



Duration of child home care allowance period and school success: Differences by parental education level and ethnic origins

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ARTICLE INFO

Keywords:

Child home care allowance
Early education
Home care
Immigration
Academic achievement
Parental education

ABSTRACT

Early childhood education and care (ECEC) participation is a key mechanism for narrowing the achievement gap between children from different family backgrounds. ECEC particularly benefits children with immigrant backgrounds by providing earlier exposure to the host country language, which boosts later school performance. We employ family fixed-effects regression models and high-quality Finnish register data to examine the association between the duration of the child home care allowance (HCA)—a special feature of Finnish family policy and the main counterfactual for child care services—and school success (as measured by literacy grade at the end of elementary education), parental education, and ethnic origins. In addition to showing that the duration of the HCA period is negatively linked to the school success of children of less educated mothers, this study shows that this duration is negatively associated with the school success of children of immigrants in universal ECEC.

1. Introduction

Given its benefits for the educational outcomes of disadvantaged children, participation in early childhood education and care (ECEC) effectively narrows the learning achievement gap between children from different family backgrounds in targeted US and universal European ECEC settings (Burger, 2010; Dietrichson et al., 2020; Heckman & Masterov, 2007; Melhuish et al., 2015). Moreover, research has highlighted ECEC as a worthwhile investment in the accumulation of children's human capital (Heckman, 2000, 2006). Children with immigrant backgrounds particularly benefit from ECEC by gaining earlier exposure to the host country language, which enhances later school performance (Drange & Telle, 2017; Votruba-Drzal et al., 2015). ECEC enrollment also helps immigrant families to integrate into society, as parents can work or study instead of caring for children, as well as connect with the host country's education system (Heath et al., 2008; Votruba-Drzal et al., 2015a). Finally, substantive access to ECEC is a powerful way to increase the employment of mothers and, in turn, promote gender equality (Esping-Andersen, 2008).

This study provides insights into the associations between the duration of the child home care allowance (HCA) period in a low-immigration country with universal ECEC settings and the literacy level of students at the end of lower secondary education while considering parental education and ethnic origins. The HCA is a widely

used cash-for-care benefit and the main counterfactual for the use of child care services in Finland. Similar cash-for-child-care policies also exist for example in Norway and Germany. Typically, studies considering early education examine the connection between ECEC and children's educational outcomes. In Finland, participation in ECEC is recorded at the municipal level, from which only aggregate data is available, whereas HCA is recorded at the individual level because it is paid through the Social Insurance Institution of Finland (Kela). Therefore, we focus on examining the connection between HCA and children's educational outcomes.

Although previous studies consistently show the positive impacts of ECEC participation for children from less educated families, existing Finnish research on the duration of the HCA period does not show significant variation according to parental education (Hiilamo et al., 2018; Karhula et al., 2017; Kosonen & Huttunen, 2018). In addition, previous research on immigrants has mostly focused on targeted ECEC interventions in the US (see Lee, 2016; Magnuson et al., 2006a; Votruba-Drzal et al., 2015); existing studies looking at universal ECEC have not differentiated ethnic origins but only compared immigrant and non-immigrant populations (see Drange & Telle, 2017; Cornelissen et al., 2018). In recent decades, the number of immigrants searching for job opportunities has increased in many European countries; combined with the growing pressure of aging European populations, the integration of this influx of immigrants is an important political matter. In this

Abbreviations: ECEC, Early Childhood Education and Care; HCA, Home Care Allowance.

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<https://doi.org/10.1016/j.rssm.2025.101063>

Received 25 June 2024; Received in revised form 8 May 2025; Accepted 13 May 2025

Available online 16 May 2025

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context, the HCA is most commonly used by low-income and immigrant families in Finland (Karila et al., 2017; Tervola, 2015), yet these groups stand to benefit most from ECEC (Heckman & Masterov, 2007; Votruba-Drzal et al., 2015).

First, we examine the association between the duration of the HCA period and a child's literacy grade at the end of lower secondary education according to parental education. Second, we investigate whether the association between literacy grade and duration of the HCA period differs by ethnic origins. We focus on second-generation immigrants—the Finnish-born children of foreign-born parents—as they have had the same opportunities to attend child care services as non-immigrant children. We utilize high-quality, full-population Finnish register data, which includes all individuals born in Finland from 1998 to 2003. The comprehensive register data with full family linkages helps us account for unmeasured confounding variables by utilizing sibling fixed-effect models to compare the literacy grades of siblings with the same biological parents. Through this approach, we can account for siblings' shared characteristics, such as familial childrearing practices and childhood home environment.

2. Theoretical framework and research questions

2.1. Finnish cash-for-care policy

Although the popularity of ECEC participation has greatly increased in Europe over the past decades, some countries have implemented cash benefits for the home care of young children. For example, Finland, Norway, and Sweden made cash-for-care benefits available in the 2000s. Originally, Finland developed HCA as a "mother's salary" for families in rural areas, but it has taken root amid the turmoil of Finnish social policy and has been justified by the families' ability to choose the form of care for young children (Hiilamo & Kangas, 2009). Introduced in 1985, Finland's HCA was initially justified by the lack of available daycare centers (Miettinen & Rotkirch, 2017).

Finland's HCA is a cash benefit and the main counterfactual for ECEC attendance for children under school age. Families can receive HCA until the child turns three years old as long as the child does not attend municipally funded ECEC. However, in families with multiple children, HCA can be extended until the child starts school if family has younger children for whom they receive HCA. Although ECEC is a universal right for children in Finland, such that municipalities must provide ECEC for all families who apply for it, HCA is still widely used. For example, at the end of 2022, HCA covered 36 % of children aged 9–24 months (Tulokas et al., 2024). Partly due to the availability of HCA, the proportion of children participating in ECEC is lower in Finland than in other Nordic countries and the EU on average (Karila et al., 2017; Miettinen & Rotkirch, 2017; Valaste, 2016).

The choice between home care and ECEC is socially stratified. For example, in Europe, children from low socioeconomic status (SES) families participate in ECEC less compared to their more materially secure counterparts (Pavolini & Van Lancker, 2018). Further, the use of HCA in Finland is more common among less educated and immigrant families, which means that these groups start ECEC later on average (Haataja & Juutilainen, 2014; Tervola, 2015). HCA encourages especially low SES families to care for their children at home, and the Finnish HCA in particular has been criticized for weakening mothers' opportunities for employment and career development. In addition, HCA reduces pension accumulation among mothers (Koskenvuo, 2016), the Organisation for Economic Co-operation and Development (OECD) has criticized HCA as undermining the integration of mothers from immigrant backgrounds (OECD, 2018). However, although immigrant families tend to care for children at home longer on average than non-immigrant families, previous research argues this is linked to the compositional differences between non-immigrant and immigrant families (Sprong & Skopek, 2023). Although HCA has been much criticized, in some cases (see section 3.1) parents can receive unemployment

benefits and HCA simultaneously, which can reduce the financial stress of low-income families and therefore potentially benefit children.

Previous studies have examined cash-for-care schemes mainly from a gender equality perspective. In Sweden and Finland, research has found that HCA has a negative impact on mothers' employment (Giuliani & Duvander, 2017; Gruber et al., 2023). However, there is a lack of comprehensive research on the link between HCA and children's long-term outcomes. In Finland, the costs of caring for young children fall on municipalities after the parental leave period (chapter 3.1). Compared to the costs of ECEC, paying HCA to parents is significantly cheaper for municipalities, which justifies support for home care from an economic perspective (Haataja, 2012). Therefore, it is important to examine how duration of the HCA period is linked to children's later outcomes within the context of families' social strata.

2.2. Children's SES and learning environment

Notably, studies within the sociology of education have found that families' economic, cultural, and social resources (Bourdieu, 1986) substantially impact children's educational outcomes (Breen & Jonsson, 2005; Duncan et al., 2015; Hout & DiPrete, 2006; Sirin, 2005). Moreover, research suggests that the differences in the achievement of children from different socioeconomic backgrounds are detectable even before school age (Skopek & Passaretta, 2021), clarifying the importance of early investments in children's development (Heckman, 2006). Early education typically takes place at home and in institutional ECEC settings. Researchers have examined the impact of SES on children's development and learning in early childhood through, for example, the family investment model and the family stress model (Ghirardi et al., 2023; Kulic et al., 2019), both of which argue that the impact of learning environment at home or in ECEC can vary according to family SES.

The investment perspective argues that parents with high SES can invest more financial, cultural, and social resources in their children, which positively impacts their development and learning (Conger & Donnellan, 2007). This can manifest, for example, in a more learning-oriented home environment, which may include better home learning materials and a higher standard of living, such as better nutrition and medical care (Conger & Donnellan, 2007), higher-quality ECEC (Kulic et al., 2019), and higher-quality parenting skills (Ermisch, 2008). On the other hand, the family stress model suggests that the stress brought on by financial pressures is reflected in parents' behavior (Conger & Donnellan, 2007), manifesting, for example, as unsupportive and cold parental behavior, which weakens the quality of parent-child interactions. All of this can have negative effects on children's cognitive development (Gershoff et al., 2007).

The investment and family stress perspectives suggest that SES is closely linked to the quality of the home learning environment, which in turn affects children's development and academic competence. The quality of early education experienced during the first years of life is crucial for skill development (Heckman & Masterov, 2007). For example, in Germany, a high-quality home learning environment predicted better numeracy skills among preschoolers (Anders et al., 2012). In addition to home learning environment, family resources can also affect the quality of ECEC, as children from high SES families tend to receive higher quality ECEC (Drange & Telle, 2020).

2.3. ECEC and social inequality in children's educational outcomes

Although existing research examines the association between ECEC and children's later educational outcomes, the literature shows gaps in understanding of the underlying mechanisms guiding ECEC's effects on children's later outcomes (Duncan et al., 2023). However, researchers have suggested that ECEC participation develops children's social skills (Heckman & Masterov, 2007) and personality traits (Heckman et al., 2013), which contribute to development and later learning. ECEC provides children with the opportunity to interact with peers of the same

age and, in the Finnish context, promotes children's holistic growth, development, and learning in cooperation with guardians (The Finnish National Agency for Education, 2022).

Especially for the development of children from low SES families, home care may not be a better option than ECEC, as their home learning environment is generally weaker compared to high SES families. Therefore, ECEC enables children to learn skills that they would not otherwise learn at home. Additionally, involving parents in ECEC activities increases their participation in home learning activities, especially among low SES families, thus strengthening children's academic readiness (Barnett et al., 2020).

Many scholars argue that ECEC enrollment helps reduce disparities between children from different backgrounds, such that today it is seen as an equalizer for social inequalities (Kulic et al., 2019; Schmutz, 2024). Generally, the research in this field follows an 'investment' perspective, which frames ECEC as an investment toward the accumulation of children's 'human capital' (Heckman, 2000, 2006), or the knowledge and skills acquired through education and training (Becker, 1962). As learning is cumulative (i.e., builds on what has been learned before), ECEC should begin at an early age in order to lay the foundation for later learning (Almond & Currie, 2011; Duncan et al., 2010; Heckman, 2000, 2006). Following a "skills beget skills" perspective (Heckman & Masterov, 2007), studies have found that high-quality ECEC can positively affect children's long-term outcomes (Melhuish et al., 2015).

Research on universal ECEC systems shows their benefits for children's educational outcomes. In Norway, the earlier that children from low-educated and low-income families started ECEC, the more positive the effects were on their language and math skills (Dearing et al., 2018; Drange & Havnes, 2018) and overall educational attainment (Havnes & Mogstad, 2011, 2015). Studies have observed similar benefits ECEC in the context of Denmark and France (Datta Gupta & Simonsen, 2016; Dumas & Lefranc, 2012).

In contrast to international research, previous studies in Finland have found that the negative association between HCA and children's outcomes is homogeneous by parental education, whether looking at grade point average (GPA) (Hiilamo et al., 2018), educational attainment (Karhula et al., 2017), or neurological development (Kosonen & Huttunen, 2018). Given that HCA is considered contrafactual for ECEC enrollment in the Finnish context, our first research question is:

RQ1: *How is the duration of the HCA period associated with literacy grades by parental education?*

3. ECEC and educational outcomes for children of immigrants

The educational achievement of immigrants tends to be lower than that of the non-immigrant population (Dustmann et al., 2012; Kilpi-Jakonen, 2012; Schnepf, 2007). In Finland, the achievement gap between non-immigrants and immigrants is one of the largest among OECD countries (Schleicher, 2019). However, these disparities in achievement seem to stem from differences in the resources available to non-immigrant and immigrant families (Heath et al., 2008; Schnepf, 2007), such that immigration status itself does not fully explain the differences in these populations' educational outcomes. The home language of children with an immigrant background is often the parents' mother tongue, so early contact with the host country's language through ECEC can improve these children's educational outcomes (Drange & Telle, 2017; Votruba-Drzal et al., 2015). Particularly if their parents do not speak the host country's language, an early ECEC start is important for boosting children's language development (Drange & Telle, 2017). Research also indicates that children whose home language is different from those in ECEC settings benefit the most from ECEC (Gormley, 2008; Votruba-Drzal et al., 2015). This finding is likely because language plays a significant role in general learning, meaning that the development of related skills through ECEC can improve children's overall school competence.

Research also shows that ECEC benefits the reading and math skills

of children with immigrant backgrounds in both US (universal and mixed type) (Gormley, 2008; Lee, 2016; Magnuson et al., 2006; Votruba-Drzal et al., 2015) and European (universal) ECEC settings (Cornelissen et al., 2018; Drange & Telle, 2017; Felfe & Lalive, 2018). In Norway, at the end of compulsory schooling at the age of 15, the daughters of foreign-born parents who attended free preschool at the age of 5 had a higher GPA by 0.25 of a standard deviation (SD) than those who received care at home (Drange & Telle, 2017). A study conducted in Germany found that increasing the ECEC participation of children aged 0–2 had a positive effect on the language skills of those with immigrant backgrounds (Felfe & Lalive, 2018); another German study found that ECEC enrollment had a positive effect on the school readiness of the 3–6-year-old children of immigrants (Cornelissen et al., 2018).

In the US, the pre-reading, pre-writing, and pre-math skills of Hispanic students reflect (universal) ECEC's benefits, which were greatest for children whose parents spoke Spanish at home or whose parents were born in Mexico (Gormley, 2008). According to another US-based study, the math and literacy test results of children with immigrant backgrounds validated ECEC as a better option for children's learning than home care (Magnuson et al., 2006). Finally, another US study found that, compared to home care, full-time preschool participation was associated with higher reading and math skills at the beginning of kindergarten for 5-year-old children of immigrant mothers (Lee, 2016).

Considering observations that learning a language through ECEC appears to be more beneficial for children of immigrants than for non-immigrants who are more likely to learn the host country's language at home, the most pertinent question is whether ECEC could benefit children of immigrants more than non-immigrants. Previous research offers inconsistent findings on this question. On the one hand, Cornelissen et al. (2018) in German context and Votruba-Drzal et al. (2015) in the US context found that the children of immigrants benefited more from ECEC attendance than non-immigrant children. On the other hand, Magnuson et al.'s (2006) US-based study found that ECEC attendance had equal benefits for the children of immigrants and non-immigrants alike. Moreover, research in the US has emphasized that it is the children whose home language differs from the language used in ECEC settings who seem to benefit the most from ECEC (Gormley, 2008; Lee, 2016; Votruba-Drzal et al., 2015), although differences by country of origin have not been found (Votruba-Drzal et al., 2015).

Therefore, our second research question is:

RQ2: *Does the association between the duration of the HCA period and literacy grade differ by ethnic origins?*

4. Country context

4.1. Child care settings and educational context in Finland in the early 2000s

Prior to Finland's 2022 parental leave reform, during which parental leave was extended to 11 months, parents—often mothers—were paid parental allowance until the child was about 9 months old. Then and now, this parental allowance is approximately 70 percent of the parent's income before the commencement of the parental allowance period. After the parental allowance period, parents can place the child in ECEC or care for the child at home. The state is responsible for the costs of the parental leave period. In contrast, the costs of ECEC and HCA are the responsibility of the municipalities. However, HCA is paid through Kela, which invoices the costs to the municipalities.

HCA is provided for children under 3 who do not participate in municipally funded ECEC. It is also possible to receive HCA for siblings who are below school age if the family has a child under the age of 3 cared for at home. Some municipalities also pay a separate municipal supplement on top of the HCA. The amount of HCA paid for one child was €252 in 2001 (Kela, 2002), 13 % of the median income of full-time employees in 2001 (calculated based on Statistics Finland, 2014). Older

children in the family can receive a sibling allowance of €50–84 toward the family's HCA in 2001 (Kela, 2002), and the amount of the sibling allowance depends on the child's age. In addition to basic HCA, one can also receive a care supplement for one child, which is means-tested and had a maximum of around €168 in 2001 (Kela, 2002).

If an unemployed parent cares for their child at home after the parental leave period, the HCA for the child is deducted from their unemployment benefits. This is why some parents may care for their child at home without claiming HCA. However, any possible municipal supplement is not deducted from the unemployment benefit, which is why claiming HCA alongside unemployment benefits is financially sensible if the municipality provides an increase on top of the HCA.

Finnish ECEC is mainly public, and most private ECEC services are purchased by municipalities. ECEC types include daycare centers, family daycare, and open daycare. Daycare centers are largely organized by the municipalities, and municipalities subsidize the majority of private daycare. Family daycare is typically organized in the caregiver's home and supervised by municipalities. Open daycare activities can consist of play and club activities, which are typically organized on municipal playgrounds. Information on open daycare activities is not available from the registers.

In six major Finnish cities, 8 % of ECEC costs were carried by customer payments in 2022 (Varhaiskasvatuksen Kuusikko-työryhmä, 2023). Since 1997, ECEC customer fees have been uniform across the country (Haataja, 2016). The maximum amount of payments for the oldest child was €295 in 2022; this fee is lower for younger children in the family, and fee subsidies mean that ECEC can even be free for low-income families.

In Finland, preschool starts the year a child turns 6. Primary school lasts 12 years (ages 7–16). Afterwards, youth apply for upper secondary education, which can be vocational education or high school (i.e., general education). Student selection for upper secondary education is based on the GPA of the subjects of the compulsory school leaving certificate, and thus school grades are a significant factor in deciding children's educational paths. Although there are no dead ends for education in Finland—as a student can, for instance, apply to university with a vocational school degree—the vast majority of those who start university studies have graduated from high school (Kilpi-Jakonen et al., 2016).

4.2. Immigration in Finland

Immigration has a relatively short history in Finland. At the beginning of the 1990s, more immigrants began to flow to Finland following the dissolution of the Soviet Union and the internal crises in Somalia and Yugoslavia (The Finnish Association of Adult Education Centres, 2024). Today, reasons for immigration include family, education, work, and refugee status (The Finnish Association of Adult Education Centres, 2024). Work-related immigration was relatively low until recent years witnessed a surge catalyzed by the COVID-19 pandemic (Finnish Immigration Service, 2023). Overall, the number of people with a foreign background in Finland nearly quadrupled from 2000 to 2020 (Statistics Finland, 2024a).

Table 1

Ethnic Origins of the Finnish Population in 2001 (Statistics Finland, 2024c).

	Born in Finland		Born Abroad		Total	
	N	%	N	%	N	%
Finland	5034113	96.90	37984	0.73	5072097	97.64
Rest of Europe	6697	0.13	70728	1.36	77425	1.49
Africa	3126	0.06	9774	0.19	12900	0.25
America	347	0.01	4408	0.08	4755	0.09
Asia	3180	0.06	19339	0.37	22519	0.43
Oceania	14	0.00	377	0.01	391	0.01
Unknown	2300	0.04	2514	0.05	4814	0.09
Total	5049777	97.21	145124	2.79	5194901	100

Table 1 shows Finland's population in 2001 by ethnic origin. A person is defined as having non-Finnish origins if either parent was born abroad or there is no information on the parents' country of origin (Statistics Finland, 2024b). If both parents were born abroad, a child's origins are defined by their mother's country of birth (Statistics Finland, 2024b). In 2001, the population of Finland was 5,194,901 people, of which 5,049,777 (97 %) were born in Finland and 145,124 (approximately 3 %) were born abroad (Table 1). Of those born abroad and non-Finnish origin, 33 % were born in the former Soviet Union (including Estonia until 1991), 7 % in Estonia (from 1991 onwards), 4 % in former Yugoslavia, 4 % in Somalia, 3 % in Sweden, 3 % in Iraq, 4 % in Russia, and the remaining 45 % in other countries (Statistics Finland, 2024c). A large part of those born abroad thus come from the surrounding region.

5. Data and methods

5.1. Data

We utilized high-quality, full-population Finnish register data. Our sample consisted of biological siblings from cohorts born between 1998 and 2003; information on HCA duration was available from 1998 onwards and information on literacy grades was available until 2019, when the youngest individuals in our data were 16 years old. We restricted the data to include only those individuals for whom we had information on either their mother or both their mother and father. We also excluded those individuals who did not have information about literacy grades. Further, we excluded twins from our data, as differences between twin siblings in the duration of the HCA period could be related to other factors (e.g., developmental issues). Our analysis sample consisted of 140,649 individuals in 66,070 families.

Table 2 describes the variables used in this study. We limited the maximum values for some variables to maintain the anonymity of the individuals in the sample. The explanatory variable is the literacy grade at the end of lower secondary education at 16 years old. This is based on the literacy grade of the final certificate of the lower secondary education. Originally, literacy grade was measured on a scale from 4 to 10, a Finnish grading scale, but we standardized the variable by birth cohort to have a mean of 0 and an SD of 1. We chose this literacy grade as the outcome variable because it is important for overall learning; particularly for the children of immigrants, it is directly linked to learning the host country's language. Our data showed some inconsistency for some grades, such as math, but included literacy grades for our entire sample.

In the Finnish context, literacy grades in the comprehensive school leaving certificate are based on teacher evaluations. Grading criteria include the interpretation of different texts; text production; understanding of language, culture, and literacy; and communication skills (Finnish national agency for education, 2022). The literacy curriculum offers Finnish, Swedish, Sámi, Romani, sign language, and student's (other) mother tongues. In theory, students can study literacy in their mother tongue if teaching is available in that language. However, the 2016 Entrance to Secondary Education register shows that, among applicants with information on their mother tongue and the language of instruction in comprehensive school, 91 % of those whose mother tongue was neither Finnish nor Swedish used Finnish as the language of instruction in comprehensive school (Statistics Finland, 2025). Additionally, 94 % of students had either Finnish or Swedish and 97 % had Finnish, Swedish, or English as the language of instruction. Thus, for the vast majority of students with an immigrant background, the literacy grade is based on the Finnish language. Unfortunately, information on the language of instruction is only available for part of the population in this study (those born before 2001), and the available data is missing significant amounts of information; hence, we do not consider the language of instruction in this study.

We defined ethnic origin according to the parents' countries of birth. If either parent or the only known parent was born in Finland, the person

Table 2
Descriptive Statistics.

	N	%	Min	Max	Mean	Sd
Gender	140649	100	0	1	0.488	0.500
Male	71946	51.15				
Female	68703	48.85				
Mother's Education	140649	100	1	3	2.412	0.661
Basic	13664	9.71				
Secondary	55425	39.41				
Tertiary	71560	50.88				
Father's Education	140649	100.00	1	3	2.238	0.694
Basic	21119	15.02				
Secondary	64919	46.16				
Tertiary	54611	38.83				
Parental Education	140649	100.00	1	3	2.574	0.563
Basic	5061	3.60				
Secondary	49767	35.38				
Tertiary	85821	61.02				
Immigration Status	140649	100	0	1	0.021	0.143
Native	137703	97.91				
Immigrant	2946	2.09				
Ethnic Origins	140649	100	1	6	1.074	0.553
Mother or Father Finland	137703	97.91				
Mother Iraq, Father Iraq	274	0.19				
Mother Somalia, Father Somalia	835	0.59				
Mother former SU, Father former SU	229	0.16				
Mother former Yugoslavia, Father former Yugoslavia	225	0.16				
Other	1383	0.98				
Mother's Status	140649	100	1	4	2.005	1.285
Employed	82076	58.36				
Unemployed	9513	6.76				
Student / in school	15346	10.91				
Other	33714	23.97				
Parents lived together when child was 3	140649	100	0	1	0.919	0.272
No	11342	8.06				
Yes	129307	91.94				
Parents lived together when child was 6	140649	100.00	0	1	0.862	0.345
No	19413	13.80				
Yes	121236	86.20				
Last child	140649	100	0	1	0.466	0.499
No	75132	53.42				
Yes	65517	46.58				
Literacy (std)	140649	100	-3.229	1.809	0.000	1.000
HCA Months	140649	100	0	80 or more	25.622	18.219
Number of Children in the Family	140649	100	2	15 or more	3.447	2.232
Sibling Order	140649	100	1	10th or higher	2.116	1.387
Mother's Unemployment in Months	140649	100	0	40 or more	4.279	7.768
Father's Unemployment in Months	140649	100	0	55 or more	3.889	10.420
Age Difference to Next Child (in Months)	75 132	53.42	0	65 or more	27.210	10.705

was defined as a non-immigrant. If both parents or the only known parent was born outside of Finland, we used an individual's parents' countries of birth categorize them into one of the following six categories: 1) mother or father born in Finland; 2) mother born in Iraq, father born in Iraq; 3) mother born in Somalia, father born in Somalia; 4) mother born in former Soviet Union, father born in former Soviet Union; 5) mother born in former Yugoslavia, father born in former Yugoslavia; and 6) mother and father born elsewhere. To justify our statistical analyses, we chose these categories so that there were more than 200 observations in each group. There were no more than 200 persons with parents born abroad in different countries, within any mother-father combination.

Our study uses measures from 2010 for parents' education to ensure congruency between siblings, and we grouped level of education into three categories: 1) Basic education—equivalent to International Standard Classification of Education (ISCED) 1–2 (approximately ages 7–16, or grades 2–10 in the context of the US); 2) Secondary education—ISCED 3–4 (approximately ages 17–18; includes US high school grades 11 and 12, as well as subsequent vocational and undergraduate education); and 3) Tertiary education—ISCED 5–8 (approximately 19 years of age and older; includes advanced bachelor, master, and doctoral level studies). We used both mother's and father's education in our

regression models. As an additional analysis, we also used the dominance principle, meaning that the value of the education variable corresponded to the data on the parent (mother or father) with the highest level of education.

The education information is inconsistent for some parents born abroad, as many of them lack education information. The education information in the data is based on post-primary school qualifications. Therefore, missing information may indicate that 1) the person's highest level of education is primary education, 2) education information is missing, or 3) primary education was incomplete. Due to our data structure, we include parents with missing education information in the first category (Basic education). However, it should be noted that register data may underestimate the educational level of immigrants (Kilpi-Jakonen, 2011), which should be taken into account when interpreting the results.

Information on HCA includes the monthly amount given in Euros. We calculated the monthly payment of the basic part of the allowance for individuals during childhood and only for those cared for at home by parents or relatives. We did not use the amount of money as it may vary by family's income or number of children. There were some individuals whose HCA duration was more than 80 months, meaning that the individual was born in the first months of the year and did not attend

preschool before starting compulsory education. However, our data includes only a few individuals with more than 80 HCA months.

The HCA does not pay for home care of children if parents receive parental allowance. Therefore, the duration of the HCA does not precisely describe the duration of the home care period in our data, as we cannot identify whether children were at home care during the parental allowance period. Further, the youngest child of a family is not eligible for the HCA sibling increase, which also causes the duration of the HCA period to vary between siblings. In some cases, the child may have been in home care, but the parents did not claim HCA because they were receiving unemployment benefits (section 3.1). We account for this variability with the following covariates: whether the parents lived together when the child was 3 years of age; sibling order; the age difference to the next child in the family; whether the child is the last born in the family; number of children in the family; the mother’s labor employment status when the child was under 1 year of age; and number of unemployment months when the child was 0–6 years old separately for mothers and for fathers. We also included whether the parents lived together when the child was 6 years of age to better account for the effects of the differences in the family structures.

The information about whether parents lived together at the end of the year when a child turned 3 and 6 years old was measured by comparing the mother’s and father’s family IDs. We accounted for whether parents lived together to control for siblings’ early childhood environment and the duration of the HCA; in the case of stepfamilies, younger siblings may be cared for with an HCA sibling increase, even if they are the last child in the family. Sibling order is defined as the order of children born to the same parents and controls the duration of the HCA period, which is usually longer the higher the sibling order is (i.e., children are more often cared for by an HCA sibling increase in families with many children).

We measured the mother’s employment status one year before the birth of the child, applying one of four categories: 1) employed, 2) unemployed, 3) student, and 4) other. The last category includes parents on parental leave. The last category also contains missing information; notably, this information was missing from a considerable number of mothers with foreign backgrounds. We controlled for the mother’s employment status because this correlates with the family’s child care choices. Age difference to the next child in the family controls for the duration of the HCA period, as it correlates with differences associated with parents being on parental leave with younger siblings. As families’ last children have no age difference from the next child in the family, we

replaced their age difference with the number 999, which we further omitted via a dummy variable indicating whether that individual was the last child in their family. We also accounted for gender in our analyses.

5.2. Methods

Because families’ child care choices are not random, we accounted for unobserved confounding variables by utilizing sibling fixed-effect (FE) ordinary least-squares (OLS) regression models with cluster robust standard errors. In these, we compared the association between HCA duration and literacy grades between biological siblings born within five years of each other (i.e., cohorts born between 1998 and 2003). We compared the OLS and family FE model results to examine how parental education and ethnic origins moderate the association between HCA months and literacy grades. We did not include the main effect of parental education and ethnic origins in our FE models as it does not vary between siblings. Our estimates regarding HCA duration show how much literacy grade changes on a z-standardized scale when HCA duration increases by one month. Previous ECEC research has used sibling FE models in the context of the US (e.g., Deming, 2009). Table 3 describes the follow-up period for this research.

We acknowledge that the association between the duration of the HCA period and literacy grade could be different for only children (i.e., the sole child of a family). For example, the duration of the HCA period is potentially detrimental to children’s outcomes, regardless of parental education, as only children educated at home cannot form social relations with peers through ECEC. However, as most children have siblings, our results are still generalizable.

We conducted our analyses using Stata 18 software. The do-files for the analyses are available online (Laaninen, 2025).

6. Results

Tables 3–5 present the results from our regression models. The estimates regarding HCA duration show how much literacy grade changes on a z-standardized scale when HCA duration increases by one month. Although we show results from both the OLS and FE models with and without control variables, we focus on describing the results from the FE models with control variables (Model 4 in Tables 3–5) because these models account for unobservable factors that siblings share, as well as the endogeneity between siblings regarding HCA duration. Models

Table 3
Follow-Up Period.

Child's Age	Parental Leave	HCA	ECEC	Pre-school Starts	Comprehensive School	Parents Lived Together Measured	Parent's Education Measured	Literacy Grade Measured
0	x	x(a)	x (a)					
1		x	x					
2		x	x					
3		x (b)	x			x		
4		x (b)	x					
5		x (b)	x					
6		x (b)	x (c)	x		x		
7					x		x(d)	
8					x		x(d)	
9					x		x(d)	
10					x		x(d)	
11					x		x(d)	
12					x		x(d)	
13					x			
14					x			
15					x			
16					x			x
17								

a = Eligibility at the age of 10 months
 b = with sibling increase
 c = Preschool is included in ECEC
 d = Measured in 2010

Table 4
OLS and Family Fixed-Effect Models on the Association between Literacy Grade and HCA Months by Mother’s Education.

	Model 1	Model 2	Model 3	Model 4
Mother’s Education				
Basic	ref. -	ref. -		
Secondary	0.1489*** 0.0185	0.0665*** 0.0165		
Tertiary	0.6848*** 0.0179	0.4100*** 0.0163		
HCA Months	0.0005 0.0005	-0.0006 0.0004		
Mother’s Education X HCA Months				
Basic X HCA months	ref. -	ref. -	0.0016 0.0009	-0.0018* 0.0009
Secondary X HCA months	0.0023*** 0.0005	0.0025*** 0.0004	0.0030*** 0.0005	-0.0007 0.0005
Tertiary X HCA months	0.0001 0.0005	0.0013** 0.0004	0.0043*** 0.0005	0.0005 0.0005
FE	No	No	Yes	Yes
Controls	No	Yes	No	Yes
N	140649	140649	140649	140649
Families			66070	66070
R-squared / Adjusted R-squared	0.0694	0.2983	0.0016	0.2756
Standard errors in second row				

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5
OLS and Family Fixed-Effect Models on the Association Between Literacy Grade and HCA Months by Immigration Status.

	Model 1	Model 2	Model 3	Model 4
HCA Months				
	-0.0021*** 0.0001	0.0011*** 0.0002		
Immigration Status				
Native	ref. -	ref. -		
2nd gen immigrant	0.0019 0.044	0.4447*** 0.0373		
Immigration Status X HCA Months				
Non-immigrant X HCA months	ref. -	ref. -	0.0034*** 0.0003	-0.0002 0.0004
Immigrant X HCA months	-0.0035* 0.0015	-0.0037** 0.0013	-0.0012 0.0022	-0.0052* 0.0022
FE	No	No	Yes	Yes
Controls	No	Yes	No	Yes
N	140649	140649	140649	140649
Families			66070	66070
R-squared / Adjusted R-squared	0.0017	0.2982	0.0015	0.2756
Standard errors in second row				

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

showing coefficients for all covariates are presented in Table A1–A3.

6.1. How is the duration of the HCA period associated with literacy grades by parental education?

Regarding our first research question, Model 4 in Table 4 aligns with previous international research in showing that the duration of home

care is negatively associated with the literacy grades of children whose mothers have basic education. More specifically,

among the children whose mothers had a basic level of education, one month more of HCA is associated with a 0.0018-SD decrease in literacy grade. We can calculate that on average, children in less educated families who have been in home care for four years achieve literacy grades that are 0.09 SD (0.0018 * 48) lower than those who attend ECEC directly following parental leave. The standard errors in Model 4 show that the difference between basic-educated and tertiary-educated individuals is statistically significant. Model 5 in Table A1 shows that when comparing families by the dominance principle, the effect sizes almost double, indicating that the negative effect of HCA is greater in families with the weakest resources.

If we compare the results in Model 4 to those of Models 1 and 2 (Table 1), we see that OLS models seem to overestimate the negative association between literacy grades and HCA months. This may be because the HCA duration reflects the overall resources of the families in OLS models, as HCA use varies according to families’ SES. Model 3, which lacks control variables, seems to indicate that HCA duration is positively associated with literacy grade. However, HCA duration is longer on average for older children in the family, who are eligible for the HCA sibling increase. Therefore, the difference between Models 3 and 4 could relate to how HCA duration reflects the order of children in the family. In fact, Model 4 in Table A1 shows that younger siblings seem to have lower literacy grades. However, as stated in the preceding paragraph, Model 4 (FE) accounts for siblings’ shared characteristics and endogeneity regarding the HCA duration between siblings.

6.2. Does the association between the duration of the HCA period and literacy grade differ by ethnic origins?

Regarding this second research question, Model 4 in Table 5 shows a negative association between HCA duration and literacy grade among the children of immigrants. Overall, HCA duration is not associated with literacy grades for non-immigrants, but among the children of immigrants, one additional month of HCA received is associated with a 0.0052-SD decrease in literacy grade. Again, if we calculate the difference between the children of immigrants who have not been in home care after parental leave and those who have been in home care for four years, the latter group has a 0.25-SD lower literacy grade. The standard errors in Model 4 show that the difference between and children of immigrants versus non-immigrants is statistically significant.

In addition, we investigated these ethnic differences in more detail according to parents’ countries of birth. The results of Model 4 (Table 6) include some differences in the association between HCA duration and literacy grades by ethnic origin. The negative association between HCA duration and literacy grades is largest among children whose parents are of former Yugoslavian ancestry. Otherwise, the associations are smaller and statistically significant only for the “Other” group, which consists of children with mixed parental countries of birth.

Although beyond the original scope of our research questions, we also analyzed whether the differences according to mother’s education were similar across ethnic origin. Table A4 shows that the negative association between HCA duration and literacy grade among immigrant children is concentrated in families the mothers of which have high education. The results might reflect that the differences between non-immigrants and immigrants are not entirely due to compositional factors between non-immigrant and immigrant families. As mentioned in Section 4.1, the parental education variable might suffer from measurement bias among immigrant parents, as missing information is included in the basic education category. Therefore, interpretation of parental education interactions among immigrants must exercise caution.

Table 6
OLS and Family Fixed-Effect Models on the Association Between Literacy Grade and HCA Months by Ethnic Origin.

	Model 1	Model 2	Model 3	Model 4
HCA Months	−0.0021*** 0.0001	0.0010*** 0.0002		
Ethnic Origin				
Mother or Father Finnish	ref.	ref.		
	-	-		
Mother and Father Iraq	−0.2124	0.4185***		
	0.1381	0.1161		
Mother and Father Somalia	−0.3835***	0.1908*		
	0.098	0.0826		
Mother and Father former SU	0.1678	0.3889**		
	0.1504	0.1262		
Mother and Father former Yugoslavia	−0.1212	0.4187*		
	0.2097	0.1759		
Mother and Father Other	0.1422*	0.5361***		
	0.0588	0.0496		
Ethnic Origin X HCA Months				
Mother or Father Finnish	ref.	ref.	0.0034***	−0.0003
	-	-	0.0003	0.0004
Mother and Father Iraq	0.0025	0.0006	0.0068	0.002
	0.0051	0.0043	0.0075	0.0085
Mother and Father Somalia	0.005	0.0027	0.0026	0.0005
	0.0031	0.0026	0.0036	0.0035
Mother and Father former SU	−0.0045	−0.0039	−0.0062	−0.0087
	0.0051	0.0042	0.0079	0.0072
Mother and Father former Yugoslavia	−0.0002	−0.0048	−0.0218**	−0.0261***
	0.0073	0.0061	0.0071	0.0069
Mother and father Other	−0.0061**	−0.0058**	−0.0012	−0.0071*
	0.0022	0.0018	0.0036	0.0035
FE	No	No	Yes	Yes
Controls	No	Yes	No	Yes
N	140649	140649	140649	140649
Families			66070	66070
R-squared / Adjusted R-squared	0.002	0.2982	0.0016	0.2757
Standard errors in second row				

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6.3. Robustness checks

We replicated our results with math grades but removed the cohort born in 1999 from the analyses due to data limitations. These results are presented in Tables A5 and A6, in which we can see that the HCA duration is not associated with math grades regardless of mother's education or immigration status in the fixed-effect models with control variables (Models 4). This difference may be due to the fact that the skills learned in ECEC specifically support skills related to literacy.

We replicated our analyses by measuring the difference in literacy scores when HCA duration increases by six months. These results reflect the results in Tables 3 and 4 and are presented in Table A7 for mother's education and A8 for ethnic origins. However, it should be noted that the results in Table A7 regarding the mother's education are not statistically significant. We also calculated our models with a sample where younger siblings had more HCA to see if our results address the endogeneity in HCA months due to sibling order. From Model 4 in Tables A9 and A10, we can see that the association between literacy grade and HCA months

is negative but not statistically significant, perhaps because our sample size was reduced to 15 % of the original.

Finally, we calculated our models only for those families where parents were living together when the youngest child in the family was 6 years old, so we could better account for unobserved, time-invariant characteristics shared by siblings in their childhood. In Table A11 in the appendix, we compare our original FE results from Tables 4–6 to models where we only include those families in which parents were living together when the youngest child in the family was 6 years old. The results remained consistent, but the differences by parental education and between non-immigrants and immigrants are not statistically significant in Models 1b and 2b in Table A11. However, when considering parent's country of birth, the results remained consistent in model 3b in Table A11. In these additional models, 34 % of those who had less educated mothers and 31 % of immigrants were excluded from the analysis because their parents were not living together when the youngest sibling was 6 years old (compared to 11 % of highly educated mothers and 16 % of non-immigrants, Table A12). The differences in our regression results might stem from the fact that HCA is negatively associated with grades, especially for children whose early childhood involved parental separation. Because the effect sizes of our main results were relatively small, a 16 % reduction in the sample size could explain the lack of statistical significance.

7. Discussion

As children from disadvantaged backgrounds particularly benefit from ECEC in terms of academic achievement, many scholars have argued that ECEC enrollment can work as an equalizer for inequalities (e. g. Burger, 2010; Schmutz, 2024). In the case of Finland, the HCA as a cash-for-care benefit serves as a counterfactual for the use of child care services. As such, the aim of this study was twofold: First, to study how parental education moderates the association between the duration of the HCA period and literacy grades, and second, to investigate any differences in the association between the duration of the HCA period and literacy grades by ethnic origin.

Addressing the first aim, we found that HCA duration was negatively associated with the literacy grades of individuals with less educated mothers, which aligns with previous international studies (e.g., Datta Gupta & Simonsen, 2016; Dumas & Lefranc, 2012) that show similar results for ECEC participation. However, previous studies from Finland have not found this heterogeneity based on parental education. The reason for this could be that previous research interest focused on educational attainment (Karhula et al., 2017) or the cognitive development of 4-year-olds (Kosonen & Huttunen, 2018); moreover, one previous study measured child care differences at the age of 6 only (Hiilamo et al., 2018). Our results suggest that ECEC attendance, as a counterfactual for home care, could compensate for the importance of family background in academic achievement in the context of Finland.

Regarding our second aim, we found that the negative association between literacy grade and duration of the HCA period is stronger for second-generation immigrants than for non-immigrants. This result also corroborates previous findings (Cornelissen et al., 2018; Votruba-Drzal et al., 2015). Such research has suggested that ECEC enables the children of immigrants to familiarize themselves with the host country's language, making ECEC an important step on the path of lifelong learning. As school starts relatively late in the Nordic countries (around the ages of 6–7), ECEC could be especially important for the academic achievement of children with immigrant backgrounds, as they would have time to familiarize themselves with the language before starting school. Similarly, home care does not offer the same opportunities for language learning and social interaction, which can hinder children's academic success and integration into society.

Notably, we found that the negative association between HCA duration and literacy grades was strongest among children whose parents were born in former Yugoslavia, who mainly moved to Finland to

escape war; this could explain why the HCA duration has this negative association, especially for the children of refugees. Investment and family stress theories also support the benefits of attending ECEC for children of refugees, including compensating for family disadvantages. However, we did not find this negative association among children whose parents were born in Iraq or Somalia. It could be that war refugees from Somalia and Iraq who came to Finland may have been well-equipped to support their children in school, while their more disadvantaged counterparts may have fled to neighboring countries. Therefore, former Yugoslavian refugees may have been in more dire situations when they fled their home country. Further, cultural factors may explain these differences. Former Yugoslavia was a socialist state with state-funded formal ECEC (Simic & Simic, 2019), whereas in Iraq and Somalia (Unesco, 1999), ECEC was very underdeveloped in the 1990s and before. Therefore, families with former Yugoslavian ancestry may be more receptive to the benefits of ECEC than their Iraqi and Somali counterparts. Unfortunately, measures for these mechanisms are not accessible using register data but this is definitely a topic that requires further research.

Although we found that HCA duration is negatively associated with educational achievement, our effect sizes are arguably small. Relatedly, previous studies suggest a “fading-away” effect when measuring long-term associations in ECEC (Abenavoli, 2019). We calculated that among the families with mothers with a basic education level, the difference between those who did not receive the HCA and those who were cared for at home for four years is about 9 % of an SD. Although this does not seem like a big difference, it could still considerably impact children’s school choices, as decisions about upper secondary school are based on the grades of the lower secondary school leaving certificate.

Based on our findings and those of previous studies, we argue that enrolling children in ECEC can address social inequalities related to learning and promote equality of opportunity, as home care does not necessarily provide the same structured learning environment and social interactions crucial for children’s development and future academic success. Following the Lisbon guidelines of the European Commission, according to which over 90 % of 4-year-olds should be in ECEC, these findings suggest the need for a broader political discussion about limiting HCA and expanding ECEC in Finland. In recent years, Finland has conducted experiments with starting preschool at the age of 5, and it might be appropriate to consider restricting HCA to children under 2 years old, as is the case in Norway. Alternatively, Finnish policymakers might consider some other support for families with children that does not guide children’s care arrangements so strongly (see Kosonen, 2022), such as a means-tested increase in child allowance. Additionally, although the primary responsibility for raising children lies with the parents, the quality of the home learning environment could be influenced through enhanced awareness campaigns conducted during nurse and doctor visits in parental clinics / child health clinics.

Immigration has increased in Europe in recent decades, and investing in high-quality ECEC could support the integration of immigrants. Early ECEC participation could be especially beneficial for first-generation immigrants, who may be even less familiar with the host country’s language than second-generation immigrants, as their parents have lived in the host country longer. In addition, the academic

achievement gap between non-immigrants and immigrants seems to be isolated to first-generation immigrants (in Finland, see Kilpi-Jakonen, 2011). Therefore, ECEC can function as an important network for both children and parents, especially from the perspective of language support, and thus promote equal opportunities. Supporting the participation of disadvantaged and immigrant-background children in ECEC should be included in both national and international (such as OECD) decision-making agendas.

We acknowledge that our methodological approach contains sources of endogeneity. For instance, our estimates could be biased by a correlation between behavioral problems (possibly stemming from learning difficulties as a child ages) and the HCA duration and literacy grade. Indeed, children of less educated parents tend to have more learning difficulties; conversely, more educated parents tend to compensate for their children’s learning difficulties more effectively. Unfortunately, we do not have information on learning difficulties in our data. Further, despite considering many family characteristics, we have not accounted for all possible characteristics; for example, later changes in family structures can undermine the reliability of our family-fixed effect models. We also did not have information on ECEC participation, including the type of care (e.g., family day care versus private day care) or the quality of ECEC. However, beginning from 2019–2020, Finland has collected individual-level register data on ECEC participation (Finnish national agency for education, 2025). In the future, it may be possible to consider the connection between ECEC characteristics and long-term child outcomes in Finnish research utilizing register data.

Funding

This research was funded by the Research Council of Finland (decision number: 345546) and Finnish Cultural Foundation.

CRediT authorship contribution statement

Markus Laaninen: Writing – original draft.

Declaration of Competing Interest

The authors declare that there is no conflict of interest.

Acknowledgements

This research was supported by the INVEST Research Flagship Centre. In particular, I would like to thank my supervisors Prof. Jani Erola, Prof. Mikko Niemelä and Dr. Alekski Karhula once again for their good and critical comments on the construction of the manuscript’s research setting. I thank my colleagues and friends Dr. Hannu Lehti for the support in using Stata program, Dr. Aki Koivula for discussion regarding the results and doctoral researcher Essi Ahlroth for clarifying the research topic. I would also like to thank Prof. Outi Sarpila and doctoral researcher Sumia Akter for their detailed comments that helped to finalize the manuscript. Finally, I would like to thank two anonymous reviewers who provided constructive feedback on the manuscript and helped me read my work out of the box.

Appendices.

Table A1

OLS and family fixed-effect models on the association between literacy grade and HCA months by mother's education

	Model 1	Model 2	Model 3	Model 4	Model 5
HCA months	0.0005	-0.0006			
	0.0005	0.0004			
Mother's education					
Basic	ref.	ref.			
	-	-			
Secondary	0.1489***	0.0665***			
	0.0185	0.0165			
Tertiary	0.6848***	0.4100***			
	0.0179	0.0163			
Mother's education X HCA months					(Parental edu)
Basic X HCA months	ref.	ref.	0.0016	-0.0018*	-0.0033*
	-	-	0.0009	0.0009	0.0014
Secondary X HCA months	0.0023***	0.0025***	0.0030***	-0.0007	-0.0011*
	0.0005	0.0004	0.0005	0.0005	0.0005
Tertiary X HCA months	0.0001	0.0013**	0.0043***	0.0005	0.0005
	0.0005	0.0004	0.0005	0.0005	0.0004
Immigration status (ref. Native)		0.3453***			
2nd gen immigrant		0.0168			
Gender (ref. Male)					
Female		0.8616***		0.8489***	0.8488***
		0.0045		0.0052	0.0052
Sibling order		-0.0246***		-0.0121	-0.0118
		0.0027		0.0084	0.0084
Number of children in the family		0.0103***			
		0.0017			
Age difference to next child (in months)		-0.0005		-0.0015***	-0.0015***
		0.0003		0.0004	0.0004
Mother's status when child was - 1 of age (ref. Employed)					
Unemployed		-0.0837***		0.0017	0.002
		0.0095		0.0122	0.0122
Student / in school		-0.0347***		-0.0289**	-0.0287**
		0.0075		0.0109	0.0109
other		-0.0875***		-0.0442***	-0.0442***
		0.0064		0.0087	0.0087
Last child in the family (ref. No)					
Yes		0.5048		1.3580***	1.3532***
		0.2846		0.3397	0.3397
Father's education					
Basic		0			
		.			
Secondary		0.1160***			
		0.0068			
Tertiary		0.4556***			
		0.0074			
Parent's lived together when child was 3 (ref. No)		0.0449***		0.0204	0.0213
		0.0107		0.0156	0.0156
Parent's lived together when child was 6 (ref. No)		0.1306***		-0.0073	-0.0066
		0.0085		0.0157	0.0157
Unemployment months mother		-0.0024***		0.0024**	0.0023**
		0.0003		0.0008	0.0008
Unemployment months father		-0.0038***		-0.0027**	-0.0027**
		0.0002		0.0008	0.0008
Intercept	-0.4471***	-0.9782***	-0.0863***	-0.3106***	-0.3125***
	0.0169	0.0193	0.0083	0.0289	0.0289
FE	No	No	Yes	Yes	Yes
Controls	No	Yes	No	Yes	Yes
N	140649	140649	140649	140649	140649
Families			66070	66070	66070
R-squared / Adjusted R-squared	0.0694	0.2983	0.0016	0.2756	0.2757
Standard errors in second row					

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5
 OLS and family fixed-effect models on the association between literacy grade and HCA months by immigration status

	Model 1	Model 2	Model 3	Model 4
HCA months	-0.0021***	0.0011***		
	0.0001	0.0002		
Immigration status				
Native	ref.	ref.		
	-	-		
2nd gen immigrant	0.0019	0.4447***		
	0.044	0.0373		
Immigration status X HCA months				
Native X HCA months	ref.	ref.	0.0034***	-0.0002
	-	-	0.0003	0.0004
Immigrant X HCA months	-0.0035*	-0.0037**	-0.0012	-0.0052*
	0.0015	0.0013	0.0022	0.0022
Mother's education (ref. Basic)				
Secondary		0.1439***		
		0.0084		
Tertiary		0.4556***		
		0.0088		
Gender (ref. Male)				
Female		0.8615***		0.8489***
		0.0045		0.0052
Sibling order		-0.0247***		-0.0116
		0.0027		0.0084
Number of children in the family		0.0107***		
		0.0017		
Age difference to next child (in months)		-0.0005		-0.0015***
		0.0003		0.0004
Mother's status when child was -1 of age (ref. Employed)				
Unemployed		-0.0834***		0.0012
		0.0095		0.0122
Student / in school		-0.0352***		-0.0295**
		0.0076		0.0109
other		-0.0869***		-0.0435***
		0.0064		0.0087
Last child in the family (ref. No)		0.5002		1.3761***
Yes		0.2846		0.3399
Father's education (ref. Basic)				
Secondary		0.1161***		
		0.0068		
Tertiary		0.4563***		
		0.0074		
Parent's lived together when child was 3 (ref. No)		0.0443***		0.0186
		0.0106		0.0156
Parent's lived together when child was 6 (ref. No)		0.1304***		-0.0086
		0.0085		0.0157
Unemployment months mother		-0.0025***		0.0025***
		0.0003		0.0008
Unemployment months father		-0.0038***		-0.0027**
		0.0002		0.0008
Intercept	0.0561***	-1.0330***	-0.0849***	-0.3080***
FE	0.0046	0.0151	0.0083	0.0289
Controls	No	No	Yes	Yes
N	No	Yes	No	Yes
Families	140649	140649	140649	140649
R-squared / Adjusted R-squared			66070	66070
Standard errors in second row	0.0017	0.2982	0.0015	0.2756

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6
 OLS and family fixed-effect models on the association between literacy grade and HCA months by ethnic origins

	Model 1	Model 2	Model 3	Model 4
HCA months	-0.0021***	0.0010***		
	0.0001	0.0002		
Ethnic origins				
Mother or Father Finnish	ref.	ref.		
	-	-		
Mother and father Iraq	-0.2124	0.4185***		
	0.1381	0.1161		

(continued on next page)

Table 6 (continued)

	Model 1	Model 2	Model 3	Model 4
Mother and father Somalia	-0.3835*** 0.098	0.1908* 0.0826		
Mother and father former SU	0.1678 0.1504	0.3889** 0.1262		
Mother and father former Yugoslavia	-0.1212 0.2097	0.4187* 0.1759		
Mother and father other	0.1422* 0.0588	0.5361*** 0.0496		
Ethnic origins X HCA months				
Mother or Father Finnish	ref. -	ref. -	0.0034*** 0.0003	-0.0003 0.0004
Mother and father Iraq	0.0025 0.0051	0.0006 0.0043	0.0068 0.0075	0.002 0.0085
Mother and father Somalia	0.005 0.0031	0.0027 0.0026	0.0026 0.0036	0.0005 0.0035
Mother and father former SU	-0.0045 0.0051	-0.0039 0.0042	-0.0062 0.0079	-0.0087 0.0072
Mother and father former Yugoslavia	-0.0002 0.0073	-0.0048 0.0061	-0.0218** 0.0071	-0.0261*** 0.0069
Mother and father other	-0.0061** 0.0022	-0.0058** 0.0018	-0.0012 0.0036	-0.0071* 0.0035
Mother's education (ref. Basic)				
Secondary		0.1437*** 0.0084		
Tertiary		0.4553*** 0.0088		
Gender (ref. Male)				
Female		0.8615*** 0.0045		0.8489*** 0.0052
Sibling order		-0.0246*** 0.0027		-0.0112 0.0084
Number of children in the family		0.0108*** 0.0017		
Age difference to next child (in months)		-0.0005 0.0003		-0.0015*** 0.0004
Mother's status when child was -1 of age (ref. Employed)				
Unemployed		-0.0836*** 0.0095		0.0015 0.0122
Student / in school		-0.0352*** 0.0076		-0.0295** 0.0109
other		-0.0867*** 0.0064		-0.0438*** 0.0087
Last child in the family (ref. No)				
Yes		0.4893 0.2846		1.3647*** 0.3399
Father's education (ref. Basic)				
Secondary		0.1171*** 0.0068		
Tertiary		0.4575*** 0.0074		
Parent's lived together when child was 3 (ref. No)		0.0438*** 0.0107		0.0188 0.0156
Parent's lived together when child was 6 (ref. No)		0.1301*** 0.0085		-0.0086 0.0157
Unemployment months mother		-0.0025*** 0.0003		0.0025*** 0.0008
Unemployment months father		-0.0037*** 0.0002		-0.0026** 0.0008
Intercept	0.0561*** 0.0046	-1.0337*** 0.0151	-0.0848*** 0.0083	-0.3089*** 0.0289
FE	No	No	Yes	Yes
Controls	No	Yes	No	Yes
N	140649	140649	140649	140649
Families			66070	66070
R-squared / Adjusted R-squared	0.002	0.2982	0.0016	0.2757
Standard errors in second row				

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A4
Family fixed-effect model on the association between literacy grade and HCA months by parental education and immigration status

	Model 1
Immigration status X Mother's education	
X HCA months	
Native X Basic X HCA months	-0.0016
	0.0009
Native X Secondary X HCA months	-0.0007
	0.0005
Native X Tertiary X HCA months	0.0006
	0.0005
Immigrant X Basic X HCA months	-0.0034
	0.0028
Immigrant X Secondary X HCA months	-0.0058
	0.004
Immigrant X Tertiary X HCA months	-0.0163*
	0.007
Gender (ref. Male)	
Female	0.8489***
	0.0052
Sibling order	
	-0.012
	0.0084
Number of children in the family	
	0
	.
Age difference to next child (in months)	
	-0.0015***
	0.0004
Mother's status when child was	
-1 of age (ref. Employed)	
Unemployed	0.0023
	0.0122
Student / in school	-0.0287**
	0.0109
other	-0.0438***
	0.0087
Last child in the family (ref. No)	
Yes	1.3723***
	0.3399
Father's education (ref. Basic)	
Secondary	0
	.
Tertiary	0
	.
Parent's lived together when child was 3 (ref. No)	
	0.0202
	0.0156
Parent's lived together when child was 6 (ref. No)	
	-0.0074
	0.0157
Unemployment months mother	
	0.0024**
	0.0008
Unemployment months father	
	-0.0027**
	0.0008
Intercept	
	-0.3099***
	0.0289
FE	Yes
Controls	Yes
N	140649
Families	66070
R-squared / Adjusted R-squared	0.2757
Standard errors in second row	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A5
OLS and family fixed-effect models on the association between math grade and HCA months by mother's education

	Model 1	Model 2	Model 3	Model 4
HCA months	0.0011*	-0.0010*		
	0.0005	0.0005		
Mother's education				
Basic	0	0		
	.	.		
Secondary	0.1762***	0.0558**		
	0.02	0.0196		
Tertiary	0.7372***	0.4041***		
	0.0193	0.0193		

(continued on next page)

Table A5 (continued)

	Model 1	Model 2	Model 3	Model 4
Mother's education X HCA months				
Basic X HCA months	0	0	0.0027**	-0.0001
	.	.	0.001	0.0011
Secondary X HCA months	0.0023***	0.0027***	0.0036***	0.0005
	0.0006	0.0005	0.0006	0.0006
Tertiary X HCA months	-0.0005	0.0012*	0.0038***	0.0005
	0.0006	0.0005	0.0006	0.0006
Immigration status (ref. Native)				
2nd gen immigrant		0.1142***		
		0.0202		
Gender (ref. Male)				
Female		0.3565***		0.3405***
		0.0054		0.0068
Sibling order				
		-0.0284***		-0.0199
		0.0033		0.0112
Number of children in the family				
		0.0242***		0
		0.0021		.
Age difference to next child (in months)				
		-0.0023***		-0.0009
		0.0004		0.0005
Mother's status when child was -1 of age (ref. Employed)				
Unemployed		-0.0942***		-0.0167
		0.0116		0.0162
Student / in school		-0.0318***		-0.0527***
		0.0091		0.014
other		-0.0782***		-0.0284*
		0.0075		0.0114
Last child in the family (ref. No)				
Yes		2.2588***		0.8062
		0.3656		0.4492
Father's education				
Basic		0		
		.		
Secondary		0.1130***		
		0.0082		
Tertiary		0.4876***		
		0.0089		
Parent's lived together when child was 3 (ref. No)				
		0.0293*		0.0162
		0.0127		0.0206
Parent's lived together when child was 6 (ref. No)				
		0.1243***		0
		0.0102		0.0203
Unemployment months mother				
		-0.0022***		0.001
		0.0004		0.001
Unemployment months father				
		-0.0044***		-0.0018
		0.0003		0.0011
Intercept				
	-0.4945***	-0.6899***	-0.0880***	-0.0860*
FE	0.0182	0.0232	0.0093	0.038
Controls	No	No	Yes	Yes
N	No	Yes	No	Yes
Families	118060	118060	118060	118060
R-squared / Adjusted R-squared				
Standard errors in second row	0.0741	0.1554	0.0018	0.0511

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A6

OLS and family fixed-effect models on the association between math grade and HCA months by immigration status

	Model 1	Model 2	Model 3	Model 4
HCA months	-0.0019***	0.0007***		
	0.0002	0.0002		
Immigration status				
Native	ref.	ref.		
	-	-		
2nd gen immigrant	-0.2413***	0.1996***		
	0.0486	0.0451		
Immigration status X HCA months				
Native X HCA months	ref.	ref.	0.0036***	0.0005
	-	-	0.0004	0.0005
Immigrant X HCA months	-0.0031	-0.0032*	-0.001	-0.0035
	0.0017	0.0016	0.0027	0.0027
Mother's education (ref. Basic)				
Secondary		0.1397***		
		0.0101		
Tertiary		0.4485***		

(continued on next page)

Table A6 (continued)

	Model 1	Model 2	Model 3	Model 4
		0.0106		
Gender (ref. Male)				
Female		0.3564***		0.3405***
		0.0054		0.0068
Sibling order		-0.0286***		-0.0199
		0.0033		0.0111
Number of children in the family		0.0247***		
		0.0021		
Age difference to next child (in months)		-0.0023***		-0.0009
		0.0004		0.0005
Mother's status when child was -1 of age (ref. Employed)				
Unemployed		-0.0937***		-0.0164
		0.0116		0.0161
Student / in school		-0.0322***		-0.0526***
		0.0091		0.014
other		-0.0775***		-0.0281*
		0.0075		0.0114
Last child in the family (ref. No)		2.2501***		0.8181
Yes		0.3656		0.4494
Father's education (ref. Basic)				
Secondary		0.1130***		
		0.0082		
Tertiary		0.4883***		
		0.0089		
Parent's lived together when child was 3 (ref. No)		0.0288*		0.0157
		0.0127		0.0206
Parent's lived together when child was 6 (ref. No)		0.1241***		-0.0005
		0.0102		0.0203
Unemployment months mother		-0.0023***		0.0011
		0.0004		0.001
Unemployment months father		-0.0043***		-0.0018
		0.0003		0.0011
Intercept	0.0533***	-0.7465***	-0.0873***	-0.0848*
FE	0.005	0.0184	0.0093	0.038
Controls	No	No	Yes	Yes
N	No	Yes	No	Yes
Families	118060	118060	118060	118060
R-squared / Adjusted R-squared				
Standard errors in second row	0.0033	0.1552	0.0018	0.0512

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A7

OLS and family fixed-effect models on the association between literacy grade and HCA groups by mother's education

	Model 1	Model 2	Model 3	Model 4
HCA groups	0.0031	-0.0046		
	0.003	0.0027		
Mother's education				
Basic	ref.	ref.		
	-	-		
Secondary	0.1375***	0.0516**		
	0.021	0.0185		
Tertiary	0.6842***	0.4026***		
	0.0202	0.0183		
Mother's education X HCA groups				
Basic X HCA months	ref.	ref.	0.0121*	-0.007
	-	-	0.0058	0.0055
Secondary X HCA months	0.0148***	0.0166***	0.0205***	-0.0015
	0.0033	0.0029	0.0031	0.003
Tertiary X HCA months	0.0005	0.0085**	0.0256***	0.0043
	0.0033	0.0029	0.0031	0.0029
Immigration status (ref. Native)		0.3447***		
2nd gen immigrant		0.0168		
Gender (ref. Male)				
Female		0.8616***		0.8488***
		0.0045		0.0052
Sibling order		-0.0249***		-0.0099
		0.0027		0.0083
Number of children in the family		0.0108***		
		0.0017		
Age difference to next child (in months)		-0.0006		-0.0015***

(continued on next page)

Table A7 (continued)

	Model 1	Model 2	Model 3	Model 4
		0.0003		0.0004
Mother's status when child was				
–1 of age (ref. Employed)				
Unemployed		–0.0838***		0.0014
		0.0095		0.0122
Student / in school		–0.0348***		–0.0289**
		0.0075		0.0109
other		–0.0870***		–0.0431***
		0.0064		0.0087
Last child in the family (ref. No)				
Yes		0.5307		1.3985***
		0.2846		0.3406
Father's education				
Basic		0		
		.		
Secondary		0.1161***		
		0.0068		
Tertiary		0.4557***		
		0.0074		
Parent's lived together when child was 3 (ref. No)		0.0448***		0.0197
		0.0107		0.0156
Parent's lived together when child was 6 (ref. No)		0.1304***		–0.0078
		0.0085		0.0157
Unemployment months mother		–0.0024***		0.0026***
		0.0003		0.0008
Unemployment months father		–0.0038***		–0.0027**
		0.0002		0.0008
Intercept	–0.4484***	–0.9726***	–0.1011***	–0.3245***
FE	0.0191	0.0208	0.0095	0.0287
Controls	No	No	Yes	Yes
N	140649	140649	140649	140649
Families			66070	66070
R-squared / Adjusted R-squared	0.0694	0.2983	0.0016	0.2757
Standard errors in second row				

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A8

OLS and family fixed-effect models on the association between literacy grade and HCA groups by immigration status

	Model 1	Model 2	Model 3	Model 4
HCA groups	–0.0140***	0.0067***		
	0.001	0.001		
Immigration status				
Native	ref.	ref.		
	-	-		
2nd gen immigrant	0.0175	0.4694***		
	0.0487	0.0412		
Immigration status X HCA groups				
Native X HCA months	ref.	ref.	0.0221***	0.002
	-	-	0.0021	0.0023
Immigrant X HCA months	–0.0221*	–0.0254**	–0.0078	–0.0317*
	0.0094	0.0079	0.0135	0.0132
Mother's education (ref. Basic)				
Secondary		0.1438***		
		0.0084		
Tertiary		0.4557***		
		0.0088		
Gender (ref. Male)				
Female		0.8615***		0.8486***
		0.0045		0.0052
Sibling order		–0.0249***		–0.0118
		0.0027		0.0083
Number of children in the family		0.0111***		
		0.0017		
Age difference to next child (in months)		–0.0006		–0.0012***
		0.0003		0.0004
Mother's status when child was				
–1 of age (ref. Employed)				
Unemployed		–0.0834***		0.0022
		0.0095		0.0122
Student / in school		–0.0352***		–0.0284**
		0.0076		0.0109
other		–0.0865***		–0.0418***

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Table A8 (continued)

	Model 1	Model 2	Model 3	Model 4
Last child in the family (ref. No)		0.0064		0.0087
Yes		0.5234		1.1316***
		0.2846		0.34
Father's education (ref. Basic)				
Secondary		0.1162***		
		0.0068		
Tertiary		0.4564***		
		0.0074		
Parent's lived together when child was 3 (ref. No)		0.0442***		0.0208
		0.0106		0.0156
Parent's lived together when child was 6 (ref. No)		0.1303***		-0.0068
		0.0085		0.0157
Unemployment months mother		-0.0025***		0.0027***
		0.0003		0.0007
Unemployment months father		-0.0038***		-0.0026**
		0.0002		0.0008
Intercept	0.0672***	-1.0374***	-0.1000***	-0.3300***
FE	0.0052	0.0153	0.0095	0.0287
Controls	No	No	Yes	Yes
N	No	Yes	No	Yes
Families	140649	140649	140649	140649
R-squared / Adjusted R-squared	0.0018	0.2983	0.0016	0.2768
Standard errors in second row				

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A9

OLS and family fixed-effect models on the association between literacy grade and HCA months by mother's education. Estimates are based on families where younger sibling had more HCA months

	Model 1	Model 2	Model 3	Model 4
HCA months	0.0005	-0.0006		
	0.0011	0.001		
Mother's education				
Basic	ref.	ref.		
	-	-		
Secondary	0.1658***	0.0907*		
	0.0459	0.0421		
Tertiary	0.7556***	0.4820***		
	0.0433	0.0415		
Mother's education X HCA months				
Basic X HCA months	ref.	ref.	-0.0027	-0.0017
	-	-	0.0029	0.0027
Secondary X HCA months	0.0015	0.0021*	0.0008	-0.0006
	0.0012	0.0011	0.0017	0.0015
Tertiary X HCA months	-0.0025*	-0.0008	-0.0029*	-0.001
	0.0012	0.0011	0.0014	0.0014
Immigration status (ref. Native)		0.3498***		
2nd gen immigrant		0.0325		
Gender (ref. Male)				
Female		0.8527***		0.8300***
		0.0112		0.0131
Sibling order		-0.0338***		-0.0229
		0.0062		0.0161
Number of children in the family		0.0104**		
		0.0037		
Age difference to next child (in months)		-0.0003		-0.0009
		0.0007		0.0008
Mother's status when child was -1 of age (ref. Employed)				
Unemployed		-0.0641**		-0.0203
		0.0239		0.0296
Student / in school		-0.0126		-0.0664*
		0.0191		0.0271
other		-0.0782***		-0.0587**
		0.0173		0.022
Last child in the family (ref. No)				
Yes		0.3083		0.8789
		0.6601		0.7892
Father's education				
Basic		ref.		
		-		

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Table A9 (continued)

	Model 1	Model 2	Model 3	Model 4
Secondary		0.0657*** 0.0178		
Tertiary		0.4332*** 0.0188		
Parent's lived together when child was 3 (ref. No)		0.0538 0.0291		0.0005 0.0434
Parent's lived together when child was 6 (ref. No)		0.1338*** 0.0244		0.033 0.0418
Unemployment months mother		-0.0037*** 0.0008		0.001 0.0019
Unemployment months father		-0.0038*** 0.0006		-0.0001 0.002
Intercept	-0.4038*** 0.0409	-0.9488*** 0.0488	0.1009*** 0.0278	-0.2346*** 0.0738
FE	No	No	Yes	Yes
Controls	No	Yes	No	Yes
N	21925	21925	21925	21925
Families			9845	9845
R-squared / Adjusted R-squared	0.0751	0.3074	0.0004	0.2652
Standard errors in second row				

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A10

OLS and family fixed-effect models on the association between literacy grade and HCA months by immigration status. Estimates are based on families where younger sibling had more HCA months

	Model 1	Model 2	Model 3	Model 4
HCA months	-0.0038*** 0.0004	-0.0001 0.0004		
Immigration status				
Native	ref. -	ref. -		
2nd gen immigrant	-0.0101 0.0792	0.4761*** 0.0678		
Immigration status X HCA months				
Native X HCA months	ref. -	ref. -	-0.0013 0.0011	-0.0009 0.001
Immigrant X HCA months	-0.0059* 0.0029	-0.0053* 0.0025	-0.0025 0.0044	-0.0012 0.0041
Mother's education (ref. Basic)				
Secondary		0.1576*** 0.0218		
Tertiary		0.4667*** 0.0228		
Gender (ref. Male)				
Female		0.8525*** 0.0112		0.8301*** 0.0131
Sibling order		-0.0347*** 0.0062		-0.0229 0.0161
Number of children in the family		0.0115** 0.0037		
Age difference to next child (in months)		-0.0003 0.0007		-0.001 0.0008
Mother's status when child was -1 of age (ref. Employed)				
Unemployed		-0.0649** 0.0239		-0.0202 0.0296
Student / in school		-0.0135 0.0191		-0.0664* 0.0271
other		-0.0730*** 0.0172		-0.0586** 0.022
Last child in the family (ref. No)		0.2694 0.6602		0.8859 0.7884
Yes				
Father's education (ref. Basic)				
Secondary		0.0671*** 0.0178		
Tertiary		0.4355*** 0.0188		
Parent's lived together when child was 3 (ref. No)		0.0561 0.0291		-0.0001 0.0435
Parent's lived together when child was 6 (ref. No)		0.1346*** 0.0244		0.0327 0.0419

(continued on next page)

Table A10 (continued)

	Model 1	Model 2	Model 3	Model 4
Unemployment months mother		-0.0040***		0.001
		0.0008		0.0019
Unemployment months father		-0.0037***		-0.0001
		0.0006		0.002
Intercept	0.1772***	-0.9698***	0.1031***	-0.2335**
	0.0117	0.0387	0.0277	0.0738
FE	No	No	Yes	Yes
Controls	No	Yes	No	Yes
N	21925	21925	21925	21925
Families			9845	9845
R-squared / Adjusted R-squared	0.0069	0.3069	0.0002	0.2652
Standard errors in second row				

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A11

Family fixed-effect models on the association between literacy grade and HCA months. A models reflect all families and B models only those families where parents lived together when youngest child in the family was 6 years old

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
Mother's education X HCA months						
Basic X HCA months	-0.0018*	-0.0016				
	0.0009	0.001				
Secondary X HCA months	-0.0007	-0.0009				
	0.0005	0.0005				
Tertiary X HCA months	0.0005	0.0007				
	0.0005	0.0005				
Immigration status X HCA months						
Native X HCA months			-0.0002	-0.0002		
			0.0004	0.0004		
Immigrant X HCA months			-0.0052*	-0.0032		
			0.0022	0.0026		
Ethnic origins X HCA months						
Mother or Father Finnish					-0.0003	-0.0002
					0.0004	0.0004
Mother and father Iraq					0.002	0.0124
					0.0085	0.0087
Mother and father Somalia					0.0005	0.0049
					0.0035	0.0044
Mother and father former SU					-0.0087	-0.0095
					0.0072	0.0083
Mother and father former Yugoslavia					-0.0261***	-0.0244***
					0.0069	0.0074
Mother and father other					-0.0071*	-0.0083*
					0.0035	0.0041
Intercept	-0.3106***	-0.2144***	-0.3080***	-0.2158***	-0.3089***	-0.2171***
	0.0289	0.0439	0.0289	0.0439	0.0289	0.0438
FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	140649	117243	140649	117243	140649	117243
Families	66070	54891	66070	54891	66070	54891
R-squared / Adjusted R-squared	0.2756	0.2835	0.2756	0.2834	0.2757	0.2836
Standard errors in second row						

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A12

Sample size by mother's education and immigration status in all families and nuclear families, and reduction in sample size when only nuclear families are accounted for

	All families		Nuclear families		Reduction of sample	
	N	%	N	%	N	%
Mother's education						
Basic	13664	9.71	8986	7.66	4678	34.24
Secondary	55425	39.41	44706	38.13	10719	19.34
Tertiary	71560	50.88	63551	54.2	8009	11.19
Total	140649	100	117243	100	23406	16.64
Immigration status						
Native	137703	97.91	115212	98.27	22491	16.33
Immigrant	2946	2.09	2031	1.73	915	31.06
Total	140649	100	117243	100	23406	16.64

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