



What Have We Learned about Success and Its Drivers in Comprehensive Residential Upgrade Programs?

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Agenda

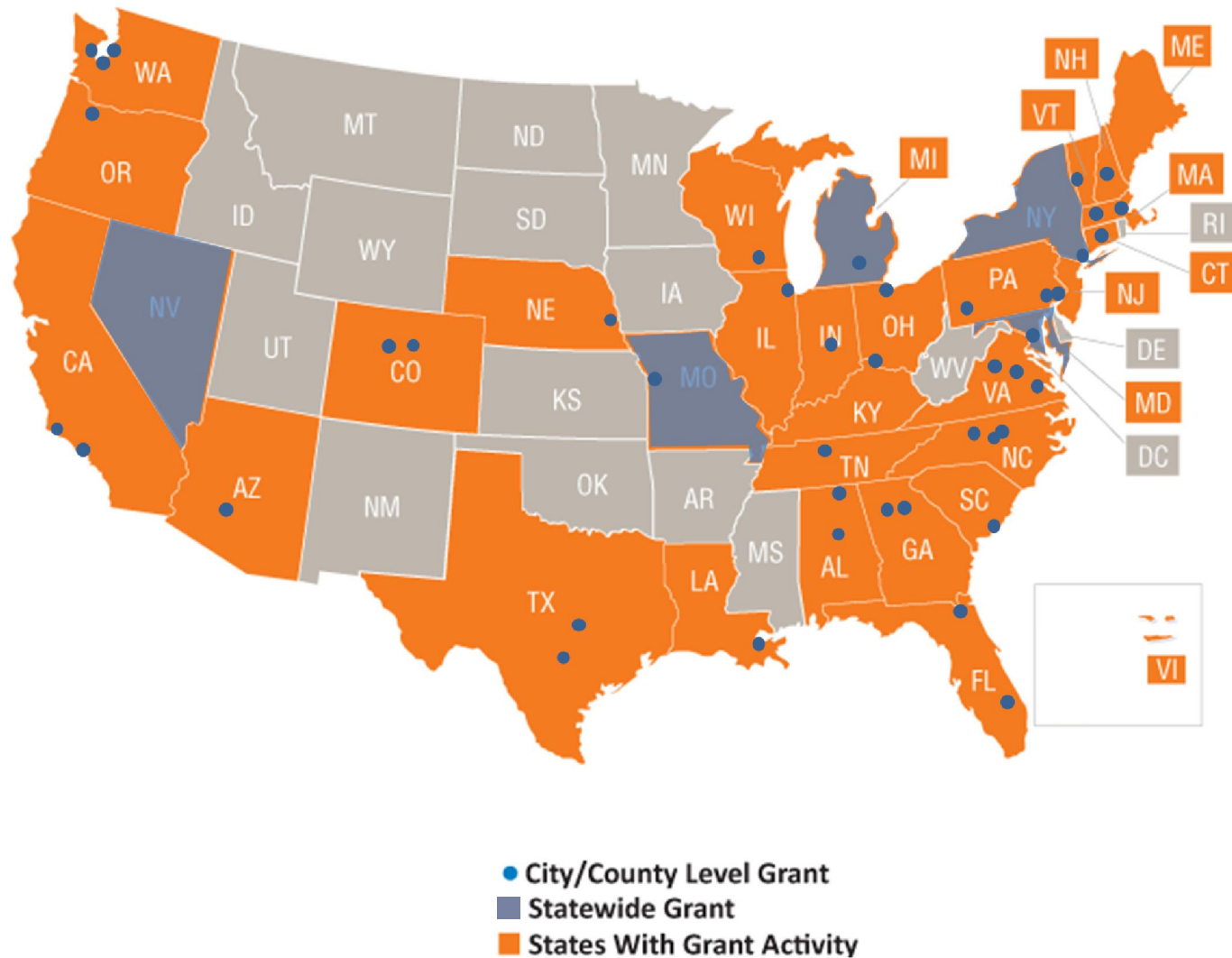
- What is BBNP?
- What did we do?
- How did we do it?
- What did we learn?
- What sense do we make of it?

What is BBNP?

US DOE's Better Buildings Neighborhood Program

- Purpose
 - Demonstrate self-sustaining efficiency retrofit programs
 - Innovate for comprehensive upgrades in local markets
- \$508 million in grants to 41 grantees and 24 subgrantees (governments and nonprofits)
 - Implemented whole building energy upgrade programs in 34 states and one territory
 - All sectors: residential, low income, multifamily, commercial, public, industrial, and agricultural buildings
- Learn what is effective and replicable

BBNP Grant Recipient Locations



BBNP Evaluation Team and Reviewers

- Independent Evaluation Team

- Research Into Action led the teams and process evaluation research
- Evergreen Economics conducted the analysis of economic impacts, the billing regression analysis of program savings, and worked with Nexant to verify program savings
- Nexant led the impact evaluation, conducted project measurement and verification (M&V) activities, and verified program savings
- NMR Group led the market effects assessment

- DOE Project Manager, Jeff Dowd, EERE
- LBNL Project Managers Edward Vine & Yaw Agyeman, providing technical oversight
- BTO POC, Dale Hoffmeyer

External peer reviewers

- Marian Brown
- Phil Degens
- Lauren Gage
- Ken Keating
- Lisa Petraglia*
- John “Skip” Laitner*

Internal reviewers

- Jeff Dowd
- Dale Hoffmeyer
- Danielle Sass Byrnett**
- Claudia Tighe**
- Bill Miller**

* Reviewed economic analysis

** Reviewed preliminary evaluation

What Did We Do? – Success Analysis

- Identify and measure metrics of EE program success, and assess which program design elements contribute to successful outcomes
- Residential sector only
- Complements other quantitative (bivariate) and qualitative findings
- Unique analysis opportunity with big insights for industry: “meta analysis on steroids”



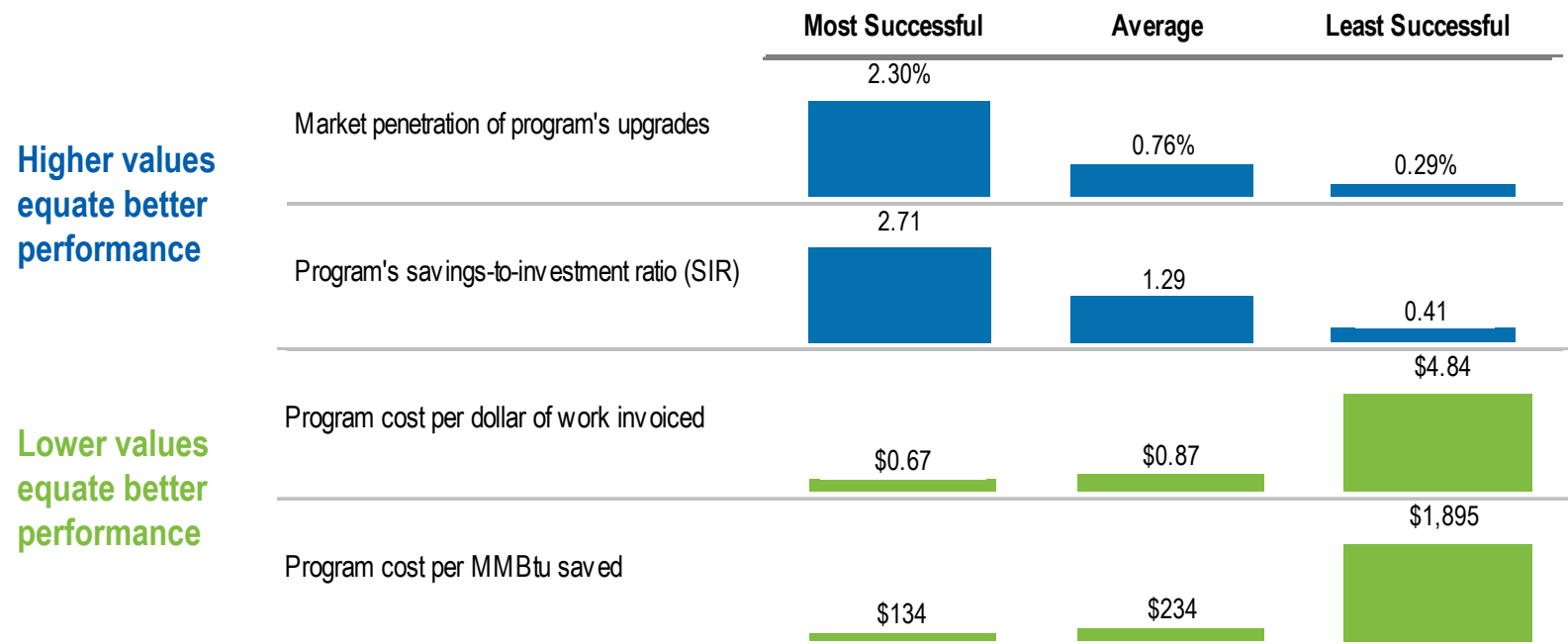
How Did We Do It? – Data Collection

Identify potential metrics of success (DV) and the factors that may contribute to them (IV)

- Survey of grantees and subgrantees
- Program data
- Collect exogenous data for control variables (ex: weather data)

How Did We Do It? – Analysis Step 1

- Calculate metrics of success
- Measure grantee success via Latent Profile Analysis



How Did We Do It? – Analysis Step 2

Identify programmatic elements predicting successful outcomes via multivariate logistic regression



Most successful cluster



Least successful cluster



What programmatic elements predict membership in the least successful cluster?



What Did We Learn?

Contractor Training

Lack of contractor training predicted membership in least successful cluster:

- Specific training types:
 - Sales
 - Program
- Training audiences:
 - Auditors/assessors
 - Upgrade contractors



What Sense Do We Make of It?

Contractor Training

- Some regions lack skilled contractor base
- Technical skills \neq sales skills
- May improve program cost per upgrade
- Contractors want it



What programmatic elements predict membership in the most successful cluster?



What Did We Learn?

Offering Multiple Audit Types

- Online, mail-in, phone-based, walk-through, or diagnostic
- Multiple audit types mitigate barriers common to diagnostic-focused audit programs:
 - Participants can choose audit that meets their varying wants and needs (cost, time, thoroughness)
 - Can increase audit uptake and thus program savings



What Did We Learn?

Offering Direct Install

- Can act as a “foot in the door” to a comprehensive upgrade project
- Cost effective source of significant energy savings
- QC is baked in



What Did We Learn?

Having a Large Number of Contractors Eligible to Conduct Upgrades

- Eases participant experience
- Increases number of program projects
- How to maximize eligible contractor base?
 - Minimize burden on contractor
 - Program-to-contractor outreach
 - Remember – training contractors is key



What Sense Do We Make of It?

Offer multiple pathways to participation and savings

- Direct install
- Multiple audit types
- Large number of trained program contractors

Study provides insight for the industry: no silver bullets or kiss of death – but good advice



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Questions?

Contact:

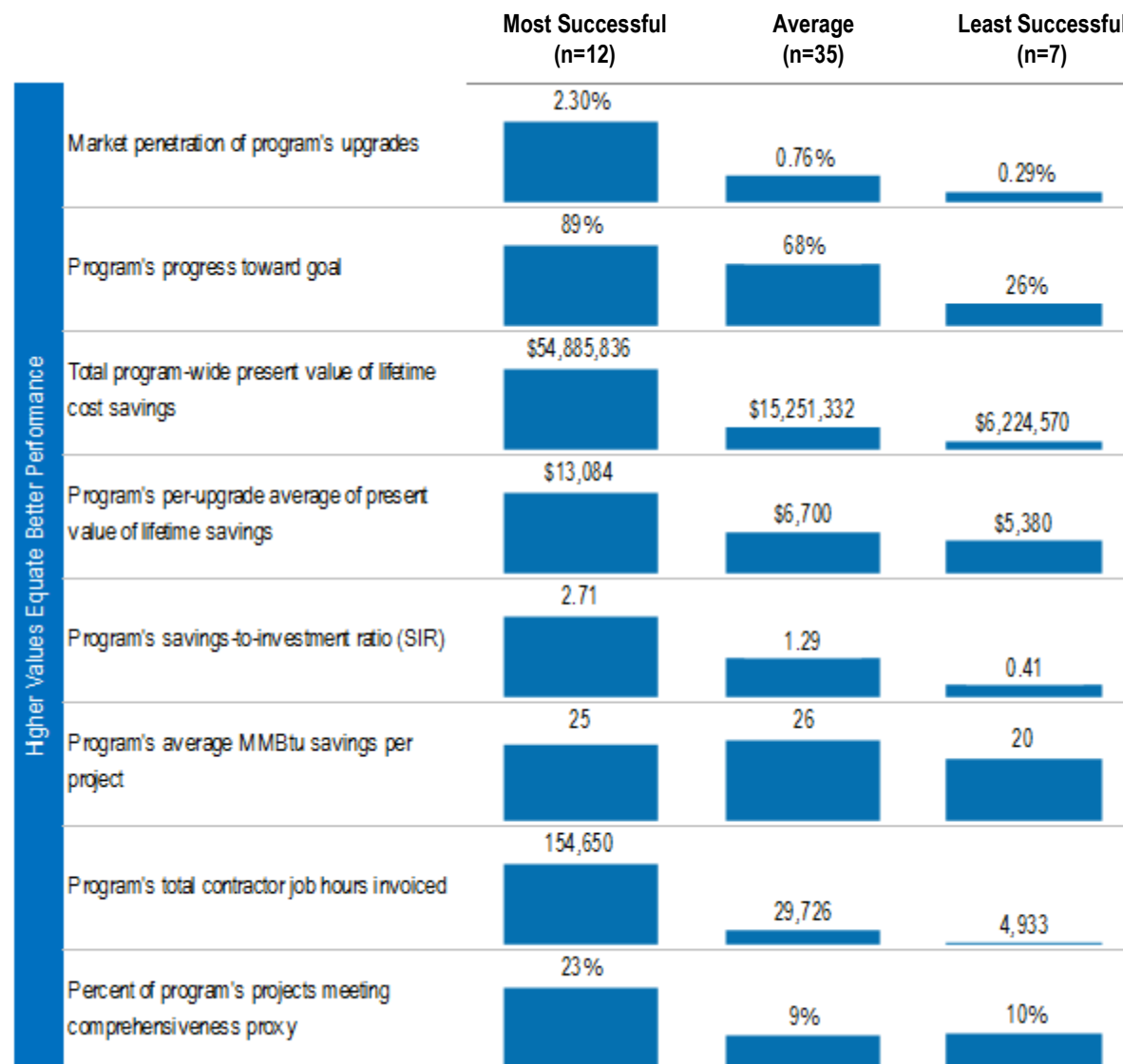
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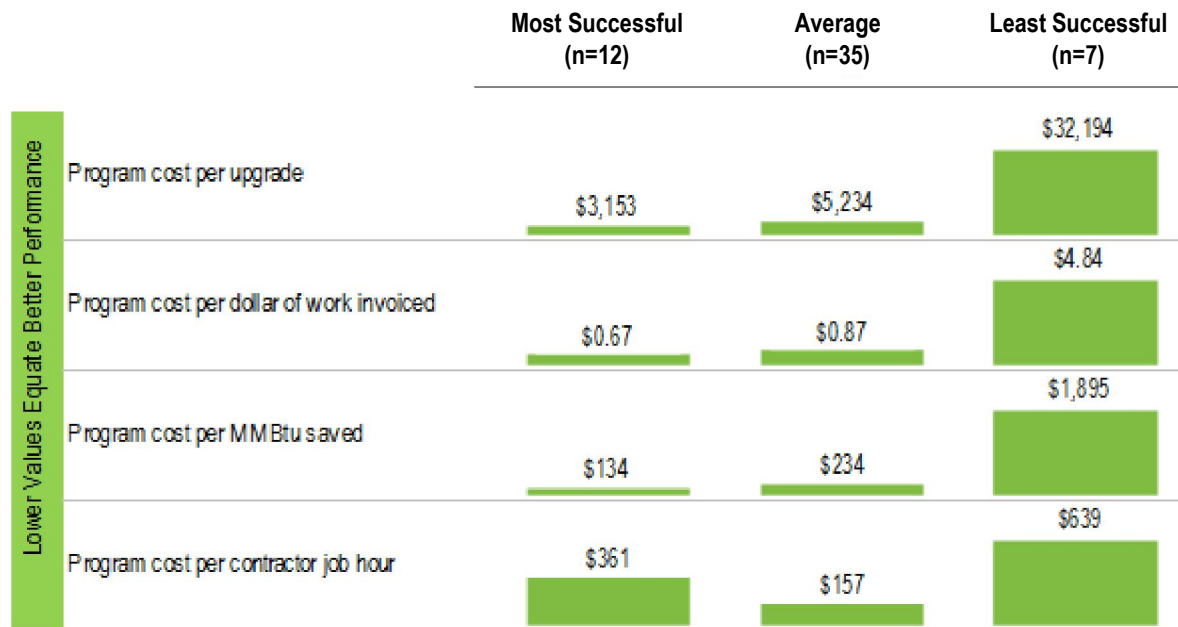
Appendix



Higher Values Mean Better Performance



Lower Values Mean Better Performance



Appendix

Table 1. Multivariate Logistic Regression Modeling of Least Successful Cluster Membership (n=54)

Variable	Model 1	Model 2	Model 3
Number of audit types offered	-	0.16*	0.56
Any contractor training offered	0.04***	-	0.07*
Wald test	9.56**	3.52*	9.04*
Tjur's R2	0.32	0.18	0.34

Note: Rows above the grey bar present odds ratios.

* $p < .05$; ** $p < .01$; *** $p < .001$

Appendix

Table 2. Multivariate Logistic Regression Modeling of Most Successful Cluster Membership, Testing Additions of Exogenous Controls (n=54)

Variable	Model						
	1	2	3	4	5	6	7
Constraints on energy use and savings opportunities index	---	1.43*	1.06	---	---	---	---
State-level average electricity cost (cents per kWh)	---	---	---	1.26*	1.3	---	---
Population of grantee's service area	---	---	---	---	---	1.00*	1.00
Direct install options offered	24.82***	---	21.12***	---	25.43***	---	24.72***
Number of audit types offered	3.89*	---	3.68*	---	4.75*	---	3.92*
Number of eligible upgrade contractor firms	1.02**	---	1.02**	---	1.02†	---	1.02*
Wald test	11.81**	3.74†	12.04*	4.157*	11.54*	3.58†	11.94*
Tjur's R2	0.55	0.11	0.56	0.10	0.61	0.10	0.58

Note: Rows above the grey bar present odds ratios. † $p < .1$; * $p < .05$; ** $p < .01$; *** $p < .001$

Appendix

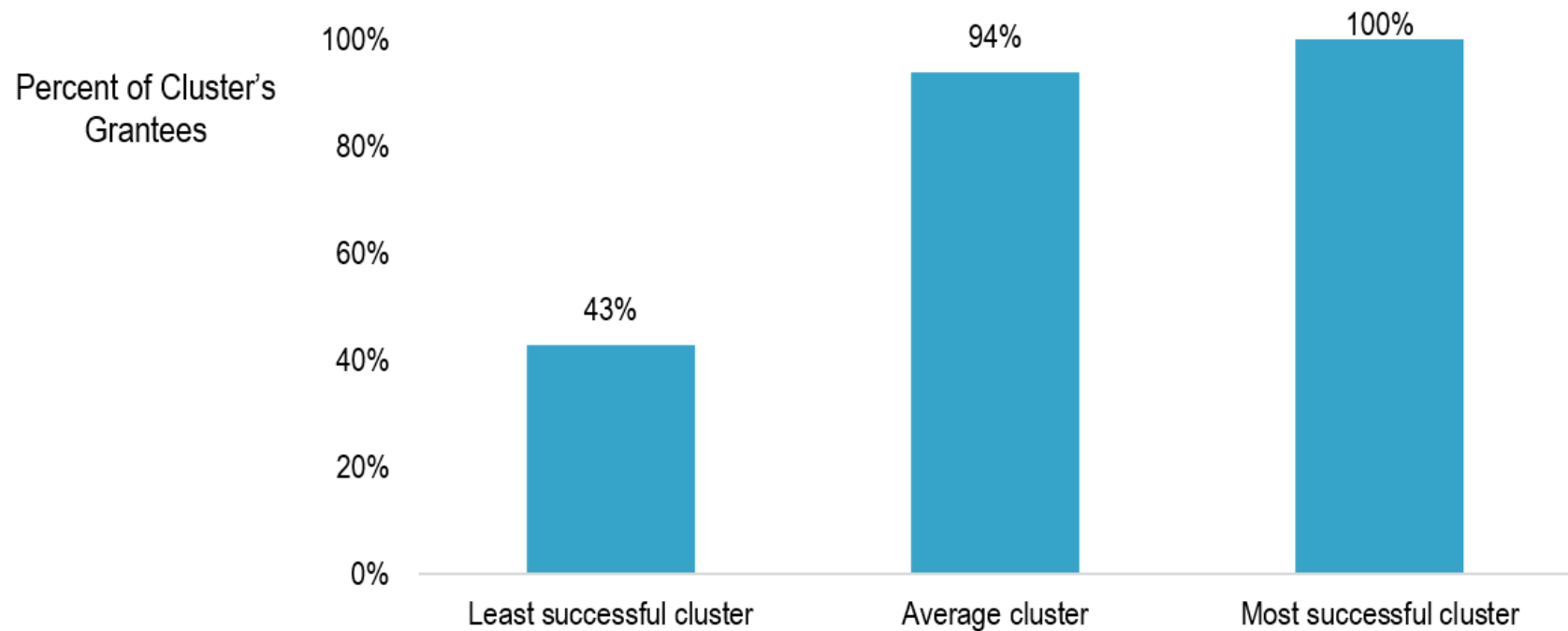
Table 3. Multivariate Logistic Regression Modeling of Most Successful Cluster Membership, Testing Additions of Programmatic Elements (n=54)

Variable	Model								
	1	8	9	10	11	12	13	14	15
Savings threshold required for qualified projects	---	.13**	0.26	---	---	---	---	---	---
Ramp up time	---	---	---	0.22**	0.39	---	---	---	---
Timeliness index	---	---	---	---	---	1.58*	1.47	---	---
At least one team member had 15 years or more of relevant previous experience	---	---	---	---	---	---	---	4.61*	1.82
Direct install options offered	24.82***	---	17.80**	---	22.32***	---	27.67***	---	18.14***
Number of audit types offered	3.89*	---	4.37*	---	3.86*	---	4.12*	---	3.77*
Number of eligible upgrade contractor firms	1.02**	---	1.02**	---	1.02*	---	1.02*	---	1.02**
Wald test	11.81**	8.17**	11.45*	5.95*	12.09*	4.91*	11.65*	3.82†	12.40*
Tjur's R2	0.55	0.19	0.58	0.18	0.59	0.14	0.60	0.09	0.56

Note: Rows above the grey bar present odds ratios. † $p < .1$; * $p < .05$; ** $p < .01$; *** $p < .001$

Appendix

Percent of Grantees that Offered Contractor Training, by Cluster (n = 54)



Appendix

Descriptive Statistics for Variables Predicting Most Successful Cluster Membership

