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International differences in gradients in early childhood overweight and obesity: the role of maternal employment and formal childcare attendance

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Background: There are significant cross-country differences in socio-economic gradients in later childhood and adulthood overweight/obesity; few studies assess whether this cross-national variation is evident from early childhood. Furthermore, the role of childcare in explaining overweight/obesity gradients might vary across countries, given differences in access, quality and heterogeneity within. Additionally, childcare is linked to parental characteristics such as maternal employment. The interplay between childcare and employment in producing early overweight/obesity gradients has received little attention, and might vary cross-nationally. **Methods:** Using harmonized data from six high-quality, large datasets, we explore the variation in gradients in early overweight/obesity (at age 3–4 years old) by parental education across several high-income countries (USA, UK, France, the Netherlands, Germany and Japan). We then assess whether differential formal group care use attenuates some of these gradients, and whether this varies across maternal employment. **Results:** Gradients in early childhood overweight/obesity by parental education are evident across several developed countries. Countries with higher overall prevalence of early overweight/obesity did not have the largest inequalities across education groups. The contribution of formal group care to producing these gradients varied across countries and across maternal employment status. **Conclusion:** Early childhood inequalities in overweight/obesity are pervasive across developed countries, as noted for older children and adults. However, mechanisms producing these gradients vary across national contexts. Our study shows that, given the right context, quality childcare and maternal employment can successfully support healthy weight trajectories and not contribute (or even reduce) social inequalities in early overweight/obesity.

Introduction

Childhood body mass index (BMI) predicts adult overweight/obesity and other long-term health outcomes, such as heart disease.[1] Socio-economic differences in overweight/obesity are evident by age 3;[2] these inequalities widen over childhood.[3] There are important cross-country differences in the link between socio-economic background and BMI in later childhood and adulthood.[4,5] Less is known about international variation in early childhood overweight or obesity. In this article, we describe gradients in early overweight/obesity by parental education across several developed countries.

To explain gradients in childhood overweight/obesity, most research has focused on individual (or, in the case of young children, parental) behaviours and characteristics, such as household socio-demographic characteristics, health behaviours and family routines.[6,7] There have been calls to also consider the wider environment in which children live.[8] An arguably important part of a child's early environment is their mode of childcare. The evidence of associations with child weight is not consistent. Informal childcare has been associated with an increased risk of obesity,[9–11] whereas there is mixed evidence for formal childcare, often depending on the characteristics of the care provided (age at entry, hours spend and extent of subsidized care). For example, a systematic review found that, while some studies, that earlier commencement age and higher intensity of formal childcare increase the risk of childhood overweight/obesity, other studies found null effects.[10] Quality of care, and the target population, may also matter: in the USA, high-quality programmes such as Head Start, aimed at disadvantaged children, either reduced or were not associated with the risk of overweight/obesity.[12] Finally, these mixed results could be due to variability in food quality in different care settings.[13]

In many contexts, childcare attendance is closely linked to parental (and in the early years, particularly maternal) employment; the two

processes cannot be studied in isolation when considering their effects on child outcomes. The available evidence suggests that maternal employment is positively associated with child weight (i.e. more employment correlates to heavier children), with a number of mechanisms put forward to explain this association. Notably, working mothers (particularly those in full-time employment, or in national settings where full-time employment is the norm) may have less time for meal preparations, supervising and participating in children's activities,[7,12,15] and be less able to establish and continue breastfeeding.[16] There is however surprisingly little evidence for the early years, with some exceptions.[7] The interplay between maternal employment, childcare use and effects on early weight have also been less explored.

Childcare use and maternal employment are not distributed equally across socio-economic groups. In most developed countries, advantaged families are more likely to make use of (formal) childcare and advantaged mothers are more likely to be employed.[17,18] Likewise, the effects of childcare or employment on child weight may vary across socio-economic groups. The detrimental effect of maternal employment on child weight seems to be more marked among advantaged families, possibly because children of advantaged families benefit more from spending time with their parents compared with less advantaged children.[14,15] Furthermore, less advantaged parents may be less able to provide nutritious meals or active playtime irrespective of their work status, diminishing the importance of employment status.[19] This evidence is mostly based on school-aged children; less is known about these socially stratified processes in early childhood.

Taken together, these insights suggest that, although child weight in the early years tends to correlate negatively with markers of socio-economic background such as parental education, maternal employment and childcare attendance might dampen these socio-economic disparities. We could expect that countries with more equal distributions of maternal employment and childcare use might have larger gradients in early overweight/obesity. Furthermore, additional national context differences could modify the complex relationship between maternal employment, childcare use, early child weight and socio-economic gradients therein, such as, differences in the built environment; availability of and access to healthy food; food assistance programmes, other cash and in-kind programmes; the type and length of parental leave available; the type of childcare available, its quality and other characteristics of the care system (age at entry, hours of attendance etc.). That is, policy environments that better support working families and family health might modify the positive relationship between maternal employment, childcare use and overweight/obesity.

Both the literatures on childcare and on maternal employment are mainly based on US data, which limits generalizability to other settings. Studies from other countries (e.g. such as Denmark[20] or Hong Kong[21]) or on specific populations (e.g. Latin-American families[22] or low-income groups[23]) suggest that a comparative angle might be fruitful. For example, in contrast to much of the literature, Greve[24] does not find associations between maternal employment and child overweight in Denmark, possibly due to the good quality of childcare and the role of fathers in early childrearing.

Finally, the 'interaction' between spheres of a child's life can be particularly salient. The link between formal childcare and maternal employment differs across countries. In some countries, formal childcare, particularly group care, might be reserved to working parents, particularly if the main goal is to increase women's employment; whereas in other countries, all children, irrespective of parental employment status, might be encouraged to attend formal collective care, particularly if child development is the main program goal.[25] Cross-national variability in childcare use across maternal employment status might have both an impact on selection into childcare, and on the quality, content and funding of the childcare program.

In this article, we explore the relationship between maternal employment, formal group care attendance and child overweight/obesity at ages 3/4, across parental education groups, in six countries (USA, UK, France, the Netherlands, Germany and Japan). After examining the raw gradients in early overweight/obesity across parental education groups, we explore the role of previous childcare attendance (we focus on formal group care, and full-time vs. part-time attendance), and the role of previous maternal employment (whether mothers worked full-time, part-time, or were not in employment). To check whether correlations vary by maternal employment, we subsequently stratify analyses by maternal employment. We make use of harmonized, high-quality birth cohort data with large sample sizes and rich, fine-grained information on children's environments.

Methods

Data

A key strength of this study is the use of large, high-quality longitudinal samples from six countries. This article draws on longitudinal birth cohort data, harmonized and analyzed through the project DICE (Development of Inequalities in Child Educational Achievement[26]) The French Longitudinal Study of Children (Elfe) is a birth cohort of children born in France in 2011 at a nationally-representative sample of 341 maternity wards;[27] the Millennium Cohort Study (MCS) is a nationally representative cohort of children born in 2000-2 and residing in the UK shortly after birth;[28] Generation R is a population-based birth cohort in the Netherlands. All pregnant women living in Rotterdam with expected delivery dates of April 2002 to January 2006 were invited to participate.[29] The Longitudinal Survey of Newborns in the 21st Century-2010 cohort (LSN21-2010) is a birth cohort of all children born in Japan in May 2010.[30] The Early Childhood Longitudinal Study, Birth Cohort (ECLS-B) is a nationally representative sample of children born in the USA in 2001 (In accordance with the restricted-data requirements, all sample sizes for the ECLS are rounded to the nearest 50).[31] In Germany, the Newborn Cohort Study of the German National Educational Panel Study (NEPS-SC1),[32] a nationally representatively sample of about 3500 infants born in 2012 is followed from 7 months of age.

Measures

Our main outcome is a binary variable measuring overweight/obesity, calculated using Stata's zbmicat command, based on age- and sex-specific BMI cut-offs.[33] We class as '1' cases who are overweight/obese and '0' those at a 'normal' weight or underweight. BMI is calculated as child weight in kilogram over the square root of child height in metres (kg/m^2). In the Netherlands, UK and USA, children's height and weight are measured by a trained interviewer or lab assistant. For the Japanese, French and German studies, this information is parent-reported with, in the latter two countries only, reference to their children's health book for the most recent measurements recorded by a health professional. Age at measurement is ~3 years for the UK, Germany and the Netherlands, 3.5 years in France and Japan and 4 years for the USA.

In sensitivity analyses, we test a number of alternative specifications for our dependent variable. First, we model BMI as a continuous variable. Second, in checks of our binary overweight/obesity variable, we run models excluding underweight children and obese children, individually and then in combination, to check they do not bias results.

Our main independent variable is the highest educational level of either cohabiting partner (low, medium and high education), harmonized as follows: High education is defined as at least a first/bachelor's university degree, requiring 3–4 years of full-time study, at

tertiary level. Low education, in countries with comprehensive education systems (i.e. little or no tracking below age 16; i.e. the UK, USA and Japan), is defined as no qualification beyond the 'expected standard' (a high school diploma in the USA and Japan; a Grade C in compulsory school-leaving exams at age 16 in the UK). In countries with early tracking and a high academic/vocational specificity (Germany, the Netherlands and France), low education is defined as no attainment beyond the lower secondary track. Medium education is all qualifications who do not fall in either the high or low categories.

Model covariates include several child and household characteristics: child sex; child age at interview, in months; child birthweight, in grams; prematurity; mother ever smoked during pregnancy; child ever breastfed; equivalized household income, post-tax, expressed in 2017$, logged when used as continuous income in descriptive analyses, and in quintiles for regression analyses; child lives with one parent only; either parent is foreign-born; mother's age at birth. In additional models, we control for mother's BMI (not available for France, Germany and Japan).

In further models, we include a maternal employment variable, measuring whether the mother worked full-time, part-time or not working; and a childcare variable, measuring whether the child attended formal group care full-time (more than 16 h a week), part-time (<16 h a week) or did not attend any formal childcare. We focus on formal group care, i.e. daycare, nurseries or crèches. This, therefore, does not include other formal arrangements such as registered childminders. Both these variables are measured with a lag (at 2 years of age; 9 months for the UK) to address potential reverse causality issues.

Statistical analyses

We run logistic regression models of child overweight/obesity on parental education: the first set of models only includes child age and sex (Model 1); the second adds the model covariates listed in the previous section (Model 2). To Model 2, we then add childcare use alone (Model 3); maternal employment alone (Model 4); and both childcare and employment variables together (Model 5). In additional analyses, available in the Supplementary annex, our main analyses are stratified by parental education. Finally, in analyses available upon request, we add to Model 5, separately, pairwise interaction terms between parental education, childcare and maternal employment. STATA[34] was used to conduct all analyses.

Sensitivity analyses include four different specifications of the outcome (see section above—results available in the Supplementary annex); measuring time-varying covariates (income and family structure) lagged at age 2; and including parents' BMI. The latter two analyses are available upon request.

All estimates from the USA, France and UK applied the recommended longitudinal weights and survey design variables to adjust estimates for complex sampling and attrition. For Germany and the Netherlands, longitudinal weights were constructed by the DICE team to account for attrition.[35] Weighting adjustments were made via the svy command.

Multiple imputations were implemented to account for item non-response, imputing 20 datasets to ensure appropriate power. The results of the analyses with 20 imputed datasets were combined in accordance with Rubin's formulas, using mi estimate. Complete case analyses, run on the non-imputed sample, were conducted as a check (available upon request); substantive results were similar to analyses run on imputed datasets.

Results

Table 1 shows that, in all countries, a gradient in overweight/obesity across parental education is observed. This gradient was starker for obesity than overweight; in some countries, such as the UK, there is almost no difference across educational groups in terms of overweight. It is also important to note that the overall prevalence of overweight/obesity varies widely across our six countries, so that, even if gradients appear starker in Germany or France, the proportion of overweight/obese children in the low education group in these countries is still lower than for the USA or UK (see figure 1). Figure 1 also shows that Japan reports both overall low levels of overall prevalence of overweight/obesity and low inequalities. Furthermore, the overall proportion of underweight children varies widely across countries, and inequalities therein are only evident in Germany, where more disadvantaged children were more likely to be underweight than more advantaged children.

Table 1 also shows expected gradients in socio-economic, demographic and child health characteristics by parental education, with some exceptions. For example, we do not find striking gradients in birthweight, except for the UK, and prematurity, except in the USA. In the Netherlands and Japan, breastfeeding rates were high across all education groups.

Gradients by parental education in overweight/obesity are confirmed in our regression models (Models 1, table 2). Across all countries, a negative gradient is observed, that is, less educated groups had a higher risk of early overweight/obesity than more educated groups. In Model 1, relative to the high education group, the increased risk associated with low education is highest in Germany, followed by France and the Netherlands, followed by the USA, then UK and Japan. In France and Japan, there were no differences between the high and medium education groups; whereas in the UK, the differences between the high and medium, and the high and low education groups were of similar magnitude.

Sensitivity analyses (Supplementary annex tables SA1 and SA2) suggest that, in the Netherlands, France and Japan, overall differences did not vary notably when obese children were excluded from analyses. On the other hand, in Germany, the UK and the USA, excluding this group diminished the overall gradients. In all countries, taking out the underweight group did not significantly modify gradients (Supplementary annex table SA3).

In all countries, the introduction of child, parent, and household covariates (Model 2) decreased initial gradients. However, with the exception of the UK and Japan, where initial gradients were already relatively small in magnitude, differences in overweight/obesity remained significant after these controls.

The use of formal group care for more than 16 h per week increased the risk of overweight/obesity in France, the UK, USA and Japan, but neither in the Netherlands (no statistically significant correlation) nor in Germany (part-time formal group care appears to decrease the risk of overweight/obesity). The introduction of the childcare variable (Model 3) induced little change in the coefficients of interest, except for a small increase in odds ratios associated with the lower education groups in the UK (indicating that, if the low and medium education groups used formal group care at the same rates as the high education group, gradients would be even larger). Supplementary annex table SA4 shows that the increased risk of overweight/obesity linked to formal group care attendance is only evident in the low education group for France and Japan; in the medium education group only for the UK; and in the low and medium education groups in the USA.

The introduction of maternal employment (Model 4) also did not change the coefficients of interest, except for a small decrease in the odds ratios in the Netherlands (i.e. maternal employment rates among the lower education groups are relatively disadvantageous for overweight/obesity), and a small increase in Germany (i.e. maternal employment rates of the lower education groups are relatively advantageous). Maternal employment itself was associated with significantly increased risk of overweight/obesity in the UK, USA and Japan but not in the continental European countries, where its effect was null or protective. Including both maternal employment and

Table 1 Descriptive statistics by highest parental education, weighted mean (in italics) or percentages, non-imputed samples

	Highest parental education			Highest parental education			Highest parental education			Highest parental education			Highest parental education			Highest parental education		
	High	Med	Low	High	Med	Low	High	Med	Low	High	Med	Low	High	Med	Low	High	Med	Low
	France			Germany			The Netherlands			UK			USA			Japan		
Child birth weight (in grams)	*3340.0*	*3331.9*	*3248.9*	*3393.3*	*3384.1*	*3313.3*	*3479.4*	*3327.0*	3420.8	*3432.3*	*3371.8*	*3290.7*	*3395.7*	*3329.1*	*3253.9*	*3009.0*	*3014.5*	*3014.5*
Prematurity at birth	4.45	5.48	6.48	4.9	6.3	7.5	4.4	7.9	2.2	6.4	7.4	8.0	9.5	10.7	12.7	4.7	5.0	5.0
Mother ever smoked during pregnancy	11.18	22.04	34.17	1.8	7.3	33.8	17.2	32.1	39.6	6.5	20.7	37.0	3.9	16.3	19.6	1.7	4.9	13.2
Mother ever breastfed	83.42	73.78	67.37	91.2	85.5	80.7	93.3	82.7	85.1	87.8	70.3	55.2	85.3	66.8	56.4	99.2	99.2	98.5
Equivalized pre-tax income—lagged (€)	*51 561*	*37 224*	*27 680*	*72 410*	*50 807*	*33 657*	*89 842*	55 583	*37 014*	*69 678*	*43 683*	*28 475*	*86 785*	*51 663*	*35 305*	*4488*	*40 653*	*36 973*
Child lives with a single parent—lagged	2.25	5.97	16.64	3.1	7.9	33.8	5.3	13.1	19.4	2.9	10.1	27.7	5.5	22.4	34.4	0.6	0.7	1.3
Foreign-born parent	23.0	17.2	24.5	24.8	36.4	45.0	20.1	34.8	53.7	17.9	10.9	14.7	15.6	14.7	30.6	2.5	1.6	2.9
Mother's age at birth of the child																		
18–24	4.86	13.63	28.63	0.7	8.4	34.5	4.2	20.7	22.7	7.0	24.9	40.2	9.8	43.6	55.5	3.3	10.0	22.3
25–29	30.36	37.12	31.98	15.3	28.2	28.5	18.6	31.1	27.9	26.6	31.0	26.1	29.1	27.6	22.3	27.4	29.5	31.0
30–34	40.80	32.09	23.26	47.2	34.3	20.5	51.2	33.0	34.2	41.6	29.0	22.1	37.4	19.7	14.1	42.4	36.5	25.4
35+	23.97	17.16	16.13	36.8	29.2	16.6	26.1	15.2	15.2	24.9	15.2	11.7	23.7	9.1	8.1	26.8	23.9	21.3
Working mother—lagged	68.02	57.6	40.78	66.1	54.7	38.4	88.2	75.0	49.4	62.5	54.0	29.7	57.1	56.7	45.4	35.2	41.3	37.5
Hours of centre-based care—lagged																		
16+ h	26.54	18.42	14.09	49.9	38.8	27.0	26.5	54.8	69.0	18.8	9.0	3.7	16.5	14.2	10.4	25.5	30.1	25.8
1–15 h	10.63	10.38	12.86	9.0	7.7	4.2	29.0	24.5	19.0	9.3	7.0	3.9	6.0	2.9	2.1	3.4	2.9	2.8
None	62.83	71.21	73.05	41.1	53.5	68.8	44.5	20.8	12.0	71.9	84.0	92.4	77.5	82.9	87.5	71.1	67.0	71.5
Continuous BMI	*15.52*	*15.61*	*15.74*	*15.7*	*16.0*	*16.8*	*16.0*	*16.1*	*16.3*	*16.7*	*16.8*	*16.8*	*16.4*	*16.7*	*17.1*	*15.7*	*15.7*	*15.8*
Obese	1.71	1.9	3.61	0.3	2.9	6.7	0.9	2.9	3.8	4.0	4.8	6.2	6.5	9.1	12.7	0.6	0.8	1.1
Overweight	5.67	6.38	10.81	5.6	7.3	15.2	7.4	7.8	12.5	17.3	18.7	17.8	15.2	17.3	18.9	5.2	5.6	6.2
Normal weight children	71.01	70.68	63.16	76.2	73.5	64.1	80.8	75.7	73.8	74.2	72.5	70.8	72.2	68.6	63.3	79.3	79.0	77.8
Underweight children	21.61	21.04	22.42	17.9	16.3	14.1	10.9	13.6	9.9	4.5	4.0	5.2	6.1	5.0	5.1	14.9	14.7	15.0
Non-imputed N	4765	2686	1229	1179	799	115	2353	700	296	4663	4126	5446	2850	2500	2450	12 755	7061	4016

Notes: Lagged variables are measured at 1.5–2 years (Germany, France, the Netherlands, USA and Japan) or 9 months (UK) of child age, except for income, family structure in the Netherlands, which were measured at enrollment. Non-lagged variables are measured at age 3.5 (France and Japan), 3 (the Netherlands, Germany and UK) and 4 (USA).

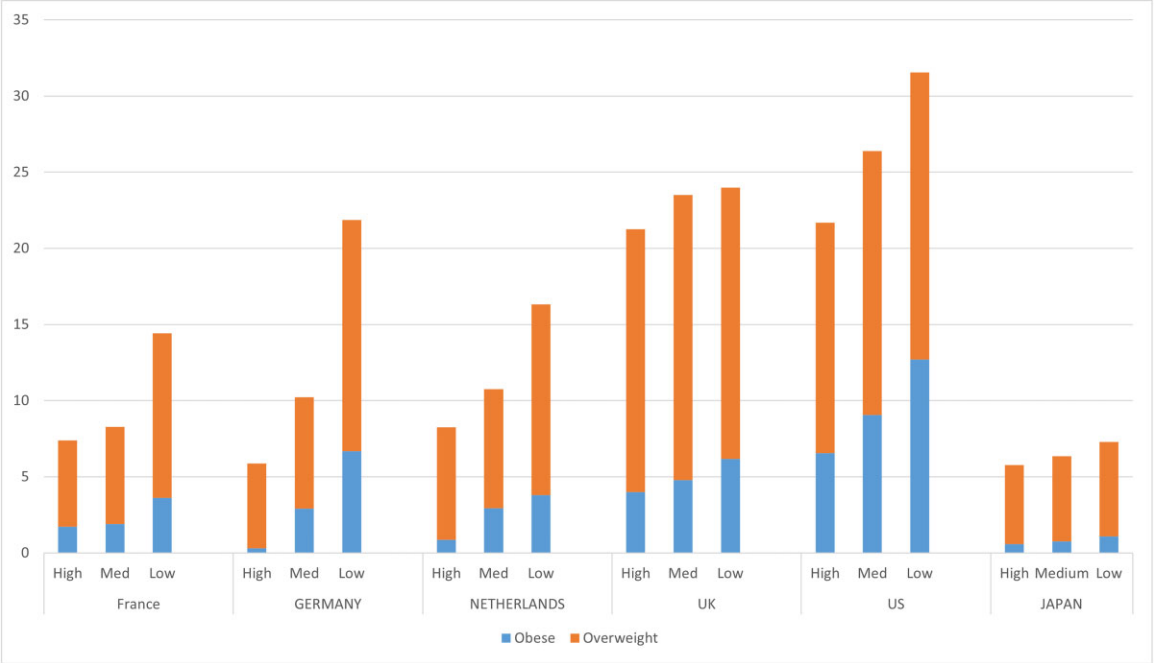

Figure 1 Percentage of overweight and obese children by highest parental education, weighted, non-imputed samples

childcare (Model 5) resulted in little change in the coefficients for parental education, for all countries.

In table 3, we stratify analyses by maternal employment. First, we show that education gradients in overweight/obesity are more evident in the non-employed than the employed groups (this is particularly evident in France and Germany). The combination of not working with low education was particularly detrimental in Germany, with an 8-fold increased risk of overweight/obesity for these children compared with high education, employed group. Except for the USA, we do not find evidence of gradients in overweight/obesity across education within the employed groups. For some countries (Germany and the Netherlands), the magnitude of the odds ratios suggests that differences might be present in the employed groups, but they are estimated rather imprecisely.

Discussion

As previously observed for older children and adults,[4,5] our results suggest that the pervasive gradients in overweight/obesity across developed countries are also evident for young children: children aged 3–4 from lower parental education backgrounds were at higher risk of overweight/obese than those from higher parental education backgrounds in six high-income countries. Inequalities in overweight/obesity widen as children age,[3] our results therefore call for global strategies combating the increasing prevalence in overweight/obesity to fully consider the earliest years of life.

Of our six countries, differences in overweight/obesity between the low vs. high education groups were systematically larger in continental European (largest in Germany, followed by France and the Netherlands), followed by the USA, then the UK and Japan. It is however important to note that the overall prevalence of overweight/obesity varied widely across our six countries, so that, e.g. while the USA exhibited smaller mean differences by parental education, they started from an overall much higher prevalence than Germany, France or the Netherlands. Because the birth cohorts used in this article span a 10-year period, with the USA, UK, Dutch data collected before the economic crisis, and the French, Germany and Japanese data collected just after, it is possible that our observed gradients are conservative in the UK, USA and the Netherlands compared with those observed for France, Germany and Japan.

Furthermore, while in the Netherlands, France and Japan overall gradients are driven by the overweight group, with relatively muted differences in obesity rates across education groups, in Germany, the UK and the USA, the obese group also contribute to gradients. These results suggest that processes producing early inequalities in overweight/obesity vary across countries, and therefore single-country results might not always be generalizable to different national contexts. These results call for further comparative data and research at early ages.

In this article, we focus on two interlinked potential mechanisms creating socio-economic inequalities in early overweight/obesity, expanding previous work that was mostly based on the USA.[12] Overall, formal group care attendance did not appear to have a large impact on gradients in early overweight/obesity by parental education, and was only significantly associated with early overweight/obesity, conditional on employment, in two of our six countries (France and USA). Maternal employment, on the other hand, appears to be protective of the risk of early overweight/obesity in continental Europe but less so in the other countries studied.

Associations between formal group care, maternal employment and child overweight/obesity did vary across education groups, and across countries. For example, in France, formal group care increased the risk of overweight/obesity, while maternal employment decreased it, but only within the low-education group. In comparison, in the UK, maternal employment increased the risk of overweight/obesity, but only in the high education group, and formal group care increased the risk of overweight/obesity, in the medium education group only.

Several reasons could explain the variability on formal group care results across countries. Previous work found that many characteristics of the care setting are important (age at entry, quality, adherence to nutritional guidelines)[10,12] as well as the distribution of these characteristics by parental education. These characteristics, and their distribution, are likely to vary across countries. For example, nutritional guidelines and standards vary widely across our six countries. As children in full-time childcare should consume about half to two-thirds of their daily dietary intake at childcare,[36] and given evidence that children's diets are established by age 4;[37] more importance should be given to food quality within childcare settings.

Table 2 Odds of being overweight or obese, by highest parental education

	M1	M2	M3	M4	M5
Child age and sex	Yes	Yes	Yes	Yes	Yes
Covariates	No	Yes	Yes	Yes	Yes
France					
Combined highest parental education—medium	1.092	0.925	0.938	0.926	0.939
Combined highest parental education—low	2.129***	1.520**	1.552***	1.505**	1.540***
Hours of centre-based care—lagged—1 to 15 h			1.240		1.181
Hours of centre-based care—lagged–16+ h			1.292*		1.337**
Working mother (ref—mother not working)—lagged				0.809*	0.794*
Observations (imputed *N*)	9407	9407	9407	9407	9407
Germany					
Combined highest parental education—Medium	1.860***	1.687**	1.681**	1.742**	1.741**
Combined highest parental education—Low	5.064***	3.795***	3.763***	3.987***	4.015***
Hours of centre-based care—lagged—1 to 15 h			0.429*		0.441*
Hours of centre-based care—lagged—16+ h			0.989		1.095
Working mother (ref—mother not working)—lagged				0.651*	0.631*
Observations (imputed *N*)	2093	2093	2093	2093	2093
The Netherlands					
Combined highest parental education—medium	1.514***	1.32	1.334*	1.316	1.333*
Combined highest parental education—low	2.201***	1.707***	1.743***	1.670***	1.705***
Hours of centre-based care—lagged—1–15 h			0.986		1.016
Hours of centre-based care—lagged—16+ h			1.13		1.176
Working mother (ref—mother not working)—lagged				0.928	0.894
Observations (imputed *N*)	4971	4971	4971	4971	4971
UK					
Combined highest parental education—medium	1.138**	1.086	1.094	1.082	1.089
Combined highest parental education—low	1.164***	1.082	1.096	1.093	1.103
Hours of centre-based care—lagged—1 to 15 h			1.062		1.052
Hours of centre-based care—lagged—16+ h			1.155*		1.111
Working mother (ref—mother not working)—lagged				1.170***	1.155**
Observations (imputed *N*)	14 235	14 235	14 235	14 235	14 235
USA					
Combined highest parental education—medium	1.290***	1.194*	1.193*	1.179	1.181
Combined highest parental education—low	1.650***	1.443***	1.452***	1.431***	1.441***
Hours of centre-based care—lagged—1 to 15 h			1.057		1.047
Hours of centre-based care—lagged—16+ h			1.273**		1.226*
Working mother (ref—mother not working)—lagged				1.173**	1.139*
Observations (imputed *N*)	7800	7800	7800	7800	7800
Japan					
Combined highest parental education—medium	1.111	1.06	1.04	1.033	1.033
Combined highest parental education—low	1.279***	1.137	1.126	1.115	1.118
Hours of centre-based care—lagged—1 to 15 h			1.24		1.114
Hours of centre-based care—lagged—16+ h			1.309***		1.144
Working mother (ref—mother not working)—lagged				1.305***	1.190*
Observations (imputed *N*)	20 453	20 453	20 453	20 453	20 453

Notes: Lagged variables are measured at 1.5–2 years (Germany, France, the Netherlands, USA and Japan) or 9 months (UK) of child age, except for income, family structure in the Netherlands, which were measured at enrollment. Non-lagged variables are measured at age 3.5 (France and Japan), 3 (the Netherlands, Germany and UK) and 4 (USA).
*: Significant at 5% level; **: significant at 1% level; ***: Significant at <1%.

While the literature tends to report that childcare and maternal employment increase the risk of early overweight and obesity,[7,11] our study questions the generalizability of these findings across different national contexts, and calls for more nuance in exploring the interactions between childcare, employment and markers of socio-economic background. Our study shows that, given the right context, quality childcare and maternal employment can successfully support early healthy trajectories and not contribute (or even reduce) social inequalities in early overweight/obesity.

Ethics statement

This work is based on secondary analysis of publicly available, anonymized data sources.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Table 3 Odds of being overweight or obese, stratified by maternal employment

	M5	M5
Child age and sex	Yes	Yes
Covariates	Yes	Yes
	Mother's employment status (lagged)	
	Not working	*Working*
France		
Combined highest parental education—Medium	0.834	1.065
Combined highest parental education—Low	1.748**	1.225
Hours of centre-based care—lagged—1 to 15 h	1.281	0.838
Hours of centre-based care—lagged—16+ h	1.298	1.317*
Observations (imputed *N*)	3045	6362
Germany		
Combined highest parental education—medium	3.387**	1.034
Combined highest parental education—low	8.474***	2.393
Hours of centre-based care—lagged—1–15 h	0.343	0.713
Hours of centre-based care—lagged—16+ h	1.483	0.871
Observations (imputed *N*)[a]	762	1327
The Netherlands		
Combined highest parental education—medium	1.258	1.278
Combined highest parental education—low	1.660	1.587
Hours of centre-based care—lagged—1 to 15 h	1.163	1.211
Hours of centre-based care—lagged—16+ h	0.886	1.477
Observations (imputed *N*)[a]	1257	3639
UK		
Combined highest parental education—medium	1.149	1.051
Combined highest parental education—low	1.162	1.041
Hours of centre-based care—lagged—1–15 h	1.034	1.069
Hours of centre-based care—lagged—16+ h	0.882	1.153
Observations (imputed *N*)[a]	7561	6633
USA		
Combined highest parental education—medium	1.056	1.274*
Combined highest parental education—low	1.562**	1.294
Hours of centre-based care—lagged—1 to 15 h	0.739	1.275
Hours of centre-based care—lagged—16+ h	1.239	1.225*
Observations (imputed *N*)	3700	4150
Japan		
Combined highest parental education—medium	1.055	0.997
Combined highest parental education—low	1.091	1.120
Hours of centre-based care—lagged—1 to 15 h	0.887	1.080
Hours of centre-based care—lagged- 16+ h	1.896***	1.011
Observations (imputed *N*)[a]	12 882	7566

Notes: Lagged variables are measured at 1.5–2 years (Germany, France, the Netherlands, USA and Japan) or 9 months (UK) of child age, except for income, family structure in the Netherlands, which were measured at enrollment. Non-lagged variables are measured at age 3.5 (France and Japan), 3 (the Netherlands, Germany and UK) and 4 (USA).

a: In these datasets, estimation samples vary slightly across imputation sets because the stratification variable (maternal employment) originally had missing values and was imputed. The smallest sample is reported.

*: Significant at 5% level; **: significant at 1% level; ***: significant at <1%.

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Key points

- There are important cross-country differences in inequalities in overweight/obesity in later childhood and adulthood. We extend this body of literature to the early childhood period, comparing six high-income countries.
- Despite lower overall prevalences of overweight/obesity at age 3–4, differences in overweight/obesity between the low vs. high education groups were systematically larger in continental European (largest in Germany, followed by France and the Netherlands), followed by the USA, then the UK and Japan.
- Maternal employment appears to be protective of the risk of early overweight/obesity in continental Europe but less so in the other countries studied.
- Associations between childcare, maternal employment and child overweight/obesity varied across education groups, and across countries.
- Our study therefore questions the generalizability the literature that tends to report that childcare and maternal employment increase the risk of early overweight and obesity, and suggests that, given the right context, maternal employment and childcare can contribute to decrease early inequalities in overweight/obesity.

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