

Health Profession Opportunity Grants (HPOG) Impact Study's Three-Year Follow-Up Analysis Plan

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Portions of the text in this analysis plan were drawn from prior project documents, including the *HPOG Impact Study Design Report* (Peck et al. 2014) and the *HPOG Impact Study Technical Supplement to the Evaluation Design Report: Impact Analysis Plan* (Harvill, Moulton, and Peck 2015).

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Overview

In 2010, the Administration for Children and Families (ACF) within the U.S. Department of Health and Human Services awarded the first round of five-year grants for the Health Profession Opportunity Grants (HPOG 1.0) Program to 32 organizations in 23 states, including five tribal organizations. The purpose of the HPOG Program is to provide education, training, and supportive services to Temporary Assistance for Needy Families (TANF) recipients and other low-income individuals for occupations in the healthcare field that pay well and are expected to either experience labor shortages or be in high demand.

The ACF Office of Planning, Research, and Evaluation is using a multipronged research and evaluation strategy to assess the success of the HPOG Program. To assess its effectiveness, the first round of HPOG grantee programs is being evaluated using an experimental design in which program applicants were assigned at random to a “treatment” group that could access the program or to a “control” group that could not and then their outcomes compared in the short- (about 15 to 18 months after randomization), intermediate- (three years), and long-term (six years).

This report presents a detailed plan for evaluating the intermediate impact of the HPOG 1.0 grants on various outcomes. It describes the operationalization of outcome measures and provides key details of the methods to be used in the intermediate impact analysis.

Primary Research Questions

Three years out...

1. *What impacts do HPOG programs have on the outcomes of participants and their families?*
2. *To what extent do impacts vary across selected subpopulations?*
3. *To what extent do the education and employment experiences of HPOG participants over time suggest that they are following a career pathway?*

Purpose

The purpose of this report is to describe a plan for answering the research questions using three-year outcomes. By specifying these details in advance, this document serves as a public commitment to the planned analysis.

Highlights

- The report identifies two *confirmatory* outcomes, which are the main indicators of the HPOG Program's progress toward its goals after three years. The confirmatory outcomes will be (1) training completion and (2) average earnings in the 12th and 13th quarters after random assignment.
- The report also describes secondary and exploratory outcomes. *Secondary* outcomes are additional important outcomes identified in the HPOG logic model. *Exploratory* outcomes include additional outcomes of interest that may be affected by the program but are not

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identified in the logic model, or alternative specifications of the confirmatory and secondary outcomes.

- Finally, the report describes the data sources that will be used to carry out the study, including the Three-Year Survey and administrative earnings data from the National Directory of New Hires.

Methods

The impact evaluation of HPOG 1.0 uses an experimental evaluation design. It will estimate the impact of HPOG using a regression model that adjusts the difference between average outcomes for treatment versus control group members by controlling for exogenous characteristics measured at baseline. The analysis will use a three-level model to account for variation at the individual participant, administrative division (intake location), and program levels. Missing data will be accounted for with multiple imputation and nonresponse weighting.

Executive Summary

In September 2010, the U.S. Department of Health and Human Services (HHS) Administration for Children and Families (ACF) awarded a first round of Health Profession Opportunity Grants (HPOG 1.0) to 32 grantees in 23 states. The purpose of the HPOG Program is to provide education, training, and supportive services to Temporary Assistance for Needy Families (TANF) recipients and other low-income individuals for occupations in the healthcare field that pay well and are expected either to experience labor shortages or to be in high demand. Grantees include government agencies, community-based organizations, postsecondary educational institutions, and tribal-affiliated organizations.

This report presents our detailed plan for evaluating the impact of HPOG 1.0 on participant outcomes three years after enrollment in the program. It adds to several previous evaluation planning documents, including the *HPOG Impact Study Design Report* (Peck et al. 2014; hereafter referred to as the *Study Design Report*) and the analysis plan for short-term outcomes detailed in the *Technical Supplement to the Evaluation Design Report: Impact Analysis Plan* (Harvill, Moulton, and Peck 2015).

This analysis plan describes our approach to addressing the following research questions. Three years out:

1. What impacts do HPOG programs have on the outcomes of participants and their families?
2. To what extent do impacts vary across selected subpopulations?
3. To what extent do the education and employment experiences of HPOG participants over time suggest that they are following a career pathway?

In particular, this analysis plan describes the study's data sources, including a participant follow-up survey and administrative records; defines key program outcomes; and describes the methods that will be used to estimate program impacts and address missing data. Specifying these details and committing to these analysis decisions prior to estimating program impacts improves the transparency of study findings.

The HPOG Program and the HPOG 1.0 Impact Study

The HPOG objectives stem from the career pathways framework of postsecondary education, designed to address the challenge of preparing nontraditional student populations who vary in their readiness for training or employment. As articulated in the HPOG Funding Opportunity Announcement (HHS 2010), HPOG is intended to:

- Target skills and competencies demanded by the healthcare industry.
- Support “career pathways”—clearly defined routes that allow participants to build a career, rather than simply getting training for a job, by advancing through successively higher levels of education and training, exiting into employment at multiple possible points.

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- Result in employer- or industry-recognized, portable education credentials (e.g., certificates or degrees) and professional certifications and licenses (e.g., a state Medical Assistant certification).
- Combine support services with education and training to help participants overcome barriers to training and employment.
- Provide education and training at times and locations that are easily accessible to targeted populations.

The HPOG Impact Study includes 20 grantees that were not otherwise participating in a study funded by ACF's HPOG Research and Evaluation Portfolio, plus three additional grantees that were included in ACF's Pathways for Advancing Careers and Education (PACE) study. Together, these 23 grantees operated 42 distinct programs; they conducted intake at 92 locations, which we refer to as "administrative divisions." The Impact Study uses an experimental design: applicants were randomly assigned either to a treatment group that could access the HPOG program, or to a control group that could not, and then their outcomes compared in the short- (approximately 15 to 18 months after randomization), intermediate- (three years), and long-term (six years). The study consists of 13,716 participants, including 5,044 control group members and 8,672 treatment group members.

The study's *HPOG Impact Study Interim Report: Program Implementation and Short-Term Impacts* (Peck et al., 2018; hereafter referred to as the *Short-Term Impacts Report*) revealed that HPOG increased occupational training and receipt of academic, career, and other support services. These differences led to the treatment group demonstrating more favorable outcomes than the control group in terms of educational progress, employment in the healthcare sector, job quality, and earnings.

The intermediate impact analysis will report on the impact of the HPOG Program on educational attainment, earnings, and economic well-being about three years after participants enrolled in the study. By this time, they will have had sufficient time to complete their training and transition into the labor market. In turn, any labor market impacts may also have an opportunity to evolve into other well-being impacts, including on children.

Data Sources and Measures

The three-year follow-up study will use data from a variety of sources, including:

- **Baseline data** for study participants, collected at time of enrollment through the Performance Reporting System (PRS). The PRS is the administrative data system developed for HPOG 1.0 grantees.
- The **Three-Year Survey**, which was administered to participants approximately three years after random assignment. The three-year survey captures data to measure impacts on key intermediate-term program outcomes, including education and employment history; credentials earned; wages, hours worked, fringe benefits, and other indicators of job quality; school loans and other educational assistance; 21st century skills; and overall indicators of financial well-being. In addition, for participants with children, the survey captures information about parenting practices and the educational experiences of children.

- **Administrative records on quarterly earnings** from the National Directory of New Hires (NNDH). These records are based on state Unemployment Insurance (UI) wage records, as well as records for federal workers. These data will be used to define key employment and earnings outcomes.

The study distinguishes among three types of outcomes: confirmatory, secondary, and exploratory. **Confirmatory outcomes** are the main indicators of the extent to which the HPOG program is making progress toward its goals. **Secondary outcomes** are additional important outcomes identified in the HPOG logic model. **Exploratory outcomes** include (1) outcomes of interest that may be affected by the program but are not identified in the logic model; and (2) alternative specifications of confirmatory and secondary outcomes.

In this analysis plan, we identify **outcome domains**, which describe an underlying concept that one or more related outcomes measure. Two outcomes that measure the same underlying concept but in different ways are said to be in the same domain. For the three-year report, we identify confirmatory outcomes within two domains, **educational progress** and **earnings**. Both of these confirmatory outcome domains were identified in the *Study Design Report*, in consultation with ACF. These two domains reflect our continued interest in measuring educational progress as a primary outcome of interest. Educational progress also was the confirmatory outcome for the *Short-Term Impacts Report*, capturing whether the HPOG program was successful in increasing training. For the intermediate impact study, we elevate earnings as the other primary indicator of program impact, because we hypothesize that additional education will have resulted in increased earnings three years after program entry.

In the educational progress domain, we define the confirmatory outcome to be **training completion**, which includes earning an academic degree, academic or vocational certificate, or professional license during the follow-up period. We hypothesize that the academic, financial, and other supportive services provided by HPOG will have led to higher rates of training completion.

In the earnings domain, the confirmatory outcome is **average quarterly earnings in the 12th and 13th quarters after random assignment**. We hypothesize that three years after enrollment in the study, participation in HPOG will have led to greater average earnings for program participants than for those in the control group, who did not have access to HPOG.

In addition to the two confirmatory outcomes, we define a set of secondary outcomes. These outcomes reflect our preferred specifications for measuring key constructs in each of the following domains: **21st century skills, employment, job quality, career progress, public assistance benefits, and financial hardship**.

Finally, we also describe exploratory outcomes that will be considered for inclusion in the report. Exploratory outcomes are intended to capture potential effects of the HPOG program that are less central to the program model and to inform new hypotheses. As such, we include some detail on the specification of these outcomes to share our thinking with the broader research community, but we do not seek to fully operationalize all of the exploratory outcomes in this analysis plan. Instead, we will take an empirical approach to specifying and reporting outcomes of interest; if our pre-specified analyses yield results that could benefit from additional exploration, we may add exploratory outcomes.

Analytic Methods

For each of the outcomes, we will estimate Intent-to-Treat (ITT) impacts of the average effect of being offered access to the HPOG program. We will use a regression model that adjusts the difference between average outcomes for treatment and control group members by controlling for exogenous characteristics measured at baseline.

We will use a three-level model to account for variation among individuals, divisions, and programs. Because individuals in the same divisions and programs are exposed to similar contexts—training opportunities in the community, local labor market conditions—individual error terms are likely to be correlated at these levels. The multi-level structure of this model accounts for these correlations to ensure that standard errors are calculated accurately.

We plan to use a model with similar structural components for all impact analyses, though model details such as the sample used and covariates included will vary across analyses. For example, analysis of survey-based outcomes will be restricted to survey respondents and survey-based covariates, whereas earnings and employment outcomes using NDNH data will include all participants and will include NDNH-based covariates.

We expect to analyze the impacts for several selected (exogenous) subgroups defined by baseline characteristics, including school enrollment, participation expectations, educational attainment, barriers to employment, employment, public assistance benefits receipt, age, race/ethnicity, and presence of dependent children. We will test for impacts separately by subgroup and for differences in impacts between subgroups.

We anticipate encountering a variety of types of missing data. There will be individuals who do not respond to the three-year survey, or whose NDNH data are unavailable because their names and/or Social Security numbers do not match to NDNH records. We refer to these cases as **unit nonresponse**. In addition, there will be some individuals who refuse to answer some survey items or supply “Don’t know” responses, which we refer to as **item nonresponse**. We plan to address these two types of nonresponse using a combination of reweighting and imputation.

1. Introduction and Study Design

This report presents our detailed plan for evaluating the impact of the first round of the **Health Profession Opportunity Grants (HPOG 1.0)** on participant outcomes **three years** after random assignment into the program.¹ It adds to previous evaluation planning documents, including:²

- The *HPOG Impact Study Design Report* (Peck et al. 2014; hereafter referred to as the *Study Design Report*), which described evaluation plans for the HPOG Impact Study including the impact and implementation studies; and
- The *Technical Supplement to the Evaluation Design Report: Impact Analysis Plan* (Harvill, Moulton, and Peck 2015; hereafter referred to as the *Short-Term Analysis Plan*), which described the plans for the short-term impact analysis in more detail.

1.1 Overview of HPOG Program

The Health Profession Opportunity Grants (HPOG) Program provides a response both to the increasing demand for qualified healthcare professionals and to the challenges that low-skilled individuals have in securing family-supporting jobs that offer advancement opportunities. In September 2010, the Administration for Children and Families (ACF) within the U.S. Department of Health and Human Services (HHS) awarded a first round of HPOG grants to 32 grantees in 23 states. Its purpose is to provide **education, training, and supportive services to Temporary Assistance for Needy Families (TANF) recipients and other low-income individuals for occupations in the healthcare field** that pay well and are expected either to experience labor shortages or to be in high demand.³ Grantees included government agencies, community-based organizations, postsecondary educational institutions, and tribal-affiliated organizations.⁴ Twenty three of the 32 funded HPOG grantees were not otherwise engaged in ACF's HPOG evaluation research and so were included in the HPOG 1.0 Impact Study.⁵ Those 23 grantees implemented 42 local HPOG programs.

¹ Unless otherwise noted, we use the term "HPOG" to refer to the collection of grantee programs funded by the first round of HPOG grants and that participated in the Impact Study.

² The *HPOG Impact Study Design Report* (Peck et al. 2014) is available at https://www.acf.hhs.gov/sites/default/files/opre/hpog_impact_design_report_11_14_14_r2_0.pdf. The *HPOG Impact Study Technical Supplement to the Evaluation Design Report: Impact Analysis Plan* (Harvill, Moulton, and Peck 2015) is available at:

https://www.acf.hhs.gov/sites/default/files/opre/hpog_impact_analysis_plan_finalamendment_reference_b508_ver4.pdf.

³ The HPOG Program was authorized by the Affordable Care Act (ACA), Public Law 111-148, 124 Stat. 119, March 23, 2010, sect. 5507(a), "Demonstration Projects to Provide Low-Income Individuals with Opportunities for Education, Training, and Career Advancement to Address Health Professions Workforce Needs," adding sect. 2008(a) to the Social Security Act, 42 U.S.C. 1397g(a), and extended by the Bipartisan Budget Act of 2018, Pub. L. 115-123, through fiscal year 2019.

⁴ Five HPOG 1.0 grants were awarded to tribal organizations, and a separate study described their implementation and outcomes (Meit et al. 2014).

⁵ All of the HPOG 1.0 grantees were part of some evaluation research, whether through an ACF-sponsored university partnership research study, tribal evaluation, or the HPOG Impact Study.

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The HPOG objectives stem from the **career pathways framework** of postsecondary education, designed to address the challenge of preparing nontraditional student populations who vary in their readiness for training or employment. As articulated in the HPOG Funding Opportunity Announcement (HHS 2010), HPOG is intended to:

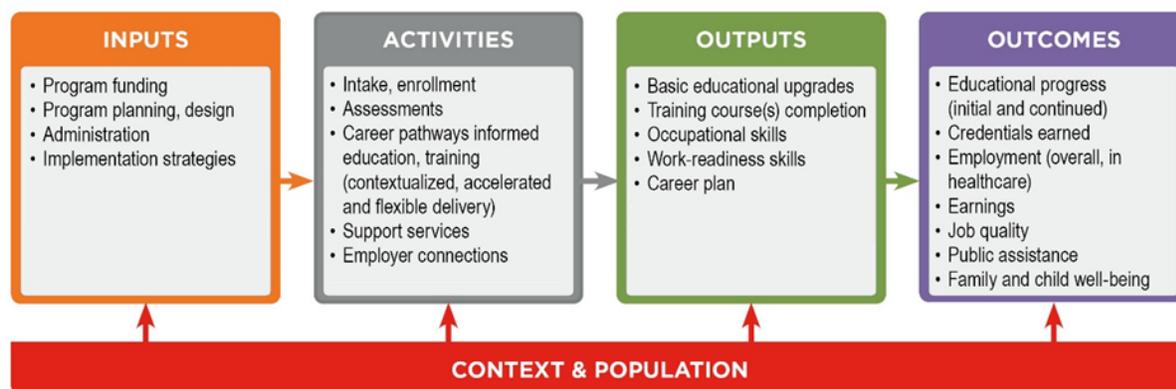
- Target skills and competencies demanded by the healthcare industry.
- Support “career pathways”—clearly defined routes that allow participants to build a career, rather than simply getting training for a job, by advancing through successively higher levels of education and training, exiting into employment at multiple possible points.
- Result in employer- or industry-recognized, portable education credentials (e.g., certificates or degrees) and professional certifications and licenses (e.g., a state Medical Assistant certification).
- Combine support services with education and training to help participants overcome barriers to training and employment.
- Provide training at times and locations that are easily accessible to targeted populations.

The demonstration projects are intended to address two pervasive problems: the increasing shortfall in the supply of qualified healthcare professionals in the face of expanding demand, and the increasing requirement for a postsecondary education to secure a job with a living wage for families.

1.1.1 Logic Model and Program Design

The *HPOG 1.0 Impact Study Interim Report: Program Implementation and Short-Term Impacts* (Peck et al. 2018; hereafter referred to as the *Short-Term Impacts Report*) displays the full career pathways logic model and discusses its causal links in the career pathways framework in detail. In Exhibit 1.1 below we present a streamlined version as implemented in HPOG (and used to conceptualize the HPOG evaluation).

Exhibit 1.1: HPOG Career Pathways Framework Logic Model (Streamlined)



In brief, the career pathways logic model suggests how program inputs and activities are associated with anticipated education, training, and labor market outcomes. We describe these outcomes in detail in Section 2.2, including the measures we will use to capture impacts. We hypothesize that after three years, program activities and outputs will lead to increased

educational progress, higher rates of employment, and increased earnings. In turn, these educational and workforce outcomes are hypothesized to produce improvements in family and child well-being.

Impacts on children might arise in multiple ways. Additional resources in the household may translate to improvements in child well-being. Children's outcomes might improve from their having role models in their parents' education/training and work. And if parents' work means that they are less present to their children during afterschool hours, then children's well-being might decline. All three of these hypotheses—resources, role models, presence—have been observed in prior research. It will be important to examine them in the HPOG context at the three-year time point, by when we might expect these impacts to arise, if they exist (Duncan, Morris, and Rodrigues 2011; Gennetian et al. 2002; Morris, Gennetian, and Duncan 2005).

The logic model also recognizes that certain factors—including local context and population characteristics—are beyond the control of program designers and operators. For instance, local labor market conditions likely contribute to employment outcomes, and population characteristics likely influence the training programs and services provided.

1.2 Overview of the HPOG Impact Study

The ACF Office of Planning, Research, and Evaluation (OPRE) is using a multipronged research and evaluation strategy to assess the success of the HPOG Program (see the textbox “**The HPOG Research and Evaluation Portfolio**” on page 9 for an overview).

The HPOG Impact Study, which uses an experimental design to evaluate the impacts of the HPOG Program compared to other services available in the community, is situated within this portfolio. This document is the analysis plan for the HPOG three-year follow-up study. This research involves collecting and analyzing data related to HPOG's impacts about three years after random assignment. This section summarizes the HPOG Impact Study, including the grantee programs included in the study, random assignment and study periods, and findings from the *Short-Term Impacts Report*.

1.2.1 Grantees and Programs in the Impact Study

The 23 grantees included in the HPOG Impact Study are as follows:

- **HPOG-only grantees**—20 of the 32 HPOG grantees funded beginning September 29, 2010, that were not otherwise already participating in a study funded under ACF's HPOG Research and Evaluation Portfolio.

- **HPOG/PACE grantees**—three additional HPOG grantees, also selected for ACF's Pathways for Advancing Careers and Education (PACE) study. The PACE study is conducting separate evaluations of these and six other career pathways programs.⁶

Together, these 23 grantees operated 42 distinct programs; they conducted participant intake at 92 locations, which we refer to as “administrative divisions” (see the textbox “**HPOG Organizational Glossary**” on page 10).

The research team developed an evaluation design and implementation plan with each of the 23 participating HPOG grantees, documenting the intervention and specifying procedures for random assignment. Many grantees operated a single program, whereas others operated multiple programs. At grantees with multiple programs, each program generally included a distinct model, process, or target population that warranted its own evaluation design and implementation plan. For example, the Will County (IL) Workforce Investment Board operated five distinct programs at local community colleges and nonprofit organizations. One program was designed to serve a Latino population; others were designed for potential community college students.

In the *Short-Term Impacts Report*, all 42 of the HPOG programs were analyzed as a group to draw overall conclusions about the impact of the HPOG Program.

1.2.2 Random Assignment and Study Periods

The HPOG Impact Study uses an experimental evaluation design. Eligible applicants were randomly assigned to either a treatment group that was offered access to the HPOG program or to a control group that was not offered such access but could use other programs and services available in the community. Random assignment of participants into the study began between March and September 2013. As of that time, the programs had been operating for about 2½ years. The random assignment of study participants ended in all programs in November 2014.

As shown in Exhibit 1.2 below, the 23 programs randomized 13,802 participants. In the 20 HPOG-only grantees, for every two persons randomized into the treatment group, one person was randomized into the control group (a ratio of 2:1). This randomization ratio reduced the need for programs to over-recruit and facilitated programs' cooperation with the evaluation while also offering sufficient power to detect plausible impacts. In the three HPOG/PACE grantees, the ratio was 1:1 in order to have sufficient power to detect plausible impacts separately for each program. Over the course of the study, some members of the sample were removed from the study.⁷

⁶ The PACE study collected data on those three HPOG grantees and from participants in their programs, evaluating the programs individually. These grantees were Pima Community College (AZ), San Diego Workforce Partnership (CA), and the Workforce Development Council of Seattle–King County (WA). The PACE study also evaluated the Carreras en Salud program at Instituto del Progreso Latino (IL), which implemented one of the Workforce Investment Board of Will County's five HPOG programs. The participants in the PACE study's evaluation of the Carreras en Salud program are also included in the HPOG Impact Study.

⁷ Eighty-six participants were removed from the study sample after random assignment: 27 treatment and 59 control group members. For the *Short-Term Impacts Report*, the sample was 13,717 participants: 8,673 treatment group members and 5,044 control group members. Since publication of the *Short-Term Impacts Report*, an additional participant has withdrawn from the study.

The HPOG Research and Evaluation Portfolio

ACF's Office of Planning, Research, and Evaluation (OPRE) is using a multipronged research and evaluation strategy to assess the implementation, outcomes, and impacts of two rounds of HPOG grants.

HPOG First Round (HPOG 1.0)

HPOG Implementation and Outcomes Research. For the first round of HPOG funding, awarded in 2010, a research team conducted implementation and outcomes research for the 27 non-tribal grants to explore how the programs were being implemented across grantees, what individual-level outcomes and outputs occurred, and how HPOG influenced service delivery systems. Data sources included surveys of grant directors and staff and administrative data on participant characteristics and training and service participation.

- A January 2018 final report on the implementation research is available at: <https://www.acf.hhs.gov/opre/resource/final-report-national-implementation-evaluation-of-the-first-round-health-profession-opportunity-grants-hpog-10>
- A separate study similarly described implementation and outcomes of the HPOG programs of five tribal grantees: <https://www.acf.hhs.gov/opre/resource/tribal-health-profession-opportunity-grants-hpog-program-evaluation-final-report>

HPOG Impact Study. For 23 of the 27 first-round non-tribal grants, the research team is conducting an experimental study—the HPOG Impact Study—to assess the HPOG Program impacts. For the HPOG Impact Study, beginning about 2½ years after the grants were awarded, eligible applicants to these programs were assigned at random to a “treatment” group that could access the program or a “control” group that could not.

Short-term impacts. In the *HPOG 1.0 Impact Study Interim Report: Program Implementation and Short-Term Impacts*, the Impact Study assessed short-term outcomes for the treatment and control groups based on surveys initiated about 15 months after random assignment and on administrative data on employment and earnings. It also drew on the implementation research results for the 23 grantees and site visits conducted specifically for the Impact Study.

- The May 2018 HPOG 1.0 *Short-Term Impacts Report* is available at: <https://www.acf.hhs.gov/opre/resource/health-profession-opportunity-grants-hpog-10-impact-study-interim-report-implementation-short-term-impacts>
- Three of the 23 HPOG 1.0 grantees are also participating in another OPRE-sponsored evaluation of career pathways programs called **Pathways for Advancing Careers and Education (PACE)**. Reports on the implementation and early impacts of nine PACE programs can be found at <https://www.acf.hhs.gov/opre/research/project/pathways-for-advancing-careers-and-education>

Longer-term impacts. OPRE is also funding follow-up to continue tracking outcomes for both HPOG 1.0 and PACE, in two longer-term studies looking at impacts at:

- Approximately three years after random assignment: as part of the *Career Pathways Intermediate Outcomes (CPIO) Study*, for which this document is the Analysis Plan.
- Approximately six years after random assignment: as part of the *Career Pathways Long-term Outcomes (CPLO) Study*.

HPOG Second Round (HPOG 2.0)

OPRE is sponsoring implementation and impact evaluations of a second round of HPOG grants, awarded in 2015 to 27 non-tribal grantees in 16 states. The second-round evaluation will also use survey and administrative data to assess short- and longer-term outcomes for new applicants to the second-round programs. An additional five grants were awarded to tribal organizations; implementation and outcomes studies are being conducted for the five tribal HPOG 2.0 grantees.

For More Information on All of These ACF Research Activities

OPRE's Research and Evaluation portfolio page: <https://www.acf.hhs.gov/opre/research/project/evaluation-portfolio-for-the-health-profession-opportunity-grants-hpog>.

Career Pathways website: <http://www.career-pathways.org/acf-sponsored-studies/hpog/>

HPOG Organizational Glossary

- **HPOG Program**—a term used to refer to the national Health Profession Opportunity Grants initiative, including all grantees, programs, and administrative divisions.
- **HPOG grantee**—an entity receiving HPOG funding and is responsible for funding and overseeing one or more local programs. **Grantee-level data** denotes information collected about the 23 individual HPOG grantees that are part of the Impact Study.
 - **HPOG-only grantees**—20 of the 32 HPOG grantees that were not otherwise participating in a study funded under ACF’s HPOG Research and Evaluation Portfolio.
 - **HPOG/PACE grantees**—three of the 32 grantees that were also evaluated as part of ACF’s PACE study.
- **HPOG program**—a unique set of services, training courses, and personnel. Many grantees fund and operate one program; some fund multiple programs. **Program-level data** denotes information collected about the 42 individual HPOG programs that are part of the Impact Study.
- **HPOG administrative division**—program intake location(s) with a dedicated case management and/or counseling staff that advises participants, connects them to education and training, and provides participants with support services or refers them to these services; a program may have one or more such divisions. **Division-level data** denotes information collected about the 92 individual administrative divisions that are part of the Impact Study.

To evaluate the relative impact of certain program components in the short term, the HPOG Impact Study randomized in a three-armed design—control group, standard HPOG treatment group, “enhanced” HPOG treatment group.⁸ We do not use the three-arm design for the proposed three-year follow-up analysis. Instead, we consider any Impact Study participant randomized to a treatment group (be it the standard or the enhanced) as part of the follow-up study’s “treatment group,” which, as noted, reflects the heterogeneity of program components across all grantees and programs in the Impact Study.

Exhibit 1.2: HPOG Impact Study Sample Sizes by Experimental Group

Group	Total Sample	Treatment Group	Control Group
Grantees	23	23	23
Programs	42	42	42
Administrative divisions	92	92	92
Individuals randomly assigned	13,802	8,699	5,103
Study sample, as of September 2018	13,716	8,672	5,044

Source: HPOG Performance Reporting System.

1.2.3 Summary of Short-Term Impact Findings

The *Short-Term Impacts Report* describes the impacts of HPOG as of about five quarters into the study period. We found a statistically significant, favorable impact on educational progress:

⁸ In 19 of the 42 programs, a third treatment group had access to one of three enhancements of the HPOG program—emergency assistance, non-cash incentives, or facilitated peer support.

a greater proportion of those randomly assigned to the treatment group had completed or were still enrolled in occupational training than would have done so without HPOG (as indicated by the experimental control group). There were also favorable impacts on a variety of secondary outcomes, including share of employment in healthcare occupations (though no change in total employment), job quality, and average earnings in the fifth quarter after random assignment.

The *Short-Term Impacts Report* also explored the impacts of being assigned to the enhanced HPOG group relative to the standard HPOG group. It found, however, that the enhancements did not improve impacts on key outcomes above and beyond the standard HPOG program. This finding likely stems from the modest contrast between the standard and enhanced treatment groups in the experience of the enhancement component. The lack of favorable impacts in the short-term coupled with the modest contrast imply that later impacts of the enhancements are unlikely. As a consequence, this analysis pools all participants randomized to a treatment group.

1.3 Plan for Three-Year Impact Study

The three-year impact analysis will report on the impact of the HPOG Program on educational attainment, earnings, and economic well-being about three years after individuals enrolled in the study. By this time, study participants will have had sufficient time to complete their training and transition to the labor market. In turn, any labor market impacts may also have an opportunity to evolve into other well-being impacts, including on children.

1.3.1 Research Questions

This analysis plan describes our approach to addressing the following impact evaluation questions. Three years out:

1. *What impacts do HPOG programs have on the outcomes of participants and their families?*
2. *To what extent do impacts vary across selected subpopulations?*
3. *To what extent do the education and employment experiences of HPOG participants over time suggest that they are following a career pathway?*

To answer the first two research questions, we will define a set of outcomes (discussed in Chapter 2) and then estimate the effect on these outcomes of being randomly assigned to the HPOG program (discussed in Chapter 3).

To answer the third research question, we will examine the patterns of education and employment in the three years after enrollment into the HPOG program (Chapter 4). We will explore whether participants are following “career pathways,” or the extent to which they experience progressively more education and higher-level credentials leading to better-paying jobs and higher earnings. To assess HPOG’s impact on these outcomes, this analysis will also estimate the impact on measures of career progress (Section 2.2.1).

To supplement these research questions, the research team may conduct additional exploratory analyses of participant outcomes. For instance, we may study the effect of program moderators, to assess whether certain types of program characteristics influence average impacts. We do not specify these potential analyses in detail in this analysis plan; instead, we will specify and

then conduct them if our pre-specified analyses yield results that could benefit from additional exploration.

1.3.2 Outline of This Analysis Plan

This analysis plan provides key details for the operationalization and implementation of the measures and analyses introduced in the *Study Design Report* for the particular purpose of studying the effects of the HPOG program after three years.

The document proceeds as follows:

- **Chapter 2** details the study's data sources and the baseline and three-year outcomes measures they provide.
- **Chapter 3** explains our approach to hypothesis testing regarding HPOG's impact on participants, and then elaborates on the methods to be used in the main impact analyses; it also includes plans for handling missing data.
- **Chapter 4** describes the planned approach to other analyses, including descriptive analyses of career pathways and a time trend analysis of employment and earnings.
- **Chapter 5** lists project activities for the three-year analysis and their timeline.
- **Appendix A** contains operationalization details for all exploratory outcomes.

2. Data and Measures

This section describes the main sources of data and defines measures to be used in the analysis, including participant outcomes, subgroups, and baseline covariates.

2.1 Data Sources

The three-year follow-up study will use data from a variety of sources, including baseline data from the HPOG Performance Reporting System (PRS); a Three-Year Survey; and the National Directory of New Hires (NDNH). A summary of each data source is given below; more details are available in the *Study Design Report*.

2.1.1 Baseline Data

Baseline data about study participants, including both treatment and control group members, were collected through the PRS. The PRS is the administrative data system that was developed for the HPOG Program to serve two main purposes. Grantees used the system as a management information system to document program activities and accomplishments of individual program participants and to track program results in the aggregate against program goals, assisting with program and grant management. The research team also used data from the system for research purposes. For the grantees participating in the HPOG Impact Study, a supplemental **baseline survey** was added to the PRS to capture data about individual participants' self-efficacy and their education and employment aspirations and expectations.

We will include various baseline data elements in the analysis, including demographic and socioeconomic data, educational attainment, and barriers to employment. Including these items will allow us to adjust for three-year survey nonresponse; to increase the precision of estimates regarding the impact of program components; and to identify subgroups for subgroup impact analysis at follow-up.

2.1.2 Three-Year Study Participant Follow-Up Survey

Abt began administering a follow-up survey of study participants approximately three years after their random assignment. The interviewing period for participants at HPOG grantees began in 2016 and ended in May 2018. The overall response rate was 73 percent, with 75 percent of those in the treatment group and 71 percent of those in the control group responding to the survey.⁹ Response times ranged from 34 to 49 months after random assignment, with a median response time of 39 months.

The **three-year survey** captures data to measure impacts on key intermediate-term program outcomes. As summarized in Exhibit 2.1, the survey captures information on participants' education and employment history; credentials earned; wages, hours worked, fringe benefits, and other indicators of job quality; school loans and other educational assistance; 21st century skills; and overall indicators of financial well-being. In addition, for participants with children, the

⁹ Because recall error is likely to increase with longer recall periods (Biemer et al. 1991), in order to consider the possible biasing influence of differential response times, we examined the possibility that the treatment and control groups' average response times differed. They did not.

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survey captures information about parenting practices and the educational experiences of children.

The three-year survey instrument overlaps with the HPOG study participant short-term follow-up survey used for the *Short-Term Impacts Report* to a considerable degree, with improved measures in several key areas. One of the new modules collects an integrated history of all education and employment, from the date of the participant’s randomization into the study through the date of the survey interview.¹⁰ This instrument allows for the study of the various patterns of education, training, and employment to support our exploratory analysis of career trajectories.

The three-year survey also has a major new module on child development and well-being. The child module asks a few questions about children of all ages, but most of the questions are asked about one “focal” child within limited school grade ranges: preschool, primary school (grades K-5), and secondary school (grades 6-12). Grade range is determined as of the time of completing the three-year survey. In order to keep the length of each interview reasonable, we ask questions about only one focal child per household. This focal child was pre-selected based on household rosters and child custody status collected at baseline or short-term (15 to 18 month) follow-up, so children recently added to the household (born, adopted, foster, or custody switched) were not included. There were 5,966 focal children selected for the three-year survey: 1,545 preschool, 2,370 in grades K-5, and 2,051 in grades 6-12. A total of 4,669 survey respondents (78.3 percent) were parents of these focal children. Of these, 589 respondents were deemed ineligible for the child development and well-being module (most commonly because the child did not live with the respondent at least half time or the parent reported that the child was enrolled in college); therefore, the survey collected data on 4,080 total children.

Exhibit 2.1: Summary of Three-Year Survey Instrument Content and Uses

Instrument Section	Content	Planned Uses
Education and Employment History (Sections C, E)	<ul style="list-style-type: none"> Dates of every school and job spell since randomization Reasons for no school/job during gaps Careful probing for simultaneous study and work, as well as holding multiple jobs 	<ul style="list-style-type: none"> Identify all job and education spells Measure total months of education Allow classification of school type (four-year, two-year, less than two-year) and control (public, private not-for-profit, private for-profit) by matching school names to the Integrated Postsecondary Education Data System
School Experiences (Section D)	For each school spell: <ul style="list-style-type: none"> Length of break periods Credits earned Full/part-time student status 	<ul style="list-style-type: none"> Measure total hours of education Measure total credits earned and program completion as signs of progress toward credentialing

¹⁰ The integrated history collects detailed information for all education and employment experiences since random assignment. This module is based on a German national survey’s model (conducted by the Federal Institute for Vocational Education and Training: <https://www.bibb.de/de/8904.php>).

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Instrument Section	Content	Planned Uses
Job Experiences (Section F)	For each job spell: <ul style="list-style-type: none"> Starting hourly wage Starting typical hours per week Current/final hourly wage Current/final typical hours per week 	<ul style="list-style-type: none"> Identify raises within jobs and across jobs as measures of career progress Allow for study of effect of work during school on school progress
Terms of Employment and Conditions at Current/Last Job (Section G)	<ul style="list-style-type: none"> Occupation Scheduling Benefits Alignment with education Support from co-workers and supervisors Formal on-the-job training Perceived opportunities for advancement 	<ul style="list-style-type: none"> Measure job quality
Credential Attainment and Education/Career Goals (Section I)	<ul style="list-style-type: none"> Academic credentials School-issued vocational credentials Licenses and certifications from other authorities Education aspirations Self-assessed career progress 	<ul style="list-style-type: none"> Identify credential receipt, which is the confirmatory measure of educational progress Measure educational goals and self-assessed progress toward education and career goals
Services and Assistance (Section J)	<ul style="list-style-type: none"> Funding mechanism for education Support provided by community organizations (for San Diego Workforce Partnership and Instituto del Progreso Latino only)^a 	<ul style="list-style-type: none"> Identify sources of funds for education
21st Century Skills (Section K)	<ul style="list-style-type: none"> Grit Academic self-confidence Core self-evaluation Access to career network Social support Confidence in career knowledge Life challenges English fluency 	<ul style="list-style-type: none"> Measure self-assessed psycho-social skills Measure support network and challenges faced
Household Composition (Section L)	<ul style="list-style-type: none"> Living arrangements Counts of adults and children Family formation Childbearing 	<ul style="list-style-type: none"> Measure household composition and childbearing

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Instrument Section	Content	Planned Uses
Income and Material Well-Being (Section M)	<ul style="list-style-type: none"> Personal and household participation in government means-tested programs Receipt of Unemployment Insurance Personal and household income Earned Income Tax Credit participation Personal and parental school debt Other unsecured debt Financial hardship Health Insurance Satisfaction with housing 	<ul style="list-style-type: none"> Measure personal and household income and sources Measure financial hardship and well-being
Child Development and Well-Being (Sections N, O, P, Q)	<ul style="list-style-type: none"> Age-specific questions about child educational progress, child leisure activities, and parenting practices 	<ul style="list-style-type: none"> Measure parenting practices and child educational progress

^aThe survey asked respondents to report whether they received support from community organizations only if they were enrolled at PACE sites where either the grantee or participant navigators were community organizations. Among the dual HPOG/PACE grantees, this includes San Diego Workforce Partnership and Instituto del Progreso Latino.

2.1.3 National Directory of New Hires (NDNH)

One of the key sources of information for intermediate outcomes will be data from the National Directory of New Hires. These data provide information on participants’ employment and earnings. The NDNH is maintained by the federal Office of Child Support Enforcement (OCSE), and it includes quarterly earnings from state Unemployment Insurance (UI) records, including data from some employers not included in the UI program (e.g., the federal government).

NDNH data are not publicly available, but OCSE permits limited access to de-identified data for research purposes in some federal- or state-sponsored studies. Through arrangements between OCSE and OPRE, this study has access to wage files containing quarterly employment and earnings data for study participants from 2011 (up to two years prior to random assignment) through the end of the evaluation period. A “pass-through” file, when matched to these OCSE data, creates a dataset containing wages, baseline, and three-year survey data for all sample members. To protect confidentiality, OCSE will remove direct identifiers from both the wage file and our pass-through file, replacing the identifiers with a non-personally identifiable key. After we receive the files from OCSE, we will use these keys to link the wage data with the pass-through data without using any personally identifiable information.

The resulting dataset will be a series of quarterly measures for each HPOG participant, including whether the participant was employed during the quarter, the number of employers in the quarter, and earnings from each employer in the quarter. This merging allows us to better estimate the effects of the HPOG programs on earnings (because of richer baseline information).

An advantage of NDNH data is their accuracy and coverage of most employers and jobs. Relative to self-reports by individuals or program staff, these administrative data come directly from mandatory employer reports as part of the UI system, and so have a high degree of accuracy and coverage and are provided in a consistent format. The NDNH also includes data for workers at federal agencies. A disadvantage is that the data do not cover earnings from private-sector jobs that are not subject to UI—including self-employment (e.g., work as an

independent contractor); work at small farms, railroads, and selected nonprofit organizations (particularly churches); and casual or irregular jobs. Together, these exclusions cover about 12 percent of the civilian workforce.¹¹ Further, the NDNH only contains quarterly earnings; it does not include details on hourly wages, hours worked, or employer benefits. Earnings data from NDNH will be used to measure HPOG's impact on quarterly earnings, which is one of two confirmatory outcomes in the three-year study (the confirmatory outcomes are described in the next section).

2.2 Measures

This section describes the outcome measures that will be used to estimate the impacts of HPOG. It also details baseline covariates and the subgroups that will be used to define subpopulations of interest.

2.2.1 Outcome Measures

This section distinguishes among three types of outcomes: confirmatory, secondary, and exploratory. The **confirmatory outcomes** are the main indicators of the extent to which the program is making progress toward its goals. **Secondary outcomes** are additional important outcomes identified in the HPOG logic model. **Exploratory outcomes** are of two types: (1) outcomes of interest that may be affected by the program but are not identified in the logic model; and (2) alternative specifications of confirmatory and secondary outcomes.

In this analysis plan, we also identify outcome domains. An **outcome domain** describes an underlying concept measured by one or more related outcomes of interest. Two outcomes that measure the same underlying concept but in different ways are said to be in the same domain. We define domains to separate distinct sets of outcomes, so that the elevated probability of false positives when testing multiple outcomes for impact can be addressed within domains, not across domains.

We seek to identify a single confirmatory measure in each of a small number of domains. This is because with each additional test performed, the probability of finding at least one false positive impact increases. Instead of adjusting for multiple tests of impact, we restrict the consideration of outcomes to only two confirmatory measures, each in its own domain. By limiting the number of tests in the confirmatory set, we protect against an unintentionally high likelihood of mistakenly concluding that the program is making progress toward its core goals.

Confirmatory Outcome Measures

For the three-year analysis, we identify confirmatory outcomes within two domains, **educational progress** and **earnings**. Both of these confirmatory outcome domains were identified in the *Study Design Report*, in consultation with ACF. Educational progress was also the confirmatory outcome for the *Short-Term Impacts Report* because the measure captures whether the HPOG

¹¹ According to the Bureau of Labor Statistics, about 10 percent of workers are self-employed (Hipple and Hammond 2017). After excluding the self-employed, another 3 percent of workers are not covered by UI (Manning and Stewart 2017). Given that there are about 1.9 million federal civilian employees (about 1.3 percent of total U.S. civilian employment) who are covered by the non-UI data in NDNH, this implies that the NDNH is missing about 12 percent of U.S. civilian workers: the 10 percent who are self-employed and the 1.7 percent or so of other uncovered civilian employees.

program was increasing training, the first step in the HPOG logic model. Evidence of educational progress in the short-term would imply HPOG was on track to meet its eventual goal of improving employment and earnings. We elevate earnings as the other primary indicator of program impact because we hypothesize that additional education will have resulted in increased earnings three years after program entry.¹² A single specific outcome in each of these domains was identified in the *Short-Term Analysis Plan*; together, they represent the two main indicators of HPOG's achievement of its main goals at the three-year follow-up point. In that earlier analysis plan, we publicly identified these confirmatory measures for the three-year follow-up; that is, prior to analyzing impacts on any outcomes, even short-term outcomes.

In the educational progress domain, we define the confirmatory outcome to be **training completion**, which measures whether the participant earned an academic degree, academic or vocational certificate, or professional license between the time of their random assignment and the three-year survey. We plan to include respondent-reports of completed training from both the short-term and three-year surveys in the three-year measure of educational progress that we use for our confirmatory analysis. That is, rather than relying only on the three-year survey data, we include both the short-term and three-year data on whether study participants report completing training or earning a credential. Doing so ensures we capture all self-reported training completion.

Building on the findings of the *Short-Term Impacts Report*, we hypothesize that the academic, financial, and other supportive services provided by HPOG will have led to higher rates of training completion as of the three-year time point, and that educational progress would have had time to translate into impacts on employment and earnings. In the earnings domain, therefore, the confirmatory outcome is **average quarterly earnings in the 12th and 13th quarters after random assignment**.¹³ We chose earnings as a confirmatory outcome because it captures changes to employment, wages, and hours worked. The HPOG logic model predicts that changes in the labor market could occur in any of these domains, and earnings is an appropriate summary measure of labor market improvements. We hypothesize that three years after enrollment in the study, those with access to HPOG will have greater average earnings than those in the control group, who did not have access to HPOG. Exhibit 2.2 defines the confirmatory outcomes.

¹² An analysis protocol with just a single confirmatory outcome at 36 months would have a statistically greater chance of establishing that the HPOG program succeeded by that benchmark. However, given HPOG's design and objectives, intermediate success can be demonstrated through impacts on either education or earnings. A career pathways intervention that raises educational attainment should be considered a success whether it increases participant earnings during the observation period or not: added pathways have been opened by that education that with time could materialize into better jobs and earnings. Similarly, raising earnings during the observation window makes HPOG a success whether this is achieved in conjunction with added educational attainment or not. Both of these indicators—educational progress and earnings—need to be checked for confirmatory evidence of program success after three years.

¹³ The continuous nature of earnings makes this outcome more desirable than other possible outcomes, such as employment. We average the 12th and 13th quarters to reduce variability due to seasonal factors and other sources of short-term fluctuations in earnings and employment; this results in a more precise estimate than analyzing the 12th quarter alone.

Exhibit 2.2: Confirmatory Outcomes at Three-Year Follow-Up

Domain	Variable Description	Data Source(s)
Educational progress	Training completion	Three-Year Survey
Earnings	Average quarterly earnings during the 12th and 13th quarter after random assignment	NDNH

Secondary Outcome Measures

This section describes the secondary outcomes to be included in the three-year report. These outcomes reflect our preferred specifications for measuring key constructs in each of the following domains: **21st century skills, employment, job quality, career progress, public assistance benefits, and financial hardship**. Exhibit 2.3 lists the secondary outcomes that will be included in the three-year report.

Exhibit 2.3: Secondary Outcomes at Three-Year Follow-Up

Domain	Variable Description	Data Source(s)
21st century skills	Confidence in career knowledge	Three-Year Survey
Employment	Employment in 12th or 13th quarter after random assignment	NDNH
Employment	Current or most recent job is in healthcare	Three-Year Survey
Job quality	Current or most recent job offers health insurance	Three-Year Survey
Career progress	Educational progress and earnings growth	Three-Year Survey
Public assistance benefits	Individual receipt of any of the following benefits during the prior month: <ul style="list-style-type: none"> • Temporary Assistance for Needy Families (TANF) • Supplemental Nutrition Assistance Program (SNAP) • Medicaid 	Three-Year Survey
Financial hardship	Participant reports not having enough money to make ends meet	Three-Year Survey

As with the confirmatory outcomes, we have designated secondary outcomes according to hypotheses that are explicitly tied to the HPOG logic model. Many of these secondary outcomes are identical to those that appeared in the *Short-Term Impacts Report*, which were:

- Employment (in the fifth quarter after random assignment)
- Current or most recent job is in healthcare
- Current or most recent job offers health insurance
- Earnings (in the fifth quarter after random assignment)
- Individual receipt of TANF

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Where feasible we have intentionally kept the secondary outcomes comparably measured to the *Short-Term Impacts Report* to allow for comparison across follow-up periods. In addition to updating the time periods to reflect the three-year follow-up window, we also have updated one secondary outcome as follows:

- **Public assistance benefits** is measured as receipt of one or more of TANF, SNAP, or Medicaid as of the follow-up survey. The measure encompasses a broader set of assistance programs, which we think is warranted because TANF use is time-limited.¹⁴

We have also added the following secondary outcomes for the three-year analysis:

- *Confidence in career knowledge* is a measure in the **21st century skills** domain that reflects the added psycho-social benefit that is predicted to materialize in the longer-term as participants make educational progress and embark on a career in their chosen field;
- *Educational progress and earnings growth* is a measure in the **career progress** domain that reflects the extent to which participants experienced growth in both confirmatory outcome domains, which would be consistent with goals of the career pathways framework; and
- *Not having enough money to make ends meet* is a measure in the **financial hardship** domain that the HPOG logic model predicts as a longer-term individual outcome and is tied to employment and earnings.

We consider our specifications of these outcomes to be a public commitment to planned analyses. As such, the HPOG Impact Study’s Three-Year Follow-Up Analysis Plan has been registered with the Open Science Framework at <https://osf.io/s8gjq/>. Both the confirmatory and secondary outcomes are fully operationalized in Exhibit 2.4.

Exhibit 2.4: Operationalization of Confirmatory and Secondary Outcomes at Three-Year Follow-Up

Domain	Variable Description	Operationalization/Details	Outcome Designation	Data Source(s)
Educational progress	Training completion	Binary variable with value 1 if one or more of the following are true in either the short-term or three-year survey: <ul style="list-style-type: none"> • Completed a degree (associate’s or higher) since randomization • Completed a professional, state, or industry certificate, license, or credential since randomization • Completed a diploma or certificate for completing regular college classes since randomization • Received a diploma or certificate from a school for completing vocational training since randomization 	Confirmatory	Short-Term Survey: Q25a, Q25b Three-Year Survey: I2, I3, I3d, I3e

¹⁴ We maintain individual receipt of TANF as an exploratory outcome.

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Domain	Variable Description	Operationalization/Details	Outcome Designation	Data Source(s)
		Value 0 if each of the previous items is false Missing otherwise <i>Note:</i> The names of reported credentials will be manually examined, and only those that reflect completion of training will be considered for this outcome ^a		
Earnings	Average quarterly earnings during the 12th and 13th quarter after random assignment	Continuous variable measuring average earnings in the 12th and 13th quarters after the quarter containing random assignment Value 0 if no earnings during either quarter Missing otherwise	Confirmatory	NDNH
21st century skills	Confidence in career knowledge	Seven-item scale measuring confidence in career knowledge. Calculated as the average across items, scale ranges from 1 to 4	Secondary	Three-Year Survey: K6
Employment	Employment in the 12th or 13th quarter after random assignment	Binary variable with value 1 if employed during either the 12th or 13th quarter after the quarter containing random assignment Value 0 if not employed during either quarter Missing otherwise	Secondary	NDNH
Employment	Current or most recent job is in healthcare	Binary variable with value 1 if current or most recent job is in healthcare Value 0 if not currently employed and most recent job was not in healthcare, or currently employed in non-healthcare job Missing otherwise	Secondary	Three-Year Survey: G2, G5
Job quality	Current or most recent job offers health insurance	Binary variable with value 1 if one or more of the following is true: <ul style="list-style-type: none"> Currently employed in a job that offers health insurance Currently not employed, but most recent job offered health insurance 0 if both conditions are false	Secondary	Three-Year Survey: G8a
Career progress	Educational progress and earnings growth	Binary variable with value 1 if the participant met the following conditions: <ul style="list-style-type: none"> Experienced positive earnings growth of at least 0.55% per quarter (on average) between the 5th quarter after randomization and 13th quarter after randomization^b Training completion (as defined in the confirmatory outcome) Value 0 if both conditions are not true Missing otherwise <i>Note:</i> The average quarterly earnings gain is calculated as the slope of the best-fit line between quarterly earnings and the relevant quarters since random assignment	Secondary	NDNH and Three-Year Survey: I2, I3, I3d, I3e

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Domain	Variable Description	Operationalization/Details	Outcome Designation	Data Source(s)
Public assistance benefits	Individual receipt of TANF, SNAP, or Medicaid	Binary variable with value 1 if the participant individually received any of the following benefits during the prior month: <ul style="list-style-type: none"> • Temporary Assistance for Needy Families (TANF) • Supplemental Nutrition Assistance Program (SNAP) • Medicaid 	Secondary	Three-Year Survey: M1
Financial hardship	Participant reports not having enough money to make ends meet	Binary variable with value 1 if, generally over the past 12 months, the participant reports typically having not enough to make ends meet. Value 0 if one or more of the following are true: <ul style="list-style-type: none"> • More than enough money left over • Some money left over • Just enough to make ends meet Missing otherwise	Secondary	Three-Year Survey: M11

^a A small number of respondents reported a credential but did not report the credential name. We treat these cases as if the credential is missing and address the missingness using our standard multiple imputation procedure (Section 3.6).

^b We use median one-year wage growth rates from the CPS between January 2011 and July 2018 as reported by the Atlanta Federal Reserve (retrieved from <https://www.frbatlanta.org/chcs/wage-growth-tracker.aspx?panel=1>). Overall, the average growth rate was 2.71%. The growth rate varied across subgroups and occupations as follows: high school or less: 2.48%; associate’s degree: 2.6%; low-skill occupations: 1.9%; education and health industries: 2.3%. Overall, this means that a one-year growth rate of between 2% and 2.5% percent is reasonable; and this annual rate corresponds to a 0.55% growth in quarterly earnings.

Exploratory Outcome Measures

This section describes the additional domains and outcomes we will consider for inclusion in the three-year report. Analysis of exploratory outcomes is intended to capture potential effects of the program that are less central to the program model and to inform new hypotheses. As such, we include some detail on the specification of these outcomes to share our thinking with the broader research community, but we do not seek to fully operationalize all of the exploratory outcomes in this analysis plan. Instead, we will take an empirical approach to specifying and reporting outcomes of interest; if our pre-specified analyses yield results that could benefit from additional exploration, we may add exploratory outcomes.

We describe exploratory outcomes grouped by domain (and further within some outcome groups) in Exhibit 2.5. These outcome domains include measures in some domains presented above as well as measures in additional domains: **barriers to employment, economic status, psychological well-being, education-related goals and support, and child development and well-being**. A complete operationalization of each of these exploratory outcomes appears in Appendix Table A.1. As we investigate these exploratory measures, we may adjust measures and/or expand the number of exploratory outcomes should the analysis warrant.

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Exhibit 2.5: Exploratory Outcomes by Domain (within Outcome Group) at Three-Year Follow-Up

Domain	Variable Description	Data Source(s)
Educational Progress		
Educational progress	Obtained a professional certificate, license, or credential since randomization (in either the short-term or three-year survey)	Short-Term Survey Three-Year Survey
Educational progress	Completed college degree, either associate's or bachelor's, since randomization (in either the short-term or three-year survey)	Short-Term Survey Three-Year Survey
Educational progress	Completed a diploma or certificate for completing regular college classes (excluding associate's or bachelor's degrees) since randomization ^a	Three-Year Survey
Educational progress	Completed a vocational training certificate since randomization ^a	Three-Year Survey
Educational progress	Currently enrolled in training	Three-Year Survey
Educational progress	Earned any college credits since randomization	Three-Year Survey
Educational progress	Perception of progress toward long-range education goals	Three-Year Survey
Employment, Job Quality, & Earnings		
Employment	Employment in each of the first 13 quarters after the quarter of randomization (Q1 through Q13)	NDNH
Employment	Number of quarters employed during the 13 quarters after the quarter of randomization	NDNH
Employment	Currently employed in a healthcare job	Three-Year Survey
Earnings	Earnings in each of the first 13th quarters after the quarter of randomization (Q1 through Q13)	NDNH
Earnings	Cumulative earnings during the 13 quarters after the quarter containing random assignment	NDNH
Earnings	Mean quarterly earnings change between 5th quarter following random assignment and 13th quarter following random assignment ^b	NDNH
Earnings	Number of quarter-to-quarter earnings increases of 1 percent or more from 5th quarter to 13th quarter after random assignment	NDNH
Income, Economic Status, & Public Assistance		
Economic status	Personal income received from all sources	Three-Year Survey
Economic status	Household income received from all sources	Three-Year Survey
Economic status	Used loans in either own name or parent's name to pay for school or living expenses	Three-Year Survey
Public assistance benefits	Number of major welfare programs (TANF, SNAP, Medicaid) from which the individual received benefits in the prior month	Three-Year Survey
Public assistance benefits	Household received any government assistance in the prior month	Three-Year Survey
Public assistance benefits	Personally received any government assistance in the prior month	Three-Year Survey
Public assistance benefits	Personally received TANF in the prior month	Three-Year Survey

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Domain	Variable Description	Data Source(s)
Public assistance benefits	Personally received SNAP in the prior month	Three-Year Survey
Public assistance benefits	Personally received Medicaid in the prior month	Three-Year Survey
Barriers to Employment & Psychological Well-Being		
Barriers to employment	Childcare arrangements very often interfered with school, work, job search, or family responsibilities	Three-Year Survey
Barriers to employment	Transportation very often interfered with school, work, job search, or family responsibilities	Three-Year Survey
Barriers to employment	Alcohol or drug use very often interfered with school, work, job search, or family responsibilities	Three-Year Survey
Barriers to employment	An illness or health condition very often interfered with school, work, job search, or family responsibilities	Three-Year Survey
Barriers to employment	Another situation very often interfered with school, work, job search, or family responsibilities	Three-Year Survey
Barriers to employment	Number of barriers that very often interfered with school, work, job search, or family responsibilities	Three-Year Survey
Psychological well-being	Core self-evaluation: a 12-item scale measuring an individual's evaluation of own abilities and control	Three-Year Survey
Psychological well-being	Perceived stress: a four-item scale measuring perceived stress	Three-Year Survey
Child Development & Well-Being		
Child development and well-being	Parental aspirations for child's education	Three-Year Survey
Child development and well-being	Child's aspirations for education	Three-Year Survey
Child development and well-being	Child development of academic skills (Pre-K): a three-item scale measuring child academic skills, defined for preschool-age children	Three-Year Survey
Child development and well-being	Child development of socio-emotional skills (Pre-K): a six-item scale measuring social and emotional skills, defined for preschool-age children	Three-Year Survey
Child development and well-being	Child development of academic skills (grades K-5): a two-item scale measuring child academic skills, defined for children in kindergarten through fifth grade	Three-Year Survey
Child development and well-being	Child development of socio-emotional skills (grades K-5): a six-item scale measuring social and emotional skills, defined for children in kindergarten through fifth grade	Three-Year Survey
Child development and well-being	Parental perception of student achievement (grades 6-12): child receives mostly A's or B's or performs above the middle of their class, defined for children in sixth through twelfth grade	Three-Year Survey
Child development and well-being	School-related risk (K-12): number of school-related risks (academic risk, attendance risk, and behavior risk), defined for children in kindergarten through twelfth grade	Three-Year Survey

^a The short-term survey did not ask respondents to report academic or vocational certificates, so this outcome is based only on responses to the three-year survey.

^b This is calculated as the slope of the best-fit line between quarterly earnings and the relevant quarters since random assignment.

2.2.2 Baseline Covariates

To increase the precision of impact estimates, we will include the following covariates when using regression equations to estimate impacts, following the earlier short-term impact analysis:

- Average quarterly earnings in the year prior to intake (NDNH outcomes only).
- Number of quarters employed in the year prior to intake (NDNH outcomes only).
- Attainment of a postsecondary degree or certificate prior to intake.
- Attainment of occupational skills license or credential prior to intake.
- Race/ethnicity.
- Foreign birth.
- Parent of one or more dependent children.
- Participation in either WIC (Special Supplemental Nutrition Program for Women, Infants, and Children) or SNAP (Supplemental Nutrition Assistance Program) at intake.

The construction of these measures is described in the *Short-Term Analysis Plan*. These covariates were selected for the *Short-Term Impacts Report* using an empirical specification approach. For the short-term impact analysis, we analyzed two outcomes—educational progress as of the short-term follow-up and earnings in the fifth quarter after random assignment—and used R^2 as a criterion to select measures for inclusion.¹⁵ To validate the model identified through this process, we compared the list of selected covariates to the list of confirmatory and secondary outcomes and noted that the empirical selection approach identified the most relevant pre-intervention measures of outcomes for inclusion in the model.¹⁶

Pre-randomization earnings reported in the NDNH will be used as a covariate for NDNH earnings outcomes, but not for survey outcomes. For survey outcomes measured for the *Short-Term Impacts Report*, we found that including NDNH covariates had very small effects on the impact estimates and standard errors, but significantly increased the computing time required to estimate the impacts.¹⁷ As a sensitivity analysis, we may estimate impacts on select confirmatory and secondary outcomes from the survey using NDNH covariates to assess whether the measured impacts differ from the model without NDNH covariates.

¹⁵ We used a modified stepwise selection procedure. In each step, we added two new covariates: one that increased the R^2 statistic for the educational progress regression the most and another that increased the R^2 for the earnings regression the most. When the next covariates identified in this manner only minimally increased R^2 , we stopped adding covariates. We considered an improvement in R^2 of less than 1 percent to be minimal.

¹⁶ For example, we include baseline measures of educational attainment, completion of an occupational skills license or credential, employment, earnings, and participation in WIC or SNAP. Each of these baseline measures is directly related to a key outcome.

¹⁷ Relative impacts estimated with NDNH covariates differed by less than one 10th of one percentage point from impacts estimated without them.

2.2.3 Subgroups Based on Individual Characteristics

The *Short-Term Impacts Report* reported differences in impacts for subpopulations defined by individual characteristics at baseline. Broadly, the report found that impacts were more favorable for those individuals who, at baseline, had more education, fewer barriers to work/school, were employed, and were not receiving TANF. Our approach to the three-year follow-up's subgroup analysis builds on prior findings, examining three-year impacts for the same subgroups so that we can follow progress. Following the *Short-Term Impacts Report*, we identify two kinds of subgroups.

The first type of subgroups consists of those based on demographics of participants at the time of study enrollment:

- Age (two subgroups): younger than age 25 (typical postsecondary age); age 25 or older.
- Race/Ethnicity (three subgroups): Hispanic; non-Hispanic black; Other (includes white/Caucasian) non-Hispanic.
- Dependent children (two subgroups): no dependent children; one or more dependent children.

The second type includes subgroups defined by school enrollment, expectations for participation in HPOG, educational attainment, barriers to school/work, employment, and receipt of public assistance—all at baseline. We label these subgroups as “policy-relevant,” because variation in the impact findings across them could suggest specific changes in program design, implementation, or policy. A program cannot change a person's age, but it could choose to target people with more or less education, for example, as fitting to program goals. The definitions of these subgroups, all of which are based on characteristics measured at the time of study enrollment, are as follows:

- School enrollment (two subgroups): enrolled in school; not enrolled in school.
- Participation expectations (two subgroups): expect to participate in HPOG full-time; expect to participate in HPOG part-time.
- Education (four subgroups): less than 12th grade; high school diploma or equivalent (GED); some college but no degree; associate's degree or higher.
- Barriers to employment (three subgroups defined based on the number of barriers—childcare arrangements, transportation, an illness or health condition, or alcohol or drug use—that fairly or very often interfere with school, work, job search, or family responsibilities): no barriers; one barrier; two or more barriers.
- Employment (two subgroups): employed; not employed.
- Public assistance (three subgroups): receiving TANF; receiving WIC or SNAP but not TANF; not receiving TANF, WIC, or SNAP.

The *Short-Term Impacts Report* presented impacts on educational progress, program completion, employment, employment in healthcare, and earnings for the policy-relevant subgroups; and it presented impacts on educational progress for the demographic subgroups. In those analyses, the smallest subgroup was participants who had two or more barriers to

employment, which included 10 percent of the total sample of 10,450 survey respondents. The three-year follow-up study will present findings from subgroup analysis in a similar fashion: we will plan to report impacts on confirmatory outcomes only for demographic subgroups and on confirmatory and secondary outcomes for policy-relevant subgroups. Depending on these findings, there is a possibility that we might analyze subgroup impacts for selected exploratory measures, although we do not plan to do so at this time. Similarly, we may explore other definitions of subgroups for exploratory purposes.¹⁸

The three-year follow-up also affords the opportunity to learn more deeply about one of the study's demographically-defined subgroups: study participants who have one or more dependent children. For this group, beyond examining impacts on only the confirmatory outcomes, we will also examine impacts on the secondary and selected exploratory outcomes, specifically measures in the child development and well-being module of the three-year survey. The *Short-Term Impacts Report* did not address impacts on child development and well-being because HPOG's logic model does not predict short-term changes in the child well-being domain. A separate assessment of the confirmatory and secondary outcomes for the parents of the children included in this analysis will help to contextualize the findings—without impacts on parents we would not expect there to be impacts on children.

¹⁸ For instance, in the *Short-Term Impacts Report* we also reported impacts on subgroups defined by program type, program duration, and level of experimental contrast.

3. Impact Analysis

This section provides an overview of the research questions, plan for hypothesis testing, description of the impact model, and other considerations for the three-year impact analyses.

To the extent possible, these analyses are designed to replicate those in the *Short-Term Impacts Report*. We anticipate that readers may be interested in comparing short-term (15 to 18 month) impacts to three-year impacts. Changes in approach might alter findings in ways that do not reflect true changes in the effect of HPOG over time. Therefore, for the three-year analyses we use the same analytical models and approach to missing data as for the prior short-term analyses. Technical details for the analyses conducted for the *Short-Term Impacts Report* are available as a technical supplement for that report (Harvill et al. 2018).

3.1 Research Questions

The study's first research question concerns the HPOG program's overall effectiveness, three years out:

1. *What impacts do HPOG programs have on the outcomes of participants and their families?*

The plan for answering Research Question 1 is described in Section 3.4.

The second research question concerns the possibility that impacts vary by segment of the target population, in that same time frame:

2. *To what extent do impacts vary across selected subpopulations?*

The plan for answering Research Question 2 is described in Section 3.5.

The third research question aims to examine the education and employment trajectories of HPOG participants to descriptively assess the extent to which they are on a career pathway:

3. *To what extent do the education and employment experiences of HPOG participants over time suggest that they are following a career pathway?*

The plan for assessing the impact of HPOG on setting participants on a career pathway is described in Section 3.4; additional descriptive analysis of career trajectories is described in the next chapter (Section 4.1).

3.2 Multiple Comparisons

Conducting tests of statistical significance for too many impact findings creates what is known as the "multiple comparisons problem." When many tests are conducted, the likelihood of detecting one or more statistically significant impacts purely by chance can be quite high—much higher than the 5 percent chance that an individual test would suggest. To keep the risk of false positive findings close to the stated level of significance, avoid the need for adjustment and attendant loss of power, and simplify interpretation, the research team and ACF together decided that the HPOG Impact Study should follow the practice of limiting confirmatory tests, as described in the *What Works Clearinghouse Handbook's* Appendix F (U.S. Department of Education 2018). We plan to conduct two confirmatory hypothesis tests at the three-year follow-

up to see whether, on average, HPOG has a positive effect on training completion and average quarterly earnings. We will not adjust for multiple comparisons because the two confirmatory outcomes are in separate domains.

Within each domain, the probability of falsely rejecting a true null hypothesis at the 5 percent level of significance is 5 percent. If we were to summarize across domains by treating any significant impact on a confirmatory outcome as evidence of HPOG's success, the probability of falsely declaring HPOG successful could rise as high as 9.75 percent (if the confirmatory outcomes are statistically independent), though the tests were conducted at the 5 percent level of significance.¹⁹ The true probability of a spurious finding when summarizing across domains depends on the correlation between the HPOG impacts in these two domains. The higher the correlation, the lower the probability of spurious findings.

We hypothesize that HPOG's impact on educational progress causes HPOG's impact on earnings, and therefore we expect these two impacts to be positively correlated. However, we will structure our reporting to avoid increasing the probability of spurious findings beyond the stated level of significance by reporting impacts in each domain separately and not summarizing across domains. Should readers of the reported findings choose to do so, the probability of wrongly concluding that an unsuccessful program is successful based on two confirmatory outcomes will still be less than 10 percent.

3.3 Approach to Hypothesis Testing

The logic model hypothesizes that HPOG will have a favorable impact on each of the confirmatory and secondary outcomes by three years after random assignment. In particular, we hypothesize that, relative to the control group, the treatment group will have:

- Greater educational progress (confirmatory hypothesis).
- Greater earnings (confirmatory hypothesis).
- Greater confidence in career knowledge.
- Greater employment.
- Greater employment in healthcare occupations.
- Greater job quality.
- Greater career progress.
- Lower receipt of public assistance benefits.
- Less financial hardship.

Because each of these hypotheses is directional, we will conduct one-sided hypothesis tests for confirmatory and secondary impacts. For one-sided tests, failure to reject the null hypothesis

¹⁹ The probability of a false test in at least one test is equal to the probability of a false positive on the first test (0.05), plus the probability of a false positive on the second test, given that no false positive occurs on the first test ($0.95 \times 0.05 = 0.0475$). Together, these probabilities sum to 0.0975, or 9.75 percent.

indicates that there is no evidence that HPOG had a favorable impact for that outcome. Further, the probability of correctly rejecting the null hypothesis for any given favorable true impact magnitude is higher with a one-sided test than a two-sided test.

We do not necessarily have directional hypotheses for impacts on exploratory outcomes. Consider, for example, *child development of academic skills*. HPOG might improve a child's academic skills development if it increases household resources; but HPOG might hinder the child's academic skills development if it removes a parent from the household to pursue training or employment. We will therefore conduct two-sided hypothesis tests for exploratory impacts.

The three-year follow-up will conduct exploratory analyses of differences in impacts across similar subgroups as in the *Short-Term Impacts Report*. As in that report, we will estimate the impact for each subgroup and test for differences in impacts between subgroups. Because these are exploratory analyses, all of the subgroup tests—both the impacts for each subgroup and differences between subgroups—will be conducted using two-sided hypothesis tests.

3.4 Model for Estimating HPOG's Impact

In this section, we describe the analysis plan for addressing Research Question 1: *Three years out, what impacts do HPOG programs have on the outcomes of participants and their families?*

For each of the outcomes (confirmatory, secondary, and exploratory) described in Section 2.2, we will estimate Intent-to-Treat (ITT) impacts of the average effect of *being offered* access to the HPOG program using a multi-level regression model that adjusts the difference between average outcomes for treatment and control group members by controlling for exogenous characteristics measured at baseline. Because policymakers usually can only *offer* access to a program (i.e., cannot mandate that enrollees partake), as is the case with HPOG, we compute the ITT estimate to learn how much consequence, on average, the offer has.²⁰ That model, described below, will be estimated using the combined sample of all individuals randomly assigned to the HPOG treatment group or the control group across the 23 grantees and 42 programs that the impact analysis will analyze.

We plan to estimate a three-level model.²¹ The unit of analysis for level one is the individual study participant; the unit of analysis for level two is the administrative division; and the unit of analysis for level three is the program. The sample size for level one is 13,716; for level two is 92; and for level three is 42. We plan to use a model with similar structural components for all impact analyses, though model details such as the sample used and covariates included will vary across analyses. In particular, analysis of survey-based outcomes will be restricted to survey respondents and survey-based covariates, whereas earnings and employment outcomes

²⁰ Among treatment group members who responded to the short-term follow-up survey, 96 percent had enrolled in training, received services, or participated in pre-training activities. Because of this very high rate of participation, a Treatment-on-the-Treated (TOT) estimate would not meaningfully differ from the ITT estimate.

²¹ If we are unable to estimate a three-level model (e.g., if the model fails to converge or if division-level measures are excluded due to degree of freedom constraints), then we will consider collapsing to a two-level model for our analyses. Using a two-level model requires additional assumptions (e.g., homogenous impacts across higher-level units), but it has the benefit of fewer computational demands than a three-level model.

using NDNH data will include all participants and will include both survey-based and NDNH-based covariates.

The level-one regression equation depicted by Equation (3-1) models the relationship between an individual study participant’s outcome Y and an HPOG program treatment indicator T while controlling for individual characteristics IC . To do this, the equation includes parameters for the conditional control group mean (α_{kj}) (i.e., the average counterfactual outcome level, after adjusting for baseline covariates) and the treatment impact (β_{kj}) for each division j and program k . These parameters provide the dependent variables for level two of the model, as depicted in Equations (3-2) and (3-3).

Level One: Individuals

$$Y_{kji} = \alpha_{kj} + \beta_{kj}T_{kji} + \sum_c \delta_c IC_{ckji} + \varepsilon_{kji} \tag{Eq. 3-1}$$

where:

- Y_{kji} = the outcome measure for individual i from division j and program k ;
- α_{kj} = the control group mean outcome (counterfactual) in division j ;
- β_{kj} = the conditional impact of being offered the HPOG program for each division j ;
- T_{kji} = the HPOG program treatment indicator (1 for those individuals assigned to the HPOG treatment; 0 for the control group individuals);
- δ_c = the effect of individual characteristic c on the mean outcome, $c = 1, \dots, C$;
- IC_{ckji} = individual baseline characteristic c for individual i from division j and program k (grand mean centered), $c = 1, \dots, C$;²² and
- ε_{kji} = a random component of the outcome for each individual.

Level Two: Divisions²³

$$\beta_{kj} = \beta_k + u_{kj} \tag{Eq. 3-2}$$

²² We plan to grand mean center all individual characteristics so the values for β_j represent the treatment impact for the typical member of the full study sample (i.e., the sample member with mean values for all individual characteristics). As described by Hofmann and Gavin (1998), raw metric and grand mean centering options provide equivalent models. However, Kreft, De Leeuw, and Aiken (1995) recommend the use of grand mean centering instead of raw metric approaches because it usually results in a reduction of the covariance between the intercepts and slopes, thereby reducing potential problems associated with multicollinearity. Related, Hofmann and Gavin (1998) note that, in most all cases, group mean centering will produce models that are not equivalent to either raw metric or grand mean centering approaches. Though all three centering options are not equivalent, Kreft et al. (1995) conclude that “there is no statistically correct choice” among the three models. The choice between grand mean centering and group mean centering must be determined by theory. Bloom, Hill, and Riccio (2003) elect to grand mean center all independent variables, which allows them to interpret all slope and intercept coefficients as representing the typical individual from the typical site. We follow Bloom et al. (2003) in scaling independent variables to be grand mean centered.

²³ We do not include division-level characteristics in level two, or program-level characteristics in level three, because the random division-level and program-level components capture variability between divisions and programs, respectively.

where:

β_k = the conditional impact of being offered the HPOG program for each program k ; and

u_{kj} = a random component of the program impact for each division.

Additionally, we have:

$$\alpha_{kj} = \alpha_k + v_{kj} \tag{Eq. 3-3}$$

where:

α_k = the control group mean outcome (counterfactual) in program k ; and

v_{kj} = a random component of control group mean outcome for each division.

Level Three: Programs

$$\beta_k = \beta_0 + u_k \tag{Eq. 3-4}$$

where:

β_0 = the grand mean impact of the HPOG treatment; and

u_k = a random component of the HPOG impact for each program.

Additionally, we have:

$$\alpha_k = \alpha_0 + v_k \tag{Eq. 3-5}$$

where:

α_0 = the grand mean control group outcome; and

v_k = a random component of control group mean outcome for each program.

Finally, we can simplify the above three-level model by substituting Equations (3-2) through (3-5) into Equation (3-1), which produces the following model:

$$Y_{kji} = \alpha_0 + \beta_0 T_{kji} + \sum_c \delta_c IC_{ckji} + \{ \varepsilon_{kji} + v_k + v_{kj} + u_k T_{kji} + u_{kj} T_{kji} \} \tag{Eq. 3-6}$$

The coefficient β_0 is the primary coefficient of interest because it equals the average impact of being offered HPOG relative to the counterfactual condition of no HPOG. We plan to use maximum likelihood procedures (which assume joint normal distributions for the random components) to estimate the above model. Given the structure of this model, the resulting impact estimates and confidence intervals can be generalized to a broader population of all potential HPOG programs implemented under similar conditions.

We note further that this is a basic impact estimation model, with treatment indicator and individual baseline variables to control for the slight, inevitable, random variations between treatment and control group characteristics; its only uncommon feature is the addition of added error terms to account for the hierarchical structure of the data, which nests individuals within

divisions within programs. Because individuals in the same divisions and programs are exposed to similar contexts—training opportunities in the community, local labor market conditions—individual error terms are likely to be correlated at these levels. The multi-level structure of this model accounts for these correlations to ensure that standard errors are calculated accurately.

3.5 Model for Estimating Subgroup Impacts

In this subsection, we describe the plan for answering Research Question 2: *Three years out, to what extent do impacts vary across selected subpopulations?*

To answer this question, we plan to use the impact model described in Section 3.4, while including a level-one interaction between the treatment indicator and the subgroup categories of interest. The coefficients on these interaction terms will provide ITT estimates of the impacts of the HPOG program on the subgroups of interest. We expect to analyze the impacts for several selected (exogenous) subgroups defined by baseline characteristics, as defined in Section 2.2.3. Furthermore, we plan to test for impacts separately by subgroup and to test for differences in impact between subgroups.

To estimate the subgroup impacts, we expand the impact model described in Section 3.4 and summarized in Equation (3-6) to include an interaction term between the treatment indicator and the subgroup categories of interest, as follows:

$$Y_{kji} = \sum_s \alpha_s S_{skji} + \sum_s \beta_s S_{skji} T_{kji} + \sum_c \delta_c IC_{ckji} + \{\varepsilon_{kji} + v_k + v_{kj} + u_k T_{kji} + u_{kj} T_{kji}\} \tag{Eq. 3-7}$$

where:

- S_{skji} = indicator of membership in subgroup s for individual i from division j and k (equal to 1 for the subgroup in which individual ijk is a member; equal to 0 for all other subgroups indexed by s);
- α_s = control group mean for subgroup s ; and
- β_s = the impact of being offered the HPOG program for subgroup s .

In this equation, subgroups are identified by S_{skji} and there is no omitted reference category. The regression directly calculates a separate control group mean (α_s) and impact (β_s) for each subgroup. In addition to testing for the significance of impact for any given subgroup (i.e., the null hypothesis that $\beta_s = 0$), we test for differences in impacts across subgroups (i.e., the null hypothesis that $\beta_s = \beta_t$ for a subgroup $t \neq s$).

For both confirmatory and secondary outcomes, we will investigate the impact of the HPOG program for all subpopulations of interest. As described in Section 3.3, the impact for each subgroup and differences in impacts between subgroups will be assessed using two-sided significance tests.

3.6 Treatment of Missing Data

We anticipate encountering a variety of types of missing data. There will be individuals lost to survey follow-up (unit nonresponse) and individuals who refuse to answer some survey items or supply “Don’t know” responses (item nonresponse). In addition, there will be a small number of individuals for whom administrative data from NDNH are missing because their Social Security numbers and name combinations do not match Social Security Administration records or because their employment is not covered by NDNH.²⁴

3.6.1 Overview of Approach to Missing Data

This section provides an overview of our approach to missing NDNH outcome data, survey data, and individual baseline characteristics. The technical details in this section originally appeared in the short-term impact report’s technical supplement (Harvill et al. 2018).

Missing NDNH Outcome and Baseline Data

Data from the NDNH are used to construct outcome measures capturing earnings and employment, as well as baseline measures of the same constructs. In the NDNH data, we observe individual quarterly earnings from state UI records, including data from some employers not included in the UI program (e.g., the federal government). Other earnings and employment types, such as self-employment income, are by construction not captured by the NDNH data system. Generally, individuals for whom we do not observe quarterly earnings in a particular quarter were not employed in covered jobs in that quarter.

However, some of these individuals may have been employed in covered jobs and the observations missing due to issues in matching administrative records. In the arrangement described in Section 2.1.2, each quarter OCSE submits the Social Security numbers and names of our HPOG participants to the Social Security Administration for verification, before using these identifiers to match our pass-through file to the NDNH database and generate a wage file. Any number and name combinations not verified by the Social Security Administration as pertaining to known individuals are eliminated from the match process.

Although NDNH output lists those individuals with verification errors each quarter, these data do not allow us to perfectly distinguish individuals with missing earnings from those with no covered employment (hereafter referred to as “unemployed”). The results of this verification are not consistent from one quarter to the next.²⁵

To distinguish between being unemployed and having missing NDNH data, we make the following assumptions:

²⁴ Our NDNH match rate is 98 percent. The survey response rate is 73 percent. We expect rates of item nonresponse to vary in the survey, but to be relatively small on average. For reference, rates of item nonresponse were less than 1 percent for nearly all survey items in the short-term impact study (Harvill et al. 2018). Among a subset of items from the psychological well-being and 21st century skills domains in the three-year survey, we find rates of item nonresponse to be less than 5 percent for all but one item (where the item nonresponse rate is 11 percent).

²⁵ OCSE indicated that Social Security number verification status can change from “verified” to “non-verifiable” or vice versa for multiple reasons. Two examples when the Social Security Administration database and submitted information may cease to be aligned are (1) when the name information submitted in a particular quarter is incomplete; and (2) when individuals change their names due to marriage or divorce.

- If an individual appears in the quarterly wage file for any quarter, we assume that quarters for which we do not observe earnings reflect periods of unemployment.
- If an individual never appears in the quarterly wage file and he or she does not appear on the list of verification errors, we assume he or she was unemployed for all quarters.
- If an individual never appears in the quarterly wage file and he or she appears on the list of verification errors in any quarter, we treat the NDNH-derived earnings and employment data as missing for all quarters.

To address missing data from NDNH, we will use multiple imputation, following the process detailed later in this section.

Missing Survey Data

For missing observations from the three-year survey data, we plan to use a combination of imputation and reweighting:

- ***Imputation will be used to impute missing outcomes due to item nonresponse to the survey***—For sample members who completed part of the three-year survey, baseline variables and completed three-year survey items will be used to impute missing outcome values.
- ***Reweighting will be used to address missing outcomes due to unit nonresponse to the survey***—For sample members who did not respond to the three-year survey, baseline variables will be used to construct nonresponse-adjusted weights.

To impute missing survey outcomes, we will use the multiple imputation procedure detailed below. To help guard against imbalances caused by attrition, we plan to apply weights that adjust for survey nonresponse for analyses of outcomes collected from follow-up surveys.

The *Short-Term Impacts Report* used NDNH baseline and outcome data to construct nonresponse weights and impute missing survey outcomes. Because the NDNH data are restricted use, there are considerable logistical and computational barriers to using these data. We conducted sensitivity analyses of impacts on the short-term follow-up survey outcomes and found that including or excluding NDNH measures in weight construction and imputation of missing survey outcomes changed measured impacts by less than a 10th of one percentage point. Given that the three-year report expands the set of survey outcomes, and that we found limited utility to incorporating NDNH data, we will not use NDNH baseline or outcome data to construct nonresponse weights or impute missing survey outcomes for the three-year analysis. Instead, we plan to analyze survey outcomes in Abt's secure analytic environment without using NDNH data, which will significantly reduce both computational and calendar time required for analysis relative to using NDNH data for those purposes.

Survey Skipouts

The three-year survey was designed such that respondents who refused to answer questions in the Education and Employment History module or could not recall specific details of their history were skipped out of that module. This feature was built into the survey skip pattern intentionally, but the procedure skipped more items than were intended. As a result, a total of 695 survey respondents (approximately 7 percent) are missing that history module and also skipped

questions about newly earned credentials, wages and hours at all jobs, and benefits and working conditions at their current/last job. We address this systematic form of missingness by treating the skipouts as an alternative form of unit nonresponse for sections that these individuals skipped; that is, by creating a second set of nonresponse weights that reweight the data of survey respondents who did not skip out to reflect responses of the full population of respondents.²⁶

Survey Non-Respondents with Special Dispositions

A total of 71 members of the study sample were unable to respond to the three-year survey because they had died, were incarcerated, or had a severe illness. For analyses of survey-based outcomes, we assign these individuals a weight of zero. These individuals are included in analysis of administrative (NDNH) data.

Missing Baseline Data

Although some baseline measures are obtained from NDNH data, most baseline covariates were collected by the study through the PRS in HPOG-only programs and via the baseline surveys in HPOG/PACE programs. As stated in the *Short-Term Analysis Plan* and as implemented in the *Short-Term Impacts Report*, we plan to use the same multiple imputation approach to adjust for item nonresponse in individual measures of baseline characteristics collected during intake for the study. These imputed values will be used for all purposes of the baseline measures—including as baseline covariates and defining subgroups. Unit nonresponse is not a concern for baseline measures: completion of the baseline survey forms was required prior to random assignment.

3.6.2 Nonresponse Weighting to Address Unit Nonresponse

As stated in prior project documents, the primary concern with unit nonresponse is sample selection resulting in the risk of bias.²⁷ The nonrandom selection of nonresponses results in a sample that may not be representative of study sample members. Furthermore, if the selection process differs between the treatment and control groups, then nonresponse can generate differences between the two groups among the subset of study sample members who completed the survey, and these differences can bias the impact estimates. Therefore, the goal of the procedure is to reweight the sample of survey respondents to represent the overall study sample (including survey nonrespondents). This is accomplished by determining the probability of response to the survey and assigning a larger weight to the responses from individuals who were least likely to respond.

Technical Description

Our approach models the probability of responding to the survey as a function of observable characteristics, which removes the bias due to these characteristics. If the data are “missing at random” (which is unknowable), then we need not be concerned of additional bias due to unobservable characteristics. As recommended by Puma et al. (2009), we estimate the models

²⁶ We generate the weights using the same procedure as described in Section 3.6.2, but we restrict the sample to survey respondents and predict the propensity of skipout. For analyses where both weights are applied, we create one set of weights by multiplying together our overall nonresponse weights and the skipout nonresponse weights.

²⁷ Because we treat all missing data from administrative sources as item nonresponse, the techniques described here apply only to survey data.

for treated and control observations separately. To properly implement this model, we need data for both respondents and nonrespondents, so we use baseline characteristics from the PRS as well as program indicators as the covariates in our model of response, which we estimate by logistic regression.

The goal is to weight survey respondents' contribution to the impact analysis by the inverse of their probability to respond. To create stable weights, we follow common practice and stratify survey respondents into bins based on their probability of response to the survey (Cochran 1968; Baker et al. 2006).²⁸ We generate the weight for each stratum by dividing the overall probability of response (within the entire sample) by the average predicted probability of response for that stratum. This implies that those who are least likely to respond will have the largest weights.

Once we have computed the appropriate weights to use for this procedure, we can generate weighted impact estimates. We estimate weighted impact estimates for each of the multiply imputed datasets we describe below.

As a final note, applying nonresponse weights adjusts only for differences in observed characteristics between respondents, nonrespondents, and the full random assignment sample, separately for the treatment and control groups; it cannot adjust for differences in unobserved characteristics. Survey-based impact estimates could remain biased if differences in unobserved characteristics result in a survey sample that does not represent all randomly assigned cases; our tests of the performance of the weights indicate this threat is minimal.

3.6.3 Multiple Imputation to Address Item Non-response

As justified and explained in prior project documents, multiple imputation uses a stochastic model-based approach to calculate a predetermined number (m) of separate datasets with imputed values that are plausible replacement values for the missing item. The analyst combines the results from these datasets into one overall impact estimate and can estimate standard errors that reflect the use of multiple datasets.

Technical Description

As with nonresponse weighting, the stochastic multiple imputation procedure removes bias under the assumption that data are missing at random. To implement this procedure, we first generate a predetermined number (m) of imputed datasets. Each of these datasets uses a regression model to assign a plausible value to the missing observation, and the stochastic element in each dataset accounts for the uncertainty inherent in the imputation procedure. We apply multiple imputation separately to treatment and control observations (per Puma et al. 2009). To generate the imputed values we employ multiple imputation with a “fully conditional specification” using the following steps (paraphrased from White, Royston, and Wood, 2011, pg. 378):

²⁸ We select the number of bins to be the largest number of bins for which the predicted rate of survey response is monotonic across bins so long as this number is larger than five (D. Judkins, personal communication). This procedure results in 10 bins.

1. Initially, all missing values are filled in by simple random sampling with replacement from the observed values.
2. The first variable with missing values, x_1 , is regressed on all other variables x_2, \dots, x_k , restricted to individuals with the observed x_1 .
3. Randomly selected values from the posterior predictive distribution (based on the original non-missing values and the model-predicted values in Step 2), replace the missing values of x_1 .
4. The next variable with missing values, x_2 , is regressed on all other variables x_1, x_3, \dots, x_k , restricted to individuals with the observed x_2 , and using the imputed values of x_1 .
5. Again, missing values in x_2 are replaced by randomly selected values from the posterior predictive distribution (based on the original non-missing values and the model-predicted values in Step 4).
6. The process (called a *cycle*) is repeated for all other variables with missing values in turn.
7. To stabilize the results, the procedure is usually repeated for several cycles to produce a single imputed dataset. Following Royston and White (2011), we use 10 cycles.
8. The whole procedure is repeated m times to give m imputed datasets. There is a large literature on the proper choice for m ; given our large sample size and small set of covariates, we follow Rubin (1987) and Schafer (1999) and choose to set m equal to 10.²⁹

An important decision in using this approach is the selection of variables to include in the regression model. We include only the covariates included in the impact analysis model in our multiple imputation procedures. We also group outcomes by report table and perform independent imputations for each table we produce. This means that for each table we will impute only the outcomes pertinent to the table along with all covariates.

Once we have constructed the 10 datasets, we will proceed by analyzing each of the datasets independently.³⁰ Because each of these datasets has imputed values instead of missing observations, item nonresponse is no longer a concern, and analysis of each dataset is straightforward. In addition, because the imputed values in each dataset differ, the impact estimates for each analysis differ. We discuss combination of these estimates below.³¹

²⁹ This is consistent with the value of m we selected in the *Short-Term Impacts Report*. Given preliminary analysis of responses to the three-year survey (see footnote 25), it is also consistent with the suggestion in White et al. (2011) that m should be at least equal to the percentage of incomplete cases in the dataset.

³⁰ This analysis includes unit nonresponse weights described in Section 3.6.2.

³¹ SAS has established procedures that can impute 10 datasets via the fully conditional specification method separately by treatment status and perform the impact analyses. To do so, we will use PROC MI, where "MI" refers to multiple imputation. In addition to the standard syntax, we will include an FCS statement, using appropriate options for the nature of the variable being imputed. We will specify that the imputation procedure begin with the variables with the lowest rate missing and end with the variables with the highest rate missing. Once we have 10 datasets, we will use standard SAS procedures (e.g., PROC MIXED or PROC SURVEYREG) to analyze each dataset using the unit nonresponse weights and saving the output separately.

3.6.4 Combining Nonresponse Weights and Multiple Imputation to Estimate Impacts

Our goal is to report a single estimate for the impact and the standard error. Therefore, we need to combine the estimates from the 10 datasets created in the multiple imputation process. The rules for this combination across multiply imputed datasets are commonly called Rubin's rules, based on Rubin (1987).³² To properly describe these rules, we begin with some notation:

$\widehat{Q}_1 \dots \widehat{Q}_{10}$: Each of the impact estimates from the 10 datasets

Using this notation, the impact of the intervention is estimated by calculating the simple average of the impact estimates from the 10 datasets:

$$\bar{Q} = \frac{1}{10} \sum_{i=1}^{10} \widehat{Q}_i$$

Rubin (1987) also describes a technique for calculating the variance and standard error of the overall impact estimate that incorporates the estimated within-imputation and between-imputation variances. When we do not use nonresponse weights (i.e., in our analysis of administrative data), we will use these rules to estimate the standard errors. When we use nonresponse weights in addition to multiple imputation (i.e., in our analysis of survey data), properly calculating standard errors requires that we account for the interaction between nonresponse weighting and the multiple imputation procedure (Shao and Sitter 1996). Therefore, we will bootstrap our standard errors rather than applying Rubin's formulae for combining standard error estimates across imputations. To implement the bootstrap, we will resample a predetermined number of replications from our original dataset (resampled with replacement such that each replicate is different).³³ These procedures are the same as what the study implemented for the *Short-Term Impacts Report*.

3.7 Sample Table Shells for Report Findings

Impact results reported in the intermediate impacts report and its appendices will follow the sample table shells shown in this section, consistent with the structures used in the *Short-Term Impacts Report* and its technical supplement (Harvill et al. 2018), respectively.

Impact results reported in the main body text of the report will follow the sample table shell represented by Exhibit 3.1 below. The table includes regression-adjusted mean outcomes for the treatment and control groups, the estimated absolute impact, and the estimated impact relative to the regression-adjusted control group mean. As shown in the exhibit's notes, impacts that are statistically significant will be flagged with one, two, or three hashtags (for one-sided

³² Rubin's rules are typically more general for m imputations. We replace m with 10 in this formula to reflect our intent to set $m = 10$.

³³ Operationalizing this procedure involves the following: We will use the SAS procedure PROC MIANALYZE to combine the individual impact estimates according to Rubin's rules. To implement the bootstrap, we will use a program that randomly samples from our original data with replacement, uses PROC MI to re-impute the missing variables with a single imputation using the same models described above, and uses the same regression technique as our impact model (i.e., PROC MIXED) to estimate impacts for this bootstrapped sample. The program will save the output for each bootstrapped sample and repeats the procedure 100 times. Last, we will use PROC MEANS to estimate the variance of impacts from all of the bootstrapped samples.

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tests) or asterisks (for two-sided tests). The notes also contain details of the specific sample sizes for the outcomes contained in the exhibit. The “Level of Evidence” column will appear in tables where the level of evidence differs across outcomes; it will be excluded if all outcomes in the table have the same level of evidence.

Exhibit 3.1: Sample Impact Table Shell for Main Impact Results

Outcome	Level of Evidence	Treatment Group Mean	Control Group Mean	Impact	Relative Impact
<i>Outcome Group 1^a</i>					
Confirmatory Outcome (unit)	Confirmatory				
Exploratory Outcome (unit)	Exploratory				
Exploratory Outcome (unit)	Exploratory				
<i>Outcome Group 2^b</i>					
Secondary Outcome (unit)	Secondary				
Exploratory Outcome (unit)	Exploratory				
<i>Outcome Group 3^c</i>					
Exploratory Outcome (unit)	Exploratory				
Exploratory Outcome (unit)	Exploratory				

Notes: Confirmatory and secondary findings use a one-sided hypothesis test, and exploratory findings use a two-sided hypothesis test. Statistical significance levels for one-sided tests are indicated with hashtags as follows: ### = 1 percent; ## = 5 percent; # = 10 percent. Statistical significance levels for two-sided tests are indicated with asterisks as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Sample Sizes and Sources:

^a Treatment: N. Control: N. Source.

^b Treatment: N. Control: N. Source.

^c Treatment: N. Control: N. Source.

Also as used in the *Short-Term Impacts Report*, additional results in the report’s appendix will include standard errors, 90 percent confidence intervals for the impact estimates, and the minimum detectable effects (MDEs; the smallest true impact that could have been detected with an 80 percent chance of significance). The sample shell for these tables appears in Exhibit 3.2.

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Exhibit 3.2: Sample Impact Table Shell for Appendix Results

Outcome	Level of Evidence	Treatment Group Mean	Control Group Mean	Impact	Relative Impact	Standard Error	90% Confidence Interval	Minimum Detectable Effect	Sample Size: Treatment	Sample Size: Control
<i>Domain 1^a</i>										
Confirmatory Outcome (unit)	Confirmatory									
Exploratory Outcome (unit)	Exploratory									
Exploratory Outcome (unit)	Exploratory									
<i>Domain 2^b</i>										
Secondary Outcome (unit)	Secondary									
Exploratory Outcome (unit)	Exploratory									
<i>Domain 3^b</i>										
Exploratory Outcome (unit)	Exploratory									
Exploratory Outcome (unit)	Exploratory									

Notes: Confirmatory and secondary findings use a one-sided hypothesis test, and exploratory findings use a two-sided hypothesis test. Statistical significance levels for one-sided tests are indicated with hashtags, as follows: ### = 1 percent; ## = 5 percent; # = 10 percent. Statistical significance levels for two-sided tests are indicated with asterisks, as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Sources:

^a Source.

^b Source.

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Subgroup results reported in the main body of the text of the report will follow the table shell in Exhibit 3.3. Results for each subgroup will be presented in a separate exhibit. Each exhibit will include all confirmatory and secondary outcomes for all those in a particular policy-relevant subgroup. Exhibits will present the regression-adjusted mean outcomes for the treatment and control group, estimated absolute impact, and estimated impact relative to the regression-adjusted control group mean. Impacts that are statistically significant will be flagged with asterisks, as indicated in the sample table notes.

Exhibit 3.3: Sample Subgroup Table Shell for Main Text Results

Outcome	Treatment Group Mean	Control Group Mean	Impact	Relative Impact
Subpopulation 1 – xx% of Sample				
Educational progress (%)^a				
Confidence in career knowledge (%) ^a				
Employment (%) ^b				
Employment in healthcare (%) ^a				
Job quality (%) ^a				
Earnings (\$) ^b				
Career progress (%) ^a				
Public assistance benefits (%) ^a				
Financial hardship (%) ^a				
Subpopulation 2 – xx% of Sample				
Educational progress (%)^a				
Confidence in career knowledge (%) ^a				
...				

Notes: Earnings and employment outcomes are measured in the 12th and 13th follow-up quarter.

Statistical significance levels for two-sided tests are indicated with asterisks as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Sample Sizes and Sources:

^a Treatment: N. Control: N. Source.

^b Treatment: N. Control: N. Source.

Additional subgroup results reported in the report’s appendix will include standard errors, 90 percent confidence intervals for the impact estimates, and the MDEs. Exhibit 3.4 provides a sample shell for this table.

Exhibit 3.4: Sample Subgroup Table Shell for Appendix Results

Outcome	Treatment Group Mean	Control Group Mean	Impact	Relative Impact	Standard Error	90% Confidence Interval	Minimum Detectable Effect	Sample Size: Treatment	Sample Size: Control
<i>Subpopulation 1 – XX% of Sample</i>									
Educational progress (%) ^a									
Confidence in career knowledge (%) ^a									
Employment (%) ^b									
Employment in healthcare (%) ^a									
Job quality (%) ^a									
Earnings (\$) ^b									
Career progress (%) ^a									
Public assistance benefits (%) ^a									
Financial hardship (%) ^a									
<i>Subpopulation 2 – XX% of Sample</i>									
Educational progress (%) ^a									
Confidence in career knowledge (%) ^a									
...									

Notes: Statistical significance levels for two-sided tests are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Sources:

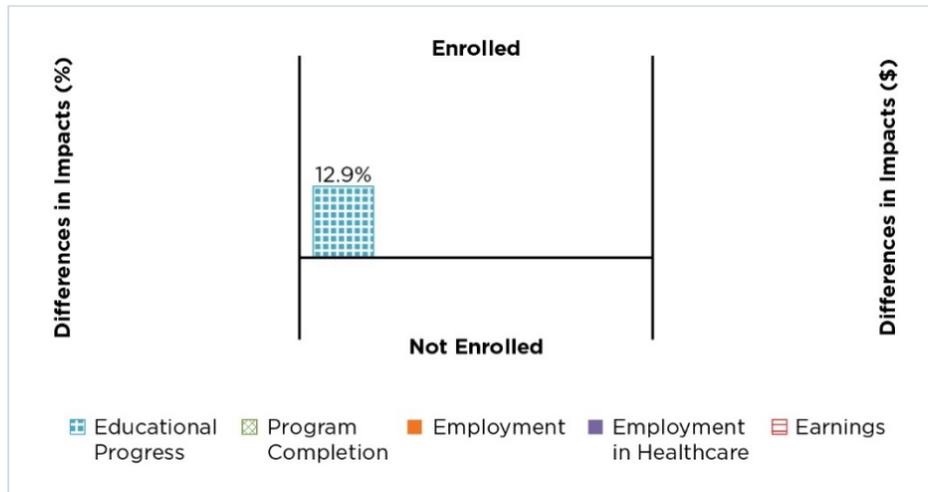
^a Source.

^b Source.

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Because we use *between-group* subgroup impacts to judge the relative effectiveness of HPOG for subgroups of interest, we expect that we will also provide tables or figures that convey for which subgroups impacts truly differ. We will separately test for differences between each pair of subgroups. Exhibit 3.5 contains a sample figure used in the *Short-Term Impacts Report* to display differences in impacts between subgroups, and Exhibit 3.6 shows the corresponding table shell for the report appendix.

Exhibit 3.5: Sample Figure



Notes: The graph compares impacts for the subgroups listed at the top and the bottom of the panel. A bar appears in the graph if differences in subgroup impacts are statistically significant at the 10 percent level. Outcomes that are not represented are not statistically significantly different between subgroups. A bar above the line indicates that impacts are larger for the top subgroup, and a bar below the line indicates that impacts are larger for the bottom subgroup.

Sample Sizes and Sources: Subgroup/s: Treatment: N. Control: N. Source.

Subgroup/s: Treatment: N. Control: N. Source.

Exhibit 3.6: Sample Differences in Impacts by Subgroup/s Table Shell for Appendix Results

Outcome	Subgroup with More Favorable Impact	Subgroup With Less Favorable Impact	Difference	Standard Error	Confidence Interval	Sample Size: Treatment	Sample Size: Control
Educational progress (%) ^a							
Confidence in career knowledge (\$) ^a							
Employment (%) ^b							
Employment in healthcare (%) ^a							
Job quality (%) ^a							
Earnings (\$) ^b							
Career progress (%) ^a							
Public assistance benefits (%) ^a							
Financial hardship (%) ^a							

Notes: Subgroup-specific sample sizes for treatment and control do not sum to analytic sample size due to missing data. The analysis model uses the full sample of individuals and imputes subgroup membership where it is missing. Statistical significance levels for two-sided tests are indicated as follows:

*** = 1 percent; ** = 5 percent; * = 10 percent. Subgroup differences are listed in the table if they are significant at the 10 percent level. Subgroup differences that are not listed are not statistically significantly different than zero.

Sample Sizes and Sources:

^a Treatment: N. Control: N. Source.

^b Treatment: N. Control: N. Source.

4. Other Analyses

In addition to the impact analysis described in Chapter 3, we plan to conduct exploratory analyses of participant experiences after their enrollment in HPOG. In particular, we will look for evidence of career progress and the extent to which participants appear to be on a career pathway, exploring how participants combine both school and work, leading to improvements over time in their labor market outcomes. In addition, we will study trends in employment and earnings over time, to assess how HPOG might have led to favorable trajectories for participants. Each of these analyses is discussed in turn.

4.1 Descriptive Analysis of Career Pathways

The career pathways model is a framework for postsecondary education and training for low-skilled adults, combining academic and vocational instruction with strong support services and connections to employment. It is hypothesized to lead to better employment and earnings outcomes over time than do older, more conventional approaches to occupational training.³⁴ We will assess the extent to which participants appear to be on a career pathway—how students combine education and work experience, leading to improvements in their employment outcomes over time. Due to the wide range of possible trajectories, we will treat this as an exploratory exercise to describe the education and employment paths of participants.

To assess whether the education and employment experiences of HPOG participants suggest that they are on career pathways, or experiencing career progress in general, we will determine the range of different education and employment trajectories that occur for treatment group participants in the HPOG program in the three years following random assignment. We will describe the most common trajectories over the three-year follow-up period and assess their consistency with the concept of career pathways. We currently classify a selected measure of career progress as a secondary outcome for the three-year impact analysis. Given what we observe in the data, however, we will also consider using a small number of career progress outcome measures in additional exploratory impact analyses to assess whether and how much HPOG treatment group members experience more career progress—across additional measures of the construct—than do control group members.

The analysis of education and employment trajectories will be driven by the patterns observed in the data. Potential trajectories of particular interest during the three-year follow-up period include:

- Single activity for the entire period (training or education; employment; neither training/education nor employment).
- Combining training or education with employment.
- Training or education followed by employment.
- Employment followed by additional training or education.

³⁴ For more on career pathways as a training strategy and an evaluation framework, see Fein (2012).

Within these trajectories, the following details will be of primary interest:

- For those employed:
 - Number of jobs.
 - Sector of employment (and alignment of training with sector of employment).
 - Extent of real wage growth.
- For those in training or education:
 - Number of trainings or credits.
 - Number of credentials earned.

The construction of these profiles of trajectories will allow us to explore related questions of interest, such as these:

- To what extent do participants who complete training find employment right away?
- To what extent does training completion lead to higher-paying employment than did employment preceding training?
- To what extent do participants complete multiple trainings? Among those who complete multiple trainings:
 - To what extent does the second training lead to a higher-level credential than the first?
 - To what extent does completion of the second training lead to higher-paying employment than the first?
- To what extent do participants report that their employment is related to their training? And how is this associated with wage growth and/or career progress?

It is our expectation that mapping these career trajectories in the data will allow us to report on the prevalence of each, as well as on the ways in which the observed trajectories reflect what we think of as being “on a career pathway.” One possibility is to code each of a small number (perhaps two or three) of observed trajectories for both the treatment and the control groups so that we can assess the difference in the prevalence of each trajectory/experience as an impact.

4.2 Time Trend Analysis of Employment and Earnings

As described in Section 2.2.1, average earnings during the 12th and 13th quarters after random assignment and employment in the 12th or 13th quarters after random assignment are defined, respectively, as the confirmatory and a secondary outcome. We will estimate the impact of HPOG on these outcomes, to assess whether participation in HPOG led to higher rates of either during these quarters.

In addition to these two-quarter estimates, we will also examine the time trend of earnings and employment during individual quarters from prior to baseline, baseline, and over the three years after random assignment, from the first to the 13th post-randomization quarters. For each post-randomization quarter, we will assess the difference in average earnings or employment between the treatment and control groups. We will also test whether the overall post-

randomization trend in these outcomes differs between groups (i.e., whether their slopes for the treatment group differ from the slopes for the control group).

To estimate the time trend, we start with the three-level model defined above by Equation (3-6) and repeated here for convenience:

$$Y_{kji} = \alpha_0 + \beta_0 T_{kji} + \sum_c \delta_c IC_{ckji} + \{\varepsilon_{kji} + v_k + v_{kj} + u_k T_{kji} + u_{kj} T_{kji}\} \quad (\text{Eq. 3-6})$$

Generalizing the outcome measure to include a time component, and denoting the quarter after random assignment by q , we redefine the model as a four-level model:³⁵

$$Y_{kjiq} = \alpha_0 + \beta_0 T_{kji} + \beta_1 q + \beta_2 T_{kji} q + \beta_3 q^2 + \beta_4 T_{kji} q^2 + \sum_c \delta_c IC_{ckji} + \{\varepsilon_{kjiq} + v_k + v_{kj} + v_{kji} + u_k T_{kji} + u_{kj} T_{kji} + u_{kji} T_{kji} + w_k q + w_{kj} q + w_{kji} q + e_k T_{kji} q + e_{kj} T_{kji} q + e_{kji} T_{kji} q + f_k q^2 + f_{kj} q^2 + f_{kji} q^2 + g_k T_{kji} q^2 + g_{kj} T_{kji} q^2 + g_{kji} T_{kji} q^2\} \quad (\text{Eq. 4-1})$$

where:

- Y_{kjiq} = the outcome for individual i from division j and program k in quarter q after random assignment
- q = the quarter since random assignment (ranges from 1 to 13)
- β_1 = the average quarterly change in the level of the outcome of interest after random assignment for the control group
- β_2 = the impact of random assignment to HPOG on the average quarterly change in the outcome of interest
- β_3 = the average change in the level of the outcome of interest after random assignment for the control group for a quadratic term of quarter
- β_4 = the impact of random assignment to HPOG on the average change in the level of the outcome of interest after random assignment for a quadratic term of quarter
- w_k = a random component of the control group linear time trend for each program
- w_{kj} = a random component of the control group linear time trend for each division
- w_{kji} = a random component of the control group linear time trend for each individual
- e_k = a random component of the HPOG impact on the linear time trend for each program

³⁵ If we are unable to estimate a four-level model (e.g., if the model fails to converge), then we will consider using a three-level model for our analyses (where the levels are time within individuals within programs). As noted in footnote 22, using a three-level model will require additional assumptions (e.g., homogeneous impacts across units, in this case administrative divisions), but it has the benefit of fewer computational demands than a four-level model.

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- e_{kj} = a random component of the HPOG impact on the linear time trend for each division
- e_{kji} = a random component of the HPOG impact on the linear time trend for each individual
- f_k = a random component of the control group quadratic time trend for each program
- f_{kj} = a random component of the control group quadratic time trend for each division
- f_{kji} = a random component of the control group quadratic time trend for each individual
- g_k = a random component of the HPOG impact on the quadratic time trend for each program
- g_{kj} = a random component of the HPOG impact on the quadratic time trend for each division
- g_{kji} = a random component of the HPOG impact on the quadratic time trend for each individual

The coefficients β_3 and β_4 jointly indicate whether the growth in the earnings or employment rate after random assignment to HPOG differs between the treatment and control groups over time. A statistically significant coefficient indicates that the impact of HPOG is growing (or shrinking) over time, suggesting that the observed impact in the 12th and 13th quarters may continue to increase (or decrease) in the future.

We will also consider alternative specifications of the time trend, including the addition of other nonlinear terms, to improve model fit.

5. Schedule and Deliverables, Report Outline

This final Chapter includes a schedule of research activities and reports along with the main report’s planned outline.

5.1 Schedule and Deliverables

Exhibit 5.1 lists the timeline for the three-year report’s activities and deliverables.

Exhibit 5.1: Year Three Follow-Up Tasks, Deliverables, and Timeline

Task	Deliverable	Date(s)
Data collection	Completion of three-year survey data collection for HPOG-only and dual PACE/HPOG sites Collection of NDNH data	Spring 2018
Reporting and dissemination	Draft and final impact study reports for three-year outcomes	Summer 2019
Data files and documentation	Submission of data files and documentation	Fall 2019

5.2 Report Outline

The three-year report will include the following:

- **Overview**—The Overview will follow OPRE guidelines and be used for the report’s online landing page.
- **Executive Summary**—Key findings presented in an accessible, reader-friendly format. We will highlight impacts on the two confirmatory outcomes. We may also include some secondary and/or subgroup impacts, but will likely not include findings that involve exploratory outcomes.
- **Chapter 1: Introduction**—Overview of the evaluation design and the study sample, and a description of the data sources.
- **Chapter 2: Program Description**—Description of the HPOG program, providing context to readers and explaining the experimental contrast. We also will summarize findings from the *Short-Term Impacts Report*.
- **Chapter 3: Impacts on Educational Progress**—Overall impact of HPOG on the *training completion* confirmatory outcome, the *21st century skills* secondary outcome, and additional exploratory outcomes in the educational progress domain.
- **Chapter 4: Impacts on Employment and Earnings**—Overall impact of HPOG on the second confirmatory outcome, *average earnings in the 12th and 13th quarters after random assignment*. We will also report results for the employment-related secondary outcomes, including *any employment*, *employment in healthcare*, *job quality*, and *career progress*. We will also explore a variety of exploratory outcomes in these domains. Finally, we will examine

the trajectory of quarterly earnings and employment over time, to assess the difference in the trend between participants enrolled in HPOG and those in the control group.

- **Chapter 5: Impacts on General Well-Being**—Estimates of impacts on income, public assistance, and economic and psychological well-being. This chapter includes two other secondary outcomes, *financial hardship* and *public assistance benefits* receipt. We will also report impacts on exploratory outcomes within these domains.
- **Chapter 6: Impacts on Subgroups**—Estimates of impacts on confirmatory and secondary outcomes by subgroup, organized by domain. We expect to analyze the impacts for several selected (exogenous) subgroups defined by baseline characteristics. We will report impacts on confirmatory outcomes for demographic subgroups and impacts on confirmatory and secondary outcomes for policy-relevant subgroups.
- **Chapter 7: Impacts on Child Development and Well-Being**—Estimates of impacts on confirmatory, secondary, and selected exploratory outcomes for the subsample of study participants with dependent children. The focus of the chapter will be on the exploratory outcomes within the child development and well-being domain.
- **Chapter 8: Descriptive Analysis of Career Pathways**—Findings from the descriptive analysis of the education and employment experiences of HPOG participants during the three years after enrollment in the program, to assess evidence of their progress along a career pathway. We will examine the extent to which participants return for additional training after completing the initial program, and the extent to which their training is associated with higher rates of employment and earnings growth.
- **Chapter 9: Summary and Conclusions**—Summary of the three-year findings and their implications for policy and practice, including discussion of implications for the second generation of the HPOG program (HPOG 2.0) and the broader career pathways literature.
- **Appendix**—We will include results of alternative specifications or additional details not included in the main body of the text. The Appendix material may be provided in a separate volume from the main report.

Works Cited

- Baker, S. G., G. M. Fitzmaurice, L. S. Freedman, and B. S. Kramer. 2006. "Simple Adjustments for Randomized Trials With Nonrandomly Missing or Censored Outcomes Arising From Informative Covariates." *Biostatistics* 7(1):29–40.
- Biemer, P. P., R. M. Groves, L. E. Lyberg, and N. A. Mathiowetz. 1991. *Measurement Errors in Surveys*. Vol. 173. New York, NY: John Wiley & Sons.
- Bloom, H. S., C. J. Hill, and J. A. Riccio. 2003. "Linking Program Implementation and Effectiveness: Lessons From a Pooled Sample of Welfare-to-Work Experiments." *Journal of Policy Analysis and Management* 22(4):551–75.
- Cochran, W. G. 1968. "The Effectiveness of Adjustment by Subclassification in Removing Bias in Observational Studies." *Biometrics* 24:295–313.
- Duncan, G. J., P. M. Morris, and C. Rodrigues. 2011. "Does Money Really Matter? Estimating Impacts of Family Income on Young Children's Achievement With Data from Random-Assignment Experiments." *Developmental Psychology* 47(5): 1263–79.
- Fein, D. J. 2012. *Career Pathways as a Framework for Program Design and Evaluation: A Working Paper from the Innovative Strategies for Increasing Self-Sufficiency (ISIS) Project* (OPRE Report #2012-30). Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. Available at: https://www.acf.hhs.gov/sites/default/files/opre/inno_strategies.pdf
- Gennetian, L., G. Duncan, V. Knox, W. Vargas, E. Clarke-Kauffman, and A. London. 2004. "How Welfare Policies Affect Adolescents' School Outcomes: A Synthesis of Evidence From Experimental Studies." *Journal of Research on Adolescence* 14(4):399-423.
- Harvill, E. L., S. Moulton, and L. R. Peck. 2015. *Health Profession Opportunity Grants (HPOG) Impact Study. Technical Supplement to the Evaluation Design Report: Impact Analysis Plan* (OPRE Report #2015-80). Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. Available at: https://www.acf.hhs.gov/sites/default/files/opre/hpog_impact_analysis_plan_finalamendment_reference_b508_ver4.pdf
- Harvill, E., D. Litwok, S. Moulton, A. Rulf Fountain, and L. R. Peck. 2018. *Technical Supplement to the Health Profession Opportunity Grants (HPOG) Impact Study Interim Report: Report Appendices* (OPRE Report #2018-16b). Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. Available at: https://www.acf.hhs.gov/sites/default/files/opre/hpog_interim_appendices_final_5_15_18_508.pdf

HPOG Impact Study's Three-Year Follow-Up Analysis Plan

- HHS [U.S. Department of Health and Human Services]. 2010. *Health Profession Opportunity Grants to Serve TANF Recipients and Other Low-Income Individuals* [Funding Opportunity Announcement], HHS-2010-ACF-OFA-FX-0126.
- Hipple, S.F., and L. A. Hammond. 2017. *Self-Employment in the United States*. Washington, DC: Bureau of Labor Statistics. Available at: <https://www.bls.gov/opub/mlr/2017/article/benchmarking-the-current-employment-statistics-national-estimates.htm>
- Hofmann, D. A., and M. B. Gavin. 1998. "Centering Decisions in Hierarchical Linear Models: Implications for Research in Organizations." *Journal of Management* 24:623–41.
- Kreft, I. G. G., J. De Leeuw, and L. S. Aiken. 1995. "The Effect of Different Forms of Centering in Hierarchical Linear Models." *Multivariate Behavioral Research* 30:1–21.
- Manning, C. D., and J. R. Stewart. 2017, October. "Benchmarking the Current Employment Statistics National Estimates." *Monthly Labor Review*. DOI: 10.21916/mlr.2017.25
- Meit, M., Hafford, C., Fromknecht, C., Knudson, A., Gilbert, T., Miesfeld, N. (2014). Tribal HPOG Evaluation Final Report, OPRE Report 2016-38, Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. Available at: https://www.acf.hhs.gov/sites/default/files/opre/tribal_hpog_1_0_final_report_3_25_16_508compliant.pdf
- Morris, P., L. Gennetian, and G. Duncan. 2005. "Effects of Welfare and Employment Policies on Young Children: New Findings on Policy Experiments Conducted in the Early 1990's." *Social Policy Report* 19(2):3–14.
- Peck, L. R., A. Werner, E. Harvill, D. Litwok, S. Moulton, A. Rulf Fountain, and G. Locke. 2018. *Health Profession Opportunity Grants (HPOG 1.0) Impact Study Interim Report: Program Implementation and Short-Term Impacts* (OPRE Report #2018-16a). Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. Available at: https://www.acf.hhs.gov/sites/default/files/opre/hpog_interim_report_final_5_11_18_b508.pdf
- Peck, L. R., A. Werner, A. Rulf Fountain, J. Lewis Buell, S. H. Bell, E. Harvill, H. Nisar, D. Judkins, and G. Locke. 2014. *Health Profession Opportunity Grants (HPOG) Impact Study Design Report* (OPRE Report #2014-62). Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. Available at: https://www.acf.hhs.gov/sites/default/files/opre/hpog_impact_design_report_11_14_14_r2_0.pdf
- Puma, M. J., R. B. Olsen, S. H. Bell, and C. Price. 2009. *What to Do When Data Are Missing in Group Randomized Controlled Trials* (NCEE 2009-0049). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.

HPOG Impact Study's Three-Year Follow-Up Analysis Plan

- Royston, P., and I. R. White. 2011. Multiple Imputation by Chained Equations (MICE): Implementation in Stata. *Journal of Statistical Software* 45(4): 1-20.
- Rubin, D. B. 1987. *Multiple Imputation for Nonresponse in Surveys*. New York, NY: Wiley.
- Schafer, J. L. 1999. "Multiple Imputation: A Primer." *Statistical Methods in Medical Research* 8:3-15.
- Shao, J., and R. R. Sitter. 1996. "Bootstrap for Imputed Survey Data." *Journal of the American Statistical Association* 91(435):1278–88.
- U.S. Department of Education, Institute of Education Sciences, What Works Clearinghouse. 2018. *Procedures and Standards Handbook Version 4.0, Appendix F*. Available at: https://ies.ed.gov/ncee/wwc/Docs/referenceresources/wwc_procedures_handbook_v4.pdf
- White, I. R., P. Royston, and A. M. Wood. 2011. "Multiple Imputation Using Chained Equations: Issues and Guidance for Practice." *Statistics in Medicine* 30:377-99.

Appendix A: Operationalization of Exploratory Outcomes

This appendix provides details on the operationalization of the three-year analysis’s exploratory outcomes, which are defined more generally in this document’s Section 2 (Exhibit 2.5).

Exhibit A.1: Operationalization of Exploratory Outcomes by Domain (within Outcome Group)

Domain	Variable Description	Operationalization Details	Data Source(s)
Educational Progress			
Educational progress	Obtained a professional certificate, license, or credential since randomization	Binary variable with value 1 if respondent earned a professional, state, or industry certification, license, or credential from an authority other than a school since randomization (in either the short-term or three-year survey) Value 0 otherwise <i>Note:</i> The names of reported credentials will be manually examined, and only those that reflect completion of training will be considered for this outcome	Short-Term Survey: Q25b Three-Year Survey: I3d
Educational progress	Completed college degree, either associate’s or bachelor’s, since randomization	Binary variable with value 1 if respondent earned an associate’s or bachelor’s degree since randomization (in either the short-term or three-year survey) Value 0 otherwise	Short-Term Survey: Q25a Three-Year Survey: I2, I2a
Educational progress	Completed a diploma or certificate for completing regular college classes (excluding associate’s or bachelor’s degrees) since randomization	Binary variable with value 1 if respondent earned a certificate for completing regular college classes since randomization ^a Value 0 otherwise <i>Note:</i> The names of reported credentials will be manually examined, and only those that reflect completion of training will be considered for this outcome	Three-Year Survey: I2, I2a
Educational progress	Completed a vocational training certificate since randomization	Binary variable with value 1 if respondent earned a diploma or certificate from a school for completing vocational training ^a Value 0 otherwise <i>Note:</i> The names of reported credentials will be manually examined, and only those that reflect completion of training will be considered for this outcome	Three-Year Survey: I3
Educational progress	Currently enrolled in training	Binary variable with value 1 if the respondent is enrolled in training at the time of the Three-Year Survey Value 0 otherwise	Three-Year Survey: Section C spell information

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Domain	Variable Description	Operationalization Details	Data Source(s)
Educational progress	Earned any college credits since randomization	Binary variable with value 1 if the respondent earned any college credits since randomization Value 0 otherwise	Three-Year Survey: D3
Educational progress	Perception of progress toward long-range education goals	Binary variable with value 1 if the respondent strongly or somewhat agrees with the statement "I am making progress towards my long-range educational goals." Value 0 if somewhat or strongly disagrees Missing otherwise	Three-Year Survey: I5
Employment, Job Quality, & Earnings			
Employment	Employment in each of the first 13 quarters after the quarter of randomization (Q1 through Q13)	Set of 13 binary variables with value 1 if employed during each of the first 13 quarters after the quarter containing random assignment Value 0 if not employed during the given quarter Missing otherwise	NDNH
Employment	Number of quarters employed during the 13 quarters after the quarter of randomization	Integer values ranging from 0 to 13, representing the number of quarters employed during the 13 quarters after the quarter of randomization Value 0 if not employed during these quarters Missing otherwise	NDNH
Employment	Currently employed in a healthcare job	Binary variable with value 1 if respondent is currently employed and the job is in healthcare Value 0 if not currently employed, or currently employed in a non-healthcare job	Three-Year Survey: Section C spell information, G2, G5
Earnings	Earnings in each of the first 13th quarters after the quarter of randomization (Q1 through Q13)	Set of 13 continuous variables measuring average earnings in each of the first 13 quarters after the quarter containing random assignment Value 0 if no earnings during the given quarter Missing otherwise	NDNH
Earnings	Cumulative earnings during the 13 quarters after the quarter containing random assignment	Continuous variable measuring total earnings in the first 13 quarters after the quarter containing random assignment Value 0 if no earnings during these quarters Missing otherwise	NDNH
Earnings	Mean quarterly earnings change between 5th quarter following randomization and 13th quarter following randomization	The average quarterly earnings gain is calculated as the slope of the best-fit line between quarterly earnings and the relevant quarters since random assignment Missing if quarterly earnings is missing in any quarter	NDNH

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Domain	Variable Description	Operationalization Details	Data Source(s)
Earnings	Number of quarter-to-quarter earnings increases of 1 percent or more from 5th quarter to 13th quarter after randomization	<p>Integer value from 0 to 8. Sum of eight binary variables, defined as follows:</p> <p>For each pair of consecutive quarters between the 5th and 13th quarter, calculate the percentage change in earnings. Binary variable takes on value of 1 if increase is 1 percent or greater. Value of 0 if less than 1 percent increase or decrease</p> <p>Missing if quarterly earnings is missing in any quarter</p>	NDNH
Income, Economic Status, & Public Assistance			
Economic status	Personal income received from all sources	<p>Continuous measure of personal income received last month</p> <p>If respondent declined to provide a continuous amount but selected a category, assume the midpoint of the category</p> <p>Missing otherwise</p>	Three-Year Survey: M2, M2a
Economic status	Household income received from all sources	<p>Continuous measure of household income received last month</p> <p>If respondent declined to provide a continuous amount but selected a category, assume the midpoint of the category</p> <p>Missing otherwise</p>	Three-Year Survey: M3, M3a
Economic status	Used loans in either own name or parent's name to pay for school or living expenses	<p>Binary variable with value 1 if used loans in either own name or parent's name to pay for school or living expenses</p> <p>Value 0 if did not use loans in either own name or parent's name</p> <p>Missing otherwise</p>	Three-Year Survey: J1e, J1f
Public assistance benefits	Number of major welfare programs (TANF, SNAP, Medicaid) from which the individual received benefits in the prior month	<p>Integer values ranging from 0 to 3, representing the number of major welfare programs from which the individual personally received benefits during the prior month</p> <p>Missing if any component is missing</p>	Three-Year Survey: M1a, M1b, M1e
Public assistance benefits	Personally received TANF in the prior month	<p>Binary variable with value 1 if the respondent reports personally receiving TANF during the prior month</p> <p>Value 0 if did not personally receive TANF during the prior month</p> <p>Missing otherwise</p>	Three-Year Survey: M1a

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Domain	Variable Description	Operationalization Details	Data Source(s)
Public assistance benefits	Personally received SNAP in the prior month	Binary variable with value 1 if the respondent reports personally receiving SNAP during the prior month Value 0 if did not personally receive SNAP during the prior month Missing otherwise	Three-Year Survey: M1b
Public assistance benefits	Personally received Medicaid in the prior month	Binary variable with value 1 if the respondent reports personally receiving Medicaid during the prior month Value 0 if did not personally receive Medicaid during the prior month Missing otherwise	Three-Year Survey: M1e
Public assistance benefits	Household received any government assistance in the prior month	Binary variable with value 1 if the respondent reports household members receiving any one of the following types of assistance during the prior month: <ul style="list-style-type: none">• TANF• SNAP• WIC• UI• Medicaid• Subsidized childcare• Section 8/Public Housing• LIHEAP• FRPL Value 0 if household did not receive any of these types of assistance during the prior month Missing if any component is missing	Three-Year Survey: M3
Public assistance benefits	Personally received any government assistance in the prior month	Binary variable with value 1 if the respondent reports personally receiving any one of the following types of assistance during the prior month: <ul style="list-style-type: none">• TANF• SNAP• WIC• UI• Medicaid• Subsidized Child Care• Section 8/Public Housing• LIHEAP• FRPL Value 0 if did not personally receive any of these types of assistance during the prior month Missing if any component is missing	Three-Year Survey: M1

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Domain	Variable Description	Operationalization Details	Data Source(s)
Barriers to Employment & Psychological Well-Being			
Barriers to employment	Childcare arrangements very often interfered with school, work, job search, or family responsibilities	Binary variable with value 1 if childcare arrangements "very often" or "fairly often" interfered with school, work, job search, or family responsibilities Value 0 if "sometimes," "almost never," or "never" interfered Missing otherwise	Three-Year Survey: K7a
Barriers to employment	Transportation very often interfered with school, work, job search, or family responsibilities	Binary variable with value 1 if transportation "very often" or "fairly often" interfered with school, work, job search, or family responsibilities Value 0 if "sometimes," "almost never," or "never" interfered Missing otherwise	Three-Year Survey: K7b
Barriers to employment	Alcohol or drug use very often interfered with school, work, job search, or family responsibilities	Binary variable with value 1 if alcohol or drug use "very often" or "fairly often" interfered with school, work, job search, or family responsibilities Value 0 if "sometimes," "almost never," or "never" interfered Missing otherwise	Three-Year Survey: K7c
Barriers to employment	An illness or health condition very often interfered with school, work, job search, or family responsibilities	Binary variable with value 1 if an illness or health condition "very often" or "fairly often" interfered with school, work, job search, or family responsibilities Value 0 if "sometimes," "almost never," or "never" interfered Missing otherwise	Three-Year Survey: K7d
Barriers to employment	Another situation very often interfered with school, work, job search, or family responsibilities	Binary variable with value 1 if another situation "very often" or "fairly often" interfered with school, work, job search, or family responsibilities Value 0 if "sometimes," "almost never," or "never" interfered Missing otherwise	Three-Year Survey: K7e
Barriers to employment	Number of barriers that very often interfered with school, work, job search, or family responsibilities (range is 0-5)	Integer value ranging from 0 to 5, containing the number of barriers that "very often" or "fairly often" interfered with school, work, job search, or family responsibilities Missing if any of the component barriers are missing	Three-Year Survey: K7a to K7e

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Domain	Variable Description	Operationalization Details	Data Source(s)
Psychological well-being	Core self-evaluation	12-item scale measuring an individual's evaluation of own abilities and control. Code each response as follows: <ul style="list-style-type: none"> Strongly disagree = 1 Somewhat disagree = 2 Somewhat agree = 3 Strongly agree = 4 <p>Impute missing items, then take the average of the 12 items</p>	Three-Year Survey: K3
Psychological well-being	Perceived stress	Four-item scale measuring perceived stress. Code response scale as follows: <ul style="list-style-type: none"> Never = 0 Almost never = 1 Sometimes = 2 Fairly often = 3 Very often = 4 <p>Impute missing items, then take the average of the four items</p>	Three-Year Survey: K8
Child Development & Well-Being			
Child development and well-being	Parental aspirations for child's education	Binary variable with value 1 if the parent thinks child will complete some schooling beyond high school 0 if parent does not think child will compete some schooling beyond high school Missing otherwise	Three-Year Survey: P1
Child development and well-being	Child's aspirations for education	Binary variable with value 1 if the parent thinks child would like to complete some schooling beyond high school 0 if parent does not think child would like to compete some schooling beyond high school Missing otherwise	Three-Year Survey: P2
Child development and well-being	Child development of academic skills (Pre-K)	Three-item scale measuring child academic skills, defined for preschool-age children, scale ranging from -2 to 2 Recode response scale as follows: <ul style="list-style-type: none"> Far below average = -2 Below average = -1 About average = 0 Above average = 1 Far above average = 2 <p>Impute missing items, then take the average of the three items</p>	Three-Year Survey: Q1, Q2, Q3

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Domain	Variable Description	Operationalization Details	Data Source(s)
Child development and well-being	Child development of socio-emotional skills (Pre-K)	<p>Six-item scale measuring social and emotional skills, defined for preschool-age children, scale ranging from -2 to 2</p> <p>Code response scale as follows:</p> <ul style="list-style-type: none"> • Far below average = -2 • Below average = -1 • About average = 0 • Above average = 1 • Far above average = 2 <p>Impute missing items, then take the average of the six items</p>	Three-Year Survey: Q4a to Q4f
Child development and well-being	Child development of academic skills (K-5)	<p>Two-item scale measuring child academic skills, defined for children in kindergarten through fifth grade, scale ranging from -2 to 2.</p> <p>Code response scale as follows:</p> <ul style="list-style-type: none"> • Not well at all = -2 • Below average = -1 • About average = 0 • Well = 1 • Very well = 2 <p>Impute missing items, then take the average of the two items</p>	Three-Year Survey: Q8 and Q9
Child development and well-being	Child development of socio-emotional skills (K-5)	<p>Six-item scale measuring social and emotional skills, defined for children in kindergarten through fifth grade, scale ranging from -2 to 2</p> <p>Recode response scale as follows:</p> <ul style="list-style-type: none"> • Far below average = -2 • Below average = -1 • About average = 0 • Above average = 1 • Far above average = 2 <p>Impute missing items, then take the average of the six items</p>	Three-Year Survey: Q7a to Q7f
Child development and well-being	Student achievement (6-12)	<p>A binary variable with value 1 if child received mostly A's or B's in school or is above the middle of their class</p> <p>Value 0 if child received mostly C's or lower or is below the middle of their class</p> <p>Missing otherwise</p>	Three-Year Survey: Q16, Q16a

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Domain	Variable Description	Operationalization Details	Data Source(s)
Child development and well-being	School-related risk (K-12)	<p>Number of school-related risks (academic risk, attendance risk, and behavior risk), ranging from 0 to 3. Scale reflects the number of domains where risk is present (as evidenced by either of two statements being true):</p> <p><i>Academic Risk</i></p> <ul style="list-style-type: none"> • Child has repeated any grades in school • Teacher has contacted an adult in the household this school year about any problems with school work <p><i>Attendance Risk</i></p> <ul style="list-style-type: none"> • Child was absent from school for more than 2 days in the last month for any reason • Child was late for school on more than 2 days in the last month <p><i>Behavior Risk</i></p> <ul style="list-style-type: none"> • Teacher has contacted an adult in the household this school year about any behavior problems in school • Child has been suspended or expelled from school in the current school year <p>Value 0 if none of the previous items is true</p> <p>Impute missing items, then combine to create scale</p>	Three-Year Survey: Q10, Q11, Q12, Q13, Q14, Q15

^a The short-term survey did not ask respondents to report academic or vocational certificates, so this outcome is based only on responses to the three-year survey.