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“Head Start and Children's Nutrition, Weight, and Health Care Receipt”

RaeHyuck Lee [Doctoral Candidate],
Columbia University School of Social Work 1255 Amsterdam Avenue, New York, NY 10027
rl2507@columbia.edu

Fuhua Zhai [Assistant Professor],
School of Social Welfare, Stony Brook University L2-093 Health Sciences Center Stony Brook, NY 11794 fuhua.zhai@stonybrook.edu

Wen-Jui Han [Professor],
Silver School of Social Work, New York University 1 Washington Square North, New York, NY 10003 wjh3@nyu.edu

Jeanne Brooks-Gunn [Virginia and Leonard Marx Professor of Child Development and Education], and
Teachers College and College of Physicians and Surgeons, Columbia University 525 West 120th Street, New York, NY 10027 brooks-gunn@columbia.edu

Jane Waldfogel [Compton Foundation Centennial Professor for the Prevention of Children and Youth Problems]
Columbia University School of Social Work 1255 Amsterdam Avenue, New York, NY 10027

Abstract

Using a sample of low-income children from the Early Childhood Longitudinal Study-Birth Cohort ($N \approx 4{,}350$) and propensity-score weighted regressions, we analyzed children's nutrition, weight, and health care receipt at kindergarten entry, comparing 1) Head Start participants and all non-participants, and 2) Head Start participants and children in prekindergarten, other center-based care, other non-parental care, or only parental care. Overall, we found that compared to all non-participants, Head Start participants were more likely to receive dental checkups but showed no differences in getting medical checkups; they were also more likely to have healthy eating patterns but showed no differences in Body Mass Index (BMI), overweight, or obesity. However, these results varied depending on the comparison group—Head Start participants showed lower BMI scores and lower probability of overweight compared to those in other non-parental care, and the effects on healthy eating and dental checkups differed by comparison group.

Keywords

Head Start; nutrition; weight; health care receipt; ECLS-B

Corresponding author: Jane Waldfogel, Compton Foundation Centennial Professor for the Prevention of Children and Youth Problems Columbia University School of Social Work 1255 Amsterdam Avenue, New York, NY 10027 jw205@columbia.edu Phone: 212-851-2408 Fax: 212-851-2206.

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Head Start (hereafter, HS), established as part of the War on Poverty in 1965, provides comprehensive services, including education, health, nutrition, and other social services, to low-income preschool-age children and their families (Vinovskis, 2005). In 2009, about $7.2 billion was allocated to provide services to over 900,000 low-income children (Office of Head Start, 2010). Since its inception, the success of HS has been debated in the literature (Zigler & Styfco, 2004). Most of the research has focused on the effects of HS on cognitive and academic outcomes (Currie & Thomas, 1995; Garces, Thomas, & Currie, 2002), while health-related outcomes remain understudied (Currie, 2001).

The lack of attention to health-related outcomes is surprising given that the original Head Start Planning Committee included clear nutrition and health components to the program due to concern about low-income children's health (North, 1979). Furthermore, in the 1998 Head Start reauthorization, the performance standards included considerable changes to bolster the nutrition and health standards (Koppelman, 2003). Programs since then are required to provide specific services related to nutrition and health (details below in the Background section) (U.S. Department of Health and Human Service, Administration for Children and Families [USDHHS, ACF], 2009).

Using data from the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B), we examined the effects of HS on children's nutrition, weight, and health care receipt at kindergarten entry. This focus is important for the following reasons. First, more than a fifth of preschool-age children are reported to be overweight or obese (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). Obesity during the preschool years tends to be predictive of obesity in adulthood (Magarey, Daniels, Boulton, & Cockington, 2003; Nader et al., 2006). It is thus important to examine if HS participation may reduce the risk of being obese. Second, given that one of the goals in HS is to provide nutrition services, it is worth examining if HS may promote children's healthy eating. Third, examining whether HS improves access to health care among low-income children is important in its own right, not to mention that HS includes mandated performance standards for health assessments and services. Finally, it is important to examine the effects of HS on children's oral health care, because dental care is one of the most unmet needs of health care among low-income children (Hughes, Duderstadt, Soobader, & Newacheck, 2005).

Head Start and Children's Health Outcomes

To understand the relationship between HS and children's health-related well-being, we built upon an integrated model of health promotion as our guiding theoretical framework (Wilson & Evans, 2003). Based on Ecological System Theory, the integrated model of health promotion considers child development as a process that unfolds through the interactions between individuals and their environments (Bronfenbrenner, 1979, 1992). The integrated model conceptualizes child health-promoting behaviors as a function of individual and environmental factors. In particular, child care arrangements serve as an important environmental factor in the development of health-promoting behaviors among children. In this view, we expect that attending HS may have beneficial effects on children's health-related outcomes given that HS programs provide comprehensive nutrition and health services to children and their families. Also, since different types of care arrangements provide different environments with respect to health-related services (as described below), we expect that HS effects on health-related outcomes may differ by the specific type of other care arrangements to which HS is compared, including state-funded prekindergarten (hereafter, pre-K), other center-based care, other non-parental care, and parental care.

Within this integrated model, we might expect several potential mechanisms to link HS to children's health-related outcomes. First, at the macrosystem level, HS's clear performance standards on comprehensive nutrition and health services may promote the use of nutrition and health services and thus, directly and indirectly, improve children's health-related well-being. Second, at the exosystem level, with HS's clear performance standards requiring HS programs to provide diverse nutrition and health services (USDHHS, ACF, 2009), children's health status may be directly influenced by attending HS. Specifically, HS programs are required to help program participants receive physical examinations by scheduling screening appointments or offering screenings directly on-site (e.g., dental, vision, and hearing screenings); to assist families in applying for age-appropriate health care services (e.g., immunizations and health care for medical, dental, and mental health needs); and to provide health promotion activities directly on-site (e.g., providing training and information on well-child care). Also, HS programs are required to track each child's health progress (e.g., assisting families in finding a medical home, encouraging parental involvement in children's health, and making appropriate referrals when needed). To promote nutrition, HS programs are mandated to provide high-nutrient meals and snacks that meet one-third to one-half of the daily nutritional needs of participants in part-day and full-day programs, respectively. In addition, it is recommended that HS programs encourage children's physical activities (e.g., through indoor and outdoor play). Third, at the mesosystem level, HS may influence children's health status by not only providing health and nutritional education for children and parents but also encouraging parental involvement in health-promoting behaviors. Specifically, HS programs are required to provide education services for parents and families to enhance parental involvement in nutrition and health (USDHHS, ACF, 2009). The education programs are designed to assist parents in understanding medical, dental, nutritional, and mental health issues. Also, the programs include nutritional education that facilitates children's food experiences and assists families in improving food preparation and nutritional knowledge. In addition to providing these education services, at the mesosystem level, HS may also influence children's health status by strengthening the connections between parents and other aspects of children's microsystems (e.g., school, teachers, and health providers). Particularly, these connections at the mesosystem level provide a basis for why we would expect HS participants to have better nutrition and health outcomes even after graduating from HS. For example, HS staff work with parents to ensure that children have a consistent source of health care so that children are more likely to receive medical and dental checkups the year following HS. Finally, at the microsystem level, HS may improve children' health status through nutrition and health practices by children and parents at home as well as at HS settings.

Prior Research on Head Start Effects on Children's Health Outcomes

Given that our study examines short-term health-related outcomes, our review of previous studies focuses on the short-term effects of HS on children's nutrition, weight, and health care receipt. The Head Start Impact Study (HSIS), the only nationwide randomized experiment on HS, found that children in HS received significantly more dental care than those in the control group, although the difference diminished by the end of first grade (USDHHS, ACF, 2010). The HSIS used very limited health measures and thus was not able to examine the effects of HS on outcomes such as obesity and eating patterns. In addition, several small-scale experiments have reported that dietary and physical activity interventions in HS centers (in addition to nutrition and health services required in the performance standards) show positive effects on children's Body Mass Index (BMI) and healthy eating. For example, children in HS centers in Chicago who were randomly assigned to receive dietary and physical activity programs reported significantly slower increases in BMI at 1-year and 2-year follow-ups compared to children who participated in HS centers without those activities (Fitzgibbon et al., 2005). In another experiment, children in HS centers in upstate New York who were randomly assigned to take part in a food service intervention showed significantly less consumption of saturated fat and lower serum cholesterol than control children in other HS centers without the intervention (Williams et al., 2002).

Evidence on the short-term effects of HS on children's health care receipt is available from two small-scale non-experimental studies. Hale, Seitz, and Zigler (1990) compared receipt of health care services among 78 children who were divided into three child care groups—a HS group, a HS waiting-list group, and a nursery school group—and found that children attending HS were more likely than those on the waiting-list and attending nursery schools to receive age-appropriate health screenings and dental examinations at the year they were in HS program. More recently, using data from the Community Action Project of Tulsa County Head Start Program and a propensity score matching method to address selection bias, Gormley, Phillips, Adelstein, and Shaw (2010) demonstrated that children in HS showed significantly higher probability of having visited a dentist within the last six months than non-HS participants, whereas there was no difference in the probability of having visited a medical doctor within the last six months.

In addition to these small-scale studies, using data from the ECLS-B and propensity-score weighted regressions, two recent studies have examined health outcomes among preschoolers. First, Belfield and Kelly (in press) investigated the associations between early childhood education and a wide set of health outcomes, including health behaviors and screening. They found that HS participants showed no differences in weight and nutrition status compared to those who received care from relatives, non-relatives, or parents. Second, Korenman, Abner, Kaestner, and Gordon (in press) compared nutrition-related outcomes (e.g., weight status and food intake) between children in centers (e.g., HS, pre-K, and other preschool centers) participating in the Child and Adult Care Food Program (CACFP) and children in non-participating centers. They found that CACFP participation among low-income children was associated with improved nutrition. However, it was unclear if the beneficial results found in this study on nutrition came from HS since the CACFP participants included children in both HS and other non-HS centers.

We built upon and extended these previous studies in the current study, focusing on the effects of HS on health-related outcomes among low-income children. We included health care receipt outcomes (e.g., medical and dental checkups), which are directly associated with HS health components but were not examined in previous studies. In addition, we investigated whether HS effects differed by the comparison group defined by other types of child care arrangements.

Head Start and Other Child Care Arrangements

An important challenge most HS research has overlooked is that the control or comparison group in most studies is composed of all non-HS participants, despite children's care arrangements being quite heterogeneous (Lee, Brooks-Gunn, & Schnur, 1988; Ludwig & Phillips, 2007; Rigby, Ryan, & Brooks-Gunn, 2007; USDHHS, ACF, 2005; Waldfogel, 2006; Zhai, Brooks-Gunn, & Waldfogel, 2011). Yet, nutrition and health services likely vary a good deal by child care setting.

Pre-K is a particularly important child care setting to which HS could be compared given that most states have started pre-K to support children's school readiness. In particular, pre-K programs provide nutrition or health services to participants, which are included in the areas mandated by HS (e.g., nutritious meals, vision tests, hearing tests, immunization, or referrals for dental, physical, and mental health services), as well as educational and other services (USDHHS, ACF, 2003). However, only about half of pre-K programs mandate specific health and nutrition services (Barnett, Carolan, Fitzgerald, & Squires, 2012; USDHHS, ACF, 2003). In their study, Gormley and colleagues (2010) found that pre-K had smaller effects on health outcomes (e.g., doctor visit and dental visit) than HS. Therefore, given not all pre-K programs enforce nutrition and health-related services versus HS programs are required to provide such services, we would expect that children who attended HS may have better health and nutrition status than those in pre-K.

With regard to other types of center-based care, most states have regulations on nutrition (e.g., nutritious meals and snacks and banning vending machines), physical activity (e.g., activity program and time), and oral health (e.g., screening, referral, and education) in child care facilities. However, considerable variation exists among and within states: only a few states have specific and comprehensive regulations, while many states' regulations are limited or are vaguely general (Benjamin, Cradock, Walker, Slining, & Gillman, 2008; Kaphingst & Story, 2009; Kranz & Rozier, 2011). Hence, given the varying regulations for non-HS child care settings versus more consistent quality regulations for HS, we would expect that children who attended HS may have better health and nutrition status than those in other center-based care.

With regard to family child care providers and informal care, in most states, family child care providers who care for more than four children are required to be licensed and follow minimum health, safety, and nutrition standard, whereas licensing for the providers who care for four or fewer children is voluntary (Hofferth, 1996; Story, Kaphingst, & French, 2006; U.S. Government Accountability Office, 2004). In addition, state regulations do not apply to informal care (e.g., care provided by grandparents, relatives, regular sitters, neighbors or friends). Therefore, we would expect that children in HS may have better health and nutrition status than those in other non-parental care (i.e., care provided by relatives or non-relatives but not centers).

Finally, we might expect the sharpest contrast to be found with children who in the absence of HS would have been home in exclusive parental care, given the nutrition and health care needs of low-income families with preschoolers (Davis, Befort, Steiger, Simpson, & Mijares, 2013; Holt, 2011; Ogden et al., 2010).

The Present Study

The purpose of this study is to examine the effects of HS on children's nutrition, weight, and health care receipt. As reviewed above, previous studies have suggested that attending HS might enhance children's nutrition and health outcomes. At the same time, we noted several important gaps in this literature. First, no studies have investigated whether the effects of HS on children's nutrition, weight, and health care receipt differ by the comparison group of child care arrangements to which HS is compared. Second, due to a lack of available data, there have been no studies that include a comprehensive set of nutrition, weight, and health care outcomes; most studies have focused on one aspect of children's nutrition and health (e.g., obesity or medical/dental checkups). Third, there have been few non-experimental studies on this topic using advanced methods to address selection bias. To fill these gaps, we examined two questions.

The first research question was: Do HS participants have better nutrition, weight, and health care receipt outcomes at kindergarten entry than non-HS participants? Using a national sample from the ECLS-B and a wide set of nutrition, weight, and health care receipt outcomes, including BMI, overweight, obesity, healthy eating, unhealthy eating, medical checkups, and dental checkups, we compared HS participants with all non-participants. To address the important selection bias in non-experimental studies, we limited our sample to low-income children and used propensity-score weighted regressions controlling for an extensive set of covariates and pre-treatment scores.

The second research question addressed in our study was: Do the effects of HS on children's nutrition, weight, and health care receipt differ by the comparison group of child care arrangements? Our study is the first examining whether the effects of HS on children's nutrition, weight, and health care receipt differ depending on what the comparison group was. Specifically, we compared HS participants with those in other specific care arrangements (i.e., pre-K, other center-based care, other non-parental care, or parental care).

Method

Participants

Our data came from the ECLS-B, a nationwide sample of approximately 10,700 children (due to the U.S. Department of Education's reporting rules, all sample sizes are rounded to the nearest 50) who were born in the US in 2001 and have been followed longitudinally from birth to kindergarten entry (Nord et al., 2004). The first parent interviews and child assessments were conducted when the child was approximately nine months old, followed by succeeding interviews when the child was approximately two, four (the preschool wave), and five or six (the kindergarten wave) years old. For the kindergarten wave, about 75% of the children entered kindergarten in the fall of 2006 and participated in the 2006 assessment; the remaining children entered kindergarten in 2007 and were assessed then. We combined the 2006 and 2007 surveys to obtain children's outcomes at the kindergarten wave.

Only about 7,700 cases were included in the kindergarten survey due to financial constraints (Snow et al., 2009) and, of these, about 700 did not complete parent interviews and child assessments (leaving $N \approx 7{,}000$). We excluded all children whose family income was *always* above 200% of the poverty threshold in the first three waves (about 2,700 excluded; $N \approx 4{,}350$). Of these, another very small number of children (under 1% of the kindergarten sample) were excluded as they had no information on child care arrangements at the preschool survey. As a result, our analysis sample included about 4,350 children—accounting for 62% of the kindergarten sample and 41% of the original sample. To adjust for the sampling structure of the ECLS-B (e.g., sample attrition at the kindergarten wave and oversampling for twins, low birth weight infants, and some ethnic groups), we employed weights (‘WK1R0’) provided by the ECLS-B in all analyses (Snow et al., 2009).

We limited our analysis to children whose families had ever had income at 200% or below of the federal poverty threshold by the preschool survey. We used this cut-off rather than 100% of the poverty threshold (which is the cut-off for HS enrollment, with the exception of children in families with above-poverty income if the child has disability) for several reasons. First, incomes at the bottom of the distribution vary over time, such that a family might be at the poverty threshold in one year and be somewhat above it in the following year (Duncan, 1991). Second, income eligibility is determined once for HS enrollment, but does not take into account volatility. Indeed, among children who were reported to attend HS in the ECLS-B data, 54% had income below the poverty threshold and 34% had family income between 100 and 200% of the threshold.

Measures

Head Start and other care arrangements—To construct child care arrangements at the preschool survey, we used a set of questions asked of parents regarding which types of child care their children were currently attending, including HS and other center-based care (e.g., day care centers, nursery schools, pre-K programs, or preschool programs). To make mutually exclusive categories of child care arrangements, following prior research (Lee, Zhai, Brooks-Gunn, Han, & Waldfogel, in press; Magnuson, Ruhm, & Waldfogel, 2007; Zhai et al., 2011; Zhai, Waldfogel, & Brooks-Gunn, 2013), we first identified children whose parents reported they were attending HS on a regular basis. Next, among children not in the first group, we distinguished another group of children whose parents reported they were participating in other types of center care on a regular basis. We further divided this second group into two sub-groups, pre-K and other center-based care. We were interested in directly comparing HS and pre-K because, as detailed above, these publicly-funded preschool programs have substantial differences in objectives, areas, and quantity of services. Next, among children who were not attending HS, pre-K, or other center-based care, we identified children who received other non-parental care (e.g., care from someone other than the custodial parents) on a regular basis for at least eight hours per week for a month or more. Finally, those children not in any of the above four groups were categorized as children who received parental care. In our sample limited to low-income children, 24.5% of children were in HS, 12.4% in pre-K, 23.4% in other center-based care, 12.1% in other non-parental care, and 27.6% in parental care. In our analysis, we first examined the effects of HS on health and nutrition outcomes compared to all non-participants (i.e., HS vs. non-HS) and then compared those outcomes between HS and four types of other care arrangements (i.e., HS vs. pre-K, HS vs. other center-based care, HS vs. other non-parental care, and HS vs. parental care).

About 41% of the HS participants also spent some time in other care arrangements (2.2% in pre-K, 7.1% in other center-based care, and 31.9% in other non-parental care). In addition, births between September and the end of the calendar year, in many preschool systems, may result in ineligibility for preschool during that calendar year and postponement of preschool entry by between nine and 12 months. Since the ECLS-B preschool-age assessment was conducted at age four in the fall, there would be some children who had started attending HS after the age four assessment and thus had reported enrollment in HS at the age five assessment. About 4.7% of all non-HS participants (0.2% in pre-K, 1.1% in other center-based care, 1.2% in other non-parental care, and 2.2% in parental care) attended HS at the kindergarten wave. Therefore, as robustness checks, we defined two alternative measures for child care arrangements: 1) excluding HS participants who also spent some time in other care arrangements and 2) excluding non-HS participants who attended HS at the kindergarten wave.

As is common in studies using survey data, our analysis may be subject to reporting bias resulting from the potential inaccuracy in parent-reported care arrangements. In particular, parents might not accurately report on whether their child was in HS or pre-K, given that HS programs are run by the public school system in several states. Although the ECLS-B also included provider-reported care arrangements, in our study, we chose to use parent report of care arrangements for the following reasons. First, given we intended to estimate the overall effects of HS on children's health-related outcomes, including all children who had attended HS on a regular basis (whether as a primary or non-primary arrangement) would allow us to obtain such estimates. Child care providers were only asked in the ECLS-B if the child spent the most time in that particular type of care. Our approach can ensure that no children whose primary care arrangement was not HS but who spent some time in HS are categorized into any of the comparison groups. In contrast, using the provider-report is likely to underestimate the total effects of HS. Second, the provider-reported measure had a high rate of missing data and, if it was used, over one fourth of our cases in HS (23.4%), pre-K (26.3%), and other center-based care (33.2%) would be excluded from the analysis (see Table A in the supplemental online material). Third, parent-report of care arrangements may not be unreliable. We cross-tabulated the overlaps between provider-report and parent-report of care arrangements, and found a 70% overlap between these two reports in HS category and a 76% overlap in pre-K category. In addition, 0.5% of our pre-K group was coded as HS in provider-report and 16.6% of our HS group was coded as pre-K in provider-report (see Table A).

Outcome measures—To examine a comprehensive set of outcomes closely related to HS health and nutrition components, based on prior research (Belfield & Kelly, in press; Gormley et al., 2010; Hale et al., 1990; Korenman et al., in press; USDHHS, ACF, 2010), we analyzed six nutrition, weight, and health care receipt outcome variables that were collected at the kindergarten wave. First, we used BMI *z*-scores, calculated by normalizing BMI to the population based on children's age in months and gender (Centers for Disease Control and Prevention [CDC], 2000). Our second outcome variable was overweight and obesity of children. Using children's BMI and the age- and gender-specific growth charts for the United States (CDC, 2000), we identified children between the 85th and 95th percentiles as overweight and those at or above the 95th percentile as obese. The third and fourth outcomes were children's healthy and unhealthy eating patterns, respectively. We used eight parent-reported questions asking about the frequency with which the child consumed vegetables, fruits, fast foods, sweet snacks, and salty snacks and drank milk, juices, and sodas for the seven days before the interview. To obtain total numbers of healthy and unhealthy eating items, following Sturm and Datar (2011), we transformed qualitative response categories of individual questions into continuous values employing median points; for example, 'three times a day' was coded as '21 times per week' and 'four to six times per week' was coded as 'five times per week.' Following the nutrition guideline of the CACFP (Korenman et al., in press; U.S. Department of Agriculture, Food and Nutrition Service [USDA, FNS], 2008), we constructed the healthy eating measure by summing four nutritious food and drink items (higher scores indicating healthier eating)—milk, 100% fruit juice, vegetables, and fruits. Given concern about whether 100% fruit juice is a healthy eating item, as a robustness check, we created an alternative healthy eating measure excluding the 100% fruit juice item. We constructed the unhealthy eating measure by summing four unhealthy food and drink items (higher scores indicating poorer eating)—soda, fast food, sweet snacks, and salty snacks. Therefore, the healthy and unhealthy eating measures indicate the total consumption frequencies per week of healthy and unhealthy eating items, respectively. The fifth outcome, medical checkups, was a binary indicator for whether the child had gone for a well-child checkup since turning four or five years old. The sixth outcome, dental checkups, was measured using a yes/no question regarding whether the child had ever been to a dentist or dental hygienist for dental care since the child's birth (for the most part, this measure would reflect the receipt of dental care post HS, since only 16% of children had been to a dentist prior to age four).

Other covariates—A wide set of covariates collected at the 9-month and 2-year surveys was included in the analysis to control for child, mother, and family characteristics that might be related to parents' selection of HS at the preschool survey as well as children's nutrition, weight, and health care receipt outcomes at kindergarten entry. Child characteristics, collected at the 9-month survey except where noted, included gender, age in months, race/ethnicity, low birth weight, prematurity, multiple birth, duration of breast-feeding, number of siblings, health status reported by the mother (at the 2-year survey), and child care arrangements (at the 2-year survey). Maternal characteristics at the 9-month survey included BMI scores before pregnancy, age in years, whether the mother lived with her parents until the age of 16 years old, depression (the average score of 12 items of the Center for Epidemiological Studies-Depression Scale [CES-D], with higher scores indicating higher levels of depressive symptoms [α = .88, range = 0 to 36]) (Radloff, 1977), marital status at birth, and immigration status. Also included were maternal characteristics at the 2-year survey including employment status, primary home language, and self-rated health. Eight parenting and home environment variables, collected at the 2-year survey except where noted, included the Knowledge of Infant Development Inventory (KIDI) scores at the 9-month survey (the total scores of 11 items, with higher scores reflecting greater knowledge of infant-related behaviors [α = .59, range = 0 to 11]) (MacPhee, 1981), cognitively stimulating activities (the total scores of three items—reading books, telling stories, and singing songs [α = .59, range = 3 to 12]) (Rodriguez et al., 2009), mother's spanking, family's sleeping routines, the frequency of eating dinner together per week, hours watching TV per weekday, and indoor and outdoor activities with a 6-point Likert scale (1 = “not at all” to 6 = “more than once a day”). We also included two indicators for father's presence at home at the 9-month and 2-year surveys. Family characteristics at the 9-month survey included parental education (whichever parent possessed the highest education degree), parental occupational prestige scores (whichever parent possessed the highest score), and family income. Family characteristics at the 2-year survey included family income, urbanicity, region of country, an indicator for the number of times being in poverty by the 2-year survey, and three indicators for the number of times receiving three types of welfare benefits (i.e., Food Stamps, WIC, and TANF) by the 2-year survey.

Pre-treatment outcome scores—To further control for possible initial differences between children in HS and other comparison groups, we included children's pre-treatment scores collected at the 2-year survey in the analysis of corresponding outcome variables. These pre-treatment covariates included BMI *z*-scores, overweight and obesity, healthy and unhealthy drinks (we used a set of questions asking parents about what type of beverages the child usually drank between meals, and constructed binary indicators for the healthy drink with a value of 1 if the child drank milk, 100% fruit juice, and/or water and for the unhealthy drink with a value of 1 if the child drank fruit-flavored drink, soda, and/or other drink), medical checkups (the frequency of having gone for well-child checkups), and dental checkups (whether the child had been to a dentist).

Missing information on covariates—Most covariates had low rates of missing data (0% to 3.5%) while some showed slightly higher rates (4.5% to 10.7%), such as mother's BMI and depression. To address missing information, we conducted multiple imputation using Stata to create five imputed data sets (Royston, 2005a, 2005b). All outcome measures were included in the multiple imputation to increase the accuracy of imputation (Moons, Donders, Stijnen, & Harrell, 2006), but the original outcome values, not the imputed ones, were used in the analysis. Using the MICOMBINE command, we estimated the average effects from five separate regressions for each imputed data set. The expected Relative Efficiency, which shows how much five imputed data sets recover missing information (Rubin, 1987), ranged from 98.2% to 99.1%.

Analytic Strategies

Selection bias is an important issue in non-experimental data. To address this, we first limited our sample to low-income children (as detailed earlier) and included an extensive set of covariates, based on the assumption that controlling for as many covariates as possible reduces selection bias on observables (Gibson-Davis & Foster, 2006). Therefore, all regressions controlled for child, maternal, family, parenting, and home environment characteristics. Furthermore, pre-treatment nutrition, weight, and health care receipt measures collected at the 2-year survey were also included in the analysis of corresponding outcome variables to control for possible pre-existing differences in those outcomes before attending HS (McCartney, Bub, & Burchinal, 2006).

To further reduce selection bias, we used a propensity score matching method, which allows us to make treatment and comparison groups as similar as possible on observed covariates (Dehejia & Wahba, 1999, 2002; Rosenbaum & Rubin, 1983, 1985). Specifically, in the first step, we estimated probit regressions controlling for all covariates and pre-treatment scores mentioned above (and weighted by the ECLS-B sampling weight, ‘WK1R0’) to predict the probability of each child being in HS compared to being in the comparison group. We first predicted the probability for HS versus non-HS and then for HS versus each comparison group. In the second step, we used a radius matching method that uses as many comparison units as possible within a caliper to allow for the use of extra comparison units when better matches are available (Dehejia & Wahba, 2002). Radius matching method matches each HS participant with all comparison units within a caliper (0.01) with a common support option limiting observations to those whose propensity scores are inside the common support region (Gibson-Davis & Foster, 2006; Leuven & Sianesi, 2003). We first matched each HS case to all comparison units in non-HS and then we repeated this process four times to match each HS case to all comparison units in each type of other care arrangements. We confirmed that matching results were successful through balancing of the propensity scores between HS and non-HS and between HS and each of the other four care arrangements (see Table B in the supplemental online material). In the last step, we estimated regression-adjusted differences using the weights generated from the matching procedure and controlling for all covariates and pre-treatment scores. We applied all these steps to each of the five imputed data sets and then produced our final estimates reflecting averages across five separate propensity-score weighted regressions.

We also conducted several supplementary analyses to check the robustness of our main estimates. First, we employed an inverse probability weighting method to increase the efficiency of the estimates of the average treatment effect (Guo & Fraser, 2009; Hirano, Imbens, & Ridder, 2003). Although there was almost no reduction in the sample with a radius matching method, we replicated our main analyses by reweighting the sample with the propensity scores (*P*-score) predicted in the first step above, so that children in the treatment and comparison groups could be representative of the population of interest. The weights for children in the treatment and comparison groups were (1/ *P*-score) and [1/(1- *P*-score)], respectively. Second, we conducted supplementary analyses to see if our estimates might change due to excluding HS participants who also used other types of care arrangement(s) or due to excluding non-HS participants who attended HS in the kindergarten wave. Third, we conducted additional analyses to estimate the effects of HS on healthy eating without including the 100% fruit juice item. Finally, we estimated the effects of HS on individual eating items. All these supplementary analyses (as well as all main analyses) were based on propensity-score weighted regressions controlling for all covariates and pre-treatment scores, and were conducted first between HS and non-HS and then between HS and each of the other four care arrangements.

Results

Descriptive Statistics

For brevity, we describe two important trends from the descriptive results. First, as shown in Table 1, HS participants tended to have higher scores in BMI, in both healthy and unhealthy eating, and to be more likely to have gone for a well-child checkup and to have been to a dentist, compared to all non-participants. These differences tended to be larger in comparisons of HS with pre-K or other center-based care, but smaller in comparisons of HS with other non-parental care or parental care. This suggests the importance of comparing HS with specific types of care arrangements. Second, consistent with prior research (Currie & Thomas, 1995; Lee et al., 1988; Lee et al., in press; Zhai et al., 2011), HS participants tended to come from more disadvantaged backgrounds. They were less likely to be non-Hispanic White but more likely to be non-Hispanic Black or Hispanic, and their mothers were more likely to be younger, unmarried at birth, unemployed, foreign-born, less-educated, poor, and receiving welfare benefits. These results show substantial negative selection into HS in our low-income sample. We addressed these differences with propensity score matching that effectively minimizes selection bias based on observed characteristics (see Table B in the supplemental online material).

Effects of Head Start on Children's Nutrition, Weight, and Health Care Receipt

We conducted propensity-score weighted regressions to estimate the effects of HS on children's nutrition, weight, and health care receipt, controlling for all of these covariates and examining only low-income children (Table 2). Linear regressions were estimated for continuous outcomes (BMI, healthy eating, and unhealthy eating), logistic regressions were used for medical and dental checkups, and multi-nominal logistic regressions were conducted for overweight and obesity (the reference group was normal weight). In our discussion, we focus on statistically significant effects at least at $p < .05$ level.

To understand the average effects of HS, we first compared HS participants to all non-participants (Panel A of Table 2). We found that HS participants had better nutritional and health status. Specifically, HS participation was associated with an increase of 2.21 times per week in the frequency of healthy eating habits, and the odds ratio of dental checkups was 3.04, indicating that the HS participants were about three times as likely to have received dental checkups as non-participants.

Next, we conducted four separate sets of analyses (Panel B of Table 2): HS vs. pre-K, HS vs. other center-based care, HS vs. other non-parental care, and HS vs. parental care. We found that the effects of HS varied by the comparison group. First, HS participants were more likely to receive dental checkups (odds ratio = 3.07) compared to children in pre-K. Second, compared to children in other center-based care, HS participants showed higher scores in healthy eating habits (an increase of 2.35 times per week) and higher probability of receiving dental checkups (odds ratio = 2.26). Third, compared to children in other non-parental care, HS participants showed lower BMI scores (−0.17*SDs*), lower probability of being overweight (odds ratio = 0.59), higher scores in healthy eating habits (an increase of 2.74 times per week), and higher probability of receiving dental checkups (odds ratio = 4.01). Finally, HS participants were more likely than children in parental care to have healthy eating habits (an increase of 2.07 times per week) and to receive dental checkups (odds ratio = 3.62).

Results of Supplemental Analyses

For robustness checks on our main estimates, we conducted a series of supplemental analyses. First, we estimated the effects of HS using the inverse probability weighting method (Table C in the supplemental online material), and found the same results as those presented in Table 2. Additionally, we found that HS participants were less likely to be obese compared to those in other non-parental care (odds ratio = 0.66) and more likely to receive medical checkups compared to all non-participants (odds ratio = 1.59) as well as those in parental care (odds ratio = 2.16). Second, our results after excluding HS participants with multiple care arrangements (Table D in the supplemental online material) were the same as those presented in Table 2 with few exceptions: we found, in addition to our main results, that HS participants (without multiple care arrangements) were more likely to have unhealthy eating habits compared to those in other center-based care (an increase of 2.01 times per week in the frequency of unhealthy eating habits) and to receive medical checkups compared to those in parental care (odds ratio = 2.21). Third, we re-estimated the effects of HS by excluding non-HS participants who attended HS in the kindergarten survey (Table E in the supplemental online material). The results were similar to those reported in Table 2 with few exceptions: HS participants were less likely to be obese compared to those in other non-parental care (odds ratio = 0.63) and more likely to receive medical checkups compared to those in parental care (odds ratio = 1.64). Finally, we re-estimated the effects of HS on healthy eating excluding the 100% fruit juice item (Table F in the supplemental online material). Results indicate that HS participants had more healthy eating patterns than non-HS participants and those in parental care.

Discussion

We used data from a nationally representative birth-cohort study to examine the effects of HS on children's nutrition, weight, and health care receipt at kindergarten entry. We limited our sample to low-income children and employed propensity-score weighted regressions with a rich set of covariates and pre-treatment scores to address selection bias. As expected with the integrated conceptual model, given attending HS programs serves as an important environmental factor with which children interact in the development of health-promoting behaviors, we found that HS participants had more healthy eating habits and were more likely to receive dental checkups compared to all non-participants. This result complements previous findings of positive associations between HS participation and nutrition (Korenman et al., in press; Williams et al., 2002) and oral health (Gormley et al., 2010; Hale et al., 1990; USDHHS, ACF, 2010).

Furthermore, as expected, because different child care arrangements provide different environments with which children interact, we found the effects of HS differed by the comparison group. In general, HS effects tended to be largest when compared to informal care settings, rather than other types of center-based care which might also include some health or nutrition services. HS participants showed lower BMI scores and lower probability of being overweight when compared to those in other non-parental care. Also, we found that the magnitude of HS effects on healthy eating and dental checkups varied by the comparison group, with more beneficial effects on healthy eating when HS was compared to other non-parental care and on dental checkups when compared to other non-parental care or parental care. In addition, our results were robust in various supplementary analyses experimenting with various measures and sample definitions.

Our findings should be considered in light of the following limitations. First, although we limited our sample to low-income children and used several empirical approaches to address selection bias, our estimates could be biased if there are other important observed or unobserved covariates that were not included in the models. While our dataset included a rich set of covariates, we were not able to control for unobserved heterogeneity between those in HS and other arrangements. Second, the information about child care arrangements reported by parents may have measurement error, leading to an underestimation of Head Start effects (Garces et al., 2002; Ludwig & Miller, 2007), particularly in the comparison of HS and pre-K. However, as described in the Method section, we showed that the information reported by parents may not be totally unreliable. Future research is welcomed to further examine this issue. Third, ECLS-B questions did not distinguish the type of milk (e.g., whole milk vs. low-fat milk), and it is not clear whether 100% fruit juice should be considered as a healthy drink. Following a recent study using 100% fruit juice as a healthy eating item based on the guideline of the CACFP (Korenman et al., in press; USDA, FNS, 2008), we included 100% fruit juice as a healthy eating item since it is still on the list of recommended foods for the CACFP. However, given there is a concern that 100% fruit juice may not be a healthy choice (Wojcicki & Heyman, 2012) and given that parents may report the contents of juice drinks with error, we also provided results not treating this as a healthy item.

Despite these limitations, our main findings (i.e., more healthy eating and more dental checkups) represent a significant contribution to the field as few studies have examined HS effects on children's nutrition, weight, and health care receipt. Our results provide promising evidence that HS has been successful in its goals to promote the healthy development of low-income children. These findings are particularly important, given that the preschool years are a key period for children's nutritional and physical development (Hagan, Shaw, & Duncan, 2008). Our findings suggest that attending preschool programs, such as HS, could be an important avenue for improving health and nutrition outcomes among low-income children, which would be particularly consequential given the poorer health status of low-income children, such as higher risk for obesity and oral disease (Holt, 2011; Ogden et al., 2010). In particular, on-site direct (e.g., identifying each child's nutritional needs and providing meal services) and indirect (e.g., education to improve nutrition for families) nutrition services may be highly related to the improvement of healthy eating habits among HS participants (USDHHS, ACF, 2009). Also, HS programs offer specific oral health services that require staff members track the provision of oral health care (e.g., assisting children in having their dental home and helping parents obtain oral examinations and follow-up care for their child), as well as to provide on-site activities for good dental hygiene (Holt, 2011).

Furthermore, our study was the first to investigate whether HS effects on children's nutrition, weight, and health care receipt differ by the comparison group defined by different types of care arrangements. Interestingly, when HS was compared to pre-K, beneficial effects of HS were only found in receiving dental checkups, with no differences in all other outcomes, which is notable since not all pre-K programs offer health or nutrition services. This result may be related to the fact that pre-K programs mandated only five health service areas (i.e., nutritious meals, immunization, vision and hearing tests, physical health service referrals, and mental health service referrals) but not including dental services (USDHHS, ACF, 2003).

While sizable benefits in terms of dental care were found in comparison to all types of other care, the magnitude varied. The odds ratios on dental checkups were much higher for comparisons of HS with other non-parental care and parental care (4.01 and 3.62, respectively) than for comparisons of HS with pre-K and other center-based care (3.07 and 2.26, respectively). These differing effects confirm that it is informative to clearly define the comparison group when estimating effects of preschool programs (Hill, Waldfogel, & Brooks-Gunn, 2002; Lee et al., in press; Zhai et al., 2011, 2013). But they also confirm that attending HS is particularly effective in promoting oral health care; rates of having ever been to a dentist were 95% in Head Start, compared to 84% in pre-K, 85% in other center-based care, 87% in other non-parental care, and 83% in parental care. Considering that access to dental care is commonly inadequate among low-income children (Holt, 2011; Hughes et al., 2005), this is clear evidence showing the importance of providing dental care to those children through public preschool programs.

Additional benefits of HS were detected when compared to other non-parental care—HS participants showed lower BMI scores and lower probability of being overweight. This result is notable given that no studies have found short-term effects of HS on obesity, though recent work has found benefits in later childhood (Frisvold & Lumeng, 2011). In addition, larger HS effects were found in healthy eating when compared to other non-parental care and in dental checkups when compared to other non-parental care or parental care. These results showing more pronounced HS effects for children who were in other non-parental care or parental care are policy-relevant given that eligible children who do not get into HS often do not have opportunities to attend other center-based care arrangements. For example, in the HSIS, over 50% of children in the 3- and 4-year-old control groups did not attend any center-based child care (USDHHS, ACF, 2005).

While our study found beneficial associations between HS participation and nutrition status, a recent study reported no differences (Belfield & Kelly, in press). This is notable given that both studies used the same data (i.e., the ECLS-B) and methods (i.e., propensity score-weighted regressions). One possible explanation is that the two studies used different ways to measure nutrition outcomes; while six dichotomized eating items (i.e., vegetables, fruits, sodas, fast foods, sweet snacks, and salty snacks) were individually used by Belfield and Kelly (in press), our study used two additional items (i.e., milk and 100% fruit juices) to create two continuous healthy and unhealthy eating scales. However, we note that another study using dichotomized individual eating items (as well as the same data and methods) reported improved nutrition status among children in CACFP-participating HS and other centers (Korenman et al., in press). Another possible explanation is that the two studies defined HS participants differently. We defined HS participants as all children who had attended HS on a regular basis regardless of whether it was the primary care arrangement, whereas in the Belfield and Kelly (in press) study, HS participants included only children whose primary care arrangement was HS. Therefore, in the Belfield and Kelly (in press) study, the comparison group might have included some children who spent some time in HS (but whose primary care arrangement was not HS).

We found no difference between HS participants and others in getting medical checkups, which is consistent with a recent study (Gormley et al., 2010). In our sample, almost all children (about 96%), regardless of the type of child care (except 92% in parental care), received checkups. We speculate that this is related to the expansion of Medicaid and SCHIP for low-income children; the uninsured rate for these children dropped from 28% in 1998 to 15% in 2007 (Marks, Hoffman, & Paradise, 2009). However, considering that HS performance standards require HS staff members to help program participants receive age-appropriate preventive and primary health care (USDHHS, ACF, 2009) and that our supplemental analyses consistently showed beneficial effects of HS on medical checkups when compared to parental care (odds ratios from 1.64 to 2.21), we speculate that children being cared for by their parents would benefit from HS services (particularly, those related to health care receipt).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- We examined the effects of Head Start on children's nutrition, weight, and health care receipt.
- Head Start participants had more healthy eating habits than all non-participants.
- Head Start participants were more likely to receive dental checkups than all non-participants.
- Head Start participants had lower BMI scores and were less likely to be overweight than those in other non-parental care.

Table 1

Descriptive Statistics by Head Start and Other Specific Care Arrangements before Matching

Variable	HS	Non-HS	Pre-K	Oth CB	Oth NP	Parental
Child outcomes at kindergarten						
BMI *z*-score	0.83	0.73 *	0.67	0.67 *	0.86	0.76
Overweight	0.19	0.18	0.17	0.17	0.22	0.17
Obesity	0.22	0.20	0.19	0.18	0.23	0.20
Healthy eating	45.99	42.09 ***	42.56 *	40.89 ***	42.60 *	42.69 **
Unhealthy eating	19.33	17.89 **	17.77	16.78 ***	18.41	18.68
Medical checkups	0.97	0.94 **	0.95	0.96	0.95	0.92 ***
Dental checkups	0.95	0.85 ***	0.84 ***	0.85 ***	0.87 ***	0.83 ***
Pre-treatment outcomes at 2-year						
BMI z-score	0.67	0.53 **	0.55	0.48 *	0.60	0.54
Overweight	0.16	0.13 **	0.12	0.12	0.16	0.13
Obesity	0.21	0.21	0.20	0.19	0.21	0.22
Healthy eating	0.91	0.93 *	0.94	0.95 *	0.91	0.93
Unhealthy eating	0.29	0.26	0.24	0.21 ***	0.30	0.30
Medical checkups	3.12	2.95 *	2.97	2.91	3.00	2.97
Dental checkups	0.16	0.13 **	0.12	0.13	0.12	0.14
Child characteristics						
Boys at birth	0.51	0.51	0.51	0.52	0.55	0.48
Age in months at 9-month	10.44	10.47	10.57	10.58	10.33	10.39
Race/ethnicity at 9-month						
Non-Hispanic White	0.22	0.40 ***	0.37 ***	0.48 ***	0.31 *	0.38 ***
Non-Hispanic Black	0.31	0.18 ***	0.25	0.18 ***	0.19 ***	0.14 ***
Hispanic	0.40	0.35 **	0.31 *	0.26 ***	0.43	0.42
Non-Hispanic Asian	0.01	0.03 **	0.03	0.03 *	0.02	0.02
Other	0.06	0.05	0.03	0.05	0.05	0.05
Low birth weight at birth	0.08	0.08	0.08	0.09	0.08	0.08
Prematurity at birth	0.15	0.13	0.12	0.13	0.15	0.12
Multiple birth at birth	0.04	0.03	0.03	0.04	0.03	0.03
Breast-feeding at 9-month						
Never	0.42	0.35 ***	0.35 *	0.33 ***	0.40	0.35 *
<3 months	0.23	0.23	0.25	0.24	0.25	0.20
3~6 months	0.17	0.19	0.16	0.17	0.20	0.20
7 months plus	0.18	0.23 ***	0.25 *	0.26 ***	0.15	0.24 **
Number of siblings at 9-month						

Variable	HS	Non-HS	Pre-K	Oth CB	Oth NP	Parental
No sibling	0.41	0.39	0.36	0.44	0.40	0.34 *
One	0.27	0.32 ***	0.36 **	0.32	0.29	0.31
Two or more	0.32	0.30	0.28	0.24 ***	0.31	0.35
Health status at 2-year						
Poor/Fair	0.05	0.03 ***	0.03	0.02 **	0.03	0.03
Good	0.12	0.13	0.13	0.13	0.15	0.11
Very good	0.31	0.28	0.28	0.27	0.28	0.28
Excellent	0.53	0.57 *	0.57	0.58	0.53	0.57
Child care arrangements at 2-year						
Parental care	0.52	0.57 **	0.53	0.48	0.37 ***	0.75 ***
Relative care	0.24	0.20 **	0.22	0.20	0.37 ***	0.12 ***
Non-relative care	0.10	0.11	0.10	0.12	0.18 ***	0.07
Center-based care	0.14	0.12	0.16	0.20 ***	0.07 *	0.06 ***
Mother characteristics						
BMI before pregnancy	25.77	25.09 ***	24.75 *	24.68 ***	25.43	25.46
Age at birth	24.65	25.79 ***	26.10 ***	25.84 ***	24.98	25.96 ***
Lived with bio-mother until 16	0.81	0.83	0.84	0.84	0.82	0.83
Lived with bio-father until 16	0.50	0.57 ***	0.54	0.58 *	0.53	0.58 **
Married at birth	0.46	0.56 ***	0.53	0.57 ***	0.47	0.61 ***
Depressed at 9-month	0.52	0.47 **	0.48	0.45 *	0.47	0.48
Employment status at 2-year						
Not working	0.55	0.51 *	0.46 *	0.43 ***	0.36 ***	0.66 ***
Full-time	0.32	0.31	0.34	0.36	0.46 ***	0.18 ***
Part-time	0.14	0.18 ***	0.20	0.21 ***	0.17	0.16
Foreign-born mom at 9-month	0.31	0.27 *	0.25	0.21 ***	0.26	0.34
English is primary home language at 2-year	0.69	0.73 *	0.77 *	0.80 ***	0.73	0.66
Health status at 2-year						
Poor/Fair	0.13	0.11	0.12	0.08 *	0.12	0.13
Good	0.31	0.29	0.26	0.26	0.32	0.31
Very good	0.32	0.32	0.34	0.37	0.29	0.28
Excellent	0.24	0.28 **	0.29	0.29	0.28	0.28
Parenting behaviors and home environments						
KIDI at 9-month	5.67	6.22 ***	6.31 ***	6.52 ***	6.07 *	5.98 *
Cognitively stimulating activities at 2-year	8.73	9.01 ***	8.96	9.20 ***	8.74	8.97
Having sleeping routines at 2-year	0.77	0.81 ***	0.81	0.83 **	0.81	0.80

Variable	HS	Non-HS	Pre-K	Oth CB	Oth NP	Parental
Eating dinner together per week at 2-year	5.25	5.38	5.24	5.30	5.20	5.61 **
No spanking at 2-year	0.60	0.60	0.58	0.61	0.59	0.61
Watching TV per weekday at 2-year	2.83	2.63 *	2.67	2.57	2.88	2.57
Indoor activities at 2-year	5.16	5.24 *	5.27	5.27	5.20	5.21
Outdoor activities at 2-year	4.51	4.47	4.37	4.42	4.51	4.54
Family characteristics						
Parent's education at birth						
Below high-school (0-11)	0.25	0.19 ***	0.13 ***	0.13 ***	0.20	0.25
High-school (12)	0.43	0.34 ***	0.36	0.28 ***	0.44	0.34 ***
Some college (13-15)	0.28	0.34 ***	0.38 **	0.40 ***	0.28	0.31
Above college (16+)	0.03	0.13 ***	0.13 ***	0.19 ***	0.08	0.10 ***
Parental occupational prestige at 9-month	1.62	1.65	1.73	1.95 **	2.13 ***	1.16 ***
Family income at 9-month						
$0-$20000	0.52	0.37 ***	0.37 ***	0.33 ***	0.34 ***	0.42 ***
$20001-$35000	0.34	0.40 ***	0.35	0.41 *	0.42	0.40
$35001-$50000	0.13	0.21 ***	0.24 ***	0.24 ***	0.22 ***	0.16
$50001+	0.02	0.02	0.04 **	0.03	0.02	0.02
Family income at 2-year						
$0-$20000	0.50	0.36 ***	0.34 ***	0.34 ***	0.33 ***	0.41 ***
$20001-$35000	0.33	0.35	0.34	0.33	0.39	0.35
$35001-$50000	0.15	0.25 ***	0.28 ***	0.29 ***	0.25 **	0.21 *
$50001+	0.01	0.03 **	0.04	0.04 **	0.03	0.03
Lived in urban area at 2-year	0.82	0.84	0.87	0.85	0.85	0.83
Region of country at 2-year						
Northeast	0.14	0.12 *	0.20 *	0.14	0.08 *	0.08 ***
Midwest	0.18	0.21 *	0.15	0.23	0.24	0.21
South	0.42	0.39	0.51 *	0.33 ***	0.38	0.40
West	0.25	0.28	0.14 ***	0.29	0.29	0.31 *
No of times receiving WIC by 2-year						
None	0.07	0.21 ***	0.21 ***	0.25 ***	0.19 ***	0.19 ***
Once	0.21	0.22	0.24	0.22	0.27	0.19
Twice	0.71	0.57 ***	0.55 ***	0.53 ***	0.54 ***	0.63 ***
No of times receiving FS by 2-year						
None	0.46	0.62 ***	0.62 ***	0.64 ***	0.60 ***	0.60 ***
Once	0.23	0.19 ***	0.15 **	0.18 *	0.20	0.20

Variable	HS	Non-HS	Pre-K	Oth CB	Oth NP	Parental
Twice	0.31	0.20***	0.23**	0.18***	0.19***	0.20***
No of times receiving TANF by 2-year						
None	0.75	0.85***	0.87***	0.86***	0.83**	0.84***
Once	0.16	0.09***	0.07***	0.08***	0.13	0.11***
Twice	0.09	0.06***	0.06	0.07	0.05	0.05*
No of times being in poverty by 2-year						
None	0.05	0.08**	0.09*	0.10***	0.07	0.05
Once	0.16	0.26***	0.28***	0.33***	0.23*	0.20
Twice	0.79	0.66***	0.63***	0.56***	0.70**	0.75
Unweighted sample sizes	1,100.00	3,250.00	550.00	1,100.00	500.00	1,050.00

Note. Sample sizes were rounded to the nearest 50, due to IES reporting rules. All numbers were weighted using ‘W1R0’ for the 9-month wave, ‘W2R0’ for the 2-year wave, and ‘WK1R0’ for the kindergarten wave. Two-tailed *t* tests were conducted to compare means between HS participants and all non-participants and between HS participants and those in each specific type of care arrangement. BMI = Body Mass Index; HS = Head Start; Pre-K = Prekindergarten; Oth CB = other center-based care; Oth NP = other non-parental; WIC = Special Supplemental Nutrition Program for Women, Infants, and Children; FS = Food Stamp Program; TANF = Temporary Assistance for Needy Families.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 2

Effects of Head Start Compared to Non-Head Start and Other Specific Care Arrangements

Reference care	BMI *z*-score		Overweight		Obesity		Healthy eating		Unhealthy eating		Medical checkup		Dental checkup	
	M	***SE***	***Odds***	***SE***	***Odds***	***SE***	***M***	***SE***	***M***	***SE***	***Odds***	***SE***	***Odds***	***SE***
Panel A:														
Non-HS	0.01	(0.04)	0.98	(0.11)	0.95	(0.11)	2.21**	(0.74)	0.63	(0.57)	1.11	(0.21)	3.04***	(0.44)
Panel B:														
Pre-K	0.01	(0.06)	0.87	(0.17)	0.78	(0.16)	1.26	(1.33)	0.36	(0.97)	0.74	(0.26)	3.07***	(0.77)
Oth CB	0.04	(0.06)	0.92	(0.14)	0.95	(0.16)	2.35*	(1.14)	0.80	(0.78)	0.71	(0.20)	2.26***	(0.44)
Oth NP	−0.17*	(0.07)	0.59*	(0.13)	0.70	(0.16)	2.74*	(1.32)	0.77	(0.98)	1.04	(0.35)	4.01***	(1.00)
Parental	0.00	(0.05)	1.15	(0.18)	1.00	(0.16)	2.07*	(1.01)	0.47	(0.77)	1.49	(0.35)	3.62***	(0.65)

Note. In the HS and non-HS comparison, sample sizes were 4,100 for BMI, overweight, and obesity and 4,250 for healthy eating, unhealthy eating, dental checkups, and medical checkups. In the HS and Pre-K comparison, sample sizes were 1,500 for BMI, overweight, obesity, and medical checkups and 1,550 for healthy eating, unhealthy eating, and dental checkups. In the HS and other center-based care comparison, sample sizes were 2,100 for BMI, overweight, and obesity and 2,150 for healthy eating, unhealthy eating, medical checkups, and dental checkups. In the HS and other non-parental care comparison, sample sizes were 1,450 for BMI, 1,500 for overweight, obesity, and healthy eating, and 1,550 for unhealthy eating, medical checkups, and dental checkups. In the HS and parental care comparison, sample sizes were 2,050 for BMI, overweight, and obesity, 2,100 for healthy eating and medical checkups, and 2,150 for unhealthy eating and dental checkups. All reported sample sizes were rounded to the nearest 50, due to IES reporting rules. All models were estimated using propensity-score weighted regressions with including all covariates (i.e., child, mother, parenting, home environment, and family characteristics as well as pre-treatment outcomes). BMI = Body Mass Index; HS = Head Start; Pre-K = Prekindergarten; Oth CB = other center-based care; Oth NP = other non-parental; *SE* = standard error of the mean or odds ratios.

* $p < .05$.

** $p < .01$.

*** $p < .001$.