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Does Maternal Employment Affect Parental Time Allocated to Children's Food Consumption and Physical Activity? Evidence from the Korean Time Use Survey[†]

This study uses the 1999-2009 Korean Time Use Survey to explore how mothers' employment affects parental time spent in activities that may relate to their children's weight. Specifically, it estimates two-part regression models to assess the effects of maternal employment upon the amount of time mothers spend in activities potentially related to their preschool children's eating and physical activity. The findings suggest that working mothers and those mothers who work longer hours allocate significantly less time in food preparation, eating with the child, and supervising the child's physical activity than mothers who are not employed and those who work fewer hours. The paper also finds that spouses of working mothers do not allocate more time to these activities to offset the reduction in mothers' time. Also, using local unemployment rates as instrumental variables, maternal employment is found to allow mothers to spend significantly more time on food preparation and family meals, although its effect on mothers' total childcare time is negative. Several aspects of Korean society may have made the relationship between maternal employment and childhood weight issues different from what was found in other countries.

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As the increase in childhood obesity has emerged as a major public health concern in North America and Western Europe, concerns regarding children's eating patterns and weight issues are escalating also in other parts of the world (Anderson & Butcher, 2006; Misra & Khurana, 2008; Wang, 2001). Increase in childhood obesity is a global trend (Anderson & Butcher, 2006). Obesity, overweight, and the metabolic syndrome are rapidly increasing among Korean children as well (Chu & Choe, 2010; Jang & Berry, 2011; Park, Lee, Choi, Kang, & Kim, 2004; Ryu, Kweon, Park, Shin, & Rhee, 2007). According to a study that used two nationwide surveys of nearly 100,000 individuals aged 2-18, the obesity rate among South Korean children and adolescents rose from 5.8% in 1997 to 9.7% in 2005 (K. Oh et al., 2008). The study reported that the number of children and adolescents who were overweight or obese almost doubled during the same period, increasing from 9.7% in 1997 to 19.0% in 2005.

Casual observation based on aggregate trends may suggest that the coincidental increase in maternal employment was a contributor. Maternal employment might limit parental time available for overseeing children's eating and physical activity at home, increase the demand for food away from home, decrease the likelihood and duration of breastfeeding, and therefore adversely affect children's weight outcomes (Anderson & Butcher, 2006; Cawley & Liu, 2007; Chou, Grossman, &

Saffer, 2004). Working mothers may also experience greater time scarcity than mothers who are fulltime homemakers, influencing the families' food consumption choices in a way to lead to obesity and chronic health problems (Jabs & Devine, 2006). Higher levels of parents' work-life stress may also be associated with less healthful diet (Bauer, Hearst, Escoto, Berge, & Neumark-Sztainer, 2012).

Negative effects of maternal employment on children's weight outcomes have been witnessed in the U.S., Canada, and the U.K. (Anderson & Butcher, 2006). However, outside North America and the U.K., the correlation between maternal employment and childhood overweight or obesity is somewhat inconsistent (Bishop, 2011; Brown, Broom, Nicholson, & Bittman, 2010; Greve, 2011; Tucker & Sanjur, 1988; Watanabe, Lee, & Kawakubo, 2011), suggesting that the way mothers' employment impacts children's weight status may be sensitive to social and cultural contexts.

In Korea, the existing literature suggests a positive correlation between maternal employment and the likelihood of childhood overweight or obesity (S. H. Oh, 2007; Yim & Nam, 1999). But these studies either were too descriptive or considered mothers' employment status as a mere control variable for anthropometric risk factors. To our knowledge, exploration of the causal mechanism through which maternal employment may contribute to the problem of childhood obesity in South Korea is rare.

This study examines the consequence of maternal employment on parents' daily time use in activities pertaining to children's food consumption and physical activity. Analyzing parents' time use provides useful insight on how maternal employment may affect children's eating and physical activity patterns, which can determine children's overweight or obesity status. The Korean Time Use Survey (KTUS) provides detailed time-diaries for large cross-sectional samples of Korean households and their demographic and socioeconomic characteristics including the employment status and work hours.

While this study can interest multi-disciplinary audience, it particularly contributes to the human ecology literature by demonstrating how public

health outcomes can be shaped by household time allocation decisions amid the changes in the labor market, technology and food environment (Moran, 2003). Also, this study contributes to the international knowledge base of childhood obesity research and provides insight on how the country-specific social and cultural environment may be a factor. Childhood weight issues are an important social concern as overweight or obese children are likely to incur higher health care costs as adults, both private and public, and result in decreased labor productivity and earnings of the future labor force (Cawley, 2004; Finkelstein, Ruhm, & Kosa, 2005). Because families' socioeconomic status is known to be negatively associated with children's weight problems in most developed countries as well as in Korea (Abdulai, 2007; Cho, Kang, Kim, & Song, 2009; Cutler, Glaeser, & Shapiro, 2003; Finkelstein et al., 2005; Sobal & Stunkard, 1989; Wang, 2001), understanding the economic cause for childhood obesity or overweight problems also sheds some light to alleviating economic inequality. In particular, the question of whether maternal employment and work hours reduce parental time to look after children's healthy weight has important implications for government policies targeting female labor force participation, policies that promote work-family balance, and policies regarding the quality of childcare and nutrition programs.

REVIEW OF LITERATURE

Maternal Employment and Children's Weight Problems

Empirical researchers have documented a significant correlation between maternal employment and weight problems among children. Yim and Nam (1999) found maternal employment to be a significant predictor of children's Body Mass Index (BMI) in South Korea. Oh (2007) found that children of working mothers had less healthful eating patterns than children of nonworking mothers. Sung and Kwon (2010) showed that Korean children who ate more family meals at home reported greater physical health. However, these are

crude measures based on correlations, and do not prove whether maternal employment is one of the causes for children's weight problems.

On the other hand, studies from North America and the U.K. suggest a significant causal effect. Maternal employment shortly after childbirth resulted in increased overweight and obesity in very young (0-3) children (Hawkins, Cole, & Law, 2008). In that study, young children's undesirable weight outcomes appeared more strongly associated with mothers' long work hours than the family's income deficiency. In another study using a sample of older (6-11) kids, mothers' longer paid-work hours was associated with a higher probability of being overweight or 'at risk to be overweight' (Phipps, Lethbridge, & Burton, 2006). After accounting for possible simultaneous determination of maternal employment and children's weight, these studies confirmed that the effects were likely causal. Using endogenous switching regressions and semi-parametric estimates with U.S. data, Liu, Hsiao, Matsumoto, and Chou (2009) claimed that mothers' fulltime employment increased the probability of their children becoming overweight by 11.6 percentage points and also increased the children's BMI by 1.647.

The effect of maternal employment seems to vary depending on timing and intensity of employment. A longitudinal study from the U.K. found that mothers' employment in mid-childhood was more detrimental to the child's healthy weight in adulthood than employment in earlier or later childhood (Von Hinke Kessler Scholder, 2008). Using Canadian longitudinal data and econometric models that assure causality, Chia (2008) found that children whose mothers had worked longer hours before they started school were substantially more likely to become obese in adolescence when compared to children whose mothers had worked at low intensity. In addition, Anderson, Butcher, and Levine (2003) found that it was the mothers' weekly hours worked, not the number of weeks worked, that increased children's probability of being overweight. Studies that compared different socioeconomic groups also found that fulltime employment led to a higher likelihood of the child being overweight only among highly educated mothers, while mothers who

were less well-educated and those who worked part-time did not hurt children's weight outcomes by working outside their homes (Anderson et al., 2003; Araneo, 2008).

In the widely-cited paper about the cause for the growth in obesity, Cutler, Glaeser, and Shapiro (2003) argued that the revolution of mass food production substantially cut the time cost of meals, replaced the time spent by married women in cooking and cleaning, and caused the increased quantity of food consumed. From a slightly different perspective but in a similar vein, Chou, Grossman, and Saffer (2004) argued that the increased market value of women's time has made monitoring calorie intake at home more expensive relatively to unhealthy fast foods, resulting in the growth of obesity.

Investigation of how working mothers spend time differently from fulltime stay-home mothers may unveil the mechanisms for the adverse effect of maternal employment on childhood overweight or obesity. A survey-based study showed that mothers who did not work provided more family meals at home, and the more family meals were eaten at home, the more nutritious and healthy the children ate (Bauer et al., 2012; Neumark-Sztainer, Hannan, Story, Croll, & Perry, 2003). Using detailed time-diary data from the Survey (ATUS), Cawley and Liu (2007) found that maternal employment significantly reduced time spent for cooking, eating and playing with children, and increase the likelihood of purchasing prepared foods. They also found that the spouse of the employed mother did not increase participation in these activities enough to offset the reduction. Fertig, Glomm, and Tchernis (2009) added to this finding by connecting mothers' employment status with children's time allocation and children's BMI. Using time diaries from the Child Development Supplement of the Panel Study of Income Dynamics, they found that the mother's work hours was related to the number of meals the child consumed, the child's television viewing, and the child's time spent in schools or childcare facilities, which only explained a small but significant percentage of the relationship between maternal employment and the child's BMI. Using the ATUS and Continuing Survey of Food Intake by Individuals, Ben-Shalom (2009) showed

similar findings, which indicate maternal employment leads to a decreased time spent for food preparation but explains only a small portion of the increase in children's obesity.

The Case of South Korea

While evidence from North America and the U.K. consistently supports the adverse effect of maternal employment, the observations are rather inconsistent in other parts of the world. Let alone the mixed findings from developing countries in Southern Africa and South Asia (Glick, 2002), maternal employment was found to have little or no effect on children's weight issues in Australia, Japan, Panama, Denmark, and many other countries in the European Union. Using proxy variables, sibling-differences and instrumental variables, Bishop (2011) found that mothers' part-time or fulltime employment increased BMI for younger children, but decreased adolescent children's BMI in Australia. Another Australian study showed that part-time employment of mothers was beneficial to children's weight, while fulltime employment had no significant effect (Brown et al., 2010). Maternal work hours did not increase the likelihood of children being overweight in Denmark either, which could be attributed to the quality child care available in that country (Greve, 2011). In Panama, maternal employment decreased time spent in household production relating to children's healthy weight, but her absence was typically filled in by other household members, leaving the total household-production time unaffected. Furthermore, the additional income brought in by working mothers offset any harmful effects, leading to a decreased likelihood of obesity or overweight in children (Tucker & Sanjur, 1988). In Japan, mothers' employment seemed to hinder children's healthy eating patterns and increase overweight and obesity, but such an adverse effect was moderated considerably in three-generation families (Watanabe et al., 2011).

A time-use study from Korea reported that changes in women's wage rate affect their paid work hours and time spent for care labor in opposite directions, suggesting a potential tradeoff between mothers' paid work time and their time allocated to care labor (Yoon, 2010a). On the other hand, a study

that measured the effect of mothers' employment on children's human capital formation in Korea showed that, despite the potentially reduced amount of childcare time, maternal employment did not cause any negative effect on children's educational attainment (Yoon, 2010b). In another study that compared married couples' time use by mothers' employment status, husbands in dual-income families did not spend significantly more time on caring for the children than husbands in single-income families (Y.-H. Lee & Lee, 2007).

Several unique aspects of Korean society may make it difficult to predict whether the effect of maternal employment observed in North American and the U.K. applies to Korea. First, considering its economic development and high education levels among women, South Korea's female labor force participation rate is low even among university graduates (Brinton, Lee, & Parish, 1995; K. J. Lee, Um, & Kim, 2004; OECD, 2011). Compared to their East-Asian neighbors, married women in Korea are even more concentrated in traditionally-female sectors and serve contingent or informal workforce.¹ Second, despite the slow growth in married women's employment, there has been an explosive growth in childcare industry, and the number of preschool children utilizing childcare facilities has increased by 1,300% during the past two decades.²

Third, contrary to the common knowledge in North America and the U.K., income is positively associated with overweight in South Korea especially among boys (Kwon, Oh, Park, & Park, 2010). Fourth, while going through rapid economic and social transitions in the past few decades, South Korea conserved its traditional diet while incorporating a western diet (M.-J. Lee, Popkin, & Kim, 2002). This calls for a close replication of an existing analytic model of maternal employment and childhood obesity on South Korean data.

Research Questions

This study analyzed household-level time-diary data

¹Data obtained from the World Bank data catalog available at <http://data.worldbank.org/>.

²Data obtained from Korean Statistical Information Service available at <http://kosis.kr/eng/>

and examined whether maternal employment decreases parents' time allocated to activities that are related to children's diet and physical activity. Specific research questions were:

1. How does mothers' employment status affect mothers' time spent on food preparation, eating with children, and supervising children's physical activity?
2. How does mothers' paid work hours affect mothers' time spent on food preparation, eating with children, and supervising children's physical activity?
3. How does mothers' employment status affect fathers' time spent on food preparation, eating with children, and supervising children's physical activity?

DATA AND METHODS

Beginning in year 1999, the Korean Statistics Bureau has conducted the Korean Time Use Survey (KTUS) every five years, where detailed time-diary data were collected for nationally representative cross-sectional samples of households. The 1999 survey included approximately 8,000 households, and the sample sizes have been slightly decreased in 2004 and 2009. All members of the sample households aged 10 or older were asked to fill out two-day time diaries and also complete brief survey questionnaires including demographic and labor market status.

This study used pooled data from 1999, 2004, and 2009 surveys. The sample was reduced to 14,228 mothers in non-farm households who lived with their preschool or school-aged children and completed time diaries for two consecutive days.³ Approximately half of them were employed either part-time or fulltime. Following the convention in time-use study, the second-day diaries were used for analysis, with individual weights to adjust for which day of the week the time diary was recorded.

³Because of the construct of the KTUS data, it was sometimes difficult to determine who was the mother of the child. Therefore, our sample may include primary female caretakers of children who live in the household but are not mothers.

Variables

The dependent variables were the total number of minutes per day spent by mothers on several activities pertaining to the child's weight. Included were the activities related to food preparation, activities related to children's food consumption, and activities related to children's physical activity.⁴ While the data do not offer a direct measure of children's weight outcomes, existing literature suggests household time spent on food preparation, family meals, and physical activity can result in better nutrition and lower incidence of overweight or obesity.

Food preparation was measured as the total daily time spent on (1) grocery shopping, (2) food preparation – which included cooking and cleaning up after meals, and (3) non-routine food preparation. It has been found that increased consumption of food prepared away from home by children is associated with more energy-dense diet and fewer nutrients (Mancino, Todd, Guthrie, & Lin, 2010), and consumption of time-saving foods such as preserved and packaged products increases the risk of obesity (Cutler et al., 2003).

For a measure of time for food consumption, time for family meals – parents' time spent eating with children or as a family – was also included in the dependent variables. A greater frequency of family meals was found to be positively associated with the quality of diet among children (Gillman et al., 2000; Neumark-Sztainer et al., 2003).

Parental involvement in children's energy expenditure was measured by the total daily time spent by parents on (1) physical care of children, (2) supervising or playing with children – which was parents' time spent on either playing with the child or watching the child play, and (3) total childcare time. The third category included the first two and was used as a more comprehensive measure of supervision. Although it is uncertain whether

⁴There are at least two reasons why the study investigates parents' time and not children's. First, children under 10 years of age were not requested to fill out a time diary, so there are significant data missing. Second, parents' time use implies information beyond simply how much time children spend eating and exercising, such as what children may be eating.

Table 1. Average Time Spent on Activities Related to Child's Diet and Physical Activity

Activities	All mothers (N=14,228)		Mothers employed (N=7,281)		Mothers not employed (N=6,947)	
	Percent >0	Minutes ²⁾ spent if >0	Percent >0	Minutes ²⁾ spent if >0	Percent >0	Minutes ²⁾ spent if >0
Grocery shopping	43.6%	15.3	34.8%*	11.1*	52.7%	19.6
Food preparation	97.0%	102.9	95.3%*	85.2*	98.7%	121.0
Non-routine food preparation	28.5%	13.2	21.3%*	9.2*	35.9%	17.3
Family meals	91.0%	50.9	88.1%*	43.8*	94.0%	58.2
Physical care of children	70.4%	48.8	60.1%*	26.5*	80.9%	71.6
Supervising or playing with children	39.7%	31.4	26.3%*	15.1*	53.4%	48.1
Total childcare time	75.8%	88.7	66.5%*	46.8*	85.3%	131.5

Notes:

- 1) Data come from the 1999, 2004, or 2009 Korean Time Use Survey. The sample consists of mothers who had children under 18 at the time of the survey.
- 2) Weighted average daily minutes.
- 3) The asterisk (*) denotes that the weighted mean differences between employed mothers and mothers not employed are significant at $p < .001$ levels by adjusted Wald test.

children would be less active when they were not in parents' company, the literature suggests that parents' unavailability can lead to decreased physical activity, more time watching television, and less nutritious diet among children (Davison et al., 2012; Fertig et al., 2009; Klesges, Stein, Eck, Isbell, & Klesges, 1991; You & Nayga, 2005).

Table 1 reports descriptive statistics for mothers' time spent in these activities. Overall, 97% of the mothers spent some time in food preparation on an average day, and 91% spent some time in family meals. Seventy-six percent of mothers spent time in some type of child care, and 70% spent time in physical care of the child. Only 40% of mothers participated in playing with the child or supervising the child play on an average day. Mothers that were not employed spent more time in all of these activities than working mothers. However, working mothers' participation in food preparation was 95.3%, which was only 3.4 percentage points lower than nonworking mothers. Grocery shopping, non-routine food preparation, physical care of children, and supervising or playing with the child were the activities in which working mothers were much less likely to participate than nonworking mothers. These differences between working and nonworking

mothers were significant at $p < .001$ by the adjusted Wald test.

Food preparation, which had over 95% participation rates for both working and nonworking mothers, was the activity that mothers spent the longest time also. Mothers spent 1 hour and 42.9 minutes a day on average in food preparation unless they did not cook at all that day. Family meals (50.9 minutes) and physical care (48.8 minutes) were among the activities in which mothers spent relatively longer time. Not only were working mothers less likely to participate in these activities than nonworking mothers, they spent significantly shorter time in all activities. The difference was greatest for food preparation time (85.2 minutes compared to 121 minutes), physical care of the child (26.5 minutes compared to 71.6 minutes), supervising or playing with the child (46.8 minutes compared to 131.5 minutes). Again, these differences between working and nonworking mothers were significant at $p < .001$ by the adjusted Wald test. However, it is unclear whether these differences were created by maternal employment per se or simply reflected other differences in characteristics between working mothers and nonworking mothers.

Empirical Model

Closely following Cawley and Liu (2007), this study estimated a two-part regression model of time devoted to each of the above-listed activities. In time-use research, a zero in the time variable is considered a *genuine zero* instead of truncated data, hence does not require Tobit-type correction. The first regression in the two-part model estimated the probability that the respondent reported spending any time in that activity. The second regression was for the amount of time (in daily minutes) the respondent spent in that activity, conditional on spending any time at all. The first part regression used Probit, and the second part was estimated with Ordinary Least Squares (OLS) for the subset of the sample for whom the dependent variable was greater than zero.

While a mother's employment can reduce her time spent in food preparation, family meals, and physical supervision of the child than a fulltime stay-home mother, it is possible that an unobserved third factor, e.g., parents' attitudes towards the child's weight, could have affected the mother's employment decision and also her time allocation simultaneously, in which case the association between maternal employment and children's weight problems would be endogenous. This study followed Anderson, Butcher, and Levine (2003) and Cawley and Liu (2007) and obtained instrumental variable (IV) estimators using IV Probit and two-stage least squares (2SLS) where maternal employment was instrumented by the municipal and provincial unemployment rates of the survey year. Whereas the labor market conditions have little to do directly with parents' time spent on children's weight-related activities, the F-statistic of the first-stage regression was $F=33.8$ for the maternal employment dummy, and $F=11.3$ for the weekly hours worked, both exceeding the suggested minimum of $F=10$ (Cawley & Liu, 2007). This supports that the unemployment rate provides sufficient instrumental power.

In this study two alternate definitions were used for the maternal employment variable: first, whether or not the mother was employed at the time of the survey; second, the number of hours she worked for

pay in an average week. Also included are demographic variables such as mothers' age, education, marital status, the spouse's employment status, number of children, and presence of grandparents in the household as controls. The variables and descriptive statistics are listed in Table 2.

Of 14,228 mothers in the sample, 51% were employed either part-time or fulltime, which is only 1 or 2 percentage points above the official female labor force participation rate of South Korea. Those that were employed worked 48.1 hours a week on average, which is nearly 12 more hours compared to the American counterpart (Cawley & Liu, 2007). On average, mothers in the sample had 0.5 preschool child and approximately 0.8 school-age child. Mothers were 36.8 years old on average. The number of school-age children and the mother's age both seemed to be positively correlated with maternal employment. Overall, 21% of the mothers had not completed high school, 56% had high-school diploma only, 10% had some college education, and 12% had college degrees. Very few (<2%) had any graduate degrees. Interestingly, working mothers seemed to have lower education than nonworking mothers in general, with an exception of graduate education. About 5% were single mothers. Single mothers were more likely to be employed than mothers who lived with a spouse. Of all mothers, 86% had a spouse working fulltime. Working mothers were less likely than nonworking mothers to have a spouse with a fulltime job. Nine percent lived with at least one grandparent of their children. Living with a grandparent was slightly more common for working mothers than for nonworking mothers. Adjusted Wald test shows that these demographic differences between working and nonworking mothers were significant at $p<.001$, supporting the importance of controlling for them in the regression models.

The model did not control for income for at least two reasons. First, the income variable was not collected in 1999 KTUS and therefore regressions with an income variable would have dropped all observations from 1999. Second, as maternal employment increases income, the effect of maternal employment estimated by the regressions in this

Table 2. *Characteristics of the Sample*

Variables	All (N=14,228)	Mother's Employment Status	
		Employed (N=7,281)	Not Employed (N=6,947)
Mother employed [‡]	0.51	1.00*	0.00
Weekly hours worked	24.32	48.06*	0.00
Number of preschool children	0.53	0.42*	0.64
Number of school-age children (approx)	0.84	1.02*	0.65
Mother's age	36.82	38.00*	35.61
Mother's education			
Less than high school [‡]	0.20	0.25*	0.16
High school [‡]	0.56	0.53*	0.58
Some college [‡]	0.10	0.09*	0.12
College graduate [‡]	0.12	0.11*	0.13
Graduate degree [‡]	0.01	0.02*	0.01
Single mother [‡]	0.05	0.06*	0.03
Whether have a spouse working fulltime [‡]	0.86	0.83*	0.90
Whether a grandparent lives in the household [‡]	0.09	0.11*	0.07

Notes:

- 1) Data come from the 1999, 2004, or 2009 Korean Time Use Survey. The sample consists of mothers who had children under 18 at the time of the survey.
- 2) Weighted mean values are reported.
- 3) [‡]Dummy variables.
- 4) The asterisk (*) denotes that the weighted mean differences between employed mothers and mothers not employed are significant at $p < .001$ levels by adjusted Wald test.

study was intended to include the effect of additional earning the working mother brings into the household.

As there may have been year-level clustering of regression residuals even with the instruments, year fixed effects were also included to account for any variation across years due to survey design and macro-level population trends. All regressions were estimated with individual weights.

RESULTS

Effects of Maternal Employment

Table 3 presents the results from two-part regressions with year fixed effects. Reported are marginal effects for the binary variable of maternal employment from regressions that used daily minutes allocated in each of the activities by mothers as dependent variables. The model controlled for the number of

preschool children, number of school-age children, mother's age, education, marital status, presence of a working spouse, and presence of a grandparent in the household. Complete regression estimates can be made available upon request.

When maternal employment was not instrumented, maternal employment was negatively associated with both the likelihood that the mother spent any time in activities related to the child's diet and physical activity and the amount of time spent in those activities. In particular, maternal employment was associated with 19.7 percentage-point reduction in playing with children or supervising them play, 18.7 percentage-point reduction in grocery shopping, and 17.0 percentage-point reduction in non-routine food preparation. The magnitude of the negative association was smallest for food preparation and family meals, 3.4 and 5.1 percentage point reductions respectively, which however were statistically significant at $p < .01$ level.

Table 3. Maternal Employment and Time Spent on Activities Related to Child's Diet and Physical Activity

Activities	Part one: Whether spent any minutes		Part two: Minutes spent if >0	
	PROBIT	PROBIT IV	OLS	2SLS
Grocery shopping	-0.187*** (0.010)	-2.121*** (0.045)	-5.67*** (0.80)	22.93 (46.28)
Food preparation	-0.034*** (0.003)	1.602*** (0.343)	-37.41*** (1.03)	-4.06 (35.64)
Non-routine food preparation	-0.170*** (0.009)	1.412*** (0.396)	-7.61*** (1.94)	84.51 (62.47)
Family meals	-0.051*** (0.006)	1.799*** (0.186)	-11.16*** (0.59)	13.81 (18.40)
Physical care of children	-0.144*** (0.009)	-1.109 (0.914)	-31.70*** (1.49)	-66.89* (39.12)
Supervising or playing with children	-0.197*** (0.010)	1.255** (0.511)	-28.73*** (1.99)	-17.58 (44.70)
Total childcare time	-0.115*** (0.008)	-1.361* (0.799)	-62.95*** (2.12)	-75.62 (64.56)

Notes:

- 1) Data come from the 1999, 2004, or 2009 Korean Time Use Survey. The sample consists of mothers who had children under 18 at the time of the survey. Weighted N=10,740.
- 2) Time variables are measured in average daily minutes.
- 3) Marginal effects are computed for a discrete change of the mother's employment status from 0 (not employed) to 1 (employed), with standard errors in the parentheses.
- 4) The regressions also included control variables (number of preschool children, number of school-age children, mother's age, mother's age squared, mother's education categories, single mother dummy, whether there is a spouse working fulltime, whether a grandparent lives in the household) and year fixed effects. Complete regression estimates are available upon request.
- 5) In the IV models, the instruments were local unemployment rates in the year of the survey.
- 6) *p<.10, **p<.05, ***p<.01

Conditional on spending some time in these activities, working mothers spent significantly fewer minutes in all of the activities analyzed. In particular, compared to fulltime homemaker mothers, they spent 63 minutes less in child care in general, 37 minutes less in food preparation, 32 minutes less in physical care, and 29 minutes less in playing with children or supervising them play.

When the endogeneity issue was addressed using an instrumental variable, the result became very different. The marginal effects from instrumental variable Probit suggest, in spite that maternal employment substantially reduced the likelihood that mothers allocated any time for grocery shopping and overall child care, employment made mothers much more likely to allocate time for food preparation, non-routine food preparation, family meals, and playing with children or supervising

them play. Results from the two-stage least square (2SLS) model suggest that the negative association between mothers' employment and the amount of their time spent in activities related to child diet and physical activity was mere correlations and did not indicate causal effects. One exception was physical care of children: mothers' employment resulted in a 66.9-minute reduction in time allocated for physical care of children, conditional on spending some time in physical care.

Effects of Maternal Work Hours

Using mothers' work hours as the variable of interest, Table 4 presents the results from two-part regressions with year fixed effects. When work hours are not instrumented, weekly paid work hours of mothers were negatively associated with both the likelihood and the amount of time spent in child diet

Table 4. *Maternal Work Hours and Time Spent on Activities Related to Child's Diet and Physical Activity*

Activities	Part one: Whether spent any minutes		Part two: Minutes spent if >0	
	PROBIT	PROBIT IV	OLS	2SLS
Grocery shopping	-0.004*** (0.000)	-0.038*** (0.001)	-0.107*** (0.016)	0.463 (0.942)
Food preparation	-0.001*** (0.000)	0.028*** (0.006)	-0.723*** (0.018)	-0.063 (0.552)
Non-routine food preparation	-0.003*** (0.000)	0.022*** (0.007)	-0.163*** (0.038)	1.839 (1.423)
Family meals	-0.001*** (0.000)	0.030*** (0.004)	-0.217*** (0.011)	0.209 (0.276)
Physical care of children	-0.002*** (0.000)	-0.017 (0.015)	-0.564*** (0.028)	-1.006* (0.579)
Supervising or playing with children	-0.004*** (0.000)	-0.021** (0.008)	-0.597*** (0.040)	-0.248 (0.631)
Total childcare time	-0.002*** (0.000)	-0.022 (0.014)	-1.133*** (0.040)	-1.073 (0.918)

Notes:

- 1) Data come from the 1999, 2004, or 2009 Korean Time Use Survey. The sample consists of mothers who had children under 18 at the time of the survey. Weighted N=10,740.
- 2) Time measures in dependent variables are constructed as average daily minutes.
- 3) Marginal effects are computed for an hour increase in the mother's normal weekly work hours, with standard errors in the parentheses.
- 4) The regressions also included control variables (number of children, age of youngest child, mother's age, mother's age squared, mother's education categories, single mother dummy, whether there is a spouse working fulltime, whether a grandparent lives in the household) and year fixed effects. Complete regression estimates are available upon request.
- 5) In the IV models, the instruments were local unemployment rate, whether she has a spouse with higher schooling, and relative size of home.
- 6) *p<.10, **p<.05, ***p<.01

and physical activity. That is, an additional hour per week a mother works outside her home was associated with 0.4 percentage-point reduction in the likelihood of grocery shopping, 0.4 percentage-point reduction in the likelihood of playing with children or supervising them play, 0.3 percentage-point reduction in non-routine food preparation on an average day, for example. Conditional on spending some time in these activities, an additional weekly hour of paid work was associated with small (less than a minute) reduction in time spent for every activity related to child diet and physical activity. The negative association was greatest for total childcare time and food preparation.

When the causal effect of maternal work hours was examined through instrumental variable Probit, each additional weekly work hour decreased the likelihood of grocery shopping and playing with

children or supervise them play on an average day by 3.8 percentage points and 2.1 percentage points, respectively, but *increased* the likelihood of routine and non-routine food preparation and also the likelihood of the mother having family meals (by 2.8 percentage points, 2.2 percentage points, and 3.0 percentage points, respectively). Effects of weekly work hours shown by the 2SLS results resembled the findings from the binary variable of maternal employment and were all insignificant, with an only exception of about 1-minute reduction in time spent in physical care of children.

Effects of Maternal Employment on Fathers' Time Allocation

One may also wonder whether the spouses of working mothers spend more time in activities related to child diet and physical activity. Table 5

Table 5. Maternal Work Hours and Fathers' Time Spent on Activities Related to Child's Diet and Physical Activity

Activities	Part one:	Part two:
	Whether spent any minutes	Minutes spent if >0
	PROBIT	OLS
Grocery shopping	-1.84e-4 (1.54e-3)	-6.32 (7.81)
Food preparation	-4.43e-4 (2.13e-3)	-19.03 (11.84)
Non-routine food preparation	-8.08e-4 (9.30e-4)	-7.85 (40.96)
Family meals	-8.42e-4 (7.80e-4)	-5.91 (7.62)
Physical care of children	-7.26e-4 (9.20e-4)	-22.90 (13.97)
Supervising or playing with children	1.06e-4 (1.60e-3)	-26.44 (24.24)
Total childcare time	-1.18e-4 (2.40e-4)	-50.33** (21.54)

Notes:

- 1) Data come from the 1999, 2004, or 2009 Korean Time Use Survey. The sample consists of mother-father pairs who had children under 18 at the time of the survey. Weighted N=7,862.
- 2) Time variables are constructed as average daily minutes.
- 3) Marginal effects are computed for a discrete change of the mother's employment status from 0 (not employed) to 1 (employed), with standard errors in the parentheses.
- 4) The regressions also included control variables (number of children, age of youngest child, mother's age, mother's age squared, mother's education categories, single mother dummy, whether there is a spouse working fulltime, whether a grandparent lives in the household) and year fixed effects. Complete regression estimates are available upon request.
- 5) *p<.10, **p<.05, ***p<.01

presents marginal effects and standard errors for the binary variable of maternal employment in regressions of fathers' time allocated in each activity. The sample was reduced to couples in which both the mother and the father completed the survey. Because the endogeneity problem may not be applicable for the spouses' time allocation, the spouses' two-part regressions were estimated without instrumental variables.

Interestingly, fathers in families with working mothers were not any more likely than fathers in families with fulltime stay-home mothers to participate in activities related child diet and physical activity. What is more counterintuitive is that, conditional on fathers spending some time in these activities, maternal employment decreased fathers' time allocated in these activities. Most of these negative effects were statistically insignificant except for total childcare time. Conditional on fathers

spending some time in child care, working mothers had a negative effect on fathers' total childcare time by 50.3 minutes per day. However, due to the very low participation rates among fathers, the overall effect of maternal employment remained unimportant.

CONCLUSION AND DISCUSSION

Motivated by growing concerns on childhood overweight and obesity in Korea, this study analyzes Korean household time-diary data to investigate how maternal employment may affect mothers' time allocation for activities related to child diet and physical activity. Two-part regression models were estimated to account both for whether they participated at all in those activities as well as the amount of time spent if they participated. This study finds, compared to mothers that are not employed,

working mothers are significantly less likely to spend time in food preparation, family meals, and supervision of children's physical activity, and even when they do, they spend significantly shorter time in those activities. These difference between working mothers versus nonworking mothers and also the difference between those who work long hours versus those who do not are similar to the U.S. example (Cawley & Liu, 2007) by even larger magnitude. The regression of the effect of maternal employment on fathers' time spent in these activities revealed that, unlike U.S. cases, the spouses of working mothers in Korea do not make up for the shortage: husbands of working mothers are neither more likely than husbands of nonworking mothers to participate in activities related to child diet and physical activity nor allocate longer time even if they do. This may reflect prevailing gender role attitudes, or suggest the importance of free or inexpensive mother substitutes, e.g., relatives, paid nannies and maids, more available in this country than in North America or the U.K. (S. Sung, 2003; Yang & Rosenblatt, 2008).

When the causal effect of maternal employment was identified in the instrumental regression framework, this study found surprising results: mothers' employment decreases their likelihood of participating in grocery shopping and any type of child care, but it greatly *increases* their likelihood of participating in routine and non-routine food preparation, family meals, and supervision of the child's physical activity or playing with children. That is, if an exogenous change such as a favorable turn of labor market conditions makes some mothers work outside the home, it will make them more likely to allocate at least some time in cooking, eating with children, and playing with children. This counterintuitive finding is difficult to explain. It is unlikely to indicate that some working mothers can afford to work fewer hours to look after their children, given that similar results are found with mothers' work intensity – measured by maternal work hours – in place of a simple employment status. One plausible explanation can be that nonworking mothers are expected to engage in greater nonmarket responsibilities as a result of their

lack of employment, and hence reduce their time available to activities related to children's weight outcomes.

Although the effect of maternal employment on time use in activities related to children's weight outcomes found in this study is quite different from findings from the U.S. (Cawley & Liu, 2007), the implication from this study is analogous to the time-use literature that affirm mothers' employment has little to do with their time shared with children. In an extensive review of literature on the topic, Bianchi (2000) pointed out that despite the increase in married women's employment, mothers' time shared with children remained stable, and children today may be spending more time with their parents than ever before.

This study has several limitations. First, the data did not contain any indicators of the family's health, food intake, or body measurements, inhibiting direct examination of whether increased parents' time in the above-examined activities really improves health and nutrition outcomes for children. Second, actual eating and physical activity by children may be different from what can be inferred from their parents' use of time, as children can eat and move while unsupervised. Findings from this study can shed some light to the problem of childhood overweight insofar as parental time use effectively predicts children's diet and weight outcomes as claimed by existing literature from the U.S. (Bauer et al., 2012; Fertig et al., 2009; Neumark-Sztainer et al., 2003). We acknowledge that the actual consequence on children's food consumption, physical activity, and ultimately on children's weight outcomes may also be influenced by other contingent factors such as family members' nutrition knowledge, behaviors, and their social, physical, and policy environment. While the question of whether maternal employment contributes to the problem of childhood overweight remains to be further investigated, this paper attests that, even if maternal employment turns out to be a contributor, the causation is not likely to be through reduced parental time on children's eating and physical activity. Third, this study analyzes primary use of time only and ignores meal preparation, eating, and physical activity as secondary activities.

However, it has been noted that secondary eating may have become increasingly common due to technological advances that promote convenience in food consumption (Bertrand & Schanzenbach, 2009). Fourth, although the instrumental variable approach controls for the variation in time allocation arising from potential reverse causation of the mothers' employment decisions by the household income, it was impossible to directly control for household income because of the omission of the income variable in one of the three survey years. Controlling for income in the regression might have increased the model's explanatory power.

As mothers' labor supply decisions are likely to be somewhat simultaneous to decisions regarding family food consumption and feeding of their children, poor quality substitutes for home-produced foods may deter mothers' labor supply, especially those with relatively high reservation wages. This paper suggests that the standards for weight-related environment at schools and daycare centers be enhanced, children be taught how to eat and exercise so that they can make informed choices when unsupervised, and social and policy-based efforts be made to support father's involvement in child's healthy weight development.

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