

Abstract Title Page
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Title: Estimating impacts of treatment random assignment on classroom quality in the Head Start Impact Study: The problem of missing data

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Abstract Body

Limit 4 pages single-spaced.

Background / Context:

Description of prior research and its intellectual context.

As a result of the 1998 reauthorization of Head Start, the Department of Health and Human Services conducted a national evaluation of the Head Start program. The goal of Head Start is to improve the school readiness skills of low-income children in the United States. There is a substantial body of experimental and correlational research that has found associations between the quality of children's early childhood classrooms and their subsequent academic success (Pianta, Barnett, Burchinal, & Thornburg, 2009; Raver et al., 2008; 2009; 2011; Zaslow et al., 2010). A particularly important part of evaluating the effectiveness of Head Start is understanding whether the program improves the quality of participants' early learning environments. Results from the original analysis of the classroom quality data from the Head Start Impact Study (U.S. Department of Health and Human Services, 2010) show that randomization to Head Start lead to improvement in the quality of care children received. However, these results are obfuscated by the way in which missing data were handled. The apparent improvements in classroom quality may be due to greater access to formal care settings, greater access to higher quality formal care settings, or more likely to a combination of the two.

Purpose / Objective / Research Question / Focus of Study:

Description of the focus of the research.

To address this problem, the primary objectives of this research are to address the challenges faced when estimating impacts of treatment random assignment on classroom quality within the Head Start Impact Study, to explore how different solutions influence the impact estimates, and to offer methodological solutions. That is, the goal of this research is to be able to accurately answer the following questions: What are the impacts of random assignment to Head Start on measures of classroom quality? Do children who are randomly assigned to Head Start receive higher/better quality care than children who are randomly assigned to the control group?

However, there are several challenges to answering these questions accurately. The largest threat to estimating unbiased impacts is missing data on the dependent variable, classroom quality. We expect that missing data on classroom quality are endogenous to treatment random assignment. Previous analyses indicate that random assignment to the invitation to participate in Head Start increased children's enrollment in formal care arrangements. Since a classroom quality rating can only be collected when a child is in formal care, "missingness" due to being in parental care is expected to be associated with treatment random assignment. Quality data are also missing if the child was in a formal care setting that should have been evaluated but was not observed because the observer was not granted access. As Head Start centers had knowledge of the study, it is expected the data collectors were more likely to gain access to Head Start centers. Data are also missing for children missing information on their type of child care arrangement. Data are less likely to be missing for this reason among children randomized to Head Start because they were more likely to be in Head Start and have their care setting known. If "missingness" is indeed correlated with treatment random assignment, we cannot estimate

unbiased impacts of treatment random assignment on quality without first accounting for this association. Yet determining the best way of handling missing data is a challenge.

Setting:

Description of the research location.

The Head Start Impact Study sample was designed to be nationally representative of 3- and 4-year-olds attending Head Start programs in the United States and included children in 22 states. Observations of classroom quality occurred in the child’s primary care setting, including Head Start centers, other public and private center-based care facilities, and family child care homes.

Population / Participants / Subjects:

Description of the participants in the study: who, how many, key features, or characteristics.

This research uses data from the Head Start Impact Study and includes 4,440 3- and 4-year-old children who were randomly assigned off a waitlist to either receive an invitation to participate in Head Start services or to the control group. The sample included 2,447 three-year-olds and 1,993 four-year-olds. Children were enrolled in 930 different centers and 1,632 classrooms. They were from 81 Head Start grantees and 351 Head Start programs. Children were randomized to treatment or control based on 202 center groups. A total of 2,644 children were randomized to receive Head Start services and 1,796 were randomized to the control group. Children in the control group could enroll in other center-based programs or family child care, or could stay at home with a parent, relative, or other caregiver (to be referred to as parental care). However, there was crossover of treatment assignment as 195 children randomly assigned to the control group were in Head Start and not all children assigned to Head Start took up the treatment.

Missing data on the classroom quality outcome measure is a serious threat to our ability to accurately estimate intent to treat impacts of randomization to Head Start on classroom quality. Classroom quality data is missing for 814 children who were in parental care, 601 children who were in formal care but whose classroom was not observed, and 601 children who were missing data on their type of child care setting and an observation.

Intervention / Program / Practice:

Description of the intervention, program, or practice, including details of administration and duration.

Children were randomly assigned to receive Head Start services or to a control group. The control group could enroll in other early childhood programs but did not have access to Head Start. As Head Start is based on a “whole child” model, children randomly assigned to the Head Start group had access to a set of comprehensive services including preschool education, medical, dental, and mental health care, nutrition services, and parental involvement activities.

Research Design:

Description of the research design.

Random assignment occurred prior to the beginning of the 2002-03 school year. Children were randomly assigned to Head Start within center groups rather than centers because of the small size of many centers. Thus small centers were combined with nearby centers into center groups.

The Head Start Impact Study was designed to examine impacts of randomization to Head Start separately for 3- and 4-year-olds in order to determine if program impacts vary by age. Thus the analyses for this poster will be done separately for 3- and 4-year-olds. Data collection began during the fall of 2002, after random assignment. Classroom quality was measured during the spring of 2003.

Data Collection and Analysis:

Description of the methods for collecting and analyzing data.

The current research utilizes data collected during the first year of the longitudinal Head Start Impact Study. The outcome data of interest, classroom quality, were collected in the spring of 2003. The Early Childhood Environment Rating Scale (ECERS-R; Harms, Clifford, & Cryer, 1998) is an observation tool used to measure classroom quality in center-based early childhood programs. Items and subscales assess the quality of space, materials, and experiences including language interactions between teachers and children. In the current research, only the total mean ECERS-R score is used. The Family Day Care Rating Scale (FDCRS; Harms & Clifford, 1989) is an analogous observation tool to the ECERS-R that is used in family child care settings. The mean total FDCRS score was used instead of an ECERS-R score for children in family child care. The ECERS-R/FDCRS was completed by independent researchers who observed the children's care settings and is scored on a scale of 1 to 7.

The original analyses of the Head Start Impact Study created classroom quality threshold variables on which to estimate impacts of random assignment. One threshold variable was "ECERS-R/FDCRS score of 5 or higher". Children whose care arrangement received a 5 or higher on the ECERS-R/FDCRS received a one on this threshold variable, and all other children received a zero, including those with missing data. Thus one problem with this method is that it does not differentiate low quality and missing data. Another problem is that it does not use the full variance of the continuous quality data.

In our analyses, we first estimate the impact of treatment random assignment on each of the three types of missing data using fixed effects for center groups. We estimate these impacts separately for 3- and 4-year-olds and for the full sample in order to demonstrate that "missingness" is endogenous to random assignment status and is a problem for estimating unbiased intent to treat impacts on quality.

$$Y_{missing} = B_0 + B_1 \text{Treatment} + B_2 \sum \text{center groups} + e$$

Next, we estimate the impacts of treatment random assignment on classroom quality using a multinomial logit model. We created nine mutually exclusive groups of children based on quality score and type of "missingness" and estimated the joint impact of randomization to Head Start on movement into formal care, observable care, and higher quality care.

$$Pr(Y_{quality}) = B_0 + B_1 \text{Treatment} + B_2 \sum \text{center groups} + e$$

Our second analytic approach relied on the use of Tobit models. Tobit models are typically used with censored or truncated data but have also been used in cases in which the censoring is due to missing data due to issues of selection. We use Tobit models to parse the estimated

impact of treatment random assignment into the dichotomous impact on use of formal care and the continuous impact on quality of care.

Findings / Results:

Description of the main findings with specific details.

Results show that treatment random assignment significantly predicts all three types of missing data. Randomization to Head Start significantly predicts lower rates of missing data on classroom quality due to (1) being in parental care, (2) being in a formal care setting that was not observed, and (3) missing data on the focal care arrangement. (Please insert table 1 here.)

Results also of the multinomial logit model indicates that random assignment to Head Start compared to the control group is associated with increases in access to formal care and increases in quality of formal care (Please insert table 2 here). For example, the odds for children randomized to Head Start to be in formal care with a score on the ECERS between 5 and 6 instead of parent care is 28 times as high as the same odds for children randomized to the control group. Moreover, 70% of Head Start compared to 24% of control group is predicted to be in formal care, a difference of 46 percentage points. And 48% of Head Start compare to 6% of control group are predicted to be in high quality care (defined as a 5 or higher on the ECERS/FDCRS), a difference of 42 percentage points.

Results of the Tobit analyses indicate that random assignment to Head Start increased the probability of having an observed quality score by 48 percentage points. Additionally, conditional on having an observed quality score, random assignment to Head Start increases the quality of care by 2 points (Please insert table 3 here).

Conclusions:

Description of conclusions, recommendations, and limitations based on findings.

These results confirm that the three types of missing data described above are indeed endogenous to treatment random assignment. Thus, methodological approaches must be used to handle missing data in order to obtain unbiased estimates of impacts of random assignment to Head Start on classroom quality. The results of the multinomial logit and Tobit analyses are similar and suggest that a portion of the impact of randomization to Head Start on classroom quality in the initial analyses (U.S. Department of Health and Human Services, 2010) is due to being in formal care and a portion is due to being in higher quality care.

Next steps for this work will focus on using multiple imputation and non-response probability weighting to estimate the impacts of random assignment to Head Start on quality. We will compare those sets of results with those reported here. Our goal is to find the most appropriate method to estimate unbiased impacts on quality given the high amount of missing data on the measure of quality while utilizing the continuous quality data which will allow for greater precision of final impacts when examining treatment impact variation by classroom quality on children's cognitive, social-emotional, behavioral, and health outcomes. Determining the most appropriate methods for handling missing data is important to both understand the true impacts of treatment random assignment on quality and to be able to correctly model how variation in quality influences impacts of treatment random assignment on child school readiness skills.

Appendices

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Appendix A. References

References are to be in APA version 6 format.

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- Zaslow, M., Anderson, R., Redd, Z., Wessel, J., Tarullo, L., & Burchinal, M. (2010). *Quality Dosage, Thresholds, and Features in Early Childhood Settings: A Review of the Literature, OPRE 2011-5*. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.

Appendix B. Tables and Figures

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Table 1. Impacts of random assignment on the three types of missing data

	<i>b</i>	S.E.	Effect Size
3-Year-Olds			
In Parental Care	-0.29***	0.02	-0.62
Missing ECERS-R/FDCRS but in formal care	-0.10***	0.01	-0.26
Missing Type of Care and Observation	-0.11***	0.01	-0.28
4-Year-Olds			
In Parental Care	-0.25***	0.02	-0.52
Missing ECERS-R/FDCRS but in formal care	-0.09***	0.01	-0.24
Missing Type of Care and Observation	-0.12***	0.02	-0.29
3- and 4-Year-Olds			
In Parental Care	-0.27***	0.01	-0.58
Missing ECERS-R/FDCRS but in formal care	-0.09***	0.01	-0.25
Missing Type of Care and Observation	-0.11***	0.01	-0.28

*** $p < .001$

Table 2. Impacts of random assignment on quality: Multinomial logit results

	Estimate	S.E.	Odds Ratio
Formal Care, ECERS/FDCRS <3	1.44***	0.23	4.21
Formal Care, ECERS/FDCRS 3 to 4	1.90***	0.17	6.71
Formal Care, ECERS/FDCRS 4 to 5	2.61***	0.14	13.55
Formal Care, ECERS/FDCRS 5 to 6	3.33***	0.13	27.86
Formal Care, ECERS/FDCRS 6 to 7	3.64***	0.21	37.99
Formal Care, Missing Observation	1.08***	0.13	2.94
Missing Type of Care & Observation	0.84***	0.13	2.31
Wald (Chi-Square)	937.40***		

Note: Parent Care is the reference group

*** $p < .001$

Table 3. Impacts of random assignment on quality: Tobit results

	Treatment Coefficient	S.E.	χ^2
Main Effect	4.691***	0.134	1796.17***
Marginal Effects			
<i>Probability of observed quality score</i>	0.484***	0.013	
<i>Quality score given observed quality</i>	1.970***	0.054	

*** $p < .001$