

RESEARCH ARTICLE

Inequalities in children's skills on primary school entry in Ireland and Scotland: do home learning environment and early childhood childcare explain these differences?

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This article draws on the Growing Up in Ireland study and the Scottish sample of the Millennium Cohort Study to explore the factors influencing inequalities in children's cognitive skills on entry to primary education. It adopts a multidimensional comparative approach, which directly compares the effects of parental education and household income on several cognitive outcomes (vocabulary, language, reading and numbers) among five-year-old children and examines the extent to which inequalities in these outcomes are mediated by the home learning environment (HLE) and early childhood education (ECE). Home learning environment plays a stronger role in explaining actual vocabulary differences in Ireland while it plays a stronger role in school readiness (teacher-assessed skills) in Scotland. In both countries, use of centre-based care at 9 months and 3 years was markedly higher among the top income quintile. Centre-based care is found to play a mediating role in school readiness in Scotland. Nonetheless, the findings point to important direct effects of family background even when HLE and childcare are taken into account. The analyses point to differences in the trajectory of early skill development in the two countries, with the impact of early skill development being more marked in Scotland than Ireland. Comparative analyses of this kind thus yield important insights for policy development by highlighting potential domains (such as childcare) or timing (preschool or within-school) for intervention.

Key words social inequalities • transition to primary school • multidimensional • comparative

Key messages

- Income makes more of a difference to child cognitive outcomes than previously thought.
- Educational inequality is not explained by differences in home learning.
- Policy should address educational inequality with broader taxation and social welfare measures.

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Introduction and conceptual background

The period from birth to school entry reflects the dynamic interplay of the different domains and contexts of children's lives (including family and early care and education) over time (Bernardi et al, 2019). There is a substantial body of literature that indicates that cognitive development at this stage has a long-lasting effect on later educational and labour market outcomes (Feinstein and Bynner, 2004; Duncan et al, 2007), highlighting the importance of understanding the processes shaping early inequality in cognitive skills. However, an important lacuna in existing studies is the failure to use comparative analyses to help understand the role of institutional factors in shaping early development and inequalities therein (for an exception, see Bradbury et al, 2012). This article draws on the Growing Up in Ireland (GUI) study and the Scottish sample of the Millennium Cohort Study (MCS) to investigate whether and how family factors, such as the home learning environment (HLE), and institutional factors, especially the nature of early childhood care and education, shape the scale of inequalities in cognitive skills by parental education and household income among children at the point of transition to primary school.

Family background and child outcomes

An enduring debate in the sociology of education has centred on how best to capture variation in family resources and their effects on child outcomes. Several studies have pointed to the dominant role played by parental education in shaping child cognitive outcomes, with better reading and numerical test scores found among children whose parents have degree-level or higher qualifications (Hansen and Hawkes, 2009; Hansen and Jones, 2010). In contrast, other researchers, mainly but not solely economists, have focused on the effect of household income on child outcomes (Gregg and Macmillan, 2010). Increasingly, however, researchers have highlighted the value of adopting a multidimensional approach to understanding educational inequality in childhood (Sullivan et al, 2013; Washbrook et al, 2014; Hartas, 2015).

Perhaps more importantly, research has shown that the effects of different dimensions of family background on child outcomes are underpinned by different mechanisms. *Parental level of education* is an indicator of cultural resources and is likely to be reflected in the intellectual stimulation and learning environment at home as well as enhanced knowledge of the educational system. *Family income* captures parental financial resources at a given time, regardless of parents' educational level. This is an important resource as it indicates the ability to pay for goods (more sophisticated toys, child's own room and so on) and services/activities (private schooling or higher quality early childcare, extracurricular activities). Furthermore, the lack of financial resources might lead to financial stress and family conflict, resulting in poorer educational and socio-emotional outcomes for children (Conger and Conger, 2002).

Two important processes through which parental education and income can influence their children's development in their early years are: the HLE and early childhood care and education (Melhuish, 2010). Therefore, we test the extent to which the HLE mediates differentiation by parental education in children's cognitive outcomes and whether this mechanism is stronger for certain outcomes than others. Similarly, we examine the extent to which the type of early childhood care used explains differences by income and, again, whether its explanatory power differs depending on the outcome in question in two different countries with broadly similar institutional settings and highly comparable data: Scotland and Ireland.

Testing these mechanisms from a comparative and longitudinal perspective and across different outcomes has important implications for the nature and timing of family policy and interventions to close the gap in cognitive skills at the start of the educational career. More specifically, it can indicate the extent to which parental practices at home and the take-up of early childcare are responsible for existing inequalities and whether structural inequalities remain over and above these mechanisms. The last two decades of family policy in the UK and, perhaps to a lesser extent, in Ireland have focused on parental practices as the main strategy to address existing inequalities. However, a solid body of literature (Sullivan et al, 2013; Washbrook et al, 2014) has provided empirical evidence that structural inequalities persist beyond such practices and have argued that the focus on what parents 'do' can result in a culture of 'blaming' the parents rather than focusing on reducing broader inequalities (Hartas, 2014; Gillies et al, 2017). The framework used in this article can help shed more light on these dynamics by disentangling the direct and indirect effects of parental resources, whether the timing of 'doing' certain activities matters and whether these processes unfold similarly in two broadly similar contexts.

Home learning environment

A dominant strand of research on inequalities has built on Lareau's (2003) concept of 'concerted cultivation' to look at the role of the HLE in fostering the kinds of skills and dispositions that are valued in the educational system. From this perspective, highly educated parents proactively provide more stimulating educational and cultural activities for their children, such as reading to them in the early years and paying for drama and music lessons when they are older. A good deal of recent research has documented the way in which the quality of this home learning environment (HLE) has not only short-term effects in supporting the transition to primary school but longer-term effects in influencing pathways through secondary education (Van Steensel, 2006; Sylva et al, 2010; Sammons et al, 2015). Using Growing Up in Scotland data, HLE was found to have a strong relationship with measures of vocabulary and picture similarities at three years of age, with a larger effect size than for other variables and completely mediating the effect of mother's education (Melhuish, 2010).

Early childhood care and education

Children's learning is also shaped by their access to early childhood care and education (ECE). The findings on the impact of non-parental care have been subject to much debate, with some studies indicating benefits of grandparent care for vocabulary development and of centre-based care for primary school adjustment (Hansen and

Hawkes, 2009) while other studies point to non-significant differences across different types of care (for a summary, see Russell et al, 2016). There is a greater consensus on the influence of the quality of ECE on child development, with high-quality early years settings leading to better cognitive and non-cognitive outcomes among children (Sylva et al, 2010), especially for children from more socio-economically disadvantaged families (for example, Del Boca et al, 2017; McGinnity et al, 2017; Blossfeld et al, 2017).

Countries have been found to vary in the provision of free or subsidised ECE, the age group at which it is targeted, rates of take-up and the focus on learning activities (Gambaro et al, 2014; Blossfeld et al, 2017; OECD Family Database). These patterns suggest that the institutional context is likely to impact on the cognitive development of preschool children. However, to date (with the exception of Bradbury et al, 2012, and Doran et al, 2020) there has been little attempt to exploit the rich potential of child cohort studies as a basis for comparative research. Cross-national analyses have indicated that parental practices, such as reading to the child, are associated with cognitive development across almost all national contexts (Araújo and Costa, 2015). However, little attention has been paid to potential cross-cultural variation in such practices or the extent to which they respond to institutional factors (for example, preschool or primary school encouragement of home reading). There is suggestive evidence that, for example, rates of reading every day for three-year-olds are higher in Scotland than in the rest of the UK (Sullivan et al, 2010; see also Araújo and Costa, 2015, on diversity among a wider range of countries) but no obvious explanations of why this may be so.

In sum, this article contributes to the literature in at least two ways. First, it directly compares the effects of parental education and household income on several cognitive outcomes (vocabulary, language, reading and numbers) for five-year-old children and the extent to which these are mediated by the HLE and ECE respectively. Second, it takes a comparative approach, analysing not only the way in which institutions (such as ECE) shape child experiences and outcomes but also the extent to which parental practices to support home learning vary across contexts.

Comparing Ireland and Scotland

Ireland and Scotland represent interesting cases for comparison as they have both commonalities and differences (see Table 1). Because of differences in the timing of the two studies (see later), the description relates to the situation over the period between birth and five years for the study children. At the time of the survey, paid maternity leave was longer in Scotland than Ireland (though this gap has since closed), which would be expected to influence the use of non-parental care (either formal or informal), especially in the child's first year. Maternal employment rates in the preschool years were broadly similar in Ireland and Scotland. In both countries, ECE provision under the age of three represents a combination of unpaid informal support (from the child's grandparents or other relatives) and paid childminders or centres. Childcare costs for the under-tuos as a proportion of average earnings appear high in both countries by international standards.¹

Both countries have free part-time centre-based provision for preschool-age children, though the systems differ in the number of hours offered and in the age of entry. In both countries, the cohort of children analysed in this article experienced a

Table 1: A comparison of the institutional and societal context in Ireland and Scotland

	Scotland 2000–05	Ireland 2008–13
Maternity leave	39 weeks paid leave plus 13 weeks unpaid leave	26 weeks paid leave plus 16 weeks unpaid leave (additional 14 weeks unpaid per parent)
Maternal employment (when child was 3 years)	52% (MCS)	55% (GUI)
Childcare provision <3	No free universal provision – mixture of paid centre/childminder and unpaid relative provision	No free universal provision – mixture of paid centre/childminder and unpaid relative provision
Preschool provision 3–5	Funded place for 12.5 hours per week for 3–4-year-olds	Funded place for 15 hours per week for 3.25–4.5-year-olds
Age at starting school	Usually start ages 4.5 to 5.5	Compulsory at age 6 but most children start at ages 4–5
Income inequality	Higher inequality in Ireland pre-tax and social welfare payments but similar levels post-tax/transfer (2011)	
Ethnic diversity	Greater in Ireland: 14% speak a language other than English/Irish/Scots Gaelic at home compared with 2% in Scotland	
Family structure	Lone parenthood slightly more common in Scotland: at age 5, 18% of MCS sample were in lone-parent families compared with 14% of GUI sample	
Family size	Larger in Ireland: 47% of the GUI cohort have two or more siblings compared with 33% of the MCS sample in Scotland	
Population dispersion	More dispersed in Ireland: 43% of the GUI cohort live in rural areas compared with 18% of the Scottish MCS sample	

newly changed approach, after a legacy of having low levels of preschool provision by international standards (OECD Family Database). In Scotland, it became a statutory requirement from 2002 to offer 412.5 hours per year to all three-year-olds (since increasing to 475 hours per year and continuing an increasing trend after 2014). In Ireland, the Early Childhood Care and Education (ECCE) scheme was introduced in January 2010 so the children in the GUI study were the first cohort to avail of the scheme. The near universal take-up of these part-time preschool places means that in both countries almost all five-year-olds have had some exposure to centre-based care and education, although children's experiences prior to this phase and the extent to which part-time provision is supplemented with additional ECE hours paid for by parents may differ within and between countries; the resulting patterns are discussed in the Results section. The systems may differ too in the kinds of learning environment provided in the preschool setting. Both countries have a curriculum that spans preschool and primary school, though there is a lack of systematic research on the extent to which these curricula are implemented at preschool level and a limitation of the current analyses is the lack of available information on the quality of provision.

As well as differing somewhat in early years policy, broader social differences are worth highlighting. Before taxes and transfers (such as social welfare payments and child benefit), levels of income inequality (measured using the Gini coefficient) in 2011 are found to be higher in Ireland than Scotland; however, post-tax/transfer inequality levels are broadly comparable (Eurostat database).² Children in Scotland are somewhat more likely to be in a lone-parent family, while family size is larger in

Ireland; both dimensions are likely to affect the resources (economic and cultural) available to children.

Following significant levels of inward migration during the economic boom, mainly from central and Eastern Europe, Ireland is more culturally and linguistically diverse than Scotland. Moreover, the Scottish population is more highly concentrated in urban areas. In the analyses to be presented, we control for population density in order to compare like with like.

There is a difference in the timing of the two studies, with the Scottish data relating to the pre-recession period and the Irish data covering the period from mid-recession to economic recovery. The use of a relative (quintile) measure of income rather than an absolute measure should provide greater stability in looking at the outcomes for children in a time of economic change (see later).

On the basis of the conceptual framework and between-country differences described earlier, we hypothesise the following:

1. Differences in broader HLE between the two contexts will mean that the role of HLE in mediating social inequalities will be stronger in Scotland than Ireland.
2. Given the similar institutional settings related to maternity leave and childcare provision in the two countries, we expect the role of early childcare and its mediating power in explaining income inequalities to operate similarly in Ireland and Scotland.

Data, measurement and methods

Data

There may be considerable challenges in conducting post hoc harmonisation of existing child cohort studies because of differences in the sampling approach, the timing of data collection over the life course and the measures used (see, for example, [Waldfoegel, 2013](#); [Doran et al, 2020](#)). The current analyses can overcome many of these challenges by using data from two cohort studies with remarkable similarities in the sampling method (a nationally representative survey of 9-month-old infants and their families) and the time intervals at which data were collected (9 months, 3 years and 5 years) as well as a strong similarity in the measures used.

The data for Ireland come from Cohort '08 of the GUI longitudinal survey, based on a nationally representative sample of 11,134 children drawn from the Child Benefit register. We analyse data from the first three waves collected at 9 months (2010/11), age 3 (2013/14) and age 5 (2015/6). For Scotland, the data come from the MCS, a longitudinal study following the lives of young people born across England, Scotland, Wales and Northern Ireland in 2000–01 and selected through Child Benefit records. For Scotland, the initial achieved sample at the first wave was 2,336 families and 2,370 children. For the Scottish analysis, we use data from the first three waves: 9 months (2000/1), age 3 (2003/4) and age 5 (2006/2007).

In both surveys, at all three waves, detailed interviews were conducted with the primary caregiver, who was usually the mother. In addition, objective individual assessments of cognitive skills were conducted at ages 3 and 5 and a teacher's survey was administered at the beginning of primary school, which included teacher reports on children's skills. The objective assessments in both countries used the same tests (the

British Ability Scale) and the teacher assessments used the very same instruments (see later). The measures of underlying mechanisms such as HLE and early years education were very similar in both countries, with only some regrouping of categories needed to achieve full comparability.

One limitation in cross-national equivalence relates to the timing of the surveys; the Scottish data relate to the pre-recession period while the Irish data cover the period from mid-recession to economic recovery. The recession resulted in a dramatic drop in average income levels in Ireland, though the scale of income inequality remained broadly stable (Callan et al, 2014). Nonetheless, we suggest that the timing differences should have little impact on our results since we use a measure of relative income (that is, quintiles) which should yield greater stability. Further, we do not expect differences in the impact of parental education to fluctuate over a decade. To test this assumption, additional sensitivity analyses (see Tables S5 and S6) have controlled for the self-reported impact of the recession on families in Ireland. The results show that the impact of the recession does not have a clear (linear) effect on child outcomes and the relationships between family background factors and child cognitive outcomes remain unchanged. Despite timing differences, the presence of the same outcome measures and very similar explanatory factors in both surveys provides a unique opportunity to look at the processes shaping inequalities in child outcomes in two contexts.

Measurement

The outcomes analysed in this study were measured at the age of five around the period of transition to primary education. The analyses focus on three outcomes reported by the teacher, who was seen as a good source of information on the extent to which children had the skills to engage in the curriculum: (1) language for communication and understanding (such as talking and listening confidently); (2) reading (including understanding story) and (3) numbers (including counting). These represent subscales of the measures used in the English Foundation Stage Profile that were replicated for the MCS teacher questionnaire in Scotland and were used for comparative purposes in the GUI study. The questions asked teachers whether or not the child had achieved specific competencies using a series of statements, scored from zero to nine. Given that the distribution was positively skewed, we dichotomised the scores distinguishing between those who exceeded the expectations for their development stage (that is, those who were assigned the highest scores of 9) and those who did not. In addition, we analysed a direct assessment of children's vocabulary skills which was collected via the British Ability subscale of 'Naming vocabulary'; scores were treated as continuous. In this wave of the survey, parents were not asked about their children's cognitive skills but instead asked about socio-emotional difficulties.

The key concepts measured in our study are *family background*, based on which we assess differences in the achieved scores, and *HLE* and *type of early years care and education*, which both play the role of potential mediators in explaining any differences by parental education and income respectively. We also test the explanatory power of vocabulary at ages 3 and 5, separately, to investigate the extent to which inequalities emerge early (before age 3) or continue to develop during those two years.

First, *family background* was measured based on maternal education and household income recorded when the child was 9 months old (Wave 1). Maternal education

was standardised to the following categories: 'lower secondary or less', 'upper secondary', 'post-secondary', 'university degree or higher' and 'unknown or missing'. Finally, household income was measured using equivalised net income quintiles. For Ireland, missing cases for income are retained in the analyses but assigned to a sixth category ('income missing'), which comprised 7% of cases. Net income provides a better measure of the economic resources available to families than gross income, especially in the context of two systems with different tax and welfare regimes. Using quintiles has advantages in capturing relative differences between the two countries and in allowing for potential non-linearity in effects within countries.

Second, *HLE* captured the frequency of different activities at age 3 (how often parents were involved in reading to the child, teaching the alphabet, counting, teaching songs, painting and screen time) and at age 5 (how often parents were involved in reading to the child, how often children were listening to music, painting, playing computer games, watching TV and going to the library). Unlike some earlier research (Melhuish, 2010, for example), the *HLE* indicators are included as separate items rather than as a composite index for two reasons. First, the internal consistency of the combined scale was relatively weak and the models would have lost explanatory power. Second, assessing the role of each specific *HLE* component may be more informative in understanding the mechanisms behind inequalities. For example, reading to the child might be expected to have a stronger effect on vocabulary skills than painting with them.

Third, *childcare and early years education* arrangements at 9 months and at age 3 were measured distinguishing between the following types: parental only, relative, childminder, centre-based and other. In addition, a binary variable captured whether the child had any exposure to non-parental care between ages 3 and 5.³

Several control variables were included in the analysis: gender, age, area density, child disability and school stage, given that some respondents were in the first and others in the second year of primary school.

Methods

In the remainder of the article, we limit the analyses to those for whom we had valid teacher responses (7,440 in Ireland and 1,084 in Scotland), who were present at all three waves and had complete information for all the key variables included in the analysis.⁴ To assess the main effects of the *HLE* and *ECE* variables on children's cognitive skills, we used a series of nested binary logistic regressions to model the dichotomous outcomes based on teacher assessments, reporting the average marginal effects for ease of interpretation (percentage points difference) and to allow comparability across models (Mood, 2010). We also used linear regression (OLS) to model vocabulary scores which were expressed as T-scores with a mean of 50 and a standard deviation of 10.

To directly test the role of the key mediators in explaining the social inequalities in cognitive skills, we used the *KHB* decomposition method (Breen et al, 2013) via the *khb* Stata package (Kohler et al, 2011). The *KHB* method decomposes the associations of interest into *total*, *direct* and *indirect* effects while being able to disentangle the mediating effect of different variables simultaneously. We run three sets of *KHB* models: (1) without socio-demographic controls, (2) with socio-demographic

controls and (3) including early vocabulary score, for both pairs of key background variables and mediators (maternal education and HLE, and household income and ECE) and for all four outcomes. In the KHB models we included all the stages of HLE and ECE factors in the same model at once, focusing on the overall mediation while discussing the contribution of the different factors at different stages to the overall mediation. Similarly, we present the mediation models with no controls while pointing out any key changes in the models controlling for the socio-demographic characteristics and vocabulary at age 3. For our KHB models with binary outcomes, we report the Average Partial Effects (APEs) for the *total*, *direct* and *indirect* effects but, in interpreting the statistical significance of the indirect effect, we rely on the KHB models with logit coefficients since the standard error for the indirect APE effect is unknown (Breen et al, 2013).

Results

Between-country differences in home learning environment and childcare arrangements

Income levels in both countries are transformed into quintiles for comparative purposes. However, the descriptive statistics indicate that maternal education is more polarised in Scotland than Ireland, with more at either end of the educational spectrum; 35% of mothers in Scotland had lower secondary education compared with 17% in Ireland and 32% of Scottish mothers had degree-level qualifications compared with 29% in Ireland (Table 2).

To what extent are there differences in the HLE? The descriptive statistics show a complex picture (Table 2). At age 3, the proportions being read to every day are more polarised in Scotland than Ireland, with levels of being read to every day and being read to infrequently *both* found to be higher. Between-country differences are variable across different aspects of the HLE, with doing the alphabet somewhat more common, and screentime slightly longer, in Ireland and counting, singing and painting more frequent in Scotland. By age 5, reading has become more frequent in Ireland than Scotland as has painting/drawing, playing with toys and playing computer games. However, educational outings (such as cinemas, concerts or art galleries) and library use were somewhat greater in Scotland. This latter pattern may be also due to a higher proportion of children living in urban areas in Scotland, which provide more opportunities for this type of cultural activities. Given our second hypothesis, this could create more room for parents to diverge in their childrearing practices in Scotland, and enable, to a larger extent, middle-class parents to practise concerted cultivation (Lareau, 2003) and embody valuable cultural capital (Bourdieu, 1986) in children's lives early on. Ultimately, children's familiarity with formal settings and structured activities may make the transition to primary school smoother.

To what extent are relative differences by maternal education different in the two countries? Figure 1 shows the difference in the percentage of parents reading every day to the child by maternal education. In both countries, three-year-olds whose mothers have degree-level qualifications are much more likely to be read to every day than those whose mothers have lower secondary education or less. In both countries, the social gradient in reading reduces between ages 3 and 5 but as the result of very different trends. In Ireland, this is mostly driven by an

Table 2: Descriptive statistics (weighted values)

	Ireland (Growing Up in Ireland, Cohort '08)	Scotland (Millennium Cohort Study)
<i>Outcomes</i>		
Vocabulary at age 5 (mean)	55.2	57.4
% exceeding expectations:		
Language for communication and thinking	57.5	49.6
Reading	44.3	35.4
Number skills	31.7	52.7
Maternal education:		
Lower secondary or less	17.4	34.6
Upper secondary	24.8	21.2
Post-secondary	28.5	7.4
Degree or higher	29.3	32.0
Missing	–	4.8
Household income:		
Bottom quintile	17.5	17.6
2nd	18.4	17.9
3rd	19.0	20.1
4th	20.5	20.1
Top quintile	17.6	24.2
Missing information on income	6.9	–
<i>Mediating variables</i>		
Care at 9 months (all that apply):		
Parents only	60.3	43.0
Relatives	19.8	42.8
Childminder	13.2	10.9
Centre-based	11.0	12.1
Other	1.2	–
Care at 3 years:		
Parents only	50.0	37.1
Relatives	11.5	34.6
Childminder	12.0	10.8
Centre-based	26.5	33.6
Received no non-parental care between 3 and 5 years of age	2.1	4.0
Frequency of being read to at 3 years:		
1–2 times a week or less	10.3	15.7
Several times a week	32.7	18.6
Every day	57.0	65.7
Frequency of doing alphabet with the child at 3:		
Less than once a week	12.6	26.6
1–2 days a week	18.8	33.2
Several times a week	44.6	22.3
Every day	24.1	17.9
Frequency of counting with the child at 3:		
Less than once a week	2.4	4.8
1–2 days a week	8.4	17.3
Several times a week	46.1	25.7
Every day	43.2	52.1
Frequency of singing with the child at 3:		
Less than once a week	2.6	2.2
1–2 days a week	8.9	11.6
Several times a week	42.4	24.8
Every day	46.1	61.4

(Continued)

Table 2: Continued

	Ireland (Growing Up in Ireland, Cohort '08)	Scotland (Millennium Cohort Study)
Frequency of painting with the child at 3:		
Less than once a week	1.8	1.8
1–2 days a week	11.1	17.7
Several times a week	50.3	31.6
Every day	36.8	48.8
Screentime at 3:		
None	2.5	1.2
<1 hour	10.9	24.1
1–3 hours	65.0	60.4
3+ hours	21.5	14.3
Attended cinema in last month at 5	49.5	78.5
Attended concert, play or art gallery in last month	61.4	77.4
Frequency of library visits at 5:		
Very rarely	36.3	27.5
Rarely	14.0	10.8
Occasionally	37.1	50.0
Frequently	12.6	11.7
Reading to child at 5:		
Occasionally	3.4	4.2
Frequently	21.8	40.8
Every day	64.9	54.9
Frequency of painting or drawing at 5:		
Occasionally	13.9	34.5
Frequently	31.5	57.4
Every day	54.5	8.2
Frequency of music or song at 5:		
Occasionally	15.4	4.2
Frequently	25.5	40.9
Every day	59.1	54.9
Plays with toys with child indoors:		
Occasionally	23.7	10.5
Frequently	40.5	68.1
Every day	35.8	21.4
Time on TV at 5:		
Never	2.5	2.5
<3 hours	83.9	84.3
3+ hours	13.7	13.2
Frequency of computer games at 5:		
Never	16.6	33.7
Often	54.4	63.2
Every day	29.0	3.2
<i>Control variables</i>		
Child gender (% female)	49.0	50.6
Child disability	14.6	15.8
Child educational stage at 5 (% in entry/reception class)	30.8	82.1
Area density:		
Large urban	28.7	36.1
Other urban	16.4	27.3
Small town	11.8	16.8
Rural	43.2	19.7
N	7,440	1,084

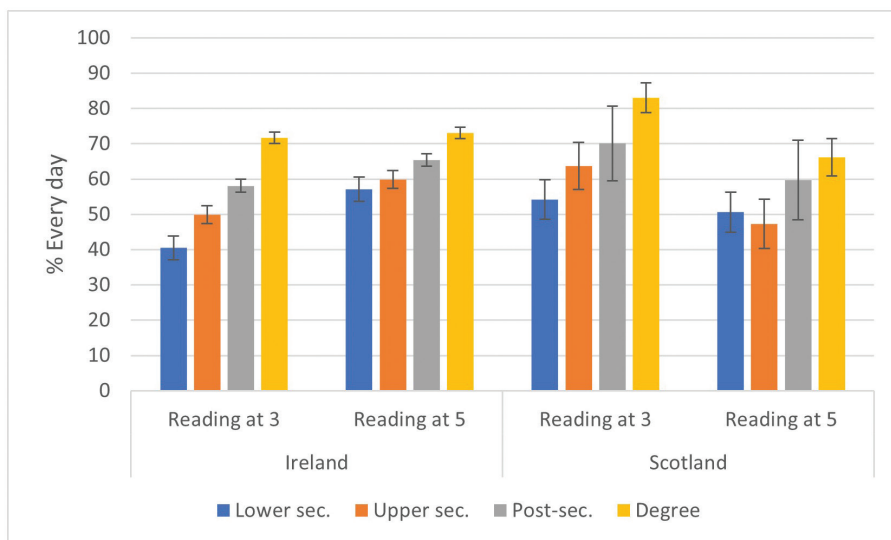
Note: Some figures do not total to 100% because of rounding or because multiple answers were possible. Figures relate to those for whom teacher assessments were available. Longitudinal weights have been used for both datasets.

increase in involvement in reading for those whose mothers have lower levels of education. In contrast, in Scotland, there is a decrease in parental reading involvement among those with upper secondary and degree-level education. It appears therefore that the transition to primary school results in very different parental home-learning behaviours in the two contexts.⁵ Nevertheless, the age-specific gap in the frequency of reading by maternal education seems to be rather similar in the two countries contrary to our second hypothesis based on differences in the broader HLE.

Figure 2 shows the difference in attendance at centre-based childcare at 9 months and 3 years by household income levels. In Scotland, just under a third of those in the highest income quintile used centre-based care when the child was 9 months old; the numbers in the other income groups are too small to report. At age 3, there is a social gradient in the use of centre-based care, with the main distinction being between the top quintile and all others. In Ireland, the gradient in centre-based care at 9 months is stark, with a marked difference between the top quintile and all others. Centre-based childcare take-up increases by age 3 across all income groups. However, as in Scotland, the main distinction is between the top income quintile and the others.

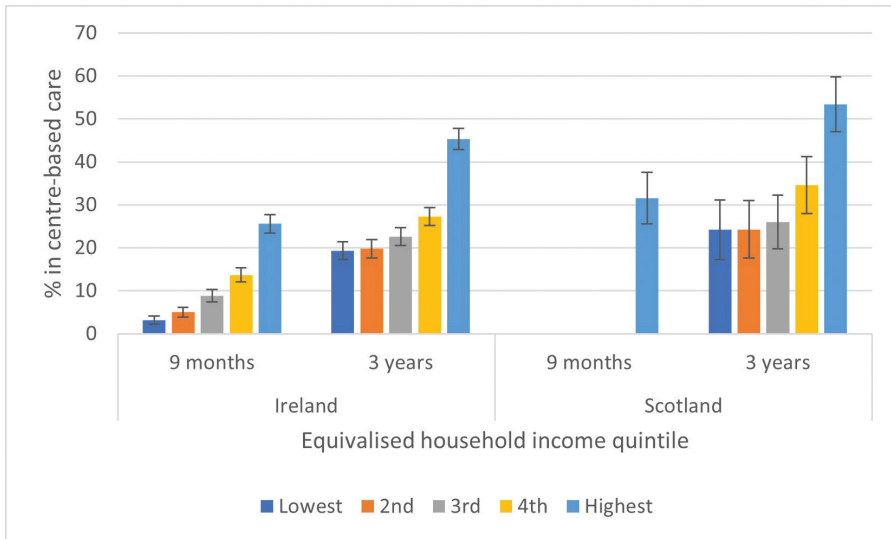
In sum, there are differences between the two countries in the level and social differentiation of both childcare and the HLE with Scotland showing a slightly higher take-up of centre-based childcare, particularly among the top-income households and stronger differentiation, especially at 9 months; these will probably be reflected in different patterns regarding the extent to which they explain inequalities in child outcomes, contrary to our ECE hypothesis based on the similarity of childcare policy characteristics in the two countries.

Figure 1: Percentage of children being read to every day at 3 and 5 years of age by maternal education in Ireland and Scotland



Source: Growing Up in Ireland, Cohort '08 data; Millennium Cohort Survey.

Figure 2: Percentage of children in centre-based care at 9 months and 3 years by household income (quintile) in Ireland and Scotland



Note: the numbers in the four lowest income quintiles in centre-based care at 9 months are too small to report using the Scottish sample.

Source: Growing Up in Ireland, Cohort '08 data; Millennium Cohort Survey.

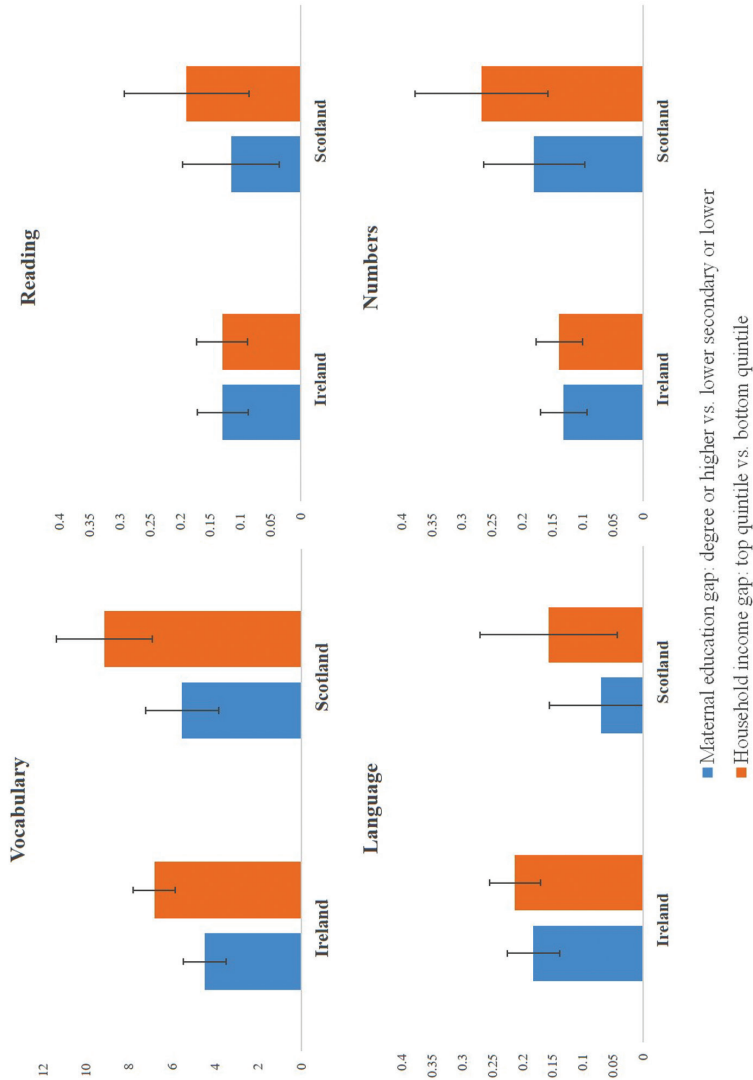
Differences by parental background in children's cognitive skills at the beginning of primary school

Figure 3 shows sizeable differences between the top and the bottom categories by both maternal education and household income for almost all outcomes considered in this study. However, the income gap was larger than or at least equivalent to the parental education gap in both countries. The differences found were generally larger in Scotland than in Ireland, particularly for household income. In vocabulary skills, for instance, the score of children from the top income quintile was about nine points higher (almost a full standard deviation) than among those from the bottom quintile in Scotland compared to 5.5 points (that is, less than half a standard deviation) in Ireland.⁶ The exception to this pattern was larger differences in teacher assessment of language in Ireland than in Scotland.

The role of childhood home learning environment and childcare arrangements in predicting children's cognitive skills at the beginning of primary school

Reading to three-year-olds was the strongest predictor among the HLE indicators, particularly in Ireland. For the teacher-assessed outcomes, this was the case even when vocabulary test scores at age 3 were taken into account (Supplementary Material Tables S1 and S2). In contrast, in Scotland reading to three-year-olds showed a significant association only with their vocabulary at age 5 and their reading skills. The influence of other aspects of the HLE was much less clear-cut, showing relatively little consistency between time points (ages 3 and 5), particularly in Scotland. These findings are consistent with earlier analyses of the English MCS sample by Hartas

Figure 3: Differences in children's skills at age 5 by maternal education and income (Scotland and Ireland)



Note: differences in vocabulary scores are based on T-scores (mean = 50, SD = 10) and differences in the teacher's assessment are based on percentage points difference in the probability of attaining the highest score.
 Source: Growing Up in Ireland, Cohort '08 data; Millennium Cohort Survey.

(2011) who found little systematic impact of HLE activities other than reading on teacher-rated skills and competencies. In contrast, in Ireland, several HLE indicators proved to have a positive role on children's cognitive skills (for example, alphabet, counting at age 3; playing computer games and library visits at age 5). In terms of timing of the HLE, both age 3 and age 5 activities played an independent positive role in Ireland, while in Scotland this was the case only for a couple of activities at age 3 and only one activity at age 5. Nevertheless, overall, in both Ireland and Scotland the findings point to a stronger direct effect of family background compared to the indirect effect mediated by HLE, an issue explored further later in this article.

In both countries, being in centre-based care at an early stage (9 months) was associated with enhanced skills in some domains (language and numeric skills in Scotland; vocabulary and reading in Ireland) (see Tables S3 and S4). This relationship was much stronger in Scotland (with differences of around 20 percentage points compared with around 4 percentage points in Ireland). Even after controlling for subsequent childcare take-up and for vocabulary at age 3, the initial strong associations of early centre-based childcare remained almost unchanged in Scotland, while in Ireland, effects remained only for reading skills. In Scotland, the relationship between being in centre-based childcare at 9 months or at age 3 and enhanced vocabulary appeared to merely reflect difference in family income; nevertheless, the take-up of early centre-based childcare shows an independent strong association when it comes to language and numeric skills. Another interesting cross-country difference was that only in Ireland was childcare provided by relatives or a childminder at 9 months and/or age 3 positively associated with vocabulary skills and teacher-rated language skills. Therefore, centre-based care in early childhood (at 9 months) had a stronger relationship with skill development in Scotland whereas in Ireland it proved to have a smaller impact at both 9 months and 3 years but non-centre-based childcare also mattered for child outcomes.

The role of home learning environment and early years care/education in explaining differences by family background

First, *to what extent do home learning practices explain differences by maternal education?* Tables 3 and 4 show the overall percentage variation mediated by the HLE in Ireland and Scotland respectively based on the KHB method. There is a clear differentiation in the cross-country patterns with Ireland showing a higher percentage mediated by HLE in the directly assessed vocabulary score at age 5 (for example, 36% versus 29% of gap between the highest and lowest educated) and Scotland showing a stronger mediating percentage in the teacher-assessed outcomes (ranging from 33% (Scotland) versus 19% (Ireland) in number skills to 82% (Scotland) versus 29% (Ireland) in language skills). There are some cross-national similarities in the timing of effects, with activities at age 3, particularly reading to the child, contributing much more to the overall indirect effect via HLE than activities at age 5 in both Scotland and Ireland. However, the overall indirect effects via HLE were statistically significant only in Ireland and only for vocabulary and language skills. In Scotland, none of the indirect effects via HLE was statistically significant. Overall, our results suggest that, contrary to our hypothesis, inequalities by maternal education in children's vocabulary scores and language skills were more strongly mediated by HLE in Ireland than in Scotland. Thus, home learning appears to foster broader vocabulary

Table 3: The mediating role of home learning environment for the inequalities by mother's education in children's cognitive outcomes in primary school in Ireland (mediation analysis using the KHB decomposition method)

	Vocabulary	Language	Reading	Numbers
Mother's education (ref. lower secondary or less)	(continuous outcome, t-score)	(binary outcomes, teacher's assessment)		
<i>Upper secondary</i>				
Total	1.936**	0.080**	0.070**	0.073**
	(0.560)	(0.024)	(0.024)	(0.022)
Direct	1.291*	0.061*	0.056*	0.062**
	(0.563)	(0.025)	(0.024)	(0.022)
Indirect	0.645	0.019	0.014	0.011
Mediation %	33.3	23.4	19.7	14.5
<i>Post-secondary</i>				
Total	2.905***	0.135***	0.069**	0.062**
	(0.513)	(0.022)	(0.022)	(0.019)
Direct	1.798**	0.098***	0.048*	0.044*
	(0.522)	(0.023)	(0.023)	(0.021)
Indirect	1.107	0.037	0.021	0.018
Mediation %	38.1*	27.2*	30.9	28.8
Degree or higher				
Total	4.477***	0.182***	0.129***	0.131***
	(0.510)	(0.022)	(0.022)	(0.019)
Direct	2.880***	0.129***	0.101***	0.107***
	(0.537)	(0.023)	(0.023)	(0.021)
Indirect	1.597	0.053	0.028	0.025
Mediation %	35.7**	29.1**	21.8	18.9
R ² /pseudo R ²	0.05	0.03	0.02	0.02
Observations	8,602	8,602	8,602	8,602

Notes:

Average Partial Effects (APE) for binary outcomes; standard errors in parentheses; * $p < .05$; ** $p < .01$; *** $p < .001$ (the asterisks for the mediation percentage indicate the statistical significance based on the indirect effect from the linear regression and the logit models respectively).

Source: Growing Up in Ireland Cohort '08.

development and (perceived) school readiness in Ireland but not to the same degree in Scotland.

In order to understand the extent to which inequalities at age 5 are an echo of earlier inequalities, we have also investigated the role of earlier vocabulary scores at age 3 in mediating inequalities in children's cognitive skills at age 5. The cross-country pattern in the magnitude of the indirect effects already described also holds for the mediating power of earlier vocabulary with 73% of maternal education being mediated jointly by HLE, control variables and vocabulary scores at age 3 in Ireland versus 57% in Scotland. Yet, the corresponding mediation percentage in teacher's assessed skills was much higher in Scotland (for example, 84% versus 30% in reading skills; 60% versus 29% in numeric skills). This time, all the indirect effects were statistically significant for all outcomes in Scotland (for the gaps between the highest and lowest educated groups), while in Ireland, the indirect

Table 4: The mediating role of home learning environment for the inequalities by mother's education in children's cognitive outcomes in primary school in Scotland (mediation analysis using the KHB decomposition method)

	Vocabulary	Language	Reading	Numbers
Mother's education (ref. lower secondary or less)	(continuous outcome, t-score)	(binary outcomes, teacher's assessment)		
<i>Upper secondary</i>				
Total	2.170* (0.905)	0.101* (0.049)	0.114* (0.047)	0.064 (0.049)
Direct	1.966* (0.910)	0.083 (0.051)	0.096* (0.049)	0.046 (0.051)
Indirect	0.204	0.018	0.018	0.018
Mediation %	9.4	17.4	17.1	27.5
<i>Post-secondary</i>				
Total	3.565** (1.362)	0.150* (0.067)	0.092 (0.067)	0.093 (0.069)
Direct	2.440 (1.394)	0.131 (0.068)	0.066 (0.067)	0.064 (0.069)
Indirect	1.125	0.019	0.027	0.029
Mediation %	31.6	12.4	29.5	31.1
<i>Degree or higher</i>				
Total	5.530*** (0.866)	0.070 (0.043)	0.115** (0.041)	0.180*** (0.043)
Direct	3.950*** (0.923)	0.013 (0.048)	0.064 (0.045)	0.122* (0.047)
Indirect	1.580	0.057	0.051	0.058
Mediation %	28.6	81.6	44.0	32.7
R ² /pseudo R ²	0.15	0.04	0.04	0.06
Observations	856	856	856	856

Notes:

Average Partial Effects (APE) for binary outcomes; standard errors in parentheses; * $p < .05$; ** $p < .01$; *** $p < .001$ (the asterisks for the mediation percentage indicate the statistical significance based on the indirect effect from the linear regression and the logit models respectively).

Source: Millennium Cohort Study (Scottish sample).

effect of early vocabulary scores was only statistically significant for reading skills but not for the other outcomes. This suggests an interesting timing pattern in how inequalities unfold in the two countries, with earlier inequalities at age 3 being more consequential for inequalities at age 5 in Scotland than in Ireland. This, in turn, implies that the inequalities are more deeply rooted in earlier childhood in Scotland and the degree of cognitive stimulation in early childhood before age 3 is crucial in alleviating inequalities on school entry.

A second key question investigated in our study is *to what extent does the type of early childhood care and education received explain differences by family background?* Generally, ECE mediated a much higher percentage of household income inequalities in Scotland than in Ireland (Tables 5 and 6). The mediation effect of ECE was strongest for language (50% in Scotland compared with 13% in Ireland), followed by numeric skills (25% compared with 15% in Ireland) and reading (19% compared with 17% in Ireland). The extent to which ECE mediated income differences in vocabulary scores was much lower, below 10% in Ireland and below 5% in Scotland for any of the income quintile gaps included in the table. The indirect effects via ECE were statistically significant for all outcomes in Ireland (for several income gaps) while in Scotland, the indirect effects via ECE were

Table 5: The mediating role of early childcare education for the inequalities by household income in children's cognitive outcomes in primary school in Ireland (mediation analysis using the KHB decomposition method)

	Vocabulary	Language	Reading	Numbers
Household income quintile (ref. bottom quintile)	(continuous outcome, t-score)	(binary outcomes, teacher's assessment)		
<i>2nd quintile</i>				
Total	2.450*** (0.555)	0.069** (0.024)	0.052* (0.023)	0.053* (0.021)
Direct	2.255*** (0.555)	0.064** (0.024)	0.051* (0.023)	0.052* (0.021)
Indirect	0.194	0.005	0.001	0.001
Mediation %	7.9	7.3	1.5	2.6
<i>3rd quintile</i>				
Total	4.445*** (0.529)	0.160*** (0.022)	0.098*** (0.022)	0.099*** (0.02)
Direct	4.009*** (0.535)	0.146*** (0.023)	0.090*** (0.023)	0.093*** (0.021)
Indirect	0.436	0.014	0.009	0.006
Mediation %	9.8**	8.7**	8.7	6.5
<i>4th quintile</i>				
Total	6.429*** (0.493)	0.210*** (0.021)	0.126*** (0.021)	0.098*** (0.019)
Direct	5.804*** (0.504)	0.188*** (0.022)	0.110*** (0.022)	0.088*** (0.02)
Indirect	0.625	0.022	0.016	0.009
Mediation %	9.7**	10.5**	12.4*	9.5
<i>5th quintile</i>				
Total	6.824*** (0.502)	0.212*** (0.022)	0.130*** (0.022)	0.139*** (0.02)
Direct	6.261*** (0.523)	0.186*** (0.023)	0.108*** (0.023)	0.118*** (0.021)
Indirect	0.562	0.026	0.022	0.021
Mediation %	8.2**	12.4**	17.2**	14.9**
R ² /pseudo R ²	0.05	0.02	0.01	0.01
Observations	8,602	8,602	8,602	8,602

Notes:

Average Partial Effects (APE) for binary outcomes; standard errors in parentheses; * $p < .05$; ** $p < .01$; *** $p < .001$ (the asterisks for the mediation percentage indicate the statistical significance based on the indirect effect from the linear regression and the logit models respectively).

Source: Growing Up in Ireland Cohort '08.

statistically significant only for language and numeric skills and only for the gaps between top and bottom income quintiles. This pattern reflects more polarised practices in Scotland. Therefore, our ECE hypothesis about no country differences in the mediating role of ECE is not confirmed, with ECE a more important mechanism through which income inequalities are reproduced in Scotland than in Ireland. The different patterns shown for actual and teacher-perceived skills suggest that ECE provides higher-income families with some advantages in terms of school readiness (rather than vocabulary development per se). The analyses show important cross-national differences in the relative timing of the impact of ECE. In Scotland, early childcare, particularly centre-based care, has the strongest indirect effect for all of the outcomes analysed. In Ireland, although smaller, the mediating impact of ECE is more cumulative, being more evenly spread across the three different stages considered in our analysis.

Table 6: The mediating role of early childcare education for the inequalities by household income in children's cognitive outcomes in primary school in Scotland (mediation analysis using the KHB decomposition method)

	Vocabulary	Language	Reading	Numbers
Household income quintile (ref. bottom quintile)	(continuous outcome, t-score)	(binary outcomes, teacher's assessment)		
<i>2nd quintile</i>				
Total	2.600* (1.263)	0.020 (0.063)	0.060 (0.056)	0.064 (0.063)
Direct	2.668* (1.274)	0.017 (0.064)	0.057 (0.058)	0.054 (0.064)
Indirect	-0.068	0.003	0.002	0.010
Mediation %	-2.6	14.8	3.6	14.9
<i>3rd quintile</i>				
Total	4.670*** (1.231)	0.144* (0.060)	0.143** (0.055)	0.201*** (0.059)
Direct	4.543*** (1.294)	0.125* (0.062)	0.133* (0.058)	0.175** (0.061)
Indirect	0.127	0.018	0.010	0.026
Mediation %	2.7	12.8	6.7	12.9
<i>4th quintile</i>				
Total	6.718*** (1.175)	0.168** (0.059)	0.217*** (0.055)	0.209*** (0.059)
Direct	6.666*** (1.228)	0.137* (0.063)	0.199*** (0.058)	0.167** (0.062)
Indirect	0.052	0.032	0.018	0.042
Mediation %	0.8	18.9	8.1	20.2
<i>5th quintile</i>				
Total	9.151*** (1.139)	0.156** (0.058)	0.189*** (0.053)	0.267*** (0.056)
Direct	8.922*** (1.284)	0.079 (0.064)	0.153** (0.059)	0.202** (0.064)
Indirect	0.229	0.077	0.036	0.065
Mediation %	2.5	49.3*	19.2	24.5*
R ² /pseudo R ²	0.11	0.03	0.03	0.04
Observations	856	856	856	856

Notes:

Average Partial Effects (APE) for binary outcomes; standard errors in parentheses; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (the asterisks for the mediation percentage indicate the statistical significance based on the indirect effect from the linear regression and the logit models respectively).

Source: Millennium Cohort Study (Scottish sample).

Conclusions

This article builds upon the body of research on inequalities in cognitive skills at the beginning of primary school, offering a new contribution by taking a comparative perspective that explores the potential for post hoc harmonisation of child cohort survey data. Using data from Growing Up in Ireland (GUI) and the Scottish sample of the Millennium Cohort Study (MCS), this article examines social inequalities by parental income and education in four different outcomes at the start of primary education, based on direct assessment (vocabulary) and teacher assessment (language for communication, reading and numbers). Further, using the KHB method, the analysis examines the extent to which income and education inequalities are mediated by early childhood education (ECE) and the home learning environment (HLE) respectively. A comparative perspective yields interesting insights given the similarity in patterns of ECE take-up and differences in the nature of the HLE in the two national settings.

Our results show significant inequalities by both maternal education and household income in all the outcomes at age 5 in both Scotland and Ireland. In Scotland, household income consistently yielded stronger gaps compared to maternal education, while in Ireland the magnitude of inequalities by household income and maternal education was fairly similar in scale. These results indicate that household income makes more of a difference than previously assumed, with family income in infancy continuing to influence children's cognitive skills four years later. These findings add to the body of literature indicating the importance of a multidimensional approach to studying inequality by continuing to differentiate between different types of parental resources (for example, cultural and economic resources). From a policy perspective, interventions aimed at reducing the attainment gap should avoid a one-size-fits-all approach and target the specific mechanisms through which income and educational inequality in child cognitive outcomes are reproduced.

Frequent reading to children is associated with improved vocabulary and other skills in both countries but the impact of other HLE activities is less clear-cut in Scotland than in Ireland. The timing of HLE matters differently, with the influence of reading concentrated in the early years in Scotland, while in Ireland reading practices continue to shape cognitive outcomes beyond the early years. HLE in Scotland is more differentiated by family background and we had therefore hypothesised that HLE would play a stronger mediating effect in Scotland than in Ireland. In fact, a more nuanced pattern emerged. HLE explained more of the differences in actual vocabulary scores in Ireland but in Scotland HLE played a more important role in (perceived) school readiness (that is, teacher-assessed skills). In both settings, HLE activities do not fully account for the inequalities found (contrary to [Melhuish, 2010](#)). The findings thus add to the body of work which emphasises structural inequalities in the early years (see [Hartas, 2014](#); [Gillies et al, 2017](#)), suggesting caution against a policy focus on what parents 'do' without considering, for example, broader anti-poverty measures.

In both countries, use of centre-based care for children at age 9 months and at age 3 was markedly higher among those in the top income quintile, reflecting, at least in part, relatively high childcare costs in the two settings. Contrary to our hypothesis, however, the mediating role of childcare operated differently in the two countries. ECE played a very modest role in mediating income differences in actual vocabulary scores in both countries but played a much more important role in explaining income differences in teacher-assessed skills in Scotland. Although the guiding principles of the early years curriculum look rather similar in the two countries, it could be the case that in Scotland the curriculum placed more emphasis on formal skill acquisition and preparation for the transition to primary education. As with HLE, significant direct effects of income on cognitive outcomes were found in both countries, even controlling for early childhood participation. Finally, the fact that the social inequalities in teacher's assessed outcomes were more strongly mediated by ECE and HLE compared to the directly assessed outcome – vocabulary – may suggest that these factors could also influence other aspects (confidence, sociability, ability to integrate and perform outside the home) which can, in turn, influence teachers' subjective assessment more than actual ability levels. Future research could disentangle in more detail the extent to which HLE, participation in structured activities outside the home and ECE directly enhance cognitive skills or rather reflect teachers' subjective bias (for example, rewarding more confident or sociable pupils).

The comparative analyses also point to differences in the trajectory of early skill development in the two countries. In Scotland, early vocabulary development (at age 3) explains much of the existing inequalities in cognitive outcomes at age 5. In contrast, in Ireland, inequalities by parental background remained to a large extent unexplained, showing that income and education continue to have direct effects on the outcomes considered net of HLE, early years provision and early vocabulary development. These remaining inequalities may relate to differences in the quality of preschool provision (which cannot be assessed using these data sets) or of the HLE (for example, the type or complexity of reading material). At the same time, our findings highlight an important feature of the processes driving inequalities in the two countries. While inequalities in Scotland seem to be rooted mostly in experiences before or at age 3, in Ireland, inequalities continue to unfold between age 3 and age 5. This difference has important implications for the potential timing and nature of interventions to counter educational disadvantage. For instance, the large inequalities already in place by age 3 in Scotland may challenge the ability of universal ECE provision (currently starting at age 3 and raised to 1,140 hours per year) to close the attainment gap at the beginning of primary school if not provided earlier or in a more targeted manner to support the most disadvantaged children. Therefore, providing high-quality ECE before age 3 to children from low-income families appears a very promising avenue for reducing inequalities in the transition to primary school in Scotland.

Nevertheless, despite the advantages of our study, there are also some limitations that should be acknowledged. First, while the two data sets provided us with very comparable data, the sample size in Scotland was considerably smaller than in Ireland and this may have affected the ability to detect statistical significance. Second, while, the two studies were very similar in the longitudinal design concerning the time points (age) at which the data was collected, there was a lag in the timing of the two studies. This limits the direct comparability due to the difficulty of separating out the differences due to period or cohort from those due to other cross-national differences. However, we believe that these limitations are wider challenges posed by comparative longitudinal studies in general rather than specific to this study. Despite these limitations, our study highlighted some very insightful differences between two similar contexts with respect to how inequalities are reproduced from early childhood to the beginning of primary school.

Taken together, the findings show the value of adopting a multidimensional and comparative approach, with inequalities and the processes through which they emerge differing depending on the outcome, the specific dimension of family background and the context, even in countries with quite similar institutional settings. Comparative analyses of this kind thus yield important insights for policy development by highlighting potential domains (such as childcare) or timing (preschool or within-school) for intervention. Differences between Ireland and Scotland in the nature of the HLE, particularly around the period of transition to primary education, are not explained by the factors considered, though may relate to broader differences in household cultural resources (as found using PISA data) or in preschool/school encouragement of home reading. Future research comparing more countries could usefully consider cultural dimensions (particularly related to parental engagement in learning activities and values) alongside institutional factors. From a policy perspective, our study implies that universal high-quality

childcare may have considerable potential to reduce inequalities, especially in countries like Scotland where both access to centre-based childcare and stimulating home learning activities are more socially stratified. Since the data on which this paper draws were collected, both countries have seen an expansion of funded early education to younger children and an increase in funded or at least subsidised hours, policies which are likely to impact on inequalities at primary school entry. However, the relatively strong effect of income on early child outcomes found in this study highlights the importance of supporting measures to address educational inequality with broader policies around taxation and social welfare to enhance more equal life chances.

Notes

- ¹ The OECD figures from the Family Database relate to England but [Coleman and Cottell \(2019\)](#) indicate that provision is only slightly cheaper in Scotland than England, suggesting that childcare in Scotland can also be regarded as relatively expensive by international standards.
- ² We do not compare absolute income levels because of differences in the time period of the survey as well as broader differences in costs of living in the two countries.
- ³ In the MCS data, childcare at age 3 combines data from Wave 2 with retrospective information from Wave 3.
- ⁴ We undertook robustness checks using multiple imputation for explanatory variables and compared the results with those based on listwise deletion but the differences were very minor because the number of missing cases was small; hence we have reported results based on listwise deletion. The main driver of missing cases relates to outcomes because of teacher non-response to the survey; imputing outcome values in this case could prove problematic.
- ⁵ The patterns are the same for parental education and social class, with the gap narrowing between ages 3 and 5 in Ireland but not in Scotland.
- ⁶ As already indicated, families of the children in the Irish sample experienced an economic recession between Waves 1 and 2 of the study. Additional analyses (Tables S5 and S6) controlled for the extent to which the recession had an effect on the family, as reported by the primary caregiver. The effects of household income quintile on child outcomes remain unchanged.

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Data availability

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Conflict of interest

The authors declare that there is no conflict of interest.

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