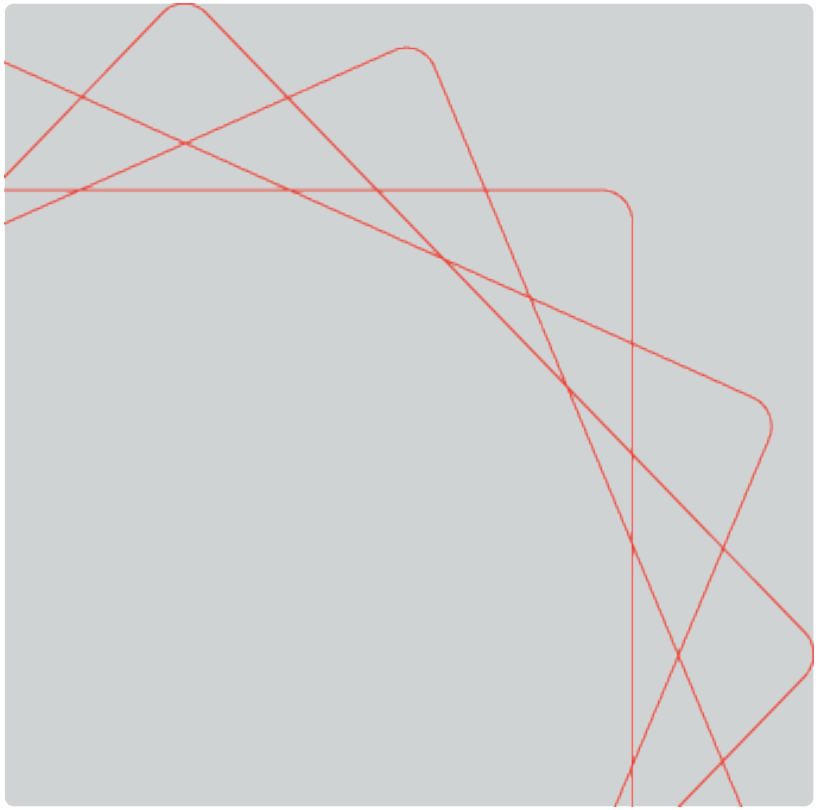
Learning more from a multisite intervention: combining natural and planned variation in program experience

Eleanor L. Harvill

OPRE Innovative Methods Meeting
Unpacking the “Black Box”
September 3, 2014



HPOG and Its Impact Evaluation

- The Health Professions Opportunity Grants Program (HPOG) is a career pathways framework-based training for TANF and low-income individuals to pursue healthcare sector careers
- The HPOG Impact Evaluation is part of a rich career pathways research portfolio at OPRE, including
  - National Implementation Evaluation of the Health Profession Opportunity Grants (HPOG)
  - Innovative Strategies for Increasing Self-Sufficiency Evaluation

Natural Variation

- Multi-site trials with individual-level random assignment allow us to construct unbiased estimates of impacts at the site level
- Unpacking the “Black Box”: Various approaches can be used to investigate which observed program components lead to higher or lower impacts
  - Intuition: site-level OLS regression with impact on the left-hand side and program components on the right
  - Common application: Multi-level modeling (Bloom Hill, and Riccio, 2003; Greenberg, Meyer, and Wiseman, 1994)
- These methods produce biased estimates of the impacts of specific components when programmatic choices correlate with other determinants of impact magnitude

Planned Variation at Some Sites

- Three-arm random assignment at the individual-level
  - Control
  - Treatment: standard program
  - Enhanced Treatment: standard program + enhancement
    - Peer support
    - Emergency financial assistance
    - Non-cash incentives
- This design allows for an experimental estimate of the effect of a particular program component: the enhancement

Goal

How can we combine information from natural variation and planned variation to:

1. Answer the research question: how do different program components mediate the treatment effect?
2. Quantify bias in the natural variation estimates
3. Use what we learn about bias in the natural variation estimates of randomly assigned program components to improve our estimates for other program components

HPOG Context

- Individuals: ~10,500 overall; 7,000 T/TE; 3,500 C
- Study sites: 20 grantees, 36 programs, 90 administrative divisions
- Planned variation sample (10 grantees, 19 programs, 33 administrative divisions; about 1,300 TEs)
  - Peer support
  - Emergency financial assistance
  - Non-cash incentives
- Natural variation in program components, including
  - Peer support
  - Emergency financial assistance
  - Non-cash incentives
  - Case management

HPOG: Site Selection

HPOG-Impact Grantees	Peer Support	Emergency Assistance	Non-Cash Incentives
Eastern Gateway Community College	Natural	Natural	Natural
Kansas Department of Commerce			
Schenectady County Community College		Natural	Natural
New Hampshire Office of Minority Health	Planned	Natural	
Milwaukee Area WIB			
South Carolina Department of Social Services			Planned
Buffalo and Erie County WDC	Planned	Natural	
Gateway Community and Technical College (KY)		Natural	Planned
Central Community College			Natural
Suffolk County Department of Labor		Natural	Planned
Pensacola State College		Natural	
WIB SDA-83 Inc. (LA)			
Research Foundation of CUNY-Hostos Community College		Planned	
Will County WIB		Natural	
Full Employment Council	Natural	Planned	Natural
Central Susquehanna Intermediate Unit		Natural	
The WorkPlace	Planned	Natural	
Alamo Community College District and University Health System			Planned
Edmonds Community College		Natural	
Bergen Community College (includes 11 programs)		Planned	Planned

Analyzing Natural Variation

Restricting attention to individuals randomly assigned to Standard HPOG Treatment or Control (i.e. no individuals in the enhanced treatment group)

$$Y_{ji} = \alpha_j + \beta_j T_{ji} + \varepsilon_{ji}$$ (plus individual level covariates)

$$\beta_j = \beta_\emptyset + \sum_{m=1} \pi_m P_{mj} + \mu_j$$ (plus site level covariates)

$$\alpha_j = \alpha_\emptyset + \eta_j$$ (plus site level determinants of untreated outcomes)

Where: T_{ji} is the treatment indicator for person i in site j

P_{mj} for $(m = 1, \ldots M)$ are the measured features of interest in intervention site j

Estimating this model gives $\hat{\pi}_1^S, \ldots, \hat{\pi}_M^S$ as non-experimental estimates of the influence on impact of the P_m features

Analyzing Natural Variation: Bias

What if there is an omitted site-level factor, F_j , that

- Influences impact magnitudes
- Is not included in $P_{1,}$ ..., P_M nor in site level covariates
- Correlates with one or more P_m?

$$\beta_j = \beta_\emptyset + \sum_{m=1}^{M} \pi_m \, P_{mj} \; + F_j \; + \; \mu_j$$

Omission of F_j biases $\hat{\pi}_m^S$ wherever $\mathrm{Cov}(P_{mj,} F_j) \neq 0$

Analyzing Planned Variation

- In sites where an enhancement was randomly assigned, the impact of the enhancement can be identified by

$$\hat{\pi}_e^X = \bar{Y}_{TE} - \bar{Y}_T$$

- The identification is nonparametric; the estimate locally unbiased
- Using a regression framework to account for individual covariates and expanding the sample to include the control group can increase the precision of the estimate

Quantifying Bias in Analysis of Natural Variation (Enhancements)

- We have two estimates of the impact of the enhancement
- $\hat{\pi}_e^X$ the experimental impact
- $\hat{\pi}_e^S$ the estimate from natural variation in standard HPOG
- We can estimate bias in the non-experimental estimator as $|\hat{\pi}_e^S - \hat{\pi}_e^X|$ because

$$E|\hat{\pi}_e^S - \hat{\pi}_e^X| = |E(\hat{\pi}_e^S) - E(\hat{\pi}_e^X)| = |E(\hat{\pi}_e^S) - \pi_e| = Bias(\hat{\pi}_e^S)$$

- Key assumption: impact of the enhancement not context dependent

Reducing Bias in Analysis of Natural Variation (Enhancements)

- Following the Design Replication literature (e.g. Cook, Shadish & Wong, 2008), we can use the measured bias to inform model specification
- Reducing the bias by
  - Including additional site-level predictors/covariates
  - Changing the functional form
- In the HPOG example, this directly addresses the bias in estimates of the influence of
  - Peer support
  - Emergency financial assistance
  - Non-cash incentives

  On the impact of the standard program

Reducing Bias for Components that Only Vary Naturally

- The steps we take to reduce bias soak up some of the variance of the omitted factor
- This can reduce the bias in the estimates of the influence of the other components
  - Formal demonstration in Bell (2013)
  - Intuition: Reduce the covariance between the measured features and the omitted factor

Next Steps

- Consider the role of multi-collinearity in program features in estimation and bias reduction
- Construct a hybrid estimator that has lower bias than the natural variation estimate and a smaller standard error than the experimental estimate

Further Information

Hilary Forster
Federal Project Officer, HPOG
HHS/ACF/OPRE
Hilary.Forster@ACF.hhs.gov

Eleanor Harvill
Scientist
Abt Associates Inc.
eleanor_harvill@abtassoc.com