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Child and Adolescent Obesity and Employment Sector in Urban China

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Abstract

Despite its importance as a part of the economic reform in China, sectoral employment has been overlooked as a potential determinant of child and adolescent obesity (CAO). Using large-scale longitudinal data from surveys conducted from 1989 to 2006, this paper examines the relationship between the sector in which a parent is employed and CAO, with the sector being based on ownership and categorised as either state or non-state. Analyses of over 1,700 children and adolescents show that children and adolescents whose parents work in the state sector are less likely to be obese. Patterns of sectoral employment's effect are robust across time periods, in fixed-effects models, and across multiple measures of obesity. Additionally, the paper shows that socioeconomic characteristics of the parent, such as income, education, and occupation, typically thought to be important predictors of CAO, are not as important when the parental working sector is included in the models.

Keywords

Urban China; Child and adolescent obesity; Sectoral employment; Socioeconomic status

Introduction

Child and adolescent obesity (CAO) in China is reaching epidemic proportions (Bradsley, 2011; Wang, Monteiro, & Popkin, 2002). While social and demographic research in general has been slow to respond to this phenomenon, the work that has been done up to this point has almost exclusively focused on parental socioeconomic status (SES) as being the key correlate of CAO in China (Cui, Huxley, Wu, & Dibley, 2010; Li, Dibley, Sibbritt, & Yan, 2008; Luo & Hu, 2002; Wang, 2001). Other potential associated factors have received less attention. The current paper focuses on sectoral employment within urban China, defined as working in the state or non-state sectors. Given previous difficulties in defining obesity, the analysis adopts multiple measures. It also tests potential mechanisms that could intervene between parental sectoral employment and CAO. The analysis is conducted using a large-scale longitudinal panel dataset covering 1989 to 2006, which allows for more confidence in identifying causal connections than is possible using cross-sectional data.

Over the last couple of decades, as China's economy changed from a socialist to a more open-market structure, one's sector of employment concomitantly became a critical factor that defined social life (Lin & Bian, 1991). The impact that the employment sector has had on people's lives have been shown in a number of ways. Studies in China, for instance, have

indicated that the sector in which an individual is employed has a powerful role in determining their living conditions (Lin & Bian, 1991; Peng, 1992; Xie & Wu, 2008; Zhou, 2000). Moreover, recent studies have demonstrated a strong link between employment sector and adult health outcomes (Nishimura, 2011; Zhang, 2011). Given these robust associations and the rising significance of employment sector within the social framework of Chinese economic and family structures, it is reasonable to ask whether associations could filter across generations. Indeed, research in the West has implicated employment characteristics of parents as factors that directly impact CAO, although the notion has been little tested elsewhere (Anderson, 2011). The current study expands the examination of health and behavioural factors associated with the employment sector in China to the children of both state and non-state employees.

Background

Social Factors Affecting CAO

The contribution of demographic and other social science literature to CAO has been largely through its concentration on social forces that influence familial behaviours such as maternal employment and socioeconomic status (SES). Maternal employment has primarily been measured by working hours and full- versus part-time status. Full-time status has been identified as a factor increasing the probability of CAO, particularly for high-SES groups. The mechanism suggested is that unhealthy behaviours are more prominent among children whose parents work long hours. These children are more likely to be inactive, spend long hours watching television, consume snacks and sweetened beverages, but not sufficient fruits and vegetables (Anderson, Butcher, & Levine, 2003; Hawkins, Cole, Law, & The Millennium Cohort Study Child Health Group, 2008; Phipps, Lethbridge, & Burton, 2006; Ruhm, 2008). Moreover, Anderson's (2011) recent review focusing on developed countries suggests that working mothers who spend less time with their children than those not working are more likely to choose 'convenient' foods for their children.

Parental SES has been shown to influence CAO mainly in two ways (Martin, 2008). The first is that poor behavioural habits that are common among adolescents living in low-SES families, such as the consumption of calorie-dense, nutrient-poor foods and lack of physical activity (Drewnowski & Specter, 2004; Guillaume, Lapidus, Björntorp, & Lambert, 1997). The second revolves around psychosocial impacts such as acute and chronic stress, depressive moods, psychosocial strain, and health-related knowledge (Björntorp, 2001; Goodman, Slap, & Huang, 2003; Link, Northridge, Phelan, & Ganz, 1998).

Past research on CAO in China has mainly focused on impacts of income and maternal education (Cui et al., 2010; Li et al., 2008; Luo & Hu, 2002; Wang, 2001). Results have generally shown higher income and maternal education to be associated with higher risk of obesity. But the literature is inconsistent. For example, He, Ding, Fong, and Karlberg (2000) found no significance association between family income or maternal education and CAO. It is possible that inconsistencies are a function of omitted variables that may be working upon the SES-CAO association. Sectoral employment in China is categorised as either in the state or non-state sectors. The state sector consists of government agencies, institutes and state-owned enterprises. The non-state sector comprises collective organisations, which are small and medium-sized firms owned by workers and controlled by local government and market establishments. The latter is also represented by other important types of ownership such as foreign-invested and joint ventures in addition to those that are privately owned. Sectoral employment is likely to be important in determining a variety of health outcomes, particularly in urban China since it is associated with multifold work and non-work characteristics including work environment, time and resources available to adults,

behaviours and psychological characteristics (M.-S. Chen & Chan, 2010; Nishimura, 2011; Zhang, 2011).

Sectoral Employment and Its Potential Association with CAO in Urban China

Parental employment has been linked to CAO in Western settings (Anderson, 2011). But China's employment sector takes on a very different form, which is a function of market reforms that have been ongoing for several decades. One of the goals of these reforms is to strengthen the competitiveness of state-owned enterprises and hence, policies have been implemented which aimed at improving the performance of those enterprises (Perkins, 1996; Xu, Pan, Wu, & Yim, 2006). With respect to the other major component of the state sector—government agencies—policies are aimed at making them more streamlined and efficient so that they can be easily adapted to the market system. As for the non-state sector, the government started to implement policies which promoted the non-state sector in the late 1970s. By 1999, a constitutional change named private firms as 'important constituents of the socialist market economy' (Heberer, 2001). Regarding foreign-invested firms, a Joint Venture Law was enacted in 1979, permitting foreign companies or individuals to join Chinese enterprises. In 1988, the Law on Sino-Foreign Cooperative Enterprises (*zhong wai he zuo qi ye jing ying fa*) was passed. This law offered greater flexibility for cooperation between foreign and Chinese enterprises.

The structure of the employment sectors impacts working individuals and their families in numerous ways. For example, employees in the state sector enjoy certain benefits that non-state sector employees do not. Gu (2001) demonstrated that welfare expenditures in the state sector increased rapidly during reforms. Occupational health and safety systems are better in the state sector (M.-S. Chen & Chan, 2010). The state sector has wider health care coverage (J. Du, 2009; M. Wu, Xin, Wang, & Yu, 2005). Overall, the state provides more benefits for employees. In addition, jobs in the non-state sector tend to be more demanding in terms of working hours and pressures. This may result in stressors on non-state employees, which end up having an impact on parenting styles, filtering down to influence behaviours related to children. Food preparation (Gaina, Sekine, Chandola, Marmot, & Kagamimori, 2009), children's activities (Hawkins et al., 2008) and, time spent with children (Cawley & Liu, 2007) have all been implicated in prior studies. We consider these three pathways as possible mechanisms through which the parental working sector could have an impact on CAO. Moreover, by demonstrating that jobs in the state sector are more stable and provide more benefits than those in the non-state sector, Chen (2009) provides a justification of the link within a parallel context. In her analysis, older parents in the state sector rely less on their children for support than do older parents in the non-state sector, while younger parents in the state sector require less childcare assistance from their older parents than do their counterparts.

Given these differences, sectoral employment may be implicated in influencing parenting behaviour equally or more so than the more commonly considered characteristic, SES. Consider, for instance, two families that earn the same amount of money. The parents of one of the families work in the state sector and the parents of the other in the non-state sector. Even with the same level of income, the two families are very likely to have different circumstances affecting their families and surrounding their parenting. Building on Anderson's (2011) argument, differences in demands may mean that state-sector employees are under less stress and are able to spend more time with their children. Parents who work in the non-state sector may spend the same amount of money on food but due to time demands, they may be less likely to have the time to monitor the behaviour and activities of their children. As such, we can hypothesise that it would be non-state-sector employees whose children would be more likely to be obese.

An additional issue that needs to be considered is one of selection. Better welfare (health insurance, etc.) implemented by the state is attractive to the general population. Therefore, there could be selection effects that influence both the sector in which parents choose to work and their parenting style, and CAO could differ across sectors due to factors that determine where people tend to locate themselves. For instance, Wu and Xie (2003) show that late entrants, or individuals who moved from the state to the non-state sector long after reforms, and early birds, or individuals who moved soon after the reform, differ in terms of education and income. The current study adopts a model that accounts for some of the potential selection effects.

Data, Measures, and Method

Data

The data examined in this study come from the China Health and Nutrition Survey (CHNS), a longitudinal ongoing survey with data collection that began in 1989. Additional data were collected in waves in 1991, 1993, 1997, 2000, 2004, and 2006. In each province, a multistage, random cluster strategy was used to draw the sample. Although the provinces were not randomly selected, they were purposively drawn in a way such that they represented a diverse range of levels of economic development, health conditions and non-public resources. Within provinces, the sample was collected within the provincial capital as well as in lower-income cities and rural areas. Urban/suburban neighbourhoods within the cities were randomly selected (more detailed information about the CHNS can be found at: <http://www.cpc.unc.edu/projects/china>). Although it is not a random sample of the Chinese population, the CHNS sample is comparable to those of national samples in terms of the characteristics of households and individuals (S. Du, Lu, Zhai, & Popkin, 2002; Entwisle & Chen, 2002; Short, Ma, & Yu, 2000).

There are two advantages of using the CHNS for the current study: (1) The longitudinal character of the data, which is in contrast to most past studies of this nature. Measures are more accurate, more reliable, and have inherently fewer errors than is the case when questions are asked retrospectively. Moreover, longitudinal data are more suitable for making casual inferences and capturing time trends than are cross-sectional data. (2) Besides being longitudinal, the data both cover a long period of time and offer very recent information. This time frame of the CHNS provides data both before and after changes in the state sector.

The study population is children aged 2 to 18 years who live in a city, town or county capital city and have information from at least one parent. We begin with the 1989 data and follow those cases forward in time. Since households are monitored, and new households enter the CHNS data over time, children can enter the survey at later waves if they are between the ages of 2 to 18. Conceptually, they leave the analysis when they are over the age of 18. The longitudinal sample consists of 1,778 children and adolescents, which make up 3,685 observations in total when all the observations are counted over time.

To look at whether being ever lost to follow-up is associated with the variables of interest in our models, we ran a logistic regression. The results (available upon request) show that younger children and higher income groups are more likely to be lost to follow-up. Our key variable, the parental employment sector, is not associated with being lost to follow-up.

Measures

Child and Adolescent Obesity—In the CHNS, trained nutritionists measure weight and height, which are then used to calculate the Body Mass Index (BMI) of an individual. BMI is defined as a person's weight divided by the square of his or her height. However, a

challenge in measuring CAO is a lack of universal cut-off points of BMI for children and adolescents since BMI varies with age and sex and across populations. Therefore, to capture a broad range of possible CAO criteria we employ three age-sex-specific measures. The first is an external measure established by The International Obesity Task Force (IOTF) (Cole, Bellizzi, Flegal, & Dietz, 2000). Although the IOTF criterion makes international comparisons feasible, there are still noticeable differences across populations. For instance, compared to European and American populations, health risks are higher at lower BMI levels among Asian populations. This suggests a different set of cut-off points may be more suitable for Asians than others (WHO Expert Consultation, 2004). Thus, a second is an external criterion from the Working Group on Obesity in China (WGOC). These cut-off points are based on 216,620 Chinese primary and secondary school students aged 7 to 18 years (Ji, Cooperative Study on Childhood Obesity, & Working Group on Obesity in China, 2005). Because of the relatively narrow age range of this criterion, the sample size is smaller—1,502 children and adolescents and 2,685 observations. This turns out to be insufficient data for the fixed-effects models which are discussed below. The third measure, which is internal, is a sample-based measure. If BMI is equal or greater than the 95th percentile for the age-sex-specific growth chart obtained from the sample, the child or adolescent is considered obese.

Table 1 presents the prevalence of CAO by parental employment sector by waves, showing cross-sectional prevalence. Overall, CAO is more prevalent in the non-state sector than in the state sector over time. According to the IOTF definition, the state sector has lower prevalence with the exception of two waves—1989 and 1997. According to the WGOC definition, the prevalence in the non-state sector is always higher. The similar conclusion can be made for the 95th percentile criterion with one wave exception—1989. Within both sectors, the prevalence of CAO increases over time. The sample size for 1989 is smaller because in 1989, only children younger than 9 years of age were surveyed due to funding limitations. The study follows a typical procedure in anthropometry to delete abnormal observations. That is, standardised BMIs with z scores greater than 5 or lower than -5 are deleted from the data. These outliers are likely caused by errors in recording measurements.

Parental Labour Sector and SES—The state sector consists of state enterprises, state institutes, governmental units, government departments and state services. The non-state sector includes the collective and market sectors. The collective sector is defined as enterprises in which individuals are working in small or large collective units. The market sector includes private, individual, joint ventures, 'three source invested enterprise' (*san zi qi ye*, which are three types of direct foreign investments, namely joint ventures, cooperative enterprises, and wholly foreign-owned firms), household businesses and private/individual enterprises. If one is self-employed, an owner-manager with employees or independent operator with no employees, the sector of employment is categorised as non-state. There are no families where both parents are unemployed in the data.

There are three categories of parental education: 1) primary school or below; 2) high school; 3) college or higher. Occupations are grouped into: 1) administrator/executive/manager, army officer and police officer; 2) senior and junior professional/technical personnel; 3) worker and office staff; 4) other. It is worth noting that in the non-state sector, many parents do not indicate specific jobs and choose to state their occupation as 'other' instead. We find that most of these parents are actually self-employed. So we consider this a separate occupation group in the descriptive analysis in Table 2 but not in the later regressions.

A sum of wage, bonus, subsidies and other monetary income is used to construct total income. Total income has been standardised according to the inflation index of 2006 in order to be comparable across waves. The overall percentage of missing responses is 3.3%.

There are four groups for total income, which were divided so that the distributions were more or less equal: 1) less than 3,000 yuan; 2) between 3,000 and 10,000 yuan; 3) more than 10,000 yuan and 4) missing responses.

Parental employment sector is coded as 'state' in the models if any parent works in the state sector. For education, occupation and parental BMI (for normalisation purposes, the natural log of parental BMI is taken), using father's or mother's information as primary parental values yields very similar results. Some previous studies suggest paternal effects are not as important as are maternal effects (Gaina et al., 2009). We present results based on mother's information. For total income, we first take the mean income of both parents when data for two parents are available to avoid the potential influence of outlier values of one parent. When the data are available for only one parent, their income becomes the parental income.

Child's Diet, Physical Activity and Childcare—While some measures are not available through every wave and therefore are left out of the regressions, they may still facilitate the exploration of possible mechanisms through which parents may influence CAO. The first is children's dietary energy intake, which consists of carbohydrate, fat, and protein. These are the three primary macronutrients for humans. A 3-day average intake is calculated from foods consumed during the CHNS Diet Survey. The second measure is the level of children's physical activity. The CHNS only started collecting this information in 1997. The numerical responses to three questions regarding physical exercises are summed to construct a physical activity index. The first question asks children if they usually do physical exercise; the second asks if they are in physical education class in school; and the third asks if they are involved in 'coached' exercises before/after school. All three questions are scored 1 or 0 with 1 indicating 'yes'. It is considered that the higher the value, the more the child participates in physical activity. Childcare is the third measure, which is a composite of two questions for both fathers and mothers: 'did you take care of the children in your household last week?', and 'how many hours were spent?' The CHNS changed these questions in 2000 for parents that had children under 6 years of age.

Additional Covariates—Considering that family instability may influence child health, we measure it using a dichotomous variable. If parents are divorced, separated, or widowed, the child is considered to be living in an unstable family. Finally, the provinces are grouped into three regions: north, middle and south. North consists of Liaoning, Heilongjiang, Henan, and Shandong; middle consists of Jiangsu, Hubei and Hunan; south consists of Guangxi and Guizhou. Table 2 presents descriptive statistics for all the variables of interest.

Analytical Strategy

A Generalized Estimating Equation (GEE) (Liang & Zeger, 1986) is used to assess effects of the variables of interest on CAO which is a dichotomous variable with 1 indicating that an individual is obese and 0 otherwise. GEE accommodates binary outcomes and accounts for correlations within repeated measures. Two levels of correlations will be addressed. The first is within-person and the second is within-community.

Equation (1) describes the basic structure of the model:

$$\log \frac{p_{ijt}}{1 - p_{ijt}} = \alpha_0 + \beta X_{ijt} \quad (1)$$

In equation (1), p_{ijt} is the probability of being obese for child i in community j at time t ; X_{ijt} are variables of interest for child i in community j at time t .

To address the issue of endogeneity, a logistic fixed-effects model is employed to control for the unobserved characteristics of parents that act as confounding variables on both the selection of employment sector and parenting style. Standard errors are adjusted for correlations within the communities. Sample sizes for the fixed-effects models are smaller than those of the GEE models because of the exclusion of cases where no variations exist in the outcome variable. Equation (1) also describes the basic structure of the fixed-effects model with the only difference being that the fixed-effects model involves only the time-varying variables. To test the issue of heterogeneity shown by Wu and Xie (2003), interaction terms between time and employment sector are added to the models.

Results

Generalized Estimating Equation (GEE) Models

Three sets of models are shown in Table 3, distinguished by the criteria of CAO. Across these three sets of models, four models are presented with identical structures. Model 1 includes parental employment sector and controls including sex, log parental BMI, family stability, period, and region. Model 2 adds parental education, occupation and income. Model 3 adds an interaction term between the parental employment sector and period when the parents joined the sector. Finally, the child's diet—one potential mechanism explaining the association of parental employment sector and obesity—is entered in Model 4.

The patterns of the variables of interest across three sets of models are remarkably similar. First, the effect of parental employment sector is identical. In all of the models labelled as 'Model 1', children of non-state sector parents are more likely to be categorised as obese. In all of the models labelled as 'Model 2' where parental education, occupation and income are added, the effect of the parental employment sector remains robust. Even when the child's diet is taken into consideration, the effect of the parental employment sector does not disappear. For parental occupation, none of the jobs have an impact on CAO. Children with parents who have elementary education or less are least likely to be obese. But, when the child's diet is added to the model, this effect can become non-significant (Model 4, the IOTF definition criterion). None of the interactions between parental employment sector and period when the parents joined the sector is significant and no evidence supports that the timing of when the parents enter the different employment sectors matters.

Results indicate there are other important factors that are associated with CAO. Higher parental BMI is associated with a higher likelihood of CAO. The 1989 to 1993 period generally carries a lower risk of obesity compared to the later period from 1997 to 2006. Children from the middle and southern regions are less likely to be categorised as obese than those from the north.

A number of complex factors may also be influencing the results. Parental BMI may be associated with factors that influence the weight of the whole family (Gronniger, 2005). Period effects can be confounded with cohort effects and the level of economic development at different stages of the economic reform. Regional effects are associated with regional differences in levels of economic development and diets. While we are therefore confident that our findings represent robust associations, we are somewhat more cautious about affirming causality.

Fixed-Effects Models

Table 4 reports the results of the logistic fixed-effects models. Only the IOTF definition and 95th percentile criterion are considered as dependent variables because the WGOC definition applies to children aged 7 to 18 years and the sample size for this criterion is too small to be

analysed in this fashion. Model 1 considers the parental employment sector and controls while Model 2 adds parental SES and Model 3 includes the child's diet.

In both models labelled as 'Model 1', the effect of the parental employment sector is significant. If a parent works in the non-state sector, their children are more likely to be classified as obese. When parental SES measures and the child's diet, are entered into the models, the effect of the parental employment sector on CAO is even greater. Parental SES measures are not significant except for parental education (Model 2, the 95th percentile definition). These patterns are largely consistent with associations found in the earlier GEE models.

Other Possible Mechanisms

Our results thus far are consistent with the notion of a link and potentially, a causal connection between parental sectoral employment and CAO. Earlier, a number of factors were outline as potential mechanisms through which employment sector might influence CAO. We consider three of these—child's diet, childcare and physical activity. These possible mechanisms were not directly introduced into the regression. For one, the child's diet does not explain much of the difference between sectors. The other two factors have too many missing values or were not asked until later waves. Therefore, Tables 5 and 6 are meant to suggest some possible ways in which parental employment sector might affect CAO. They are presented mostly to provide impetus for further analysis.

In the upper panel of Table 5, childcare by the father is reported. The proportions of fathers who took care of their children are generally higher in the state sector from 1989 to 1997. The sample sizes in 2004 and 2006 are fairly small and show opposite trends—fathers in the non-state sector seem to take care of the children more. Regarding the number of hours spent on childcare, fathers working in the state sector on average spend more time taking care of children, particularly in 1989 and 1997, although all seven waves have large standard deviations. The lower panel of Table 5 presents the results for mothers. Although the proportions of mothers who took care of their children are generally higher in the state sector, in the 1991, 2000, 2004, and 2006 waves, there are no significant differences between the two sectors. The overall trend in hours spent on taking care of children by mothers is similar to the trend for fathers. State sector mothers spend more time with their children than non-state sector mothers with the exception of the 1991 and 2004 waves, but the difference is only significant in 1989.

Table 6 shows physical activity scores by parental employment sector. In all four waves, mean physical activity scores of children of parents working in the state sector are higher than those of parents working in the non-state sector, although the difference between two sectors is significant only in 2004. Therefore, the results of Table 5 and 6 are consistent with the notion that parents in the non-state sector take less care of and spend less time with their children due to heavier demand of their jobs.

Conclusion and Discussion

The current study sought to advance the literature on CAO in China by examining a previously overlooked variable that may have an impact—sectoral employment. China's employment structure is unique and, unlike other countries, whether an individual works in the state or non-state sector is important in determining a number of work and non-work characteristics, including health and health-related behaviours. Moreover, the employment sector may have a substantial influence on people's lives, given the rapid social changes that have taken place in China and the links that exist between employment sector, SES and

psychosocial factors that work upon the family. The study also tested for the possibility of endogeneity among predictors and examined descriptively several possible mechanisms.

Using large-scale longitudinal data, the results are consistent with the notion that children whose parents work in the state sector are much less likely to be obese, across time periods, in fixed-effects models, and across multiple measures of CAO. As for parental SES, most of the effects are insignificant when the sector of employment is considered simultaneously. SES patterns are also unclear, which is consistent with previous studies of CAO in other countries (Martorell, Khan, Hughes, & Grummer-Strawn, 2000).

With respect to possible mechanisms, the effect of the parental employment sector holds when the child's diet is controlled for in regression equations. We need to be cautious here about the interpretation of the results. Essentially, obesity is caused by imbalanced metabolism. Thus, diet is crucial. Carbohydrate, fat and protein do not represent all the elements in a diet that affect obesity. More limited descriptive analysis is carried out on childcare and physical activity. A general pattern that children whose parents work in the state sector receive more care and are more physically active is observed, which suggests that the difference in CAO between the two sectors can be partly attributed to these factors. Due to data limitations, we were unable to consider these variables in our multivariate models and thus suggest that further research is needed to confirm that these associations hold when other factors are adjusted.

It is also important to be cognisant that the social meaning of obesity varies across contexts. Obesity did not become common in Europe until about 200 years ago (Trowell, 1975). Many societies consider fatness to be a good thing because it is a result of having access to sufficient food. Many developing countries including China still value fatness even as food shortage becomes less and less common. Thus, there is the possibility that for parents in China, letting children gain weight is accepted and perhaps even encouraged as a social norm.

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REFERENCES

- Anderson, PM. Maternal employment. In: Cawley, J., editor. *The Oxford handbook of the social science of obesity*. Oxford University Press; New York: 2011.
- Anderson PM, Butcher KF, Levine PB. Maternal employment and overweight children. *Journal of Health Economics*. 2003; 22(3):477–504. [PubMed: 12683963]
- Björntorp P. Do stress reactions cause abdominal obesity and comorbidities? *Obesity Reviews*. 2001; 2(2):73–86. [PubMed: 12119665]
- Bradsley, D. Childhood obesity is on the rise in China. 2011. Retrieved October 12, 2012, from <http://www.thenational.ae/news/world/childhood-obesity-on-the-rise-in-china>
- Cawley, J.; Liu, F. Maternal employment and childhood obesity: A search for mechanisms in time use data. 2007. NBER Working Paper 13600
- Chen F. Family division in China's transitional economy. *Population Studies*. 2009; 63(1):53–69. [PubMed: 19184721]

- Chen M-S, Chan A. Occupational health and safety in China: The case of state-managed enterprises. *International Journal of Health Services*. 2010; 40(1):43–60. [PubMed: 20198803]
- Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal*. 2000; 320(7244):1240–1247. [PubMed: 10797032]
- Cui Z, Huxley R, Wu Y, Dibley MJ. Temporal trends in overweight and obesity of children and adolescents from nine provinces in China from 1991–2006. *International Journal of Pediatric Obesity*. 2010; 5(5):365–374. [PubMed: 20836722]
- Drewnowski A, Specter SE. Poverty and obesity: The role of energy density and energy costs. *American journal of clinical nutrition*. 2004; 79(1):6–16. [PubMed: 14684391]
- Du J. Economic reforms and health insurance in China. *Social Science & Medicine*. 2009; 69(3):387–395. [PubMed: 19520475]
- Du S, Lu B, Zhai F, Popkin BM. A new stage of the nutrition transition in China. *Public Health Nutrition*. 2002; 5(1A):169–174. [PubMed: 12027281]
- Entwisle B, Chen F. Work patterns following a birth in urban and rural China: A longitudinal study. *European Journal of Population*. 2002; 18(2):99–119.
- Gaina A, Sekine M, Chandola T, Marmot M, Kagamimori S. Mother employment status and nutritional patterns in Japanese junior high schoolchildren. *International Journal of Obesity*. 2009; 33(7):753–757. [PubMed: 19528966]
- Goodman E, Slap GB, Huang B. The public health impact of socioeconomic status on adolescent depression and obesity. *American Journal of Public Health*. 2003; 93(11):1844–1850. [PubMed: 14600051]
- Gronniger JT. Familial obesity as a proxy for omitted variables in the obesity-mortality relationship. *Demography*. 2005; 42(4):719–735. [PubMed: 16463918]
- Gu EX. Beyond the property rights approach: Welfare policy and the reform of state-owned enterprises in China. *Development and Change*. 2001; 32(1):129–150.
- Guillaume M, Lapidus L, Björntorp P, Lambert A. Physical activity, obesity, and cardiovascular risk factors in children: The Belgian Luxembourg Child Study II. *Obesity Research*. 1997; 5(6):549–556. [PubMed: 9449139]
- Hawkins SS, Cole TJ, Law C, The Millennium Cohort Study Child Health Group. Maternal employment and early childhood overweight: Findings from the UK Millennium Cohort Study. *International Journal of Obesity*. 2008; 32(1):30–38. [PubMed: 17637703]
- He Q, Ding ZY, Fong DYT, Karlberg J. Risk factors of obesity in preschool children in China: A population-based case-control study. *International Journal of Obesity*. 2000; 24(11):1528–1536. [PubMed: 11126352]
- Heberer, T. Private entrepreneurs in China and Vietnam: social and political functioning of strategic groups. Vol. Vol. 4. Koninklijke Brill NV; Leiden, The Netherlands: 2001.
- Ji C-Y, Cooperative Study on Childhood Obesity, & Working Group on Obesity in China. Report on childhood obesity in China (1) Body mass index reference for screening overweight and obesity in Chinese school-age children. *Biomedical and Environmental Sciences*. 2005; 18(6):390–400. [PubMed: 16544521]
- Li M, Dibley MJ, Sibbritt D, Yan H. Factors associated with adolescents' overweight and obesity at community, school and household levels in Xi'an City, China: Results of hierarchical analysis. *European Journal of Clinical Nutrition*. 2008; 62(5):635–643. [PubMed: 17440524]
- Liang K-Y, Zeger SL. Longitudinal data analysis using generalized linear models. *Biometrika*. 1986; 73(1):13–22.
- Lin N, Bian Y. Getting ahead in urban China. *American Journal of Sociology*. 1991; 97(3):657–688.
- Link BG, Northridge ME, Phelan JC, Ganz ML. Social epidemiology and the fundamental cause concept: On the structuring of effective cancer screens by socioeconomic status. *The Milbank Quarterly*. 1998; 76(3):375–402. [PubMed: 9738168]
- Luo J, Hu FB. Time trends of obesity in pre-school children in China from 1989 to 1997. *International Journal of Obesity and Related Metabolic Disorders*. 2002; 26(4):553–558. [PubMed: 12075583]

- Martorell R, Khan LK, Hughes ML, Grummer-Strawn LM. Overweight and obesity in preschool children from developing countries. *International Journal of Obesity*. 2000; 24(8):959–967. [PubMed: 10951533]
- Nishimura J. Socioeconomic status and depression across Japan, Korea, and China: Exploring the impact of labor market structures. *Social Science & Medicine*. 2011; 73(4):604–614. [PubMed: 21794969]
- Peng Y. Wage determination in rural and urban China: A comparison of public and private industrial sectors. *American Sociological Review*. 1992; 57(2):198–213.
- Perkins FC. Productivity performance and priorities for the reform of China's state-owned enterprises. *Journal of Development Studies*. 1996; 32(3):414–444.
- Phipps SA, Lethbridge L, Burton P. Long-run consequences of parental paid work hours for child overweight status in Canada. *Social Science & Medicine*. 2006; 62(4):977–986. [PubMed: 16099085]
- Ruhm CJ. Maternal employment and adolescent development. *Labour Economics*. 2008; 15(5):958–983. [PubMed: 19830269]
- Short SE, Ma L, Yu W. Birth planning and sterilization in China. *Population Studies*. 2000; 54(3): 279–291. [PubMed: 11640214]
- Trowell H. Obesity in the western world. *Plant Foods for Man*. 1975; 1:157–165.
- Wang Y. Cross-national comparison of childhood obesity: The epidemic and the relationship between obesity and socioeconomic status. *International Journal of Epidemiology*. 2001; 30(5):1129–1136. [PubMed: 11689534]
- Wang Y, Monteiro C, Popkin BM. Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia. *American journal of clinical nutrition*. 2002; 75(6):971–977. [PubMed: 12036801]
- WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *The Lancet*. 2004; 363(9403):157–163.
- Wu M, Xin Y, Wang H, Yu W. Private and public cross-subsidization: Financing Beijing's health-insurance reform. *Health Policy*. 2005; 72(1):41–52. [PubMed: 15760697]
- Wu X, Xie Y. Does the market pay off? Earnings return to education in urban China. *American Sociological Review*. 2003; 68(3):425–442.
- Xie Y, Wu X. Danwei profitability and earnings inequality in urban China. *The China Quarterly*. 2008; 195:558–581. [PubMed: 20445771]
- Xu D, Pan Y, Wu C, Yim B. Performance of domestic and foreign-invested enterprises in China. *Journal of World Business*. 2006; 41(3):261–274.
- Zhang W. The impact of public employment on health and health inequalities: Evidence from China. *International Journal of Health Services*. 2011; 41(4):647–678. [PubMed: 22053527]
- Zhou X. Economic transformation and income inequality in urban China: Evidence from panel data. *American Journal of Sociology*. 2000; 105(4):1135–1174.

Table 1

Prevalence of Child and Adolescent Obesity by Parental Sector and by Wave

CAO Criterion		1989	1991	1993	1997	2000	2004	2006
IOTF Definition	State Sector	1.68	1.05	2.28	3.25	3.28	4.95	7.38
	Non-State Sector	1.10	4.01	3.81	2.42	3.90	6.67	10.97
WGOC Definition	State Sector	0.00 ^a	2.03	1.67	2.59	3.32	4.19	6.92
	Non-State Sector	0.00 ^b	3.82	4.90	4.17	3.70	5.97	10.08
95 th Percentile	State Sector	1.68	2.52	3.30	4.14	4.18	6.93	10.07
	Non-State Sector	1.10	4.01	5.28	4.50	6.06	7.88	12.90
Sample Size for IOTF and 95 th Percentile Criteria								
Number of Observations		210 ^d	876	735	627	566	367	304
Total Observations								3,685
Sample Size for WGOC Criterion								
Number of Observations		5 ^c	606	544	510	460	301	259
Total Observations								2,685

Note:

a, b, c, d IN 1989 the CHNS only surveyed children under the age of 9 due to funding limitations and the WGOC definition applies to the age range 7 to 18 years.

Table 2

Frequency and Mean for Interested Variables by Wave

	1989	1991	1993	1997	2000	2004	2006
Child Age (Mean)	3.90	9.69	10.08	10.58	11.14	11.17	11.44
S.D.	1.52	4.77	4.49	4.27	4.27	4.47	4.33
Child Sex Male	117	465	399	331	301	203	169
Female	93	411	336	296	265	164	135
Parental Sector State sector	119	477	394	338	335	202	149
Non-State sector	91	399	341	289	231	165	155
Parental Education							
Elementary or Below	57	370	258	154	81	39	21
High School	150	485	455	435	430	279	230
College or Higher	3	21	22	38	55	49	53
Parental Occupation							
Administrator etc.	4	47	30	38	35	25	16
Professional	18	75	64	82	101	78	44
Worker	145	504	484	379	344	206	195
Self-employed ^a	18	222	130	96	56	40	37
Others	25	28	27	32	30	18	12
Parental Income							
<3,000 Yuan	139	351	252	92	35	25	17
3,000 to 10,000 Yuan	62	480	415	444	354	140	108
>10,000 Yuan	6	29	55	74	157	165	162
Missing ^b	3	16	13	17	20	37	17
Log Parental BMI (Mean)	3.07	3.10	3.11	3.13	3.14	3.15	3.14
S.D.	0.11	0.11	0.10	0.10	0.11	0.18	0.13
Family Stability Stable	202	832	693	574	500	307	262
Unstable	8	44	42	53	66	60	42
Children's Diet							
Carbohydrate (Mean)	201.52	291.29	281.75	267.18	261.50	251.95	245.03
S.D.	88.25	113.23	114.59	100.18	108.44	100.93	100.87
Fat (Mean)	39.03	56.71	61.20	64.08	72.36	72.18	67.26
S.D.	27.32	31.39	33.40	32.97	37.51	36.73	35.94
Protein (Mean)	40.99	58.71	59.26	58.73	62.00	63.20	59.20
S.D.	16.65	21.39	21.44	21.99	24.83	26.03	24.00
Region							
North	75	300	255	247	250	155	119
Middle	68	336	280	218	171	125	108
South	67	240	200	162	145	87	77
Number of Observations	210	876	735	627	566	367	304
Total Observations							3,685

Note:

^aThis category is separated from the category of 'other occupation' in the non-state sector.

^bThe overall percentage of missing responses for parental income is 3.3% although the percentage of missing varies across the waves.

Table 3

Generalized Estimating Equations Models Predicting Child and Adolescent Obesity: Coefficients of Parental Characteristics and Other Variables

CAO Criterion	IOTF Definition				WGOC Definition				95 th Percentile			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Male (Female)	0.43 *	0.44 *	0.44 *	0.51 *	0.35	0.36	0.37	0.39	-0.01	-0.02	-0.03	-0.04
Parental Sector (State Sector)												
Non-State Sector	0.50 *	0.58 **	0.63 *	0.56 *	0.68 **	0.94 ***	0.77 *	0.93 ***	0.46 **	0.62 ***	0.69 **	0.62 ***
Parental Education (College or Higher)												
Elementary or Below		-1.09 *	-1.09 *	-0.77		-0.97	-0.97	-0.79		-0.42	-0.43	-0.35
High School		-0.30	-0.31	-0.20		-0.05	-0.02	0.02		0.22	0.20	0.24
Parental Occupation (Administrator etc.)												
Professional		0.81	0.82	0.79		0.78	0.74	0.85		0.32	0.33	0.37
Worker		0.27	0.27	0.16		0.71	0.70	0.69		0.33	0.33	0.34
Other		0.50	0.51	0.43		0.99	0.96	0.99		0.55	0.55	0.55
Parental Income (>10,000 Yuan)												
<3,000 Yuan		-0.27	-0.28	-0.28		0.05	0.09	0.14		-0.47	-0.48	-0.41
3,000 to 10,000 Yuan		-0.02	-0.03	-0.04		0.10	0.13	0.14		-0.13	-0.14	-0.11
Missing		-0.09	-0.11	-0.24		-0.39	-0.33	-0.42		-0.15	-0.17	-0.12
Log Parental BMI	0.74	0.84	0.84	0.89 *	1.34 **	1.49 **	1.49 **	1.49 **	1.05 *	1.09 *	1.08 *	1.10 *
Family Stability (Stable)												
Unstable	-0.30	-0.35	-0.35	-0.35	-0.03	-0.05	-0.06	-0.05	-0.04	-0.05	-0.05	-0.05
Period (1997–2006)												
1989–1993	-0.71 ***	-0.51 *	-0.45	-0.44 *	-0.43 *	-0.24	-0.45	-0.16	-0.66 ***	-0.41 *	-0.33	-0.37 *
Sector × Period												
State sector × 1993			-0.10				0.36				-0.14	
Child's Diet												
Carbohydrate				-0.01 *				-0.003 *				0.00
Fat				0.00				-0.002				0.00
Protein				0.01				0.013 *				0.01
Region (North)												

CAO Criterion	IOTF Definition		WGOC Definition		95 th Percentile	
Middle	-0.70 **	-0.70 **	-0.70 **	-0.70 **	-0.58 **	-0.58 **
South	-1.39 ***	-1.34 ***	-1.35 ***	-1.37 ***	-1.76 ***	-1.75 ***
Number of Observations						
Number of Children						

Note: Reference groups in parentheses.

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$; (two-tailed tests)

Table 4

Logistic Fixed-Effects Models Predicting Child and Adolescent Obesity: Coefficients of Parental Characteristics and Other Variables

CAO Criterion	IOTF Definition			95 th Percentile		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Parental Sector (State Sector)						
Non-State Sector	1.01 [*]	1.10 [*]	1.26 [*]	1.67 ^{***}	1.76 ^{***}	1.74 ^{***}
Parental Education (College or Higher)						
Elementary or Below		0.84	0.90		-1.86 [*]	-1.84
High School		1.15	1.08		0.10	0.14
Parental Occupation (Administrator, etc.)						
Professional		0.44	0.23		1.22	1.20
Worker		-0.32	-0.50		0.99	0.95
Other		-0.63	-0.73		0.43	0.40
Parental Income (>10,000 Yuan)						
<3,000 Yuan		0.58	0.47		0.28	0.35
3,000 to 10,000 Yuan		0.00	0.02		-0.01	0.04
Missing		-0.33	-0.41		0.17	0.23
Log Parental BMI	0.27	0.71	0.75	0.17	0.06	0.05
Family Stability (Stable)						
Unstable	1.10 [*]	1.10	1.11	0.64	0.66	0.68
Child's Diet						
Carbohydrate			-0.002			0.0004
Fat			-0.007			-0.0006
Protein			0.01			0.002
Number of Observations			229			304
Number of Children			79			105

Note: Reference groups in parentheses.

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$; (two-tailed tests).

Table 5

Childcare by Parental Sector and By Wave

	1989	1991	1993	1997	2000 ^a	2004	2006
Father							
Whether Cared for Children Last Week (No-0; Yes-1)							
State Sector (Mean)	0.44 *	0.44 *	0.52 **	0.80 **	0.74	0.60	0.79
Non-State Sector (Mean)	0.29	0.31	0.29	0.26	0.76	0.83	0.88
Number of Observations	204	330	187	96	72	38	30
Hours Spent							
State Sector (Mean)	0.11 *	0.25	0.09	4.41 *	4.00	8.16	12.90
S.D.	0.27	0.94	0.29	11.69	15.04	12.05	15.02
Non-State Sector (Mean)	0.05	0.13	0.06	0.83	3.62	14.04	6.36
S.D.	0.11	0.60	0.32	2.01	11.01	14.15	7.50
Number of Observations	204	233	122	94	64	34	25
Mother							
Whether Cared for Children Last Week (No-0; Yes-1)							
State Sector (Mean)	0.75	0.88	0.75	0.96	0.92	0.75	0.79
Non-State Sector (Mean)	0.71	0.89	0.74	0.88	0.94	0.85	0.95
Number of Observations	207	337	213	97	68	59	40
Hours Spent							
State Sector (Mean)	0.24 *	2.04	1.02	7.02	8.69	11.46	19.76
S.D.	0.35	3.31	2.72	13.07	18.71	14.34	28.67
Non-State Sector (Mean)	0.14	3.10	0.33	3.74	4.86	21.50	19.78
S.D.	0.21	7.01	0.86	4.42	3.64	24.84	24.35
Number of Observations	202	102	70	93	64	52	35

Note:

^aStarting in 2000, only adults who had children under the age of 6 years were asked.* $p < 0.05$;** $p < 0.05$;*** $p < 0.001$ (two-tailed tests).

Table 6

Physical Activity Score by Parental Sector and by Wave

	1997 ^a	2000	2004	2006
State Sector				
Mean	0.99	1.28	1.33**	0.99
S.D.	0.48	0.54	0.58	0.74
Number of Observations	317	289	187	140
Non-State Sector				
Mean	0.98	1.24	1.15	0.96
S.D.	0.43	0.56	0.69	0.7
Number of Observations	251	184	148	140

Note:

^aThe CHNS started to collect information on physical activity in 1997.* $p < 0.05$;** $p < 0.01$;*** $p < 0.001$ (two-tailed tests).