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Research Article

Cumulative risk, center-based childcare and socio-emotional difficulties in early childhood: Evidence from Hungary

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Cumulative risk, center-based childcare and socio-emotional difficulties in early childhood: Evidence from Hungary

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Abstract

BACKGROUND
Although center-based childcare attendance under age 3 is widespread in Europe, there is mixed evidence on its impact on children's socio-emotional well-being.

OBJECTIVE
This study examines whether attendance at Hungarian center-based childcare and the timing of entry into such care influenced the development of socio-emotional difficulties in children growing up during the COVID-19 pandemic. We pay particular attention to the impact of cumulative risks and whether enrollment in center-based care can compensate for their adverse effects.

METHODS
Using the Strengths and Difficulties Questionnaire as a measure, we examine the effects of cumulative sociodemographic risk and center-based childcare attendance on socio-emotional difficulties at age 3 in 2021–2022. Data were drawn from the Cohort '18 Growing Up in Hungary study (n = 5,511). Multivariate associations were tested through logistic regression models. With its follow-up design, the study controls for unobserved heterogeneity and supports causal interpretations from temporal order.

RESULTS
Cumulative risk, independent of all other factors, clearly and strongly increased the odds of socio-emotional difficulties. While internalizing symptoms were reduced by both early (OR = 0.55) and late (OR = 0.63) entry into center-based childcare, externalizing

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symptoms were reduced only by late entry (OR = 0.75). No compensatory effect of center-based childcare attendance for the disadvantaged could be confirmed.

CONCLUSION
The adverse effect of cumulative risk on early socio-emotional difficulties is evident. Attending center-based childcare provides benefits for the socio-emotional well-being of children of diverse social backgrounds.

CONTRIBUTION
This study corroborates that center-based childcare eases children's socio-emotional difficulties; however, its resilience-enhancing role for children facing sociodemographic disadvantages could not be confirmed.

1. Introduction

Across the world, parents are confronted with social and economic disruptions and experience the consequences of structural disadvantages that place strains on family life, such as job insecurity. These structural and economic conditions may shape children's developmental trajectories (Högberg, Baranowska-Rataj, and Voßemer 2023) and their well-being in childhood (Gassman-Pines, Gibson-Davis, and Ananat 2015) and adolescence (Baranowska-Rataj, Högberg, and Bernardi 2024).

Such early life challenges can, in part, be mitigated through resilient family practices and, where available, through compensatory, supportive institutional practices (Walsh 2016). One such institutional resource is center-based childcare, provided that its potential resilience-enhancing effects in early childhood can be demonstrated. In this study, resilience is conceptualized in a wider sense: not only at the level of individual and family strategies of service use (Masten 2018) but also within the broader social and ecological systems that shape institutional availability and patterns of utilization (Folke 2006; Walsh 2016; Masten 2018). Within this framework, center-based childcare can function as a crucial external resource that families strategically mobilize when facing vulnerability or crisis.[4] Thus childcare institutions may become an integral part of families' resilience strategies, enabling them to adapt or even transform their circumstances in institutional ways that support child well-being – particularly during periods of acute disruption, such as the COVID-19 pandemic (Pereirinha and Pereira 2021), which provides the temporal context of our analysis.

[4] Although institutional support, such as the use of center-based care, is clearly part of family resilience processes, it cannot be considered the most important factor (Walsh 2016).

In Hungary, however, despite the potential contribution of center-based childcare to family resilience practices, the prevailing view remains that it is best for a child's development if the mother stays at home during early childhood and does not return to work or take on a new job. A quarter (25.8%) of those who were pregnant with a child born in 2018 believe that a mother should not work until her child is at least 2 years old, and three-fifths (63.2%) believe that a mother should not work until the child is 3 years old or even older (Veroszta et al. 2021). Accordingly, few children attend nurseries – less than one-fifth (17%) of 1- and 2-year-olds (KINCS 2020). All this clearly indicates that the vast majority of the Hungarian population does not perceive any benefits of organized center-based childcare in the early years.

On the other hand, experts on child development in Hungary argue that nurseries – which in Hungary are of relatively high and consistent quality due to detailed and uniform legislation – are not harmful to child development but beneficial, especially for disadvantaged children, as they can help compensate for social disadvantages from an early age (Ferge and Darvas 2012). This argument is in line with international literature, which indicates that attendance in non-parental early childhood education and care (ECEC) during the first three years of life has a positive impact on cognitive skills and language development, particularly for disadvantaged children and especially if the care is of high quality. (See the works of Bradley and Vandell 2007, Melhuish et al. 2015, and van Huizen and Plantenga 2018 for reviews.)

Beyond the benefits for cognitive development, evidence concerning the association between center-based childcare attendance and a child's socio-emotional development is less conclusive (Bradley and Vandell 2007; Melhuish et al. 2015; van Huizen and Plantenga 2018). Some analyses found that participation in ECEC had a positive impact on different indicators of social and emotional well-being; others found that the impact was neutral and in some cases negative. Our analysis seeks to address this inconsistency and to contribute to the existing knowledge on the topic.

Within the concept of social resilience (Keck and Sakdapolrak 2013; Pereirinha and Pereira 2021), the increased provision and utilization of ECEC facilities worldwide can be seen as a coping (helping families overcome existing adversities), adaptive (helping families adapt to future challenges and risks), or transformative (compensating for socioeconomic inequalities) capacity of societies and individuals. In this perspective, the resilience-enhancing function of the institution emerges through its capacity to offset disadvantages in early developmental outcomes, particularly when it's embedded in families' broader coping and adaptation strategies. Socioeconomically disadvantaged and vulnerable families may decide to send their children to center-based childcare to cope with or adapt to existing or anticipated risks, since formal childcare allows parents (particularly mothers) to work in the paid labor market while their children benefit from high-quality early education and care (Gambaro, Stewart, and Waldfogel 2014).

In this paper, we examine how crisis conditions – whether macro social crises or (cumulative) family risks – influence the socio-emotional outcomes of childhood and whether early center-based childcare plays a supportive role, strengthens the resilience of families, and contributes to child outcomes. The subject of our investigation is the social and emotional difficulties of 3-year-old children, and we utilize the broad-band dimensions of internalizing and externalizing symptoms (Achenbach et al. 2016). Internalizing symptoms include problems such as anxiety, depression, social withdrawal, and somatic complaints with no apparent medical cause; externalizing symptoms mainly include behavioral problems, such as impulsive, disruptive, aggressive, and inattentive behavior.

We use data from a cohort study to investigate the effect of center-based childcare on early childhood socio-emotional difficulties. The children included in the study were born in 2018 or 2019; consequently, a substantial part of their early development took place during various waves of the COVID-19 pandemic. The follow-up nature of the study allows us to seek answers to the question of whether and when childcare attendance affects the internalizing and externalizing symptoms of these children by the age of 3. Furthermore, we explore whether center-based childcare attendance plays an attenuating role among children with sociodemographic disadvantages.

Using a less frequently studied socioeconomic background approach that involves vulnerability factors and accounts for disadvantage in a cumulative way, we show that (1) greater sociodemographic cumulative risk is associated with more socio-emotional difficulties for young children; (2) such problems are less pronounced when children attend center-based childcare, especially if they start at a later age; and (3) attending center-based childcare cannot offset social and emotional difficulties that are amplified by cumulative sociodemographic risk.

In the following, we first review the relevant literature and then briefly outline the Hungarian and pandemic contexts. As part of the analytical strategy, we present the sample of the Cohort ’18 Growing Up in Hungary database to be analyzed, as well as the construction of the dependent, independent, and confounding variables. This is followed by a presentation of the results and then a discussion.

2. Literature review

2.1 Socioeconomic status and socio-emotional well-being in early childhood

In the investigation of child outcomes, composite indices of family socioeconomic status (SES) are typically based on the “big three” – household income, occupational status, and parental education – and are often supplemented with additional factors, such as school-

or neighborhood-level SES. This is the case particularly in the context of assessing child development (Hauser 1994). At the same time, extensive international research has consistently demonstrated the detrimental short- and long-term effects of low socioeconomic status on children's socio-emotional well-being (see reviews by Bradley and Corwyn 2002; Poulain, Vogel, and Kiess 2020; Reiss 2013). Socioeconomic and demographic background characteristics serve as critical environmental influences on the development of internalizing and externalizing symptoms in early childhood, alongside parental and child-specific factors (Carneiro, Dias, and Soares 2016).

Similar findings have been yielded by Hungarian studies applying SES measurements. Data from Cohort '18 have revealed correlations between lower parental occupational status and various indicators of early childhood deprivation, including poorer birth conditions, health outcomes, living standards, and quality of care received by children aged 0–18 months (Veroszta 2022). This study also demonstrated that socioeconomic disadvantages and family vulnerabilities are primarily linked to poor parental education, unemployment, low income, Roma ethnicity, residence in underdeveloped regions, and related adverse parental psychosocial and physical characteristics (Veroszta et al. 2022). Additional research using time-use and household budget surveys has highlighted significant social disparities in early home-based human capital investment (Hajdu, Kertesi, and Kézdi 2022). Furthermore, a greater prevalence of developmental problems – including social, psychological, fine motor, mental, and behavioral issues – was observed among children from low-income families (Hajdu and Kertesi 2023).

2.2 Cumulative risk index approach

Recently, cumulative risk indices have been increasingly used instead of individual background-related variables. A substantial body of literature on cumulative risk highlights the fact that exposure to multiple risk factors leads to more adverse developmental outcomes than exposure to a single risk factor (Evans, Li, and Whipple 2013). This approach aligns with the bioecological model of human development (Bronfenbrenner and Morris 1998), which posits that disruptive environmental characteristics can interact with and exacerbate one another, exerting a significant influence on early childhood development. Furthermore, as a result of the economic crisis, especially as a consequence of the Great Recession, social inequalities usually increase parallel in several areas, which draws attention to the importance of multidimensional, cumulative measurement of life circumstances (OECD 2011).

In contrast to studies employing either single or composite SES measures, our approach adopts the risk index framework, which has been widely applied and proved to

be effective for modeling children's social, behavioral, and health development. In their seminal work, Sameroff et al. (1987) demonstrated that, with respect to cognitive outcomes in childhood, the cumulative effects of multiple risk factors increase substantially the likelihood of compromised development.[5] Unlike composite SES measures, the cumulative sociodemographic risk index captures the accumulation of disadvantages, which are often determined less by classical socioeconomic indicators than by the presence of multiple risks.

This approach is also better suited to our specific outcome, early socio-emotional difficulties, where risk factors may exert different weights than traditional SES components (Davis et al. 2010). While SES composites primarily reflect social hierarchy, the sociodemographic risk index more sensitively incorporates dimensions of childhood vulnerability and crisis periods, which is central to our focus. (For application on health outcomes, see Iguacel et al. 2018.)

The concept that multiple social risks exert a stronger cumulative impact on child outcomes than any single factor has been corroborated across multiple domains. For instance, this approach has been applied to the study of children's health status (Larson et al. 2008) and, more specifically, to cognitive delay in infancy (Cheng et al. 2014). The additive model of cumulative risk factors has shown its worth in predicting socio-emotional development in infancy (Lobermeier et al. 2022) and middle childhood (Hogye et al. 2022; Lima et al. 2010; Wustmann Seiler et al. 2022), as well as in predicting externalizing problems in middle childhood (Deater-Deckard et al. 1998) and adolescence (Appleyard et al. 2005). Prior research further indicates that cumulative SES risk explains significant variance in children's socio-emotional outcomes even after accounting for additional intervening variables such as parental depression (Sullivan et al. 2019).

2.3 Center-based childcare attendance and socio-emotional well-being in early childhood

Previous review studies have shown that although participation in high-quality ECEC during the first three years of life has a positive impact on cognitive skills and language development, particularly among disadvantaged children, it may also increase the risk of behavioral problems (Bradley and Vandell 2007; Melhuish et al. 2015; van Huizen and Plantenga 2018). The effect on social and emotional well-being of attending center-based care was less favorable if the care was of lower quality, was in a group setting, started before the child reached the age of 1, or was for 30 or more hours per week.

[5] Importantly, the multiple risk index accounted for a greater proportion of variance in developmental outcomes than any single risk factor in isolation, including socioeconomic status.

Recent birth cohort studies have examined the relationship between center-based childcare attendance and socio-emotional well-being in early childhood, exploring the predictive and moderating effects of such care. Studies from Germany have shown that ECEC attendance has a beneficial effect on social skills by age 3 (Felfe and Lalive 2013) and on peer problems by age 5 (Ghirardi et al. 2023). Furthermore, data from the United Kingdom showed that universal take-up of center-based care between the ages of 2 and 3 years reduced inequality in socio-emotional difficulties created by parental education and lone parenthood (Green et al. 2021). A Norwegian study was also consistent with these findings, showing that ECEC cushions the adverse effect of changes in income-to-needs ratios on internalizing problems in early childhood (Zachrisson and Dearing 2015). However, studies conducted in Finland (Tervahartiala et al. 2024) and France (Berger, Panico, and Solaz 2021) showed a negative impact on socio-emotional well-being. More specifically, Tervahartiala et al. (2024) found that children attending center-based childcare had a higher level of internalizing problems at the age of 2 than children who were cared for at home, while no differences were observed for externalizing symptoms or social competence. The study by Berger, Panico, and Solaz (2021), on the other hand, showed elevated levels of behavioral problems by the age of 2 among children who were receiving center-based care at the age of 1, with a pronounced impact observed among more advantaged children. In a study by Paquin et al. (2020), no association was found between formal childcare attendance and internalizing and externalizing problems among children living in Quebec. However, participation in formal childcare reduced the impact of symptoms of depression observed in the mother – when her child was 3.5 years old – on the child's mental health at age 5. As well as possible variations in the quality of care, differences in the age at which the children in these studies entered center-based care and in the number of hours per week they attended may account for the different findings.

The quality of childcare is particularly important in terms of its impact and may be a critical factor in the mixed results (van Huizen and Plantenga 2018). Higher-quality formal childcare may protect against the detrimental effects of early childhood risk on mental health problems, whereas lower-quality childcare seems to exacerbate them (Wilhelmsen et al. 2023). The way that high quality in regular ECEC can protect against cumulative early family risks has also been demonstrated (Wustmann Seiler et al. 2022). Center-based childcare is considered to be of high quality if caregivers are responsive, affectionate, and readily available; if they are well trained and committed to their work; if ratios and group sizes allow appropriate interactions; if the curriculum is developmentally appropriate; if there is continuity and stability in the quality of care, maintained by supervision and staff development; and if the facility is safe, sanitary, and accessible to parents (Melhuish et al. 2015).

It should also be noted that systematic selection into center-based childcare has been demonstrated across the studies: The children of parents with higher education and a

higher income are more likely to attend center-based childcare (Berger, Panico, and Solaz 2021; Felfe and Lalive 2013; Paquin et al. 2020; Tervahartiala et al. 2024).

In Hungary, there is a lack of studies investigating the socio-emotional impact of early center-based childcare. One exception is the work of Bass, Darvas, and Szomor (2012), who investigated children born in 1982 in the capital, Budapest. They found that those who had started to attend center-based care by the age of 1 had higher scores on intelligence tests than those who had not – albeit with a greater prevalence of behavioral problems. However, the small sample size meant that this analysis could not take account of the role of socioeconomic background. Another study examined parental perceptions of the impact of formal childcare among those whose children started such care in 2011 (Nyitrai and Kontra 2015). It found that about 70% of parents believed that center-based childcare had a positive impact on their child's social relationships.

Overall, the evidence from the literature reviewed above indicates that center-based, high-quality, non-parental childcare in the early years may have a positive impact on socio-emotional well-being and may also moderate socioeconomic differences in children's socio-emotional development, although some findings are not consistent with this conclusion. According to Felfe and Lalive (2013), the possible underlying mechanisms include an increase in the average quality of maternal care and a rise in maternal earnings among those utilizing center-based childcare.

2.4 The Hungarian childcare system

In Hungary, children under the age of 3 are usually cared for by their mothers, who receive family support benefits; this is in line with prevailing social attitudes (Makay 2018). Parental leave is long, and the payment is meant to compensate for the loss of earnings. During the first 24 weeks after the birth, women receive full wage compensation (maternal leave benefit). In the period 6–24 months after the birth, the mother or father receives benefits valuing 70% of their previous earnings (up to twice the current minimum wage). After the child turns 2 and up until their third birthday, the mother receives a much lower flat-rate payment. This is also available to those who were not employed before they had children and did not pay social security contributions. Importantly, those with jobs must be taken back by employers after finishing parental leave.

In addition to supporting mothers to stay at home during the early years, the system also provides strong financial incentives to return to the labor market. Although women may not be employed in the first 24 weeks after the birth, once the child is six months old, a parent can return to work, and parents are still entitled to the compensation allowance even if they start or resume work (Makay 2021). It is a reflection of the

generosity of the parental leave system – as well as prevailing views about raising a young child using center-based childcare – that the employment rate for mothers with young children is remarkably low: In 2019 (when the children in the Cohort '18 study turned 1), only 9.7% of mothers with children under 2 were employed (Makay 2021).

ECEC in Hungary is regulated by the Child Protection Act.[6] Age-appropriate formal childcare is available to children between the ages of 20 weeks and 3 years and is primarily taken up by those whose caregivers are working, studying, or unable to care for them due to illness or another reason. Children over the age of 3 are obliged to attend preschool (*óvoda*).

Since 2017, childcare has been provided in four types of nurseries (*bölcsőde*) and in two types of substitute childcare: daytime childcare (*napközbeni gyermekfelügyelet*) and alternative daycare (*alternatív napközbeni ellátás*) (HCSO 2019a). Nurseries include the mainly state-funded customary (normal) and mini nurseries and the privately organized family and workplace nurseries. In 2019, the vast majority of children who attended a nursery (n = 45,889) were enrolled in a customary (84.1%) or family (12.4%) nursery; only 3.4% and 0.1% of children attended a mini or workplace nursery (HCSO 2019a). Most of the children enrolled in a nursery in spring 2019 were 2 years old (58.5%). Because preschools often do not enroll children as soon as they turn 3, a significant proportion (29.1%) were at least 3 years old. Meanwhile 12% were 1 year old, and only 0.3% were younger than that (HCSO 2019b).

The quality of formal childcare in Hungary is relatively high and consistent, and standards are put forth in detailed and uniform legislation. Childcare in nurseries is provided by early childhood educators (with relevant post-secondary or tertiary education), nannies, or childminders. Their qualifications are set out in law, as are the physical environment, the group sizes, and the caregiver-to-child ratios.[7,8] Customary nurseries have a maximum of 12 children per group (or 14 if all the children are at least 2 years old); mini nurseries and workplace nurseries have a maximum of seven children per group (or eight if all the children are at least 2 years old). Family nursery groups have a maximum of five or seven children (depending on whether there is one caregiver or two). Based on the regulations, caregiver-to-child ratios can vary from 1:3.5 to 1:7, with statistical data showing an average of four to five children per adult caregiver (HCSO 2019b). This ratio is higher than international recommendations (1:3; see Melhuish et al. 2015) for those 0 to 2 years old but is in line with the recommended 1:4 or 1:5 ratio for those 2 to 3 years old. Childcare in nurseries follows a national core program (Magyar

[6] 1997. évi XXXI. törvény a gyermekek védelméről és a gyámügyi igazgatásról.
[7] 15/1998. (IV. 30.) NM rendelet a személyes gondoskodást nyújtó gyermekjóléti, gyermekvédelmi intézmények, valamint személyek szakmai feladatairól és működésük feltételeiről.
[8] 6/2016. (III. 24.) EMMI rendelet a személyes gondoskodást nyújtó gyermekjóléti, gyermekvédelmi intézmények, valamint személyek szakmai feladatairól és működésük feltételeiről szóló 15/1998. (IV. 30.) NM rendelet módosításáról.

Bölcsődék Egyesülete 2023). According to this program, the aims of childcare in nurseries include:

- to help children acquire optimal behavior and the ability to adapt to changes in their cultural environment,
- to provide protection and preventive activities for children who are at risk; abused; neglected; in need of early development, care, or special education; permanently ill; or exposed to harmful environmental or social influences,
- to contribute to improving the quality of life for families and to increasing employment opportunities for parents.

In recent years, significant improvements have been made to the availability of nurseries, with 50,208 nursery slots available for families by 2020. Some 30,578 children under the age of 3 were attending nursery, which accounted for 17.1% of all children aged 1 and 2. But the system also faces structural problems, with a tenth of places not being filled. At the same time, a fifth of children (22%) live in a settlement without a nursery, urban–rural and regional disparities are significant (HCSO 2021), and fewer nursery slots are available in small villages and poorer areas (Baranyai 2023). In addition, although the Child Protection Act covers other groups as well, it is predominantly the children of mothers returning to the labor market who attend childcare centers (Keller 2018; Makay 2011; Ökrös et al. 2023). Given the difficulties that non-working, disadvantaged mothers in small settlements have in accessing childcare, the potential leveling-up effect of nurseries is less likely to be realized (Keller 2018). This effect is also hampered by the fact that mothers who have higher education and who live in central regions and urban settlements are more inclined to use childcare facilities (Kapitány 2020). Furthermore, regarding the affordability of nurseries, with a few exceptions – such as families with children receiving regular child protection benefits or those that have three or more children – access to nurseries is subject to a state-regulated fee.[9] According to the law, the fee for customary and mini nurseries may not exceed 20%–25% of the family's net per capita income, or 50% in the case of family nurseries. In practice, compared to the EU average, the monthly fees for customary nurseries are typically very low, while family nurseries are quite expensive (Baranyai 2023).

[9] 1997. évi XXXI. törvény a gyermekek védelméről és a gyámügyi igazgatásról.

2.5 The COVID-19 pandemic

As our study follows a cohort of children whose early development took place during the COVID-19 pandemic in Hungary, it is important to briefly introduce this contextual background. Beginning in early 2020, the COVID-19 pandemic and the measures introduced to limit its spread had a profound impact on the daily lives of families across the globe. In Hungary, the first coronavirus cases were registered on March 4, 2020. A few days later, the government declared a state of emergency and implemented lockdown measures, including remote learning, self-quarantine, and the prohibition of social gatherings. The pandemic and the related containment measures gave rise not only to a health crisis but also to a socioeconomic one, including deteriorating economic performance and an increase in the unemployment rate (Kovács et al. 2020). The first epidemic wave in Hungary was marked by relatively low infection rates, whereas the highest numbers of cases and deaths were recorded at the peak of the third wave, in spring 2021, when mass vaccination also began (Uzzoli et al. 2021).

The pandemic had a negative impact on the mental health of the general population, including children and young adults (see Di Fazio et al. 2022 and Bevilacqua et al. 2023 for reviews). The burden on the mental health of mothers and the development of young children has also been emphasized (see Penna et al. 2023 for a review). Furthermore, a slight deterioration in young children's personal-social (Johnson et al. 2024) and social cognition skills (Scott, Nguyentran, and Sullivan 2024) has been observed. This negative impact was more pronounced for low SES children and might be explained by changes in the quality and quantity of parent–child and peer interactions, which were affected by caregivers' elevated stress levels, social distancing, and childcare center closures (Scott, Nguyentran, and Sullivan 2024).

Although our study does not investigate formal childcare, children's well-being, or the connection between the two from the perspective of family resilience by comparing pre- and post-COVID cohorts, this broader context should be considered when interpreting the findings.

3. Objectives

This study has three primary objectives. First, we aim to demonstrate the negative impact of cumulative sociodemographic risk on children's socio-emotional well-being. Although the association between multiple socioeconomic risk factors and children's well-being is well-known in the literature, this association has not yet been examined using representative Hungarian data. Second, we examine whether attending center-based childcare has a positive or negative impact on children's socio-emotional well-

being while also taking into consideration the age of entry into such care. With this aim, we seek to contribute to clarifying the mixed findings on the influence of center-based childcare on internalizing and externalizing symptoms in early childhood. Lastly, we ask whether center-based childcare has a differential effect. Specifically, we examine whether it is more supportive for families with greater cumulative risk, thereby playing a resilience-enhancing role by mitigating the socio-emotional disadvantages associated with cumulative sociodemographic risk. We also provide descriptive evidence on the relationship between cumulative sociodemographic risk and the likelihood of attending center-based childcare, thereby highlighting selection into care.

By addressing those objectives among children raised during the COVID-19 pandemic, this study provides fresh insight into the role of early childcare in supporting the socio-emotional well-being of children who face varying levels of sociodemographic risk, compounded by the challenges of a global crisis. Consequently, the study makes a significant contribution to the field of social science by offering insight into whether providing nursery care in the early years, and increasing access to such care, can have a beneficial effect on the mental health of children and furthermore whether it can serve to mitigate the detrimental effect of cumulative sociodemographic risk on the mental well-being of young children.

4. Data and methods

4.1 Study sample and design

This study utilizes data from the Cohort ’18 Growing Up in Hungary study, conducted by the Hungarian Demographic Research Institute (HDRI). The dataset is constructed from multiple data collection waves and is representative of women who gave birth in 2018 in terms of educational attainment, parity, marital status, age, and the developmental index of the mother’s place of residence. Participants in the study were women sampled during their second trimester of pregnancy between April 2018 and April 2019. The database is weighted accordingly to ensure representativeness. Detailed descriptions of the survey design, sampling, and weighting procedures are provided in previous publications (Szabó 2021; Veroszta et al. 2020).

Participation in the study was voluntary, and written informed consent was obtained from all participants. The research methodology adhered to the principles of the Helsinki Declaration and the Code of Ethics of the Hungarian Psychological Association. The study was reviewed and approved by an independent ethics committee established for the Cohort ’18 study (reference number 2022/1), which included professionals external to the research group.

This analysis is based on data from the first, second, fourth, and fifth waves of the Cohort ’18 study. Recruitment and data collection during the first two waves were conducted by local health visitors trained by HDRI. These data collections occurred during the third trimester of pregnancy and when the child was six months old (between January 2018 and November 2019 – i.e., before the pandemic) using both computer-assisted and paper-assisted personal interviews (CAPIs and PAPIs), as well as self-administered paper-pencil questionnaires. Data collection for the fourth and fifth waves was performed by professional interviewers after the outbreak of the COVID-19 pandemic. In the fourth wave, data were gathered via computer-assisted telephone interviews (CATIs) when the child was aged 25–30 months (between October 2020 and September 2021), while the fifth wave employed CAPIs and a self-administered questionnaire when the child reached 36 months (between May 2021 and June 2022).

The initial sample for this study was derived from the longitudinal dataset of biological mothers of 3-year-old children (n = 5,946) – i.e., from the fifth wave of the Cohort ’18 study. Cases where respondents, as the main caregivers, were not the biological mother of the child at six or 18 months of age (n = 5), where data were observed to be missing for the Strengths and Difficulties Questionnaire (SDQ) after data imputation (n = 17), and where respondents had no data on nursery attendance (n = 414) were excluded; this resulted in an analytical sample of 5,511 mother–child pairs. In cases of twin pregnancies, data for the firstborn child was analyzed (n = 68). As no imputation was applied for missing data other than for the SDQ, the sample size varies across different analyses.

The mean age of the children at the time of data collection in the fifth wave was 36.7 months (SD = 0.8). These children were between 1 and 2 years old when the COVID-19 pandemic broke out in Hungary. Consequently, a considerable part of their early development coincided with the COVID-19 crisis.

4.2 Variables

4.2.1 Dependent variables

Dependent variables included children’s internalizing and externalizing symptoms when they were 3 years old. These socio-emotional difficulties were assessed by the SDQ for 2- to 4-year-olds (Goodman 1997; Hungarian adaptation: Birkás et al. 2008), which was administered during the fifth wave of the Cohort ’18 study with verbal responses. From the questionnaire, 20 items, consisting of four hypothesized subscales – emotional symptoms, conduct problems, hyperactivity/inattention, and peer relationship problems – were analyzed. Each subscale comprises five items, which are rated on a three-point

Likert-type scale (0 = not true, 1 = somewhat true, 2 = certainly true). When calculating aggregated scores, missing values were replaced by the mean of the responses to the other questions in the same subscale, provided that at least three items in the given subscale were answered. As recommended by Goodman, Lamping, and Ploubidis (2010) for low-risk samples, items representing internalizing problems (emotional symptoms and peer problems) and externalizing problems (conduct problems and hyperactivity/inattention) were summed to compute raw total scores for each, ranging from 0 to 20. Both the internalizing (Cronbach's $\alpha = 0.70$) and the externalizing (Cronbach's $\alpha = 0.70$) subscales had good internal consistency. Scores on both scales were relatively low, reflecting the low risk of the sample. Internalizing symptoms (M = 3.39, SD = 3.10, Mdn = 3, skewness = 1.41, kurtosis = 2.25) were less frequent and exhibited greater deviation from normality compared to externalizing symptoms (M = 7.54, SD = 3.73, Mdn = 7, skewness = 0.17, kurtosis = –0.48). From the aggregated continuous scores, dichotomous variables indicating high levels of internalizing and externalizing symptoms were calculated. In the absence of population-specific norms, the top 20% of children were identified as having significant symptoms. This resulted in 19.9% of children (n = 1,097; score $\geq$ 6) in the analytical sample being classified as having internalizing difficulties and 22.5% of them (n = 1,240; score $\geq$ 11) being identified as having externalizing difficulties.

4.2.2 Independent variables

The research employs the cumulative risk concept, along with a continuous variable derived from it, as the primary independent variable. The theoretical foundation for the cumulative risk factor is based on evidence suggesting that exposure to multiple risk factors during childhood has a more significant adverse impact on development than exposure to singular risk factors (Evans, Li, and Whipple 2013). In this study, cumulative risk serves as the metric for assessing multiple socioeconomic and demographic risks.

To conceptualize cumulative risk, we drew upon the risk factors identified in previous systematic literature reviews (Carneiro, Dias, and Soares 2016; Reiss 2013) of internalizing and externalizing symptoms in early childhood, as well as on previous Hungarian results regarding family adversity and child outcomes (Veroszta 2022). From the dataset available, we selected 11 socioeconomic and demographic environmental and parental variables, all reported by mothers during the first or second wave of data collection. (See Table 1 for definitions and frequencies.) These variables were operationalized to create the cumulative risk index by dichotomizing each factor (0 = no risk; 1 = risk), giving children one point for the presence of each sociodemographic risk, and then summing the dichotomous scores to form a continuous cumulative risk measure

(Cronbach's α = 0.70). The cutoff points for dichotomization of risk components were chosen on the basis of previous literature and sample size considerations. Children were exposed to between 0 and 9 of the 11 assessed sociodemographic risk components, with a mean score of 1.91 (SD = 1.93). The median value was 1, indicating that at least half of the participants were exposed to one or no risk factors. The distribution of the index showed slight deviations from normality, as indicated by the skewness (1.12) and kurtosis (0.68) values.

Although used as a continuous variable in the explanatory models, the cumulative risk index was transformed into an ordinal variable for bivariate analysis, with categories exhibiting low cell counts (the presence of six or more factors) collapsed (see Table 4).

Table 1: Definitions and prevalence of risk factors

Risk factor	Definition of high risk	Prevalence of risk on the analytical sample (n = 5,511)
		n (%)
Low maternal education [w1]	Less than secondary level[a]	1,602 (29.1)
Low paternal education [w1]	Less than secondary level[a]	2,197 (39.9)
Low cultural capital [w1]	Fewer than 50 books in household	1,821 (33.0)
Financial pressure [w1]	Subjective household income level: poor	508 (9.2)
Disadvantaged region of residence [w1]	Residence in eastern Hungary	1,967 (35.7)
Ethnicity of mother [w2]	Roma by self-declaration	332 (6.0)
Paternal unemployment [w1,2]	Father unemployed in perinatal period	183 (3.3)
Intensity of maternal employment [w1,2]	Mother had no work experience until perinatal period	443 (8.0)
Does not own property [w1]	Family not living in a property it owns	1,062 (19.3)
Young maternal age [w1]	Mother younger than 20 at time of birth	260 (4.7)
Single mother [w1,2]	Mother had no partner in perinatal period	145 (2.6)

[a] ISCED 0–2, based on the International Standard Classification of Education 2011 (UNESCO Institute for Statistics 2012).
[w1] Measured at wave 1 during pregnancy.
[w2] Measured at wave 2 when child was six months old.
[w1,2] Measured at wave 1 or wave 2 – i.e., the risk factor was present during pregnancy and/or at six months.

To examine the potential compensatory effect of center-based childcare on cumulative sociodemographic risk, we constructed a variable for nursery attendance between the ages of 6 and 35 months. This variable was derived from maternal reports from the fourth and fifth waves concerning the child's age at enrollment in center-based care. Based on the responses, we categorized nursery attendance into three groups. The majority of children in the sample (63.9%) did not attend nursery until they were 3 years old. Early nursery entry – defined in the Hungarian context as attendance between 6 and 18 months of age – was relatively rare, occurring in only 7.5% of the sample. Additionally, 28.6% of children entered center-based care after 18 months of age.

Table 2: Distribution of nursery attendance up to 35 months of age

Nursery attendance	n	%
Non-attendance	3,523	63.9
From 6 to 18 months	412	7.5
From 19 to 35 months	1,577	28.6
Total	5,511	100.0

4.2.3 Confounding variables

Confounding variables were selected based on their potential to influence both the independent and dependent variables and were collected during the first (third trimester of pregnancy) and/or second wave (six months postpartum), thus covering the perinatal period. To limit bias from unmeasured selection, we also controlled for nursery attendance preference during pregnancy. The data from Growing Up in Hungary is unique in international comparison, since it includes prenatal measures; this allows us to take account of pregnancy intentions, depression symptoms reported during pregnancy, and the socioeconomic background into which the child is born.

Most variables were binary coded, with the exception of parity (coded into three categories). Dummy coding was applied where relevant. Maternal depression symptoms were assessed by the eight-item version (CES-D-8; Bracke, Levecque, and Van de Velde 2008) of the Center for Epidemiologic Studies depression scale (Radloff 1977; Hungarian version: Szeifert 2010). Depression symptoms were identified on the basis of the CES-D-8 total score ≥ 8 either during pregnancy (Cronbach's $\alpha = 0.75$) or six months after birth (Cronbach's $\alpha = 0.78$). Children's negative affectivity was assessed using five items on the Infant Behavior Questionnaire-Revised-Very Short Form (IBQ-R-VSF; Putnam et al. 2014; Hungarian version: Lakatos, Tóth, and Gervai 2014) at six months of age (Cronbach's $\alpha = 0.72$). The top 20% of children based on the total score were identified as having high levels of negative affectivity.

Table 3: Descriptive statistics of confounders on the analytical sample (n = 5,511)

	n	%
Maternal characteristics		
Parity of mother during pregnancy [w1]		
Expecting 1st child	2,587	46.9
Expecting 2nd child	1,845	33.5
Expecting 3rd or subsequent child	1,074	19.5
Missing value	5	0.1
Unplanned pregnancy declared during pregnancy [w1]		
Yes	604	11.0
No	4,907	89.0
Preference for nursery attendance during pregnancy [w1]		
Yes	2,620	47.5
No	2,667	48.4
Missing value	224	4.1
Maternal depression symptoms in the perinatal period [w1,2]		
Yes	1,267	23.0
No	4,188	76.0
Missing value	55	1.0
Child characteristics		
Child's sex [w2]		
Boy	2,868	52.0
Girl	2,643	48.0
Low birthweight (< 2,500 grams) [w2]		
Yes	328	6.0
No	5,182	94.0
High level of negative affectivity at 6 months [w2]		
Yes	1,083	19.7
No	4,241	76.9
Missing value	187	3.4
Family relocation within 6 months of birth [w2]		
Yes	588	10.7
No	4,923	89.3

[w1] Measured at wave 1 during pregnancy.
[w2] Measured at wave 2 when the child was six months old.
[w1,2] Measured at wave 1 or wave 2 – i.e., significant depression symptoms were present during pregnancy and/or at six months.

4.3 Data analyses

To examine the bivariate associations between cumulative sociodemographic risk, nursery attendance, and children's socio-emotional outcomes at age 3, cross-tabulations were computed. As socio-emotional outcomes, significant internalizing and externalizing symptoms were analyzed separately, as reflected by the dichotomous variables based on SDQ scores. Pearson's chi-squared tests were applied to assess the relationship between categorical variables, and Cramer's V was used as a measure of effect size, interpreted considering the degrees of freedom (Cohen 1988).

Logistic regression was employed to examine the independent and joint effects of the two key variables – cumulative risk and center-based childcare attendance – on socio-emotional difficulties – i.e., the odds of having significant internalizing and externalizing symptoms. To identify the pure effect of the two key variables, it is of great importance to control for social and individual characteristics that may influence the emergence of difficulties. Furthermore, to assume causality, it is paramount that the measurement of the control factors should precede in time the measurement of the two factors of interest (time order criterion; cf. Ní Bhrolcháin and Dyson 2007). Since the first wave of data collection took place in the seventh month of pregnancy (Veroszta et al. 2021), explanatory models can account for the circumstances of pregnancy. Furthermore, child characteristics measured at the second wave (child aged six months) also account (albeit only partly) for heterogeneity in a child's behavior before enrollment in center-based care. For both dependent variables, internalizing and externalizing symptoms, three models were tested. Model 1 tested the effect of cumulative risk on socio-emotional difficulties, adjusted for confounding variables. Model 2 expanded on Model 1 with the effect of center-based childcare attendance; Model 3 also included the interactions between cumulative risk and center-based childcare attendance.

All analyses were conducted using SPSS Statistics 25.

5. Results

5.1 Bivariate associations

Nursery attendance before the age of 3 was markedly less common among children with higher levels of cumulative risk (Table 4). While 45.5% of children with no risk factors attended nursery (7.6% between 6 and 18 months and 37.9% between 19 and 35 months), this proportion decreased progressively with increasing risk exposure, reaching only 4.8% among those with six or more risk factors. A clear risk gradient was also observed for socio-emotional outcomes. Internalizing symptoms at age 3 were reported for 12.3% of children without any risk factors, whereas the prevalence increased steadily with the number of risks, peaking at 50.4% among those with six or more. Similarly, externalizing symptoms were present in 14.0% of children with no risk factors but affected 43.8% of those with six or more.

Chi-squared tests indicated significant, strong associations between the cumulative number of risk factors and each outcome: nursery attendance ($\chi^2(12) = 415.18$, $p < 0.001$, Cramer's V = 0.194), internalizing symptoms ($\chi^2(6) = 397.57$, $p < 0.001$, Cramer's V = 0.269), and externalizing symptoms ($\chi^2(6) = 261.40$, $p < 0.001$, Cramer's V = 0.218).

Table 4: Distribution of nursery attendance and socio-emotional difficulties by the number of sociodemographic risk factors (n = 5,511)

Number of risk factors	Nursery attendance			Internalizing symptoms		Externalizing symptoms	
	From 6 to18 months	From 19 to 35 months	Non-attendance up to age 3	No	Yes	No	Yes
	row (%)			row (%)		row (%)	
0	7.6	37.9	54.5	87.7	12.3	86.0	14.0
1	9.1	35.3	55.6	86.1	13.9	82.9	17.1
2	8.9	29.9	61.3	82.3	17.7	77.1	22.9
3	7.6	22.9	69.5	76.8	23.2	71.6	28.4
4	6.8	14.7	78.5	72.2	27.8	67.0	33.0
5	3.1	5.9	91.0	60.6	39.4	61.7	38.3
6+	1.3	3.4	95.2	49.6	50.4	56.2	43.8
Total	7.5	28.6	63.9	80.1	19.9	77.5	22.5

Table 5 shows the associations between nursery attendance and socio-emotional difficulties at age 3. Internalizing symptoms were more frequently observed among children who did not attend nursery by age 3 (24.1%) compared to those who entered between 6 and 18 months (12.4%) or between 19 and 35 months (12.4%). A similar, though less pronounced, pattern was found for externalizing symptoms: prevalence was 25.2% among non-attenders compared to 24.3% for children entering between 6 and 18 months and 16.0% for those entering between 19 and 35 months.

Chi-squared tests indicated significant and weak associations both for internalizing ($\chi^2(2) = 109.27$, $p < 0.001$, Cramer's $V = 0.141$) and externalizing symptoms ($\chi^2(2) = 54.06$, $p < 0.001$, Cramer's $V = 0.099$). The results suggest that nursery attendance before the age of 3, particularly for those entering between 19 and 35 months, was associated with a lower prevalence of socio-emotional difficulties at age 3.

Table 5: Distribution of socio-emotional difficulties at age 3 by nursery attendance (n = 5,511)

Nursery attendance	Internalizing symptoms		Externalizing symptoms	
	No	Yes	No	Yes
	row %		row %	
From 6 to 18 months	87.6	12.4	75.7	24.3
From 19 to 35 months	87.6	12.4	84.0	16.0
Non-attendance up to age 3	75.9	24.1	74.8	25.2
Total	80.1	19.9	77.5	22.5

5.2 Multivariate analysis

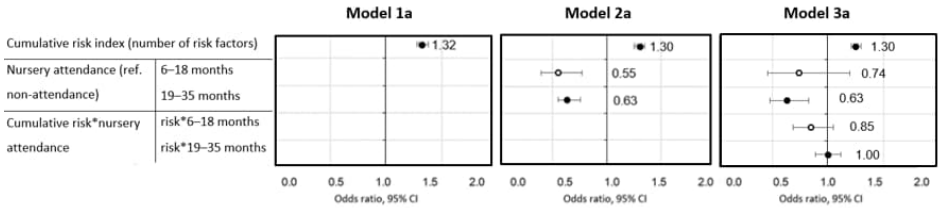
Multivariate analysis (logistic regressions) examined the odds of having significant internalizing and externalizing symptoms at the age of 3 (see Figures 1 and 2 for results). First, it was demonstrated that a one-unit increase in cumulative sociodemographic risk was associated with a 1.3-fold increase in the odds of exhibiting internalizing and externalizing symptoms, after controlling for various child and maternal characteristics (Models 1a and 1b).

Second, the effect of center-based childcare attendance was somewhat different in terms of internalizing and externalizing difficulties. It reduced the odds of having internalizing symptoms by 0.6 times, regardless of age at enrollment (Model 2a), whereas it reduced the odds of externalizing symptoms by 0.8 times only when center-based childcare commenced between 19 and 35 months (Model 2b). In other words, while internalizing difficulties are reduced by attending center-based childcare, externalizing difficulties are reduced by the timing of childcare enrollment.

Third, the moderating role of center-based childcare on the relationship between cumulative risk and socio-emotional difficulties was not confirmed, given the non-significant interaction between cumulative risk and center-based care attendance (Models 3a and 3b). The complete set of regression tables, including estimates for all control variables, are presented in the appendix (see Tables A-1 and A-2).

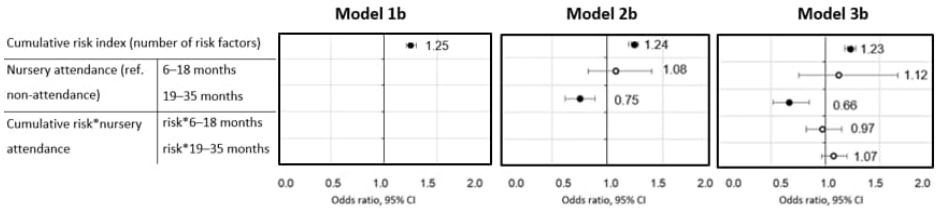
Nevertheless, it is worth noting that examining the interaction effects reveals a subtle indication of a link between cumulative risk and center-based childcare attendance, with differential impacts on internalizing and externalizing symptoms. In Model 3a, introducing the interaction caused the previously significant effect of early childcare attendance (6–18 months) on internalizing difficulties to become non-significant. Nonetheless, early attendance appears to have a greater effect in reducing internalizing symptoms for children facing higher cumulative risks, as shown by the odds ratio, though this effect is uncertain (OR = 0.85, 95% CI: 0.69, 1.05) and does not reach significance ($p = 0.130$). For externalizing symptoms, late attendance (19–35 months) continues to show a protective effect in both Model 2b (OR = 0.75) and Model 3b (OR = 0.66). However, when interaction effects are included, the positive impact of late attendance is reduced slightly for children from disadvantaged backgrounds (OR = 1.07, 95% CI: 0.97, 1.20; $p = 0.184$), suggesting that late childcare attendance might offer greater benefits for children from more advantaged backgrounds.

Figure 1: Effects of cumulative risk and center-based care attendance on internalizing symptoms, controlled for confounders



Notes: All models are adjusted for parity of mother during pregnancy, unplanned pregnancy declared during pregnancy, preference for nursery attendance during pregnancy, maternal depression symptoms in the perinatal period, child's sex, low birthweight, high level of negative affectivity at six months, and family relocation within six months of the birth. Model parameters for internalizing symptoms (n = 5,098): Model 1a: –2LL = 4646.63, R^2 = 0.070 (Cox and Snell), 0.112 (Nagelkerke), $\chi^2(10) = 369.30$, $p < 0.001$. Model 2a: –2LL = 4615.95, R^2 = 0.076 (Cox and Snell), 0.121 (Nagelkerke), $\chi^2(12) = 399.98$, $p < 0.001$. Model 3a: –2LL = 4613.59, R^2 = 0.076 (Cox and Snell), 0.122 (Nagelkerke), $\chi^2(14) = 402.34$, $p < 0.001$.

Figure 2: Effects of cumulative risk and center-based care attendance on externalizing symptoms, controlled for confounders



Notes: All models are adjusted for parity of mother during pregnancy, unplanned pregnancy declared during pregnancy, preference for nursery attendance during pregnancy, maternal depression symptoms in the perinatal period, child's sex, low birthweight, high level of negative affectivity at six months, and family relocation within six months of the birth. Model parameters for externalizing symptoms (n = 5,098): Model 1b: –2LL = 5061.51, R^2 = 0.057 (Cox and Snell), 0.087 (Nagelkerke), $\chi^2(10) = 296.06$, $p < 0.001$. Model 2b: –2LL = 5048.55, R^2 = 0.059 (Cox and Snell), 0.091 (Nagelkerke), $\chi^2(12) = 309.02$, $p < 0.001$. Model 3b: –2LL = 5046.61, R^2 = 0.060 (Cox and Snell), 0.091 (Nagelkerke), $\chi^2(14) = 310.96$, $p < 0.001$. Models 2b and 3b were also examined with nursery attendance from 19 to 35 months as the reference group. Children who did not attend (Model 2b: OR = 1.34, 95% CI: 1.13, 1.60, p = 0.001; Model 3b: OR = 1.51, 95% CI: 1.17, 1.93, $p < 0.001$) or who attended nursery earlier (Model 2b: OR = 1.45, 95% CI: 1.09, 1.92; p = 0.001; Model 3b: OR = 1.69, 95% CI: 1.11, 2.58, p = 0.015) were more likely to have externalizing problems than those who attended nursery from 19 to 35 months.

6. Discussion and conclusion

This study has examined the effects of cumulative sociodemographic risk, as well as attendance and timing of enrollment in center-based childcare, on the development of socio-emotional difficulties in young children in Hungary raised during the COVID-19 pandemic. Furthermore, we have investigated whether participation in, and timing of,

center-based childcare might mitigate the socio-emotional disadvantages associated with cumulative sociodemographic risks.

Our findings confirm the well-established association between socioeconomic disadvantage and an increased prevalence of socio-emotional difficulties (Bradley and Corwyn 2002; Poulain, Vogel, and Kiess 2020; Reiss 2013). This relationship was identified through a cumulative risk framework, in line with prior research by Hogye et al. (2022) and Lima et al. (2010), who explored broader cumulative risk indices for internalizing and externalizing symptoms in the first years of middle childhood. Cumulative risk is a robust predictor, as the odds ratios remained stable across all models, even after including confounders and attendance in center-based childcare.

In contrast to some earlier evidence (Melhuish et al. 2015) and recent findings from France (Berger, Panico, and Solaz 2021) and Finland (Tervahartiala et al. 2024), our study indicates that attending center-based childcare is not detrimental, as it does not increase the likelihood of a child developing socio-emotional difficulties. In fact, the findings suggest a beneficial effect, consistent with prior results from Germany (Felfe and Lalive 2013; Ghirardi et al. 2023). Furthermore, center-based childcare attendance and its timing had a slightly different impact on internalizing and externalizing symptoms, which confirms the suggestion that difficulties should be investigated and interpreted along different dimensions.

Our results indicate that center-based childcare attendance per se is beneficial for reducing internalizing difficulties (including peer problems), since the effect was observed regardless of the age of entry. This is consistent with previous evidence that ECEC attendance enhances children's social skills – such as peer interactions and role play – with particularly notable benefits for younger children (Felfe and Lalive 2013), and that it is also associated with fewer peer problems (Ghirardi et al. 2023). By contrast, a reduction in externalizing symptoms was associated only with entry into center-based childcare at a later age (19–35 months). This distinction between participation and timing underscores that attending childcare in itself may protect against some risks but that the age of entry plays a more critical role for externalizing outcomes. These findings are in line with prior studies that suggest potential adverse behavioral effects of intensive non-maternal care beginning in early infancy (Bradley and Vandell 2007). However, our results do not suggest that early formal childcare confers a disadvantage relative to parental care; rather, they highlight an advantage of later childcare attendance over both early attendance and non-attendance. It should be noted, however, that the positive effects were demonstrated among children experiencing the COVID-19 pandemic and related lockdown measures. Consequently, it can be posited that the observed positive impact of nursery attendance may have been facilitated by its capacity to buffer against the negative effects of social isolation, similar to the results observed by Jarvers et al. (2023) for preschoolers.

Due to data limitations, we could not account for the quality differences of center-based childcare in our analysis, though such factors are known to play a crucial role in developmental outcomes (Melhuish et al. 2015; Wilhelmsen et al. 2023; Wustmann Seiler et al. 2022). For interpretation, we rely on the fact that Hungary's childcare system is relatively uniform and of high quality, similar to that described by Berger, Panico, and Solaz (2021) in the French context. The observed divergence from the findings of Berger and colleagues (who reported increased behavioral difficulties at age 2 among children who had been in center-based care from the age of 1) may stem from a difference in the timing of enrollment: In Hungary, children generally enter nursery at a later age. It is also worth noting that in our sample, early entry – defined internationally as entry before the age of 1 – was rare and therefore could not be examined in more detail. Thus these findings should be interpreted with caution.

The findings of this study do not provide strong support for the hypothesis that center-based childcare attendance mitigates socio-emotional difficulties in children experiencing cumulative disadvantage, although this hypothesis aligns with previous research indicating that childcare participation before the age of 3 may help reduce socioeconomic disparities in socio-emotional development (Green et al. 2021; Zachrisson and Dearing 2015). Thus we could not confirm the assumption that utilizing institutional services such as center-based childcare has a compensatory effect (Folke 2006; Masten 2018), at least in the case of children facing cumulative sociodemographic and economic disadvantages. However, in light of observed (though tentative) trends in the multivariate models with interaction terms, it may be reasonable to suggest that early nursery attendance could offer a modest risk-compensating effect on internalizing symptoms, while later nursery attendance might be more beneficial in reducing externalizing difficulties, particularly for children from more advantaged backgrounds. Notably, no existing studies have examined this question within a cumulative risk framework. So further research is needed to clarify whether center-based childcare attendance moderates the relationship between cumulative social adversity and socio-emotional well-being in early childhood. Furthermore, our finding that center-based childcare attendance benefited children's socio-emotional well-being suggests that although participation could not clearly offset cumulative socioeconomic risks, it may have helped buffer some of the socio-emotional challenges of early childhood during a period of global crisis, namely the COVID-19 pandemic. The results of the study underscore the potential of expanding access to high-quality center-based childcare as part of broader strategies to promote child well-being and resilience, and to mitigate the long-term consequences of social adversity.

The size and representativeness of the sample; the insights provided from a less-explored European country; the longitudinal design, which allows adjustments to be made for maternal and family characteristics before the birth of the child; and the ability

to control for unmeasured heterogeneity are notable strengths of the study. The results, however, due to the great institutional variety in Europe, may be country-specific and not necessarily generalizable to other countries. An important limitation of the study is that we could not examine the specific role of the pandemic, as all children were exposed to the COVID-19 context; therefore contextual and individual effects could not be distinguished. Future research should investigate the impact of childcare on socio-emotional well-being within a resilience framework by comparing cohorts across pre-, during-, and post-pandemic contexts. A further limitation of this study is that neither quality characteristics nor information on the duration (months in care) or dosage (hours and days in care) of center-based care could be taken into account, as only information on age at entry was available. Additionally, maternal reporting of children's socio-emotional difficulties introduces the potential for cognitive and social desirability biases. Finally, apart from controlling for negative affectivity at six months of age, we cannot account for selection into center-based childcare influenced by socio-emotional difficulties already present prior to entry.

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Appendix

Table A-1: Effects of cumulative risk and center-based care attendance on internalizing symptoms, controlled for confounders

Independent variables		Model 1a			Model 2a			Model 3a		
		OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
CRI		1.32	1.28, 1.38	< 0.001	1.30	1.25, 1.35	< 0.001	1.30	1.25, 1.36	< 0.001
Nursery attendance (ref. non-attendance)	6–18 months				0.55	0.40, 0.77	< 0.001	0.74	0.46, 1.20	0.226
	19–35 months				0.63	0.52, 0.76	< 0.001	0.63	0.48, 0.83	0.001
CRI*nursery attendance	CRI* 6–18 months							0.85	0.69, 1.05	0.130
	CRI* 19–35 months							1.00	0.89, 1.12	0.967
Preference for nursery attendance during pregnancy	yes	1.17	1.00, 1.36	0.045	1.01	0.86, 1.19	0.866	1.02	0.87, 1.19	0.846
Child's sex (ref. girl)	boy	1.28	1.10, 1.48	0.001	1.28	1.10, 1.48	0.001	1.28	1.10, 1.48	0.001
High level of negative affectivity at 6 months	yes	1.25	1.05, 1.49	0.011	1.24	1.04, 1.48	0.014	1.24	1.05, 1.48	0.014
Low birthweight (< 2,500 grams)	yes	0.90	0.68, 1.20	0.474	0.92	0.69, 1.22	0.564	0.92	0.69, 1.23	0.573
Parity of mother during pregnancy (ref. expecting first child)	expecting 2nd child	0.80	0.67, 0.94	0.008	0.79	0.67, 0.94	0.006	0.79	0.66, 0.93	0.005
	expecting 3rd or subsequent child	0.79	0.65, 0.97	0.028	0.78	0.64, 0.96	0.018	0.78	0.64, 0.96	0.017
Maternal depression symptoms in perinatal period	yes	1.51	1.29, 1.78	< 0.001	1.54	1.31, 1.82	< 0.001	1.55	1.31, 1.82	< 0.001
Family relocation within 6 months of birth	yes	0.89	0.71, 1.12	0.323	0.89	0.71, 1.23	0.341	0.90	0.71, 1.13	0.357
Unplanned pregnancy declared during pregnancy	yes	1.02	0.80, 1.29	0.893	1.01	0.79, 1.28	0.943	1.00	0.79, 1.27	0.971

Notes: CRI = cumulative risk index (number of risk factors). Model parameters for internalizing symptoms (n = 5,098): Model 1a: –2LL = 4646.63, R2 = 0.070 (Cox and Snell), 0.112 (Nagelkerke), $\chi2(10) = 369.30$, $p < 0.001$. Model 2a: –2LL = 4615.95, R2 = 0.076 (Cox and Snell), 0.121 (Nagelkerke), $\chi2(12) = 399.98$, $p < 0.001$. Model 3a: –2LL = 4613.59, R2 = 0.076 (Cox and Snell), 0.122 (Nagelkerke), $\chi2(14) = 402.34$, $p < 0.001$.

Table A-2: Effects of cumulative risk and center-based care attendance on externalizing symptoms, controlled for confounders

Independent variables		Model 1b			Model 2b			Model 3b		
		OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
CRI		1.25	1.21, 1.30	< 0.001	1.24	1.19, 1.28	< 0.001	1.23	1.18, 1.28	< 0.001
Nursery attendance (ref. non-attendance)	6–18 months				1.08	0.83, 1.41	0.577	1.12	0.75, 1.67	0.573
	19–35 months				0.75	0.62, 0.89	0.001	0.66	0.52, 0.85	0.001
CRI*nursery attendance	CRI* 6–18 months							0.97	0.82, 1.15	0.756
	CRI* 19–35 months							1.07	0.97, 1.20	0.184
Preference for nursery attendance during pregnancy	yes	1.05	0.91, 1.21	0.497	1.00	0.86, 1.17	0.965	1.00	0.86, 1.17	0.969
Child's sex (ref. girl)	boy	1.26	1.09, 1.44	0.001	1.26	1.10, 1.45	0.001	1.26	1.10, 1.44	0.001
High level of negative affectivity at 6 months	yes	1.38	1.17, 1.62	< 0.001	1.37	1.16, 1.61	< 0.001	1.37	1.16, 1.61	< 0.001
Low birthweight (< 2,500 grams)	yes	0.96	0.72, 1.26	0.755	0.96	0.72, 1.27	0.762	0.95	0.72, 1.26	0.744
Parity of mother during pregnancy (ref. expecting first child)	expecting 2nd child	0.96	0.82, 1.12	0.599	0.96	0.82, 1.12	0.618	0.96	0.82, 1.12	0.608
	expecting 3rd or subsequent child	0.88	0.72, 1.07	0.203	0.87	0.72, 1.06	0.156	0.87	0.72, 1.06	0.162
Maternal depression symptoms in perinatal period	yes	1.62	1.39, 1.89	< 0.001	1.62	1.39, 1.89	< 0.001	1.62	1.39, 1.89	< 0.001
Family relocation within 6 months of birth	yes	1.02	0.83, 1.27	0.830	1.03	0.83, 1.27	0.813	1.03	0.83, 1.27	0.819
Unplanned pregnancy declared during pregnancy	yes	1.06	0.85, 1.33	0.605	1.07	0.85, 1.34	0.575	1.07	0.85, 1.34	0.552

Notes: CRI = cumulative risk index (number of risk factors). Model parameters for externalizing symptoms (n = 5,098): Model 1b: –2LL = 5061.51, $R^2 = 0.057$ (Cox and Snell), 0.087 (Nagelkerke), $\chi^2(10) = 296.06$, $p < 0.001$. Model 2b: –2LL = 5048.55, $R^2 = 0.059$ (Cox and Snell), 0.091 (Nagelkerke), $\chi^2(12) = 309.02$, $p < 0.001$. Model 3b: –2LL = 5046.61, $R^2 = 0.060$ (Cox and Snell), 0.091 (Nagelkerke), $\chi^2(14) = 310.96$, $p < 0.001$.