# Child Care Choices, Food Choices, and Children's Obesity Status:
# A Comparison of Two-parent and One-parent Households

Bidisha Mandal[1]    Lisa M. Powell[2]

[1]Washington State University  [2]University of Illinois at Chicago

December 10, 2012

# Public Policy

- In 2007-2008, 9.5% infants and toddlers and 16.9% children and adolescents aged 2-19 years were obese
- Childhood obesity remains a costly public health issue as it has both immediate and long-term effects on health and well-being (CDC, 2008)
    1. Obese children are more likely to have risk factors for cardiovascular disease, such as cholesterol or high blood pressure
    2. Obese children are more likely to have prediabetes
    3. Obese children are at greater risk for bone and joint problems, sleep apnea, and social and psychological problems
    4. Children who are obese are likely to be obese as adults and are, therefore, more at risk for adult health problems such as heart disease, type 2 diabetes, stroke, several types of cancer, and osteoarthritis
- In this study, we discuss the antecedents of this particular issue
- We examine the role of choice of child care services and food consumption patterns in explaining prevalence of obesity at very young age (9-months to 5-years)

# Research Questions

- Our overall goal is to understand the mechanisms that affect children's obesity status at a very young age through differences in child care and food environments
- Specifically, we examine parent's choice of child care and amount of time spent in paid and unpaid (non-parental) care settings
- These are likely to be affected by prices and wages
- Next, we examine the role of child care choices on food consumption patterns
- We analyze likelihood of childhood obesity as a function of
    1. Child care choices and time in different care settings
    2. Quantity of consumption of various types of food items

# Role of Parental Employment

- Anderson, Butcher and Levine (2003) find that mothers' work intensity is positively associated with children's overweight status
- Benson and Mokhtari (2011) discuss the role of both parents' employment behavior, and joint economic decision-making in influencing childhood obesity. They find that shared parent-child activities such as reading and physical activities help achieve weight control goals
- Regarding maternal employment and breastfeeding:
    1. Simultaneous decision to breastfeed and return to labor market, and each hinders the other (Mandal, Roe, and Fein, 2012)
    2. Arenz et al. (2004) find that breastfeeding has a protective effect against obesity in children

# Role of Nutrition Intake

- Gable and Lutz (2000) discuss the importance of parents' knowledge of child nutrition and physical activity in reducing childhood obesity rates
- Powell (2009) finds that weight of adolescents in low- to middle-socioeconomic status families is most sensitive to fast food prices
- Guthrie et al. (2002) report that adolescents consume the largest proportion of calories away from home at quick service restaurants
- Binkley et al. (2000) find significant associations between fastfood consumption and increased BMI
- Sturm and Datar (2005, 2007) and Powell and Bao (2009) find that changes in child weight are statistically significantly and positively related to the price of fruits and vegetables among younger children

# Role of Child Care

- Fertig, Glomm, and Tchernis (2009) find that longer maternal work hours are associated with higher likelihood of childhood obesity due to less supervision and attention to nutrition. But they also find that more work hours are associated with more time spent in child care, and lower child BMI among children of more educated mothers

- Herbst and Tekin (2011) find that child care subsidy receipt is associated with increases in the likelihood of being overweight and obese, through greater participation in non-parental child care settings

- In a large dataset of 9 months to 3 years old children in the UK, Pearce et al. (2010) find that children from more advantaged families who use informal childcare are at increased risk of overweight

- Related literature:
  1. Effect of child care on cognitive development of children (for example, Havnes and Mogstad, 2011; Bernal and Keane, 2011; Blau, 1999
  2. Child care costs as barriers to maternal employment(for example, Kimmel, 1998; Powell, 1997)

# Underlying Behavioral Model

- We, first, explain the impact of child care prices on choice of child care (Kimmel, 1992, 1998; Powell, 1997)
- We, then, investigate the impact of different child care settings and food choices on childhood obesity
- Parents are assumed to maximize utility, where utility is a function of leisure time, market goods, and quality of child care
- The maximization problem is subject to a time constraint, a budget constraint, and a production function for children's body mass index
- Solution to the maximization problem subject to the constraints yields demands for paid and unpaid non-parental child care services
- It is not possible to separate parent's leisure time, parent's time spent on caring for child, and time spent on other household activities
- Finally, children's obesity status is expressed as a function of child care inputs, food inputs, household characteristics, and child-specific endowments

Childhood Obesity

# Early Childhood Longitudinal Study - Birth Cohort

- The data are drawn from the Early Childhood Longitudinal Study - Birth Cohort (ECLS-B), sponsored by the U.S. Department of Education
- The cohort is a nationally representative sample of 10,688 children born in the U.S. in 2001, with oversampling from among some minority racial and ethnic groups, twins, and low birth weight children
- We use data from four waves - 9-month, 2-year, preschool, and kindergarten entry in 2006-2007
- A fifth wave was conducted to collect information from children who were born later in 2001 and entered kindergarten in 2007-2008, and from children who repeated kindergarten. We exclude data from the fifth wave given its selective nature
- In the first round, 821 twin pairs were surveyed. Preliminary analysis shows that in around 12% pairs, one child was obese while the twin counterpart was not. This provides an opportunity to specifically study role of differences in food choices in explaining childhood obesity

# Household Types

- We separately analyze two-parent and one-parent households due to inherent differences with regards to time and income

- We limit analysis to households with at least one biological parent in our study, which is the majority of the sample (over 99% in the first round of surveys)

- 'Parent' in two-parent households is the residential mother, and in one-parent households is the biological residential parent

- The father was the single parent in about 0.13% of the one-parent households in the first round of surveys. In more than 95% of the two-parent households the respondent parent was the residential mother

- There were 8,384 two-parent households and 2,221 one-parent households in wave 1

- Consistent with past findings and as expected, the average permanent income of two-parent households was significantly higher compared to one-parent households ($60,421.3 versus $26,002.7)

## Labor Market Participation

| Variables | Two-parent households | One-parent households |
|---|---|---|
| Full-time work | M:36.78% F:87.14% | 43.03% |
| Part-time work | M:19.36% F:5.00% | 16.07% |
| Out of labor force | M:39.54% F:4.41% | 25.54% |
| Unemployed and looking for work | M:4.32% F:3.45% | 15.36% |
| Number of cross-sectional observations | 29,536 | 8,032 |

Note: In 51.57% two-parent households both parents worked, either full-time or part-time

# Childhood Obesity

- In each round, children's height and weight were measured using a stadiometer and a SECA digital scale, respectively
- Gender-specific percentiles for body mass index-for-age (BMI-age) are calculated using growth charts from the Centers for Disease Control and Prevention
- Overall, obesity rates are significantly different across household types in waves 2, 3, and 4, with higher prevalence of childhood obesity in one-parent households (18.3% compared to 14.7% in two-parent households)

## Obesity Across Waves

| | Obesity status across cross-sections | | | |
|---|---|---|---|---|
| Obesity status | Wave 1 | Wave 2 | Wave 3 | Wave 4 |
| Not obese | 85.33 | 83.79 | 84.13 | 84.64 |
| Obese | 14.67 | 16.21 | 15.87 | 15.36 |
| Total | 9,829 | 8,224 | 8,299 | 6,596 |
| | Change in obesity status, t-1→ t | | | |
| Change in obesity | | Wave 1 to | Wave 2 to | Wave 3 to |
| status | | Wave 2 | Wave 3 | Wave 4 |
| Not obese → Not obese | | 74.80 | 74.46 | 79.55 |
| Not obese → Obese | | 10.67 | 9.45 | 4.62 |
| Obese → Not obese | | 9.11 | 9.38 | 5.19 |
| Obese → Obese | | 5.43 | 6.71 | 10.65 |
| Total | | 7,808 | 7,154 | 6,341 |

## Child Care Environment

- Child care settings are classified as parental care, relative care, non-relative care, and center care in waves 1 and 2
- Head Start is an additional option in waves 3 and 4
- Parents may continue to use child care services even as children enter kindergarten as wrap-around care. Almost equal percentages of children from either household type entered kindergarten in wave 4 - around 74%
- Non-parental care may be paid or unpaid, and parents may use any combination of care arrangements
- The amount of time spent in care arrangements and in kindergarten is measured in number of hours per week. Parental care is then calculated as total number of hours spent in any non-parental care setting or in kindergarten subtracted from the total number of hours in a week

# Child Care Use

- In waves 1 and 2, parental care was more common in two-parent households, while relative care and center care were more common among one-parent households

- Higher percentages of children from one-parent households entered Head Start in waves 3 and 4



**Use of different care settings: Two-parent households**



**Use of different care settings: One-parent households**
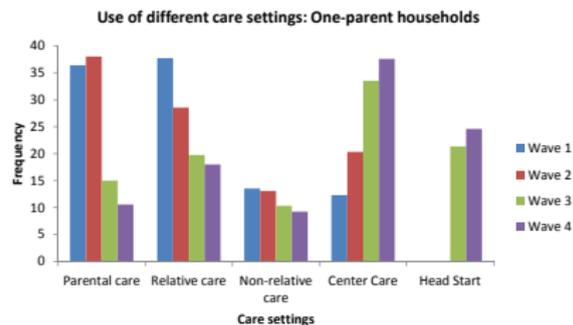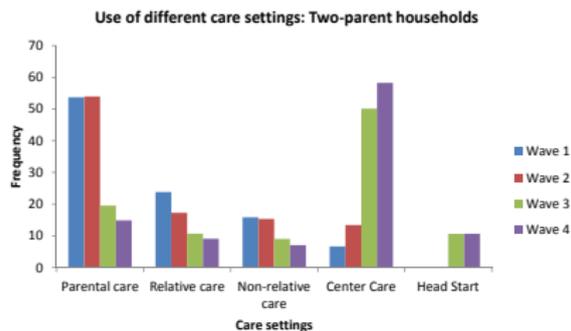
# Child Care Expenditure and Time Spent in Care

| Characteristic | Two-parent household | One-parent household |
|---|---|---|
| Average cost/hour: center care | $4.93/hr | $2.86/hr |
| Average cost/hour: Head Start | $1.60/hr | $1.33/hr |
| Time in any paid care, hours/week (Waves 1-3) | 30.7 hr/week | 39.1 hr/week |
| Time in any unpaid care, hours/week (Waves 1-3) | 26.7 hr/week | 33.6 hr/week |

- Two-parent households spent approximately $462 per week on center care or 9% of their monthly earnings, on average

- One-parent households spent approximately $354 per week on center care or 16% of their monthly earnings, on average

## Food Environment

- Beginning wave 3 parents reported children's frequency of consumption of milk, fruit juice, soda, fruits, vegetables, salty snacks, sweet snacks, and fast food in past week

- Responses were categorized into never in past seven days, 1-3 times in past seven days, 4-6 times in past seven days, once/day, twice/day, thrice/day, and four or more times per day

- Statistically significant difference in consumption of soda, fastfood, vegetables, juice, salty snacks, and milk was noted among children between one-parent and two-parent households

- Children from two-parent households consumed less soda, fastfood, vegetables, and juice

- Children from two-parent households consumed more milk

## State-level Data

There are various endogenous or 'jointly dependent' variables. We include
multiple state-level characteristics for identification

| Economic Indicators | Definition | Mean (SD) or % |
| --- | --- | --- |
| Wage | Average hourly wage rate from 2001-2007 in 2001 dollars | 8.69 (0.75) |
| Unemployment rate | Rate of unemployment from 2001-2007 | 5.17 (1.14) |
| TANF eligibility | Maximum earnings an applicant can retain and still be eligible for Temporary Assistance for Needy Families (TANF) from 2001 to 2007 ($/month) | 734.07 (300.50) |
| Non-employer business | Number of non-employer child care business establishments per thousand children, as of 2002 | 32.17 (14.31) |

| Tax credits | Definition | Mean (SD) or % |
|---|---|---|
| Full or partial refundable credits | If state offered a refundable child care credit or a credit that was refundable for at least low-income families, as of 2004 | 31.97% |
| Non-refundable tax credits | If state offered child care credits that were non-refundable, as of 2004 | 16.28% |
| Deductions | If state offered a deduction on child care expenses, as of 2004 | 2.78% |

| Food related variables | Definition | Mean (SD) or % |
|---|---|---|
| Menu posted - child care centers | Regulation regarding menus in child care centers be posted or made available to parents, as of 2007 | 78.45% |
| Menu posted - family child care homes | Regulation regarding menus in family child care homes be posted or made available to parents, as of 2007 | 41.27% |
| Food menu - child care centers | Regulation regarding menus in child care centers reflect the food served, as of 2007 | 31.56% |
| Food menu - family child care homes | Regulation regarding menus in family child care homes reflect the food served, as of 2007 | 40.67% |

| Other child care variables | Definition | Mean (SD) or % |
|---|---|---|
| Screen time - child care centers | Regulation regarding television and other screen time in child care centers, as of 2007 | 33.34% |
| Screen time - family child care homes | Regulation regarding television and other screen time in family child care homes, as of 2007 | 22.66% |
| Children-to-staff ratio | Number of children per staff member, as of 2005 | 8.77 (4.09) |
| Minimum education | If state-level minimum education requirement for lead/master teacher in a center was at least a High School Diploma or GED, as of 2007 | 28.30% |
| Minimum training | Number of annual on-going training requirement for lead/master teacher in a center, as of 2007 | 12.97 (7.62) |

# Child Care Price

- We only observe child care expenditure when parents choose to use paid care services
- We do observe child care expenditure even among non-working parents
- Our model assumes that employment and use of paid child care services are decided simultaneously
- This requires predicting market price of paid care
- We use a system of simultaneous equations - whether parent worked (probit model), whether parent used paid care (probit model), and child care expenditure if observed (selection model)

# Use of Paid Care and Food Choices

- Using predicted price of child care, observed average state-level wages, household permanent income, and other covariates, we estimate the joint demand for paid care and unpaid non-parental care
- Bivariate tobit models jointly estimate the demand for the two types of care, and account for correlated errors
- We, then, use fixed effects regression models to examine food consumption patterns across care settings, controlling for food prices
- External data on food prices were obtained from the American Chamber of Commerce Researchers Association (ACCRA) Cost of Living Index reports, 2005 to 2007

# Childhood Obesity

- We estimate (1) the effect of child care inputs, (2) the effect of food inputs, and (3) the joint effect of child care and food inputs on childhood obesity
- We use fixed effects logit models to control for individual-specific unobserved heterogeneity
- We conduct sensitivity analysis with alternative specifications of child care inputs
- Finally, we use twins' data to estimate the effect of difference in food choices on difference in obesity status between twins
- Using twins' data controls for both household-specific and sibling-specific unobserved heterogeneity

# Child Care Choices in Two-parent Households

Coefficients (*t*-statistics) from bivariate tobit models

| Variables | Hrs/wk in paid care | Hrs/wk in unpaid non-parental care |
| --- | --- | --- |
| *Two-parent households:* | | |
| Predicted price of child care | -6.006 (-28.68)*** | 0.781 (3.04)*** |
| State-level wage rate | 4.658 (8.29)*** | -1.562 (-2.50)** |
| Log (permanent income) | 14.443 (23.84)*** | -6.210 (-8.30)*** |
| Correlation in bivariate model | -0.829 (-26.39)*** | |

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Note: Clustered robust standard errors estimated.

# Child Care Choices in One-parent Households

Coefficients (*t*-statistics) from bivariate tobit models

| Variables | Hrs/wk in paid care | Hrs/wk in unpaid non-parental care |
|---|---|---|
| *One-parent households:* | | |
| Predicted price of child care | -7.010 (-12.02)*** | 2.485 (4.59)*** |
| State-level wage rate | 4.517 (4.45)*** | -2.890 (-2.86)*** |
| Log (permanent income) | 10.609 (11.45)*** | -1.425 (-1.43) |
| Correlation in bivariate model | -0.800 (-11.79)*** | |

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Note: Clustered robust standard errors estimated.

# Child Care Choices

- Price of child care is negatively related to the quantity of time spent in paid care in both household types
- Price of child care is positively related to the quantity of time spent in unpaid non-parental care
- Higher wages and higher permanent income imply relatively more time in paid care and less time in unpaid non-parental care compared to parental care
- The bivariate model indicates significant negative correlation between the errors, which implies use of paid care and unpaid non-parental care are decided simultaneously

# Food Choices in Two-parent households

- Higher percentage of time in relative care (paid or unpaid) is associated with higher consumption of soda

- Higher percentages of time in paid relative care, paid non-relative care, both paid and unpaid center care, and unpaid Head Start are associated with lower consumption of fast-food

- Children in kindergarten also consume less fast-food and juice

- Children who spend a significant amount of time in paid center care consume more milk and less salty snacks, while those in unpaid non-relative care consume more sweet and salty snacks

- Children who spend a lot of time in paid relative care consume more sweet snacks and milk

- We do not find differences in consumption of fruits or vegetables across care settings

- All comparisons are with respect to percentage of time in parental care

# Food Choices in One-parent households

- Vegetable consumption is higher among children who spend relatively longer time in paid center care

- Fast-food consumption frequency is lower in unpaid center care and in kindergarten, and is marginally higher in paid relative care

- Soda consumption is higher among children who spend relatively longer time in unpaid non-relative care

- Sweet and salty snacks are consumed less frequently with longer duration of time in unpaid Head Start

- Salty snacks are also consumed less frequently when children spend a longer duration in paid center care, while higher frequency of consumption is associated with longer duration of time spent in unpaid relative care

- All comparisons are with respect to percentage of time in parental care

# Food Choices - Summary

- Overall, the $R^2$ values are quite low in these models
- Food choices were observed for an average week as an aggregate measure combining all environments - whether at home or in care setting(s) or in kindergarten
- Thus, even if a care setting strictly regulates the consumption of, say sweet snacks, a child could snack more outside of the care setting and the positive effect of that particular care environment would be diluted
- In most models, fixed effects are important

## Childhood Obesity as a Function of Time in Different Care Settings

Odds-ratios ($t$-statistics) from fixed effects models

| Variables | Waves 1-3 | Waves 3-4 |
|---|---|---|
| *Two-parent households:* | | |
| Hrs/wk in paid care | 0.994 (-2.25)** | 0.996 (-0.66) |
| Hrs/wk in unpaid | 1.001 (0.49) | 0.991 (-1.38) |
| non-parental care | | |
| Pseudo $R^2$ | 0.004 | 0.020 |
| *One-parent households:* | | |
| Hrs/wk in paid care | 0.998 (-0.46) | 0.993 (-0.60) |
| Hrs/wk in unpaid | 1.004 (1.01) | 0.993 (-0.83) |
| non-parental care | | |
| Pseudo $R^2$ | 0.008 | 0.014 |

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Note: Robust standard errors estimated. Covariates include number of children in the household, urban area residency, parent's age and education (spouse's age and education included in two-parent households), logarithm of permanent income, race and ethnicity, and if child was breastfed.

### Childhood Obesity as a Function of Food Environment

Odds-ratios (*t*-statistics) from fixed effects models

| Variables | Two-parent households | One-parent households |
|---|---|---|
| Soda | 1.095 (1.40) | 1.088 (0.79) |
| Fastfood | 1.116 (1.19) | 1.359 (1.92)* |
| Juice | 1.197 (3.02)*** | 0.864 (-1.29) |
| Sweet snacks | 0.069 (-0.48) | 0.893 (-0.89) |
| Salty snacks | 1.025 (0.35) | 1.107 (0.78) |
| Milk | 0.967 (-0.51) | 0.908 (-0.85) |
| Fruits | 1.073 (1.00) | 0.938 (-0.53) |
| Vegetables | 0.886 (-1.71)* | 0.840 (-1.47) |
| Pseudo $R^2$ | 0.043 | 0.095 |

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Note: Robust standard errors estimated. Covariates include number of children in the household, urban area residency, parent's age and education (spouse's age and education included in two-parent households), logarithm of permanent income, race and ethnicity, and if child was breastfed.

## Childhood Obesity as a Function of Child Care and Food Environments

- Outcomes are quite robust even when we analyze the joint effect of child care and food environments
- Additionally, the effect of food consumption patterns remains unchanged under alternate specifications of child care environment
- We test two alternate specifications - (1) indicator values for most used child care type, and (2) percentage of time spent in different care types
- In the first alternate specification, unpaid relative care and paid center care uses are associated with lower rates of childhood obesity in two-parent households. Parental care is the comparison category
- In the second alternate specification, longer duration in unpaid Head Start, in paid center care, and in kindergarten are associated with lower prevalence of childhood obesity in two-parent households. Percentage of time in parental care is the comparison category
- Child care environment do not predict childhood obesity in one-parent households

## Childhood Obesity as a Function of Food Environment - Twins' Data

Difference in obesity status due to difference in nutritional intake - Odds-Ratios
($t$-statistics in parentheses)

| Variables | Identical twins | Non-identical twins |
|-----------|-----------------|---------------------|
| Soda | 1.525 (0.81) | 0.936 (-0.33) |
| Fastfood | 1.242 (0.24) | 0.757 (-0.93) |
| Juice | 0.554 (-1.26) | 1.431 (2.00)** |
| Sweet snacks | 1.962 (1.35) | 0.819 (-0.81) |
| Salty snacks | 0.956 (-0.09) | 1.403 (1.44) |
| Milk | 1.878 (1.13) | 1.252 (1.33) |
| Fruits | 0.769 (-0.66) | 0.984 (-0.08) |
| Vegetables | 1.247 (0.44) | 0.609 (-2.35)** |
| Number of twin pairs | 141 | 279 |

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Note: Covariates include child's birth weight, and square of birth weight. Dependent variable is coded as 1 if one child is obese and other is not within a twin-pair, and it is coded as 0 if either both are obese or neither is obese.

# Conclusion

- We apply fixed effects logit models to account for unobserved heterogeneity and obtain consistent and unbiased estimates in analyzing prevalence of obesity among young children
- First, we show that with the increase in price of paid care, parents switch to unpaid care settings
- This is a key finding, since we then show that significant associations exists between care settings and frequency of consumption certain food items among pre-school and kindergarten age children
- Also, as expected, with increase in wages and income, use of paid care increases while use of unpaid care decreases
- Food environment has higher explanatory power than child care environment
- Higher consumption of juice in two-parent households and fastfood in one-parent households increase likelihood of childhood obesity

# Key Policy Implication

**Subsidies for and greater access to formal child care settings are likely to improve children's food consumption patterns and weight outcomes**

# Future Research

- Focus on households with working mothers and dual earners
- Redefine care setting categories as center care, Head Start, non-relative care, paid and unpaid relative care, and parental care to directly analyze the role of subsidies