Development and Aging

Longitudinal pathways of engagement, social interaction skills, hyperactivity and conduct problems in preschool children

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Preschool children's engagement/social interaction skills can be seen as aspects of positive functioning, and also act as protective aspects of functioning. On the other hand, hyperactivity/conduct problems are risk aspects that negatively affect children's everyday functioning. Few studies have investigated such orchestrated effects on mental health in young children over time. The aims of the study are first, to identify homogeneous groups of children having similar pathways in mental health between three time points. Second, to examine how children move between time points in relation to risk and protective factors. Alongitudinal study over 3 years, including 197 Swedish preschool children was used. Questionnaire data collected from preschool teachers. Statistical analysis using person-oriented methods with repeated cluster analyses. Children high in engagement/social skills and low in conduct problems continue to function well. Children with low engagement/social skills exhibiting both hyperactivity and conduct problems continue to have problems. Children with mixed patterns of protective factors and risk factors showed mixed outcomes. The stability of children's pathways was quite high if they exhibited many positive protective factors but also if they exhibited many risk factors. Children exhibiting a mixed pattern of protective and risk factors moved between clusters in a less predictable way. That stability in mental health was related to the simultaneous occurrence of either many protective factors or many risk factors supports the notion of orchestrated effects. The results indicate that early interventions need to have a dual focus, including both interventions aimed at enhancing child engagement and interventions focused on decreasing behavior problems.

Key words: Preschool children, engagement, hyperactivity, conduct problems, risk indicators.

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INTRODUCTION

Children's mental health has primarily been studied as a lack of mental health problems or, for young children, a lack of behavior problems (Goodman, 1997). However, good mental health can also be seen as engagement in everyday activities. According to earlier studies, engagement is negatively correlated with behavior problems (Sjöman, Granlund & Almqvist, 2015). In mental health studies of adults, Westerhof and Keyes *et al*. (2010) propose that mental health and mental ill-health exist on two different continua, with mental health able to co-exist with mental health problems but also to protect from mental ill-health. According to the World Health Organisation (2019), mental health is a state of wellbeing in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully and is able to make a contribution to his or her community. In children, positive expressions of mental health relate to active participation in everyday life (Augustine, Lygnegård, Granlund & Adolfsson, 2018). Participation has two dimensions: being there and being engaged while being there. Engagement can be described as the extent to which the child is actively involved in daily activities such as play and social interaction with adults or other children in a manner relevant to the context and the child's functional level (McWilliam, Bailey, Bailey & Wolery, 1992). Engagement may protect from mental health problems by enhancing mental health.

THE ORCHESTRATED EFFECTS OF PROTECTIVE FACTORS AND RISK FACTORS

Although most young children who are highly engaged in everyday activities display low levels of behavior problems, some will depart from this pattern (Sjöman *et al*., 2016). It is also possible to display low levels of engagement in the absence of behavior problems or emotional symptoms (Almqvist, Sjöman, Golsäter & Granlund, 2018). Engaged children usually have positive social interactions with both adults and peers. This is not necessarily true, however, when studying this relationship for the individual child (Almqvist, 2006). Therefore, a profile approach considering several factors simultaneously is necessary when studying trajectories of mental health in young children. We hypothesize that several mental health profiles characterized by different combinations of engagement, social interaction and behavior problems are detectable within a limited sample of preschool children. In this study, we explore mental health in groups of young children having homogeneous profiles with varying levels of engagement, social interaction skills,

hyperactivity and conduct problems. These profiles represent interrelated, but distinctly different, aspects of mental health.

Mental health profiles probably evolve differently over time and also differ in stability, thus leading to different mental health outcomes. These differences are related to several factors, both within the child and in the environment (Beernink, Swinkels & Buitelaar, 2007; Henricsson & Rydell, 2006; Jones & Forehand, 2003). Some of the influential intrinsic factors increase the risk of mental health problems, such as behavior problems or emotional symptoms (Jones & Forehand, 2003). Others are protective of mental health, such as children's engagement and social skills (Henricsson & Rydell, 2006). In addition, some factors are static over time (e.g., sex), while others are dynamic over time (e.g., peer interaction in preschool) and therefore possible to change. This assumption is based on the revised bioecological model presented by Bronfenbrenner and Evans (2000). Personal intrinsic factors mentioned above affect the child–environment fit (Bergman, Cairns, Nilsson & Nystedt, 2000; Bronfenbrenner & Morris, 2006). The exploration of a combined effect over time of both positive and negative factors on children's mental health can generate a more holistic picture than if single variables are studied in isolation (Magnusson & Stattin, 2006). Thus, in order to identify dysfunctional and/or functional mental health pathways, several intrinsic and environmental factors need to be investigated simultaneously (Hatakenaka & Hirano, 2015; Rutter, 1994; Wille & Ravens-Sieberer, 2008).

FACTORS KNOWN TO AFFECT MENTAL HEALTH WHEN ORCHESTRATED

Research focusing on older children indicates that, when several risk factors co-occur, the prevalence of mental health problems increases (Wille & Ravens-Sieberer, 2008). Conversely, a smaller number of risk indicators coincides with a reduced occurrence of mental health problems (Wille & Ravens-Sieberer, 2008). This may also be true for younger children. Together with one or several protective factors, resilience may further increase and the child may function and develop well despite the presence of risks.

Protective and risk factors related to children's mental health profiles are nested within the child's microsystem, including family and preschool environment (Bergman *et al*., 2000; Bronfenbrenner & Morris, 2006; Wille & Ravens-Sieberer, 2008). Characteristics such as age, gender and mother tongue are static child factors and may occur with dynamic factors within different preschool structures, such as child–teacher ratio, age-homogeneous or heterogeneous group compositions and the number of children entitled to mother tongue in the preschool group (Almqvist *et al*., 2018; Bradley & Corwyn, 2002). Dynamic factors in the preschool environment, considered in this study, include teacher responsiveness, peer-to-child interaction and collaboration with parents (Coolahan, Fantuzzo, Mendez & McDermott, 2000; Luttropp & Granlund, 2010; Petrenko, 2013).

The child's interaction with the environment and the environment's response to the child are important in the socioemotional development of the child (Bronfenbrenner & Ceci, 1994; Denham, Bassett, Mincic *et al*., 2012). Hyperactive behavior and/or conduct problems often manifest as low frustration tolerance and difficulty controlling emotions and impulses. Such behavior affects children's engagement and interaction with others, leading to a higher risk of negative social experiences (Campbell, Halperin & Sonuga-Barke, 2014; Shaw, Stringaris, Nigg & Leibenluft, 2015). Children with behavior problems may attract more negative attention from teachers, peers and parents, and have a higher risk of experiencing conflicts (Barkley, 2014; Dodge, Lansford, Burks *et al*., 2003). In addition, children with conduct problems may experience less closeness and lower social response from teachers (Denham, McKinley, Couchoud & Holt, 1990; Nurmi, 2012). Difficulties with activity competence (developmental delay in body functions, cognition and language) may also affect children's functioning in an array of everyday activities (Andersson, Martin, Brodd & Almqvist, 2016; Lewis, 2011; Prior, Bavin, Cini, Eadie & Reilly, 2011).

THIS STUDY

A child's mental health profile is affected over time by factors intrinsic to the child, other characteristics of the child, such as developmental delay or other mother tongue, and risk and protective factors in the preschool, such as child–teacher ratio and collaboration with parents, and the child–environment fit may vary (Denham *et al*., 1990; Prior *et al*., 2011; Wlodarczyk, Pawils, Metzner, Kriston, Klasen & Ravens-Sieberer, 2017). Thus, it is not meaningful or representative to assume that the total group average values (Bergman, Magnusson & El-Khouri, 2003) for a single variable, as commonly used in studies of young children, are representative of the mental health of all children. Rather, we can expect to find a number of mental health profiles that over time display mental health pathways differently related to protective and risk factors. We assume that the accumulation of risk or protective factors is a better predictor of mental health pathways than single risk or protective factors. Identifying patterns of risk and protective factors may thus contribute to the development of better interventions.

AIMS

The aims of this study were, first, to identify homogeneous groups of children with similar profiles in mental health for three time points and, second, to examine developmental pathways of mental health profiles over time, and to study how these are related to risk and protective factors at different ecological levels.

Hypothesis

High-risk functional profiles and stable pathways between such profiles are expected to be associated with a larger number of risk factors and fewer protective factors, while low-risk functional profiles and stable pathways between such profiles are expected to be associated with fewer risk factors and more protective factors.

METHOD

Procedures

Cluster analyses were performed for each year of a 3-year longitudinal study (2012–2014) of preschool children. Preschools from a stratified

sample of various-sized Swedish municipalities were invited to participate (Granlund *et al*., 2016; Gustafsson, 2019; Gustafsson, Gustafsson & Proczkowska-Bjorklund, 2016; Gustafsson, Proczkowska-Björklund & Gustafsson, 2017; Sjöman et al., 2015). The management of 31 preschools in various municipalities were contacted and consent was requested for the participation of their preschool units (92 preschool classes). The preschool teachers then informed the parents and asked for written informed consent. The preschool teachers answered the questionnaires at three time points, basing their answers on their knowledge of the child covering a period of at least two months. Their evaluation was based on how the child had acted during the previous 2 weeks. The questionnaires could be filled in by different teachers for different children in the same class. The instruction was that the same preschool teacher should fill in the questionnaire on any given child at the different times points. The researcher visited the preschool at each data collection for information, questionnaire management and to answer the preschool teachers' and parents' questions about the study (Gustafsson, 2019, 2016; Gustafsson *et al*., 2016).

This study is one of several sub-studies in a longitudinal project (Granlund, Almqvist, Gustafsson *et al*., 2016; Gustafsson, 2019; Gustafsson *et al*., 2016; Gustafsson, Proczkowska-Björklund & Gustafsson, 2017). All the sub-studies were planned in advance and were approved by the Regional Ethical Review Board in Linköping (Dnr 2012/199-31). Preschool management, preschool teachers and both parents of all children provided written informed consent. In Sweden it is mandated that both parents give consent when it comes to asking about "sensitive issues" for material involving healthy children. All questionnaires were given a code number, and the coding key was kept separate from the questionnaires after the data was collected. If preschool teachers identified children with previously unknown mental health problems during the course of the study, they were instructed to refer them to Child Healthcare for support.

Participants

In the first year, 651 children were included in the project. One hundred and ninety-seven children participated in all three data collections (110 (56%) boys, 87 (44%) girls), with a mean age of 2 years and 8 months, or 32 months (SD = 9, range 15–57). They came from 43 different preschool classes, with between one and five participants in each class. There were 174 children who could have been included (regarding their age in data collection year 1) who did not participate in all data collections due to the child being moved to another preschool or because the preschool teachers could not answer the questionnaires due to lack of time in their work situation in year 2 and/or year 3. The only significant difference (p = 0.019) between these two groups was the proportion of mother tongue other than Swedish (participant group 23%, nonparticipant group 34%).

INSTRUMENTS

Instruments used to define clusters

Cluster variables were chosen based on previous knowledge about children's mental health and functioning in preschool (Bergman & Wångby, 2014; Frønes, 1995; Fuchs, Klein, Otto & von Klitzing, 2013; Goodman, 1997; Sterba & Bauer, 2010; Van Lier, der Ende, Koot & Verhulst, 2007). The cluster variables were specific child variables, including both positive variables, such as engagement and social interaction skills in child-to-other-children encounters, and negative variables, such as hyperactivity and conduct problems. Hyperactivity was the most stable variable over time (Gustafsson, Danielsson, Granlund, Gustafsson & Proczkowska, 2018). The focus of the analysis was on typical pathways between cluster profiles based on these variables at three time points.

Children's Engagement Questionnaire (CEQ). Engagement was measured, by the preschool teacher, using the Children's Engagement Questionnaire (McWilliam, 1991). This is a 32-item instrument designed to rate preschool children's global engagement by free recall impressions as: (1) "not at all typical," (2) "somewhat typical," (3) "typical," or (4) "very typical." Translation of the CEQ into Swedish resulted in minor adaptations and the use of 29 of the original 32 items (Almqvist, 2006), and this 29-item version was used in this study. The Cronbach's alpha coefficient for internal consistency was 0.92 for teachers' ratings (Almqvist, 2006). In the present study, the Cronbach's alpha was 0.94 for the total scale.

Social interaction skills in preschool questionnaire. Social interaction with other children and teachers were measured using two subscales in the questionnaire, in which preschool teachers rated their experiences of different types of social interactions between child, teacher and peers in preschool (Granlund & Olsson, 1998). The instrument consists of a total of 36 items, and responses are based on a five-point Likert scale: (1) "seldom"; (2) "quite often"; (3) "50% of the time"; (4) "fairly often"; and (5) "often." In the cluster analysis in the present study, scores for how the child interacted with the teacher (10 items), and how the child interacted with other children (11 items) were used for measuring the child's social interaction skills. Cronbach's alphas were 0.86 and 0.092, respectively.

Strengths and Difficulties Questionnaire (SDQ). The SDQ is a well-known, 25-item questionnaire measuring child behaviors. In this study, the SDQ teacher version for children aged 2–4 was used (Goodman, 2016). The instrument consists of 25 items, divided into five subscales of five items each (conduct problems, hyperactivity, emotional problems, peer problems and prosocial behaviors), and responses are scored on a three-point Likert scale; (0) "not true," (1) "somewhat true," (2) "certainly true" (apart from questions 7, 11, 14, 21, and 25, which are scored in reverse) (Goodman, 1997, 2016). In an earlier report using data from the first year of this longitudinal study, the SDQ was validated, and it was found that preschool teachers can use it in a preschool setting as a valid instrument for identifying early signs of distress/behavioral problems in young children. In the present study, the Cronbach's alpha for the subscale hyperactivity was 0.85 and split half 0.73; conduct problems 0.77, and split half 0.75 (Gustafsson *et al*., 2016).

Instruments used to compare pathways

To compare the characteristics of children and their preschool environments in the different pathways with total sample means, the following variables were used. For preschool environment: collaboration with parents, proportion of children with a mother tongue other than Swedish in the preschool group, number of children per teacher, teacher's response to the child and other children's interactions with the child. For child characteristics: age, sex, developmental delay, emotional problems, peer problems, and prosocial behavior.

Children and Youth version (ICF-CY code sets). The Developmental code set was based on the International

Classification of Functioning, Disability and Health: ICF-CY code sets (Ellingsen, 2011). In this study, seven items were used to assess developmental delay regarding bodily function and cognition (3 questions about each) and language (1 question), on a scale of (1) "not true at all," (2) "partly true," (3) "completely true." In this study, the Cronbach's alpha was 0.76. In the following text, results from the ICF-CY developmental code sets will be referred to as "developmental delay."

SDQ

From the SDQ, two subscales describing child characteristics were used for comparison: emotional symptoms and prosocial behavior (Goodman, 2016). In the present study, the Cronbach's alpha for the subscale emotional symptoms was 0.66 and split half 0.63; prosocial behavior 0.82, and split half 0.75; and peer problems 0.66, and split half 0.56. The peer problems subscale was used as an interactional indicator, with items involving both child and environmental factors that ask about both the child's behavior and other children's behavior towards the child.

Collaboration with parents. A questionnaire about collaboration with parents was used as an environmental measure. This instrument was developed for use in the project Educational Efforts in Preschool – Generally and Specifically (PEGS) (Lillvist & Granlund, 2010) and concerns how preschool teachers judge collaboration with the parents of the child. It consists of five items, on a scale of: (1) "not true at all; (2) "disagree somewhat"; (3) "partly true"; and (4) "completely true." In this study, Cronbach's alpha was 0.70.

Social interaction skills in preschool questionnaire. The questionnaire in which preschool teachers rated their experiences of different types of social interactions among the child, teacher and peers in preschool (Granlund & Olsson, 1998), used two subscales, with a five-point Likert scale: (1) "seldom"; (2) "quite often"; (3) "50% of the time"; (4) "fairly often"; and (5) "often," to assess the interactional environment. The subscales were: teacher's responsiveness towards the child (10 items), and other children's interactions with the child (5 items). The Cronbach's alpha coefficients for internal consistency were 0.73 and 0.90, respectively.

Information given by the preschool managers. The preschool managers answered questions (i)–(iii) that are used in the environmental measures. First: (i) "How many children in the preschool class are entitled to support in their mother tongue?" Then, the number of children per teacher was calculated from the questions; (ii) "How many preschool teachers work in the preschool class?" and (iii) "How many children are placed in the preschool class?"

Statistical analyses

Both person-oriented and variable-oriented analyses were used. For the person-oriented analyses, we used the statistical package for person-oriented analyses SLEIPNER 2.1. (Bergman *et al*., 2003). The variable-based analyses were performed using SPSS package, version 23 (IBM SPSS). Initial analyses were performed, including reparatory analyses of skewness, analyses of internal consistency, normal probability and multicollinearity were implemented and showed approximately normally distributed values. Pearson's correlation analysis was used to identify associations and possible multicollinearity in the cluster variables.

Cluster analyses. The person-oriented analyses were performed in three steps following the procedure of Linking of Clusters after Removal of a Residue (LICUR) (Bergman *et al*., 2003). First, we identified and removed possible residues separately at each age. The decision about whether individuals should be included in the clusters or not is a matter to be decided in each specific case, although a strict statistical criterion is often used. In this study, cases with less than one twin and with an Average Squared Euclidean Distance (ASED) of > 0.5 were identified as outliers and excluded prior to clustering (Bergman, 1998). As Bergman (1988) argues, it is not reasonable to believe that all subjects will fit into a small number of homogeneous profiles. Second, we performed a hierarchical cluster analysis using Ward's method, separately for each of the three time points. The variables hyperactivity, conduct problems, engagement, child-to-teacher interaction skills and child-to-other-children interaction skills were summed as follows: hyperactivity and conduct problems by means of the sum of the scores; engagement, child-to-teacher interaction and child-to-other-children interaction by means of the score. The possibility of using cases in the analyses was investigated. In cases with one missing value, a new value was imputed by the use of a twin procedure (i.e., a missing value in one case was replaced with the value from a "twin" case with complete data) (Bergman & Magnusson, 2003). Cases with more than one missing value were excluded before the cluster analyses. In estimating the cluster solution with the best fit, solutions were chosen using the following criteria: a maximum number of 15 clusters, a minimum percentage of explained variance (ESS) over 67% before a sharp increase in explained error sums of squares (EESS), an approved homogeneity in the clusters, and a theoretically meaningful and interpretable solution (Bergman, 1998). The homogeneity of clusters should preferably not exceed 1.00. The centroids within each cluster were also taken into consideration, as well as the associated variances. In the third step, we related the cluster solutions from the three time points to one another by cross-tabulation to test for individual stability, that is, a tendency for individuals in a specific cluster to demonstrate a similar pattern over time. We tested for significant typical pathways and atypical pathways by using the EXACON module in SLEIPNER, (Bergman & El-Khouri, 2002) for single-cell contingency analysis. A typical pathway is defined as an observed frequency that is significantly higher than expected by chance, while an atypical pathway denotes an observed frequency that is significantly lower than expected. To correct for the mass significance problem, we first analyzed the cluster solutions from each year for structural stability, which is obtained when clusters from the different time points are at least partially identical. Structural stability was assessed by comparing the centroids (= cluster means) between the three time points (T1–T2, T2–T3). The homogeneity between cluster centroids should preferably be < 1.00. The probability of individual stability is higher between highly matched clusters (i.e., when the structural stability

is high), so cells representing such matching were tested at the nominal significance level. For the rest of the cells, typical and atypical pathways were tested by adjusting the nominal significance level according to the Bonferroni procedure (Bergman *et al*., 2003). In this study, the typical pathways form the basis for comparative analyses.

The typical pathways were compared in terms of the following categorical and continuous protective and risk factors: *children's personal characteristics*: age, developmental delay, emotional problems, peer problems and prosocial behavior, and *preschool environmental variables*: collaboration with parents, percentage of children with another mother tongue in the group, number of children per teacher, teachers' responsiveness to the child and other children's interactions with the child. For the categorical variable children's sex, we used cross-tabulation with Fisher's Exact Test to compare types. For the other continuous variables, we used one-way analysis of variance (ANOVA) followed by Tukey's B Post Hoc Test in order to compare children in each of the typical pathways.

RESULTS

Preparatory analyses

A correlation analysis was conducted to determine whether it was possible to use the variables selected for clusters (i.e., engagement, child-to-teacher interaction, child-to-other-children interaction, hyperactivity and conduct problems) as independent in the cluster analysis (i.e., the overlap between the variables).The correlation between the variables ranged between r = −0.444 and 0.821, $p < 0.001$ year 1; r = −0.470 and 0.794, $p < 0.001$ year 2; and r = −0.637 and 0.848, $p < 0.001$ year 3. The most significant positive relationships in all 3 years were found between engagement and child-to-teacher social interaction skills, and between engagement and child-to-other-children social interaction skills. The most significant negative relationships were found between hyperactivity and child-to-teacher social interaction skills, and between hyperactivity and child-to-other-children social interaction skills. Due to the high correlations between the variables engagement and social interaction skills, a principal component analysis (PCA) with Varimax rotation was conducted. The PCA extracted 13 components of the 54 included items, with eigenvalues exceeding 1 and explaining 74% of the variance. A scree plot inspection revealed a clear break after the second component, indicating that the first two factors primarily loaded in the instrument-specific factors. Although this two-component solution explained only 22% of the variance, the result revealed a minor degree of overlap between items from different instruments. Based on these results, it was decided to use engagement and social interaction skills as separate variables in the cluster analysis, despite this minor overlap.

Cluster analysis

A six-cluster solution (i.e., homogeneous patterns of engagement, social interaction, hyperactivity and conduct problems), was chosen for each year, based on the pre-specified statistical criteria. Cluster titles, means and standard deviations for each year are presented in Tables 1–3. The cluster solution in year 1 explained 68% of the variance, and cluster homogeneity coefficients (HCs) ranged from 0.24 to 1.22. The cluster solution in year 2 explained 67% of the variance and cluster HCs ranged from 0.24 to 1.62. The cluster solution in year 3 explained 70% of the variance and cluster HCs ranged from 0.25 to 1.58. Four residue cases were found in year 2 and six residue cases in year 3. The cluster solutions showed acceptable structural stability between the time points, with an ASED ranging from 0.01 to 0.15 (years 1–2) and 0.01 to 0.39 (years 2–3) (see Table 4).

Longitudinal typical pathways

Longitudinal pathways between cluster profiles of engagement, social interaction skills, hyperactivity and conduct problems were analyzed for typical pathways between years 1 and 2, and

Table 1. *The six-cluster solution from year 1 (Y1)*

	Engaged (range 1–4)		Child/teacher interaction (range 1–5)		Child/child interaction (range 1–5)		Hyper-activity (range 0–10)		Conduct problem (range 0–10)		
Cluster	M	SD	M	SD	M	SD	M	SD	M	SD	HC
ENG/SOC (n.=44)	3.64	0.26	4.61	0.28	4.66	0.26	0.70	0.70	0.34	00.68	0.24
AVERAGE (n.=36)	2.94	0.26	4.03	0.27	4.12	0.35	1.78	0.92	0.67	0.89	0.34
PASSIVE (n.=53)	**2.54**	0.40	**3.52**	0.34	**3.10**	0.52	3.29	1.77	1.80	1.19	0.77
ENG/COND (n.=45)	3.40	0.39	4.32	0.34	4.05	0.49	3.91	2.18	**4.09**	2.00	1.04
HYPER/COND (n.=6)	**2.36**	0.34	**3.18**	0.19	**2.36**	0.52	**9.50**	0.93	**7.75**	0.89	0.64
HYPER (n.=13)	**1.92**	0.43	**2.47**	0.51	**2.05**	0.71	**4.90**	3.23	0.90	1.07	1.22
Sample (n.=197)	2.99	0.63	3.95	0.68	3.75	0.90	2.77	2.35	1.87	2.10	

Notes: Engaged and interacting are analyzed by means of the score, hyperactivity and conduct problems are analyzed by means of the sum of the scores. Bold text = 1/2 SD or less (engagement, interaction)/more (hyperactivity, conduct problems) difference from Sample M. Note; explanation name of the clusters: ENG/SOC Engagement and interaction high, hyperactivity and conduct problems below mean. AVERAGE Engagement, interaction and hyperactivity average, conduct problems below mean. PASSIVE Engagement and interaction below mean, hyperactivity and conduct problems average. ENG/COND Engagement above mean, interaction and hyperactivity average, conduct problems high. HYPER/COND Engagement and interaction low, hyperactivity and conduct problems very high. HYPER Engagement and interaction very low, hyperactivity above mean, conduct problems average

Table 2. *The six-cluster solution from year 2 (Y2)*

	Engaged (range 1–4)		Child/teacher interaction (range 1–5)		Child/child interaction (range 1–5)		Hyper-activity (range 0–10)		Conduct problem (range 0–10)		
Cluster	M	SD	M	SD	M	SD	M	SD	M	SD	HC
ENG/SOC (n.=44)	3.64	0.26	4.61	0.28	4.66	0.26	0.70	0.70	0.34	00.68	0.24
AVERAGE (n.=36)	2.94	0.26	4.03	0.27	4.12	0.35	1.78	0.92	0.67	0.89	0.34
PASSIVE (n.=53)	**2.54**	0.40	**3.52**	0.34	**3.10**	0.52	3.29	1.77	1.80	1.19	0.77
ENG/COND (n.=45)	3.40	0.39	4.32	0.34	4.05	0.49	3.91	2.18	**4.09**	2.00	1.04
HYPER/COND (n.=6)	**2.36**	0.34	**3.18**	0.19	**2.36**	0.52	**9.50**	0.93	**7.75**	0.89	0.64
HYPER (n.=13)	**1.92**	0.43	**2.47**	0.51	**2.05**	0.71	**4.90**	3.23	0.90	1.07	1.22
Sample (n.=197)	2.99	0.63	3.95	0.68	3.75	0.90	2.77	2.35	1.87	2.10	

Notes: Engaged and interacting are analyzed by means of the score, hyperactivity and conduct problems are analyzed by means of the sum of the scores. Bold text = 1/2 SD or less (engagement, interaction)/more (hyperactivity, conduct problems) difference from Sample M. Note; explanation name of the clusters: ENG/SOC Engagement and interaction above mean, hyperactivity and conduct problems below mean. AVERAGE Engagement, interaction, hyperactivity and conduct problems average. PASSIVE Engagement and interaction low, hyperactivity and conduct problems average. ENG/HYPER Engagement above mean, interaction average, hyperactivity above mean, conduct problems average. HYPER/COND Engagement and interaction average, hyperactivity high, conduct problems very high. HYPER Engagement and interaction very low, hyperactivity very high, conduct problems above mean.

between years 2 and 3. Additionally, non-significant pathways were found in the analysis; these are not reported in this paper, but do explain why many children were not included in the significant pathways. Five significant typical pathways were found in years 1–2, including 37% of the children in the total sample for year 1, and four significant typical pathways in years 2–3, including 30% of the children in the total sample for year 2. Significant typical pathways including at least four children are reported in Fig. 1. The typical pathways including the largest numbers of children were found between cluster groups "Engagement and interaction above mean, hyperactivity and conduct problems below mean" (ENG/SOC). The lowest proportion of children (n = 4), was found in the pathway from cluster "Engagement and interaction very low, hyperactivity above mean, conduct problems average" (HYPER) in year 1 to cluster "Engagement and interaction low, hyperactivity and conduct problems average" (PASSIVE) in year 2. The children in this pathway were younger than the children in the other pathways, with a mean age of 25 months in the first year of data collection. There was no significant typical pathway for the cluster AVERAGE in years 1 and 3, or from PASSIVE in year 2 (i.e., the children followed no stable pathways).

Protective and risk indicators associated with typical pathways

The typical pathways were compared in relation to environmental and personal protective and risk indicators (Table 5). The total number of protective and risk indicators was then calculated for each pathway (Figure 2); personal protective or risk factors (gender, developmental delay, emotional problems, prosocial behavior, another mother tongue than Swedish), factors at micro (teacher responsiveness, other-children-to-child interaction), meso (collaboration with parents), and exo (proportion of another mother tongue than Swedish in the preschool group) levels. The

Table 3. *The six-cluster solution from year 3 (Y3)*

	Engaged (range 1–4)		*Child/teacher interaction (range 1–5)*		*Child/child interaction (range 1–5)*		*Hyper-activity (range 0–10)*		*Conduct problem (range 0–10)*		
Cluster	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*HC*
ENG/SOC (n.=78)	3.88	0.14	4.60	0.22	4.76	0.18	0.42	0.73	0.26	0.60	0.25
AVERAGE (n.=51)	3.39	0.25	4.30	0.20	4.34	0.32	1.44	1.24	0.94	1.35	0.63
PASSIVE (n.=18)	**2.77**	0.31	**3.57**	0.41	**3.55**	0.49	3.06	2.04	0.94	0.98	1.17
ENG/SOC/HYPER (n.=19)	3.86	0.19	4.56	0.27	4.75	0.14	**3.69**	1.23	1.06	1.41	0.52
HYPER/COND/HIGH (n.=12)	3.65	0.17	4.29	0.17	4.19	0.33	**5.92**	1.21	**5.33**	1.83	0.72
HYPER/COND (n.=19)	**3.00**	0.47	**3.41**	0.22	**3.42**	0.40	**6.50**	2.14	**4.22**	2.23	1.58
Sample (n.=197)	3.52	0.51	4.25	0.56	4.32	0.66	2.25	2.52	1.29	1.96	

Notes: Engaged and interacting are analyzed by means of the score, hyperactivity and conduct problems are analyzed by means of the sum of the scores. Bold text = 1/2 SD or less (engagement, interaction)/more (hyperactivity, conduct problems) difference from Sample M. Note; explanation name of the clusters: ENG/SOC Engagement and interaction above mean, hyperactivity and conduct problems below mean. AVERAGE Engagement, interaction, hyperactivity and conduct problems average. PASSIVE Engagement and interaction low, hyperactivity and conduct problems average. ENG/SOC/HYPER Engagement, interaction and hyperactivity above mean, conduct problems average. HYPER/COND/HIGH Engagement and interaction average, hyperactivity high, conduct problems very high. HYPER/COND Engagement and interaction low, hyperactivity very high, conduct problems high.

Table 4. *Names and sizes of the clusters and the ASEDs between matched clusters in years 1, 2, and 3*

Six-cluster solution year 1	*y.1*	*ASED between years 1–2*	*Six-cluster solution year 2*	*n. y.2*	*ASED between years 2–3*	*Six-cluster solution year 3*	*n. y.3*
ENG/SOC	44	0.01	ENG/SOC	50	0.01	ENG/SOC	78
AVERAGE	36	0.04	AVERAGE	59	0.01	AVERAGE	51
PASSIVE	53	0.04	PASSIVE	18	0.01	PASSIVE	18
ENG/COND	45	0.08	HYPER/COND/HIGH	22	0.05	HYPER/COND/HIGH	12
HYPER/COND	6	1.99	ENG/HYPER	35	0.03	ENG/SOC/HYPER	19
HYPER	13	0.15	HYPER	12	0.39	HYPER/COND	19

total number of both protective and risk indicators associated with the typical pathways were higher between years 1 and 2 than between years 2 and 3.

The following variables were identified as personal protective indicators: developmental indicators scored as no delay, low incidence of emotional problems and high degree of prosocial behavior. A low degree of peer problems was perceived as both a personal and an environmental protective indicator. The environmental protective indicators were: low proportion of mother tongue other than Swedish in the preschool group, high teacher responsiveness and high interaction from other children. The pathways with high/above-mean engagement and/or social interaction without conduct problems were characterized by predominantly having relations to protective indicators and no risk indicators.

The personal risk indicators were: male sex, developmental delay, high level of emotional problems and low level of prosocial behavior. A high degree of peer problems was perceived as a risk indicator related to both the child and the environment. The environmental risk indicators were: low teacher ratings of collaboration with parents, high proportion of another mother tongue than Swedish in the preschool group, low teacher responsiveness and low other-children-to-child interaction.

Typical pathways ENG/SOC years 1–2 (Y1–2) (n = 22) and ENG/SOC years 2–3 (Y2–3) (n = 35). Engagement and interaction high, hyperactivity and conduct problems below mean

The pathways between "Engagement and interaction high, hyperactivity and conduct problems below mean" ENG/SOC Y1, "Engagement and interaction above mean, hyperactivity and conduct problems below mean" ENG/SOC Y2, and "Engagement and interaction above mean, hyperactivity and conduct problems below mean" ENG/SOC Y3 were characterized by several

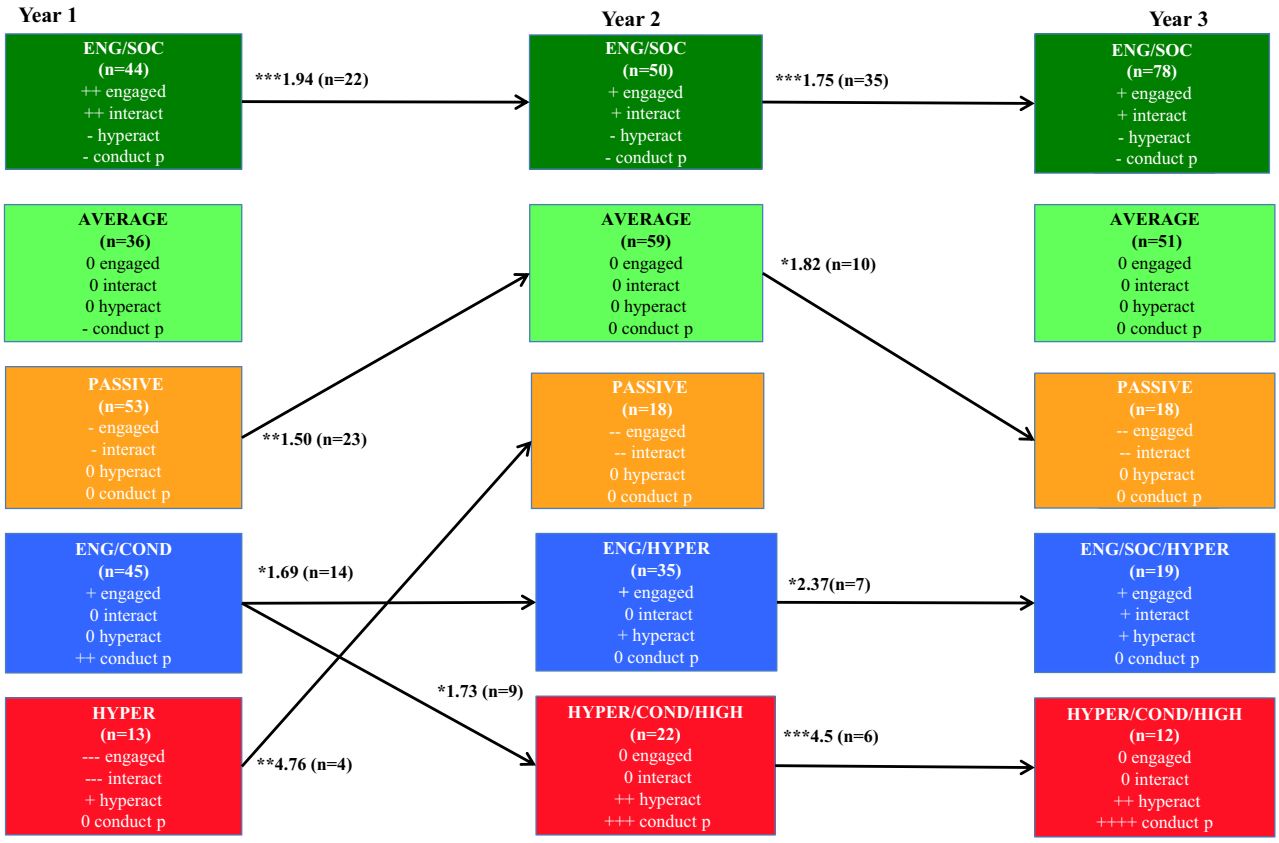

Fig. 1. Significant longitudinal typical pathways between years 1–2 and between years 2–3.

Table 5. *Typical pathways between clusters, column, years 1–2 (means year 1) and typical pathways years 2–3 (means year 2)*

		Total sample	ENG/ SOC	PASSIVE/ AVERAGE	ENG/ COND/ HYPER	COND/ HYPER		Difference	Total Sample	ENG/ SOC	AVERAGE/ PASSIVE	ENG/ SOC/ HYPER	COND/ HYPER/ HIGH		Difference
		Years 1–2	n = 22	n = 23	n = 14	n = 9	p	(df, N) = F	**Years 2–3**	n = 35	n = 10	n = 7	n = 6	p	(df, N) = F
Personal	Age months	32	39[b]	29[a,c]	37[b]	35	<0.001[1]	F(4,195) = 5.809	44	48[f]	38[e,g,h]	49[f]	48[f]	0.001	F(4,157) = 5.144
charact-	Male sex	55%	41%	52%	57%	78%	0.341[2]	X^2(4,196) = 4.516	55%	31%[f,h]	**60%**[e]	43%	**100%**[e,g]	0.006[2]	X^2(4,159) = 13.611
eristics	Developmental delay	2.60	*2.90*[b,d]	**2.41**[a]	2.69	**2.60**[a]	<0.001[1]	F(4,192) = 6.578	2.79	*2.98*[f,h]	**2.63**[e]	2.88	**2.65**[e]	<0.001[1]	F(4,158) = 8.030
	SDQ emotional	0.87	*0.41*	**1.57**	*0.43*	0.67	0.037[1]	F(4,190) = 2.608	0.75	0.54	1.10	0.86	1.17	0.589[1]	F(4,158) = 0.705
	SDQ prosocial	5.89	*8.14*[b,c,d]	**5.0**[a]	**5.5**[a]	**4.33**[a]	0.001[1]	F(4,190) = 7.056	7.24	*8.97*[h]	7.40	7.14	**5.50**[e]	<0.001[1]	F(4,158) = 9.437
Both Pers./ Environm	SDQ peer problems	1.86	*0.55*[b,d]	**2.70**[a]	1.57	**2.33**[a]	0.002[1]	F(4,190) = 4.383	0.94	*0.46*[h]	1.00	0.86	**2.17**[e]	0.024[1]	F(4,158) = 2.904
Environ-mental factors	Collaboration with parents	3.53	3.77	3.43	3.47	3.47	0.126[1]	F(4,192) = 1.824	3.51	3.81[f]	**3.10**[e,g]	3.71[f]	3.53	<0.001[1]	F(4,158) = 6.156
	Entitled to other mother tongue	22%	19%[d]	*11%*[d]	*10%*[d]	**74%**[a,b,c]	0.004[1]	F(4,169) = 4.081	26%	*9%*	21%	*9%*	30%	0.022[1]	F(4,150) = 2.969
	Child:teacher ratio	5.54	6.21	5.44	5.92	5.61	0.034[1]	F(4,195) = 2.662	6.03	6.54	5.61	6.59	6.03	0.033[1]	F(4,152) = 2.706
	Teacher responsiveness	4.56	*4.78*[b]	**4.47**[a]	4.69	4.59	0.002[1]	F(4,190) = 4.283	4.62	4.76	4.67	4.76	4.62	0.072[1]	F(4,158) = 2.199
	Other child interaction	3.83	*4.7*[b,c,d]	**3.11**[a,c,d]	**3.99**[a,b]	**3.91**[a,b]	<0.001[1]	F(4,191) = 10.452	4.33	*4.85*[f,h]	**4.16**[e]	*4.71*[h]	**4.10**[e,g]	<0.001[1]	F(4,158) = 10.105

Notes: [1]= ANOVA, [2] = Chi^2, Bold text = Risk indicators, Italics = Protective indicators

a = Tukey's B compared to cluster ENG/SOC (Y1-2) $p < 0.05$, b = Tukey's B compared to cluster PASSIVE/AVERAGE (Y1-2) $p < 0.05$, c = compared to cluster ENG/COND/HYPER (Y1-2) $p < 0.05$, d = compared to cluster COND/HYPER (Y1-2) $p < 0.05$, e = compared to cluster ENG/SOC (Y2-3) $p < 0.05$, f = compared to cluster AVERAGE/PASSIVE (Y2-3) $p < .05$, g = compared to cluster ENG/SOC/ HYPER (Y2-3) $p < 0.05$, h = compared to cluster COND/HYPER (Y2-3) $p < 0.05$.

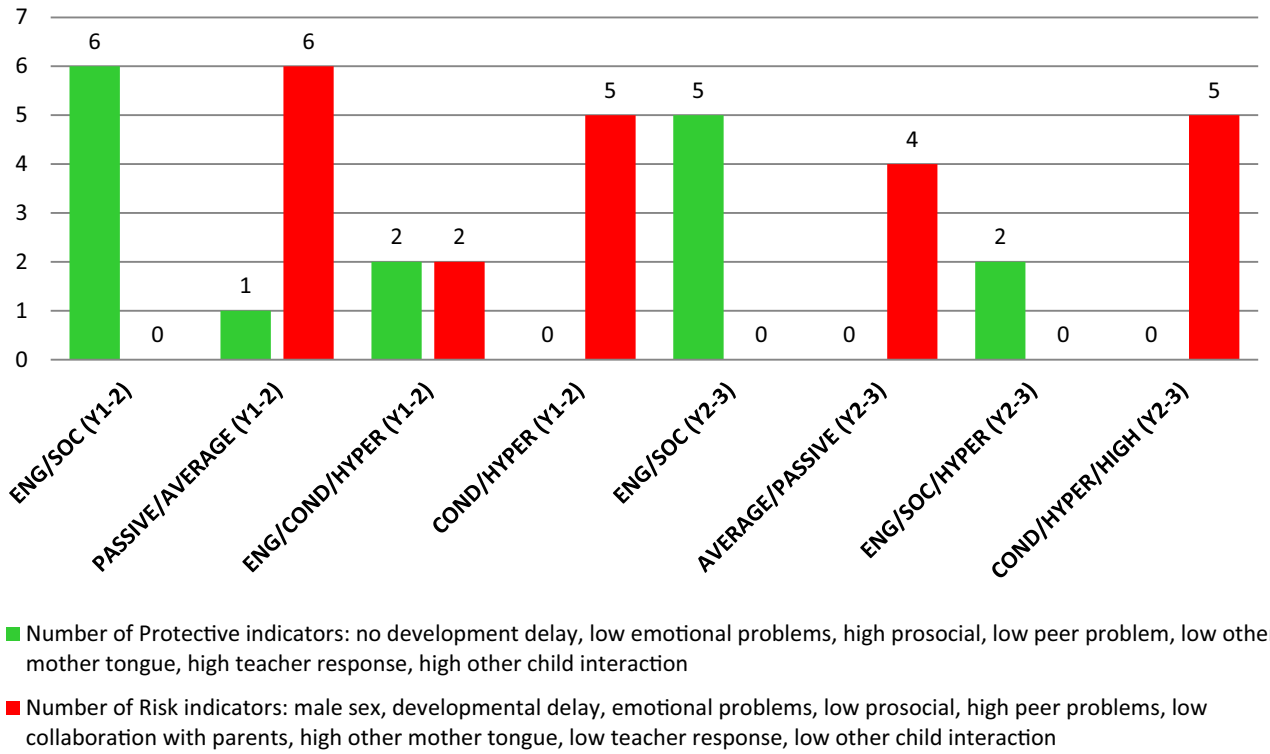

Fig. 2. Number of protective and risk indicators for each typical pathway year 1–2 (Y1–2) and year 2-3 (Y 2–3).

protective indicators and no risk indicator. The children in these pathways were older compared to the total sample ($p = 0.001$) and had the lowest proportion of boys (ENG/SOC Y2–3, $p = 0.031$). There was a lower proportion of children with developmental delay in ENG/SOC Y1–2 than in the total sample ($p < 0.001$), and a lower degree of emotional problems ($p = 0.037$) and peer problems ($p = 0.002$ and Y2–3, $p = 0.024$), together with a higher degree of prosocial behavior ($p = 0.001$). The child-to-teacher ratio ($p = 0.034$), and the teachers' collaboration with parents (ENG/SOC Y2–3, $p < 0.001$) were higher in these preschool groups in relation to the total sample. Preschool teachers rated their own responsiveness towards the children as higher compared to the total sample (ENG/SOC Y1–2, $p = 0.002$). The peers of these children were perceived to interact better with the children in these pathways compared to the average in the total sample ($p < 0.001$).

Typical pathways PASSIVE/AVERAGE Y1–2 (n = 23) and AVERAGE/PASSIVE Y2–3 (n = 10). Engagement, interaction, hyperactivity and conduct problems average

The pathways between "Engagement and interaction below mean, hyperactivity and conduct problems average" PASSIVE Y1, "Engagement, interaction, hyperactivity and conduct problems average" AVERAGE Y2, and "Engagement and interaction low, hyperactivity and conduct problems average" PASSIVE Y3 were characterized by a maximum of one protective indicator and several risk indicators. The children in these pathways were younger compared to the total sample ($p = 0.001$). The pathway AVERAGE/PASSIVE Y2–3 included a higher proportion of boys than in the total sample ($p = 0.031$). More children than expected were rated with developmental delay ($p < 0.001$). The children in PASSIVE/AVERAGE Y1–2 had a higher degree of emotional ($p = 0.037$) and peer problems ($p = 0.002$), and lower prosocial behavior ($p = 0.001$) than in the total sample. The teachers' collaboration with parents was rated lower in AVERAGE/PASSIVE Y2–3 than in the total sample ($p < 0.001$). The preschool teachers in PASSIVE/AVERAGE Y1–2 judged themselves as showing lower responsiveness to these children than to children in the total sample ($p = 0.002$). The peers of the children in these pathways were perceived to have more negative interactions with the children than in the total sample ($p < 0.001$).

Typical pathways ENG/COND/HYPER Y1–2 (n = 14) and ENG/SOC/HYPER Y2–3 (n = 7). Engagement, interaction and hyperactivity high, conduct problems average

The pathways between "Engagement above mean, interaction and hyperactivity average, conduct problems high" ENG/COND Y1, "Engagement above mean, interaction average, hyperactivity above mean, conduct problems average" ENG/HYPER Y2, and "Engagement, interaction and hyperactivity above mean, conduct problems average" ENG/SOC/HYPER Y3, were characterized by children with two protective indicators and a maximum of two risk indicators. The children in these pathways were older than in the total sample ($p = 0.001$). The children in the pathway ENG/COND/HYPER Y1–2 had a lower degree of emotional problems than the total sample ($p = 0.037$). Concerning environmental measures, a smaller proportion of children in these pathways were entitled to support in a mother tongue other than Swedish in the preschool groups than in the total sample (ENG/COND/HYPER Y1–2, $p = 0.004$, ENG/SOC/HYPER Y2–3, $p = 0.022$). The

peers of the children in ENG/COND/HYPER Y1–2 had more negative social interaction with these children than in ENG/SOC Y1–2 ($p <= 0.050$), but more positive social interaction with them than in PASSIVE/AVERAGE Y1–2 ($p <= 0.050$). The peers in ENG/SOC/HYPER Y2–3 had more positive interaction with the children than in COND/HYPER/HIGH Y2–3 ($p \leq 0.050$).

Typical pathways COND/HYPER Y1–2 (n = 9) and COND/HYPER/HIGH Y2–3 (n = 6). Engagement and interaction average, hyperactivity high, conduct problems very high

The pathways between "Engagement above mean, interaction and hyperactivity average, conduct problems high" ENG/COND Y1, "Engagement and interaction average, hyperactivity high, conduct problems very high" HYPER/COND/HIGH Y2, and "Engagement and interaction average, hyperactivity high, conduct problems very high" HYPER/COND/HIGH Y3, were characterized by no protective indicator, but several risk indicators. A higher proportion of boys was present in these pathways (COND/HYPER/HIGH Y2–3 $p = 0.031$). The children showed less prosocial behavior ($p = 0.001$), and more peer problems than the total sample (COND/HYPER Y1–2 $p = 0.002$, COND/HYPER/HIGH Y2–3 $p = 0.023$). There was a higher proportion of children entitled to support in a mother tongue other than Swedish in the preschool groups than in the total sample (ENG/COND/HYPER Y1–2 $p \leq 0.004$, COND/HYPER/HIGH Y2–3 $p = 0.022$).

DISCUSSION

We aimed to investigate the orchestrated effects of protective factors and risk factors on the development of mental health in young children by identifying homogeneous groups of children with similar mental health profiles at three time points. In addition, we aimed to examine the developmental pathways of mental health profiles over time. Developmental pathways with high structural stability over time were found (i.e., similar cluster patterns emerged at all three time points). This supports the notion of Bergman and El-Khouri (2002) that in a population of individuals, such as children in preschool, it is probable that a limited number of profiles will occur more often than expected by chance. Several such profiles of pathways of young children in our sample did indeed occur more often than by chance. The identified clusters with structural stability were characterized by a high number of risk or protective factors, respectively. Thus, our findings support the importance of the orchestrated effects of several factors.

The children in this study who displayed high engagement and positive interaction (that is, good mental health) continued to function well, even in the presence of hyperactivity. Children with low levels of engagement and interaction alone (poor mental health) or in combination with both hyperactivity and conduct problems (many mental health problems) continued to have problems. Stability in pathways of mental health profiles was related to a number of protective or/and risk indicators. Thus, as previously stated, our findings support our hypothesis that stable pathways between high-risk functional patterns were associated with a larger number of risk factors, while stable pathways between low-risk functional patterns were associated with fewer risk factors and more protective factors. These results support earlier studies on older children that report the importance of cumulative protection and risk factors (Aguiar & McWilliam, 2013; Galéra, Côté, Bouvard e*t al*., 2011; Leblanc, Boivin, Dionne *et al*., 2008; Romano, Tremblay, Farhat & Côté, 2006; Wille & Ravens-Sieberer, 2008; Willoughby, Pek & Greenberg, 2012). Probably a certain mental health profile does not determine a child's future mental health pathways, but having knowledge about the risk and protective factors at an individual level has implications for how to facilitate a child's continued everyday functioning and development (Bronfenbrenner & Ceci, 1994; Magnusson & Stattin, 2006).

A novel aspect of the results from this study is the occurrence of young children having low engagement despite few behavior problems. This result indicates that it is important to study not only the occurrence of risk factors but also the absence of protective factors, such as engagement and positive social interaction. The result provides implicit support for Westerhof and Keyes *et al*. (2010), who argue that mental health exists partly independently of mental health problems or behavior problems. In terms of promoting mental health, low engagement has to be seen as an indicator of a need for intervention. When analyzing data from the same data set at the preschool unit level, it was found that some units promoted high engagement of children to a larger extent than other units (Beteinaki, 2020; Granlund *et al*. 2016).

A further aim was to study how these developmental pathways of mental health are related to the simultaneous occurrence of risk and protective factors at different ecological levels. The most frequently occurring typical pathway was characterized by children with high levels of engagement and social interaction with teachers and peers, and with low levels of hyperactivity and conduct problems. This pathway was associated with several protective indicators, but few risk indicators (Wille & Ravens-Sieberer, 2008). The number of children in this cluster with high levels of engagement/interaction and no behavior problems increased over time, indicating that psychological functioning is age dependent. It is likely that children with high engagement over time develop positive social interaction with peers and teachers and that this generates positive spirals of good mental health and socio-emotional development (Aydogan, 2012; Denham *et al*., 2012; Fuhs, Farran & Nesbitt, 2013; Hughes, Bullock & Coplan, 2014; Raspa, McWilliam, Maher & Ridley, 2001).

Two of the typical pathways in this study included children with more mixed mental health profiles, having above-mean levels of engagement despite high levels of conduct problems. In one of these pathways, the children's hyperactivity levels increased over time, while their level of conduct problems decreased. These children displayed moderate levels of most protective and risk indicators and their level of social interaction increased over time. Thus, mental health as engagement and positive social interaction may partly protect against the influence of hyperactivity on functioning. Different components of socioemotional development organize together to form distinct groups in young children (Denham *et al*., 2012). It might be, as suggested by Sjöman *et al*. (2015), that good social interaction sustains positive spirals by mutually reinforcing interactions

between the child, peers and adults. This highlights the importance of promoting social interaction in preschool, especially for children with high-risk patterns of behavior.

Lahey, Pelman, Loney, Lee, and Willcutt (2005) have demonstrated the importance of detecting a combination of hyperactivity and impulsiveness in preschool children in order to identify children who may later be diagnosed with ADHD (i.e., identifying children who need early support, including support for their skills in social interaction). In the second of the mixed-pattern pathways, hyperactivity and conduct problems increased over time. These children displayed no protective indicators and several risk indicators. As in other studies focusing on these older children, risk indicators were present in both the environment and in their personal characteristics, together with few protective indicators (Andersson *et al*., 2016; Searle, Miller-Lewis, Sawyer & Baghurst, 2013; Wille & Ravens-Sieberer, 2008). Child engagement decreased over time (Searle *et al*., 2013). Other studies have shown that children with behavioral difficulties frequently sustain only low-complexity social interactions and do not develop in their engagement (Rasmussen & Gillberg, 2000). To identify children at high risk of negative development, it is likely that both behavioral problems and engagement need to be screened (Aguiar & McWilliam, 2013; Romano *et al*., 2006). It is also important to identify and distinguish both hyperactivity and conduct problems, since these different behaviors affect each other (Gustafsson *et al*., 2018; Yu, Ziviani, Baxter & Haynes, 2012).

When screening children with behavioral problems, it is especially important to identify patterns of dynamic risk factors (i.e., malleable risk factors) (Sideridis, Prock & Sheridan, 2014; Willoughby *et al*., 2012) and the stability of risk over time. Studies have demonstrated that 7% of preschool children displaying hyperactivity symptoms are stable over time (Leblanc *et al*., 2008; Romano *et al*., 2006). Lavigne, Arend, Rosenbaum, Binns, Christoffel & Gibbons (1998) showed that as many as 50% of 2- to 3-year-old preschool children with disruptive behavioral symptoms receive a diagnosis 42–48 months later. In the pathway with both high hyperactivity and conduct problems, a lower level of positive change in prosocial behavior was found compared to other pathways. This may indicate an increased risk of receiving more negative attention from teachers and experiencing more conflicts in relationships with both adults and children, leading to less focus on learning prosocial behavior. In the long run, social exclusion from preschool activities may appear (Barkley, 2014; Dodge *et al*., 2003; Nurmi, 2012). Early intervention could limit or reverse this negative trend. However, how and what support is provided is a key issue in interventions for children with behavioral problems. Almqvist *et al*. (2018), using the same population as in this study, showed that interventions were primarily focused on decreasing negative behavior, with little enhancement of positive engagement or social interaction. Routines are needed for early detection and support for children with behavioral problems in order to increase their engagement (Egger & Angold, 2006). Support focused on engagement and social interaction may influence the balance between risk factors, favoring a more positive outcome.

Two of the typical pathways displaying predominantly negative patterns were characterized by a high proportion of children in their preschool group with a mother tongue other than Swedish. This risk indicator may lead to difficulties in developing the nuances of the Swedish language, and the children may exhibit conduct problems as a consequence of not being understood by teachers and/or peers (D'Souza, Waldie, Peterson, Underwood & Morton, 2017). A Swedish cross-sectional study on preschool unit level reports that, in units having a high proportion of children with another ethnic background, children were observed to exhibit a lower engagement level on average (Beneteaki, 2020). However, the proportion of children with a mother tongue other than Swedish in the group may also affect how children's behavioral problems are perceived and dealt with. Other explanations might be related to differences in socioeconomic status between groups, and approaches to parenthood in different ethnic groups (Williams & Collins, 1995). Various risk factors are embedded in a child's microsystem and affect the child's development (Bronfenbrenner & Ceci, 1994). Thus, in order to obtain a better prognosis for individual children, it is important to focus on patterns of risk rather than single factors.

Children in cluster A2 (engagement, interaction and hyperactivity average, conduct problems below mean) (Table 1) were younger than the average for the total sample, and from this cluster there were no significant typical pathways. Younger children may more commonly change cluster profile, depending on the orchestrated effect of protective indicators, risk indicators and personal factors (Sameroff, Seifer, Barocas, Zax & Greenspan, 1987). The pathway for younger children with low engagement and social interaction together with multiple risk factors seemed to deteriorate over time, even where they did not initially exhibit behavioral problems. This stable negative pathway indicates that engagement is affected negatively if several risk factors are present (Sameroff *et al*., 1987). Improving engagement might be an important focus for early prevention and interventions.

El-Radhi (2015) found that it was difficult to recognize children with emotional problems early, for both parents and preschool teachers. Many children attending preschool have not developed appropriate vocabulary or comprehension to express their emotions intelligibly (El-Radhi, 2015). Preschool teachers, parents and also healthcare workers find it difficult to distinguish developmentally normal reactions (fears, crying) from severe and prolonged emotional distress that should be regarded as disorders requiring external help (Gardner & Shaw, 2009). In our study, preschool teachers generally scored children low on the SDQ subscale for emotional problems at 1–3 years old, even if they were able to identify emotional problems in combination with disruptive behavior (Granlund *et al*. 2016). It seems that teachers react more to externalizing behavioral problems that have an impact on the functioning of the whole group (Almqvist *et al*., 2018).

We predicted that the number of children per teacher would be a potential environmental risk indicator (Perlman, Falenchuk, Brunsek, McMullen & Shah, 2017). However, the child-to-teacher ratio was higher in the pathways that included children with high levels of engagement and social interaction who continued to function well over time. Pathways involving children with lower levels of engagement and social interaction had fewer children per teacher. Thus, it seems that preschools adjust the child-to-teacher

ratio according to needs in different preschool groups, and thus this ratio is not a meaningful risk indicator in relation to engagement (Samuelsson, Williams & Sheridan, 2015; Swedish National Agency for Education, 2017; Swedish Schools Inspectorate, 2018).

The revised bioecological model developed by Bronfenbrenner and Evans (2000), in which the children are nested within different micro-systems, such as the family, preschool and peer group, guided the approach of this study. Positive links between these systems are assumed to promote better functioning by affecting interactional processes. Preschool teachers reported that they collaborated better with the parents of engaged, interacting children without behavioral problems. Engagement may develop positively depending on the interrelationships between personal and environmental factors (Imms *et al*., 2017; Sommer, Pramling Samuelsson & Hundeide, 2013); for example, more engaged children may have more engaged parents. Preschool teachers' ratings of parents as "engaged" may indicate stable and committed parents, or the fact that teachers prefer, or are better at managing collaboration with, highly engaged parents. According to, Woodard, Kim, Koenig, Yoon & Barry (2010), having engaged and present parents who can develop a secure attachment is an important factor for ensuring young children's mental health and future positive socialization. The pathways in which children showed the lowest levels of engagement and interaction were also connected to low ratings in collaboration with parents. How to support preschool teachers in their collaboration with parents who need to develop their ability to engage with and attach to their child is therefore an important topic for future research. Almqvist *et al*. (2018) showed that preschool teachers work extensively to find strategies for providing individualized support to children with behavioral problems, before involving the parents. However, a first step might be to engage the parents, before the children's issues are formally identified and receive special individualized support.

The present study has some limitations. According to Bergman *et al*. (2003), there is a restricted number of patterns of functioning, which can be organized into a classificatory system and analyzed longitudinally as typical pathways. The majority of children in this study did not follow a significant typical pathway. Despite high coverage in the cluster structure at each time point (10 residue cases over the three time points), only 37% of the children in sample year 1 followed a typical pathway. This is not uncommon, since it cannot be expected that all children in the studied age span will follow homogeneous pathways within the limits of a distinct cluster structure (Bergman, 1998). In a larger sample, the percentage of children included in significant typical pathways might have been larger. However, it is also important to examine how children's memberships may shift along unique pathways of characteristics and behavior over time, due to the complex interaction between individual characteristics and environment (Bergman *et al*., 2003). The rather small sample size was partly due to a high proportion of parents who did not consent to the participation of their children. For ethical reasons, we required informed consent from both parents, which reduced the number of available children. This might have imposed a bias in the study, since it is possible that these children had a different symptomatology compared to those who were included. In the group that did not participate for all 3 years, significantly more children had a mother tongue other than Swedish, and here we may have lost important information. Preschool teachers were instructed to score the children based on their current age. Our interpretation of the children's higher mean age in the well-functioning cluster largely supports Berk's (2013) notion that, in normal child development, function improves with age. For the children aged 1–3 years, the SDQ emotional scale has shown limited validity (Gustafsson *et al*., 2016), but it was still used in this study to enable a comparison of pathways. Another challenge to interpretation is that pathways involving younger children improved in both engagement and interaction over time, which was probably primarily an effect of maturation due to normal development. It can be difficult for preschool teachers to screen a child's developmental age in mixed-age groups, and children with different problems present together in the preschool group. This study is based upon children in preschool environments and the Swedish preschool teachers providing the ratings had professional knowledge (university education) of child development and had known each specific child for at least six months. However, it may also be a limitation that it was preschool teachers and not parents who judged the children's behavior, and that we do not know if the same or different teachers estimated the ratings for several children in the preschool group.

CONCLUSIONS

The stability in young children's pathways regarding mental health was quite high, both for groups identified as well-functioning and for those with problems. Children high in engagement and interaction function well, even in the presence of hyperactivity, while children with low engagement and interaction, alone or in combination with exhibiting hyperactivity and conduct problems, continue to have problems over time. Stability was related to the existence of a larger number of protective or risk indicators, respectively. The results indicate that early interventions need to have a dual focus, including both interventions aimed at enhancing child engagement and interventions focused on decreasing behavior problems. From a long-term perspective, interventions focusing on enhancing engagement seem to be particularly important.

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DECLARATION OF INTEREST STATEMENT

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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