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The Relationship between Relative-Provided Child Care and Obesity in 5th graders in the United States

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University of Connecticut
2010

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Abstract

The Relationship between Relative-Provided Child Care and Obesity in 5th graders in the United States
By Parini M. Shah

This study explores the relationship between relative provided childcare and childhood obesity in round 6 (fifth grade) children of the Early Childhood Longitudinal Study- Kindergarten Cohort 1999 (N=9324). Survey adjusted logit models were used to assess the association between obesity, as defined by the International Obesity Task Force cut-off points, and receipt of regular relative care, the type of relative care provider, and type of non-parental care. First the bivariate association was analyzed for each main exposure and then controlled for with child socio-demographic characteristics, family socio-economic status (SES) variables, and household structure variables. In the bivariate analysis, only receipt of regular relative care had an association with obesity in the bivariate analysis. No association was found between relative care, type of relative care provider and type of non-parental and childhood obesity once controlling variables were added to the models. However, several socio-demographic, family SES and household characteristics were found to be significantly associated with obesity in all of the models, a finding consistent with prior research. In addition, many of these characteristics were also significantly associated with children receiving relative provided child care. These results provide insight that relative care may not be an independent risk factor for early childhood obesity, but may be a characteristic of children who are already at risk for childhood obesity.

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Introduction

The rise in obesity in children throughout time is well documented in the literature with data showing obesity prevalence tripling from 1976 to 1980 in children and adolescents [1, 2]. However, while these rates continue to be high and childhood obesity continues to increase in some countries, in other countries, like the US, it seems to have plateaued [3]. Results from Ogden et al's study using National Health and Nutrition Examination Survey (NHANES) data from 2009 to 2010 indicate that the prevalence of childhood obesity in the overall U.S population remains unchanged at approximately 17% and overweight or obese at 31% [3]. Obesity is a significant Public Health problem as childhood obesity has many short term and long term health effects as overweight children are more likely to become overweight or obese adults[4, 5] and childhood obesity is also associated with increased risk of hypertension, hyperlipidemia, type 2 diabetes mellitus and cardiovascular disease [6-8].

One of the main determinants for childhood obesity is the family environment. The family environment provides the primary source of social learning, influence, and exposure to and adoption of health habits for children [6]. It is within this environment children learn and adopt behaviors from modeling parents and other relatives. However, the family environment is not the sole determinant for childhood obesity. Social-contextual factors interplay with family environment factors which in turn interplay with childhood obesity. Socio-contextual factors, family environment factors and obesity as an outcome are all interrelated and each level has a relationship to childhood obesity. Social and family characteristics, which include the educational level and employment status of the mother, family wealth, and household structure, in addition to many other characteristics, are shown to have a direct impact on children's health behavior and are found to significantly influence children's attitudes and behaviors [9]. Social-contextual factors can help determine the resources available to a child in the family environment which are

critical in childhood obesity as these resources, such as, diet, can reduce or increase the risk of obesity in children.

One of the integral parts of the family environment and the resources it provides to children is child care. According to the 2010 U.S Census, of children aged 5 to 14 in the U.S, 13.6% of children received care from grandparents, 8.1% received care from siblings and 5.5% of children received care from another relative [9]. Only 3.6% of children received care from a day care center [9]. Child care could potentially have a relationship with childhood obesity as it is situated within the family environment. However, since there are several types of child care, there may be differing relationships with each type of child care. Since children are shown to adopt parental behaviors [10, 11], it may be that children who spend a significant portion of time in child care may also begin to adopt behaviors of their care givers and be equally influenced by their child care environment, especially relatives who provide childcare, as they are already members of the family and the family environment.

While there is some conflicting evidence for the relationship between obesity and center-based care [12, 13], several authors did find an association between relative provided child care and obesity [14-16]. Relative provided child care can be provided by different family members, such as, aunts, siblings or grandparents. The majority of literature that discusses relative provided childcare focuses on grandparents. The available research suggests that routine grandparent care is related to a number of maternal and family factors, such as, low incomes, maternal employment, younger maternal age, and lower education[17-19]. Grandparental care is also shown to be more common when grandparents reside in the household and more likely to occur in African American and Hispanic families, but this finding has some conflicting evidence [17-19].

The limitations with these studies are that many of them focus on the relationship between relative provided child care and childhood obesity in either pre-school children or in

adolescents. Very few studies focus on children in fifth grade or in that age range. This limits the ability to ascertain possible associations between relative care and obesity in older children, such as those in 5th grade, as children are going through a different development period. Also, majority of these studies also look at parents, not relatives as care givers. Finally, those studies that do look at relative care, group relative care into informal care or another composite care category that included relative care, nannies, neighbors or friends. This cloaks possible associations between relative care as the primary non-parental care and obesity outcomes.

This study, which aims to look at the association between relative care and child obesity, will add to the literature by providing another dimension of analysis on the family environment and childhood obesity. This study will explore the following research questions:

1. Is there an association between receipt of regularly provided relative childcare and obesity in U.S fifth graders?
2. Is there an association between the type of relative care provider and obesity in U.S fifth graders?
3. Is there an association between the type of non-parental care and obesity in U.S fifth graders.

These research questions aim to understand what associations might exist between relative provided child care and obesity and if there are differences in associations between relative care and other forms non-parental care, such as, center-based care. The first research question will assess if there is an association between any type of regularly provided relative child care and obesity in early childhood. The second research question will examine if there are differing associations between which relative provided the child care and obesity. Finally, the third research examine the association between different types of non-parental child care and obesity in children to understand if different types of non-parental child, including relative provided child

care, have different associations with childhood obesity. This study will utilize publically available data from the Early Childhood Longitudinal Study- Kindergarten Cohort 1999. This will allow the results to be generalizable to fifth graders in the United States and provide insight into relative provided childcare and early childhood obesity outcomes.

Chapter 1 Literature Review

Levels, Trends and Consequences of Obesity

The rise in obesity in children throughout time is well documented in the literature with data showing rise in obesity with a tripling in obesity prevalence since 1976 to 1980 in children and adolescents [1, 2]. Children aged 6 to 11 years saw an increase in obesity of about 13% from 1976-1980 to 2007-2008 [1]. In the past decade African American and Mexican American children had the greatest odds of being obese compared to white children [2, 3]. There was also a significant trend where males had increased prevalence of obesity [3]. However, when looking at age groups, 6 to 11 year olds did not show increased odds of becoming obese compared to older children[3].

While these rates continue to be high and childhood obesity continues to increase in some countries, in other countries, like the US, it seems to have plateaued [3]. Results from Ogden et al's study using NHANES data from 2009 to 2010 indicate that the prevalence of childhood obesity in the overall U.S population remains unchanged at approximately 17% and overweight or obese at 31% [3]. Although the authors show some increases in obesity prevalence may be occurring among males, the data presented suggest that the rapid increases in obesity prevalence seen in the 1980s and 1990s have not continued in this decade and may be leveling off [3, 20].

The significance of childhood obesity lies in its health effects both in the short term and the long term as overweight children are more likely to become overweight or obese adults[4, 5]. Children who have a BMI greater than or equal to the 95th percentile have 2 to 6 times the risk of becoming an obese adult [6]. In a study that utilized data from the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) which aimed to identify possible trajectories of overweight and at risk for overweight as children aged, the authors found that children's weight either stayed normal, at risk or overweight or they moved from at risk to overweight. No group of children were shown to move from overweight to normal, highlighting the long term weight issues with

childhood obesity [21]. Also, being an overweight child has serious health ramifications as it is associated with increased risk of hypertension, hyperlipidemia, type 2 diabetes mellitus and cardiovascular disease [6-8].

Childcare and Obesity

There are several types of child care that can be provided to children. Formal care, defined for this study, is when child care is provided outside the home by a trained caretaker, which can include a day care center, an after or before school program. Informal care, defined for this study, is child care provided by relatives in the child's home or in the relative's home. According to the 2010 U.S Census, of children aged 5 to 14 in the U.S, 13.6% of children received care from grandparents, 8.1% received care from siblings and 5.5% of children received care from another relative [9]. Only 3.6% of children received care from a day care center [9].

The literature on childcare and obesity showed differing results and there was equal variance in findings when looking at different aspects of childcare and obesity. However, there were some similarities in findings, which illustrate that variation in findings for associations between childcare and obesity depend on various types of childcare. While some conflicting evidence was found for the relationship between obesity and center-based care [12, 13], several authors found an association between relative provided child care and obesity [14-16].

There are multiple studies that looked at the relationship between formal childcare and obesity. In several studies that examined the obesity outcomes in children who received childcare, both formal and informal, no association was found for obesity and center-based childcare [15, 22]. All of these studies looked at childcare in young children and obesity at later time points. In Maher et al's study, the authors utilized the ECLS-K to look at the association between type of child care, participation in different types of child care in the year before kindergarten and the likelihood of obesity at the start of kindergarten. In Pearce et al's study, the authors used birth cohort data from the United Kingdom to analyze the association between childcare use between 9

months and 3 years of age and overweight at age 3 years. In Benjamin et al, which collected data from women in eastern Massachusetts, the authors examined the association between child care attendance from birth to 6 months and adiposity at 1 and 3 years of age, where child care was divided in to three categories, center care, care in another's home and care in own home by a non-parent [14]. In addition to finding no association between formal childcare and obesity, there was no significant difference in overweight status between children cared for in formal childcare and those cared for only by a parent [14].

These findings differ from studies that showed a decreased risk of obesity for children who receive less than 15 hours of child care per week. Lumeng et al, using the Panel Study of Income Dynamics (PSID) data, conducted a longitudinal study that aimed to determine if there is a relationship between center-based child care attendance from ages 3 to 5 and future overweight at ages 6–12. Unlike other studies mentioned, this study focused on center care, and saw that with limited center-based child care, there was a decreased risk for obesity in future years. However, the authors also illustrate there was no association with obesity with extensive center-based care, where children received greater than 15 hours of child care per week. The lack of association with extensive child care and obesity was in consensus with previous literature and provided added insight that there is no predictive association with center-based care and obesity and can be protective, so child care at early ages may not greatly influence obesity later in childhood [23]. Also, this study is important because it was consistent with other studies that showed no significant association with formal childcare and obesity. It also showed that different types of non-parental child care may have different relationships with obesity.

Though the lack of association between center-based child care and obesity was shown throughout the literature, one study showed an increased odds of children becoming obese when using center-based child care. In Gubbels et al, the authors aimed to study the relationship between child care use and BMI z-scores and overweight, as well as, association with child care

use in children up to 2 years old. Using a Dutch cohort, a dichotomized child care variable with use at 1 and 2 years positively predicted BMI z-scores at age 2 years, as well as change in BMI z-score between 1 and 2 years [13]. Furthermore, child care use had significantly higher odds of being overweight at age 1year with few differences between intensive, greater than 16 hours per week, and limited, less than 16 hours per week, child care use [13].This association may exist in part due to parental characteristics. In looking at the association between child care use and parental characteristics, there was a positive association with greater parental working hours, older maternal age and higher maternal education [13].

While the literature on center-based care showed there may be no association between childcare and obesity, informal care was shown in many cases to increase risk of obesity. These studies are critical in understanding a possible association between relative provided child care exposures and obesity outcomes. Studies have found that obese children had significantly higher odds than non-obese children to be in family, friend, and neighbor care and less likely to be in parent care [15]. In a study using ECLS-K data, non-parental care, which included relative provided childcare, was shown to have an association with obesity [24]. A similar association was found in Pearce et al, which found that of the quarter of 3 year old children in the UK Millennium Cohort Study that received informal care, three-quarters received care from grandparents[22]. The authors found that fulltime informal childcare was associated with an increased risk of overweight, both before and after adjustment [22]. However, this association between informal care and higher risk of obesity was only seen in mother's in the highest and middle SES when stratified by SES, both before and after adjustment of confounders [22]. The finding of most interest from this study is that when informal care was dichotomized between the grandparent care and other informal care, the higher risk of overweight was only significant in children who were cared for by grandparents, both full time and part time [22]. In three-generation families there may be conflicting behaviors practiced within the household depending

on the main care-giver of the child or whom the child spends the most time with [25-29]. These findings are meaningful as this study aims to look at the association between relative care and obesity outcomes, and is consistent with findings from other studies looking at types of childcare where informal care was associated with increased risk of obesity.

As with studies that examined formal care, or center-based care, there was some conflicting evidence for the association between informal care and obesity. Though Benjamin et al looked at BMI z-score, not a categorical obesity variable, the researchers still found that more hours in child care during the first 6 months of life was associated with an increased weight-for-length z-score at 1 year of age and increased BMI z-score at 3 years of age. The association was limited to child care attendance in someone else's home and neither center-based child care nor care in the child's own home by a nonparent was related to the adiposity outcomes [14]. However, since the authors included relatives as care providers in the "care in someone else's home" category, this finding is also relevant in understanding what relationship relative care may have to obesity as there was an association in the care provider's home, but not in the child's own home [14]. This finding may be related to findings in other studies where parents felt that children's eating habits were altered when they received care at a relative's home compared to eating habits in the child's own home, such as in Styles et al [30].

In addition to conflicting evidence, there was some variation in findings for informal care, where for Latino children, participation in some types of non-parental child care had a protective effect [15]. This illustrates that informal care may have different effects depending on the family characteristics, as there was also a difference in association between informal childcare and obesity when stratified by SES [22]. It is important to understand what family and family environment characteristics may be associated with informal care, as these may be driving some of the associations seen between informal care and obesity.

The limitations with the previously described studies were that with the exception of Pearce et al, none of these studies focused directly on relative care. Most of these studies grouped relative care into informal care or another composite care category that included relative care, nannies, neighbors or friends. This cloaked possible associations between relative care as the primary non-parental care and obesity outcomes. Also, like similar studies on childcare and the family environment, most of these studies were conducted with very young children, usually children around 3 years of age. This limits the ability to ascertain possible associations between relative care and obesity in older children, such as those in 5th grade, as children are older and are going through a different development period.

In one study that looks directly at informal care and its association with obesity outcomes, Lin et al, the authors examined the association of child care at 6 months and at 3, 5 and 11 years with BMI z-score and overweight, including obesity, at 11 years in a Hong Kong Chinese birth cohort. When looking at the association between informal care at each age separately and obesity at 11 years of age, there was an association with informal care at 3, 5 or 11 years and higher BMI z-score and an association with the presence of overweight (including obesity) at 11 years [28]. This is consistent with previously discussed findings from other studies that looked at childcare overall [14, 15, 22]. The authors also found that current informal care, at age 11, was the most strongly associated with obesity, followed by informal care at age 5 [28].

The findings for the association between information care and obesity were also seen in Pearce et al's study when informal care was stratified by grandparents, other family members or domestic helpers [28]. Other studies that have looked at the presence of expanded families and obesity also saw that children who live with grandparents had higher levels of obesity than those children who did not live with grandparents [11, 30, 31]. Grandparents were also shown in other studies to promote excess eating when care taking for children and that food was also shown to be used as a reward [27-29, 31] , which may be related to the association between grandparents

providing child care and childhood obesity [27]. These findings are very important as our study looks at obesity in similar aged children and relative care. These associations raise the possibility that there may be an association between relative care and obesity in 5th grade aged children, especially considering some positive associations found in informal care studies in other countries as mentioned in Kagamimori et al, Wu et al and Styles et al [11, 30, 31].

Characteristics of Families Using Relative Care

There were several studies that looked at the characteristics of families that used relative care as a form of child care. However, while these studies focused on relative care provided by grandparents of the children, they are still important as majority of relative care is provided by grandparents [9]. The available research suggests that routine grandparent provided child care is related to a number of maternal and family factors, such as, low incomes, maternal employment, younger maternal age, and lower education[17-19]. Grandparental care was also shown to be more common when grandparents resided in the household and more likely in African American and Hispanic families, but this finding has some conflicting evidence [17-19].

In a study by Fergusson et al, the authors investigated why families use grandparent provided childcare in the UK [32]. This study used the Avon Longitudinal Study of Parents and Children (ALSPAC) data and grandparents were shown to be regularly involved in providing child care to their grandchild in 45% of the households [32]. The authors showed that grandparent provided child care was associated with maternal age, educational level and maternal employment outside of the home [32]. The authors also illustrated that grandparents were more likely to be providing care for mothers who worked part time, single parent households and those families with some financial difficulty [32].

In another study which looked longitudinally at the use of grandparental care over the first three years of life for the child, it was found that grandparental care was also associated with non-white mothers and mothers who work full time [17]. This study also showed that

grandparental care was more common in intergenerational households than in households where the grandparents do not live [17]. These findings were consistent with the literature on households who use grandparental childcare.

The limitation with many of these studies was that majority of these studies tended to look at very young children, usually under age 5. This does not allow insight onto grandparental care in older children, which might illustrate a different type or form of grandparental care. Also, another limitation of these studies is that they all focus on grandparents. There is a lack of literature on relative care provided by other relatives, such as, aunts or siblings.

Caregiver Perceptions of Obesity

The perception of caregivers on obesity is important in exploring possible pathways for how relative care might be associated with childhood obesity. One possible pathway is that lack of recognition of overweight or obesity may cause relative care to be associated with childhood obesity because relative care providers may not see a reason to alter unhealthy eating or physical activity behaviors.

Recent studies showed that 32% to 89.5% of parents do not recognize that their overweight child is overweight or perceive their child as overweight, accept it as a problem, and recognize that excess weight puts their child at risk for cardiovascular disease, diabetes, cancer, and hypertension [5]. Many studies had similar findings where caregivers did not recognize or underestimate their child's weight problem [30]. One key finding from a study that used longitudinal data from the National Institute for Child Health and Human Development's Study of Early Child Care and Youth Development cohort [33], was the sensitivity in care givers towards overweight and obesity and recognizing risk factors. Children who first became overweight in preschool had less sensitive mothers than those who never became overweight. This showed clues into the possible effects of maternal knowledge on childhood obesity related to child care [33]. If a child's care giver, whether it be a mom or another family relative, does not

have knowledge of proper eating and physical activity behaviors, that could potentially increase the risk of childhood obesity later in life.

One study found that mothers who misclassified their overweight preschool children were more likely to have a high school education or less and those caregivers who recognized their children as overweight had children whose BMIs were greater than the 99th percentile [5]. Other studies also found that minority caregivers also have lower knowledge on weight issues for their children and have different perceptions of healthy weights for their children [27, 30].

Related to the recognition of weight problems in children, was the perceived concern by care givers on overweight in their children. Similar to other studies, Styles et al aimed to understand parents' and caregivers' concerns and beliefs regarding their children's weight problems and best practices for addressing those concerns [30]. In this study participants clearly mentioned relative caregivers as an issue in attempting to address the child's obesity, an issue seen in many other studies and in varying populations [27, 30, 34, 35]. In many households, specifically those in multiple generation households or where the primary caregiver had to work, relatives other than primary caregivers, mainly parents, played a pivotal role in the children's nutritional intake [27, 30, 34-36]. Grandparents were the most common care providers, which led to issues in consistency in eating patterns between the grandparent's home and at the child's own home, where parents reported problems managing their children's eating habits because of different rules at the grandparents' home [30]. These qualitative data supported findings from Kagamimori et al and Wu et al, which showed higher obesity prevalence with grandparents in the household. These studies highlighted important issues that may affect obesity outcomes in children who receive relative care. The possibility of having less restrictive eating habits in grandparents', or in another relative's care, may be a pathway in the association between relative care and child obesity

These studies illustrated that most caregivers may not recognize or may underestimate their child's weight issues, especially grandparent caregivers. The lack of recognition in grandparents and grandparental concerns of their grandchildren being too thin may play a role in relative care provided to children, especially in early childhood where children are developing rapidly [25-29]. However, grandparental concern and recognition also played a role in the relationship between obesity and relative provided child care. Unlike other studies that illustrated that some grandparents are more concerned with their child being underweight and promote over eating [27, 30, 34, 36], Adams et al, found that grandmothers were more likely to be concerned about overweight or at risk children [5]. The authors posited that the increased level of concern in grandmothers may be attributable to their witness of the changes in body size and behavior, such as, television watching or increased consumption of junk food.

The limitations with these studies were that individually, the studies focused on a minority population. However, as a collective, they studied many minority groups found in the United States. These studies provided an insight on concerns and recognition of overweight by grandmothers, who may be child care providers for many U.S families and these studies were important in trying to understand concerns and perceptions of child care providers on obesity in their children.

Characteristics Related to Obesity

Family characteristics, which included the educational level and employment status of the mother, family wealth, and household structure, in addition to many others, were shown to have a direct impact on children's health behavior and were found to significantly influence children's attitudes and behaviors [9]. As a result, many of these characteristics are possible confounders as they have also shown a significant association with obesity and relative care in the literature.

Family Environment and Obesity

The family environment allows insight on the social contextual factors of childhood obesity, as the family environment provides the primary source of social learning, influence, and exposure to and adoption of health habits [6]. The family environment for this study includes the resources available to the child, as in diet, spaces for physical activity, child care, support from family members and parental influence, which consists of parental knowledge, attitudes and behavior. The family environment also includes the family composition of the household, and socio-economic factors that determine the types of resources available to the child and parental influence.

Understanding the family environment is important in understanding the possible relationship between relative provided child care and obesity. The strong influence of the family, in parental modeling, arranging the environments for children's lifestyles and encouraging and reinforcing behavioral patterns, suggests that familial and social factors are involved in promoting child health [11]. The family environment provides the social and interpersonal support that is instrumental in shaping and maintaining children's eating habits and physical activity patterns as the general condition of the family, lifestyle habits and parental concern and guidance influence child obesity outcomes [6, 31, 37]. Wilkins et al, who looked at family functioning and obesity, suggested that greater familial support and supervision by main caregivers played an important role in regulating and supervising weight control behaviors[38]. Understanding the family environment is important as it is will identify potential issues in the relationship between relative provided care and obesity, as relatives and the support they provide are part of the family environment.

In the O'Brien et al study [33] and Wu et al study [31], they illustrated that family is important in supervision of and encouragement of healthy eating and exercise. Those children with less supervision were more likely to be obese. One finding was that parents did not have the

proper knowledge about exercise to provide supervision to their children, whereas with diet parents had a general understanding that fast food, soft drinks and too many snacks can lead to overweight [31]. This lack of knowledge on exercise may be inhibiting or reversing efforts by parents to supervise diet by not encouraging their child to play or exercise properly in addition to healthy diet to prevent childhood overweight and obesity. However, in many studies, parents were well aware that their behaviors can and will influence the behaviors of their children, such as for diet and exercise, but many parents mentioned lack of time or fatigue from work that prevented them from proper role modeling of diet and exercise [10].

Family Structure

Another way family can influence childhood obesity related health and behaviors is family structure. In the U.S in 2007, according to the U.S census, 69% of households were dual parent households and about 25% of households were single parent families [39]. Since 1950, the number of dual parent households with children under 18 have declined from 93% to 71%, while the number of single parent families increased, where single mother households increased from 6% to 23% and single father households increased from 1% to 5% [39].

In several studies, that focused on single parent households, those children in single parent households were more likely to be obese [6, 40]. In Byrne et al, which used data from the Longitudinal Study of Australian Children, looked at single parent households and also found an association between children in single parent households and obesity, particularly in girls [41]. Huffman et al found an association between single parent households and overweight in children, especially in black children [42]. However, unlike Byrne et al, Huffman et al did not see a difference between gender and obesity in single parent families [41, 42]. Other studies that looked at physical activity, rather than obesity, also found that children in single parent households were less physically active and spent more time watching TV than those children with two parents [43].

A possible reason for why children in single parent households have higher obesity prevalence provided by the literature was that single mothers were likely to have fewer resources, including lower availability of time and social support, to regularly provide homemade meals for themselves and their children[6]. In Byrne et al's study, children from single parent households had fewer servings of fruit and vegetables, greater servings of high fat and sugar foods and drinks and spent more time watching TV than children in dual parent households [41]. A similar finding was also seen in Huffman et al which saw greater calorie and fatty acid up take in in single parent households compared to dual parent households [42]. Similarly, single mothers lacked the time or energy to play actively with their children and to encourage physical activities [2].

Also, when looking at family structure, understanding the role of siblings in a family is also important as in some studies those children with no siblings were also more likely to be obese [6, 24]. Having more children may make it difficult for parents to meet their children's healthcare needs and lead to parental time and resource dilution [6]. However, having more children may also lessen the effects of parental resource dilution as older siblings can potentially serve as or share the care taker role with the parents [6]. For example, girls who had siblings spent more time participating in physical activity than girls who were only children [43] and in Bhargava and Jolliffee, who used the ECLS-K data, siblings were shown to be negatively associated with body weights. More importantly for understanding the association between relative care is that older siblings can be providing care to younger siblings, which is a form of relative provided childcare. Bhargava and Jolliffee found that informal childcare was common in younger ages, but was reduced by age 11 and the highest level of parental education, occupation and monthly household income were all positively associated with informal care [24].

Socio-Economic Status

One aspect of family life that was well linked to obesity is the family's socio-economic status. The socio-economic status is important in looking at obesity in early childhood as the resources

available and knowledge that parents or care-takers have can influence the type of environment they can provide their children. In Matijasevich et al, the authors discussed the effects of socio-economic status in two different population cohorts, the ALSPAC in Britain and the Pelotas in Brazil. This study looked at two factors related to socio-economic status one being family income and the second being maternal education. The analyses illustrated that overweight was associated with income and maternal education, but in different ways depending on the context [4]. In U.S based studies, there were also associations between obesity and income, where children whose families were in the lower income levels had higher associations with obesity than those with higher incomes [44, 45].

Related to both family structure and SES, maternal employment also had an association with childhood obesity. In Kagamimori et al, maternal employment and the presence of expanded family in the household, such as, grandparents were shown to be associated with increased obesity in Japanese 3 year olds [11]. While this study sample was Japanese 3 year olds, the significance of an expanded family with obesity in the children is still important. In addition to Kagmimori et al, also supporting the association between maternal employment and childhood obesity was Hawkins et al which used the UK Millennium Cohort data to look at maternal employment in Britain. The authors found that for every 10 hours a week a mother worked, it increased the risk of her child being obese, especially in higher income brackets [46]. There was also increased risk for obesity in children who were in day care when the mother was working, but there was no increased risk for obesity if the mother was working and the child received informal or parental care [46]. Mothers who worked reported fatigue from work, which caused many parents to rely on unhealthy foods as treats to please their children in times where their kids were disobedient or if they did not have enough time to cook food [10, 30, 34, 36].

In a US based study, Martin et al who used data from the National Longitudinal Study of Adolescent Health, the authors aimed to look at the relationship between being poor and obesity

in adolescents, as well as, parental education and school resources and found no association between poverty and obesity [47]. The authors used a dichotomous poverty variable, instead of specific income levels, which may be a possible explanation why they did not find a significant association with families being poor and obesity. However, the researchers did find a significant relationship with parental education and adolescent obesity, where higher parental formal education decreased the odds of the adolescent being obese [47].

In another U.S based study, the authors estimated dynamic random effects models for children's body weights and BMI, and households' food insecurity scores for children in first, third and fifth grade in the ECLS-K [24]. The household food insecurity score was not a significant predictor of children's weights, BMI and Z-scores of BMI [24]. The findings also showed that higher parental education and household incomes, physical exercise and numbers of siblings were significantly negatively associated with body weights and by contrast, poor health status of respondents, time spent watching television and non-parental care were positively and significantly associated with body weights [24].

Race

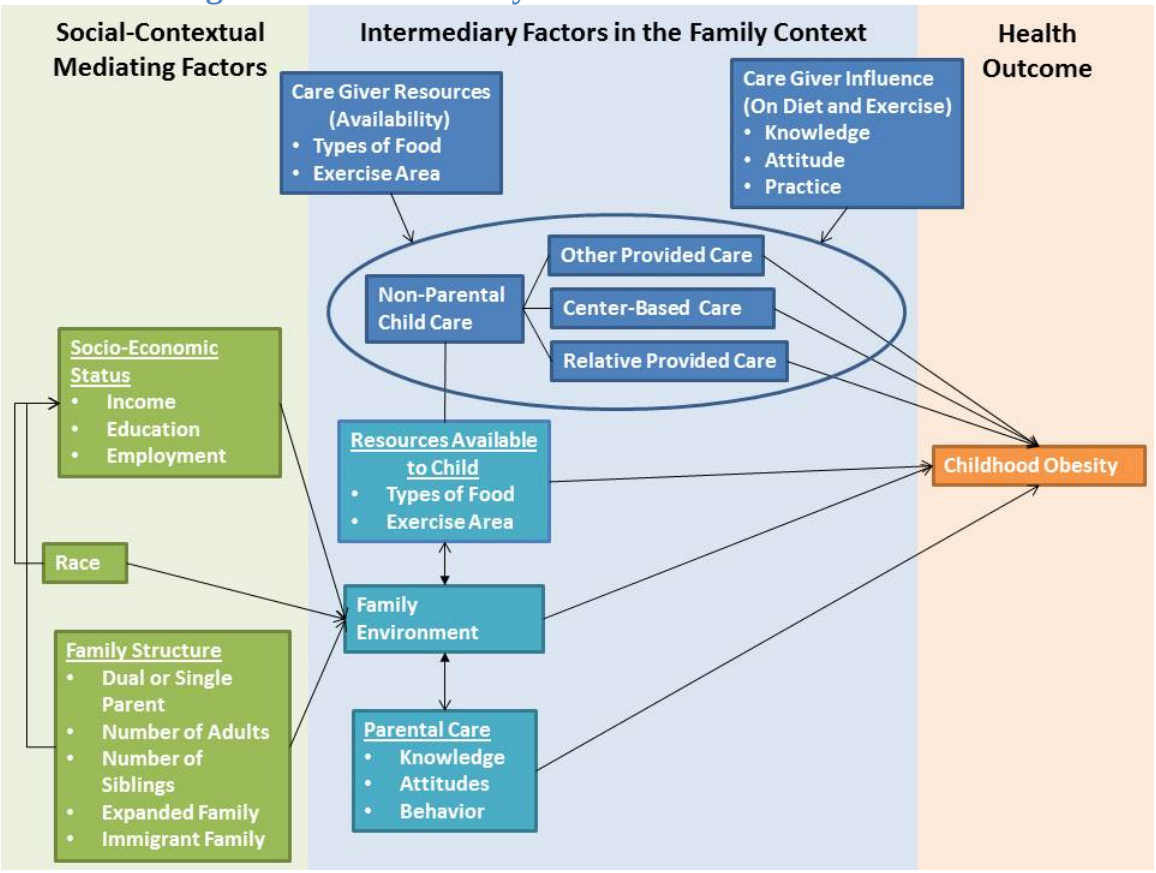
Also influencing childhood obesity in the family environment is race. In Gordon-Larsen et al, the authors looked at the association between race, income and parental education and obesity in U.S. adolescents with data from the National Longitudinal Study of Adolescent Health. While the authors found that overweight status was high among all U.S adolescents, it was the highest for African-American females, followed by Hispanics of both genders and white males [45].

The limitations with these studies that assessed relationships between various socio-contextual factors and obesity were that many of them focused either on pre-school children or on adolescents. Very few focused on children in fifth grade or in that age range. Majority of these studies also look at parents, not relatives as care givers. Also, while majority of these studies looked at cohorts, some studies differ in how they created or measured various variables related

to the family environment, such as, income, education or family structure. However, even with these limitations, these studies helped to inform the relationship of obesity and the family by illustrating that the relationship is multifaceted. This study, which aims to look at the association between relative care and child obesity, will add to the literature by providing another dimension of analysis on the family environment and childhood obesity.

Chapter 2 Conceptual Framework

Figure 1. The conceptual framework for childhood obesity and child care with mediating factors of the family environment and social factors.



The above conceptual framework for this study uses a socio-ecological approach towards childhood obesity and relative care. Socio-contextual factors, family environment factors and obesity as an outcome are all interrelated and each level has a relationship to childhood obesity. The social-contextual factors interplay with family environment factors that in turn interplay with childhood obesity. As described in the literature, the family environment is a critical place of growth and learning for children (see Family Environment section in Chapter 1). It provides a space for learning and acquiring behaviors, which is especially important when looking at childhood obesity. The resources available to a child in the family environment are critical in understanding childhood obesity as they can either reduce or increase the risk of obesity in children. If children do not have access to healthy food in their family environment, children will

be eating junk food or consuming sugary drinks which can increase the risk of obesity. Also, if children are living in areas that do not facilitate physical activity, such as, playgrounds, parks or other safe areas for being active, this can also increase the risk of obesity, especially in conjunction with the consumption of unhealthy foods.

Most importantly for this study, child care is also a resource provided in the family environment that has a potential to have a relationship with childhood obesity. Childcare, as described by the conceptual framework above, is situated within the family environment. Child care in the family environment can come in various forms in the family environment. It can be in the form of parental child care or non-parental child care, but both provide support to the children in their everyday lives, whether it be emotional support, helping with school, or preparing meals and being active with the children.

Non-parental care also has varying types. Non-parental care can be relative provided care, center-based care or other care provided by babysitters or friends . Of interest in this study is relative provided care. Relatives, such as, grandparents, aunts or uncles, and siblings can provide care to children, both or either, before or after school. And like parents, who are major influencers of their child's eating and exercise habits, especially as parents determine what food is available to the children [30], relative caregivers, may also exert varying amounts of control and discipline on the children depending on parenting and caretaking style, skill level and involvement on children's diet and physical activity [28, 30]. This makes informal sources of child care an important factor in childhood obesity. Relative care can also create a different environment for children as shown in various qualitative studies looking at informal care, caregiver concern and recognition of overweight (see second on Caregiver Perceptions of Obesity in Chapter 1). The relative's knowledge, attitudes, and behaviors can also serve as models for children in regard to forming healthy eating and activity behaviors.

Of course, like all resources available to children, relative care and child care overall, are influenced by social-contextual factors related to SES, family structure and race. Not all children may receive relative care and this receipt of relative care may be mediated by whether the household includes other relatives besides the child and its parent(s). Family households that are intergenerational or expanded may have more relative care arrangements as these relatives are already in the household [17]. It could also be plausible that households that are run by single parents may also utilize relative provided child care for support in raising their child, especially if that parent is working full time [32]. Parental employment can also have a role in the provision of child care. If both parents, or the single parent, are working full time, they may not have the time to spend in caring for their child compared to if they did not work fulltime. In addition, parents who work full time may not have time to prepare healthy meals for their children or may use the television to occupy their children if they have other responsibilities to fulfill [30]. Maternal employment is especially key in this aspect, as the literature shows that increased maternal employment is related to childhood obesity outcomes [46].

Race can also mediate relationships between childcare and childhood obesity. Throughout the literature, race was shown to have a statistically significant association with obesity [45]. Children of certain races may already be at higher risk for obesity, such as, black children and Hispanic children, and child care may mitigate or increase these risks. Also, it may be that certain racial groups are more likely to use relative provided child care or center-based care which can also mediate a relationship between childcare and obesity. Like race, income is also associated with childhood obesity, and child care may have differing relationships with childhood obesity depending on the income of the child's family [18]. Also, a family's income may also be related to children receiving relative care that could also have various relationships with childhood obesity [17, 32].

In addition to resources available to the child, the family environment can mediate childhood obesity through parental influence and the resources that are available to the child. Parents throughout the literature are shown to be greatly influential in the adoption of children's behaviors because they are the primary modelers of behaviors [37, 48]. Obesity in parents is shown to be associated with obesity in their children, and children will adopt eating and physical activity behaviors of their parents [37, 40, 48]. However, parental influence is also mediated by social-contextual factors.

Rationale for Study

Many of the studies presented in the literature review that have studied childcare and obesity outcomes have focused on very young children, formal care or have lumped relative care into a broad category for various types of informal care. As a result there is a need to look at older children and directly at relative provided childcare. This study aims to add to the literature by examining the association between regular relative care and obesity in fifth grade children in the ECLS-K 1999 cohort.

As shown in the conceptual frame work, there are many macro and intermediate factors between childcare and obesity in children (Figure 1). This study hopes to provide an insight into the association between relative provided childcare and obesity. The outcome looked at in this study was obesity, and the main exposures included received relative care, type of relative care and type of non-parental care. The covariates considered include: gender, race, urban or rural residence, census region, number of siblings, height, weight, total household size, mother's and father's age, mother's and father's employment, mother's education, wealth quintile, poverty status, immigrant family status, married parents, number of adults in household, number of children in household, current non-parental care, number of non-parental care arrangements, hours in non-parental care, hours per week in relative care, number of days per week in relative care, location of relative care, relative care before school, relative care after school, center-based

care, number of hours per week in center-based care, and number of days exercised for 20 minutes. These covariates were selected through review of the literature and through potential relationships as shown in the conceptual framework (Figure 1).

Chapter 3 Methodology

Due to the comprehensive nature of the ECLS-K, which collects data on the children's development, family and school environment, it was chosen as the appropriate data set to analyze the association between relative care and childhood obesity. The data used in this study were from round 6 of the ECLS-K which collected data from 5th graders. The round 6 data were used as it included all of the necessary variables related to non-parental childcare. The round 7 or 8th grade data were not used as it did not contain childcare measurements.

ECLS-K Study Methodology

The ECLS-K was developed under the sponsorship of the U.S. Department of Education, National Center for Education Statistics (NCES). Westat conducted the study with assistance provided by Educational Testing Service (ETS) in Princeton, New Jersey [49].

The ECLS-K provided longitudinal data on children enrolled in kindergarten in 1999 through 8th grade in 2007 in the United States (N=21,280). The data from these children were collected in the fall and the spring of kindergarten (1998-99) and 1st grade (1999-2000) and the spring of 3rd (2002), the 5th grade (2004), and 8th grade (2007) [50]. The data collected are nationally representative of the kindergarteners, their parents and schools of the United States. The information collected in the ECLS-K consists of the children's physical and social health and development, as well as, family and household information and school information. These data included detailed information on children's home environment, home educational activities, school environment, classroom environment, classroom curriculum, and teacher qualifications [50]. While key topics, such as, family structure, parental involvement in school, and the child's home environment and cognitive stimulation were covered in most rounds, other topics, such as parent income, employment, and education, were measured at least once in each school year [49].

Prior to the ECLS-K, no large longitudinal national study focused on education had followed a cohort of children from kindergarten entry to middle school [50]. The ECLS-K was

designed to provide comprehensive and reliable data to be used to describe and to better understand children's development and experiences in the elementary and middle school grades, as well as, how children's early experiences relate to their later development, learning, and experiences in school [50]. The multifaceted data collected across the years allow researchers to study how various child, home, classroom, school, and community factors at various points in children's lives relate to cognitive, social, emotional, and physical development [50].

ECLS-K Study Design and Data Collection

The ECLS-K was a multisource, multi-method study that included interviews with parents, the collection of data from principals and teachers, and student record abstracts, as well as, direct child assessments. The ECLS-K employed a multistage probability sample design to select a nationally representative sample of children attending kindergarten in 1998–99. In the base year the primary sampling units (PSUs) were geographic areas consisting of counties or groups of counties. The second stage units were schools within sampled PSUs. The third and final stage units were students within schools [49].

The data were collected by trained evaluators who assessed the children in their schools and collected information from their parents over the telephone. Teachers and school administrators were contacted in their schools and asked to complete questionnaires [50]. The data were collected using computer-assisted interviewing (CAI) for parent interviews and child assessments [49]. The ECLS-K data were de-identified by NCES which took steps to minimize the likelihood that an individual school, teacher, parent, or child participating in the study could be identified [49]Variables identified as posing the greatest disclosure risk were altered by combining categories, and in some instances, entirely suppressed and were not available in the publicly available data [49].

Round 6 (Fifth Grade) Sample and Data Collection

The round 6 data was nationally representative for children who were enrolled in kindergarten in 1999. The total number of children sampled in this round was 11,280 unadjusted (10,996 survey adjusted). The sample was not freshened after the first-grade year with third or fifth-graders who did not have a chance to be sampled in kindergarten or first grade, as was done in first grade In fifth grade, children who became ineligible in an earlier round were excluded in the sample, these included third or fifth-graders who did not have a chance to be sampled in kindergarten or first grade, such as those that immigrated to the US after third grade or those that may have skipped or stayed back a grade [49]. However, this does not impact the generalizability of these data.

The ECLS-K fifth-grade data collection occurred in the spring of the 2003–04 school year. As part of the direct child assessments, children completed a short self-description questionnaire on their own and were interviewed using a food consumption questionnaire [49]. The fifth-grade parent interview was conducted using CAI. The parent interview was conducted primarily in English, but provisions were made to interview parents who spoke other languages with bilingual English-Spanish interviewers or interpreters for other languages [49]. Most of the interviews were conducted by telephone, but a small percentage (2.5 percent) was conducted in person [49].

Selection and Modification of Variables for Data Analysis

The ECLS-K data were obtained from the NCES on a CD-ROM. This CD-ROM included all publically available data and interview questionnaire guides that were also available free online. The 5th grade data was exported into STATA using the ECLS-K electronic codebook version 5.4.3.3 included on the CD-ROM. After the variables from round 6 were selected for the study, listwise deletion was used to remove all observations that did not have information for all of the variables that would be included in the model. This caused the survey adjusted sample size to be reduce from 10,996 to 9,324 children.

Outcome Variable

There are several ways to measure obesity in children. In one method is the BMI percentiles where childhood obesity in ages 2 through 19 is measured by using weight for height BMI. Children are classified into either obese or overweight categories depending on age and sex of the child as the distributions of height and weight change by age and by sex as children develop [51]. Children whose BMI is at or above the 95th percentile are classified as obese and those children with BMIs at the 85th and below the 95th percentile are considered overweight. Another method to classify children as obese are the International Obesity Task Force cut-off points that use centile curves that are linked to adult obesity cut-off points. This method, which calculated obesity and overweight cut-off points using international data, give more specific cut-off points by age and sex [52]. In comparing both methods, the two methods showed similar results in estimated prevalence of overweight and obesity [53]. This study used the International Obesity Task Force cut-off points.

The outcome studied in this analysis is obesity, dichotomized as yes obese or no obese. The obesity variable was created using the zanthro and zbmicat functions using the egen command in STATA [54]. While zanthro was not used in this study, zbmicat was. The zbmicat function allowed the categorization of children by normal weight, overweight and obese accordingly by BMI using international cut off points recommended by the Childhood Obesity Working Group of the International Obesity Task Force [52, 54]. These cut off points, obtained by averaging data from Brazil, Great Britain, Hong Kong, Netherlands, Singapore and the United States, corresponded to adult BMI cut off points endorsed by the World Health Organization [52, 54]. These international cut off points for BMI for overweight and obesity by gender and age between 2 and 18 years, were defined so that by age 18, the children would pass through BMIs of 25 (overweight) and 30 (obese) [52].

The zbmicat function requires the following variables: BMI, gender, and age. BMI was calculated using the composite height and weight variables collected in the direct child

assessment. Since height and weight measurements were collected in inches and pounds, height and weight were converted into meters and kilograms and were then used to calculate BMI in kg/m2. As age was presented in categories of months, not in continuous form as required by the zbmicat function, the age of the children was computed by taking the difference in the date of birth and the date of the direct child assessment and dividing by 365 to get the number of years to create a continuous age variable.

The zbmicat function was run by entering BMI, gender and age of the children in years to create the obese, overweight and normal weight categories for the ECLS-K round 6 children. The weight categories created by the zbmicat function were recoded into a new variable where all of those classified as either overweight or normal were recoded as not obese and those that were categorized as obese were kept as obese. The reference group was those that were not obese.

Main Exposure of Interest Variables

The main exposures of interest in this study were received relative care, relative care provider, and type of non-parental care. The data for these variables was collected by the ECLS-K during the parent interview through the child care questionnaire and a composite variable created by the ECLS-K in the 5th grade data.

The exposure for relative care was created from a question that asked parents if their child was receiving regular child care from relatives before or after school ("Is (CHILD) now receiving care from a relative on a regular basis before or after school? This may include grandparents, brothers and sisters, or any relatives other than (you/(his/her) (parents/guardians)") [55]. Care from a relative was defined by the questionnaire as care from a non-parental relative, such as, a grandparent, aunt, uncle, sibling or other relative, which was provided regularly or occurring on a routine schedule at least once a week. The definition of care excluded care by a parent who did not live in the household, such as, a divorced parent that has visitation and occasional babysitting or back-up arrangements with relatives. This variable was already

dichotomized by the ECLS-K, where those who reported regular relative care were classified as having relative care. Those that reported no relative care were set as the reference group.

The exposure variable for type of relative care was created from a succeeding question of which relative provided the most care for the child ("Who is the relative who cares for (CHILD) before or after school?") [55]. These relatives were recorded as grandparent, aunt, uncle, brother, sister, or another relative, and all were regular care providers either before or after school. Due to the low numbers of parents reporting relative care by aunts, uncles, brothers, sisters and another relative, these categories were collapsed into three large categories. Since grandparents were the most reported, they were kept separate. Aunts, uncles and other relatives, such as, cousins, were combined into one category. Brothers and sisters were also combined into one category of siblings. Those that reported not applicable, or no relative care, were placed in the no relative care category and were set as the reference.

For the third exposure of interest, the main type of non-parental care, the variable was created by the ECLS-K as a composite variable that indicated the primary, regular non-parental childcare arrangement in which the child spent the most hours per week at the time of the 5th grade parent interview. The composite levels included relative care in the child's home ("How many hours each week does (CHILD) receive care from (his/her) (RELATIVE)/that relative?") or in other home ("Is the care provided by (CHILD)'s (RELATIVE)/ that relative in your home or another home?"), non-relative care in child's home ("How many hours each week does (CHILD) receive care from that person?") or in other home ("(Let's talk about the nonrelative who provides the most care for (CHILD) now.) Is that care provided in your home or another home?") and center/or before or after school program care ("Does (CHILD) go to that program before school, after school, or on weekends?") [55]. The variable was collapsed to create the following categories: relative care in the child's home or other home, non-relative care in the child's or other home was combined, children who had center-based care, multiple arrangements and those that responded no non-parental care arrangements were set as the reference group.

Child Care Variables (Non-Parental Care)

The variables for current non-parental care at time of interview, hours in regular non-parental care, and number of non-parental care arrangements were created by the ECLS-K as composite variables using information collected from the child care questionnaire in the parent interview. The variable for current non-parental care was already dichotomized and included irregular non-parental care arrangements as well. Those that reported no non-parental care were set as the reference group. The number of hours in non-parental care per week was a numeric and continuous variable. Those that reported zero hours in non-parental childcare were set to missing. For the number of days the child participated in 20 minutes of rapid activity per day per week was collected through the child health questionnaire. The number of days entered was numeric and continuous.

Relative Care Variables

The ECLS-K child care questionnaire asked the parents the number of different regular relative care arrangements ("How many different regular care arrangements do you currently have with relatives before or after school?") [55]. The variable was originally categorized as 1, 2, 3, 4 and 5 or more arrangements. This variable was used to create a variable for how many different regular relative care arrangements the child had by collapsing responses into one arrangement and two or more. The childcare questionnaire also asked if relative care was provided in the child's home, the relative's own home, or both ("Is the care provided by (CHILD's RELATIVE/ that relative in your home or another home?") [55]. This variable was not altered except for setting not applicable to missing.

The variables for relative care before and after school were both separate variables created by the ECLS-K from the same childcare question that asked parents when children received the relative care, before, afterschool, or on weekends. Relative care before school was already dichotomized, as was afterschool. Those that did not receive care before school were set as the reference for the before school variable and those that did not receive care afterschool were

set as a reference for the after school variable. Relative care on the weekends was not considered in this study.

For all non-parental care reported afterschool, those that reported afterschool included those that had relative care, center-based care and non-relative care afterschool. Those that reported no afterschool care did not report either relative, center-based or non-relative care afterschool, but included children who received care from either of these sources before school or on the weekends.

The variables for the number of days per week and the number of hours per week the child spent in relative care were numeric and continuous. They were asked directly in the parent interview in the child care questionnaire ("How many days each week does (CHILD) receive care from (his/her) (RELATIVE)/that relative before or after school?" and "How many hours each week does (CHILD) receive care from (his/her) (RELATIVE)/that relative?, respectively"). Those that reported zero hours and days were set to missing.

Center-based Care Variables

The variable for center-based care was collected through a separate question in the child care questionnaire that asked the parent if the child is currently attending day care, a semester or a before or after school program on a regular basis ("Is (CHILD) now attending a day care center or a before or after school program at a school or in a center on a regular basis?") [55]. This variable was already dichotomized. The number of hours per week in center-based care was collected by directly asking the parent in the child care questionnaire ("Other than regular school hours, how many hours each week does (CHILD) go to that program?"). Those that reported zero hours were set to missing

Covariates

The following variables used in this study were composite variables created by the ECLS-K for the 5th grade data collection: age, gender, child DOB, race, height, weight, number of siblings,

maternal and paternal age, number of children in the household, number of adults in the household, wealth quintile, poverty status, maternal and paternal employment and maternal education. Detailed procedure on how the ECLS-K created these variables can be found in the publically available ECLS-K 5th grade manual. For all variables, those observations that were not ascertained, reported as do not know or were refused were set to missing. For variables regarding non-parental care and relative care, those that responded as not applicable were set to either no non-parental care or no relative care and were used as reference groups.

Socio-Demographic Variables

Gender was not modified in this study and males were used as the reference group. For the race variable, the composite variable consisted of two Hispanic levels, one where parents reported the child as either Hispanic with an ethnicity reported and one where parented reported the child as Hispanic, but no ethnicity was reported. These two levels of Hispanic race were collapsed into one level for easier comparison with the reference group, white children.

The census regions and urban area variables were also collected from the direct child assessment survey and were compiled by the ECLS-K. These variables were not altered except for setting unknown variables to missing. For this study, the Northeast was set as the reference group for the census region and a large to mid-size city was set as the reference group for urban area.

Family Socio-Economic Status (SES) Variables

For the wealth quintile variable, those that were in the lowest wealth quintile were placed in the first quintile and those in the highest quintile were placed in the fifth quintile by the ECLS-K. This variable was not altered with the exception of setting unknown observations to missing. The fifth or highest wealth quintile was used as the reference group in this study. The poverty status variable was already a dichotomized variable and those that were above the poverty threshold were set as the reference group.

The maternal education variable was a composite variable created through the parent education questionnaire by the ECLS-K. The maternal education category was classified into mothers, who had 8th grade or below education, 9th through 12th grade education, high school diploma or equivalent, vocational or tech program, some college, a bachelor's degree, graduate-professional school with no degree, master's degree, doctorate or professional degree and not applicable. These variables were collapsed into up to a high school diploma, up to a bachelor's degree, and up to a graduate or professional degree category. All of the women who had reported 8th grade through a high school diploma were in the first category, those that reported a vocational or technical college degree, some college or a bachelor's degree were placed in the second category and all women reporting some graduate or professional education, a masters or a professional degree were placed in the last category. All not applicable responses were coded as missing and the up to high school diploma were set as the reference.

The maternal employment status had four levels of employment. These were greater than or equal to 35 paid working hours per week, less than 35 paid working hours per week, women looking for work, women not in the labor force and no mother in the household. This variable was not altered, and women who worked full time, or 35 or more paid hours a week, were set as the reference group. The same was done for paternal employment status.

Household Structure Variables

The variables of the number of children in the household, number of adults in the household, paternal age and maternal age were not altered. These three variables were numeric and continuous. The number of siblings for each child was a numerical variable and was not altered. An additional variable was created from the number of siblings to categorized children who had siblings and those who did not. Those who did not have a sibling were placed in the reference group, no siblings, and those who reported one or more siblings were placed in the has siblings group.

An immigrant family variable was created using the family structure questionnaire where the parents were asked where their country of birth was ("Now I have a few questions about (your/NAME's) country of birth. In what country (were/was) (you) born?") [55]. Those parents who were not born in the United States were classified as immigrant families and those that were born in the us were classified as not immigrant families and were set as the reference group.

A married parents variable was created using the family structure questionnaire that asked if the parents were currently married, separated, divorced, widowed, or never married. Those that responded that they were married were set as the reference group, while all others were placed in a not married category.

Methods

Since the sample was nationally representative of kindergarteners born in 1999 in the United States, all data were analyzed using survey weights. The survey weight used was the parent weight for 5th grades as these included weights for parents and children. The parent weight for the 5th grade round was used as it was associated for child-level estimates and with data collected through the parent interview [49]. These weights were used as directed for both direct child assessment data and when analyzing parent and child assessment data together and with parent interview data [49]. It is important to note that this weight is at the child level even though the data were collected from the parents, where they sum to fifth-grade children, not to the parents of fifth-grade children [49].

The data were analyzed using STATA 12 SE, College Station, TX. The data were survey adjusted prior to each round of analysis. First, descriptive statistics were run on each variable to understand the over distribution of the variable in the sample. Second, chi square tests for categorical variables and two sample t-tests were run to see the differences in characteristics for children who received regular relative care and those that did not. Third, the variables were then

analyzed by after school non-parental care, as majority of children who received no-parental care received it afterschool.

Fourth, survey adjusted logit models were run for each main exposure. For each main exposure variable, first a bivariate logit model was run, followed by the addition of child characteristics in the second, the addition of family SES variables in the third, and then finally the addition of household structure variables completing the full model. All of these confounders were identified from prior literature related to childhood obesity (see Chapter 1). Finally, a survey adjusted logit model was run to assess the association of relative care and sample characteristics. All analyses were analyzed using an alpha of 0.05.

Chapter 4 Results

Descriptive Results

Obesity and Non-Parental Care

About 16% of all U.S children in fifth grade are obese, with the average BMI at 20.71 kg/m^2 (Table 1). Children regardless of having received relative care, report an average of 4 days of at least 20 minutes of exercise per day per week (Table 1). In terms of non-parental care, 29.80% of fifth graders receive some form of non-parental care, with the most common form of non-parental care reported isrelative care (18.52%) (Table 1). Children who receive non-parental care spend an average of 12 hours per week in non-parental care (Table 1).

There are numerous characteristics that show a statistically significant difference when comparing fifth grade children who receive relative care and those who do not receive relative care. In looking at the anthropometric measurements of the children, there is a statistical difference in obesity in children who receive relative care, where over 18% of children who receive relative care are obese and about 15% of children who do not receive relative care are obese (p=0.0268) (Table 1). Those who receive relative care have a statistically significantly higher BMI than those children that do not report relative child care (21.25 kg/m^2 versus 20.55, p= 0.0010) (Table 1). Those that do have non-parental care, most report receiving relative care (18.52%, p=<0.0001) (Table 1). Also statistically significant, children in relative care spend on average more time in non-parental care than children that do not receive relative care (12.32 hours per week versus 9.28 hours per week, respectively, p=<0.0001) (Table 1).

Covariates

In terms of socio-demographics of fifth grade children, there is a difference in the distribution of race between children with relative care and those without (p= <0.0001), where more white

children do not receive relative care (60.08%) and more Hispanic children receive relative care (22.76%) (Table 1).

Also with the household characteristics, the maternal characteristics all show a statistically significant difference (Table 1). Mothers are older for children with no relative care (39.01 years versus 37.54 years, p=<0.0001), have more graduate level education (10.32% versus 5.65%, p=0.0010) and less are employed full time (44.56% versus 75.05 %, p=<0.0001) (Table 1). More immigrant families report children receiving relative care (22.59%) than not receiving relative care (19.43%, p=0.0486). In terms of SES, more households using relative child care are in the lowest wealth quintiles than those households not using relative child care (23.65% compared to 19.79%, p=<0.0001) (Table 1).

In analyzing the characteristics of relative care in fifth graders (Table 2), majority of children receiving relative care have only one arrangement at the time of the survey (19.39%). Most children receive care from their grandparents (11.21%), followed by a sibling (5.93%) (Table 2). Most of this care is provided in the child's own home (12.19%) and afterschool (119.34%) (Table 2).

Since majority of relative care is provided afterschool rather than before school, the differences in afterschool non-parental care are explored (Table 3). Majority of children who receive afterschool care receive it from a relative (52.23%), with majority being grandparents (31.56%) (Table 3). These findings are statistically different from children who do not receive afterschool care, where the vast majority receive no non-parental care (95.11%, p=<0.0001) (Table 3). These children who receive relative care afterschool spend on average 10.68 hours per week in relative care (Table 3). It is important to highlight that 3.29% of children who report no afterschool care report relative care (Table 3). This may be before school or on the weekends. In addition to a statistically significant difference in relative care afterschool, 35.44% of children

receive afterschool care in centers compared to less than 1% of children who have no afterschool care (p=<0.0001) (Table 3).

Analytic Results

Received Relative Care, Type of Relative Care Provider and Type of Non-Parental Care Models

Table 4 illustrates the odds ratios for the multivariate regression models for the association between received relative care and obesity in ECLS-K 5th graders. In the bivariate analysis, there is a significant association between relative care and obesity in fifth grade children, where children who receive relative care are 1.27 times more likely to be obese than children that do not receive relative care (Table 4). For the association between obesity and the type of relative care provider, there was also a marginally significant association before controlling for socio-contextual variables, where children who received relative care from grandparents were 1.28 times more likely to be obese than children who did not receive relative care from grandparents (Table 5). However, there was no association between type of non-parental care and obesity in the bivariate analysis (Table 6). For all three main exposures, received relative care, type of relative care provider and type of non-parental care, there was no association with obesity when controlling for child characteristics, family SES, and household characteristics (Table 4, 5 and 6).

Control Variables in Multivariate Analysis

All associations are insignificant once various characteristics of the child, family and household are controlled for. Gender, throughout the survey adjusted logit models, continues to show a significant association, where females have a lower odds of being obese than males (Table 4). At the alpha level of 0.05, Hispanic children show a significant association with obesity in all of the models, even when controlling for family SES and household structure (Table 4, Table 5 and Table 6).

Also, statistically significant in all of the models, children whose mother works part time have about 25% lower odds of being obese than the odds of being obese in children whose

mother works full time (Table 4, Table 5 and Table 6). For wealth, children in the lowest quintile do not have a statistically significant difference in the odds of being obese than those children in the highest wealth quintile, but there was a statistically significant difference between the second lowest and the middle wealth quintile (Table 4, Table 5 and Table 6). Children in the second lowest wealth quintile have about 1.85 times the odds of being obese than children in the first wealth quintile when controlling for both family SES and household structure (Table 4, Table 5 and Table 6). But, there is no statistical difference in the odds of being obese by poverty status (Table 4, Table 5 and Table 6). Characteristics such as immigrant status, single parent households and maternal age show no statistical significance in the odds of being obese (Table 4, Table 5 and Table 6). However, the number of adults in the household show a 20% increase in the odds of being obese in children as one adult increased in the household ($p<0.0001$) (Table 4). The number of hours children spend in relative care show no statistical significance in the odds of being obese for any of the models (Table 4, Table 5, and Table 6).

Determinants of receipt of Relative Care

Table 7 illustrates the characteristics of children who receive relative care. There is no statistically significant association between receipt of relative care and gender, but there are several significant associations with race and receipt of relative care (Table 7). Hispanic children have higher odds of having relative care than white children (Table 7). When controlling for child characteristics, Hispanic children have 1.71 times the odds of having relative child care than the odds of white children having relative child care when controlling for child characteristics ($p<0.0001$) (Table 7). This association disappears when controlling for all social-contextual characteristics (Table 7). Asian and Black children show a similar finding (Table 7).

Also, children whose mothers do not work full time have lower odds of receiving relative care, where mothers who have part time employment, are looking for work and are not in the labor force all have significantly lower odds of receiving relative care than those children whose

mother is working full time (all $p<0.0001$) (Table 7). Children in the lowest wealth quintile have 2.24 times the odds of receiving relative care than the odds of children in the first wealth quintile receiving relative care when controlling for family SES and child characteristics and 2.11 times the odds of receiving relative care than the odds of children in the first wealth quintile receiving relative care when controlling for family SES, child and household structure characteristics (both $p<0.0001$).

Chapter 5 Discussion

This study aims to look at the association between children who received relative provided child care and obesity. The underlying assumptions of this study are that since parental behaviors and family characteristics and obesity are shown in the literature to be associated with obesity [37, 56], similar associations may exist for children who receive care from other relatives [34]. In several qualitative studies looking at the family environment and its relationship to childhood obesity, these data show the behaviors of relatives providing care are different from the behaviors of parents providing care and also influence the habits of children in the relative's care [27, 34]. Children were also shown to exert different levels of weight control depending on family factors and concern of care givers on the child's weight [31].

This study illustrates that about a third of U.S fifth graders receive regular non-parental care, and a fifth of U.S fifth graders received relative provided care. Most children receive non-parental care afterschool compared to those who receive non-parental care before school. In looking at the type of relative who provides care, grandparents are the most common care provider followed by siblings. In looking at each main exposure and obesity separately, there as a statistically significant association between whether the child received relative care and obesity. However, there is no association between type of relative care provider and type of non-parental care. While there is an association between relative care and obesity in the bivariate analysis, our multivariate analysis does not show that there is a statistically significant difference in obesity in the children who receive relative care and those who did not when controlling for various socio-contextual factors. The lack of association may be a result of the strong association of socio-contextual variables that are shown in the literature to be highly associated with obesity and are depicted in the conceptual framework (Figure 1). These factors include race, maternal education, maternal employment status and wealth, among others shown in this analysis of 5^{th} graders in the ECLS-K cohort. Since this analysis shows that receipt of relative care by children, regardless of

who provided the relative care, is not an independent risk factor for obesity, relative care use may be another characteristic of those children that have increased odds of becoming obese.

This idea is supported in this analysis by the significant associations of race, employment, family structure and wealth quintile for obesity and receipt of relative care. Children who are non-white, have mothers who are employed full time and are in the lower wealth quintiles all have higher odds ratios for receiving relative care than those children who do not have these characteristics, a finding consistent with other studies [14, 22, 28, 57, 58]. These characteristics are similarly associated in this study with obesity, where children who are non-white, have full time employed mothers and are poorer, also have higher odds ratios of being obese than those children who do not have these characteristics, a finding also supported by other researchers [6, 13, 21, 24, 31, 40, 46, 59].

The lower odds of becoming obese in children who have mothers that work part time or do not work are consistent with findings in the literature. Maternal employment and longer hours of maternal employment are shown to be associated with obesity in children [48, 56, 57]. This association may be explained by mothers having a lack of time to prepare or provide healthy foods or have time to be physically active with their children or to role model these behaviors [27, 56]. In various studies, mothers who work long hours report using fast food or television as a way to oversee their children so they have time to complete other household responsibilities [6, 30].

The lower odds of children receiving relative care when the mother is not employed part time seem intuitive as the mother is devoting less time to work. And as maternal employment is shown to be associated with obesity and in this study, less maternal employment is also associated with decreased odds of obesity and relative child care, women who work less may be able to devote more time to their children [30, 46] and do not have to use relative care providers. The lack of association seen between relative provided care and childhood obesity may also be attributable to the age of the children. This study looks at older children, with most children in this sample about 11years in age (data not shown), whereas most studies looking at the

relationship between relative care and obesity in children focus on very young children [13-15, 23, 59].

Since this study only looked at relative care provided during the time of the survey round, spring of 2004, more studies should look at the longitudinal and cumulative effects of relative provided care and childhood obesity outcomes. There are several studies looking at childcare and obesity outcomes in future years, but researchers focus on center-based care that was provided to very young children [13, 14, 23]. However, these studies report conflicting associations between center-based child care and obesity, where some studies report a positive association between child care and obesity [13, 14], and some report a negative association between child care and obesity [23]. In another study, that did not use ECLS-K data, but used data from a similar birth cohort study in Hong Kong, shows a significant association between relative child care and obesity in 11 year olds [28]. However, this study uses BMI z-scores and overweight including obesity as outcomes which may be a reason for the significance in association between relative care and childhood obesity.

Another cohort study using overweight instead of obesity is Pearce et al's study of the UK Millennium Cohort Study. Researchers found that informal care between the ages of 9 months and 3 years is associated with overweight outcomes in 3-year-old children [46]. Some other studies looking at child care, primarily center-based care for very young children, use overweight instead of obesity and also see a positive association between child care use and obesity [13]. However, Pearce et al's study uses overweight as the outcome and also investigates the duration of time throughout young childhood children spend in informal care, both factors that are not looked at in this study and could have altered findings. Although, this analysis on the association between relative provided care and obesity does consider the amount of time spent in relative care per week in an attempt to understand if more time spent in relative care may be an intermediary factor in the receipt of relative care and obesity relationship.

Limitations and Strengths

A limitation of this study is that it uses cross-sectional data. This analysis only looks at the association between relative care during 5th grade in ECLS-K 5th graders. It does not account for previous relative care in younger grades or the length of relative care from younger ages, such as, the overall amount of time spent in relative care from kindergarten to 5th grade. In one study looking at preschool child care and overweight risk in 6 to 12 year old children, there is a decreased risk of becoming overweight in 6 to 12 year olds that received limited center-based care [23]. It is possible that if this study looked at longitudinal data, there may also be an association between prior relative provided childcare and obesity. Further studies should be conducted looking at relative care throughout early childhood to see if there is an effect on consistent and long term relative provided childcare and obesity in children. Especially as many qualitative studies looking at grandparental care reported differences in children's behavior when under care of grandparents compared to parents [3-5].

Another limitation is that these data do not account for the quality of relative care. It may be that the quality of relative care is not the same as it may be in younger years. The ECLS-K does not collect data on the characteristics of the care provided by relatives, such as, relative provider's obesity, education status, wealth quintile, etc. This study also does not look at what activities compromised relative provided care, such as, time spent in relative care watching television or consuming junk food or sweetened beverages. It may be that the quality of relative care, where children who receive low quality relative care may spend most of their time playing video games, may show differing associations with childhood obesity.

Also, at this age, most children have more autonomy than when they were younger. Relative care at this age may be more supervision than actual care. In a longitudinal study looking at overweight outcomes, children who were overweight at school age were less physically active and watched more television [33]. It may be plausible that children at this age may spend more time watching television, but further analysis is need to clarify a possible relationship. In

younger ages, such as kindergarten, preschool, or possibly even 1st grade, relatives who provide care may be preparing meals for the children or promoting physical activity in the children. However, relative care providers may also be preparing meals and promoting activity in their fifth grade children. In order to gain more insight into the association between relative care and childhood obesity, studies should be conducted at understanding the level and quality of care provided by relatives to children and if there is a change in the level and quality of care as children grow older.

This study adds to the discussion of the association between various characteristics of the family environment and childhood obesity, by providing insight into the association of relative care and obesity in fifth grade children in the United States who were in enrolled in kindergarten in 1999. One study did use the ECLS-K to look at child care use, including relative care and other non-parental care sources, but looked at the relationship between child care and obesity in kindergarteners [15]. Maher et al found a significant association and increased odds for obesity in children who received care from family, friends or neighbors [15]. Maher et al's finding is in contrast to this study's findings, which showed no association between relative care and obesity in ECLS-K 5th graders in presence of controlling variables. This difference in findings may highlight different relationships of relative care and obesity as children age. However, this study controlled for more possible confounding variables than Maher et al and added controlling variables in sequence to see differing associations, whereas Maher et al's models consisted of all controlling variables at once. Also, this study did not modify variables to the extent of Maher et al who dichotomized majority of the controlling variables.

Chapter 6 Conclusion and Recommendations:

The family environment is critical in exploring possible associations for childhood obesity as the family environment provides the most integral environment for a child's development. It is the space in which children learn and develop habits and behaviors that can have major health

consequences into their adult lives. The family environment is an informal learning space that teaches children through modeling of behaviors and attitudes by parents and family members. Since parental modeling is shown to be associated with children's food and exercise habits, and factors related to the family environment, such as SES, education, and family structure, also influence childhood obesity, it is important to understand other dimensions of the family environment, such as child care. This study aims to understand the association between relative provided child care and obesity in early childhood by using a nationally representative sample of U.S fifth graders.

Children spend a large portion of their time in child care and relative provided child care may have similar relationships with obesity as parental child care. However, this study illustrates that receipt of relative care, type of relative care provider and type of non-parental care are not independent risk factors for obesity in 5th grade children in the United States. While the bivariate analysis show an association between the receipt of relative care and obesity, the presence of controlling variables in the models took away the association. The family environment factors, such as, maternal education, employment, age, the child's race, family SES and structure all show a significant association with obesity when looking at relative care exposure variables. Relative provided child care may be a facet of the family environment, but as shown in analyzing the characteristics of received relative care, relative care may be a function of family characteristics that are also shown to be independently associated with obesity in the literature.

This study adds to the literature by illustrating non-parental child care may be another characteristic of children whose family environments already put them at risk for obesity. Relative provided care may not be an independent risk factor, but it still may play a role in creating a family environment that may be associated with childhood obesity. Further studies need to be conducted that use longitudinal data and collect data on the quality of child care given by relatives to understand the relationship between relative care and childhood obesity. By

looking at these factors, the influence of the greater family environment and childhood obesity may be discerned.

Tables

Table 1. The differences in socio-demographic, family SES, household structure, and non-parental care characteristics between those who received relative care and those who did not in fifth grade children (n=9324).

Variables	All % (SE)	Relative Care %(SE)	No Relative Care % (SE)	p value
	Socio-Demographic Characteristics			
BMI (kg/m^2)º	20.71 (0.08)	21.25 (0.19)	20.55 (0.09)	0.0010
Obese	15.97 (0.01)	18.56 (0.02)	15.24 (0.02)	0.0268
Male	50.65 (0.01)	51.96 (0.01)	50.28 (0.01)	0.4420
Race				<0.0001
White	57.16 (0.02)	46.86 (0.3)	60.08 (0.02)	
Black	16.08 (0.01)	22.26 (0.02)	14.33 (0.01)	
Hispanic	19.80 (0.01)	22.76 (0.03)	18.96 (0.01)	
Asian	2.87 (0.003)	3.58 (0.01)	2.66 (0.003)	
Pacific Islander	0.64 (0.003)	0.62 (0.003)	0.65 (0.003)	
American Indian	1.48 (0.01)	2.00 (0.01)	1.34 (0.01)	
More than one Race	1.97 (0.002)	1.92 (0.01)	1.98 (0.002)	
Urban				0.9593
Large City	35.35 (0.02)	35.80 (0.02)	35.23 (0.02)	
Large Town or Suburb	41.61 (0.03)	41.14 (0.04)	41.74 (0.02)	
Small Town or Rural	23.04(0.02)	23.05 (0.03)	23.03 (0.02)	
Region				0.6772
Northeast	18.77 (0.01)	20.17 (0.02)	18.37 (0.01)	
Midwest	24.50 (0.01)	23.85 (0.02)	24.69 (0.01)	
South	34.83 (0.01)	34.89 (0.02)	34.82 (0.02)	
West	21.89 (0.01)	21.09 (0.02)	22.12 (0.01)	
	Family SES characteristics			
Mother's Age (years) º	38.69 (0.15)	37.54 (0.28)	39.01 (1.7)	<0.0001
Mother's Education Level				0.0010
Up to or Completed High School	39.73(0.01)	42.89 (0.02)	38.84 (0.01)	
Up to College Degree	50.98 (0.01)	51.46 (0.02)	50.84 (0.01)	
Up to Professional or Graduate Degree	9.29 (0.006)	5.65 (0.01)	10.32 (0.01)	
Mother's Employment				<0.0001
Full Time	51.28 (0.01)	75.05 (0.02)	44.56 (0.01)	
Part Time	22.02 (0.01)	15.89 (0.01)	23.76 (0.01)	
Looking for Work	3.62(0.004)	3.21 (0.01)	3.74 (0.004)	
Not in Labor Force	23.07 (0.01)	5.85 (0.01)	27.94 (0.01)	

º Mean (SE); Data Source: Round 6 data of ECLS-K, collected in Spring of 2004
Note: p values obtained through chi-square tests for categorical variables and two sample t-tests for continuous variables

Table 1(Cont.). The differences in socio-demographic, family SES, household structure, and non-parental care characteristics between those who received relative care and those who did not in fifth grade children (n=9324).

Variables	All % (SE)	Relative Care %(SE)	No Relative Care % (SE)	p value
Father's Employment				<0.0001
Full Time	65.11 (0.01)	51.26 (0.02)	69.02 (0.01)	
Part Time	3.42 (0.004)	2.39 (0.01)	3.71 (0.01)	
Looking for Work	1.35 (0.002)	1.72 (0.01)	1.24 (0.002)	
Not in Labor Force	3.51 (0.003)	2.29 (0.01)	3.85 (0.004)	
No Father in Household	26.61 (.01)	42.34 (0.02)	22.17 (0.01)	
Wealth Quintile				<0.0001
First (Lowest)	20.64 (0.01)	23.65 (0.02)	19.79 (0.01)	
Second	20.13 (0.01)	23.18 (.02)	19.27 (0.01)	
Third	19.85 (0.01)	23.84 (0.02)	18.72 (0.01)	
Fourth	19.75 (0.01)	17.31 (0.01)	20.44 (0.01)	
Fifth (Highest)	19.63 (0.01)	12.03 (0.01)	21.78 (0.01)	
Below Poverty Status	23.66 (0.01)	25.69 (0.02)	74.31 (0.02)	0.2258
Household Structure Characteristics				
Immigrant Family	20.13 (0.01)	22.59 (0.02)	19.43 (0.01)	0.0486
Married Parents	67.78 (0.01)	52.19 (0.02)	47.81 (0.02)	<0.0001
Number of Siblingsº	1.58 (0.03)	1.54 (0.05)	1.59 (0.03)	0.3040
Number of Adults in Householdº	2.05 (0.01)	2.09 (0.04)	2.04 (0.01)	0.1470
Number of Children in Household º	2.52 (0.03)	2.47 (0.06)	2.53 (0.03)	0.3490
Non-Parental Care Characteristics				
Ever Had Non-Parental Care	35.47 (0.01)	100.00 (0.00)	17.22 (0.01)	
Type of Non-Parental Care				<0.0001
No Non-Parental Care	65.53 (0.01)	3.40 (0.01)	83.09 (0.01)	
Relative Care	18.52 (0.01)	84.00 (0.02)	0.00 (0.00)	
Non-Relative Care	4.10 (0.004)	1.99 (0.01)	4.69 (0.004)	
Center-Based Program	10.17 (0.01)	3.54 (0.01)	12.05 (0.01)	
Type of Care Varies	1.69 (0.002)	7.07 (0.01)	0.16 (0.00)	
Hours in Non-Parental Care per Week º	11.16 (.31)	12.32 (0.46)	9.28 (0.38)	<0.0001
Current Center Care	11.96 (0.01)	10.19 (0.01)	89.81 (0.01)	0.1848
Hours in Center Care per Weekº	8.14 (0.30)	6.83 (0.70)	8.44 (0.31)	0.0280
Days of 20 minutes of Physical Activity per Weekº	3.72 (0.04)	3.68 (0.09)	3.74 (0.04)	0.6110

º Mean (SE); Data Source: Round 6 data of ECLS-K, collected in Spring of 2004
Note: p values obtained through chi-square tests for categorical variables and two sample t-tests for continuous variables

Table 2. The characteristics of regular relative care in fifth grade children (n=9324).

Variables	Relative Care % (SE)
Current Relative Care	22.04 (0.01)
Number of Current Relative Care Arrangements	
No Relative Care Arrangements	77.96 (0.01)
One	19.39 (0.01)
Two or more	2.66 (0.001)
Primary Relative Caregiver	
No Relative Caregiver	77.96 (0.01)
Grandparents	11.21 (0.01)
Aunt or Uncle or Other Relative	4.90 (0.004)
Sibling	5.93 (0.005)
Place of Relative Care	
No Relative Care	77.96 (0.01)
Child's Home	12.19 (0.005)
Other Home	8.66 (0.01)
Both or Varies	1.20 (0.002)
Relative Care Before School	6.08 (0.004)
Relative Care After School	19.34 (0.01)
Days of Relative Care [o]	4.15 (0.06)
Hours in Relative Care per Week[o]	10.51 (0.45)

[o]Mean (SE)
Data Source: Round 6 data of ECLS-K, collected in Spring of 2004

Table 3. The characteristics of types of care received by when care is provided in fifth graders (n= 9324).

Variable	Care is Afterschool n= 2704 (%)	Care is Not Afterschool n= 5430 (%)	p value
Type of Non-Parental Care			<0.0001
No Non-Parental Care	2.36 (0.01)	95.11 (0.01)	
Relative Care	52.23 (0.02)	2.72 (0.01)	
Non-Relative Care	10.65 (0.01)	1.03 (0.003)	
Center-based Care	29.92 (0.02)	0.93 (0.003)	
Various Types of Care	4.84 (0.01)	0.21 (0.00)	
Hours in Non-Parental Care º	11.38 (0.31)	9.05 (1.13)	0.0390
Received Relative Care	62.08 (0.02)	3.29 (0.004)	<0.0001
Relative Care Provider			<0.0001
No Relative Care	37.92 (0.02)	96.71 (0.004)	
Grandparents	31.56 (0.02)	1.68 (0.003)	
Aunt, Uncle or Other	13.22 (0.01)	1.01 (0.003)	
Sibling	17.30 (0.01)	0.60 (0.002)	
Number of Relative Care Arrangements			<0.0001
No Relative Care Arrangements	37.92 (0.02)	96.71 (0.004)	
One	54.75 (0.02)	2.82 (0.004)	
Two or More	7.33 (0.01)	0.46 (0.001)	
Place of Relative Care			<0.0001
No Relative Care	37.92 (0.02)	96.71 (0.004)	
Child's Home	34.47 (0.02)	1.75(0.003)	
Relative's Home	24.33 (0.02)	1.32 (0.003)	
Both or Varies	3.28 (0.01)	0.22 (0.00)	
Number of Days per Week of Relative Careº	4.19 (0.06)	3.79 (0.25)	0.1070
Hours per Week for Relative Care º	10.68 (0.45)	8.91 (1.33)	0.1740
Current Center-based Care	35.44 (0.02)	0.96 (.003)	<0.0001
Hours per Week for Center-based Careº	8.35 (0.28)	4.42 (0.89)	<0.0001

º Mean (SE)
Data Source: Round 6 data of ECLS-K, collected in Spring of 2004

Table 4. The survey adjusted logit model for the association between received relative care and obesity (n=9324).

Variables	Bivariate OR (SE)	Child Characteristics OR (SE)	Family SES Characteristics OR (SE)	Household Characteristics OR (SE)
Outcome= Obesity				
Received Relative Care	1.27* (0.14)	1.19 (0.13)	1.09 (0.12)	1.06 (0.15)
Female		0.78** (0.07)	0.77** (0.07)	0.78** (0.07)
Race				
White		Reference	Reference	Reference
Black		1.39* (0.22)	1.28 (0.24)	1.27 (0.24)
Hispanic		1.84** (0.25)	1.72** (0.25)	1.69** (0.29)
Asian		1.34 (0.32)	1.31 (0.32)	1.23 (0.31)
Pacific Islander		2.43* (1.06)	2.01 (0.92)	1.73 (0.80)
American Indian		2.08** (0.53)	2.00* (0.61)	1.94* (0.61)
More than one race		1.41 (0.41)	1.31 (0.38)	1.34 (0.37)
Census Region				
Northeast		Reference	Reference	Reference
Midwest		0.87 (0.13)	0.88 (0.13)	0.89 (0.13)
South		1.03 (0.14)	1.00 (0.13)	1.02 (0.13)
West		0.72+ (0.12)	0.73+ (0.12)	0.72* (0.12)
Urban Area				
Large or Mid-Size City		Reference	Reference	Reference
Large Town or Suburb		0.80+ (0.11)	0.81 (0.11)	0.81 (0.11)
Small or Rural Town		1.06 (0.15)	1.02 (0.14)	1.02 (0.15)
Maternal Employment Status				
Full Time			Reference	Reference
Part Time			0.77* (0.09)	0.76* (0.08)
Looking for Work			0.66 (0.17)	0.69 (0.18)
Not in Labor Force			0.93 (0.13)	0.94 (0.13)
Maternal Education				
Up to High School Diploma			Reference	Reference
Up to College Degree			1.15 (0.17)	1.17 (0.17)
Up to Professional or Graduate Degree			1.10 (0.33)	1.08 (0.33)

Key: ** p<0.01, * p<0.05, + p<0.1; Odds Ratios with Standard errors in parentheses
Data Source: Round 6 data of ECLS-K, collected in Spring of 2004

Table 4 (Cont.). The survey adjusted logit model for the association between received relative care and obesity (n=9324).

Variables	Bivariate OR (SE)	Child Characteristics OR (SE)	Family SES Characteristics OR (SE)	Household Characteristics OR (SE)
Outcome= Obesity				
Paternal Employment Status				
Full Time			Reference	Reference
Part Time			1.15 (0.38)	1.12 (0.37)
Looking for Work			0.99 (0.35)	0.94 (0.33)
Not in Labor Force			1.58* (0.32)	1.48+ (0.32)
No Father in Household			1.09 (0.15)	1.59 (0.65)
Wealth Quintile				
Fifth (Highest)			Reference	Reference
First (Lowest)			1.34 (0.39)	1.34 (0.39)
Second			1.87* (0.46)	1.85* (0.46)
Third			1.66* (0.33)	1.64* (0.33)
Fourth			0.96 (0.19)	0.95 (0.19)
Below Poverty Status			0.90 (0.13)	0.92 (0.13)
Immigrant Family				1.03 (0.16)
Married Parents				1.16 (0.23)
Maternal Age				1.00 (0.01)
Paternal Age				1.01 (0.01)
Number of Siblings				0.93 (0.10)
Number of Children in Household				0.99 (0.10)
Number of Adults in Household				1.21** (0.08)
Number of Hours Spent in Relative Care				1.00 (0.01)
Constant	0.18**(0.01)	0.25** (0.06)	0.20** (0.06)	0.09** (0.06)

Key: ** p<0.01, * p<0.05, + p<0.1; Odds Ratios with Standard errors in parentheses
Data Source: Round 6 data of ECLS-K, collected in Spring of 2004

Table 5. The survey adjusted logit model for the association between relative care provider and obesity in fifth graders (n=9324).

Variables	Bivariate OR (SE)	Child Characteristics OR (SE)	Family SES Characteristics OR (SE)	Household Characteristics OR (SE)
Outcome = Obesity				
Relative Care Provider				
Grandparents	1.28+ (0.17)	1.25+ (0.17)	1.12 (0.15)	1.08 (0.18)
Aunt, Uncle, Other	1.15 (0.27)	0.98 (0.23)	0.92 (0.22)	0.88 (0.23)
Sibling	1.35 (0.28)	1.27 (0.29)	1.19 (0.26)	1.18 (0.27)
Female		0.78** (0.07)	0.76** (0.07)	0.78** (0.07)
Race				
White				
Black		1.41* (0.23)	1.30 (0.25)	1.29 (0.24)
Hispanic		1.85** (0.25)	1.73** (0.25)	1.70** (0.30)
Asian		1.35 (0.32)	1.32 (0.32)	1.24 (0.32)
Pacific Islander		2.47* (1.06)	2.04 (0.92)	1.77 (0.81)
American Indian		2.10** (0.53)	2.01* (0.62)	1.95* (0.62)
More than one race		1.40 (0.41)	1.30 (0.38)	1.33 (0.37)
Census Region				
Northeast				
Midwest		0.87 (0.13)	0.88 (0.13)	0.89 (0.13)
South		1.03 (0.14)	1.00 (0.13)	1.02 (0.13)
West		0.72* (0.12)	0.73+ (0.12)	0.72* (0.12)
Urban Area				
Large or Mid-Size City				
Large Town or Suburb		0.80(0.11)	0.81 (0.11)	0.81 (0.11)
Small or Rural Town		1.06 (0.15)	1.01 (0.14)	1.02 (0.15)
Maternal Employment Status				
Full Time				
Part Time			0.78* (0.09)	0.77* (0.08)
Looking for Work			0.66+ (0.17)	0.69 (0.18)
Not in Labor Force			0.94 (0.13)	0.94 (0.13)
Maternal Education				
Up to High School Diploma				
Up to College Degree			1.15 (0.17)	1.16 (0.17)
Up to Professional or Graduate Degree			1.10 (0.33)	1.08 (0.33)

Key: ** p<0.01, * p<0.05, + p<0.1; Odds Ratios followed with Standard errors in parentheses
Data Source: Round 6 data of ECLS-K, collected in Spring of 2004

Table 5 (Cont.). The survey adjusted logit model for the association between relative care provider and obesity in fifth graders (n=9324).

Variables	Bivariate OR (SE)	Child Characteristics OR (SE)	Family SES Characteristics OR (SE)	Household Characteristics OR (SE)
Outcome = Obesity				
Paternal Employment Status				
Full Time				
Part Time			1.16 (0.38)	1.13 (0.37)
Looking for Work			1.00 (0.35)	0.95 (0.33)
Not in Labor Force			1.58* (0.32)	1.48+ (0.32)
No Father in Household			1.09 (0.15)	1.59 (0.66)
Wealth Quintile				
Fifth (Highest)				
First (Lowest)			1.34 (0.39)	1.34 (0.39)
Second			1.86* (0.46)	1.83* (0.45)
Third			1.65* (0.32)	1.63* (0.32)
Fourth			0.96 (0.19)	0.95 (0.19)
Below Poverty Status			0.90 (0.13)	0.92 (0.13)
Immigrant Family				1.02 (0.16)
Married Parents				1.16 (0.23)
Maternal Age				1.00 (0.01)
Paternal Age				1.01 (0.01)
Number of Siblings				0.92 (0.10)
Number of Children in Household				1.00 (0.11)
Number of Adults in Household				1.21** (0.08)
Number of Hours Spent in Relative Care				1.00 (0.01)
Constant	0.18**(0.01)	0.25** (0.06)	0.20** (0.06)	0.09** (0.06)

Key: ** p<0.01, * p<0.05, + p<0.1; Odds Ratios followed with Standard errors in parentheses
Data Source: Round 6 data of ECLS-K, collected in Spring of 2004

Table 6. The survey adjusted logit model for the association between type of non-parental care and obesity in fifth graders (n=9324).

Variables	Bivariate OR (SE)	Child Characteristics OR (SE)	Family SES Characteristics OR (SE)	Household Characteristics OR (SE)
Outcome = Obesity				
Type of Non-Parental Care				
No Non-Parental Care	Reference	Reference	Reference	Reference
Relative Care	1.28* (0.16)	1.19 (0.15)	1.09 (0.14)	1.09 (0.16)
Non-Relative Care	0.82 (0.21)	0.87 (0.21)	0.81 (0.19)	0.77 (0.18)
Center-based Care	1.15 (0.19)	1.11 (0.18)	1.08 (0.19)	1.04 (0.18)
Type Varies	1.54 (0.58)	1.51 (0.56)	1.34 (0.51)	1.33 (0.51)
Female		0.78** (0.07)	0.76** (0.07)	0.78** (0.07)
Race				
White		Reference	Reference	Reference
Black		1.38* (0.22)	1.27 (0.24)	1.26 (0.24)
Hispanic		1.84** (0.25)	1.72** (0.25)	1.70** (0.29)
Asian		1.34 (0.31)	1.31 (0.31)	1.23 (0.30)
Pacific Islander		2.42* (1.06)	1.99 (0.92)	1.72 (0.80)
American Indian		2.08** (0.53)	1.99* (0.61)	1.93* (0.61)
More than one race		1.39 (0.40)	1.29 (0.37)	1.33 (0.36)
Census Region				
Northeast		Reference	Reference	Reference
Midwest		0.87 (0.13)	0.87 (0.13)	0.88 (0.13)
South		1.03 (0.14)	1.00 (0.13)	1.01 (0.13)
West		0.72* (0.12)	0.72* (0.12)	0.71* (0.12)
Urban Area				
Large or Mid-Size City		Reference	Reference	Reference
Large Town or Suburb		0.81 (0.11)	0.82 (0.11)	0.82 (0.11)
Small or Rural Town		1.07 (0.15)	1.02 (0.14)	1.03 (0.15)
Maternal Employment Status				
Full Time			Reference	Reference
Part Time			0.78* (0.09)	0.76* (0.09)
Looking for Work			0.66+ (0.17)	0.68 (0.18)
Not in Labor Force			0.94 (0.13)	0.94 (0.13)
Maternal Education				
Up to High School Diploma			Reference	Reference
Up to College Degree			1.15 (0.17)	1.17 (0.17)
Up to Professional or Graduate Degree			1.10 (0.33)	1.08 (0.32)

Key: ** p<0.01, * p<0.05, + p<0.1; Odds Ratios followed with Standard errors in parentheses
Data Source: Round 6 data of ECLS-K, collected in Spring of 2004

Table 6 (Cont.). The survey adjusted logit model for the association between type of non-parental care and obesity in fifth graders (n=9324).

Variables	Bivariate OR (SE)	Child Characteristics OR (SE)	Family SES Characteristics OR (SE)	Household Characteristics OR (SE)
Outcome = Obesity				
Paternal Employment Status				
Full Time			Reference	Reference
Part Time			1.14 (0.38)	1.11 (0.37)
Looking for Work			0.99 (0.35)	0.94 (0.32)
Not in Labor Force			1.58* (0.33)	1.47+ (0.32)
No Father in Household			1.09 (0.15)	1.58 (0.65)
Wealth Quintile				
Fifth (Highest)			Reference	Reference
First (Lowest)			1.33 (0.39)	1.33 (0.39)
Second			1.87* (0.46)	1.84* (0.46)
Third			1.65* (0.32)	1.63* (0.32)
Fourth			0.96 (0.19)	0.95 (0.19)
Below Poverty Status			0.90 (0.13)	0.92 (0.13)
Immigrant Family				1.02 (0.16)
Married Parents				1.17 (0.23)
Maternal Age				1.00 (0.01)
Paternal Age				1.01 (0.01)
Number of Siblings				0.93 (0.10)
Number of Children in Household				0.99 (0.11)
Number of Adults in Household				1.21** (0.08)
Number of Hours Spent in Relative Care				1.00 (0.01)
Constant	0.18**(0.01)	0.25** (0.06)	0.20** (0.06)	0.09** (0.06)

Key: ** p<0.01, * p<0.05, + p<0.1; Odds Ratios followed with Standard errors in parentheses
Data Source: Round 6 data of ECLS-K, collected in Spring of 2004

Table 7. The characteristics predicting relative care and the sample characteristics of fifth graders (n=9324).

Variables	Child Characteristics OR (SE)	Family SES Characteristics OR (SE)	Household Characteristics OR (SE)
Outcome = Obesity			
Female	0.93 (0.08)	0.96 (0.09)	0.98 (0.09)
Race			
White			
Black	2.16** (0.30)	1.39* (0.22)	1.29 (0.21)
Hispanic	1.71** (0.20)	1.39* (0.19)	1.11 (0.17)
Asian	1.84** (0.35)	1.82** (0.37)	1.38 (0.33)
Pacific Islander	1.27 (0.47)	1.03 (0.43)	0.55 (0.33)
American Indian	1.85** (0.38)	1.98** (0.49)	1.72* (0.48)
More than one race	1.33 (0.37)	1.09 (0.31)	1.06 (0.32)
Census Region			
Northeast			
Midwest	0.86 (0.10)	0.84 (0.11)	0.90 (0.11)
South	0.77+ (0.10)	0.72* (0.10)	0.76+ (0.11)
West	0.74* (0.10)	0.81 (0.12)	0.83 (0.13)
Urban Area			
Large or Mid-Size City			
Large Town or Suburb	1.10 (0.12)	1.11 (0.13)	1.12 (0.13)
Small or Rural Town	1.19 (0.14)	1.07 (0.13)	1.12 (0.14)
Maternal Employment Status			
Full Time			
Part Time		0.45** (0.06)	0.46** (0.06)
Looking for Work		0.38** (0.11)	0.39** (0.11)
Not in Labor Force		0.12** (0.03)	0.12** (0.02)
Maternal Education			
Up to High School Diploma			
Up to College Degree		1.08 (0.14)	1.15 (0.15)
Up to Professional or Graduate Degree		0.81 (0.17)	0.91 (0.20)

Key: ** p<0.01, * p<0.05, + p<0.1; Odds Ratios followed with Standard errors in parentheses
Data Source: Round 6 data of ECLS-K, collected in Spring of 2004

Table 7 (Cont.). The characteristics predicting relative care and the sample characteristics of fifth graders (n=9324).

Variables	Child Characteristics OR (SE)	Family SES Characteristics OR (SE)	Household Characteristics OR (SE)
Outcome = Obesity			
Paternal Employment Status			
Full Time			
Part Time		0.71 (0.18)	0.76 (0.21)
Looking for Work		1.67 (0.57)	1.57 (0.51)
Not in Labor Force		0.69 (0.17)	0.69 (0.19)
No Father in Household		1.95** (0.26)	3.20* (1.53)
Wealth Quintile			
Fifth (Highest)			
First (Lowest)		2.24** (0.56)	2.11** (0.51)
Second		1.67* (0.34)	1.48+ (0.31)
Third		1.72** (0.29)	1.61** (0.27)
Fourth		1.22 (0.19)	1.15 (0.18)
Below Poverty Status		0.87 (0.13)	0.75+ (0.11)
Immigrant Family			1.29+ (0.17)
Married Parents			1.10 (0.27)
Maternal Age			0.98** (0.01)
Paternal Age			1.00 (0.01)
Number of Siblings			0.88 (0.08)
Number of Children in Household			1.14 (0.10)
Number of Adults in Household			1.68** (0.11)
Constant	0.26** (0.05)	0.26** (0.07)	0.15** (0.10)

Key: ** p<0.01, * p<0.05, + p<0.1; Odds Ratios followed with Standard errors in parentheses
Data Source: Round 6 data of ECLS-K, collected in Spring of 2004

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