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ABSTRACT

Maternal Employment and Childhood Obesity: A European Perspective*

The substantial increase in female employment rates in Europe over the past two decades has often been linked in political and public rhetoric to negative effects on child development, including obesity. We analyse this association between maternal employment and childhood obesity using rich objective reports of various anthropometric and other measures of fatness from the IDEFICS study of children aged 2-9 in 16 regions of eight European countries. Based on such data as accelerometer measures and information from nutritional diaries, we also investigate the effects of maternal employment on obesity's main drivers: calorie intake and physical activity. Our analysis provides little evidence for any association between maternal employment and childhood obesity, diet or physical activity.

JEL Classification: I12, J13, J22

Keywords: maternal employment, children, obesity, Europe

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Maternal Employment and Childhood Obesity: A European Perspective

1 Introduction

It is estimated that across most EU countries, one in seven children is overweight or obese, and in virtually all European countries, the share of overweight and obese children has increased substantially over the last 10 years (OECD, 2010). According to the European Commission (EC, 2007) white paper “A strategy for Europe on nutrition, overweight and obesity related health issues”, this rise in childhood obesity can be expected to increase future levels of a number of chronic conditions, including cardiovascular disease, hypertension, type 2 diabetes, stroke, certain cancers, musculo-skeletal disorders and even a range of mental health conditions. In the long term, this increase could result in a negative impact on life expectancy in the EU.

The past decades have also witnessed a large increase in the female employment rate in Europe: in the EU, female employment rates increased from 44% in 1987 to 59% in 2011 (Eurostat, 2011). Maternal employment rates in Europe are also high, with approximately 70% and 50% of mothers with children under the age of 15 and 3, respectively, currently employed (OECD, 2012). This rise in female (and particularly maternal) employment is often associated with the increase in childhood obesity. The reasoning is that, first, employed mothers spend less time at home and thus possibly also less time preparing meals and taking care of children, which could result in an increase in unhealthy eating behaviours. Second, because employed mothers spend more time away from home, their children may spend more time in the care of others, whose quality of childcare can vary substantially. Third, without parental supervision, children may be more likely to stay indoors (watching TV, playing video games) and spend less time on more active recreation. Maternal employment can, however, also give rise to higher family income, which in turn may have a beneficial effect on a child’s nutrition and physical activity through, for example, the ability to afford healthier foods, quality childcare and health club memberships.

A growing body of literature has emerged that addresses the relation between maternal employment and child obesity[1], most of which studies originate in the United States (Anderson et al., 2003; Benson and Mokhtari, 2011; Cawley and Liu, 2012; Fertig et al., 2009; Herbst and Tekin, 2011; Liu et al., 2009; Miller, 2011; Miller and Han, 2008; Morrissey et al., 2011; Ruhm, 2008). Research on this topic has also been conducted in Australia (Bishop, 2011; Brown et al., 2010; Champion et al., 2012; Zhu, 2007), Canada (Baker and Milligan, 2008; Chia, 2008; Phipps et al., 2006), Japan (Gaina et al., 2009) and the UK (Champion et al., 2012; Hawkins et al., 2007; Scholder, 2008), Denmark (Greve, 2011) and Spain (Garcia et al., 2006). This literature provides strong evidence for a positive effect of maternal employment on childhood obesity, although the magnitude of this effect varies substantially.

We contribute to the extant literature in three ways. Firstly, by basing our findings on the unique IDEFICS dataset, which covers children aged 2 to 9 in eight countries (Belgium, Cyprus, Estonia, Germany, Hungary, Italy, Spain and Sweden), we increase our understanding of how maternal employment could affect childhood obesity across Europe. Such increased insight is especially important given the ambitious goals for actively promoting female employment envisioned by EU leaders in the Lisbon Strategy. Yet prior research on maternal employment and childhood obesity provides only limited evidence for continental Europe. Secondly, because our data set contains alternative fatness measures shown to be more valid and reliable than BMI, we are able to examine several different objective measures for childhood obesity. Thirdly, because we have access to rich information on the two main drivers of childhood obesity – diet and physical activity – we are also able to examine these two aspects, which have received limited attention in earlier research on maternal employment and childhood obesity.

The general conclusion of this paper is that our European sample of children provides limited evidence that maternal employment is related to child obesity, unhealthier diet or lower levels of physical activity. The remainder of the paper proceeds as follows: Section 2 reviews the relevant research on the topic, section 3 describes our data and methodology, section 4 discusses the study results and section 5 summarises our conclusions.

[1] There is also some research that assesses the impact of maternal employment on other aspects of child development, such as cognitive ability and general health (e.g. Baker and Milligan, 2008; Gennetian et al., 2010; Morrill, 2011; Ruhm, 2008, Waldfogel et al., 2002).

2 Previous research

Since Anderson et al.'s (2003) seminal paper on the effect of maternal employment on child weight, a relatively large body of literature has evolved on this topic,[2] one thoroughly reviewed by Greve (2008) and Scholder (2008), among others. For the purpose of our study, however, three insights from this extant research are worth noting:

First, very few *continental* European studies on maternal employment and childhood obesity exist.[3] We are only aware of two such studies: Garcia et al. (2006) for Spain and Greve (2011) for Denmark. Garcia et al. (2006), using data from the 2003 Spanish National Health Survey, show that maternal employment increases a child's likelihood of being overweight and obese by 2.5 and 2.3 percentage points, respectively. Greve's (2011) study, in contrast, which uses data from the Danish Longitudinal Survey of Children (DALSC) and the official register to analyse the effect of maternal employment when the child is 3½ years old on overweight at age 7½ years, is the only research we know of that finds that increased maternal work hours might actually *reduce* child obesity.[4]

Second, past studies on maternal employment and childhood obesity focus on obesity as the outcome variable and seldom address the two main drivers of obesity: diet and physical activity. Although some do show that maternal employment positively affects expenditures on purchased meals (Horton and Campbell, 1991; McCracken and Brandt, 1987) and that such meals tend to contain more calories and fats (Lin et al., 1996, 1999), we are aware of only a few that directly analyse the effect of maternal employment on meal patterns and diet. Among these, Cawley and Liu (2012), who examine mothers' time use based on the American Time Use Survey, find that employed women spend less time cooking and eating with their children. Likewise, Gaina et al. (2009), who investigate the effects of maternal employment on nutrition habits such as the regularity of breakfast, snacks and dinner and the speed at which meals are eaten, show that among a sample of 12- to 13-year-old Japanese schoolchildren, mother's employment status affects children's eating habits in a way that could lead to weight problems. Studies on adolescents' meal patterns and maternal

[2] Two earlier studies worth mentioning from the medical literature are Takahashi et al. (1999) for Japan and Johnson et al. (1992) for the United States.

[3] The only country in Europe that has several studies on this topic is the UK. Scholder (2008), drawing on data from the British National Child Development Study (NCDS), shows that full-time maternal employment when the child is aged 7 increases the child's probability of becoming overweight by age 16 by about 5.5 percentage points. Likewise, Hawkins et al. (2007), using data from the UK Millennium Cohort Study (MCS) to examine the relationship between maternal employment and overweight in children aged 3 years, show that maternal employment after the child's birth is associated with early childhood overweight.

[4] Another recent (non-European) study that estimates a negative effect of maternal employment on weight is Bishop (2011) for Australia.

employment are more common. For instance, Neumark-Sztainer et al. (2003) find that in the United States, family meals are less frequent when the mothers of teenagers aged 11 to 18 years are employed full time. Siega-Riz et al. (1998), on the other hand, in their analysis of data from the Continuing Survey of Food Intake by Individuals in the United States, find no associations between meal patterns and maternal employment. There is some research evidence that children with more frequent family meals have healthier diets (Gillman et al., 2000; Haapalahti et al., 2003; Videon and Manning, 2003). However, we are not aware of any research that takes a direct look at the relation between maternal employment and children's *calorie intake*.

With regard to physical activity, Brown et al. (2010), using data from the Longitudinal Study of Australian Children, show that the children of employed mothers generally watch more television than the children of mothers who are not employed. Likewise, using diary data from the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID), Fertig et al. (2009) reveal that maternal employment affects a child's inclination to perform activities like reading and watching TV. In a more recent study, Bonke and Greve (2012), using the Danish Time-Use and Consumption Survey (DTUC) from 2008/09 with information on fathers', mothers' and children's time use, find no evidence of a relation between parental working hours and children's time allocations. A similar result is obtained by Ziol-Guest et al. (2012) using data from the U.S. National Longitudinal Survey of Youth. They show that paternal work hours do not affect child BMI, whereas for children of highly-educated mothers, an association between maternal work hours and child BMI exists and that this is partially mediated by television viewing time. A more direct measure for the extent of children's physical activity can be obtained using data from accelerometers. However, to our knowledge, such data have not yet been used to assess the relation between maternal employment and child obesity.

A *third* important aspect of prior research is its exclusive use of BMI, defined as weight in kilograms divided by height in meters squared, as the obesity measure. Although attractive to the social sciences because of the ease with which height and weight data can be collected, the large body of medical literature that assesses BMI's validity as a proxy for fatness raises some concerns (see e.g. Burkhauser and Cawley, 2008; Gallagher et al., 1996; McCarthy et al., 2006; Romero-Corral et al., 2006; Wellens et al., 1996; Yusuf et al., 2005). The main concern is that BMI does not distinguish fat from muscle, bone and other lean body mass.[5]

[5] Burkhauser and Cawley (2008, p. 527) express this concern as follows: "Social scientists should acknowledge that, because of its failure to distinguish body composition, BMI is a deeply flawed measure".

Nevertheless, the use of BMI for children is widespread and has been endorsed by an expert committee convened by the American Medical Association (AMA) in collaboration with the U.S. Department of Health and Human Services Health Resources and Services Administration (HRSA) and the CDC. This committee concludes that "although BMI does not measure body fat directly and therefore may lead to imprecise assessment of adiposity, it is feasible and has acceptable clinical validity if used thoughtfully" (Barlow et al., 2007, p. S167). More problematic, however, is that a number of studies (Bishop, 2011; Baker and Milligan, 2008; Chia, 2008; Garcia et al., 2006; Greve, 2011; Liu et al, 2009; Phipps et al., 2006; Zhu, 2007) use self-reported BMI, usually in the form of the children's height and weight as reported by their parents. There is considerable evidence that such self-reporting leads to large biases (e.g. Huybrechts et al., 2006; Shields et al., 2011).[6]

Our paper, therefore, not only investigates the association between maternal employment and obesity but contributes to the existing literature by exploring the association between maternal work and meal patterns, diet and physical activity from a European perspective. We also circumvent the potential problems associated with BMI by using objective reports of various anthropometric and other measures, while recognising, as will be discussed in the methods section, that these measures have their own weaknesses.

3 Data and Methods

The data used in this study are taken from the IDEFICS study ("Identification and prevention of Dietary and lifestyle induced health EFfects In Children and infantS"), which is supported by the Sixth Framework Programme of the European Commission and uses standardised data collection methods in all survey countries (see Ahrens et al., 2011 for a description of IDEFICS). Specifically, IDEFICS is a multi-centre population-based study on childhood obesity carried out in two selected regions[7] in each of eight European countries – Belgium,

[6] For example, in their representative study for Canada, Shields et al. (2011) report that "the use of parent-reported values resulted in significant misclassification errors for children of all ages. A substantial percentage of children who were obese according to their measured height and weight were classified in a lower BMI category. For the most part, these errors resulted from the under-reporting of weight. On the other hand, many children who were classified as obese based on parent-reported height and weight were actually overweight or even normal weight. These errors generally resulted from the under-reporting of height" (p. 8). Likewise, in their Belgian study, Huybrechts et al. (2006) stipulate how substantial these biases can be: "Among all children requiring nutritional advice on the basis of being overweight or obese, more than one half of the overweight children and >75% of the obese children would be missed with the use of parentally reported weight and height values" (p. 2109).

[7] The regions are comparable with regard to their infrastructural, sociodemographic and socioeconomic characteristics. The regions are as follows: Belgium: Geraardsbergen and Aalter; Cyprus: Strovolos and

Cyprus, Estonia, Germany, Hungary, Italy, Spain and Sweden. Children were approached through school and kindergarten settings, which facilitated enrolment of children. Because of budgetary constraints and feasibility considerations, it was not intended to generate a representative sample for a given country. The unique feature of the IDEFICS study is the large number of objective measurements and the amount of laboratory data it provides in addition to the questionnaire data.

The IDEFICS survey, administered between September 2007 and June 2008, comprised a detailed self-administered questionnaire in which parents described their children's lifestyle, diets, consumer behaviour, parental attitudes and socio-demographic circumstances. The questionnaire was developed in English, translated into the corresponding languages and translated back in order to reduce translation errors. The overall response rate was 53.5%, resulting in a sample of 16,224 children aged between 2 and 9 years, in a total of 390 kindergartens and school, with an average of 41.6 children per setting. A thorough physical examination was also conducted on all children in the sample to determine their amount of body fat and other health indicators. As will be discussed below, our analysis focuses on measures collected through various tests in which not all the children participated. Thus, sample sizes inevitably differ in the different analyses.

Maternal employment and child obesity

Although obesity is commonly defined as excess body fat, body fat itself cannot be directly measured in a living subject (see Sweeting, 2007). Moreover, laboratory methods such as density-based measures (hydrodensitometry; air displacement plethysmography) and scanning techniques (computerized tomography; magnetic resonance imaging; dual-energy X-ray absorptiometry), which can determine body fat with a certain accuracy, are not feasible in large-scale epidemiological studies, which must necessarily employ field methods. The most common such methods are assessment of body mass index (body mass in kg / squared standing height in m^2), bioelectrical impedance (fat free mass estimated based on the measured electrical resistance of the body) and anthropometrics (body circumferences and skinfold thicknesses). All of these methods have age- and sex-specific disadvantages and there is no consensus on which measure of body fat is best (Burkhauser and Cawley, 2008).

Paphos; Estonia: Tartu and Tallinn; Germany: Delmenhorst and Wilhelmshaven; Hungary: Pecs and Zalaegerszeg; Italy: Atripalda/Monteforte I/Volturara I and Avellino/Forino/Pratola Serra; Spain: Zaragoza 1. District and Huesca; Sweden: Partille and Alingsas/Mölndal. For a description of the regions, see Bammann et al. (2012).

BMI, for example, is easily collected but ignores body composition. Similarly, the waist circumference measure, one of the most reliable field method for measuring abdominal visceral fat (Snijder et al., 2003), which is medically well documented as being especially problematic and associated with higher levels of morbidity and mortality, completely ignores such factors as larger amounts of body fat at the hip and thus also disregards body composition. Bioelectrical impedance methods, on the other hand, use body density assumptions that may or may not be true for the measured individual. Moreover, the IDEFICS study used a leg-to-leg device that measures only the bottom half of the body.

To investigate how a range of field measurements perform relative to a more precise laboratory combination of isotope dilution, air displacement plethysmography, dual energy X-ray absorptiometry and total body mass measurement (see Wells et al., 1999), the IDEFICS project included a validation study (Bammann et al., 2013) carried out on a sub-sample of 100 children. The results of the laboratory test were compared to those for a composite measure developed using data from the hip circumference, triceps skinfold and resistance index (derived from BIA) field methods.[8] The comparative results indicate that, in the IDEFICS study at least, waist circumference and the imputed fat values from the composite measure have a very high validity. BMI performed significantly worse – a result also observed in Burkhauser and Cawley (2008). It should again be stressed, however, that all methods used to measure fatness have advantages and disadvantages, and there is little consensus on which measures of fatness is best, meaning that the use of more than one measure makes sense.

Based on the results of the IDEFICS validation study, we decided to rely primarily on three measures: We first include (measured) BMI in order to highlight possible differences that may arise from sole reliance on BMI.[9] More specifically, we use a continuous variable describing BMI z-scores based on the growth charts of the International Obesity Task Force (IOTF) (Cole et al., 2000), which were calculated with six nationally representative data sets of body mass indices in childhood (the countries being Brazil, Great Britain, Hong Kong, the Netherlands, Singapore, and the United States). These growth charts are differentiated by age

[8] The composite measure was derived by fitting regression models to the data from the validation study. Body fat mass was estimated by the following formula:

body fat in kg = -15.226 + (.26912 * hip circumference) + (.16961 * triceps skinfold) + (.34585 * FM_{res})

where FM_{res} is fat mass calculated as weight (kg) minus RI (cm^2/Ohm). The resistance index (RI) was calculated as squared height (cm^2) divided by resistance (Ohm) as measured by bioelectrical impedance.

[9] Burkhauser and Cawley (2008) demonstrate, for example, that the correlation of fatness with one important labour market outcome, employment, is sensitive to the measure of fatness used.

and sex[10], so a z-score reveals the corresponding percentile of the underlying growth chart (e.g. a z-score of 1.92 corresponds to the 97th percentile). We calculate BMI by dividing measured weight in kilograms by squared (measured) height in meters. The underlying weight and height measures were obtained by qualified health personnel. Our second measure is waist circumference, for which we use the corresponding z-scores based on the growth charts of the International Obesity Task Force (IOTF). The third measure is based on the fitted model described above, which is also the most valid measure of child obesity according to the IDEFICS validation study (Bammann et al., 2013).

Ideally, the choice of *explanatory variables* should be driven by a theoretical child health production function in which child health (in our case, obesity) is a function of parental time and other invested commodities (e.g. Ruhm, 2008). As in most studies, however, we take a relatively eclectic approach and include a wide range of explanatory variables. Our choice includes three dummy variables for maternal employment: full-time employment, defined as working 30 hours or more a week; part-time employment, less than 30 hours a week; whether the mother is undertaking further education; and a reference category of mothers who are not in paid employment (e.g. homemakers, retired, on temporary leave, on maternity leave or unemployed). As in Scholder (2008), we also distinguish three sets of control variables – child characteristics, family and parental characteristics and socio-economic characteristics.

Our set of *child characteristics* includes child's age, sex, birth weight, premature birth and breastfeeding, as well as three variables that capture health problems during the first four weeks after birth (respiratory problems, infections and jaundice), four variables that indicate the number of younger, older or same aged sibling (or no siblings), and one variable indicating birth in a foreign country. Child's age is a dummy variable, with age 7 serving as the reference group; birth weight is captured by actual birth weight in grams. The additional dummy variables are non-exclusive breastfeeding and three health problems (respiratory problems, infections and jaundice).

Our set of *family and parental characteristics* includes parents' age, foreign country of origin, household size, age of mother at birth, weight gained during pregnancy and smoking during pregnancy (dummy). Paternal employment is represented by three dummy variables (full-time, part-time and in school/university, with non-working fathers as the reference group). As regards parental BMI, Scholder (2008) excludes it based on the argument that after birth, any changes in maternal employment that affect a child's weight (via changes in eating patterns,

[10] We also ran our regressions using growth charts from the U.S. Center for Disease Control (Kuczmarski et al., 2002), but the main conclusions did not change.

use of spare time, etc.) are likely to also affect parents' weights, an effect that researchers may want to avoid controlling for. Given the importance of parental BMI in determining child weight and also the fact that maternal employment may have different effects on the parents' weight than on their children's, however, we include parental BMI in our regressions. Nevertheless, it is worth noting that the main conclusions of the paper do not change if this variable is omitted.

Our *socio-economic variables* are the parents' educational level (ISCED 1–6) and household income (net income after taxes and deductions), which is classified into nine categories. To derive comparable income categories by country, we built country-specific categories based on the median equivalent income adjusted for the number of household members. The lowest category is defined by each country's poverty line for a single parent with one child. The middle category is the median country-specific income for a household consisting of two adults and one child. The numbers were obtained from Eurostat[11] for the year 2007 and a detailed description of the categories is presented in Bammann et al. (2012).

The IDEFICS data has a nested structure with three levels: country, kindergarten / school ("setting"), and child. In such samples, the individual observations are in general not independent, as children in the same school tend to be more similar to each other due to, for example, selection processes, in which some schools may attract children from higher socio-economic status levels (Hox, 2002). We therefore estimate a 3-level random intercept model of the following form[12]:

$$\begin{aligned} W_{ijk} &= \beta_{0jk} + \beta_1' X^E_{ijk} + \beta_2' X_{ijk} + \varepsilon_{ijk} \\ \beta_{0jk} &= \beta_{0k} + u_{0jk} \text{ (kindergarten / school level)} \\ \beta_{0k} &= \gamma_0 + v_{0k} \text{ (country level)} \end{aligned} \quad (1)$$

where W_{ijk} is the measure for fatness of child i, in school j, and in country k. β_{0jk} is the average outcome in school j and country k which is equal to the sum of the population average (γ_0), a country-specific effect (v_{0k}) and a school-specific effect (u_{0jk}). $\mathbf{X}_{ijk}$ captures the child, family and parental, and socio-economic characteristics of child i in school j and country k. $\mathbf{X}^E_{ijk}$ captures the maternal employment. ε_{ijk} is the individual-level error term. The composite model thus looks as follows:

$$W_{ijk} = \gamma_0 + \beta_1' X^E_{ijk} + \beta_2' X_{ijk} + u_{0jk} + v_{0k} + \varepsilon_{ijk} \quad (2)$$

11 http://epp.eurostat.ec.europa.eu

12 An alternative approach would be to use OLS with multilevel clustering, which, in our case, gives rise to similar results.

Equation (2) is estimated using ML methods. When running regressions for individual countries, a corresponding two-level random intercept model is estimated.

It is important to stress that establishing a causal relation between maternal employment and child weight is not possible in our cross-sectional setting, especially given that maternal employment status might be endogenous. Determining a priori the magnitude and direction of a possible bias is difficult and purely speculative. According to Anderson et al. (2003), mothers who work more hours could be thought of as generally less attentive to their children's health, irrespective of their work effort. If this were the case, then the coefficient on maternal employment would be biased upwards. Alternatively, high-ability mothers may be more likely to work more hours and better able to ensure child health, which would lead to a downward bias. Put another way, mothers who are more likely to work could have skills that make it less likely that their children are obese. For example, they might have better organizational (multi-tasking) ability, which makes them more likely to work, but also more likely to be able to find good childcare alternatives or cook healthier home meals. It is also conceivable that a possible bias may differ depending on the country analysed. For instance, in Scandinavian countries most women work and are employed full time (37 hours per week), implying that women who work fewer hours are deviating from the norm and may be low-ability mothers who are less attentive to their children.[13]

To better explore the heterogeneous association with maternal employment at different points on the children's BMI distribution, we, like Greve (2011), Herbst and Tekin (2011) and Terry et al. (2007), run quantile regressions whose estimated coefficients show the marginal change in the n^{th} BMI quantile that results from changes in the maternal employment status. We also apply quantile regressions to the other measures of waist circumference and fat mass.

Of the 16,224 children that participated in IDEFICS, all three measures of fatness are available for 14,402 children. After taking the explanatory variables into account, we are left with a sample of 8,239 children.

[13] In our analysis, we try to account for this endogeneity by using a very rich set of child and family characteristics. However, because it is impossible to test whether or not our variable set eliminates all unobserved heterogeneity, we also employed an instrumental variable (IV) approach. Specifically, as in several other papers (e.g. Greve, 2011), we used the local unemployment rate as our instrument. However, because our sample includes only 16 regions, the instrument's variation is too low. In any case, there is some concern that such an instrument is not valid, especially if the state of the macro economy affects health (Cawley and Liu, 2012). It is nevertheless worth noting that all the papers that we are aware of that use an IV approach show maternal employment status to be clearly exogenous, which may lend some support for the assumption that the endogeneity of maternal employment is perhaps not a major problem in such models. The best we can do with our data set, however, is to echo Cawley and Liu (2012, p. 362): "An important direction for future research is to find valid and powerful instruments for maternal employment, and investigate whether maternal employment has the causal effect of reducing mother's time spent in activities that relate to child diet, physical activity, and weight."

Maternal employment, diet and physical activity

According to Scholder (2008), the timing of maternal employment is important: in her study, full-time maternal employment during mid-childhood positively affects the probability of the child being overweight at age 16, although there is no evidence that part-time or full-time maternal employment at earlier or later ages affects this probability. Although very few studies address this important point (see also Miller, 2011), most assess the effect of *past* maternal employment on *future* child weight, which they measure using different lag lengths. Using our cross-sectional data set, we can control only for maternal employment status on the date that the children were surveyed[14], which may not be an ideal explanatory variable for current child obesity. There is, however, usually a strong correlation between current and past employment, and, more important, current maternal employment is the relevant variable when examining the child's current diet and physical activity.

Although obesity is obviously the result of an imbalance between energy intake and energy expenditure, the exact mechanism of this imbalance is hard to pinpoint. Two points are clear, however. There is considerable marketing pressure on children to consume processed foods and the opportunities for them to do so are many. As a result, passive overconsumption is an important determinant of obesity (Livingstone, 2000). We therefore analyse three variables associated with food consumption. The *first* is the ratio of meal frequency at home to the total meal frequency (per week), which captures the number of meals both at home and in school or day care. Meals at home are defined as meals consumed in the child's home or at other people's houses (e.g. grandparents or friends). This variable takes into account Michaud et al.'s (2007) finding that differences in obesity rates between the United States and Europe are partially associated with the type or quality of food eaten away from home.

The *second* dependent variable is a continuous variable that describes diet on the Youth Healthy Eating Index (YHEI) (Feskanich et al., 2004), which ranges from 0 to 80, with a higher score indicating a healthier diet. Because there is no corresponding index for European children nor common European guidelines on which to base one, the YHEI, although based on U.S. dietary guidelines, is the best available instrument for generating comparable data among the eight survey countries and drawing conclusions on the relative healthiness of a diet. This index, which measures food consumption and food-related behavioural patterns, is

[14] Although we include a variable for the mother never having been employed, it does not really capture the mother's employment history.

based on food consumption frequencies, which are collected in the IDEFICS survey using the Children's Eating Habits Questionnaire (CEHQ) (Lanfer et al., 2011). Specifically, parents responded to the following question about their children's food consumption of 43 food categories: "*In the last month, how many times did your child eat or drink the following food items? – Please refer to the last four weeks and exclude foods served at school.*" Respondents were asked to exclude foods served at school or childcare so that YHEI measures solely the healthiness of the diet under parental control. We also include meal pattern information from the CEHQ – for example, the frequency of fast food consumption, the frequency of breakfast at home or in school/childcare or the frequency of family dinners. Based on these data, we are able to replicate 10 of the 13 original YHEI dimensions[15]. To calculate our amended YHEI, we use the sum of all available scores for the 10 dimensions, the criteria for which are adapted from Feskanich et al. (2004) (see table 1). The possible minimum for the index is 0 and the maximum is 80.[16]

Table 1 about here

Our *third* measure captures the calorie intake of children in calories (kcal) per day. The data were collected using SACINA, a 24-hour self-administered children and infant nutrition assessment tool (Ahrens et al., 2011) based on the YANA–C questionnaire (Vereecken et al., 2008), which was filled out by the children's parents. For school and childcare meals, there was also an additional on-site meal assessment undertaken by qualified dieticians. We use this information, together with country-specific food composition tables, to calculate energy intake (kcal) for each child on a daily basis.

For energy expenditure, we employ two dependent variables: first, as a proxy for sedentary behaviour, we use the children's audiovisual and media time (AVM time), measured as the average hours children spend per week watching television, video, DVD or in front of a

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[15] Food types: 'Whole grains' (source of fibre, vitamins and minerals), 'Vegetables' (source of vitamins and minerals), 'Fruits' (source of vitamins), 'Dairy' (source of calcium), 'Snack foods' (unnecessary energy), 'Soda and drinks' (unnecessary energy), and 'Margarine and butter' (sources of fat). Food behavioural patterns: 'Fried foods outside home' (high energy intake), 'Eat breakfast' (indicator of healthy dietary patterns), and 'Dinner with the family' (indicator of healthy dietary patterns).

[16] The original YHEI also includes the dimensions 'meat ratio', 'multivitamin use' and 'visible animal fat', but these factors are not covered in the IDEFICS data.

computer or a game console.[17] Second, we calculate non-sedentary behaviour on the basis of uniaxial accelerometry (Ojiambo et al., 2011), a practical method for quantifying children's physical activity whose efficacy has been demonstrated in several studies (Jackson et al., 2003). As Johnston and Lee (2011) point out, the benefit of such monitors is that they can capture non-structured activities that are overlooked in self-reports, which, although widely used in the economics literature, are generally recognized as unreliable (Troiano et al., 2008), especially when parents are reporting on their own children's physical activities. In the IDEFICS study, the monitoring device, secured directly to the skin on the right hip using an elastic belt and removed at night, was worn for an average of 3.7 days (including weekdays and weekends). The resulting activity data were sampled using 15-second epochs and then averaged over a whole week, although the analysis includes only days with greater than 600 minutes of registered data. The total volume of physical activity is expressed as total counts divided by number of days registered; the time engaged in moderate and vigorous physical activity is calculated based on Pate et al. (2006) and presented as a proportion of total time.

For the analysis of diet and physical activity a similar multilevel regression was estimated as in the case of our fatness measures. Of the 16,224 children that participated in IDEFICS, all three diet measures are available for 6,802 children. After taking the explanatory variables into account, we are left with a sample of 4,375 children. Of the original 16,224 children, both physical activity measures are available for 7,112 children. After taking the explanatory variables into account, we are left with a sample of 4,425 children.[18]

To better assess the role of socio-economic status (SES), we also carry out analyses for three SES classes[19]: low, medium and high. This classification is based on an additive SES indicator comprising equalised household income, parental education and occupation (Bammann et al., 2012). All three components were recoded to the interval 1–5 and summed; the resulting SES indicator ranges from 3–15. To obtain the three SES categories used, we split the sample into terciles.

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[17] We also tested physical activity using parentally reported physical activity and leisure time (as further proxies for sedentary behaviour), but the conclusions did not change.

[18] For a sample of 2,278 children, we have complete information; that is, data on all the fatness measures, diet measures, physical activity measures and all explanatory variables. However, because we lose 86% of our original sample and the resulting sample size is too small to conduct country analyses, we have refrained from such an approach. We did, however, analyse this sample separately, and the conclusions did not change.

[19] Although the IDEFICS survey is not representative of the individual countries, we have checked for a bias related to SES. One IDEFICS study (Bammann et al., 2012) identifies certain deviations in household income between IDEFICS households and national country averages (Eurostat statistics), albeit not in any one direction. Thus, our regions in Cyprus, Germany and Italy are poorer than the national averages, whereas Estonia, Spain and Sweden cover more prosperous areas. When we compare the total Eurostat averages with the IDEFICS averages across all eight countries, however, we note that our sample has a slightly lower average household income, although the difference is not large (€15,661 vs. €13,619).

The descriptive statistics for all variables are given in appendix table A1.[20]

4 Results

Maternal employment and child weight

The descriptive statistics for (part- and full-time) employed and non-employed mothers on the three measures of fatness (BMI, waist circumference, fitted model) are given in table 2. In our full sample, fatness measures are significantly higher among non-employed than employed mothers. Only with regard to waist circumference do we observe no significant difference between children of full-time employed mothers and those of non-employed mothers. There also appears to be a difference between the part-time and full-time variables, with children of part-time employed mothers having generally lower fatness measures (albeit only significant for the waist circumference measure). This point is also highlighted in the country statistics (see table 3), although few results are significant and sample sizes are relatively small. In our Belgian, Cypriot and Hungarian samples, we note that children of full-time employed mothers have a larger fatness value than children of non-employed mothers. It is particularly noteworthy that no country differences are significant when the BMI measure is used.

Table 2 about here

Table 3 about here

The regression results for our three dependent variables on child fatness and for different SES categories are summarised in table 4. Four points are worth noting: first, in the full sample we note a positive correlation between full-time maternal employment and child fatness. This result is primarily being driven by low SES household. Second, whereas we find no significant evidence that maternal employment correlates with child BMI at a low SES, we do

[20] These descriptive statistics are based on the sample of 8,239 children for which all fatness measures are available.

find such a correlation for waist circumference and body fat. This observation echoes Burkhauser and Cawley's (2008) conclusion that different measures of fatness can give rise to different results. Third, we only find significant effects for full-time employment: part-time employment does not correlate significantly with child fatness in any measure. This finding is further support that, if at all, it is primarily the full-time employment of mothers that could have detrimental effects. Finally, the effects are relatively small – the significant coefficient in the body fat model in low SES households corresponds to approximately 340g of fat.

Table 4 about here

The results of the individual country regressions are listed in table 5. Clearly, and despite large variations in obesity among the regions in our sample, maternal employment is seldom significant. Only in Cyprus (with BMI) and Italy (with BMI and the fitted model) do we observe a significant correlation. Needless to say, however, small sample sizes are affecting the power of these models.

Table 5 about here

The results for the quantile regressions are presented in table 6. Here, we observe a number of significant coefficients. For BMI, we observe significant positive coefficients for full-time employment at the upper ends of the distribution (greater than 75%). The results using waist circumference are similar, although there is also evidence of positive correlations at the low end of the distribution. In our fitted model, we observe a significant positive coefficient at the 85% cut-off. In the case of part-time employment, with the exception of negative effects at the 10% and 25% cut-offs in the fitted model, no coefficients are significant. The general picture given by these results is that positive correlations seem more likely at the upper end of a fatness distribution, and apply only to full-time employment. This observation mirrors Herbst and Tekin's (2011) finding for the U.S. that children at the upper end of the distribution experience BMI gains that are greater than those experienced by children at the lower end.

Table 6 about here

To summarize, our different measures of fatness provide no strong evidence that current maternal employment is associated with children's current obesity. An exception is low SES mothers and children at the upper end of the fatness distribution, although the magnitude of the coefficients is not particularly large. Very little evidence exists that part-time employment is correlated with child fatness. However, as we cannot rule out the possibility that current maternal employment affects future obesity levels, we further analyse the effect of maternal employment on the direct drivers of obesity: energy intake and expenditure.

Maternal employment, diet and physical activity

Descriptive statistics for (part- and full-time) employed and non-employed mothers on meal patterns and diet and physical activity are given in table 7. Although it is not surprising that meals at home are more common among the children of non-employed mothers, we find slightly higher YHEI scores for the children of employed mothers (with the difference being significant for full-time employed mothers). Children's calorie intake is significantly lower among full-time employed mothers than among non-employed mothers and energy expenditure is significantly higher among children of part-time employed mothers than among non-employed mothers. The differences, however, are very small. At the country level (table 8), few differences are significant. Only in Belgium do we note that calorie intake is lower among the children of employed mothers, whereas the opposite is true in our Swedish sample. In our Hungarian sample, the children of non-employed mothers have a significantly higher level of physical activity. Again, however, the differences are relatively small.

Table 7 about here

Table 8 about here

As shown by the regression results for maternal employment on meal patterns and diet (table 9), the children of employed mothers consume meals at home less frequently, a finding supported by both Neumark-Sztainer et al. (2003) and Cawley and Liu (2012). In fact, some studies suggest a positive relation between the frequency of family meals at home and diet healthiness (Gillman et al., 2000; Haapalahti et al., 2003; Videon and Manning, 2003). In our analysis, we observe a significant negative correlation between full-time employment and the healthiness of children's diet under parental control (as measured by the YHEI index), although the effect is relatively low. With regard to calorie intake, AVM time and physical activity, we observe no significant results in the full sample. These three measures are particularly relevant because they capture meals taken both at home and outside the home. In the corresponding results for different SES levels (also in table 9), only two coefficients are significant in the medium-SES sample: full-time employment in the YHEI case, and full-time employment associated with AVM time.

Country regressions are presented in table 10. We note that, in Spain and Belgium, maternal employment appears to be related to lower YHEI values. In addition, the children of full-time employed mothers have a significantly larger calorie intake in Cyprus and Germany, a significantly lower calorie intake in Belgium, and higher levels of AVM time in Italy and Cyprus. Analyses based on accelerometer data provide little evidence that maternal employment is associated with children's physical activities.

Table 9 about here

Table 10 about here

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5 Discussion and Conclusions

Our analysis of European children provides little evidence that maternal employment is related to childhood obesity. Some nuances, however, are worth noting. First, socio-economic status (SES) and the child's position on the fatness distribution appear to be important: in general, in low SES households and among children at the upper end of the fatness distribution, we observe a positive relation between maternal employment and childhood fatness. These two factors also go hand-in-hand; that is, there is evidence in Europe of a widening social gradient in child overweight (Knai et al., 2012). Second, different measures of fatness can give rise to different results. In particular, we note that the results of our SES analysis are sensitive to the measure used. For example, in the low SES sample, maternal employment is not related to child BMI but has significant positive effects on the other two measures, probably because BMI does not distinguish between total body fat and fat-free mass. Third, and in line with recent findings for Denmark (Greve, 2011), these results hold only for full-time employment – there is little evidence of a mother's part-time employment being associated with childhood obesity. We also find little evidence that maternal employment is related to a child's diet and physical activity. Specifically, although maternal full-time employment does have a negative effect on a child's dietary composition (as measured by the YHEI), this effect is small. Moreover, neither a child's calorie intake nor physical activity is related to a mother's employment status, a result that holds irrespective of the household's SES.

These findings stand at odds with those of a number of studies conducted primarily in the U.S. and thus raise the question of why maternal employment is not seemingly related to child obesity in the European context. In answer, we point first to the importance of institutional differences in public support for parental childcare. Such public support can affect the health of employed mothers' children in two ways: first, higher expenditures on childcare facilities can lead to better quality care in such facilities and thus healthier diets and more physical activity. Second, cash benefits like child-family allowances and tax relief may allow parents to forgo some employment-related earnings in order to spend more time caring for children; that is, they allow more parental attention to be allotted without compromising household income. Such increased care could also benefit the children's health. There is some evidence that this kind of public support is quite generous in many European countries (Sayer et al., 2004a, 2004b; OECD, 2011). Yet within Europe, large differences exist in the magnitude and form of support. In our sample of countries (and for children aged 2 to 9), Belgium, Germany and Hungry have relatively generous cash benefits and tax breaks amounting to between 10–20% of household income (see OECD, 2011), but such support is very limited in Estonia, Italy and Spain. Expenditure on childcare in pre-schooling years is particularly generous in Hungry and Sweden, at around 50% of median household income, and relatively low in

Estonia, at approximately 20% of median household income. Yet despite these differences, European public support through cash benefits and in-kind service provisions including childcare and tax breaks is significantly higher than in many non-European countries, in particular, the United States (OECD, 2011). In fact, the oft-claimed poor quality of childcare in the United States (UNICEF, 2008), although admittedly difficult to measure, may partly explain the differences between the findings for continental Europe and the United States.[21]

Lifestyle and environmental differences between Europe and the United States may also matter. For example, the portions of meals eaten away from home tend to be larger in the United States than in Europe (Steenhuis et al., 2010). The sizes of chain fast-food portions in the United States, especially, appear to be considerably larger (Young and Nestle, 2002), which seems to have an adverse effect on diet quality in ways that could plausibly increase the risk for obesity (Bowman et al., 2004).

One final point that appears to apply as much to the United States as to Europe is that the dramatic rise in maternal employment has not necessarily led to a qualitatively significant reduction in the time mothers spend with their children (Bianchi, 2000). Rather, employed mothers maximise such time by working part-time or by having fewer children, a particularly relevant factor in Southern European countries where fertility rates have been extremely low for a number of decades. They may also use their non-market time differently; for example, by using market substitutes for housework or by expending less time on leisure. At the same time, working fathers are spending more time with their children than in the past (Benson and Mokhtari, 2011). Bianchi (2000) thus concludes that, despite large increases in maternal employment, mothers' time and attention to children has been far more constant over the past few decades than might be expected.

Ideally, an analysis of maternal employment and childhood obesity in Europe should use several waves of panel data, rich data on labour supply, objective measures of adiposity, should cover several countries in a representative manner and have large sample sizes. Needless to say, such a data set does not exist, meaning that a few words of caution are warranted on the interpretation of our results. First, one drawback of using such rich and costly data is that it nearly always implies reliance on a cross-section. Yet because the relations between a mother's work hours and her child's activities, and between the child's activities and the child's weight status, may be due not only to a direct causal link but also to some unobservable characteristic(s) of the family or the mother, we must interpret findings

[21] Of the 10 benchmarks defined by UNICEF, the United States fulfils only 3 and is ranked 4th from last in a group of 25 developed countries.

based on cross-sectional data as suggestive and not causal. Second, more detailed information (in conjunction with panel data) on labour supply would be useful for assessing whether changes in working time affect children's fatness at different ages. Third, although the IDEFICS sample is reasonably large, a more detailed regional analysis is hampered by the relatively small sample sizes at the country level. This restriction, too often encountered in European cross-national research, is unfortunate because it prevents exploitation of the full heterogeneity among the regions. Finally, it must be stressed that the regional data are not fully representative of their corresponding countries.

Our paper provides initial evidence for selected regions in Europe that maternal employment may not be detrimental to childhood obesity. Considering the dearth of research on this topic for continental Europe, more country studies are needed to shed additional light on this important issue. Further cross-national research is also particularly valuable for establishing the generality of findings and the validity of interpretations derived from single-nation studies. As pointed out by Kohn (1989, p. 77), "in no other way can we be certain that what we believe to be social structural regularities are not mere particularities, the product of some limited set of historical or cultural or political circumstances".

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Tables and figures

Table 1: Youth Healthy Eating Index (YHEI) scoring criteria, based on Feskanich et al. (2004)

YHEI dimensions	YHEI scoring criteria: Requirements for max. score of 10	YHEI scoring criteria: Requirements for min. score of 0	Scores Mean (SD)
	← Servings per day	→	
1. Whole grain	≥ 2	0	3.26 (3.39)
2. Vegetables	≥ 3	0	3.92 (2.62)
3. Fruits	≥ 3	0	3.95 (2.63)
4. Dairy	≥ 3	0	6.52 (2.44)
5. Snack foods	0	≥ 3	6.47 (2.59)
6. Soda & drinks	0	≥ 3	8.50 (2.52)
	Requirements for max. score of 5	**Requirements for min. score of 0**	
7. Margarine & butter	Daily	≥ 2 pats/day	3.25 (1.72)
8. Fried foods outside home	Never	Daily	4.80 (.24)
9. Eat breakfast	≥ 5 times/week	Never	4.83 (.72)
10. Dinner with the family	Daily	Never	4.82 (.75)
YHEI (0-80)			50.53 (8.41)

Table 2: Descriptive statistics: children's weight status by employed vs. non-employed mothers

Variable	Full-time employed	Part-time employed	Non-employed
BMI (z-score, Cole)	.206***	.168***	.450
Waist circumference (z-score, Cole)	.278	.090***	.270
Fat (kg, fitted model)	4.024***	3.963**	4.340
Observations (8,125)	4,017	1,539	2,683

Note: ANOVA with group comparison by Tukey-Kramer for unequal cell sizes. Asterisks indicate statistically significant difference between full- or part-time employed and non-employed (excluding 'in school/university')

* $p < .05$, ** $p < .01$, *** $p < .001$

Between full-time and part-time employment, we find a statistically significant difference for waist circumference ($p < .001$).

Table 3: Descriptive statistics across countries: BMI and overweight values

	BMI (z-score, Cole)			Waist circumference (z-score, Cole)			Fat (z-score, fitted model)		
Country	**Full-time employed**	**Part-time employed**	**Non-employed**	**Full-time employed**	**Part-time employed**	**Non-employed**	**Full-time employed**	**Part-time employed**	**Non-employed**
Belgium *(1,009)*	-.233 *(576)*	-.285 *(266)*	-.382 *(167)*	.010	.008	.006	2.809*	2.807	2.388
Cyprus *(728)*	.502 *(479)*	.419 *(116)*	.294 *(133)*	.102	.129	.054	4.591*	4.937	4.247
Estonia *(886)*	.110 *(556)*	-.091 *(84)*	.110 *(246)*	.036	.024	.036	3.599	3.595	3.553
Germany *(896)*	.287 *(100)*	-.006 *(404)*	.141 *(392)*	.060	.032	.042	4.231	3.669	4.046
Hungary *(1,651)*	.068 (916)	.054 (115)	-.088 (620)	.057**	.052	.053	4.045***	3.648	3.377
Italy *(1,353)*	1.230 *(345)*	1.006 *(243)*	1.081 *(765)*	.235	.210	.194	6.734	5.897	6.192
Spain *(799)*	.354 *(407)*	.291 *(203)*	.455 *(189)*	.057	.054	.045	4.078	3.698	4.461
Sweden *(917)*	.002 *(638)*	-.134 *(108)*	.047 *(171)*	.013	.028	.015	3.504	3.640	3.204

Note: ANOVA with group comparison by Tukey-Kramer for unequal cell sizes. Asterisks indicate statistically significant difference between full- or part-time employed and non-employed (excluding 'in school/university'); * p < .05, ** p < .01, *** p < .001; Cell sizes in parentheses.

Table 4: estimates of maternal employment status on various obesity measures

Variable	(1) BMI	(2) Waist circ.	(3) Fat mass
	Full sample		
Full-time employment	.101**	.099**	.193*
	(.035)	(.035)	(.081)
Part-time employment	-.014	-.005	-.036
	(.041)	(.041)	(.094)
ICC (country and setting)	.103	.132	.114
	(.042)	(.046)	(.036)
Observations	8,239	8,239	8,239
	Low SES		
Full-time employment	.089	.180**	.347*
	(.066)	(.069)	(.158)
Part-time employment	-.021	-.001	.049
	(.077)	(.079)	(.184)
ICC (country and setting)	.099	.112	.113
	(.038)	(.041)	(.034)
Observations	2,445	2,445	2,445
	Medium SES		
Full-time employment	.134*	.098	.228
	(.054)	(.053)	(.122)
Part-time employment	.019	.006	-.042
	(.061)	(.060)	(.140)
ICC (country and setting)	.097	.155	.132
	(.045)	(.005)	(.042)
Observations	3,374	3,374	3,374
	High SES		
Full-time employment	.088	.067	.102
	(.072)	(.072)	(.156)
Part-time employment	-.035	.006	.033
	(.086)	(.086)	(.186)
ICC (country and setting)	.118	.159	.140
	(.054)	(.054)	(.052)
Observations	2,234	2,234	2,234

Note: estimates of a 3-level random intercept model. Standard errors in parentheses. Dependent variables are three obesity measures (BMI z-score by Cole, waist circumference z-score by Cole and fat mass in kg by Bammann et al., 2013) for children below the age of 10 years. All variables presented are dummy variables. Reference category for the employment status variables is non-employment. We control for child, family and parental, and socio-economic characteristics. The intraclass correlation coefficient (ICC) is the proportion of total variance that is attributed to the clusters “country” and “setting”.

* p < .05, ** p < .01, *** p < .001

Table 5: estimates of maternal employment status on various obesity measures at country level

Variable	Belgium	Cyprus	Estonia	Germany	Hungary	Italy	Spain	Sweden
Dependent: BMI								
Full-time employment	.071	.389**	-.036	.159	.088	.200*	.092	-.012
	(.096)	(.142)	(.098)	(.130)	(.081)	(.097)	(.108)	(.111)
Part-time employment	.067	.301	-.264	.002	.104	.002	-.095	-.084
	(.103)	(.174)	(.140)	(.087)	(.136)	(.101)	(.113)	(.144)
ICC (setting)	.001	.000	.021	.019	.015	.000	.006	.000
	(.019)	(.000)	(.015)	(.016)	(.010)	(.004)	(.010)	(.000)
Observations	1,009	728	886	896	1,651	1,353	799	917
Dependent: Waist circumference								
Full-time employment	.048	.243	-.008	.262	.247	.129	.121	.048
	(.096)	(.145)	(.096)	(.149)	(.133)	(.102)	(.115)	(.102)
Part-time employment	.023	.205	-.146	-.067	.040	.031	.029	.130
	(.103)	(.176)	(.138)	(.090)	(.130)	(.106)	(.121)	(.133)
ICC (setting)	.027	.049	.020	.019	.035	.000	.050	.015
	(.021)	(.025)	(.016)	(.021)	(.012)	(.000)	(.023)	(.013)
Observations	1,009	728	886	896	1,651	1,353	799	917
Dependent: Fat mass								
Full-time employment	.264	.571	-.010	.164	-.215	.574*	-.071	.052
	(.160)	(.340)	(.227)	(.283)	(.176)	(.265)	(.241)	(.212)
Part-time employment	.178	.721	-.234	-.292	.148	-.002	-.327	.263
	(.172)	(.411)	(.330)	(.190)	(.296)	(.275)	(.254)	(.277)
ICC (setting)	.002	.049	.075	.018	.005	.019	.023	.000
	(.018)	(.029)	(.022)	(.017)	(.009)	(.005)	(.014)	(.000)
Observations	1,009	728	886	896	1,651	1,353	799	917

Note: estimates of a 2-level random intercept model. Standard errors in parentheses. Dependent variables are three obesity measures (BMI z-score by Cole, waist circumference z-score by Cole and fat mass in kg by Bammann et al., 2013) for children below the age of 10 years. All variables presented are dummy variables. Reference category for the employment status variables is non-employment. We control for child, family and parental, and socio-economic characteristics. The intraclass correlation coefficient (ICC) is the proportion of total variance that is attributed to the cluster "setting".

* p < .05, ** p < .01, *** p < .001

Table 6: Quantile regression estimates of maternal employment status on various obesity measures

Variable	(10%)	(25%)	(50%)	(75%)	(85%)	(95%)
Dependent: BMI						
Full-time employment	.026	.045	.081	.149**	.190***	.181*
	(.055)	(.046)	(.042)	(.047)	(.055)	(.085)
Part-time employment	-.046	-.029	.014	.019	.080	-.017
	(.063)	(.051)	(.049)	(.053)	(.054)	(.085)
Observations	8,239	8,239	8,239	8,239	8,239	8,239
Pseudo R^2	.089	.095	.120	.161	.183	.190
Dependent: Waist circumference						
Full-time employment	.053	.125**	.048	.111*	.139*	.187*
	(.058)	(.043)	(.044)	(.048)	(.065)	(.087)
Part-time employment	-.002	.044	.007	-.025	-.043	.013
	(.067)	(.047)	(.053)	(.059)	(.072)	(.097)
Observations	8,239	8,239	8,239	8,239	8,239	8,239
Pseudo R^2	.124	.120	.127	.159	.188	.199
Dependent: Fat mass						
Full-time employment	-0,031	0,029	0,133	0,147	.290*	0,294
	(.059)	(.060)	(.075)	(.111)	(.132)	(.238)
Part-time employment	-.141*	-.142*	-0,021	-0,003	0,155	-0,117
	(.072)	(.067)	(.092)	(.133)	(.144)	(.228)
Observations	8,239	8,239	8,239	8,239	8,239	8,239
Pseudo R^2	.148	.172	.208	.277	.310	.343

Note: dependent variables are three obesity measures (BMI z-score by Cole, waist circumference z-score by Cole and fat mass in kg by Bammann et al., 2013) for children below the age of 10 years. Bootstrapped standard errors (100 repetitions) clustered at the settings level are in parentheses. All variables presented are dummy variables. Reference category for employment status variables is non-employment. We control for child, family and parental, and socio-economic characteristics.

* p < .05, ** p < .01, *** p < .001

Table 7: Descriptive statistics for diet and physical activity

Variable	Full-time employed	Part-time employed	Non-employed
Diet: meals home (percent)	.250**	.241*	.384
Diet: YHEI (0–80)	51.444***	50.180	49.630
Diet: Energy intake (kcal/day)	1,505.703**	1,545.725	1,559.746
Observations (4,375)	1,931	814	1,630
Physical activity: sedentary AVM (hours/week)	11.669	10.547**	11.757
Physical activity: moderate/vigorous (%)	10.084	10.569**	9.953
Observations (4,425)	2,184	815	1,426

Table 8: Descriptive statistics across countries: diet and physical activity

	Diet: energy intake (kcal/day)			Physical activity: moderate/vigorous (%)		
Country	**Full-time employed**	**Full-time employed**	**Part-time employed**	**Full-time employed**	**Part-time employed**	**Non-employed**
Belgium	1,323.432	1,244.348*	1,541.583	10.645	9.486	10.842
	(70)	*(30)*	*(36)*	*(178)*	*(80)*	*(58)*
Cyprus	1,366.885	1,301.689	1,224.206	8.087	8.090	8.271
	(69)	*(21)*	*(29)*	*(119)*	*(24)*	*(29)*
Germany	1,597.417	1,513.532	1,442.152	9.198	9.747	9.472
	(72)	*(265)*	*(244)*	*(67)*	*(220)*	*(217)*
Hungary	1,239.141	1,165.749	1,272.006	.057**	.052	.053
	(528)	*(66)*	*(358)*	*(625)*	*(77)*	*(395)*
Estonia	1,686.607	1,595.289	1,664.365	10.680	10.177	10.920
	(205)	*(43)*	*(115)*	*(410)*	*(65)*	*(197)*
Italy	1,771.803	1,595.289	1,664.365	7.694	8.323	8.151
	(282)	*(203)*	*(640)*	*(157)*	*(104)*	*(308)*
Spain	1,638.001	1,588.717	1,604.411	10.637	10.574	10.668
	(172)	*(101)*	*(65)*	*(364)*	*(193)*	*(164)*
Sweden	1,546.224**	1,474.457	1,405.136	12.251	12.134	10.867
	(533)	*(85)*	*(143)*	*(264)*	*(52)*	*(58)*

Table 9: estimates of maternal employment status on various diet and physical activity measures

Variable	(1) Diet: % meals home	(2) Diet: YHEI	(3) Diet: Energy intake	(4) PA: sedentary (AVM time)	(5) PA: moderate & vigorous activity (Pate)
			Full sample		
Full-time employment	-4.643***	-.746*	2.565	.431	-.065
	(.443)	(.305)	(19.490)	(.250)	(.156)
Part-time employment	-2.258***	-.189	-33.160	-.183	.035
	(.511)	(.351)	(22.480)	(.295)	(.184)
ICC (country and setting)	.547	.130	.182	.089	.176
	(.095)	(.053)	(.054)	(.027)	(.048)
Observations	4,375	4,375	4,375	4,425	4,425
			Low SES		
Full-time employment	-3.869***	.713	-60.810	.384	-.343
	(.842)	(.585)	(37.440)	(.511)	(.298)
Part-time employment	-1.592	.167	-20.640	-.280	-.341
	(.954)	(.671)	(43.170)	(.591)	(.345)
ICC (country and setting)	.601	.214	.189	.063	.173
	(.099)	(.070)	(.076)	(.029)	(.047)
Observations	1,241	1,241	1,241	1,190	1,190
			Medium SES		
Full-time employment	-3.735***	-1.379**	36.110	.770*	-.116
	(.734)	(.493)	(31.840)	(.374)	(.249)
Part-time employment	-1.524	-.622	-1.258	-.053	.133
	(.818)	(.548)	(35.400)	(.438)	(.292)
ICC (country and setting)	.581	.125	.191	.105	.191
	(.127)	(.055)	(.056)	(.040)	(.056)
Observations	1,582	1,582	1,582	1,709	1,709
			High SES		
Full-time employment	-5.580***	-.898	-24.380	-.004	.408
	(.978)	(.672)	(44.010)	(.483)	(.342)
Part-time employment	-2.967*	-.090	-86.010	-.219	-.007
	(1.157)	(.797)	(52.150)	(.584)	(.415)
ICC (country and setting)	.546	.127	.165	.193	.189
	(.096)	(.060)	(.061)	(.065)	(.063)
Observations	1,075	1,075	1,075	1,161	1,161

Note: estimates of a 3-level random intercept model. Standard errors in parentheses. Dependent variables are five measures for diet and physical activity (percentage of meals at home, Youth Health Eating Index based on Feskanich et al., 2004, energy intake in calories per day, audiovisual and media time in hours per week, and moderate and vigorous physical activity as a proportion of total time based on Pate et al., 2006) for children below the age of 10 years. All variables presented are dummy variables. Reference category for the employment status variables is non-employment. We control for child, family and parental, and socio-economic characteristics. The intraclass correlation coefficient (ICC) is the proportion of total variance that is attributed to the clusters "country" and "setting".

* p < .05, ** p < .01, *** p < .001

Table 10: estimates of maternal employment status on various measures of diet and physical activity at country level

Variable	Belgium	Cyprus	Estonia	Germany	Hungary	Italy	Spain	Sweden
Diet: % meals home								
Full-time employment	-3.460	-3.770	-5.710***	-9.930***	-2.461*	-.868	-9.707**	-11.640***
	(2.200)	(4.180)	(1.370)	(2.120)	(.873)	(.616)	(1.670)	(1.180)
Part-time employment	-6.350*	5.920	-2.130	-.773	-4.104**	-.853	-8.121**	-9.584***
	(2.540)	(5.050)	(1.820)	(1.510)	(1.480)	(.633)	(1.740)	(1.550)
ICC (setting)	.074	.280	.096	.086	.105	.558	.186	.009
	(.097)	(.162)	(.046)	(.038)	(.029)	(.094)	(.089)	(.010)
Observations	136	119	363	581	952	1,125	338	761
Diet: YHEI								
Full-time employment	-3.156*	-2.615	-1.285	.736	-.441	-.861	-2.238*	.325
	(1.600)	(1.890)	(1.110)	(1.290)	(.619)	(.578)	(1.050)	(.807)
Part-time employment	.163	-1.119	-1.173	.287	.056	.286	-3.141**	1.609
	(1.830)	(2.280)	(1.480)	(.909)	(1.050)	(.596)	(1.100)	(1.060)
ICC (setting)	.000	.126	.056	.004	.026	.009	.000	.000
	(.000)	(.110)	(.042)	(.022)	(.016)	(.010)	(.000)	(.000)
Observations	136	119	363	581	952	1,125	338	761
Diet: Energy intake								
Full-time employment	-239.000*	232.900*	27.630	161.900*	-38.720	-24.960	42.700	53.910
	(105.000)	(106.000)	(77.800)	(69.500)	(37.300)	(43.400)	(70.600)	(45.100)
Part-time employment	-285.700*	112.800	-42.800	17.480	-94.580	-11.150	-8.868	-5.526
	(121.000)	(130.000)	(103.000)	(48.800)	(63.200)	(44.800)	(73.800)	(49.400)
ICC (setting)	.053	.553	.057	.000	.015	.003	.042	.016
	(.126)	(.105)	(.056)	(.000)	(.003)	(.007)	(.043)	(.013)
Observations	136	119	363	581	952	1,125	338	761
PA: sedentary (AVM time)								
Full-time employment	.893	3.662*	-.170	.142	-.721	1.978*	-.283	-1.413
	(.991)	(1.450)	(.681)	(.851)	(.471)	(.889)	(.551)	(.826)
Part-time employment	.011	2.166	-.099	-.905	.434	.007	-.878	-.155
	(1.100)	(1.810)	(.979)	(.605)	(.787)	(.893)	(.575)	(.950)
ICC (setting)	.057	.056	.007	.011	.031	.005	.000	.000
	(.044)	(.072)	(.015)	(.021)	(.016)	(.014)	(.000)	(.000)
Observations	316	172	672	504	1,097	569	721	374

PA: moderate & vigorous activity (Pate)								
Full-time employment	-.369	-.131	-.107	-.794	-.546	-.348	.072	1.366
	(.607)	(.896)	(.381)	(.717)	(.284)	(.447)	(.379)	(.770)
Part-time employment	-1.364*	.138	-.405	-.052	-.093	.252	-.023	1.342
	(.674)	(1.122)	(.550)	(.511)	(.475)	(.446)	(.397)	(.886)
ICC (setting)	.047	.000	.092	.022	.094	.061	.016	.055
	(.044)	(.000)	(.031)	(.022)	(.029)	(.044)	(.016)	(.041)
Observations	316	172	672	504	1,097	569	721	374

Note: estimates of a 2-level random intercept model. Standard errors in parentheses. Dependent variables are three diet measures and two physical activity measures for children below the age of 10 years. All variables presented are dummy variables. Reference category for the employment status variables is non-employment. We control for child, family and parental, and socio-economic characteristics. The intraclass correlation coefficient (ICC) is the proportion of total variance that is attributed to the cluster "setting".

* p < .05, ** p < .01, *** p < .001

Appendix

Table A1: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Dependent variables					
BMI (z-score)	8,239	0.244	1.350	-8.023	5.228
Waist circumference (z-score)	8,239	0.240	1.385	-4.904	5.980
Fat mass (kg)	8,239	4.116	3.520	0	30.438
Diet: % Meals at home	4,375	76.939	17.442	18.750	100
Diet: YHEI	4,375	50.533	8.407	17.762	79.857
Diet: Energy intake (kcal)	4,375	1533.284	544.335	0	4220.405
PA: Sedentary behaviour (AVM)	4,425	11.490	6.901	0	56
PA: Moderate & vigorous activity	4,425	10.131	4.338	0.706	29.303
Maternal employment					
Full-time employment	8,239	.488	.500	0	1
Part-time employment	8,239	.187	.390	0	1
In school/university	8,239	.014	.117	0	1
Country					
Belgium	8,239	.122	.328	0	1
Cyprus	8,239	.088	.284	0	1
Estonia	8,239	.108	.310	0	1
Germany	8,239	.109	.311	0	1
Hungary	8,239	.200	.400	0	1
Italy	8,239	.164	.370	0	1
Spain	8,239	.097	.296	0	1
Sweden	8,239	.111	.315	0	1
Child characteristics					
Age: 3- years	8,239	.143	.350	0	1
Age: 4 years	8,239	.169	.375	0	1
Age: 5 years	8,239	.124	.330	0	1
Age: 6 years	8,239	.170	.376	0	1
Age: 7 years	8,239	.237	.425	0	1
Age: 8+ years	8,239	.156	.363	0	1
Sex	8,239	.489	.500	0	1
Birth: weight (g)	8,239	3347.422	559.290	1,000	6,100
Birth: premature	8,239	.292	.455	0	1
Infancy: breastfed	8,239	.580	.494	0	1
Infancy: respiratory problems	8,239	.030	.170	0	1
Infancy: infections	8,239	.029	.166	0	1
Infancy: jaundice	8,239	.159	.366	0	1
No of siblings: older	8,239	.647	.799	0	6
No of siblings: same age	8,239	.037	.202	0	2

No of siblings: younger	8,239	.467	.619	0	5
No of siblings: none	8,239	.171	.376	0	1
Country of birth: foreign	8,239	.015	.123	0	1
Family and parental characteristics					
Age: mother	8,239	35.463	4.990	18	73
Age: father	8,239	38.214	5.697	19	71
No. household members	8,239	3.938	1.121	1	22
Country of birth mother: foreign	8,239	.090	.286	0	1
Country of birth father: foreign	8,239	.078	.269	0	1
Pregnancy: age mother	8,239	29.432	4.817	15	46
Pregnancy: weight gain mother	8,239	14.220	5.921	0	50
Pregnancy: maternal smoking	8,239	.126	.332	0	1
BMI mother	8,239	23.939	4.305	15.427	60.606
BMI father	8,239	26.444	3.725	14.815	57.025
Socio-economic characteristics					
Education mother: ISCED	8,239	3.738	1.144	1	6
Education father: ISCED	8,239	3.594	1.149	1	6
Household net income	8,239	5.523	2.383	1	9
Father: Full-time employment	8,239	.886	.318	0	1
Father: Part-time employment	8,239	.026	.160	0	1
Father: In school/university	8,239	.003	.057	0	1