

博士論文（要約）

The Effects of Preprimary Education on Child Health in Japan
and the United States

（日米において就学前教育・保育が子どもの健康に与える
影響）

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論文の内容の要旨

論文題目

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Introduction

The purpose of this dissertation is to investigate the effectiveness of pre-primary education on childhood severe asthma across two countries, the United States (US) and Japan. The effects of pre-primary education have been conventionally evaluated based on the development of children's cognitive and socioemotional skills. Prior studies also revealed the longitudinal positive health effect of pre-primary education such as lower risk of life-style related diseases on participants after they become their' 20-30's. However, relatively short-term and disease-specific effects of pre-primary education is an important yet undeveloped issue in the public health field. This dissertation aimed to contribute to the literature by broadening the aspects of evaluation on pre-primary education using one of children's common diseases.

In this dissertation, I specifically selected severe childhood asthma as an adverse health outcome among various diseases for the following reasons. First, previous studies showed controversial results on the association between pre-primary enrollment and the onset of asthma. The contradicted results may be yielded from cross-sectional or retrospective nature of the study designs that did not overcome selection bias (i.e. endogenous bias). Causal relationship of pre-primary enrolment and asthma onset should be more rigorously investigated. Second, among children eligible for pre-primary education, asthma is one of most common and severe disease in both the U.S. and Japan. Approximately 10% of all children aged five to nine have asthma in the U.S., and 4% of all six-year-old Japanese children have asthma. Asthma has a longitudinal negative health impact on children's overall quality of life, including their physical, social, and psychological functioning. Therefore, causal relationship between the use of pre-primary education and child severe asthma should be investigated because it deteriorates children's quality of life as well as at-risk population is large.

There is virtually no established mechanisms or theories that explain how pre-primary education affects childhood asthma. However, prior studies have suggested a conceptual framework based on Anderson's "social environment and health logic model" as shown in Fig.1 in the dissertation. First, attending pre-primary education increase the detection of diseases by teachers or periodic health checkups. Consequently, pre-primary use of appropriate medical service may attenuate disease symptoms. Second, amelioration of parental factor such as parents' participation in social and health opportunities affects every aspect of child's life including health status. Third, in addition to the original framework, a Guideline on child asthma predicts clean air and adequate food that pre-primary programs provide may decrease onset

of asthma.

Given the framework above, childhood severe asthma can be positively affected by early detection of symptoms, early health care service use, ameliorated family condition, and adequate air condition and food. To investigate the association between pre-primary enrollment and childhood severe asthma, I conducted two empirical studies on the effectiveness of pre-primary education on childhood severe asthma (Study 1 is on US and Study 2 is on Japan) in this dissertation. In these studies, asthma with exacerbation/asthmaticus (in Study 1) and asthma-related hospitalization (in Study 2) were used as indicators of severe asthma.

Two countries, the United States and Japan, were selected for the following reasons. First, ensuring universal pre-primary education is an important but undeveloped policy issue in these two countries. Thus, policy implication derived from this dissertation should be useful for the both countries. Second, using data sources from different countries enabled us to address certain aspects of pre-primary education's effects on children's health over varied time spans. Third, the targeted populations investigated for this research differed in the two countries. The different target populations may clarify the differing effectiveness of programs based on socioeconomic status.

Study 1: A Quasi-Experimental Study of the Effects of Pre-Kindergarten Education on Pediatric Asthma

The objective of Study 1 is to investigate how Pre-Kindergarten (Pre-K) program enrollment affects children's asthma-related medical service use at different time periods in North Carolina state in US. Data from an existing Pre-K evaluation study conducted in 2015 in North Carolina was linked with state Medicaid claims data from 2011 to 2017. The unit of analysis was person-month: 51,408 observations (84 months x 612 children) of 279 children enrolled Pre-K and 333 not enrolled. The outcome variable was severe asthma identified by ICD 9/10 codes. Panel analysis using a difference-in-difference model with three time periods was conducted. Inverse probability weighting was calculated using 18 covariates to adjust for selection bias. The explanatory variables were interaction terms between Pre-K enrollment and 1) prior vs. during enrollment and 2) during vs. after enrollment.

Results of the analyses suggested children enrolled in Pre-K had greater asthma-related service use during the Pre-K period ($b = 0.0047$, $p = 0.05$). In the follow-up period, enrolled children had lower rates of asthma ($b = -0.0056$, $p = 0.06$). Findings suggested that state-funded Pre-K program affected the health of the children who enrolled in it by enabling teachers to detect early symptoms in and promote adequate disease management for the children they supervised. Universal Pre-K should be ensured as a form of investment in child health, which is an important aspect of children's future human capital. Early detection of child asthma could possibly decrease Medicaid expenditure in the long term, but further studies of the cost-effectiveness of universal Pre-K are needed. This study's findings support the hypothesis that Pre-K can increase the use of health services related to asthma in the short term and attenuate the future risk of asthma-related service use. Attending Pre-K may have a surveillance effect, in which teachers

identify symptoms in children and encourage caregivers to seek health services for them. Pre-K might also decrease medical service use as children proceed on to elementary school, due to decreased incidence of severe asthma symptoms among children who engaged in appropriate care during the Pre-K period.

Study2: The Effects of Pre-Primary Education on Children's Health in Japan

The purpose of Study 2 is 1) to investigate how preprimary education program enrollment in Japan affects children's asthma-related hospitalization, and 2) whether the effects differ by family socioeconomic status and parental smoking habit. Data were derived from the Longitudinal Survey of Newborns in the 21st Century (2001 Cohort; LSN21). Data of 2002-2006 were used for main analysis, and data of 2002 includes 47,015 children. The unit of analysis was person-year. The outcome variable was severe asthma identified by asthma-related hospitalization. Panel analysis using two-stage least squares (2SLS) was conducted. In the first stage, the probability of enrolling preprimary education was calculated using children on waiting list per childcare slot (i.e., waiting rate) by prefecture as instrumental variable. The predicted probability of enrolling preprimary education was explanatory variable in the second stage. Covariates were child's gender, number of siblings in the household, parental educational attainment, family equivalent income, parental smoking habit, mother's working status, and low birth weight. Lag analysis of one-year between the exposure and the outcome was conducted using the same 2SLS model above.

Results indicated children enrolled in any preprimary educational program had lower asthma-related hospitalization (OR = 0.63, $p < 0.001$). When there is one-year lag, the preventive effect of preprimary education became greater (OR = 0.50, $p < 0.001$). Stratified analysis showed this effect did not differ by any indicator of socioeconomic status and parental smoking habit. This study revealed that preprimary enrollment decreased the rates of asthma-related hospitalization among children, irrespective of the socioeconomic status of their families. This preventive effect was greater when there was a one-year lag between preprimary enrollment and asthma-related hospitalization, which means the effects endured at least 1 year after a child enrolled in any pre-primary program. Further examinations of the mechanism by which preprimary education affects child health are needed.

Discussion

In sum, Studies 1 and 2 demonstrate that pre-primary education decreased severe child asthma longitudinally in the U.S. and Japan. Study 1 identified the detection effects of pre-primary education leading to increased medical service interventions that could attenuate future incidences of severe asthma. Study 2 suggested that the preventive effects of early education on asthma lasted at least one year after a year of attendance. Although the educational systems and content naturally differed in each respective country, the two studies indicated similar results, thereby suggesting that pre-primary education may have universally positive impacts on children's health regardless of any unique characteristics of the educational systems in different countries.

Policy implications

In essence, both countries can learn from each other. For Japan, Study 1 demonstrated how to link and utilize administrative data to improve policies and programs. In Japan, although the use of linked data is not legally prohibited—including an individual’s demographic and socioeconomic information and administrative data—they are rarely utilized for the purposes of program evaluation. According to the underlying philosophy of the most recently enacted data utilization law, the Basic Act on the Advancement of Public and Private Sector Data Utilization (2016), administrative data should be put to better use for the evaluation and improvement of programs and policies. Study 1 showed a U.S. example linking personal information to administrative data that can be similarly applied in Japan. Studies utilizing rich data sources should be given more consideration in Japan.

For the United States, US policies regarding pre-primary education have primarily targeted the financially disadvantaged population, as represented by programs like Head Start and Early Head Start. This may also explain why public-funded Pre-K programs in many U.S. states have eligibility criteria based on income. Nevertheless, the effectiveness of early education on children’s health should not be reserved only for economically marginalized children. Instead, it should be available for all children because health is a basic human right. Public discussions related to the importance of early education as an investment in child’s health should be encouraged, and ensuring universal early education should not only be a political slogan but a realistic goal in the United States.

Strength and Limitation

There are some strengths of this dissertation. First, I addressed a very important yet undeveloped issue in public health. The results of the two empirical studies demonstrated pre-primary education’s positive impact on child severe asthma which is one of most common diseases to deteriorate children’s well-being. Second, I adopted rigorous quasi-experimental methods in the two studies to control for selection bias as well as unobservable heterogeneity across individuals. These methods to rigorously investigate causal inferences should assure the results of the studies.

This dissertation has several limitations. First, as it dealt with only two developed countries, generalizability to developing countries is not guaranteed. Second, special attention should be given to the comparability of the two studies because the outcomes and age of the participants differed. Finally, as childhood severe asthma is only one of health outcomes which comprises children’s wholistic health, the effects of pre-primary education on other health outcomes such as various pediatric diseases and mental health conditions should be investigated in further studies to illustrate total effects on children’s health.

Conclusion

In the United States and Japan, pre-primary education has been shown to attenuate severe childhood asthma. The underlying mechanisms can be partially explained by early detection of symptoms and subsequent early medical treatment. Although early education positively impacts children’s health, the evaluation of its effectiveness has been largely overlooked. Despite this lack of literature, ensuring universal pre-primary education is important worldwide for the promotion of children’s health.