 3.12 | 2.35 | 2.70 | 2.17 | 2.89 | 2.18 |
| CST-SPS: aggressive | 0.94 | 1.51 | 0.48 | 0.92 | 0.95 | 1.76 | 1.09 | 2.24 | 0.86 | 1.77 | 0.54 | 1.36 | 0.52 | 0.98 | 0.65 | 1.46 |
| CST-SPS: inept | 0.54 | 0.99 | 0.54 | 1.15 | 0.68 | 1.17 | 0.81 | 1.46 | 0.67 | 1.39 | 0.58 | 1.07 | 0.50 | 1.01 | 0.41 | 0.87 |
| IC1: knock and tap task | 23.64 | 6.33 | 26.02 | 5.74 | 16.91 | 7.03 | 22.21 | 7.85 | 26.85 | 3.97 | 25.80 | 4.82 | 25.76 | 4.84 | 26.18 | 4.76 |
| IC2: day-night task | 27.24 | 12.23 | 31.86 | 13.30 | 15.79 | 16.25 | 29.71 | 15.03 | 30.55 | 12.47 | 36.72 | 11.78 | 30.57 | 12.87 | 35.85 | 10.74 |
| WM: word span task | 10.49 | 4.37 | 13.17 | 4.41 | 8.09 | 4.63 | 10.27 | 4.04 | 11.43 | 4.76 | 14.45 | 4.30 | 11.61 | 4.21 | 11.91 | 4.71 |
| **Secondary outcomes** | | | | | | | | | | | | | | | | |
| Prosoc/communication | 2.90 | 0.80 | 3.08 | 0.81 | 2.45 | 0.79 | 2.88 | 0.99 | 3.01 | 1.04 | 3.12 | 0.73 | 2.98 | 0.89 | 3.17 | 0.79 |
| Prosocial skills (observer) | 3.68 | 0.70 | 3.69 | 0.68 | 3.10 | 0.67 | 3.34 | 0.60 | 3.43 | 0.72 | 4.20 | 0.55 | 3.74 | 0.70 | 3.60 | 0.59 |
| Task orientation | 2.90 | 0.83 | 2.90 | 0.79 | 2.22 | 0.95 | 2.54 | 1.06 | 2.97 | 0.82 | 3.37 | 0.83 | 3.06 | 0.82 | 3.08 | 0.76 |
| Social cooperation | 2.64 | 0.41 | 2.61 | 0.56 | 2.30 | 0.45 | 2.28 | 0.69 | 2.64 | 0.49 | 2.63 | 0.41 | 2.66 | 0.40 | 2.73 | 0.35 |
| Social interaction | 2.32 | 0.60 | 2.48 | 0.55 | 2.33 | 0.44 | 2.27 | 0.63 | 2.31 | 0.56 | 2.45 | 0.44 | 2.54 | 0.49 | 2.67 | 0.38 |
| Social independence | 2.64 | 0.44 | 2.70 | 0.46 | 2.54 | 0.42 | 2.49 | 0.37 | 2.65 | 0.38 | 2.66 | 0.42 | 2.71 | 0.28 | 2.80 | 0.28 |
| **Distal outcomes** | | | | | | | | | | | | | | | | |
| Social withdrawal | 0.55 | 0.60 | 0.49 | 0.59 | 1.01 | 0.38 | 1.05 | 0.64 | 0.49 | 0.50 | 0.50 | 0.50 | 0.68 | 0.65 | 0.54 | 0.56 |
| Anxiety/somatic symptoms | 0.40 | 0.53 | 0.32 | 0.44 | 0.80 | 0.86 | 0.92 | 0.97 | 0.39 | 0.44 | 0.40 | 0.38 | 0.53 | 0.58 | 0.51 | 0.54 |
| Aggression | 0.41 | 0.63 | 0.54 | 0.74 | 0.54 | 0.55 | 0.77 | 1.03 | 0.51 | 0.86 | 0.45 | 0.65 | 0.46 | 0.62 | 0.41 | 0.63 |
| Inattention | 0.89 | 0.79 | 0.73 | 0.78 | 1.19 | 0.83 | 1.35 | 1.00 | 0.60 | 0.66 | 0.60 | 0.63 | 0.59 | 0.76 | 0.47 | 0.59 |
| Hyperactivity/impulsivity | 0.71 | 0.74 | 0.87 | 0.93 | 1.59 | 0.86 | 1.37 | 1.09 | 0.71 | 0.64 | 0.62 | 0.69 | 0.54 | 0.65 | 0.54 | 0.64 |

EDN, economically disadvantaged neighborhood; EAN, economically advantaged neighborhood.

($M$ = 2.80, $SD$ = 0.28). The difference between PATHS and control group children attending preschools in disadvantaged neighborhoods was negligible (below 0.20). In contrast, children in the control group in advantaged neighborhoods showed more gains in terms of social independence than PATHS children in advantaged neighborhoods. This result was not hypothesized.

Furthermore, there was a PATHS*income interaction effect on three of the examined distal outcomes, namely teacher

rated social withdrawal, anxiety symptoms and inattention. The interaction effect for social withdrawal was $b$ = 0.549 [0.094, 1.00], $p$ = 0.047. Among children attending preschool in economically disadvantaged neighborhoods, the difference between the intervention and control group was negative, $b$ = –0.389 [–0.750, –0.028], $p$ = 0.079, while the estimate for children attending schools in economically advantaged neighborhoods did not meet the cut off value. Examination of the subgroup means, and standard deviations showed that children attending preschool in economically disadvantaged neighborhoods, who were in PATHS decreased in social withdrawal from pre-test ($M$ = 0.55, $SD$ = 0.60) to post-test ($M$ = 0.49, $SD$ = 0.59) while children in economically disadvantaged neighborhoods who were in control group slightly increased in social withdrawal from pre-test ($M$ = 1.01, $SD$ = 0.38) to post-test ($M$ = 1.05, $SD$ = 0.64). This subgroup difference was supportive of hypothesis 2 with a unique intervention benefit for children attending preschool in disadvantaged areas. Thus PATHS children attending schools in economically disadvantaged neighborhoods showed more a decline in social withdrawal relative to children in control group also attending preschool in disadvantage neighborhoods.

Also, within the examined distal outcomes, we found a PATHS*income interaction on anxiety symptoms, $b$ = 0.618 [0.020, 1.216], $p$ = 0.089. Among children attending preschool in economically disadvantaged neighborhoods, the difference between the intervention and control group was negative, $b$ = –0.566 [–1.101, –0.031], $p$ = 0.082. The estimate did not meet the cut off for children attending schools in economically advantaged neighborhoods. Further analyses showed that children attending preschool in economically disadvantaged neighborhoods who were in PATHS decreased in anxiety from pre-test ($M$ = 0.40, $SD$ = 0.53) to post-test ($M$ = 0.32, $SD$ = 0.44) while children in economically disadvantaged neighborhoods who were in control group increased in anxiety from pre-test ($M$ = 0.80, $SD$ = 0.86) to post-test ($M$ = 0.92, $SD$ = 0.97). Intervention change was as hypothesized (hypothesis 2) meaning that PATHS children attending preschool in economically disadvantaged neighborhoods showed greater a decrease in anxiety relative to children in control group who were also attending preschool in disadvantaged neighborhoods.

Finally, we found a PATHS*income interaction on inattention (distal outcome), $b$ = 0.619 [0.062, 1.176], $p$ = 0.068 showing that among children attending preschools in economically disadvantaged neighborhoods the difference between the intervention and control group was negative, $b$ = –0.367 [–0.882, 0.149], $p$ = 0.242, while the estimate was positive in children attending schools in economically advantaged neighborhoods, $b$ = 0.252 [–0.043, 0.547], $p$ = 0.159. Children in economically disadvantaged neighborhoods who were in PATHS decreased in inattention from pre-test ($M$ = 0.89, $SD$ = 0.79) to post-test ($M$ = 0.73, $SD$ = 0.78) while children in economically disadvantaged neighborhoods who were in control group increased in inattention from pre-test ($M$ = 1.19, $SD$ = 0.83) to post-test ($M$ = 1.35, $SD$ = 1.00). Moreover, PATHS children in economically advantaged neighborhoods were relatively stable in inattention from pre-test ($M$ = 0.60, $SD$ = 0.66) to post-test ($M$ = 60, $SD$ = 0.63), while children in economically advantaged neighborhoods who were in control group showed a decrease in inattention from pre-test ($M$ = 0.59, $SD$ = 0.76) to post-test ($M$ = 0.47, $SD$ = 0.59). Intervention change was as hypothesized (hypothesis 2) meaning that PATHS children attending preschool in economically disadvantaged neighborhoods showed a decrease in inattention relative to children in control group who were also attending preschool in disadvantaged neighborhoods. The finding for this outcome for the economically advantaged subgroups was not hypothesized.

## Discussion

Promoting the use of evidence-based SEL interventions in ECEC settings may enable engagement and participation and boost the psychosocial development of a diversity of children. However, not all children live in optimal or even sufficient conditions in order to achieve the best possible development and growth. The economic level of the neighborhood context has important implications in terms of the quality of ECEC (Cloney et al., 2016) and in turn child development (Vinopal and Morrissey, 2020). In that sense, it is possible that the effects of SEL-interventions on social emotional development of children may differ depending on the economic level of the neighborhood where the ECEC institutions are situated. In this study, we wanted to understand whether the effects of PATHS on child social emotional competence and adjustment might have differed depending on the resident incomes of those people living in the neighborhoods where participating children's preschools were located (i.e., economically disadvantaged and advantaged neighborhoods, relative to the rest of the local region).

The overall goal with the PATHS conceptual model is to support children's ability to self-regulate emotions and behaviors as well as to prevent or reduce behavioral and emotional problems. From an earlier study with the same dataset (Eninger et al., 2021), it is clear that the PATHS intervention was beneficial in terms of the development of child social emotional competence and adjustment, including for example higher emotional knowledge and lower anxiety in children four to five years of age.

However, the present study indicated that there are some important baseline differences in participating children's social emotional competence and adjustment. Indeed, our results showed that at baseline, children attending preschools in economically disadvantaged neighborhoods, relative to children attending preschool in advantaged neighborhoods, showed

lower levels on a number of measured outcomes such as inhibitory control, working memory, task orientation as well as higher levels of inattention. This is in line with the theoretical assumptions of the importance of neighborhood contexts for child development (e.g., Bronfenbrenner, 1979; Bronfenbrenner and Morris, 2006) and a growing body of evidence which indicates that economic disadvantage may affect cognitive function in a variety of ways (Dean et al., 2018) including limitations in the development of self-regulation skills including skills associated with cognitive, emotional and stress regulation (e.g., Lipina and Evers, 2017). Put briefly, economic disparities could have adverse effects on child development.

To address such possible disparities in the opportunities for children's social emotional competencies to develop, ECEC with emphasis on social emotional development is key. The implementation of SEL-interventions in ECEC in economically disadvantaged neighborhoods in particular, has been suggested as key preventive effort in terms of child developmental disparities (Domitrovich et al., 2007; Ryan et al., 2019). Our findings suggested that preschool PATHS seemed to uniquely benefit children attending preschool in economically disadvantaged neighborhoods in terms of improvements in inattention, such that children in the economically disadvantaged group who participated in PATHS showed significantly greater reductions in inattention compared to children in the control group from economically disadvantaged neighborhoods. Pretest group comparisons by neighborhood income level showed that the children attending preschool in disadvantaged neighborhoods were higher on this construct at pretest than children attending preschool in advantaged neighborhoods, speaking to the need for intervention on this outcome in particular. These findings regarding inattention (in H1 and H2) are particularly important given that childhood inattention has been identified as a core risk factor for poor academic achievement (Lundervold et al., 2017a,b). Inattention could also be understood as a risk factor for child engagement putting barriers on child active involvement in activities and interactions with the environment (Castro et al., 2017). The findings in our study suggest that PATHS may provide an important boost for the group that appears to enter PATHS with less access to resources (at the school neighborhood level) and in that sense enhance the potential for increased engagement.

Similarly, in economically disadvantaged neighborhoods, children participating in PATHS showed reductions in social withdrawal and anxiety compared to control group children. Although children attending preschool in economically disadvantaged neighborhoods did not differ in these outcomes at entry into PATHS (H1 results), the group from economically disadvantaged neighborhoods appeared to benefit more in these outcomes from PATHS when compared to control group children. This is an important finding as these outcomes have been found to be concurrently and predictively associated with an increased risk of a range of negative adjustment outcomes, including social-emotional difficulties (Rubin et al., 2009; Damelang and Kloss, 2013). Taken together, the PATHS program may provide an important boost for this subgroup of children (attending preschool in disadvantaged neighborhoods).

The beneficial effects of PATHS on the development of social emotional skills and adjustment in children in economically disadvantaged neighborhoods could however be tempered with the findings that PATHS children from advantaged neighborhoods also appeared to improve in their teacher rated prosocial behavior, but not their social independence, when compared to control group children also attending preschool in advantaged neighborhoods. Possibly, such a finding may be indicative of a maintenance of disparity between the advantaged and disadvantaged groups, in that children from both advantaged and disadvantaged groups entered the project with similar levels of these outcomes.

In this study, we could not investigate the potential linking mechanisms to the associations between PATHS and child outcomes which could provide some explanations to the results in this study. Based on the research from earlier studies, one potential mechanism to these links could be the family-level variables, such as parenting practices (Minh et al., 2017) or family instability (Brown et al., 2013). When parents are faced with stressful conditions, such as high neighborhood violence and economic problems, parents are at risk of becoming less sensitive to child needs which in turn may have adverse impact on their cognitive development (Blair and Raver, 2016). Another potential mechanism could be rather structural; the quality of formal and informal institutional resources, including ECEC could either promote or impede children's social emotional development (Cloney et al., 2016).

In Sweden, ECEC is publicly subsidized and thus affordable for many parents. Consequently, more than 95% of children four to five years old attend ECEC on a daily basis (Swedish National Agency for Education, 2018). The quality of Swedish ECEC is highly ranked in international comparisons (OECD, 2017). Even so, there is a considerable local variation in the quality of ECEC in Swedish municipalities. Well documented differences between ECEC institutions in Sweden are variations in class group-size, child-teacher ratio, teacher practices, and the proportion of teachers with a university degree (Swedish Teacher Union, 2018). These differences could potentially play a role in children's engagement in school and opportunities to grow (e.g., Blatchford et al., 2011; Pedler et al., 2020). In that sense, the risk of poorer psychosocial functioning evident in children attending schools in economically disadvantaged areas could, at least in part, be a product of a lack of adequate resources in preschools. In addition to efforts to reduce disparities in the quality of ECEC settings throughout all neighborhoods in Sweden, the results in the present study implicate that prioritizing support for universal interventions such as PATHS, or other evidence based SEL interventions and

practices, could be a key measure to impede the disparities among children being cared for and educated in ECEC.

## Limitations and strengths

There are several study limitations that are important to note. We measured only one facet of the neighborhood context, namely mean level of all residents' income in a postal code (an administrative registry-based neighborhood demarcation), to address the neighborhood economic advantage/disadvantage. Other facets, such as physical characteristics and possibilities for social and economic development, including business reforms in the neighborhood could be important to more holistically capture economic advantage/disadvantage in neighborhoods, as well as resident perceptions of neighborhood boundaries and economic advantage/disadvantage.

Moreover, teachers who rated participating children and observers of children's play (in the play task) were not blind to study condition. As we lack measurements of the quality of preschools in the projects, we assume that the quality of ECEC is, at least in part, based on the economic level of the neighborhood context (Leventhal and Brooks-Gunn, 2000). Such an assumption is based on the criticism from OECD (2017) stating that Swedish municipalities do not always reallocate resources to schools with vulnerable group of students, such as in schools in economically disadvantaged neighborhoods, which could also be the case in preschools in our project.

Even though parents are important socializing agents in their children's development (Bronfenbrenner, 1979), we did not assess parent-child relationships and parent involvement in child social emotional development or parental social and economic status variables (family income or parents' education). Future studies should investigate the role of parent involvement when studying the effects of social interventions aimed at children. As noted, information about family socioeconomic status (SES) was not collected as part of this study and can therefore not address important questions such as whether children's family level SES differed significantly across neighborhood income level, and whether there are significant associations between neighborhood and family level income and other indicators of SES, like parental education.

Other limitations include the overall relatively small sample in the study, particularly in economically disadvantaged group, which could potentially be a risk for a type II error (Jones et al., 2003). We also lacked the ability to test statistically (due to limited power) if intervention fidelity at the school level differed among preschools in low income relative to high income neighborhoods (i.e., a limited number of schools participated in the PATHS intervention). While this is a limitation of the present study, this could be an important focus (i.e., PATHS implementation variation based on contextual resources) for future PATHS trials in diverse communities with varying economic resources.

Despite these limitations, there are several strengths to be noted. This study is to our knowledge, the first study to investigate the possibility of moderated intervention-related effects of PATHS with the preschool neighborhood context as one of the key moderators examined, with the use of registry data on income for all inhabitants' living within the immediate neighborhoods in which children's preschools are located. Moreover, the beneficial effects of the intervention delivered in the proximal context of ECEC, as evidenced in this study, provide an important basis for development of high-quality ECEC particularly in economically disadvantaged neighborhoods in Sweden, as a means to reduce possible disparities in societal opportunities for children to develop their social emotional competence in equitable and optimal ways.

The overall implications of the study findings for the future implementation of PATHS in settings in which children experience less economic resources are provisional and require additional examination in further similar Swedish trials to come away with firm conclusions for a Swedish context in particular. Past studies in lower income areas with preschool PATHS have primarily been conducted in the U.S. where income distribution and social welfare system is different than in Sweden. Thus, we are cautious in interpreting the future implications of the study findings for Swedish settings until further Swedish studies with preschool PATHS are conducted. In future Swedish trials, it would be important to test the relative importance and benefits of PATHS implemented for one versus two years (with the same cohort of children). Such an approach could help to determine if PATHS would be associated with even more profound benefits if it is conducted over a longer period of time in order to achieve a very broad array of intended outcomes across a range of social emotional competence domains, in children in general and for children attending preschool in lower resourced neighborhoods as well.

## Conclusions

Our study showed that there are some disparities in social and emotional competence and adjustment among children attending preschools in economically disadvantaged and advantaged neighborhoods (see results for H1), some of which could be reduced with the inclusive educational program focusing on socioemotional learning (SEL interventions and practices). Children in preschools in economically advantaged neighborhoods involved in PATHS showed improvements in their prosocial skills, but not social independence in comparison to children in control group also attending preschool in advantaged neighborhoods. In addition, children attending schools in economically disadvantaged neighborhoods, who took part in PATHS showed reduced levels of inattention, social

withdrawal, and anxiety relative to children in control group who also attend preschool in disadvantaged neighborhoods. Given that inattention (e.g., Lundervold et al., 2017a,b), as well deficits in other social and emotional skills (e.g., Damelang and Kloss, 2013) are critical risk factors for academic achievement and adjustment, offering PATHS as an early intervention in ECEC, particularly in preschools in economically disadvantaged areas, could be a key societal measure to impede disparities among children and to promote the best possible development. As PATHS endorses child engagement, including appropriate interactions between children and their environment, such as teachers and peers, a social and emotional learning (SEL) preschool curriculum may be an important tool for teachers who work with preschool children. Finally, evidence based universal SEL interventions such as PATHS could be regarded as potentially powerful tool for achieving inclusion in terms of engagement for each child.

## Data availability statement

The datasets presented in this article are not readily available because this study's ethical review does not allow for study data to be in a public repository. Requests to access the datasets should be directed to SK.

## Ethics statement

The studies involving human participants were reviewed and approved by The Stockholm Regional Ethics Review Board (dnr. 2012/1714-31/5). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

## Author contributions

SK, HG, and LF-W: manuscript conceptualization and writing. SK and KE: data analysis. LF-W, HG, KE, TO, and LE: funding acquisition. All authors: writing. All authors approved the final draft of the manuscript and are accountable for attesting to the accuracy of the work represented in this manuscript.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note



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