Preschool and Child Health: Evidence from China's Subsidized Child Care Program*

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Abstract

Early childhood education programs have been found to effectively promote children's social and cognitive development. However, the health impact of these programs is less understood. Using a quasi-experiment of the first universal child care program in China from 2010, this paper aims to identify whether preschool attendance produces any short-term effects on health-related outcomes of preschoolers (3-6 years old). I exploit the variation in the number of subsidized preschools across provinces and implement difference-in-differences and triple-difference strategies. Results confirm the effectiveness of this program by showing a strong and positive impact on preschool attendance. This paper then documents the benefits to alleviating underweight among preschoolers. Estimates show a larger effect in rural areas, suggesting that the program narrows rural-urban disparities in education access and undernutrition prevention. I also explore the impact on caregivers' health consciousness and find that the expansion of subsidized child care has led to improved health-seeking behavior when children get sick.

Keywords: Early childhood education, preschool, health, underweight, health-seeking behavior, China

JEL classifications: H52, H75, J13, I12

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1 Introduction

Although China has experienced remarkable economic growth in recent years, the provision of quality early childhood education (ECE) remains a major issue of public concern. According to the Ministry of Education of the People's Republic of China (MOE), the national enrollment rate in pre-primary education was only 50.9% in 2009, ranking China behind not only developed countries (e.g., Australia 81.3%, the United Kingdom 79.8%, Finland 66.1%) but also developing countries (e.g., Chile 86.4%, Malaysia 76.91%, Vietnam 69.4%) (UNESCO, 2009). With the growing realization that child care and early interventions are powerful and necessary mechanisms for alleviating poverty and overcoming disparities, China's government issued two key policy documents in 2010, ushering in the nation's first universal child care program with the aim of increasing the accessibility, affordability, and accountability of preschools.

This paper studies the causal effects of the first universal child care program in China on preschool attendance rates and health-related outcomes. I utilize this program as a quasi-experiment to investigate whether preschool attendance, together with nutrition and health services at school, produces any short-term effects on health-related outcomes of preschoolers (3-6 years old). I measure the health of children with three indicators, including underweight, overweight, and being sick in the previous month, all of which are broadly used in health-related research. This paper also looks at a measure of caregivers' health consciousness to examine any potential impact on their health-seeking behaviors: namely, whether the child is sent to the doctor when they become sick. I implement difference-in-differences (DID) and triple-difference (DDD) strategies to exploit the variation across provinces and cohorts in treatment intensity measured by the number of newly established preschools. The data comes from the China Family Panel Studies (CFPS), a national representative dataset available from 2010, supplemented with provincial statistics data from the Educational Statistics Yearbook.

My estimates show that the program is effective in promoting preschool attendance. The program led to an increase of approximately 300 seats per 1,000 preschool-aged children and an increase of 26 percentage points in the preschool attendance rate from 2010 to 2016. When I compare the change of preschoolers' health-related outcomes before and after the introduction of the policy, in high-intensity provinces and low-intensity provinces, the DDD estimates reflect a strong and robust impact on reducing the rate of underweight among preschoolers relative to that of toddlers. Specifically, preschoolers from provinces with a large expansion in subsidized preschools are 5 percentage points (38%) less likely to be underweight than their counterparts from provinces with only a small change in access to preschool education. Results also show that overweight and the probability of being sick are unaffected. Further investigation finds a larger effect on children residing in rural areas than those in urban areas. This trend suggests a potential narrowing of the rural-urban gap in education and health. I also detect some evidence of caregivers' health-seeking behavioral response to the program when handling the illness of preschoolers. Results show that the program has encouraged caregivers of preschoolers to refer sick children to a doctor instead of finding medicines to treat the children themselves. The universal child care program may have beneficial effects on preschoolers' health and caregivers' medical-seeking behavior through several potential mechanisms, such as nutritional needs, outdoor activities, and healthy eating habits established in school; the interactions between school health personnel with children's families; and the improved employment of mothers and grandmothers as a result of subsidized child care (Lin and Wang [2019]; Wang and Lin [2019]).

Early childhood education (ECE) programs have been found to provide wide-ranging benefits to children, families, and society as a whole. They can be effective in promoting children's social and cognitive development (Burchinal et al. [2000];Peisner-Feinberg et al. [2001]; Burger [2010]). Studies in China find that preschool education has positive impacts on children's readiness, mathematics, self-regulation, and language development in the first several years of primary school as well as long-term benefits to social skills (Luo et al. [2012]; Rao et al. [2012]; Wu et al. [2012]; Liu et al. [2013]; Gong et al. [2016]). However, less research has investigated the health impacts associated with ECE programs, with most evidence focusing on the increased risk of infectious diseases and injury in the short term (Ball et al. [2002]; D'Onise et al. [2010]). Several papers have studied the health impacts of the Head Start program, the largest federally funded preschool program in the

United States for children up to age five from low-income families, and they find that participation in the Head Start program is associated with improvements in health, such as healthier BMI, reduced overweight, and reduced underweight, especially for preschoolers with an unhealthy weight status (Lumeng et al. [2015]; Ansari et al. [2015]). Despite the sparse evidence pointing to potential health benefits, findings from targeted interventions (e.g., Perry Preschool, Abecedarian, and Head Start programs in the United States) have limited applicability to universal ECE programs across larger populations, and studies on universal ECE programs typically do not study health outcomes (van Huizen and Plantenga [2018]). The health impacts of child care in developing countries have not been well explored in the literature. This study seeks to remedy this gap, which is particularly important because children in developing countries are more likely to be exposed to malnutrition, poor access to safe playgrounds, and child neglect.

This paper contributes to the literature in three ways. First, it extends the broad literature on the relationship between preschool and child development by examining the impact on preschoolers' health-related outcomes. Wu, Young, and Cai (Wu et al. [2012]) conducted a household survey in 2010 in Hunan Province of China and found a positive correlation between preschool enrollment and preschoolers' weight, height, and cognitive development. However, their findings from Hunan are only suggestive, while this paper conducts a nationally representative analysis. Second, this study is the first to rigorously examine the causal effects of this universal preschool program in China on preschool attendance. Although previous literature has documented that this program has promoted mothers' entrepreneurial activities and grandmothers' labor force participation (Lin and Wang [2019]; Wang and Lin [2019]), it is unknown at the first stage how effective this child care expansion program is in promoting preschool attendance and how it affects children heterogeneously across demographic groups. Finally, this is the first paper to examine caregivers' health-seeking behavioral response to preschool education, highlighting the importance of child healthcare.

This paper introduces background information about this program in Section 2 and data sources used to analyze it in Section 3. Next, Section 4 provides an overview of the empirical strategies used in this analysis and presents the main results. Finally, Section 5 concludes with a discussion of future research.

2 Background

2.1 Preschool education in China

In this paper, the term "preschool" refers to all early childhood education (ECE) programs for children between the ages of 3 and 6 in China.[1] There have been two major center-based ECE programs in China since the 1980s: kindergartens and pre-primary classes. Kindergartens have independent premises and provide full-day care and education to children between 3 and 6, or sometimes 7 years of age before formal schooling. Pre-primary classes, which are usually attached to rural primary schools, offer a one-year pre-primary program for literacy and numeracy preparation before children start the first grade in primary school (Rao et al. [2012]). It caters to the needs of children from 5 to 6, or sometimes 7 before formal schooling. Preschool attendance is voluntary, followed by six years of compulsory education in primary school, typically starting at the age of 6 or 7, and another three years of compulsory education in junior secondary education (junior middle school). In this paper, I will focus on preschool attendance generally without distinguishing the differences between kindergarten and pre-primary classes.

There are mainly three types of preschool providers, including the government, private providers, and work units (state-owned and public enterprises). Work units usually provide child care to a certain group of parents that work and reside in work-related comprehensive communities.

In China, preschool was underdeveloped before the launch of the program. Why did so few children participate in preschools in China? Both the availability and affordability of services proved challenging. First, insufficient numbers of facilities have hindered access to educational resources for preschool children. In 1978, China launched the transition from a centrally planned to a market economy, which unintentionally led to a dramatic decline in publicly funded child care programs. The

[1] This is a definition that is in line with recent studies, such as Rao et al. [2012]

number of preschools decreased by 28.5% between 1997 and 2006 due to the economic transition (Du and Dong [2013]). Many public child care facilities previously run by state-owned enterprises were shut down, but some of them had been changed to private service providers, inducing the increase of the private service provision in preschools. As a result, China's ECE system became more privatized and market-oriented before the preschool reform in 2010. However, private markets for child care pose cost barriers for disadvantaged families since the tuition and fees can be relatively expensive and government subsidies had been largely missing before 2010 (Wang and Lin [2019]). This is the second reason why many families, especially low-income ones, would choose to forego preschool education for their children and use informal child care at home instead.

2.2 China's subsidized child care program

2010 is a milestone year in the history of ECE development in China. With the growing realization that child care and early interventions are powerful and necessary mechanisms for alleviating poverty and overcoming disparities, China's government made great progress in preschool education policy development by issuing two key policy documents. It was then that the Chinese government decided to devote greater efforts to the development of ECE. In July 2010, China announced the "Outline of China's National Plan for Medium and Long-term Education Reform and Development" (hereinafter referred to as 'Plan'). This Plan provided a blueprint for promoting child development and the modernization of education over the next 10 years. It set forth the goals of universalizing preschool education, reassuring nine-years of compulsory education at primary schools and junior secondary schools, and improving the enrollment rate in senior high school and the higher education. To better implement preschool strategic goals in the Plan, in November 2010, China's State Council (State Council, 2010) published "Issues Regarding Current Development of Early Childhood Education" (hereinafter referred to as 'Issues'). Issues required every county in the nation to develop one or more phases of a three-year action plan for the development of preschool services, offering a balance between public and private providers. Thus, in 2011 each province began developing its 3-year Action Plan to implement the policy in several phases, beginning with the first 3-year action plan in

2011-2013, followed by the second phase from 2014-2016 and the third phase from 2017-2020.

This is the first universal child care program in China. One major development mission in the Plan was to realize universal preschool education by the year 2020. In particular, by 2020, the target enrollment rate for those enrolled in 1-year, 2-year, and 3-year preschools was planned to be 95%, 80%, and 70%, respectively (State Council, 2010). Issues encouraged the establishment of public preschools but also provided financial support to private programs. Financially supplemented by the central government, local governments were expected to devote greater efforts to fund, plan, and manage preschools. In general, the goal was to promote the accessibility, affordability, and accountability of preschools. Accordingly, there have been three important strategies implemented under the guidelines of the Plan and Issues.

First, the government pledged a substantial increase in funding to strengthen the preschool service provision. Governmental funding for preschool development has rapidly increased since 2010, accounting for 7.2% of the entire education budget in 2016, compared with 1.48% in 2009 and 3.7% in 2010. As illustrated in Figure 1, the number of preschools in mainland China increased from 150,420 in 2010 to 266,677 in 2018, a 77% rise in eight years. The number of educational personnel in preschools experienced a 145% rise from 1,849,301 in 2010 to 4,531,454 in 2018. The increase in funding from the central government was more intense in provinces with underdeveloped child care systems. Figure 2 shows that the program intensity was negatively related to the baseline preschool enrollment in 2009. This negative relationship reflects the program's provision that more preschools were built in provinces where baseline enrollment rates were low. As a result of the school expansion program, preschools have become more accessible to the public.

Second, school enrollment is subsidized, enhancing the affordability of preschool education. Before 1997, most kindergartens in China were publicly run by the government and government institutions, state-owned and public enterprises, and even neighborhoods and rural collectives (Xiaodong [2008]). Due to the economic transition in the early 1990s, a substantial number of private preschools have been established. Under the guidelines of the Plan and Issues, the Chinese government supports the development of each type of “universal preschools”. The government has vigorously increased funding in supporting the establishment of public-run preschools with subsidized prices. Some provinces, such as Shanxi, have begun offering one-year and three-year free public preschools since 2011 (Shanxi Government, 2011). In addition, the Chinese government uses a variety of strategies to support private preschools so that they are run by the market but charge low tuition fees that are close to those of public- or enterprise-operated facilities (Wang and Lin [2019]). For instance, Beijing’s government provides private schools with subsidies for rent, educational toys, and facility reconstructions, and each enrolled student in Beijing receives 1200 CNY per year to cover tuition and fees (Beijing Bureau of Finance, 2011).

Last but not least, preschools have experienced a substantial improvement in the accountability of education under the guidelines of the Plan and Issues. The universal preschool program aims to promote educational quality and emphasizes that early childhood education is critical for young children’s health, habit formation, and intellectual development. Thus, the Chinese government launched national training projects for preschool directors in 2011 and 2013 and also required local governments to complete training for all preschool teachers before 2015 to ensure their professionalization. Comprehensive standards and guidelines have also been progressively issued for the utilization of space, healthcare delivery and education, and qualification requirements of preschool educational personnel.

2.3 Child’s health development

The nutritional status of children has been one of the most important global public health issues. Despite the impressive and sustained socioeconomic development in China over the past two decades, inadequate nutrition remains a serious problem in China’s poor households due to poverty and food insecurity, especially in rural areas and in western areas. The prevalence of under-five stunting in China has significantly declined from 32.3% in 1990 to 17.8% in 2000 (The World Bank). As of 2013, the national prevalence of under-five stunting was 8.1%, which is less than the developing country average of 25% but still much higher than that of developed countries such as the United States (2.1% in 2012). Research by Shen et al. [2015] suggests that the prevalence of food insecurity was 6.1% among rural elementary school students aged 6-14 years, with 16.3% experiencing severe malnutrition. Generally, undernutrition remains a public health challenge in China and shows a significant difference separating Western and Eastern provinces and rural and urban areas. At the same time, China has also experienced a shift toward increased obesity among children, bearing the dual burden of undernutrition and overnutrition. From 1985 to 2015, the possible risk of overweight increased from 6.51% to 12.57% among children between the ages of 2 and 7 (Zong et al. [2019]). For older children, the prevalence of overweight and obesity was even higher (19.4% in 2014 among 7- to 18-year-old Chinese children) (Wang et al. [2017]). A potential cause behind this increase is that Chinese children have easier access to fast food and are less physically active, along with the rapid urbanization in China (Ji and Cheng [2008]; Van de Poel et al. [2009]). Given that overweight in childhood can be carried into adulthood and increases the risk of type 2 diabetes, cardiovascular disease, and some cancers (Pulgaron and Delamater [2014]), the burden of overweight and obesity needs special attention, signaling the importance of strong nutritional governance.

The universal preschool reform under the Plans and Issues can potentially serve as a strategy to improve children's nutrition status and physical health through nutritious meals, outdoor play, and healthy eating habits in school. The typical daily schedule of preschoolers starts at around eight o'clock when they arrive at school. After breakfast on campus, children alternate between class sessions and free playtime, have a nutritious lunch at the scheduled time, take a long nap, have some snacks and fruit, and then go back to class sessions and playtime. At around five or six o'clock, families, usually parents or grandparents, pick the children up from school. In this process, a variety of educational personnel takes the responsibility to provide a safe and hygienic environment, ensure a healthy and regular diet and work to help children develop in a healthy and happy manner.

Center-based preschools often have health care teachers, caretakers, and sometimes school doctors (medical college-trained doctors) on campus to provide health-related services. Their duties include, but are not limited to, health screenings, maintaining a hygienic environment, planning for nutritious meals, and detecting sick or injured children as early as possible. When a child gets sick or injured in school, teachers and caretakers will notify the child's families immediately and suggest further treatment, such as visiting a doctor and taking sick leave. Guided by an action plan brief report from China's Ministry of Education (MOE), they also cooperate with local medical workers to deliver health knowledge lectures to children's families occasionally, especially during preschool publicity month (May 20 to June 20, MOE), but the frequency of such practices varies among provinces. Common interactions between school health personnel and children's families suggest a potential mechanism that attending preschool may yield some impacts on families' health-seeking behavior when their children get sick. Under the guidelines of the Plans and Issues, the number of school health personnel and others (e.g., security guards) nationwide has more than tripled after the initiation of the reform, increasing from 543,990 in 2010 to 1,657,945 in 2018 (MOE, 2018).

3 Data

3.1 Data source

My research draws on a nationally representative data set, the China Family Panel Survey (the CFPS), supplemented with provincial statistics data from the Educational Statistics Yearbook of China. Designed and launched by Peking University, CFPS is a longitudinal social survey conducted every two years since 2010. Its baseline sample covers 15,717 households, 33,600 adult respondents (age 16 or above), and 8999 children (aged 0–15) in 25 provinces, representing 94.5% of the total population in China. The statistics for this study are derived from the 2010, 2012, 2014, and 2016 waves.[2] The CFPS collects individual-, family-, and community-level longitudinal data biannually to keep track of China's economic development and social change. All household members older than 15 had in-person questionnaires. There are direct interviews with children between 10 and 15

[2]Thus far, five waves of the CFPS (2010, 2012, 2014, 2016, and 2018) have been made available. The 2018 wave is not used in this study because of inconsistencies in the weighting variables. Focusing on the time period until 2016 also helps to evaluate the policy effect at a 6-year interval following the first phase (2011-2013) and the second phase (2014-2016) of 3-year action plans.

years old, and data from caregiver reports are also available for all children below 15 years old.

In addition to the CFPS individual dataset, information about provincial school constructions is obtained from the Educational Statistics Yearbook of China published by the Ministry of Education of China. To exploit the variation in treatment intensity across provinces and over the years, this study follows Duflo [2001] and defines the program intensity as the provincial number of newly established preschools between 2010 and 2016 per 1,000 children in 2010. It is easier to interpret the findings if the program intensity is measured by dividing the number of newly constructed preschools by the number of preschool-aged children (3-6 years old) in each province. Due to data availability, this paper instead utilizes the number of children aged 0-14 at the baseline (2010) to construct the intensity measure. I analyze the effects of the universal preschool program employing four waves of the CFPS data (2010, 2012, 2014, 2016). Children aged 0–15 are studied in the paper, with preschool attendance, physical health indicators, and a measure of medical-seeking behavior being the dependent variables. The unit of the analysis is a child.

3.2 Outcome measures

3.2.1 Preschool attendance

In the CFPS survey, the caregiver of children reports whether a child is currently attending preschool or had ever attended preschool. As indicated above, neither the CFPS survey nor my research design distinguishes between kindergartens and pre-primary classes. Thus, my dependent variable of interest is a dummy variable reflecting whether this child is attending/has attended any type of preschool.[3] When assessing the impact of the program on preschool attendance, I restrict my analysis to children with non-missing information about preschool attendance, which leaves an effective sample of 7,882 unique participants between 3-15 years old.

[3]As previously discussed, one major development mission of the preschool program in China is to realize the target enrollment rate (95%, 80%, and 70% for those taking 1-year, 2-year, and 3-year preschools, respectively) by 2020. The preschool measure in this paper is similar to a 1-year preschool enrollment indicator because the preschool measure is equal to 1 if a child had ever attended any type of preschool, no matter the length of the enrollment.

3.2.2 Physical health

Physical health is the foundation of children's comprehensive development, and it influences their long-term well-being. Physical health refers to the biological status of a child, including his/her overall health and functioning, BMI, and involvement in healthy lifestyle behaviors. I construct three indicators from the CFPS survey data, including underweight, overweight, and the incidence of sickness, to examine the effects of preschool reform on children's physical health. Based on age in months, gender, height, and weight measurements, I calculate the weight-for-age and BMI-for-age z-scores (standard deviation scores) according to the World Health Organization (WHO) 2006 growth standards for children aged 0-5 years and WHO 2007 growth reference for children aged 5-19 years. These standards enable us to access child nutrition status relative to the reference population of the same age and sex. Undernutrition, which is most widely measured by the underweight indicator, has adverse functional consequences on children in several domains, such as morbidity risk and cognitive capacity. Based on WHO standards, weight-for-age z-score (WAZ)$<$-2 is termed as underweight. BMI-for-age z-score (BAZ), an indicator for body fat, is useful to screen for overweight and obesity, a global trend that has been extensively documented (Popkin et al. [2006]). Therefore, I construct the overweight measure according to BAZ to evaluate the program effects on the spreading of overweight in China. Based on references developed by the WHO, school-aged children and adolescents aged 5-15 are defined as overweight if their BAZ is greater than 1 (BAZ$>$+1SD). However, WHO defines overweight for young children with a different standard so that children below 5 years old are overweight if their BAZ is more than two standard deviations above the median (BAZ$>$+2 SD). Given that information about height and weight is reported by caregivers, this has the potential to introduce measurement errors into z-score calculations as well as the following analysis. To address the confounding effects of these measurement errors, children who are flagged for biologically implausible z-scores based on WHO standards are dropped. [4]

[4]Less than 1% observations are flagged and dropped from my sample. I make use of an online application called Shiny to calculate a variety of anthropometric z-scores and flag biologically implausible values based on the WHO 2006 standards (0-5 years) and 2007 references (5-19 years). For example, WAZ$<$-6 or WAZ$>$5 are defined as biologically implausible values for children ages 0–5 years. For more details on the use of Shiny, see https://cpeg-gcep.net/content/shiny-apps.

Additionally, caregivers are asked whether their child became sick within the last month. This self-reported measure of individual morbidity, an important health indicator, refers to the incidence rate of sickness and helps to explore children's health status by measuring, quantifying, and comparing illness and disease in individuals (Murray and Chen [1992]; Choi et al. [2019]). Thus, I add the indicator of being sick last month to my analysis to explore the policy effects on a child's individual morbidity.

3.2.3 Preschooler's health-seeking behavior

Under the reform, preschools are guided to acknowledge children's development and use scientific teaching methods to ensure that children develop in a healthy and happy manner. With an increased number of school health personnel providing health-related services on campus, preschool may introduce health benefits to preschoolers and also gradually change their health-seeking behavior. The CFPS survey for caregivers asked how they dealt with their child's illnesses. Options include seeing a doctor right away, finding/buying medicine by oneself, or choosing other options such as asking for religious help or taking no action and waiting for a natural recovery. In the baseline year 2010, seeing a doctor right away is the first preferred choice, reported by 70% caregivers of preschoolers, while finding/buying medicine by themselves constitutes an alternative with 27% voters. To understand the impact of China's preschool reforms on children's health, the last variable of interest in my analysis is preschoolers' health-seeking behaviors, which reflects the health consciousness of caregivers. It is constructed as a dummy variable indicating whether a caregiver takes their children to see a doctor right away when the children get sick.

To highlight the importance of the health-seeking behaviors of young children, it is important to provide context for the medical development and environment in China. Thanks to improved healthcare conditions, big countries like Brazil and China have reduced their child mortality rates 10-fold over the last 4 decades. In China, the under-five child mortality rate has fallen from 15.8 deaths per 1,000 live births in 2010 to 8.6 in 2018, compared with a decrease from 7.3 in 2010 to

6.5 in 2018 in the US (UNICEF). Noting that poor or delayed care-seeking contributes to up to 70% of all under-five child deaths worldwide (WHO), the motivation for care-seeking delivers significant benefits to the child. This is especially relevant in China, where mistrust of the healthcare system has become a prominent issue.

There are three main issues that discourage Chinese people from seeking healthcare. First, China has been experiencing a widespread and prominent crisis of mistrust in healthcare services; the number of conflicts between patients and physicians in China has increased by 12,000 cases from 2002 to 2010, more than tripled in 8 years (Chan [2018]). The second issue is the lack of health literacy in China, which is highly correlated with lower levels of education and income in rural areas. Nevertheless, if people with sickness decide to find medicines by themselves, such as buying over-the-counter drugs without consulting a healthcare professional or using folk medicine, then they must rely on their own understanding of the illness. This can be dangerous for preschool-aged children if their caregivers incorrectly judge the cause of the sickness and provide incorrect treatment. Last but not least, expensive medical bills and the difficulty of accessing quality medical services build barriers to care seeking. Many disadvantaged residents in China are not only uncovered by healthcare insurance but also have difficulties finding high-quality health facilities near their residences. According to the World Health Organization Global Health Expenditure database, the out-of-pocket expenditure (% of current health expenditure) in China was 40.8% in 2010, higher than many countries like the United States (12.4%) and France (10.2%). This suggests a serious impediment for families with financial constraints to utilize medical services where they may not be able to receive even the most basic healthcare for their children.

The following mechanisms may impact health-seeking behavior when preschoolers get sick under the universal preschool program. First, school health personnel on campus tend to suggest a doctor visit when a child gets sick, promoting the child's caregiver's decision to see a doctor when his/her children are ill. Second, health knowledge lectures held on campus for caregivers occasionally may improve their health knowledge gradually, leading to more careful decision-making when dealing with a child's sickness. Another mechanism is through any potential impact on children's health, as evidenced by preschoolers' nutrition status and morbidity. On the one hand, nutrition improvement can reduce child morbidity from infectious diseases. On the other hand, children's health status also depends upon environmental hygiene as well as exposure to infections. Considering this factor, the impact of preschool may be reflected in increased children morbidity. Given the two sides of potential effects, this paper examines the net impact of preschool attendance on children's health status, which may trigger their caregivers' health-seeking behavior response. Finally, this universal preschool program has a strong positive effect on promoting mothers' entrepreneurial activities and grandmothers' labor force participation (Lin and Wang [2019]; Wang and Lin [2019]). Income effects from increased labor supply lead to increased purchasing power in healthcare services, while substitution effects tend to reduce doctor visits, given escalated time costs. Thus, it is unclear how caregivers' labor supply response has changed their health-seeking decisions when children get sick.

Seeing a doctor right away is not necessarily a better choice than caregivers finding medicine on their own. Recuperating at home is also a rational choice when children manifest only mild symptoms. However, there are substantial health benefits when caregivers, mostly parents and grandparents, consult health professionals when they have any unanswered questions, such as the cause of illness and medication dosages.

4 Methods and results

This section presents my methodology and main empirical results. First, I provide a descriptive picture of the sample used in this paper. Next, I study the effect of establishing subsidized preschools on preschool attendance. I then examine changes in preschoolers' health-related outcomes and how these changes vary by demographic group.

4.1 Summary statistics

Table 1 presents summary statistics for the sampled children in the baseline wave before the policy (the 2010 wave) and across all three waves after the policy (2012, 2014, 2016 waves), respectively. I code the policy as being implemented from 2011 because each province started to develop its 3-year Action Plan in 2011. Table 1 includes the mean and the standard deviation of the overall samples and subsamples of children by the program intensity. The results are weighted with individual-level national sampling weights. In the 2010 wave, there are 8,007 children aged 0-15, with an average of 42% urban and 55% male. Family members in the CFPS are defined as financially related household members, and the average family size is 4.9. Differencing samples in the high-expansion provinces and low-expansion provinces depending on whether the provincial program intensity is larger than the national median, I find that children in high-intensity provinces tend to be less likely to live in an urban area, have lower household income, and most importantly have a lower preschool attendance rate, which is consistent with the policy design.

The provincial program intensity is defined as the level change in the number of preschools from 2010 to 2016 per 1,000 children aged 0 to 14 in each province.[5] A value of 1 in intensity indicates that 1 more subsidized preschool per 1,000 children was established after the reform. Assuming that the number of children is evenly distributed by age, a value of 1 in intensity can be interpreted as 1 more preschool per 267 preschool-aged children (3-6 years old). Given that a Chinese preschool, on average, had around 200 enrolled children in 2010[6], this magnitude is equivalent to offering 200 more seats in preschool per 267 preschoolers, or around 750 more seats in preschool per 1,000 preschoolers. Based on this, I define a high-intensity dummy to equal 1 if the provincial program intensity is greater than the national median and 0 otherwise. Thus, by definition, 12 provinces are high-expansion provinces, and 13 provinces are low-expansion ones. As shown in Table 1, an average value of 0.4 in program intensity in the sample indicates that 0.4 more preschools were newly

[5] As discussed earlier, the number of preschool-aged children in each province is unavailable. Due to data availability, this paper instead utilizes the number of children aged 0-14 in each province from the Educational Statistics Yearbook of China to construct the intensity measure.

[6] The size of preschools in China varies from 97 enrolled children to 522 enrolled children across different provinces (Educational Statistics Yearbook of China, 2010).

built per 1,000 children from 2010 to 2016. Moving from low-expansion to high-expansion provinces reflects a 0.34 increase in program intensity from 0.23 to 0.57, corresponding to obtaining 255 more seats in preschool per 1,000 preschool-aged children.[7] In the regression analysis, I explore the results of representing the program intensity as a dummy variable and a continuous variable.

Table 1 also displays that in the 2010 wave, about 33% children (aged 0-15) were overweight, 17% were underweight [8], 29% were sick last month, and 68% of caregivers would take children to see a doctor when they got sick instead of finding medicines by themselves without consulting healthcare professionals.

4.2 Effects on preschool attendance

4.2.1 Empirical strategy

This section displays the empirical strategy used in this study to identify the effect of increasing accessibility to formal child care facilities on children's preschool attendance. The date of birth and the region of education jointly determine an individual's exposure to the program. Chinese children normally attend preschool between the ages of 3 and 6, while delayed school entry could lead a few 7-year-old children to stay in preschool. All children born in 2003 or before were 7 or older in 2010, the year immediately before the expansion of child care facilities. Thus, they did not benefit from the program since they should have left preschools before the implementation of the program. For younger children, who were between the ages of 2 and 6 in 2010, the exposure is a decreasing function of their age in 2010. Children born in 2009 or after (the calculated age below 1 in 2010) were fully exposed; thus, the program has potentially imposed a similar effect on these youngest cohorts. In summary, the effect of the program should be close to 0 for children 7 or older in 2010, the year

[7] A 0.34 increase in program intensity means that provinces that experienced a high level of expansion after the reform newly constructed 0.34 more preschools per 1,000 children than provinces that experienced a low level of expansion during 2010-2016. In other words, moving from low-expansion to high-expansion provinces corresponds to obtaining 255 (0.34*200/267*1000=255) more seats in preschool per 1,000 preschool-aged children.

[8] Chen and Meng [2015] used the CFPS 2012 wave and found that 30% of adult respondents were overweight or obese, and 11% were underweight. Their results are based on the standard specifically designed for China, in which underweight is defined as BMI$<$18.5 and overweight or obese as BMI $\geq$ 24.

immediately before the expansion of child care facilities, and increasing for younger children until they reach full exposure.

The region of education is the second dimension of variation in the intensity of the program. However, it could be endogenous if families moved to benefit from the program, which would lead to bias in the program effect (Rosenzweig and Wolpin [1988]). Selective location is less of an issue in this study because strong institutional constraints imposed by the household registration system (hukou) make interprovincial movement in China difficult.[9] Even when parents move for opportunities, many migrant parents leave their children at home (approximately 60% in 2007) considering financial barriers and the difficulty of enrolling in public preschools for migrant children without a local hukou (Démurger and Xu [2015]). To eliminate any potential bias from endogenous migration, preschoolers who experienced interprovincial migration during the sample period are not included in my sample.[10]

I evaluate the effect of this program on preschool attendance by combining differences across provinces in the number of subsidized preschools constructed with differences across cohorts induced by the timing of the program. To exploit the variation in treatment intensity across provinces and cohorts, I implement a DID model that yields the following:

$$Attendance_{isk} = C + \alpha_s + \lambda_k + \{P_s * T_i\}\gamma_1 + \{E_s * \lambda_k\}\delta_1 + X_{isk}\eta_1 + \varepsilon_{isk} \quad (1)$$

$Attendance_{isk}$ indicates whether child i in province s from cohort k is attending/has attended preschool. P_s denotes a high-intensity dummy indicating whether this child resided in a province s that experienced a high level of preschool expansion after the reform. The program intensity is defined as the level change in the number of preschools from 2010 to 2016 per 1,000 children aged 0 to 14. P_s equals 1 if the intensity is larger than the national median and 0 otherwise. T_i is a young-cohort dummy indicating whether the child i belongs to the "young" cohort in the subsample who were

[9] The Chinese government uses the household registration system (hukou) to control internal migration and regulate resource allocation. The rigidity of hukou imposes strong migration restrictions, especially for people who want to relocate from the countryside to a city.

[10] As a result, around 1.7% observations are dropped.

young enough to be affected by the preschool reform. The "young" cohort refers to individuals with age 0-6 in 2010 and individuals born in 2011 and 2012 with calculated age -2 and -1 in 2010. They are those who were exposed to the preschool reform between 2010 and 2016. C is a constant. α_s is a province fixed effect, and λ_k is a cohort of birth effect. E_s is the pre-reform enrollment rate in 2008, and X_{isk} is a vector of various individual and household characteristics that may relate to school choice, including age, gender, urban-rural residence status, and family size.[11]

A DID approach generally assumes that in the absence of the program, the increase in attendance rate between cohorts would not have been systematically different across provinces. It will be violated if the pattern of increased attendance would have been observed even if the program had no effect. As illustrated, the program intensity is negatively correlated with the initial level of preschool enrollment. If provinces with a low baseline enrollment level would experience a substantial rise in enrollment in the absence of the program, the estimated differences in differences will be biased upward due to mean reversion. To control for this factor, I present specifications that control for the interactions between cohort dummies and the provincial preschool enrollment rate in 2008. In addition, I compute robust standard errors clustered at the province level to account for serial correlation within provinces over time.

4.2.2 Results

Table 2 presents the estimated effects on preschool attendance. I compare the attendance history of children who had no exposure to the program (aged 9 to 13 in 2010) to those of individuals who were exposed (aged -2 to 6 in 2010) in high-intensity provinces and low-intensity provinces. Estimates in Table 2 are positive and statistically significant, indicating a positive impact on preschool attendance under the universal preschool program. The estimates for the specifications controlling for mean reversions and other control factors in columns 2-3 are slightly smaller in magnitude than that in column 1 but are still robust and significant. The suggested effect in column 3 of Table 2 is that

[11] It is preferred not to control for variables that could be potentially affected in my main specifications, such as household income. However, regressions that include household income as controls exert similar estimates. This result can be provided upon request.

moving from low-intensity provinces to high-intensity provinces would have increased the preschool attendance rate by 14.3 percentage points (20% compared with the baseline mean) if the child was young enough to experience the reform.

To obtain better statistical power, I measure intensity as a continuous variable in the model and run the following regression:

$$Attendance_{isk} = C + \alpha_s + \lambda_k + \{Intensity_s * T_i\}\gamma_1 + \{E_s * \lambda_k\}\delta_1 + X_{isk}\eta_1 + \varepsilon_{isk} \tag{2}$$

$Intensity_s$ denotes the intensity of the program in province s. It is defined as the level change in the number of preschools from 2010 to 2016 per 1,000 children aged 0 to 14. C is a constant. α_s is a province fixed effect, and λ_k is a cohort of birth effect. E_s is the baseline enrollment rate in 2008, and X_{isk} is a vector of various individual and household characteristics that may relate to school choice.

In Panel A of Table 3, the estimated coefficients reflect that one additional preschool per 1,000 children contributes to an increase in the preschool attendance rate by 65 percentage points. To state it differently, 1 more preschool per 267 preschool-aged children, which is equivalent to offering around 750 more seats in preschool per 1,000 preschoolers, is associated with a 65 percentage point rise in preschool attendance. Since on average the program intensity is 0.4, as shown in Table 1, the program introduced 300 (0.4*750) more seats in subsidized preschools per 1,000 preschool-aged children nationwide. Correspondingly, the estimated effect is a 26 (65*0.4) percentage point increase in the preschool attendance rate (defined as attending at least some preschool) in China from 2010 to 2016. Controlling for mean reversion does not change the estimate, as shown in column 2 of Table 3, suggesting that my estimates are not driven by mean reversion.

Even though it is not feasible to directly test the parallel trends assumption of the DID framework, it is reassuring that one implication of the identification assumption can be tested using a control experiment. Given that children aged 7 or older in 2010 were not exposed to the program, I should not expect the increase in preschool attendance between cohorts in this age-group to differ systematically across provinces. I consider two cohorts in the control experiment. Children aged 9 to 13 in 2010 constitute the "young" cohort, and those aged 14 to 15 constitute the "old" cohort. I would expect to see some effects if the pattern of increase in preschool attendance varies systematically across provinces. As suggested in Panel B of Table 3, no significant effect is detected. This helps validate the parallel assumption that treatment and control groups show a nonsignificant difference in preschool attendance in the absence of the program. The results are robust under different model specifications.

To explore the estimated effects on attendance for each birth cohort respectively, I also show results from an interaction terms analysis. Consider the following:

$$Attendance_{isk} = C + \alpha_s + \lambda_k + \{Intensity_s * \lambda_k\}\gamma_1 + \{E_s * \lambda_k\}\delta_1 + X_{isk}\eta_1 + \varepsilon_{isk} \tag{3}$$

In this specification, I measure the time dimension of exposure to the program with 18 cohort-of-birth dummies (aged -2 to 15 in 2010). The omitted dummy is the dummy for age 15 in 2010. After controlling for province fixed effects and cohort fixed effects, interactions between dummy variables indicating the age of the child in 2010 and the provincial program intensity are plausibly exogenous. Figure 3 plots the γ_1. Each dot is the coefficient of the interaction between a dummy for being a given age in 2010 and the number of preschools constructed per 1,000 children. A 95-percent confidence interval is shown in line widths. As expected, the program had almost zero effect on the attendance of cohorts not exposed to it, and it had a positive effect on the attendance of younger cohorts.[12] The coefficients generally decrease with age for exposed cohorts. Overall, Figure 3 validates that the identification strategy is plausible and that the program positively influenced preschool attendance.

[12]One exception is at age 7 in 2010, which is expected to be close to zero but displays some effect there. One possible reason is that the CFPS survey is mostly investigated after July of the survey year. Therefore, children who just became 7 during the 2010 survey could be affected in 2011 because the provincial action plan was put into practice prior to their entry into primary school.

4.2.3 Heterogeneity analysis

Rural residents usually face greater financial barriers regarding the decision to send children to preschool than urban residents. Considering this budget constraint, it may be the case that children who reside in rural areas experience a larger effect under the preschool program. To examine the heterogeneity of my estimated effects by urban-rural residence status (defined based on the administrative district), I estimate Equation 2 for urban and rural children, respectively. As demonstrated in the first two columns of Table 4, the positive effects on preschool are mainly driven by rural children. In particular, one preschool per 1,000 children contributed to an increase in the preschool attendance rate by 58 percentage points in rural areas, while it contributed to an increase of 40 percentage points in urban areas. In addition, the effect of child care expansion on preschool attendance may be heterogeneous to the child's gender. Because preference for sons is common in China (and in some other Asian countries like the Republic of Korea and India) (Das Gupta et al. [2003]), there may be differential impacts for girls as compared to boys due to gender-based discrimination. The last two columns of Table 4 present the results of boy and girl subsamples and reveal a slightly greater effect on boys than girls.

4.3 Effects on health-related outcomes

4.3.1 Empirical strategy

To estimate the causal effects of the universal preschool program on preschoolers' health-related outcomes, I utilize a DID strategy. Slightly different from the DID model in the prior section, I track the health indicators for preschoolers in highly-treated provinces before and after the policy implementation and compare these changes with the corresponding changes for preschoolers in provinces that experienced a small change in the supply of subsidized preschools. Thus, instead of using cohort of birth dummies in previous sections, I implement indicators of year as well as age in each year to determine treatment status in this section. The year 2010 serves as the year before the expansion of preschool facilities, and the years 2012, 2014, and 2016 are treated as the years after the expansion. The outcomes of interest consist of dummy indicators including underweight, overweight, ever sick last month, and see a doctor when children get sick. Regression analyses are weighted with CFPS individual-level weights.

I first estimate a DID model of the following form:

$$Y_{ist} = C + \alpha_1 High_s + \alpha_2 Post_t + \gamma\{High_s * Post_t\} + \delta_1 \sum\{E_s * \lambda_t\} + \eta_1 X_{ist} + \varepsilon_{ist} \qquad (4)$$

The variable Y_{ist} represents a health-related outcome for child i (a preschooler aged 3-6) residing in province s in year t. $High_s$ denotes a high-intensity dummy indicating whether province s experienced a high level of preschool expansion after the reform. The program intensity is again defined as the level change in the number of preschools from 2010 to 2016 per 1,000 children aged 0 to 14. $High_s$ again equals one if the intensity is larger than the national median and zero otherwise. $Post_t$ is a post-reform dummy which equals one for the years after 2010 and zero for the year 2010. As mentioned earlier, 2010 is the first wave available in my dataset and is prior to the implementation of the preschool program. λ_t denotes year dummy, and E_s is the baseline enrollment rate in 2008. X_{isk} is a vector of characteristics that may be related to the child's health outcomes, including age, gender, urban-rural residence status, and family size.

The key coefficient of interest is γ, which is the simple DID estimate of the effect of subsidized preschool expansions. The key identifying assumption in the DID model is that provinces with varying levels of treatment intensity have similar trends in outcomes in the absence of treatment. Although this common trend assumption is fundamentally not testable, I can test if high- and low-intensity provinces had the same trends prior to 2010 as compelling evidence. Ideally, I want to probe pre-existing time trends in the outcomes of interest. However, 2010 is the first wave available in the CFPS survey dataset, so I explored other data sources to show pre-existing trends. Specifically, I obtained moderate to severe malnutrition rates in each province for children below 5 years old from the China's Health and Family Planning Statistics Book. Figure 4 shows that before 2010, the malnutrition rate in provinces with a higher level of established subsidized preschools moved together with provinces that experienced less intense treatment. To probe the validity of DID assumptions, I also check if the estimated impact of the program on toddlers (aged 1-2) yields a zero coefficient. An estimate close to zero is the most compelling evidence since toddlers are too young to be affected by the preschool program in the current year.

One may be concerned that several issues can bias my DID estimates. Besides pre-program differential trends, concerns about biased estimates remain if other confounding factors and policies happen at the same time while affecting provinces differently. For instance, this situation might occur in cases where the government grants funding to rural regions to improve health outcomes; in such cases, the intervention's impact on individuals might be more significant in our treatment provinces than in the control provinces since the treatment provinces are comprised of more rural areas. To address such possible confounding factors, I develop a DDD model adding another dimension of differencing between preschoolers (aged 3-6) and toddlers (aged 1-2).

The DDD regression model takes the following form:

$$\begin{aligned} Y_{ist} = \alpha_0 + \alpha_1 Post + \alpha_2 High + \alpha_3 Presch + \alpha_4 \{Post * High\} + \alpha_5 \{Presch * High\} + \\ \alpha_6 \{Post * Presch\} + \gamma Post * High * Presch + \delta_1 \sum \{E_s * \lambda_t\} + \eta_1 X_{ist} + \varepsilon_{ist} \end{aligned} \tag{5}$$

The variable Y_{ist} represents the health-related outcomes of interest for child i (either a preschooler aged 3-6 or a toddler aged 1-2) in province s in year t. *Presch* is a dummy variable indicating whether this child was a preschooler (aged 3-6) in that year, with 1 denoting age group 3-6 and 0 denoting age group 1-2. The key coefficient of interest is γ, which is the DDD estimate of the effect of the universal preschool program on children's health-related outcomes.

Unlike the DID model, I add another dimension of differencing between preschoolers (aged 3-6) and toddlers (aged 1-2). Considering that toddlers in the current year should not be impacted by the preschool program but may be exposed to "other" changes that occur at the same time in treated provinces, my identifying assumption is that the difference in trend between high-intensity and low-intensity provinces is the same for preschoolers as it is for toddlers in the absence of the preschool reform. The DDD model does not assume that provinces have similar trends in outcomes in the absence of treatment anymore. Instead, it is assumed that preschoolers and toddlers were equally impacted by other contemporaneous shocks, and the difference in the trends between high-expansion and low-expansion provinces would be the same for preschoolers or toddlers without the preschool program. This method can potentially account for the unobserved trajectories in health outcomes across provinces and the outcome changes of both preschoolers and toddlers in the treatment provinces.

4.3.2 Results

Table 5 presents the estimation results from the DID framework. Panel A shows strong evidence that the preschool expansion program had significant effects on reducing underweight. Specifically, a preschool-aged child is 5 percentage points less likely to be categorized as underweight if the child resides in a high-expansion province. The results indicate that attending preschool contributes to alleviating undernutrition among preschool-aged children. In addition, results from Panel A also show that the program led to improved health-seeking behavior by showing that caregivers of preschoolers were more likely to see a doctor when children got sick instead of finding medicines by themselves. Panel B in Table 5 shows the results of the control experiment using toddlers. All estimated coefficients are close to zero and statistically insignificant. This is reassuring because toddlers are too young to be affected by the preschool program.

Table 6 compares the results from my DDD regression model with those from the DID framework. Similarly, my DDD results from Panel B suggest that the preschool reform contributes to alleviating underweight among preschoolers. Also, I find no significant effect on the overweight indicator and individual morbidity. Based on the DDD estimates, preschoolers from provinces with a large expansion in subsidized preschools are 5.4 percentage points (38%) less likely to be underweight than their counterparts from provinces with only a small change in access to preschool education. When children get sick, caregivers residing in high-intensity provinces are 10.7 percentage points (15%) more likely to seek professional help from doctors, under the impact of preschool expansion.[13] Those results are robust to several specification checks, as displayed in Table 7.

As noted earlier, the validity of my DDD model relies on several assumptions. Although it is not feasible to directly test these assumptions, I conduct two convincing checks to support the soundness of my DDD model design. First, I use systematic/healthcare management rates from the China's Health and Family Planning Statistics Book and look at the pre-reform trends between high-intensity and low-intensity provinces. Children will be in the system of healthcare management if their caregivers have taken them to an appointment for a systematic examination, growth monitoring, or healthcare guidance at least once. Like the indicator of seeing a doctor when children are ill, this healthcare management rate measure also reflects caregivers' attitudes toward child healthcare services. Figure 5 demonstrates that the difference in trends, between two types of provinces differencing in program intensity, evolves similarly for preschoolers and toddlers before the initiation of preschool reform.[14]

Second, I make great efforts to alleviate potential concerns by conducting several parallel analyses. The triple-difference design contains three dimensions of differencing: high-intensity versus low-intensity provinces, pre-reform versus post-reform, and treated group (preschooler) versus untreated group (toddler). As a control experiment, I change the third differencing to toddlers (aged 1-2) versus infants (aged 0) and children aged 11-14 versus children aged 9-10, respectively. Those cohort comparisons are adjacent to those used in the main specifications. Theoretically, the outcomes of infants, toddlers, and children aged 9-14 should not be influenced by the universal preschool pro-

[13]The effect on care seeking is direct for preschoolers. However, the siblings of preschoolers may experience indirect effects since preschool may reshape their caregiver's health knowledge and habits and impress upon them the importance of professional consultation when children get ill. To rule out any confounding effects from siblings residing together, I also explore estimates after dropping observations who are in the control group (toddlers) but have preschool-age siblings in my sample. The results are similar and can be provided upon request.

[14]To test the empirical results, I evaluate the triple-difference estimates for the systematic/healthcare management rate when a post indicator is turned on at a random year during the pre-period. A minimal estimate would support the identification assumption. As shown in Table A1, all of those triple-difference estimates for the systematic/healthcare management rate are small (less than 2% of the mean value) and insignificant, offering compelling evidence to support my assumptions.

gram, so the absence of effects would support the plausibility of my identification. Panel B and Panel C in Table 8 present the triple-difference results in two control experiments individually. Specifically, Panel B in Table 8 explores outcomes of young children (aged 0-2) between 2010 and 2016, while Panel C in Table 8 explores outcomes of children aged 9-14 between 2010 and 2014, considering those children are never exposed to the preschool program. As expected, each of these coefficients is small and not significantly different from zero across all specifications. Overall, I implement two types of falsification checks to support my triple-difference methodology, and convincing evidence is provided.

4.3.3 Heterogeneity analysis

The effect of the accessibility of affordable preschool on children's health-related outcomes may be heterogeneous to individuals' characteristics. Given the common issue of gender inequality worldwide, it is important to investigate whether the effect shows some heterogeneity by children's gender. In addition, a large gap between China's rural and urban areas has existed for a long time in various dimensions, such as income, education, and health.[15] Thus, it is of great importance to examine the differential effects by children's urban-rural residential status.

Heterogeneous effects on the underweight indicator and caregiver's health-seeking behavior are displayed in Table 9 and Table 10. Column 1 in Table 9 indicates that alleviation of underweight is solely driven by children living in rural areas. Rural families are more economically disadvantaged and are more likely to suffer from childhood malnutrition and food insecurity (Chen et al. [2007]; Hannum et al. [2014]). This implies that nutritious meals, outdoor play, and healthy eating habits in preschool could reduce undernutrition more effectively in rural areas, consistent with the findings in this paper. Column 2 in Table 9 shows that the preschool expansion leads to a greater impact on urban areas' health-seeking behavior (11.6 percentage points) than it does on rural areas (7.9 percentage points). This may result from a low baseline level of health-seeking behavior, a larger positive effect

[15] The underweight ratio among children in rural areas is 18%, which is 9 percentage points larger than that in urban areas based on my sample in the CFPS 2010 survey.

on mother's entrepreneurship, and better access to healthcare services in urban areas.[16] Table 10 presents the heterogeneous effects by gender. Results in column 1 indicate that preschool expansion has a greater effect for girls than boys on preventing underweight. One possible explanation can be the root of preferences for sons in China (Das Gupta et al. [2003]); some girls may be poorly taken care of in the absence of preschool attendance compared with boys, especially in rural areas with greater scope for improvement. This differential effect by gender suggests that preschool attendance, together with nutrition and health services at school, contributes to narrowing the gender gap in preventing nutritional deprivation of children. In contrast, results in column 2 suggest a larger influence on boys regarding caregivers' medical-seeking behavior. Considering that China has the cultural stigma of having female children as well as the historical preference for sons, this might imply such gender inequality in child healthcare.

5 Conclusion

I set out to answer the following question using a quasi-experiment of China's first universal child care program: Can preschool improve health-related outcomes for preschoolers? This paper first confirms the positive effects on attendance rates that result from providing access to affordable preschool education. On average, the program has led to an increase of approximately 300 seats per 1,000 preschool-aged children and an increase of 26 percentage points in the preschool attendance rate from 2010 to 2016. Further investigation shows a larger effect on children residing in rural areas than those in urban areas. This trend suggests a potential narrowing of the current gap in access to education between rural and urban areas.

Then I examine the impact on preschoolers' health-related outcomes and find that the program has the potential to address undernutrition. My estimates suggest that the program is effective in reducing underweight, which significantly enhances the welfare of low-income families. Specifically,

[16] Wang and Lin [2019] find suggestive evidence that China's subsidized child care program has a larger effect on entrepreneurial activities of mothers in urban areas.

preschoolers from provinces with a large expansion in subsidized preschools are 5 percentage points (38%) less likely to be underweight than their counterparts from provinces with only a small change in access to preschool education. The test of heterogeneity shows alleviating underweight mainly occurs in rural areas, which could lead to a reduction in health disparities between China's rural and urban areas. On the other hand, results suggest that the probability of being overweight or being sick among preschoolers is unaffected.

This paper also detects some evidence of caregivers' health-seeking behavioral response to the program. When children get sick, caregivers residing in high-expansion provinces are, on average, 10.7 percentage points (15%) more likely to seek professional help from doctors instead of finding treatments themselves. Combining the program's effects on preschool attendance and health-related outcomes demonstrates that attending preschool at subsidized prices is a powerful tool to reduce children's underweight that may come from food deficiencies and imbalances of nutrients. These results are robust to various changes in model and sample specifications.

In closing, future research should prioritize identifying the mechanisms that underlie the relationship between preschool and caregivers' medical-seeking behavior on children's behalves. Considering the underlying financial costs and welfare benefits, it is also important to evaluate the direct welfare effects of such a program. Given that 12 years have passed since the initiation of China's universal preschool program, it is imperative for future research to study the long-term effects of preschool attendance on child development.

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Table 1: Summary Statistics

	2010 Before the program			2012-2016 After the program		
	(1) All	(2) Hign Intensity	(3) Low Intensity	(4) All	(5) Hign Intensity	(6) Low Intensity
Individual and Family Characteristics						
Age	7.98	7.81	8.24	8.09	8.06	8.13
	(4.48)	(4.47)	(4.47)	(4.28)	(4.29)	(4.26)
Male	0.55	0.56	0.55	0.52	0.51	0.53
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Urban	0.42	0.39	0.48	0.49	0.44	0.55
	(0.49)	(0.49)	(0.50)	(0.50)	(0.50)	(0.50)
Family size	4.91	4.94	4.86	5.03	5.04	5.02
	(1.59)	(1.58)	(1.60)	(1.66)	(1.65)	(1.67)
Household income per capita	5,591.35	5,179.44	6,205.36	8,618.64	7,985.53	9,494.10
	(4,047.92)	(3,893.32)	(4,194.14)	(6,228.85)	(5,851.46)	(6,617.19)
School Expansion						
Preschool program intensity	0.40	0.57	0.23	0.40	0.57	0.23
	(0.23)	(0.17)	(0.15)	(0.23)	(0.17)	(0.15)
Outcome Variables						
Ever attended preschool (Age$\geqslant$ 3)	0.76	0.74	0.78	0.87	0.86	0.88
	(0.43)	(0.44)	(0.41)	(0.34)	(0.35)	(0.32)
Overweight	0.33	0.34	0.33	0.32	0.32	0.32
	(0.47)	(0.47)	(0.47)	(0.47)	(0.47)	(0.47)
Underweight	0.17	0.18	0.16	0.12	0.11	0.12
	(0.38)	(0.38)	(0.37)	(0.32)	(0.32)	(0.32)
Child ever sick last month	0.29	0.29	0.29	0.27	0.26	0.29
	(0.45)	(0.46)	(0.45)	(0.44)	(0.44)	(0.45)
See a doctor when children get sick	0.68	0.67	0.70	0.60	0.59	0.61
	(0.47)	(0.47)	(0.46)	(0.49)	(0.49)	(0.49)
Observations	8,007	4,691	3,316	19,036	11,527	7,509

Notes: Sample includes children aged 0-15. Columns (1)–(3) report summary statistics for the year 2010 (before the program), (4)–(6) for 2012, 2014, and 2016 (after the program). Statistics are weighted with CFPS individual-level national weights. Standard deviations are reported in parentheses.

Table 2: Effects of the program on preschool attendance

	Attendance	Attendance	Attendance
(Aged below 6 in 2010)*High Intensity	0.179**	0.139**	0.143**
	(0.072)	(0.055)	(0.055)
Province FE	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes
Cohort Dummy*Pre-reform Enrollment	No	Yes	Yes
Controls	No	No	Yes
Baseline Mean	0.716	0.716	0.716
R-squared	0.239	0.250	0.276
Obs	7,882	7,882	7,882

Notes: This table presents the DID estimates of the program on preschool attendance. It compares the attendance history of children who had no exposure to the program (aged 9 to 13 in 2010) to those of individuals who were exposed (either below age 6 in 2010 or born between 2010 to 2012) in high-intensity provinces and low-intensity provinces. The dependent variable is a dummy variable reflecting whether a child is attending/has attended any preschools. Controls include child age, gender, urban-rural residence status, and family size. Robust standard errors are clustered at the province level and presented in parentheses. Significance levels: * 10%, ** 5%, ***1%.

Table 3: Effects on preschool attendance: experiment of interest and control experiment

Panel A: Experiment of Interest: Individuals aged below 6 or aged 9-13 in 2010			
(Youngest cohort: Individuals aged -2 to 6 in 2010)			
	Attendance	Attendance	Attendance
(Aged below 6 in 2010)*Program intensity in that region	0.672***	0.651***	0.654***
	(0.074)	(0.107)	(0.105)
Province FE	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes
Cohort Dummy*Pre-reform Enrollment	No	Yes	Yes
Controls	No	No	Yes
Baseline Mean	0.716	0.716	0.716
R-squared	0.260	0.264	0.290
Obs	7,882	7,882	7,882
Panel B: Control Experiment: Individuals aged 9 to 15 in 2010			
(Youngest cohort: Individuals aged 9 to 13 in 2010)			
	Attendance	Attendance	Attendance
(Aged 9-13 in 2010)*Program intensity in that region	0.008	0.084	0.059
	(0.044)	(0.056)	(0.054)
Province FE	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes
Cohort Dummy*Pre-reform Enrollment	No	Yes	Yes
Controls	No	No	Yes
Baseline Mean	0.716	0.716	0.716
R-squared	0.255	0.255	0.334
Obs	4,058	4,058	4,058

Notes: This table presents the estimated effects on preschool attendance. Panel A shows the results of the experiment of interest (comparing the cohort aged below 6 in 2010 to the cohort aged 9 to 13 in 2010). Panel B shows the results of the control experiment (comparing the cohort aged 9 to 13 in 2010 to the cohort aged 14 to 15 in 2010). The dependent variable is a dummy variable reflecting whether a child is attending/has attended any preschools. Controls include child age, gender, urban-rural residence status, and family size. Robust standard errors are clustered at the province level and presented in parentheses. Significance levels: * 10%, ** 5%, ***1%.

Table 4: Heterogeneous effects by urban-rural residence status and gender

	Attendance			
	(1)		(2)	
	Urban	Rural	Boy	Girl
(Aged below 6 in 2010)*Program intensity in that region	0.396***	0.582***	0.721***	0.594***
	(0.133)	(0.115)	(0.110)	(0.106)
Province FE	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Cohort Dummy*Pre-reform Enrollment	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Baseline Mean	0.874	0.589	0.719	0.711
R-squared	0.127	0.338	0.298	0.287
Obs	3,050	4,832	4,284	3,598

Notes: This table presents the estimation results on sub-samples by urban-rural residence status and gender. The dependent variable is a dummy variable reflecting whether a child is attending/has attended any preschools. Controls include child age, family size, and gender or urban-rural residence status. Robust standard errors are clustered at the province level and presented in parentheses. Significance levels: * 10%, ** 5%, ***1%.

Table 5: Effects on health related outcomes: DID estimates

Panel A: Experiment of Interest: Preschoolers (3-6)				
Outcome	Underweight	Overweight	Sick last month	See a doctor
High intensity*Post	-0.050**	-0.006	-0.050	0.062*
	(0.021)	(0.024)	(0.036)	(0.032)
Year Dummy*Pre-reform Enrollment	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Baseline Mean (3-6)	0.142	0.442	0.411	0.701
R-squared	0.024	0.025	0.019	0.026
Obs	8,511	8,511	8,511	8,511
Panel B: Control Experiment: Toddlers (1-2)				
Outcome	Underweight	Overweight	Sick last month	See a doctor
High intensity*Post	0.005	-0.026	-0.048	-0.048
	(0.014)	(0.042)	(0.037)	(0.048)
Year Dummy*Pre-reform Enrollment	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Baseline Mean (1-2)	0.090	0.549	0.525	0.738
R-squared	0.025	0.036	0.013	0.027
Obs	4,554	4,554	4,554	4,554

Notes: This table presents the DID estimates on health-related outcomes. Panel A shows the results of the experiment of interest, and the sample consists of preschoolers (aged 3-6) in each year from 2010 to 2016. Panel B shows the results of the control experiment, and the sample consists of toddlers (aged 1-2) in each year from 2010 to 2016. Controls include child age, gender, urban-rural residence status, and family size. Robust standard errors are clustered at the province level and presented in parentheses. Significance levels: * 10%, ** 5%, ***1%.

Table 6: Effects on health related outcomes: DID vs DDD estimates

Panel A: Difference-in-difference estimates				
Sample: Preschooler (aged 3-6)				
Outcome	Underweight	Overweight	Sick last month	See a doctor
High intensity*Post	-0.050**	-0.006	-0.050	0.062*
	(0.021)	(0.024)	(0.036)	(0.032)
Year Dummy*Pre-reform Enrollment	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Baseline Mean (3-6)	0.142	0.442	0.411	0.701
R-squared	0.024	0.025	0.019	0.026
Obs	8,511	8,511	8,511	8,511
Panel B: Triple-difference estimates				
Sample: Preschooler (aged 3-6) and Toddlers (aged 1-2)				
Outcome	Underweight	Overweight	Sick last month	See a doctor
Post*High intensity*Preschooler	-0.054**	0.020	-0.008	0.107***
	(0.025)	(0.043)	(0.042)	(0.037)
Year Dummy*Pre-reform Enrollment	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Baseline Mean (3-6)	0.142	0.442	0.411	0.701
R-squared	0.025	0.031	0.026	0.026
Obs	13,065	13,065	13,065	13,065

Notes: This table compares the DID estimates (Panel A) with the DDD estimates (Panel B) for health-related outcomes. Controls include child age, gender, urban-rural residence status, and family size. Robust standard errors are clustered at the province level and presented in parentheses. Significance levels: * 10%, ** 5%, ***1%.

Table 7: Robustness checks: Specifications with different controls

Outcome	Underweight			See a doctor		
	(1)	(2)	(3)	(1)	(2)	(3)
Post*High intensity*Preschooler	-0.047*	-0.047*	-0.054**	0.112***	0.117***	0.107***
	(0.024)	(0.024)	(0.025)	(0.039)	(0.037)	(0.037)
Year Dummy*Pre-reform Enrollment	No	Yes	Yes	No	Yes	Yes
Controls	No	No	Yes	No	No	Yes
R-squared	0.005	0.007	0.025	0.007	0.015	0.026
Obs	13,065	13,065	13,065	13,065	13,065	13,065

Notes: This table presents the estimated effects from the DDD model under different specifications. Controls include child age, gender, urban-rural residence status, and family size. Robust standard errors are clustered at the province level and presented in parentheses. Significance levels: * 10%, ** 5%, ***1%.

Table 8: Experiment of interest and control experiment: DDD estimates

Panel A: Experiment of Interest				
Preschooler (aged 3-6) vs Toddlers (aged 1-2)				
Sample: Children aged 1-6, 2010-2016				
Outcome	Underweight	Overweight	Sick last month	See a doctor
Post*High intensity*Preschooler	-0.054**	0.020	-0.008	0.107***
	(0.025)	(0.043)	(0.042)	(0.037)
R-squared	0.025	0.031	0.026	0.026
Obs	13,065	13,065	13,065	13,065
Panel B: Control Experiment				
Toddlers (aged 1-2) vs Infants (aged 0)				
Sample: Children aged 0-2, 2010-2016				
Outcome	Underweight	Overweight	Sick last month	See a doctor
Post*High intensity*Aged 1-2	-0.037	0.024	0.031	-0.023
	(0.063)	(0.071)	(0.066)	(0.123)
R-squared	0.056	0.044	0.040	0.022
Obs	5,715	5,715	5,715	5,715
Panel C: Control Experiment				
Children aged 11-14 vs Children aged 9-10				
Sample: Children aged 9-14, 2010-2014				
Outcome	Underweight	Overweight	Sick last month	See a doctor
Post*High intensity*Age11-14	0.033	0.002	-0.018	0.087
	(0.046)	(0.048)	(0.055)	(0.069)
R-squared	0.030	0.054	0.005	0.041
Obs	8,490	8,490	8,490	8,490

Notes: This table compares the DDD estimates for health-related outcomes in the experiment of interest (Panel A) and two control experiments (Panels B and C). Controls include child age, gender, urban-rural residence status, and family size. Robust standard errors are clustered at the province level and presented in parentheses. Significance levels: * 10%, ** 5%, ***1%.

Table 9: Heterogeneous effects by urban-rural residence status

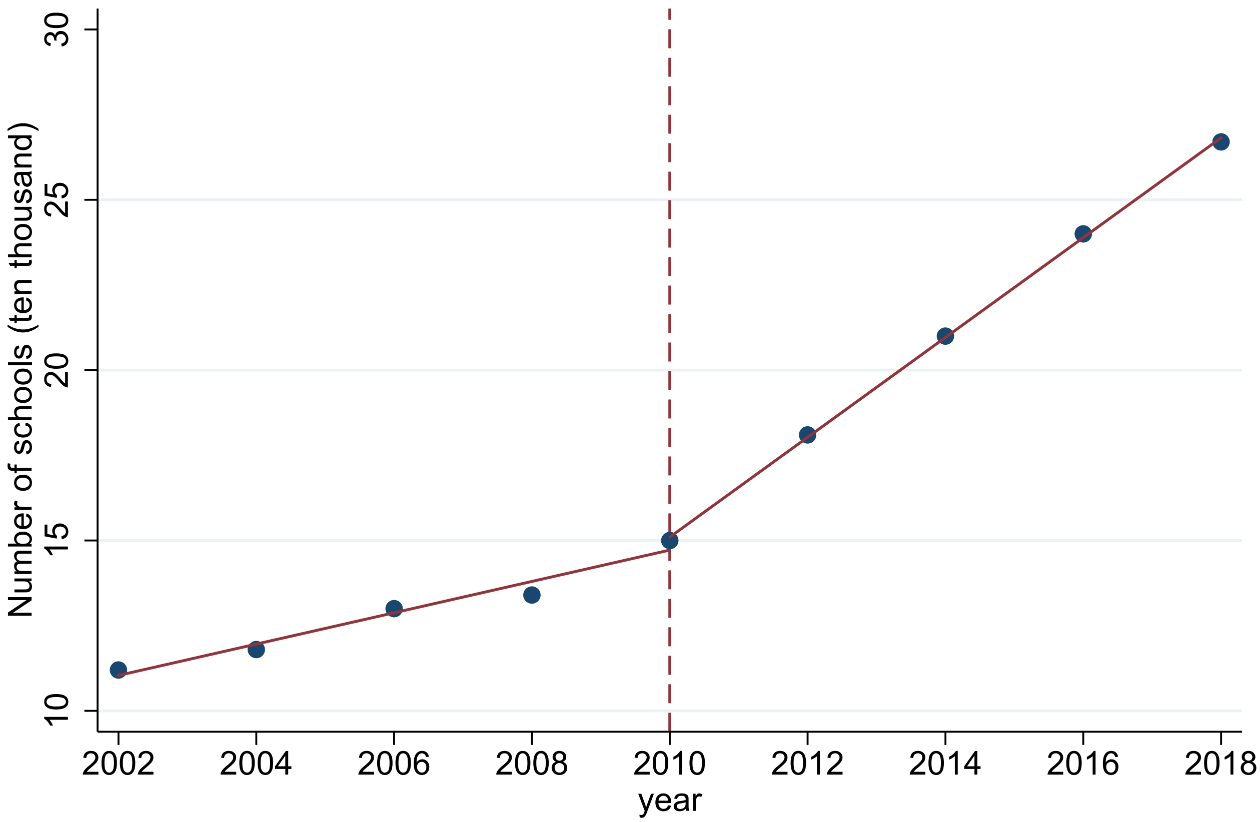
	Underweight		See a doctor	
	(1)		(2)	
	Urban	Rural	Urban	Rural
Post*High intensity*Preschooler	0.004	-0.108**	0.116*	0.079*
	(0.029)	(0.040)	(0.064)	(0.045)
Year Dummy*Pre-reform Enrollment	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Baseline Mean (3-6)	0.087	0.180	0.653	0.734
R-squared	0.012	0.020	0.021	0.018
Obs	5,066	7,999	5,066	7,999

Notes: This table presents the estimation results on sub-samples by child urban-rural residence status. Controls include child age, gender, and family size. Robust standard errors are clustered at the province level and presented in parentheses. Significance levels: * 10%, ** 5%, ***1%.

Table 10: Heterogeneous effects by gender

	Underweight		See a doctor	
	(1)		(2)	
	Boy	Girl	Boy	Girl
Post*High intensity*Preschooler	-0.011	-0.110*	0.167**	0.024
	(0.032)	(0.054)	(0.064)	(0.055)
Year Dummy*Pre-reform Enrollment	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Baseline Mean (3-6)	0.139	0.146	0.715	0.683
R-squared	0.025	0.026	0.024	0.028
Obs	7,175	5,890	7,175	5,890

Notes: This table presents the estimation results on sub-samples by child gender. Controls include child age, urban-rural residence status, and family size. Robust standard errors are clustered at the province level and presented in parentheses. Significance levels: * 10%, ** 5%, ***1%.



Notes: The solid lines are the linear fits during pre- and post-reform periods. Data come from Educational Statistics Yearbook of China

Figure 1: Number of preschools in China

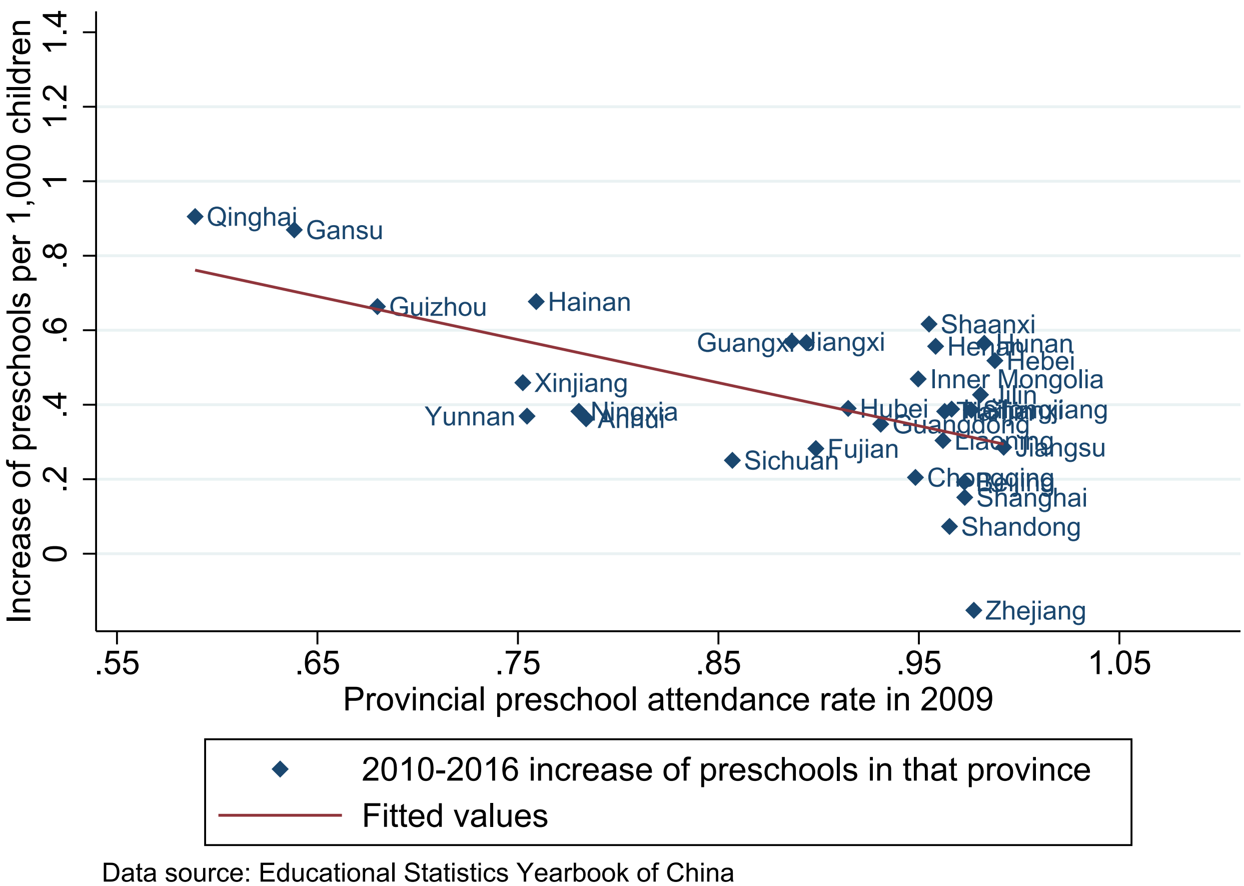


Figure 2: Correlation between pre-reform attendance rate and the increase of preschools (program intensity)

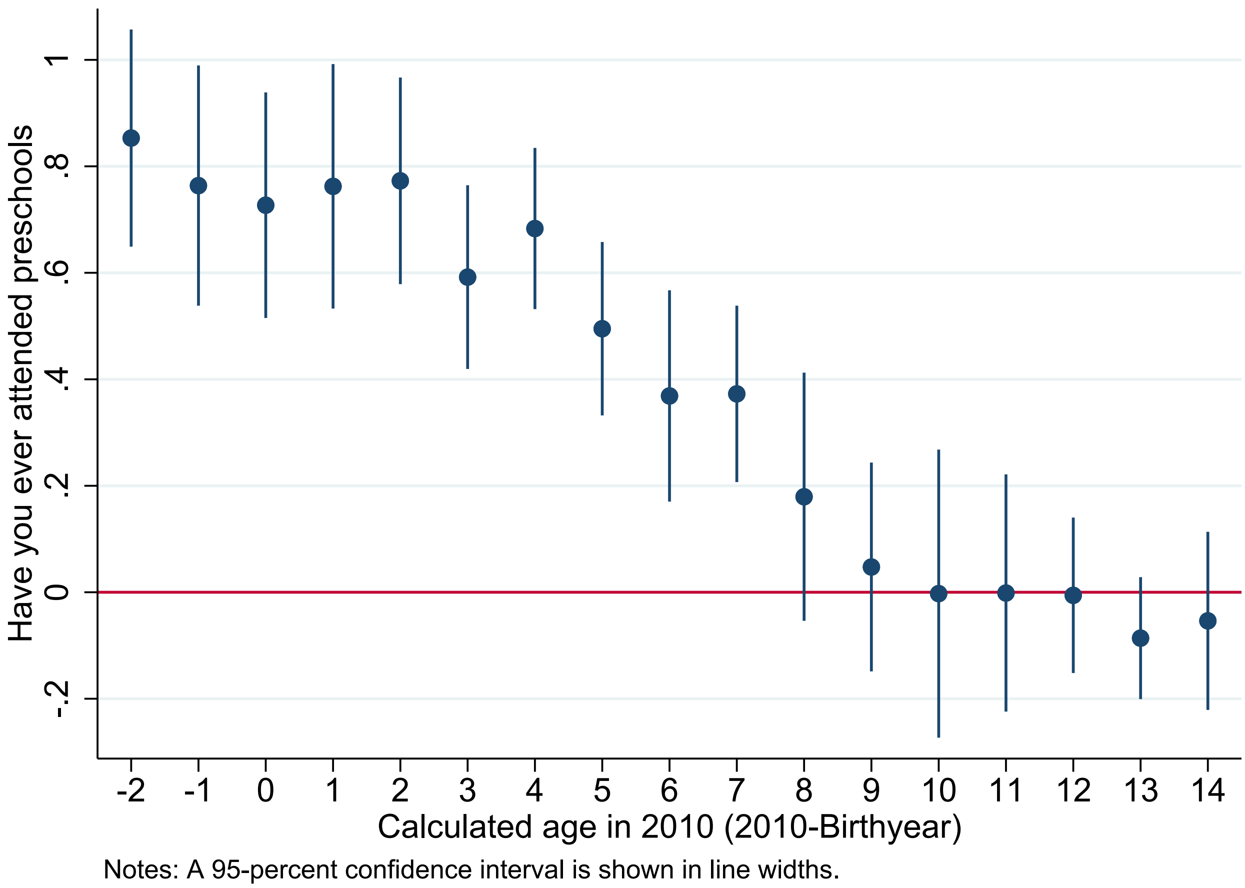


Figure 3: Coefficient of the Interactions Program Intensity*Cohort Dummy

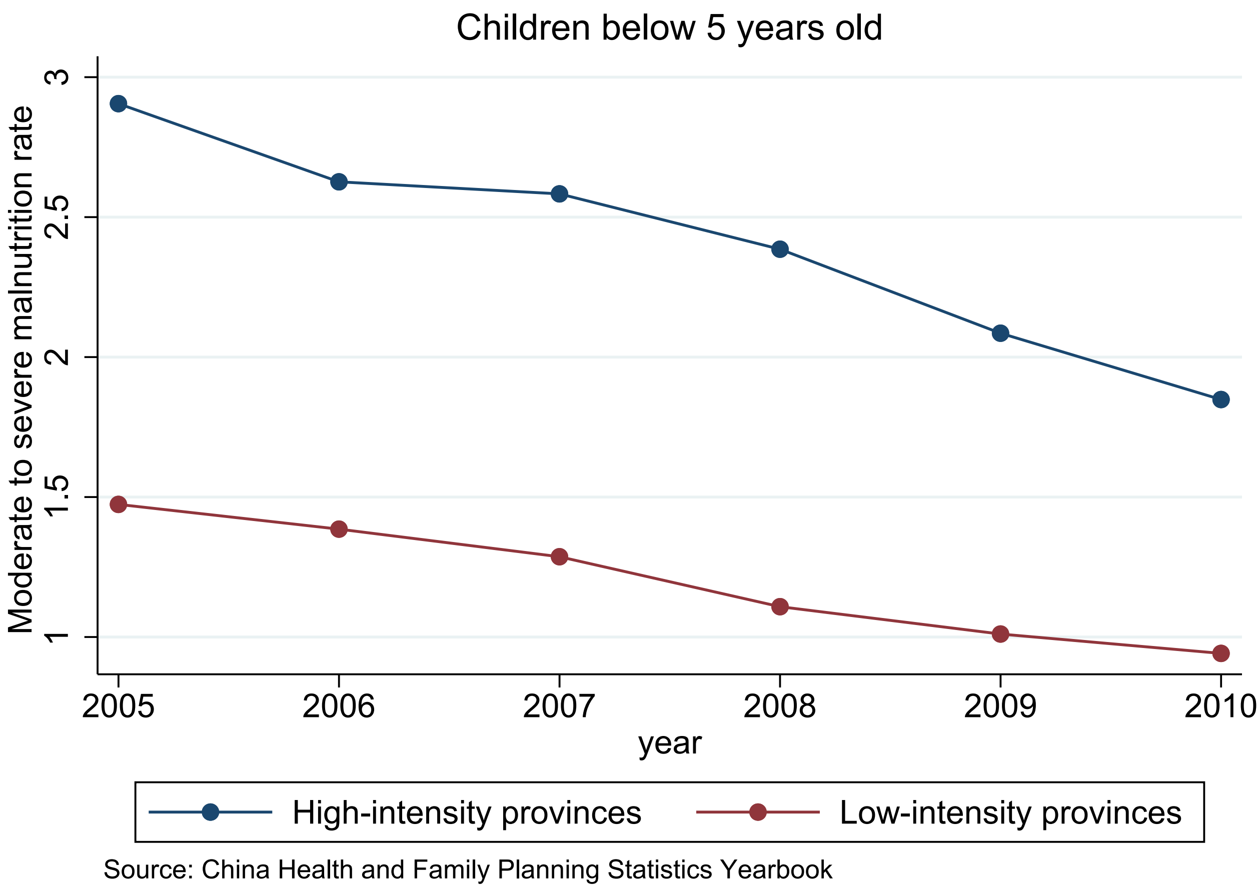


Figure 4: Moderate to severe malnutrition rate

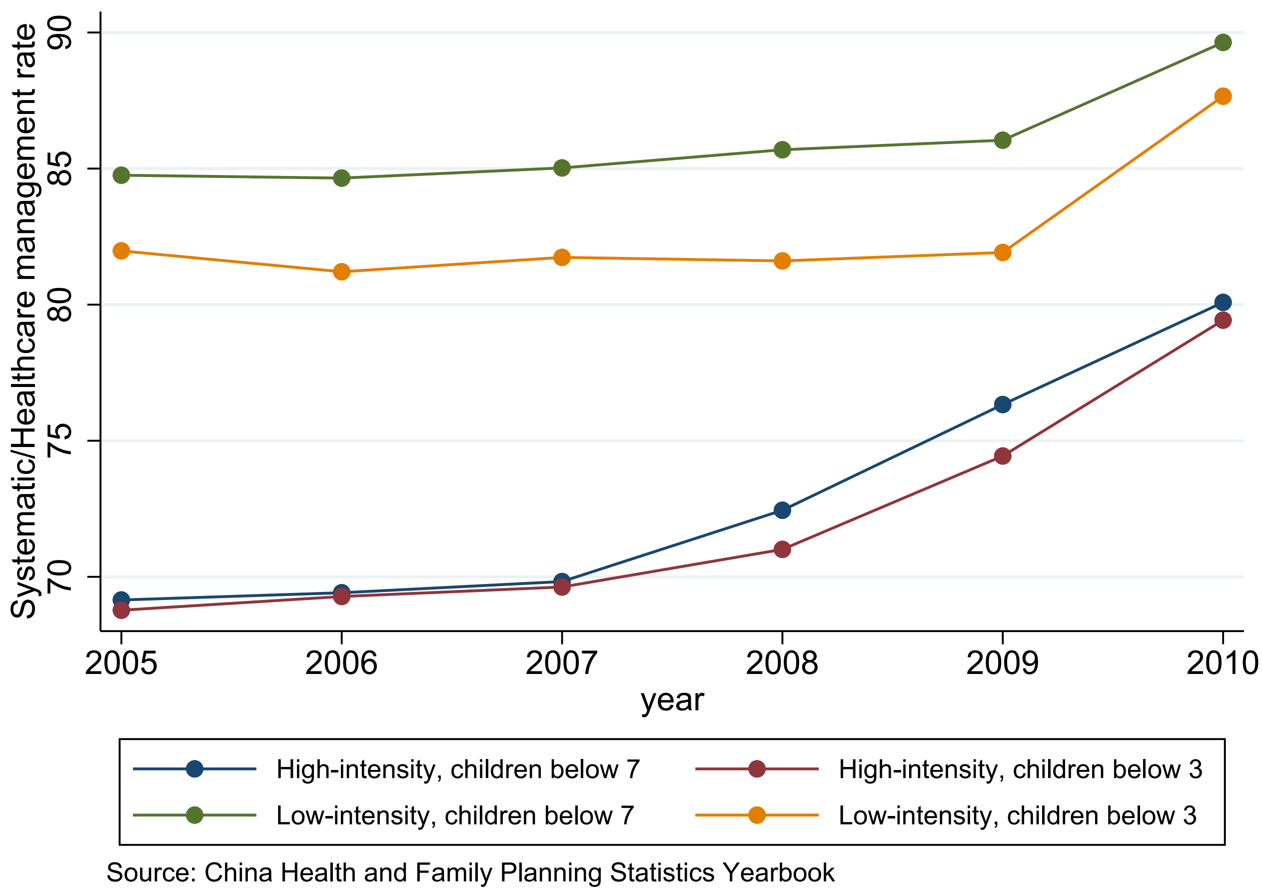


Figure 5: Systematic/Healthcare management rate for kids

6 Appendix

Table A1: Estimates for the systematic/healthcare management rate with a random cutoff year

Outcome	Systematic/Healthcare management rate			
	Random Cutoff Year			
	(1)	(2)	(3)	(4)
	2006	2007	2008	2009
DDD	0.531	0.865	1.083	1.413
	(5.429)	(4.058)	(3.154)	(4.231)
Mean of dep.	78.40	78.40	78.40	78.40
R-squared	0.858	0.911	0.952	0.946
Obs	24	24	24	24

Notes: This table presents the DDD estimates for the systematic/healthcare management rate, a proxy for caregiver's health-seeking behavior regarding child healthcare, using a random cut-off year. The unit of observation is a province. Standard errors are presented in parentheses. Significance levels: * 10%, ** 5%, ***1%. Source: China Health and Family Planning Statistics Book