Maternal Working Hours and Early Childhood Overweight in Japan: A Population-based Study

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Abstract: Maternal Working Hours and Early Childhood Overweight in Japan: A Population-based Study: Toshiharu Mitsuhashi, et al. Department of Epidemiology, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences—Objectives: There has been a growing concern that maternal employment could have adverse or beneficial effects on children’s health. Although recent studies demonstrated that maternal employment was associated with a higher risk of childhood overweight, the evidence remains sparse in Asian countries. We sought to examine the relationship between maternal working hours and early childhood overweight in a rural town in Okayama Prefecture. Methods: In February 2008, questionnaires were sent to parents of all preschool children aged ≥3 yr in the town to assess maternal working status (working hours and form of employment), children’s body mass index, and potential confounders. Childhood overweight was defined following the age and sex-specific criteria of the International Obesity Task Force. Odds ratios (ORs) and 95% confidence intervals (CIs) for childhood overweight were estimated in a logistic regression. We used generalized estimating equations with an exchangeable correlation matrix, considering the correlation between siblings. Results: We analyzed 364 preschool children. Adjusting for each child’s characteristics (age, sex), mother’s characteristics (age, obesity, educational attainment, smoking status, and social participation), and family’s characteristics (number of siblings), children whose mothers work <8 h/day had a substantially lower risk for being overweight (OR: 0.28, 95% CI: 0.09, 0.93) compared with children of non-working mothers, whereas the relationship was less pronounced among children whose mothers work ≥8 h/day (OR: 0.71, 95% CI: 0.19, 2.68). We observed similar patterns in a stratified analysis by the form of maternal employment. Conclusion: Short maternal working hours are associated with a lower odds of early childhood overweight. (J Occup Health 2012; 54: 25–33)

Key words: Cross-sectional study, Employment, Japan, Mother, Overweight, Preschool children

In developed countries, the prevalence of obesity and overweight in childhood has increased markedly1–3). We also observe the same trend in Japan; the prevalence of overweight was 3.12% among children aged six years in 1985, and it steadily increased to 4.68% in 20054). Recently, obesity or overweight has been conceptualized as being influenced by factors across multiple domains, including individual and family risk factors as well as characteristics of the community and region5). In line with this, previous studies have suggested various risk factors for early childhood overweight, ranging from prenatal to postnatal and early life factors6). These include gestational weight gain, birth weight, infant feeding practices, lone parenthood, sleep duration, smoking during pregnancy, parental overweight, prepregnancy overweight, maternal employment and breastfeeding5–7).

In recent decades, maternal employment has increased in developed countries8, 9), including Japan10). To promote maternal employment and to achieve equal employment opportunities for men and women in Japan, the Occupational Safety and Health Law was revised to abolish the upper limits on working hours for women in 2003. In response to the social trend of an increasing number of working mothers, there has been a growing concern that maternal employment could have adverse or beneficial effects on children’s health, including early childhood overweight. Many studies of this issue have been carried out in Western populations, primarily in Europe and North America11–15), and a recent review concluded that there was some evidence that maternal employment is asso-
associated with a higher risk of childhood overweight.6 Meanwhile, evidence concerning maternal employment and early childhood overweight remains sparse in Asian countries. Indeed, no studies have examined the relationship between maternal working hours and early childhood overweight in Japan. Given the increasing number of employed mothers as well as the legislative abolishment of the upper limits on working hours for women in Japan, further studies are warranted to examine the relationship between maternal working hours and early childhood overweight.

Accordingly, we sought to examine the relationship between maternal working hours and early childhood overweight in Japan. Given the diversified forms of employment (e.g., increasing contract workers), we also aimed to investigate the effects of maternal working hours, taking account of the form of maternal employment.

Materials and Methods

Study design and participants

In February 2008, M town conducted a population-based cross-sectional survey to investigate the descriptive features related to maternal and child health. M town is a rural area in Okayama Prefecture, which is located west of Osaka, and has a population of about 15,000. In the present survey, all 616 preschool children aged two to six years and their parents were chosen from the February 2008 population registry of this town to be the target population. A self-administered questionnaire was sent to the parents by the municipality office staff of M town. Parents filled in their children’s basic characteristics, lifestyle factors and their own characteristics and returned the questionnaire by mail. In order to increase the response rate, municipal office staff reminded the parents to return the completed questionnaire. A thorough explanation about the aim of the survey was provided on the cover of the questionnaire. When parents did not agree to participate in this survey, they could freely choose not to respond without any disadvantages. It was therefore considered that the return of the questionnaire indicated that informed consent had been given.

In the present study, we restricted the analysis to preschool children aged three years or more in line with previous studies on early childhood overweight.5, 7, 14, 19–25.

Measurements

We assessed the form of maternal employment by asking the following question: “What is the current form of maternal employment?” There were 4 possible responses: regular worker, contract worker, not working and other. We presumed that regular workers included mothers who had regular paid work and that contract workers included bonus workers, casual staff and part-timers. Likewise, other apparently included self-employed people in the agriculture and commerce sectors. Then, excluding mothers who responded with not working, we assessed maternal working hours per day by asking the following question: “How many hours do you work per day?” There were 4 predetermined categories for responses: less than 4 h, 4–8 h, 8–12 h and 12 h or more. These responses were dichotomized as <8 h/day and ≥8 h/day. In Japan, the Labor Standards Law limits working hours to eight hours per day. We note a possibility that some mothers who had regular paid work were offered an opportunity to work a reduced schedule. Not working was used as a referent category in the present analysis.

The heights and weights of the children were collected by their mothers as part of the self-administered questionnaire, and were reported to the nearest 0.1 cm and 0.1 kg, respectively. Although these measurements were self-administered, previous studies suggested that such measurements have high validity among children and adolescents.26, 27 Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. Following the age and sex-specific criteria of the International Obesity Task Force,28 we dichotomized BMI into overweight and non-overweight.

In line with previous studies11, 12, we considered the following variables as potential confounders.

1) Children’s characteristics:
   Using the questionnaires, we assessed the age (continuous) and sex of the children.

2) Mothers’ physical characteristics:
   We adjusted for mother’s age (continuous) and BMI (less than 25 kg/m² vs. 25 kg/m² or more).

3) Mothers’ social characteristics:
   We regarded educational attainment (junior/senior high school, secondary college and university or more), smoking status (non-smoker vs. smoker) and social participation as mothers’ social characteristics. It has been suggested that community- and area-level factors influence the risk of obesity/overweight among children.5, 12, 14, and we decided to adjust for maternal social participation. Social participation was derived from survey item responses to participation in 13 different types of organizations or clubs, e.g., community associations, Parents and Teachers Associations (PTA), sports clubs, alumni associations, religious groups, consumers’ cooperatives (co-ops), political campaign clubs, citizen’s groups and etc. We calculated the number of organizations in which mothers participated and categorized the number into one of three categories (no organizations, one or two organizations, and three or more organizations).
4) Families’ characteristics:
We assessed the number of siblings of the children. The respondent included all children in the number of children who were in their family regardless of whether a child was included in the target of this study. The children included in the study were excluded from the number of siblings.

Statistical analysis
We first examined the prevalence of overweight children and other sociodemographic characteristics separated by maternal working hours. We also examined the relationship between maternal working hours and form of maternal employment. We then examined the association between maternal working hours and childhood overweight by conducting a logistic regression analysis. In reference to a past study\(^5\), we sequentially adjusted for children’s, mothers’ and families’ characteristics to run the following five models. After conducting a crude model (model 1), we adjusted for children’s characteristics (model 2). Then, we additionally adjusted for mothers’ physical characteristics (model 3) and mothers’ social characteristics (model 4). Finally, we adjusted for families’ characteristics (model 5). In general, maternal working status could be influenced by children’s age\(^4\). Although this might cause multicollinearity in the analyses, we observed quite low correlations between children’s age and maternal employment (Pearson’s correlation coefficient: 0.0787) or maternal working hours (Pearson’s correlation coefficient: –0.0762). We also examined the effect of maternal employment by dichotomizing the exposure as working (both <8 h/day and ≥8 h/day) and not working. Then, we conducted the whole analysis after stratifying by the form of maternal employment (regular worker vs. contract worker), excluding children of mothers who responded as regular workers, children whose mothers work ≥8 h/day as contract workers, children whose mothers work <8 h/day in some other form of employment and children whose mothers work ≥8 h/day in some other form of employment. In addition, as a further supplementary analysis, we conducted a multiple linear regression analysis by using children’s BMI as a continuous outcome variable.

All analyses were conducted using the statistical software package Stata10 (StataCorp LP, College Station, TX, USA).

Results
Questionnaires were returned by the parents of 476 of the 616 preschool children (77.3%). A total of 355 families returned the questionnaire, and the number of preschool children per a family ranged from 1 to 4 (median: 2). We excluded those who had no identification number (n=2), children aged less than three (n=78) and those who had no information about exposure or outcome (n=32). Therefore, we included 364 (59.1%) preschool children in the final analyses. All the main caregivers of the subjects were mothers.

Table 1 shows sociodemographic characteristics of the subjects by maternal working hours. A total of 29 children (8.0%) were overweight. The prevalence of overweight was lowest among children whose mothers work <8 h/day (4.5%), while it was highest among children whose mothers work ≥8 h/day (12.6%). With regard to maternal educational attainment, more than half of the non-working mothers had attained junior/senior high school education, whereas working mothers had higher educational attainment. The prevalence of smokers was higher among working mothers; although the prevalence of smokers was 7.0% among non-working mothers, the prevalences were 20.9 and 24.1% among mothers who work <8 h/day and ≥8 h/day, respectively. We also observed that children with no siblings were more frequently found among children of working mothers. Table 1 also shows the relationship between maternal working hours and form of maternal employment. Among mothers who work <8 h/day, more than 60% were contract workers, whereas the pattern was reversed among mothers who work ≥8 h/day.

Table 2 shows ORs and 95% CIs for childhood overweight associated with maternal working hours. In the crude regression model (model 1), we found that childhood overweight is least common among children whose mothers work <8 h/day (OR: 0.43, 95% CI: 0.16, 1.12), compared with children of non-working mothers. Among those whose mothers work ≥8 h/day, however, the association was reversed (OR: 1.30, 95% CI: 0.52, 3.26). In model 3, we observed a qualitative change in the OR among chil-
children whose mothers work ≥8 h/day, which occurred when adjusting for mothers’ age. In model 4, the OR moved further downward, which occurred when adjusting for mothers' social participation. In model 5, compared with children of non-working mothers, children whose mothers work <8 h/day had approximately 70% lower odds of being overweight (OR: 0.28, 95% CI: 0.09, 0.93). Among children whose mothers work ≥8 h/day, the point estimate of OR was lower than 1.00, although its precision was quite low (OR: 0.71, 95% CI: 0.19, 2.68). Notably, the ORs associated with covariates were not statistically significant, except for maternal age. The correlation in each GEE model was relatively low (range: –0.0375 to –0.0190), indicating that the correlation within siblings in each family was relatively low. When we dichotomized the exposure variable, compared with children of non-working mothers, the OR among children of working mothers was 0.40 (95% CI: 0.14, 1.14) in model 5.

When we conducted stratified analyses by the form of maternal employment, the GEE calculation did not converge among children of contract workers. Given the fact that the correlation within siblings in each family was relatively low, we a posteriori conducted the stratified analyses without using GEE (Table 3).

Table 1. Early childhood overweight, sociodemographic characteristics, and the form of maternal employment according to maternal working hours, Japan 2008

<table>
<thead>
<tr>
<th>Maternal employment status</th>
<th>Not working (n=100) (%)</th>
<th>Workinga (&lt;8 h/day (n=177) (%)</th>
<th>≥8 h/day (n=87) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early childhood overweight</td>
<td>Non-overweight</td>
<td>90 (90.0)</td>
<td>169 (95.5)</td>
</tr>
<tr>
<td></td>
<td>Overweight</td>
<td>10 (10.0)</td>
<td>8 (4.5)</td>
</tr>
<tr>
<td>Children’s characteristics</td>
<td>Age (yr)</td>
<td>Mean 4.89, SD 1.15</td>
<td>Mean 5.05, SD 1.09</td>
</tr>
<tr>
<td></td>
<td>Sex</td>
<td>Girl 50 (50.0)</td>
<td>93 (52.5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Boy 50 (50.0)</td>
<td>84 (47.5)</td>
</tr>
<tr>
<td>Mothers’ physical characteristics</td>
<td>Age (yr)</td>
<td>Mean 32.9, SD 4.34</td>
<td>Mean 33.8, SD 4.70</td>
</tr>
<tr>
<td></td>
<td>Body mass index</td>
<td>&lt;25 kg/m² 81 (90.0)</td>
<td>146 (90.7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥25 kg/m² 9 (10.0)</td>
<td>15 (9.3)</td>
</tr>
<tr>
<td>Mothers’ social characteristics</td>
<td>Educational attainment</td>
<td>≤high school 52 (53.6)</td>
<td>73 (41.2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some college 33 (34.0)</td>
<td>79 (44.6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>College+ 12 (12.4)</td>
<td>25 (14.1)</td>
</tr>
<tr>
<td></td>
<td>Smoking status</td>
<td>Non-smoker 93 (93.0)</td>
<td>140 (79.1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smoker 7 (7.0)</td>
<td>37 (20.9)</td>
</tr>
<tr>
<td></td>
<td>Social participation</td>
<td>No organizations 11 (11.0)</td>
<td>26 (15.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1–2 organizations 46 (46.0)</td>
<td>65 (38.5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥3 organizations 43 (43.0)</td>
<td>78 (46.2)</td>
</tr>
<tr>
<td>Families’ characteristics</td>
<td>Number of siblings</td>
<td>No siblings 8 (8.0)</td>
<td>23 (13.0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 sibling 50 (50.0)</td>
<td>86 (48.6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 siblings 38 (38.0)</td>
<td>53 (29.9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥3 siblings 4 (4.0)</td>
<td>15 (8.5)</td>
</tr>
<tr>
<td>Form of maternal employment</td>
<td>Regular worker</td>
<td>NA NA 42 (23.7)</td>
<td>62 (71.3)</td>
</tr>
<tr>
<td></td>
<td>Contract worker</td>
<td>NA NA 109 (61.6)</td>
<td>15 (17.2)</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>NA NA 25 (14.1)</td>
<td>9 (10.3)</td>
</tr>
</tbody>
</table>

NA: not applicable, SD: standard deviation. Responses were obtained from the following four predetermined categories: <4 h/day (n=23), 4–8 h/day (n=154), 8–12 h/day (n=81) and ≥12 h/day (n=6).
We could not estimate the OR among children whose mothers work ≥8 h/day as contract workers in models 4 or 5. We observed patterns similar to those of all the subjects, although the precisions were relatively low.

When we further examined the association between maternal working hours and the form of maternal employment and childhood overweight in a mutually exclusive manner, the GEE calculation did not converge. Then, we conducted the same analysis.
without using GEE, which yielded comparable results with the stratified analysis (data available from the authors on request).

Table 4 shows the results of a multiple linear regression analysis by using childhood BMI as a continuous outcome variable. In model 5, compared with children of non-working mothers, the BMIs of children whose mothers work <8 h/day were lower by 0.33 kg/m^2 (95% CI: −0.81 kg/m^2, 0.15 kg/m^2), whereas no clear difference was observed with children whose mothers work ≥8 h/day (0.02 kg/m^2, 95% CI: −0.61 kg/m^2, 0.65 kg/m^2).

**Discussion**

In the present study, we investigated the association between maternal working hours and early childhood overweight, by targeting all preschool children aged three years or older in a rural town in Okayama Prefecture. We found that children had approximately 70% lower odds of being overweight when their mothers work <8 h/day, compared with children of non-working mothers. Although we observed a tendency of lower odds for being overweight among children whose mothers work ≥8 h/day, its precision was quite low. We observed similar patterns in the stratified analysis by the form of maternal employment. We showed the robustness of the present findings by examining the relationship between maternal working hours and childhood BMI in a linear regression analysis. The correlations of GEE were relatively low in all models, indicating that there were few correlations within the siblings. To our knowledge, this is the first study that has examined the association between maternal working hours and early childhood overweight, simultaneously taking account of form of maternal employment. Given the strong correlation between working hours and form of employment as well as a marked increase in the number of contract workers in Japan, it is imperative to examine the health effects of maternal working hours as well as form of maternal employment. Indeed, we should not ignore the possibility that form of maternal employment is also an important determinant of early childhood overweight.

To date, the majority of studies have shown that childhood overweight is more common in the children of employed mothers, and a recent review concluded that increasing maternal working hours may be associated with increase of childhood overweight (OR: 1.12, 95% CI: 1.06, 1.18). By contrast, in a cross-sectional study of children aged five to seven years in Germany (OR: 1.05, 95% CI: 1.02, 1.29), adjusting for potential confounders (i.e., the lowest risk for overweight among children of part-time workers and the second lowest risk among children of full-time workers. This pattern, however, was only observed in crude analyses and was not statistically significant after adjustment. The relationship between maternal employment and early childhood overweight has been investigated in three studies from Japan (OR: 1.18, 95% CI: 1.06, 1.18), all of which were based on the same birth cohort born in 1989 in Toyama Prefecture. These studies, however, provided only crude estimates, without considering maternal working hours.

The present findings of maternal working hours and early childhood overweight could be explained by three possible mechanisms. First, when mothers work outside the home, the disposable income of the household is assumed to increase, which could lead to healthier lifestyles of their children (e.g., increase of exercising opportunity and healthier eating habits).

**Table 4. Coefficients for early childhood body mass index associated with maternal working hours, Japan 2008**

<table>
<thead>
<tr>
<th>Maternal working hours</th>
<th>Estimate (95% CI)</th>
<th>Estimate (95% CI)</th>
<th>Estimate (95% CI)</th>
<th>Estimate (95% CI)</th>
<th>Estimate (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not working</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>&lt;8 h/day</td>
<td>−0.16 (−0.63, 0.24)</td>
<td>−0.17 (−0.60, 0.27)</td>
<td>−0.23 (−0.68, 0.22)</td>
<td>−0.35 (−0.83, 0.12)</td>
<td>−0.33 (−0.81, 0.15)</td>
</tr>
<tr>
<td>≥8 h/day</td>
<td>0.30 (−0.28, 0.87)</td>
<td>0.29 (−0.28, 0.87)</td>
<td>0.14 (−0.47, 0.74)</td>
<td>−0.01 (−0.63, 0.62)</td>
<td>0.02 (−0.61, 0.65)</td>
</tr>
<tr>
<td>ρ</td>
<td>0.290</td>
<td>0.286</td>
<td>0.286</td>
<td>0.299</td>
<td>0.294</td>
</tr>
</tbody>
</table>

CI: confidence interval. These five models were estimated by generalized estimating equations using an exchangeable correlation matrix with robust standard errors. See Table 2 for the covariates included in each model.
mothers tend to spend less time with their children to take care of them and feel increased stress\(^\text{16}\). According to the Survey on Time Use and Leisure Activities in 2006\(^\text{31}\), which has been conducted every five years by the Ministry of Internal Affairs and Communications, the weekly average time spent on child care was 128 min among women in dual-earner couples who have a child (ren) aged less than six years, whereas the corresponding time was 230 min for housewives who have a child (ren) aged less than six years. Although the information concerning the time spent on child care was not available in this study, this may explain the present finding of children whose mothers work ≥8 h/day. Thirdly, mothers who work for relatively short hours outside the home may experience good work-life balance, and this may produce positive affective states, including a sense of security for being “accepted” within society as well as home\(^\text{25, 33}\). Positive affective states (e.g., empowerment) are in turn hypothesized to increase motivation for child care\(^\text{16}\). Further studies are warranted to understand how mothers balance home life and work and how this may influence the types of food or opportunities for physical activity parents can offer their children. On a related issue, a recent paper from Japan suggested that paternal parenting involvement could reduce the likelihood of childhood injury\(^\text{34}\), which deserves further attention.

It might be noteworthy that the point estimate of the OR associated with maternal obesity was lower than 1 (i.e., 0.44) in model 5 (Table 2). Although we assessed maternal BMI only at the time of study, we should note a possibility that maternal pre-pregnancy BMI or gestational weight gain could be rather important determinants of early childhood overweight\(^\text{35–37}\). To examine the robustness of the present findings, we conducted the analyses without adjusting for maternal BMI, which did not substantially change the results; compared with children of non-working mothers, the ORs among children whose mothers work <8 h/day and ≥8 h/day were 0.26 (95% CI: 0.08, 0.82) and 0.68 (95% CI: 0.20, 2.31), respectively, in model 5.

There are also some limitations in this study. First, information about household income was not available. Anderson et al.\(^\text{11}\) reported that the association between maternal working hours and childhood overweight was more pronounced in affluent households, although association was less clear in poorer families. There have been no studies in Japan that investigated whether the association between maternal employment and childhood overweight differed by socioeconomic status of households. Given the global tendencies of widening economic inequalities, future studies should aim to assess the impact of household income. Second, we only assessed maternal working hours at the time of study, and this does not necessarily reflect the relevant maternal working conditions\(^\text{25}\). It is likely that both maternal working hours and employment status vary substantially depending on the economic conditions and environment, especially among contract workers. When we stratified the analyses by the form of maternal employment, however, we observed patterns similar to those of all the subjects. Third, we could not assess unpaid work of mothers. Since employed mothers may struggle with a dual burden of paid and unpaid work, future studies should assess the health effects of maternal working hours outside the home as well as unpaid work in the home simultaneously. Fourth, although we considered confounders in line with previous studies, the possibility of residual confounding cannot be completely ruled out, e.g., lone motherhood\(^\text{35}\). Fifth, reverse causation is possible because this study was conducted in a cross-sectional manner. However, it is less likely that childhood overweight affects maternal working hours. Finally, although we included all preschool children in M town, we could not fully estimate the relationship between maternal working hours and childhood overweight among children of contract workers, partly due to the small sample size.

The present study investigated the association between maternal working hours and early childhood overweight in a rural area in Japan. Compared with children of non-working mothers, children of mothers who work <8 h/day had a substantially lower risk of being overweight, whereas no clear risk reduction was observed among children of mothers who work ≥8 h/day. This striking pattern may well reflect both beneficial and adverse effects of maternal employment on children’s health. As women have become more active throughout society, the potential impacts of maternal employment may be further intensified and affect childhood overweight, widening the health disparities across social classes in Japan\(^\text{38–43}\). With the employment pattern becoming diversified\(^\text{10}\), future studies should aim to elucidate the association between maternal employment and early childhood overweight by carefully assessing the maternal employment patterns from the life-course perspective.

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