Evaluating the Effectiveness of Good Agricultural Practices Training Through Maryland Extension Programs on Maryland Farmers

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NAREA Annual Meeting
June 12, 2017

Background

- Good Agricultural Practices (GAP) program
  - Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables (FDA guide -1998)
  - Certification by MDA or USDA/AMS
  - Required by many wholesale buyers
- University of Maryland Extension program
  - One-day voluntary regional training
  - Surveys: 2014-2016
- New produce safety rules under FSMA (Jan. 2016)
  - Mandatory training
  - Large farms cannot be exempt
  - Large farms are subject to earlier compliance date

Training Overview

Training Program	2014	2015	2016
Pre test and	Pre questionnaire	Pre questionnaire	-
		Included farm size	
Lecture			
Lunch			
Post test and	Post questionnaire	Post questionnaire	Combined questionnaire
	Baltimore County: after workshop		*Included farm size*
Workshop			

Training Effectiveness

Trainee Characteristics → Alvarez et al. (2004) → **Training Outcome**

- Potential non-linear effects
  - Categorical variables and interactions
  - Colquitt et al. (2000)
    - Each characteristic can affect training outcomes through various channels
  - Bell et al. (2017)
    - Three types of trainee characteristics/ channels: aptitude, personality, and motivation

- Test performance
  - Pre test scores
  - Score improvements = post score – pre score
- Decision to leave early
  - Absence in post test
  - Conditional on presence in pre test
- Training Evaluation (Kirkpatrick, 1994)
  - Short-term: trainee reaction and learning outcomes
  - Long-term: behavioral change and organizational results.

Main Findings

- Test performance
  1. Participants perform better before training in later years.
  2. Participants from large farms did not perform significantly better before training, but they improved more after training.
  3. Effects of experience and education attainment on learning are non-linear.
- Participant satisfaction
  4. Participants showed interests in different sections of the training.
  5. Participants might have faced time constraints.

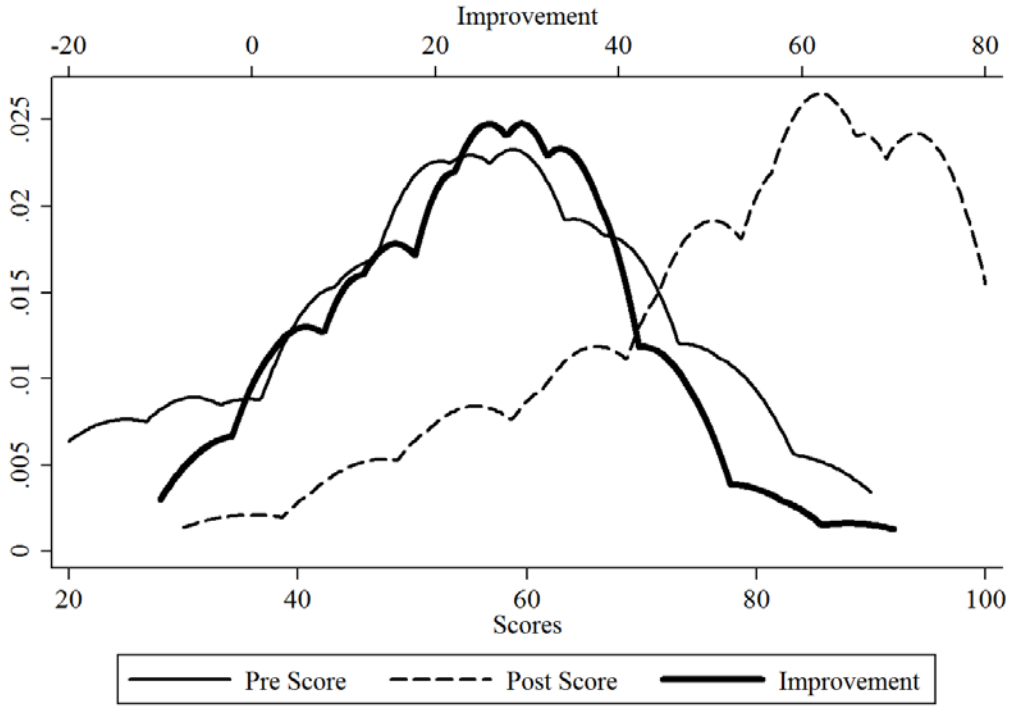
Participant Characteristics

	Proportion in sample	(s.d.)
2014	0.39	(0.49)
2015	0.28	(0.45)
2016	0.32	(0.47)
Baltimore City	0.04	(0.20)
Baltimore County	0.06	(0.23)
Central Maryland	0.31	(0.47)
Lower Eastern Shore	0.15	(0.36)
Southern Maryland	0.15	(0.36)
Upper and Central Eastern Shore	0.10	(0.30)
Western Maryland	0.19	(0.39)
Observations	**127**	

Participant Characteristics

	Proportion in sample	(s.d.)	
Female	0.43	(0.50)	X_{person}
Age 24 and younger	0.13	(0.33)	
Age 25-44	0.39	(0.49)	
Age 45 or over	0.49	(0.50)	
No Bachelor's Degree	0.38	(0.49)	
Bachelor's Degree	0.34	(0.48)	
Graduate Degree	0.28	(0.45)	
Farmers	0.88	(0.32)	X_{farm}
Experience 2 years or less	0.21	(0.41)	
Experience 3-10 years	0.40	(0.49)	
Experience 11-25 years	0.17	(0.37)	
Experience 26 years or more	0.22	(0.42)	
Attend Previous Training	0.20	(0.41)	
Cert Required	0.36	(0.48)	
Cert Not Required	0.54	(0.50)	
Cert Requirement Not Sure	0.10	(0.30)	
Large Farm*	0.49	(0.50)	
Observations	**127**		

Test Performance



Pre score mean=54, s.d.=17.3;
post score mean=79, s.d.=17.0;
improvement mean=25, s.d.=16.0

Empirical Strategy

- Pre score:

$$y_{pre,i} = \alpha_0 + \boldsymbol{X}_{person,i} \cdot \boldsymbol{\beta} + \boldsymbol{X}_{farm,i} \cdot \boldsymbol{\gamma} + \boldsymbol{D_t} \cdot \boldsymbol{\alpha_t} + \epsilon_i$$

- Improvement:

$$y_{imp,i} = \alpha_0 + \theta \cdot y_{pre,i} + \boldsymbol{X}_{person,i} \cdot \boldsymbol{\beta} + \boldsymbol{X}_{farm,i} \cdot \boldsymbol{\gamma} + \boldsymbol{D_t} \cdot \boldsymbol{\alpha_t} + \epsilon_i$$

- Year dummies
- Clustered standard errors
- Sub-sample: farm size variable

Evidence of Info Diffusion

Pre score	2014-2016		2015-2016	
Female	1.446	(0.45)	3.277	(0.79)
Age 24 and younger	-1.542	(-0.34)	-1.061	(-0.22)
Age 45 or over	1.315	(0.86)	0.0139	(0.00)
No Bachelor's Degree	-9.143**	(-2.29)	-6.672	(-1.23)
Graduate Degree	-6.304	(-1.52)	-2.948	(-0.54)
Farmers	4.889	(0.91)	1.287	(0.24)
Experience: 2 years or less	6.168	(0.76)	4.082	(0.39)
Experience: 3-10 years	10.17**	(2.63)	9.970**	(2.46)
Experience: 11-25 years	4.412	(0.96)	1.253	(0.21)
Attend Previous Training	12.19***	(4.68)	11.91**	(3.23)
Cert No	-4.398	(-0.73)	-6.817	(-1.27)
Cert No × 2014	1.883	(0.23)		
Cert No × 2015	-5.192	(-0.64)		
Cert Not Sure	-31.89***	(-5.60)	-29.13***	(-3.63)
Cert Not Sure × 2014	33.44***	(3.26)		
Cert Not Sure × 2015	6.758	(0.74)		
Large Farm			5.207	(1.20)
2014	-13.85*	(-1.97)		
2015	-3.644	(-0.58)	-7.397***	(-4.00)
Constant	55.94***	(6.99)	56.95***	(5.51)
Observations	127		73	

Evidence of Difficulty in Learning

2015-2016	Pre score		Improvement	
Pre Score			-0.681***	(-13.89)
Female	3.277	(0.79)	-0.153	(-0.04)
Age 24 and younger	-1.061	(-0.22)	5.768	(1.28)
Age 25 - 44 years (baseline)				
Age 45 or over	0.0139	0.00	0.136	(0.04)
No Bachelor's Degree	-6.672	(-1.23)	-8.423***	(-3.61)
Bachelor's Degree (baseline)				
Graduate Degree	-2.948	(-0.54)	-2.063	(-0.60)
Farmers	1.287	(0.24)	-1.724	(-0.44)
Experience: 2 years or less	4.082	(0.39)	6.711	(1.07)
Experience: 3-10 years	9.970**	(2.46)	11.42**	(2.75)
Experience: 11-25 years	1.253	(0.21)	5.113	(0.59)
Experience: 26 years or more (baseline)				
Attend Previous Training	11.91**	(3.23)	-0.0541	(-0.02)
Cert No	-6.817	(-1.27)	2.31	(0.70)
Cert Not Sure	-29.13***	(-3.63)	-5.053	(-0.66)
Large Farm	5.207	(1.20)	9.508***	(3.38)
2015	-7.397***	(-4.00)	2.013	(0.84)
Constant	56.95***	(5.51)	55.87***	(7.11)
Observations	73		73	

Empirical Strategy

- Absence in post test:

$$Absence_i = f(\boldsymbol{X}_{person,i}, \boldsymbol{X}_{farm,i}, y_{pre,i}, AbsenceRate_i, \boldsymbol{D_t})$$

- Absence Rate:

$$AbsenceRate = \frac{\#\ of\ post\ test - I(Absence)}{\#\ of\ pre\ test - 1}$$

- Year dummies
- Clustered standard errors
- Sub-sample: 2014-2015
- Probit regression

Evidence of Training Interests and Time Constraints

Exclude Baltimore County (2014) & 2016	All		Farmers	
Pre Score	0.0291**	(2.37)	0.0203	(1.56)
Female	1.381***	(2.59)	1.083***	(2.64)
Age 24 and younger (baseline)				
Age 25-44	4.202***	(6.66)	4.121***	(5.02)
Age 45 or over	4.061***	(7.71)	4.315***	(7.10)
Completed College	-0.2	(-0.33)	-0.325	(-0.50)
Farmer	-3.999*	(-1.86)		
Farmer × Cert Not Required	4.410*	(1.88)		
Cert Not Required	2.102	(1.14)	4.785**	(2.08)
Absence rate	28.08**	(2.14)	21.67**	(2.43)
Cert Not Required × Absence rate	-28.14**	(-2.10)	-21.03***	(-2.63)
Attend Previous Training	-0.215	(-0.47)	-0.094	(-0.24)
2015	-1.137	(-1.40)	-0.777	(-1.07)
Constant	-9.356***	(-4.31)	-11.35***	(-5.52)
Observations	88		77	

Main Findings

1. Participants perform better before training in later years.
2. Participants from large farms did not perform significantly better before training, but they improved more after training.
3. Some participants have difficulty learning new information on food safety practices because of the lack of background knowledge or willingness to change.
4. Some are more interested in writing food safety plan; some are not.
5. Some participants face time constraints.

Main Findings

- **Suggestions**
  - Extend the lecture sections.
    - Alleviate time constraints in lectures
    - Introduce more background information on farming
    - Accommodate different interests
    - Encourage participation
  - Address “willingness to change” problem by explaining why the conventional practices are not sufficient.

Main Findings

- **Produce Safety Rules Implications**
  - Mandatory training is helpful. Farmers from large farms are not significantly more knowledgeable before training.
  - Farmers from large farms, which cannot be exempt from the new produce safety rules, are likely to understand the new requirements better after training.
- **Caveats**
  - Decision to participate
    - Introducing background knowledge on farming and motivating farmers to improve their farming practices are more important in produce safety rules training.
  - Tests for evaluation purpose

Next Steps

- Examine long-run effect by looking at farm certification outcomes
  - Follow-up surveys (2015-2017)
  - MDA and USDA records of certified farms
- Collecting information on GAP certification, produce safety rules compliance, and farm income