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**Long work hours of mothers and fathers are linked to increased risk for
overweight and obesity among preschool children:
Longitudinal evidence from Germany**

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Running title: Parental work hours and child body weight in Germany

Key words: mothers' work hours, fathers' work hours,
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What is already known about this subject?

1. The majority of existing studies on this topic are based on cross-sectional data.
2. Studies from the US consistently show a linear relationship between the number of maternal work hours and risk for overweight and obesity in children. However, the evidence for this association in other countries is less conclusive.
3. Father's work hours have not previously been associated with risk for overweight and obesity in children

What this study adds?

1. The study shows that maternal work hours 35 or more per week was associated with an increased risk for overweight or obesity in preschool children.
2. Fathers' work hours play an important role when they are jointly examined with mothers' work hours.
3. The study contributes longitudinal evidence for the link between maternal work hours and childhood overweight and obesity in Germany, a different social welfare regime than other developed countries.

Abstract

Background: Most existing studies on maternal employment and childhood overweight/obesity are from the US. They are predominantly cross-sectional and show a consistent linear association between the two. Less is known about the joint impact of fathers' and mothers' work hours on childhood overweight and obesity

Objectives: To examine the impact of maternal and paternal work hours on overweight/obesity among 1-6 year old children in Germany, using longitudinal data.

Methods: Child body weight and height and their parents' work hours were collected for 2,413 children at age 0-1, ages 2-3, and ages 5-6. Overweight and obesity was defined using the BMI percentiles based on the Cole LMS-Method. Random-effects model was conducted, adjusting for demographic, socioeconomic, and health characteristics of parents and children.

Results: Compared to non-employment, when mothers worked 35 or more hours per week, the risk for child overweight and obesity increased among preschool children. When fathers worked 55 or more hours per week, this effect was strengthened and maternal part-time hours (24-34 per week) also became a risk for child overweight and obesity. The effect was mainly found in high income families.

Conclusions: Both mothers' and fathers' long work hours matter to young children's overweight status. Employment protection and work time regulation for both working parents during the first 6 years of the child's life should be considered in future policy.

INTRODUCITON

The rapid increase in childhood overweight and obesity in the last four decades worldwide coincide with rising maternal employment in developed countries. This co-occurrence has drawn much research attention to the link between the two trends.[1] The vast majority of existing studies[2-10] focused on US children. Fewer studies were conducted in Europe and elsewhere.[1, 11-13]

Emerging evidence suggests that the association between maternal work hours and child body mass index (BMI) differs between the US and other developed economies. Research in the US typically shows a linear association between the number of mothers' work hours and the likelihood of childhood overweight or obesity,[2-6, 10] implying that any maternal employment is a risk for overweight or obesity in children. However, studies conducted in Australia and Europe show a nonlinear relationship, suggesting a possible threshold of maternal work hours for child bodyweight.[1, 12-14] A non-US perspective is therefore needed to consider how mothers' time constraints from paid employment may amplify risk for childhood overweight, especially given high prevalence of children with overweight and obesity[15] and weak social support for working parents in the US relative to other developed countries.[16, 17]

The reasons for increased childhood obesity risk with maternal working hours are likely to be similar in the US and other developed countries: As mothers increase their market work hours, they have less time and energy for preparing healthy meals and to engage children in adequate physical activities. However, more generous family support in other developed countries, such as cash transfer and tax breaks may enable working families to purchase household services (e.g., meal preparation and home-based child care) and afford good quality child care. Such family support measures may mitigate the negative effect of maternal work hours on child bodyweight, thus making the effect non-linear, whereby not any maternal employment but only long work hours above a certain threshold that becomes a risk for child overweight. The threshold may be a tipping point where mothers' times constrains and stress associated with increased work hours can no longer be counter-balanced by family support measures.

Despite extensive literature on the association between maternal employment and childhood overweight and obesity, only a handful of studies used longitudinal data,[1, 3, 4, 10] thus limiting our understanding of the causal nature of this association. Further, fathers play an important role in child health and development [18-20] and the link between fathers' work hours and child health warrants more in-depth analysis. Previous studies generally show that fathers' work hours, analysed

as a separate predictor, bear no significant relationship with child bodyweight.[6] This is because the majority of fathers work full time and there is far less variation in paternal work hours compared to mothers' work hours. Limited research has investigated the joint effect of both parents' work hours on child bodyweight and it showed that fathers' work hours did matter, when they were analysed jointly with mothers' work hours.[1, 4, 13] Despite this suggestive evidence for joint parental work time impacts, current research and policy remains focussed on mothers' work, potentially underestimating the contemporary drivers of childhood overweight and obesity.

This study focused on the preschool years as this is a critical developmental stage for growth in child BMI. Among US children the steepest increase in body weight occurs during the first five years of life.[4] Maternal work hours have a greater impact on child BMI and diet quality during preschool period than later years.[4, 21] This is because healthy eating in children begins early in life and takes time to develop as children need to develop a taste for healthy food and learn to conform to parental guidance for healthy eating habits. It requires parental time and energy to help children develop healthy eating patterns early and to maintain them through childhood and adolescence.

The connection between parental work hours and child overweight may be confounded by parental socioeconomic, demographic, and health factors, which can co-vary with both parents' work hours and child body weight. The impact of parents' long work hours may be mediated by decreased child diet quality, less physical activity and child sleep pattern [6, 9] because long maternal work hours may constrain mothers' time devoting to such health promoting activities in children.

The present study focused on Germany for several reasons. Germany is not only different from the US but also different from other European countries in terms of family support policy. Family support in cash benefits and tax breaks amount up to 20% of household income in Germany, similar to Belgium and Hungary.[12] Despite the predominant male-bread winner model in Germany (meaning many German fathers work long full-time hours), various policy measures have been implemented to enable greater labour force participation of mothers with dependent children. These measures include increases in state-owned day care centres with low fees for young children, generously paid paternal and maternal leaves in the first year of a new born child. Partly as a response to these support measures, maternal employment has been increasing since 2000 up to 66% in 2012.[22, 23] Hence increasingly more families face the challenge for re-conciliating work and family. Yet research on the relationship between both maternal and paternal work hours and child BMI remains scarce in Germany despite the policy need.

We are aware of only two other studies on this topic for Germany. Gwozdz et al.[12] analysed maternal employment (full-time versus part time) and childhood obesity (aged 2-9) in 16 regions of eight European countries including Germany. The findings show no significant relationship between maternal employment and childhood obesity in Germany and other European countries, except for Cyprus. Meyer [22] analysed two nationally representative German datasets and found that full-time maternal employment (\Rightarrow 32 hours per week) was associated with higher risk for childhood overweight. These two studies have provided important information on the link between maternal employment and child BMI in Germany. However, both studies were based on cross-sectional data. The Gwozdz et al. study [12] was also based on a non-representative sample of German children. Neither study analysed preschool children separate from older children or examined the joint effect of mothers' and fathers' work hours on child body weight. German fathers spend on average 2.7 hours on a week day and 5.7 hours on a weekend on child rearing activities of preschool children in the West (2.5 and 6.6 hours respectively for the East).[24] Paternal share of child rearing activities is likely to decrease when fathers work long hours, which would increase maternal stress associated with juggling work and family. This could magnify the influence of maternal work hours on child health.

In light of the limitations of previous research, this study aimed to examine the relationship between mothers' work hours and overweight among preschool children ages 1-6 in Germany and interactions between fathers' and mothers' work hours, using longitudinal and nationally representative data from the German Socioeconomic Panel Study (SOEP) between 2003 and 2014. The analysis adjusted for a wide range of socio-economic and demographic factors and parent and child health characteristics.

METHODS

Data

This study uses the data from the SOEP Study, which is a representative multi-purpose panel survey of private households in Germany, conducted by the German Institute for Economic Research (DIW) that started in 1984.[25]. The SOEP uses several modes of data collection with face-to-face interviewing as the default. All household members aged 16 and older are interviewed every year, with their consent to participate, on a wide range of subjects, including employment, income, housing, health and subjective well-being. Since 2003, the SOEP respondents report the health characteristics of their children (including body weight and height). This information is reported by the mother using the mother-child questionnaire when the child is 0-1, 2- 3, and 5-6 years old. Both

parents were interviewed at each time point. Parents were asked to report (but not to measure) the current height and weight of their children.

We compared the BMI scores of the study sample with the distribution of child BMI in Germany.[26] Outliers (BMI ≤ 10 or ≥ 25 for ages 0 to 6) were excluded from the analysis. Our final unbalanced panel sample was restricted to children of married or cohabiting parents who shared a child (N= 3979 child-year observations clustered in 2413 children) in the survey years 2003 -2014. For an overview of all variables analyzed see supplementary files (Tables S1 and S2).

Variables

Outcome variable

To define childhood *overweight and obesity* we first calculated BMI as body weight/body height² (kg/m²). We then used the gender-age specific BMI-percentiles in all German children to identify overweight and obesity for our study sample, namely 90 to 97 percentiles as recommended by Kromeyer-Hausschild et al.[26] The percentile distribution was constructed based on the LMS method by Cole.[27] A dichotomous variable was constructed (1= overweight or obesity; 0=normal) as we were mainly interested the qualitative change in BMI from normal to overweight or obesity which has more direct health consequences than continual increase in BMI. Children who are overweight or obese are more likely to suffer from health problems even before they enter adulthood, including high blood pressure, early symptoms of hardening of the arteries, type 2 diabetes, nonalcoholic fatty liver disease, polycystic ovary disorder, and disordered breathing during sleep [28, 29]. They are also at higher risk for anxiety and depression, lower self-esteem, bully and stigma [29].

Main independent variables

Mothers' and father's weekly working hours were analyzed as categories rather than continuous variables because previous studies in Germany suggest a non-linear association between mothers' work hours and childhood obesity.[12, 22] Mothers' weekly working hours were: (0) not employed, (1) 1-24 hours, (2) 25-34 hours, (3) 35 or more hours. Fathers' working hours included (0) not employed, (1) 1-34 hours, (2) 35-44 hours, (3) 45 or more hours. Not employed was used as the reference group for both mothers and fathers. These different categories of working hours for mothers and fathers reflect the gender-specific employment patterns in Germany.

In all models we controlled for potential confounders such as net household income, maternal and paternal years of schooling, their age, migration background (0=no, 1=yes), smoking (0=not smoking, 1=smoking) and fathers' and mothers' BMI score (weight/height² (kg/m²)). Other covariates included the region (0=West Germany, 1= East Germany), child age (in month), child age², child gender (0=male, 1=female), child care attendance (0=no, 1=yes), the number of children in the household, and whether or not the parents were cohabiting (0) or married (1).

Analytical methods

We used logistic panel regression models. While the random-effects (RE) and fixed-effects (FE) models both have their respective advantages and weaknesses,[30, 31] we chose the RE model as it takes into account both within and between individuals/households variation [32]. We were interested in understanding not only within but also between individuals/households variation in both parents' work hours and child overweight, which are of interest to readers and policy makers. We stratified the analysis by fathers' long work hours with three different cut offs: <45 vs => 45, <50 vs =>50 and <55 vs =>55 per week. We also stratified the analysis by household income: below vs. above the median of the income distribution in the sample. We added clustered standard errors at the household level to account for possible clustering of child observations in the same household.

Our study was based on secondary data from the German Socioeconomic Panel (SOEP) Study. The SOEP data are accessible to researchers employed in all German institutions and abroad without ethics committee approval. Our study was submitted to the Ethics Committee of the WZB Berlin Social Science Center (where the study was located) and it was exempted from ethics review.

RESULTS

Sample characteristics

About 5% of children had a BMI in the overweight or obesity category in infancy and this rose to 12.4% at ages 2-3 and 11.85% at ages 5-6. Mothers' employment changed substantially when their newborns became toddlers and 5-6 year olds. During infancy, about 84% mothers were not employed, and this decreased to 46.6% and further down to 32.8 % when the child reached 2-3 and 5-6 years of age, respectively. The proportion of mothers who worked part-time and full-time both increased considerably over the three periods: at ages 0-1 9.4% of mothers and at ages 5-6 about 44% of them worked 1-24 hours per week.; similarly, the proportion of mothers who worked 35 or more

hours increased from about 5% when the child was 0-1 year old to 17% when the child reached ages 5-6.

In contrast, fathers' employment status and working hours changed far less during these child developmental periods. When the child was in infancy, about 11% of the fathers were not employed and this decreased to 8.8% when the child aged 2 to 3 and further down to 6.5%. Similarly, we observe only a small change in the proportion of fathers who worked part-time (1-34 hours per week) and long hours (e.g., 45 or more hours per week). Notably, more than 40% of the fathers worked 45 or more hours per week before their children entered school.

Multivariate results

The estimates from the pooled random-effects model are shown in Table 1. Compared to not employed, 35 or more maternal work hours per week was associated with an increased risk for childhood overweight and obesity (OR=1.64, 95% CI 1.10-2.44, $p=0.02$). Fathers' work hours alone were not associated with childhood overweight and obesity. Several co-variables were important predictors of overweight and obesity in children. Fathers' BMI score was associated with higher odds of overweight (OR=1.06, 95% 1.03-1.09, $p<0.001$). So was maternal migration background (OR=1.72, 95% CI 1.22-2.41, $p=0.002$). Attendance of formal child care was associated with lower odds of overweight and obesity (OR=0.68, 95% CI 0.51-0.93, $p=0.02$). Child age has a curvilinear relation with child overweight/obesity.

To examine the interactive effect of fathers' work hours on childhood overweight, we stratified the analysis by fathers' long work hours (≥ 45 or ≥ 50 , or ≥ 55 per week). The results showed that in both strata, maternal work hours of 35 or more per week were associated with higher odds of overweight or obesity in children, compared to when mothers were not employed (Table 2). However, this effect was slightly stronger when fathers worked 45 or more hours per week (OR=2.04, 95% CI=1.11-3.74, $p=0.02$), compared to when fathers worked below 45 hours (OR=1.77, 95% CI=1.05-2.99, $p=0.03$). When fathers worked 50 or more hours per week, the effect of maternal full-time work increased even further but it did not reach significance ($p < 0.05$). Importantly, maternal part-time work hours (24-34) became significantly (OR=2.90, 95% CI=1.13-7.41, $p=0.03$) associated with risk for childhood overweight and obesity. When fathers worked extreme long hours (≥ 55 per week), the effect of maternal part-time work hours became significant and the effect of full-time work hours became even larger, compared to when fathers worked below 55 hours per week.

We tested the interactions between maternal working hours and paternal long work hours (≥ 45 , ≥ 50 , ≥ 55). Only the interactions between mothers' high part-time hours (24-34) and long full-time hours (≥ 35) and fathers' long work hours (≥ 55) were positive and significant (OR=5.14, 95% CI=1.70-15.53, $p=0.004$; OR=3.61, 95% CI=1.36-9.60; $p=0.01$, respectively), confirming the result in the stratified model (Table 2) that when fathers worked extremely long hours (≥ 55), the effect of maternal part-time and full-time work hours on the risk for child overweight was augmented.

Compared to not employed, children whose mothers worked 25-34 hours (OR=2.02, 95%CI =1.07-3.81, $p=0.03$) or 35 or more hours per week (OR=2.27, 95%CI=1.27-4.08, $p=0.01$) had a higher risk for overweight or obesity in families above the income median (Table 3). However, among families below the median, maternal work hours were not associated with an increased risk for childhood overweight or obesity. We have also estimated the model with the thresholds 40% and 60% of the median income. The results were largely consistent with those from the model using income median: it was only among households that were above either 40% or 60% of the median income that maternal work hours of ≥ 35 was linked to increased risk for child overweight or obesity (OR=1.63, 95% CI=1.09-2.44, $p=0.03$; OR=1.62, 95% CI=1.09-2.43, $p=0.03$). Below these alternative thresholds, maternal work hours ≥ 35 was not statistically significant.

The effect of maternal long work hour on child body weight may change with child age. To address this concern, we examined the interaction between maternal work hours (≥ 35) and the time points when the child was 0-1, 2-3, 4-5 years of age. We found that the effect of maternal work hours (≥ 35) on the outcome variable was larger when the child reached ages 2-3, but it did not differ between ages 0-1 and 4-5 or between ages 2-3 and 4-5.

DISCUSSION

Main findings

Our results show that there is a threshold effect of maternal work hours (≥ 35 per week) on overweight and obesity in preschoolers, and that such an effect needs to be considered in context of fathers work patterns. When fathers worked very long hours (≥ 55 hours per week), this effect strengthened; moreover maternal part-time hours (24-34) also became a risk for child overweight. We also found that the effect of mothers' work hours differed by family income: among families above the income median, mothers work hours of 25-35 or 35 or more per week were linked to higher odds of childhood overweight or obesity, compared to being not employed; however there was no comparable association among families below the income median.

How are our findings related to previous research?

Previous research in Germany suggests three potential mechanisms linking maternal employment to child BMI: children's diet quality, physical activity and sedentary behavior.[12, 22] Gwozdz et al.[12] found that maternal full-time employment was associated with fewer home meals consumed but with more high energy intake in children ages 2 to 9. Meyer [22] showed that maternal full-time employment was associated with decrease in consumption of fruits and vegetables but increases in soda drinks and processed food; it was also positively associated with longer time spent watching TV or playing video games. These potential mechanisms and sleep patterns need to be examined in mediation analysis to elucidate to what extent they indeed explain the maternal work-child weight association in Germany. Previous research based on the US data only showed a weak mediating effect of these factors on child BMI.[5-7]

Our finding that the effect of mothers' long work hours was more pronounced when fathers worked long hours is consistent with previous studies which have analysed fathers' and mothers' work hours jointly.[1, 4, 13] Li and co-authors[1] found that the effect of maternal long work hours on child overweight and obesity strengthened when fathers worked 45 hours or more per week in an Australian cohort. We examined three different definitions of fathers' long work hours (≥ 45 , ≥ 50 , ≥ 55) and there appeared an increasing trend in effects of maternal work hours as the threshold of fathers' long work hours rose. Particularly, when fathers worked ≥ 55 hours per week, the effect of maternal work hours (25-34 and ≥ 35) on the risk for child overweight was augmented. Thus fathers' work hours do matter to child bodyweight, when they are examined jointly with maternal work hours. However, due to the small size and wide confidence intervals for the stratified models paternal work hours (≥ 50 and ≥ 55), this finding needs replication in larger representative samples of German preschoolers.

We found that maternal full-time work hours was associated with higher risk for childhood overweight and obesity only in families with medium to high income, but not in families below the income median. Previous studies based on US samples showed similar results.[2, 6] Anderson et al.[2] offer some explanations for this differential effect: when mothers from high income families spend more time with their children by working fewer hours, they are more likely to promote high quality diet and physical activities for children than mothers from low income families. In Germany, maternal work hours did not matter to child body weight for low income families as much as for high income families possibly because low SES parents are less knowledgeable and therefore less concerned about children's diet quality and physical activities. Thus even when low SES mothers

have more time by working fewer hours, they are not more likely to promote high quality diet and physical activities for children than when they have less time by working more hours.

Strength and limitations

The main strengths of our study are that we analyzed longitudinal and nationally representative data, examined the interaction between mothers' and fathers' work hours, and adjusted for a host of important covariates. Much of previous research on this topic is based on cross-sectional data, thus limiting researchers' ability to make causal inferences. By analyzing longitudinal data we moved one step further by establishing the time sequence in the causal pathway, minimizing reverse causality. The study has also limitations. The child BMI was calculated based on parent-reports of child weight and height, which could lead to some bias. We were unable to examine the potential mechanisms as discussed above due to lack of data. Our study focused on child overweight and obesity, but underweight can be a pathological response to long parental working hours. Moreover, parental psychopathology is also a risk for child unhealthy body weight [33] and this factor might mediate or exacerbate the negative effect of long parental work hours on child health. These issues warrant future investigation.

Despite these weaknesses, our study contributes longitudinal evidence for non-linear association between maternal work hours and childhood overweight and obesity. The study suggests that fathers' work hours do matter to child health, when they are jointly examined with mothers' work hours. It demonstrates that the impact of long work hours of both parents on overweight emerges in infancy and throughout the preschool period.

Policy implications

Employment protection and work time regulation for both working parents during the first 6 years of the child's life should be considered in future policy. Government investment in raising or maintaining the quality of child care centers, particularly in provision of healthy food and adequate physical activities, would help working parents manage child diet and physical activity. While we need to continue to support working mothers (e.g., equal pay, good quality childcare), we also need to support men to have time to care without suffering a job or pay penalty. Policies that encourage fathers to spend more time with their children (leave, flexible or reduced hours) and be more active in healthy food provision will help take the pressures off mothers. We need to tackle the widespread belief that it is fair or feasible for parents to work long hours without compromising health (including children's).

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Authors' contribution

Jianghong Li played a lead role in the study design and the writing of the manuscript and she contributed to the data interpretation. Till Kaiser conducted the data analysis, contributed to results interpretation, and writing of the manuscript. Matthias Pollmann-Schult contributed to the study design, data interpretation and writing of the manuscript. Lyndall Strazdins contributed to results interpretation and reviewed drafts of the manuscript. All authors had final approval for submitted and published version of the paper.

References

- 1 Li J, Akaliyski P, Schäfer J, *et al.* Non-linear relationship between maternal work hours and child body weight: Evidence from the Western Australian Pregnancy Cohort (Raine) Study. *Soc Sci Med* 2017;186: 52-60.
- 2 Anderson PM, Butcher KF, Levine PB. Maternal employment and overweight children. *J Health Econ* 2003;22(3):477-504.
- 3 Anderson PM. Parental employment, family routines and childhood obesity. *Econ Hum Biol* 2012;10(4):340-351.
- 4 Morrissey TW. Trajectories of growth in body mass index across childhood: Associations with maternal and paternal employment. *Soc Sci Med* 2013;95:60-68.
- 5 Ziol-Guest KM, Dunifon RE, Kalil A. Parental employment and children's body weight: Mothers, others, and mechanisms. *Soc Sci Med* 2013;95:52-59.
- 6 Datar A, Nicosia N, Shier V. Maternal work and children's diet, activity, and obesity. *Soc Sci Med* 2014;107:196-204.
- 7 Fertig A, Glomm G, Tchernis R. The connection between maternal employment and childhood obesity: Inspecting the mechanisms. *Review of Economics of the Household* 2009;7(3):227.
- 8 Cawley J, Liu F. Maternal employment and childhood obesity: A search for mechanisms in time use data. *Econ Hum Biol* 2012;10(4):352-364.
- 9 Speirs KE, Liechty JM, Wu C-F, *et al.* Sleep, but not other daily routines, mediates the association between maternal employment and BMI for preschool children. *Sleep Med* 2014;15(12):1590-1593.
- 10 Jung H, Chang C. Is Mothers' Work Related to Childhood Weight Changes in the United States? *Journal of Family and Economic Issues* 2016;37(4):581-593.
- 11 Hawkins SS, Cole TJ, Law C. Examining the relationship between maternal employment and health behaviours in 5-year-old British children. *J Epidemiol Community Health* 2009;63(12):999-1004.
- 12 Gwozdz W, Sousa-Poza A, Reisch LA, *et al.* Maternal employment and childhood obesity—A European perspective. *J Health Econ* 2013;32(4):728-742.
- 13 Greve J. New results on the effect of maternal work hours on children's overweight status: Does the quality of child care matter? *Labour Economics* 2011;18(5):579-590.
- 14 Brown JE, Broom DH, Nicholson JM, *et al.* Do working mothers raise couch potato kids? Maternal employment and children's lifestyle behaviours and weight in early childhood. *Soc Sci Med* 2010;70(11):1816-1824.
- 15 OECD. Obesity Update 2017[Internet]. Paris: OECD. <http://www.oecd.org/health/obesity-update.htm>. Accessed July 25, 2017._.

- 16 Livingston G. Among 41 nations, U.S. is the outlier when it comes to paid parental leave. FACTANK: News in the numbers. Fact Tank: Our Lives in Numbers [Internet], 2016. Washington: Pew Research Center. <http://www.pewresearch.org/fact-tank/2016/09/26/u-s-lacks-mandated-paid-parental-leave/>. Accessed 29 June, 2017.
- 17 OECD. Doing Better for Families. OECD Publishing; 2011.
- 18 Lamb ME. How do fathers influence children's development? Let me count the ways. In: Lamb ME, ed. *The Role of the Father in Child Development*. 5 ed. Hoboken, New Jersey: John Wiley & Sons, Inc. 2010:1-26.
- 19 Li J, Pollmann-Schult M. Fathers' commute to work and children's social and emotional well-being in Germany. *Journal of Family and Economic Issues* 2016; 37(3):1-14.
- 20 Kaiser T, Li J, Pollmann-Schult M. Evening and night work schedules and children's social and emotional well-being. *The Journal of Community, Work & Family* 2017; 1-16
- 21 Li J, O'Sullivan T, Johnson S, *et al.* Maternal work hours in early to middle childhood link to later adolescent diet quality. *Public Health Nutr* 2011;15(10):1861-1870.
- 22 Meyer S-C. Maternal employment and childhood overweight in Germany. *Econ Hum Biol* 2016;23:84-102.
- 23 BMFSFJ. Dossier Müttererwerbstätigkeit. Erwerbstätigkeit, Erwerbsumfang und Erwerbsvolumen 2012. Berlin: BMFSFJ 2014.
- 24 Adler MA, Lenz K, Stöbel-Richter Y. Father involvement in the early years: An international comparison of policy and practice. In: Adler MA, Lenz K, eds. *Germany: Policy Press* 2017:61-96.
- 25 Wagner GG, Frick JR, Schupp J. *The German Socio-Economic Panel study (SOEP)-evolution, scope and enhancements*. Berlin: SOEP,2007.
- 26 Kromeyer-Hauschild K, Wabitsch M, Kunze D, *et al.* Perzentile für den Body-mass-Index für das Kindes-und Jugendalter unter Heranziehung verschiedener deutscher Stichproben. *Monatsschrift Kinderheilkunde* 2001;149(8):807-818.
- 27 Cole TJ. The LMS method for constructing normalized growth standards. *Eur J Clin Nutr* 1990;44(1):45-60.
- 28 Daniels SR. The consequences of childhood overweight and obesity. *Future Child* 2006;16(1):47-67.
- 29 Centers for Disease Control and Prevention (CDC). *Childhood Obesity Causes & Consequences* [Internet]. Atlanta: Center for Disease Control and Prevention, 2016. <https://www.cdc.gov/obesity/childhood/causes.html>. Accessed 9 October, 2018.
- 30 Wooldridge JM. *Econometric analysis of cross section and panel data*. In: MIT press 2010.
- 31 Allison PD. *Fixed effects regression models*. Vol 160: SAGE publications 2009.

- 32 Bell A, Jones K. Explaining fixed effects: random effects modelling of time-series cross-sectional and panel data. *Political Science Research and Methods* 2015;3(1):133-153.
- 33 Vila G, Zipper E, Dabbas M, *et al.* Mental Disorders in Obese Children and Adolescents. *Psychosomatic Medicine* 2004;66(3):387–394.

Table 1. Fathers' and mothers' work hours and childhood overweight and obesity: Ages 0-6

	Random effects		
	Odds Ratios (Standard Error)	p-values	95% Confidence Intervals
Father's weekly work hours			
Not employed (ref.)			
1-34 hours	1.38 (0.41)	0.28	0.77-2.47
35-44 hours	0.81 (0.18)	0.34	0.53-1.24
45 or more hours	0.90 (0.20)	0.63	0.57-1.40
Mother's weekly work hours			
Not employed (ref.)			
1-24 hours	0.88 (0.15)	0.47	0.63-1.24
25-34 hours	1.46+ (0.32)	0.09	0.94-2.25
35 or more hours	1.64* (0.33)	0.02	1.10-2.43
Monthly net household income(log)	1.00 (0.00)	0.64	.9999-1.0001
Father's education	0.96 (0.03)	0.25	0.91-1.03
Mother's education	0.95+ (0.03)	0.08	0.89-1.01
Father's age	1.01 (0.02)	0.66	0.98-1.04
Mother's age	1.00 (0.02)	0.85	0.97-1.04
Married/cohabiting			
Married (ref.)			
Cohabiting	0.80 (0.17)	0.28	0.53-1.20
Father's BMI	1.06** (.02)	<0.001	1.03-1.09
Mother's BMI	1.02+ (0.01)	0.07	1.00-1.05
Father smokes			
Yes (ref.)			
No	0.80 (0.12)	0.14	0.60-1.07
Mother smokes			
Yes (ref.)			
No	0.85 (0.14)	0.34	0.62-1.18
Father's migration background			
No (ref.)			
Yes	0.88 (0.16)	0.47	0.62-1.25
Mother's migration background			
No (ref.)			
Yes	1.72** (0.30)	0.002	1.22-2.41
Region			
West Germany (ref.)			
East Germany	1.22 (0.22)	0.27	0.86-1.73
Child gender			
Girl (ref.)			
Boy	0.89 (0.11)	0.37	0.70-1.15
Child age	1.04** (0.01)	0.001	1.02-1.06
Child age²	1.00** (0.00)	0.01	1.00-1.01
Child care attendance			
No (ref.)			
Yes	0.69* (0.11)	0.02	0.51-0.93
Number of children in household	1.10 (0.07)	0.14	0.97-1.24
Number of observations	3979		
Number of groups	2413		

+: p<0.1; *: p<0.05; **: p<0.01

Table 2. Mothers' work hours and childhood overweight and obesity (ages 0-6) by fathers' work hours

	FWH < 45 hours			FWH ≥ 45 hours		
	Random effects			Random effects		
	OR (SE)	p-values	95% CI	OR (SE)	p-values	95% CI
Mother's work hours Not employed (ref.)						
1-24 hours	0.76 (0.19)	0.27	0.47-1.24	1.16 (0.28)	0.53	0.72-1.87
25-34 hours	1.39 (0.43)	0.28	0.76-2.54	1.84+ (0.62)	0.07	0.56-3.56
35 or more hours	1.77* (0.47)	0.03	1.05-2.99	2.04* (0.63)	0.02	1.11-3.74
No. of observations	2309			1670		
No. of groups	1561			1176		
	FWH < 50 hours			FWH ≥ 50 hours		
	Random effects			Random effects		
	OR (SE)	p-values	95% CI	OR (SE)	p-values	95% CI
Mother's work hours Not employed (ref.)						
1-24 hours	0.81 (0.17)	0.31	0.54-1.22	1.29 (0.47)	0.48	0.63-2.68
25-34 hours	1.28 (0.33)	0.34	0.77-2.12	2.90* (1.39)	0.03	1.13-7.41
35 or more hours	1.69* (0.39)	0.02	1.07-2.67	2.31+ (1.02)	0.058	0.97-5.48
No. of observations	2998			981		
No. of groups	1931			715		
	FWH < 55 hours			FWH ≥ 55 hours		
	Random effects			Random effects		
	OR (SE)	p-values	95% CI	OR (SE)	p-values	95% CI
Mother's work hours Not employed (ref.)						
1-24 hours	0.80 (0.15)	0.23	0.56-1.15	3.06 (1.64)	0.04	1.07-8.75
25-34 hours	1.29 (0.30)	0.28	0.81-2.05	7.70* (6.25)	0.01	1.57-37.76
35 or more hours	1.65* (0.34)	0.02	1.10-2.48	4.37* (2.81)	0.02	1.24-15.43
No. of observations	3479			500		
No. of groups	2171			380		

All models controlled for household income, mother's education, father's education, mother's age, father's age, mother's BMI, father's BMI, mother's smoking status, father's smoking status, mother's migration background, father's migration background, married/cohabiting status, sampling region, child gender, child age, child age², child care attendance, number of children in household.

+: p<0.1; *: p<0.05; **: p<0.01

Table 3. Fathers' and mothers' work hours and childhood overweight and obesity (ages 0-6) by income group

	Below income median			Above income median		
	Random effects			Random effects		
	OR (SE)	p-values	95% CI	OR (SE)	p-values	95% CI
Father's work hours Not employed (ref.)						
1-34 hours	1.39 (0.50)	0.35	0.69-2.80	1.13 (0.68)	0.84	0.35-3.60
35-44 hours	0.86 (0.22)	0.55	0.51-1.42	0.76 (0.37)	0.57	.29-1.95
45 or more hours	0.95 (0.26)	0.85	0.56-1.61	0.86 (0.41)	0.76	0.34-2.19
Mother's work hours Not employed (ref.)						
1-24 hours	1.00 (0.23)	0.98	0.64-1.56	0.86 (0.24)	0.59	0.50-1.48
25-34 hours	1.19 (0.41)	0.61	0.61-2.34	2.02* (0.65)	0.03	1.07-3.81
35 or more hours	1.44 (0.42)	0.22	0.81-2.56	2.27** (0.68)	0.006	1.27-4.08
No. of observations	2048			1931		
No. of groups	1314			1409		

Both models controlled mother's education, father's education, mother's age, father's age, mother's BMI, father's BMI, mother's smoking status, father's smoking status, mother's migration background, father's migration background, married/cohabiting status, sampling region, child gender, child age, child age², child care attendance, number of children in household.

+: p<0.1; *: p <0.05; **: p <0.01