Model Farmers: A Culturally Relevant and Scientifically Sound Injury Prevention Program

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Improving Worker Health among AI/AN

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acknowledgements

- Shiprock Extension Service, U AZ
- San Juan Extension Service, NMSU
- Navajo Nation Department of Agriculture
- Navajo Nation Department of Environmental Health
- Shiprock Area Chapters Grazing Committees
- Indian Health Service, Shiprock
- Navajo Nation Farm Board
- Navajo Nation Water Board
- Northern Navajo Agency Council
- Navajo Nation Human Research Review Board
- University of Texas Health Sciences Center, Tyler
- National Institutes of Occupational Health and Safety (**CDC U50 OH0754-01**)

background

- Farmers have the highest injury rate of all occupations
- A stakeholder group was formed 10 years ago to collaborate on an agricultural injury prevention initiative
- During the first five years, preventing pesticide exposure and increasing safety knowledge, attitudes and behaviors was identified as a high priority for the stakeholder group
- Formative research conducted in the first five years identified traditional ways of learning farming
- This information was used by the stakeholder group to develop an intervention and write a grant to NIOSH

community-university partnership

- *Stakeholder group* – Individuals representing four Navajo Nation communities that comprise the majority of Shiprock Agency farms
- *University of New Mexico* – Deborah Helitzer
- *New Mexico State University Cooperative Extension Service* – Gary Hathorn
- *Shiprock Area Cooperative Extension Service* (University of Arizona) – Jeannie Benally

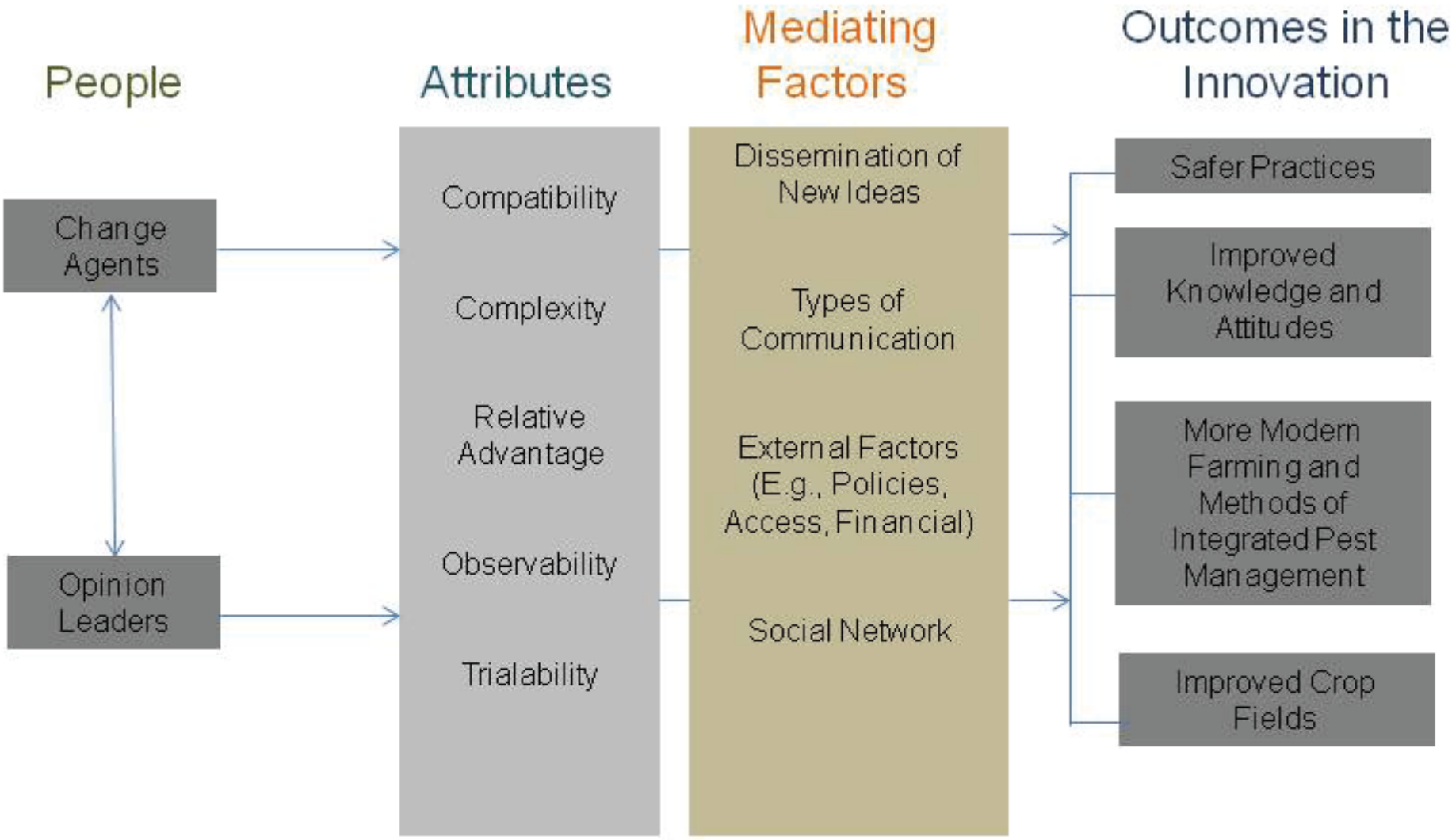
specific aims

- Enhance the capacity of Navajo Model Farmer "*change agents*"
  - Provide training to selected farmers to be certified crop inspectors
- Conduct a randomized treatment/control study with Navajo farmers in a 3-ditch system area
  - Assess the effectiveness of best management practices and pesticide safety application procedures on farm yield and safety behaviors.
- Evaluate chemical contaminants levels in ditch water to determine if study is causing harm
- Develop recommendations about "model farms" and training approaches that can be used to disseminate best practices to neighboring farmers on the Navajo Nation.

theoretical foundations

- Diffusion of Innovations Theory (Rogers, 1962)
  - 5 main elements that influence the spread of a new idea: the type and mechanism of the decision: **innovation, communication channels, time**, and a **social system**
  - The type of decision (**optional, collective**, or **authority driven**)
  - Mechanism of decision: Individuals progress through 5 stages: **knowledge, persuasion, decision, implementation**, and **confirmation**
  - Innovation "attributes" (**trialability, observability, relative advantage, compatibility**, and **complexity**)
  - Type of communication channel: the means by which messages get from one individual to another (e.g., face-to-face, mass media, social network communication)
  - Time = the rate of adoption – the relative speed with which an innovation is adopted by members of a social system
  - Social system: a set of interrelated units that are engaged in problem solving to accomplish a common goal

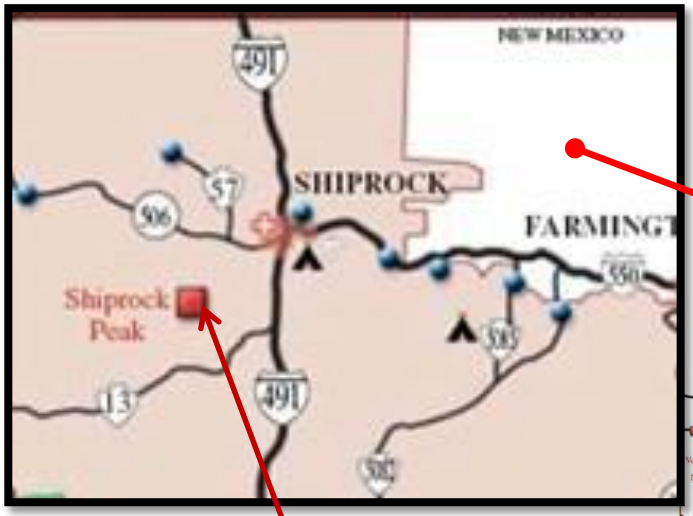
theoretical framework

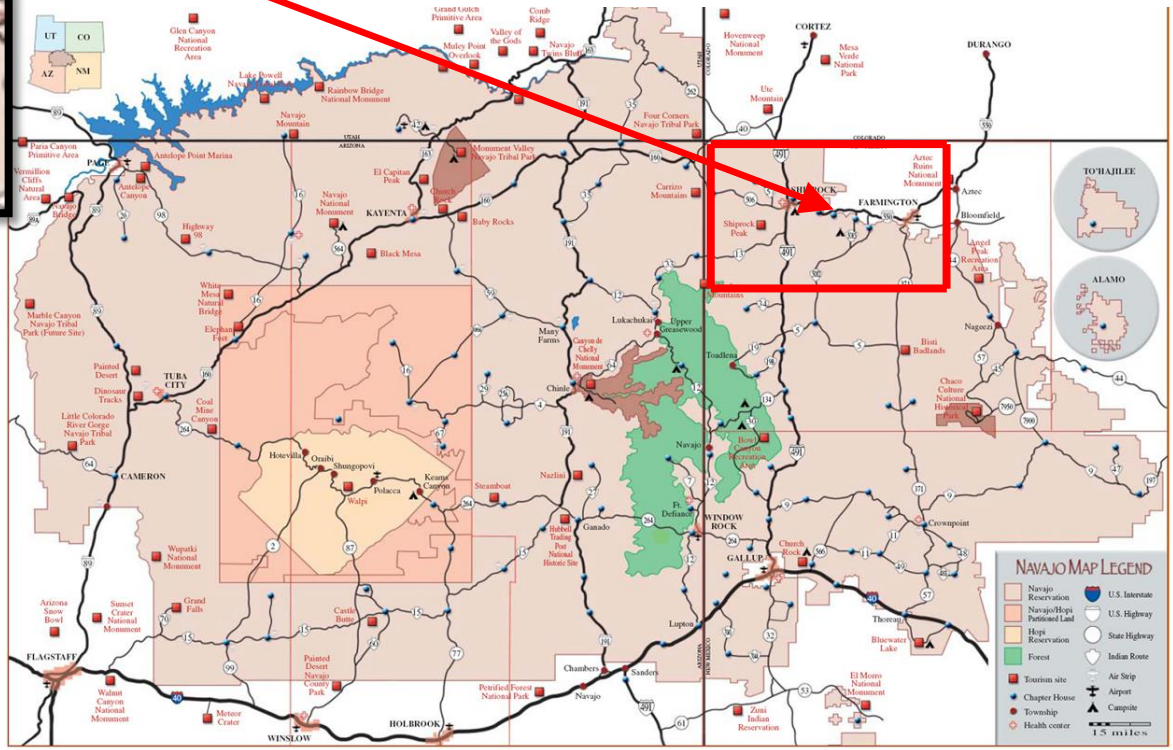


application of theory

- Type of Decision: optional innovation-decision
- Attributes of the Innovation:
  - Observability
  - Compatibility
  - Trialability
  - Relative Advantage
  - Complexity
- Type of Communication: Face-to-face by Model Farmer "Opinion Leaders"
- Social System:
  - Navajo farmers in **3 drainage system area** within Shiprock Agency (Cudei, Fruitland, Hogback).
  - **6 Chapters** within the Shiprock Agency (Upper Fruitland, San Juan, Nenahnezad, Hogback, Shiprock and Cudei).
  - There are approximately **800 farmers** in this area, and **8,907 acres**.

map of Navajo Nation Shiprock Agency





intervention content

- Identify Opinion Leaders (Hathorn and Benally)
- Identify Change Agents - Model Farmers from 3 drainage areas in 4 chapters: Cudei, Fruitland, Shiprock and Hogback
- Train Model Farmers and certify them as crop specialists
- Design training program for farmers (farm families)
  - Proper use of Integrated Pest Management (IPM) techniques including pesticides
  - Knowledge about benefits of IPM use and safe storage of pesticides
  - Discussions about IPM "attributes"
  - Use of demonstration plots for "observational learning"
  - Model Farmers' "role modeling"

study design

- 2 Groups: First Intervention and Delayed Intervention
- 120 farmers, 60 in each group
- Cross-over design
  - Group 1 (early intervention) trained in years 2-3, maintenance in years 4-5
  - Group 2 (delayed intervention) control group in years 2-3, trained in years 4-5
- Two types of training: F2F plus workshops; F2F only

evaluation measures

- **Walk through observations** of farms to observe pesticide storage, protection measures, and safety behaviors
- **Pre/Post test about knowledge and attitudes** related to IPM
- Training workshop **attendance**
- Crop Yield (**demonstration and check plots**)
- **Chemical assessment of ditch water** 2x/annually

timing of measures

Group		2008	2009	2010	2011
Group 1		**Pre-training**	**Post-training**	**Maintenance**	**Maintenance**
	Walk-through analysis	✎	✎	✎	✎
	Knowledge and Attitude Survey	✎	✎	☒	✎
	Agricultural Yield (Apr and Sept)	✎	✎	✎	✎
		Pre-training		**Pre-training**	**Post-training**
Group 2	Walk-through analysis	✎	☒	✎	✎
	Knowledge and Attitude Survey	✎	☒	✎	✎
	Agricultural Yield (Apr and Sept)	✎	✎	✎	✎

model farmer training

demonstration plots

Field grown as usual

Demonstration Plot

data analysis

- Walk through Analysis:
  - Log-likelihood Test for Goodness of Fit tests (rather than chi-square)
  - Regression analysis for improvement over years
- Pre/Post Test Analysis
  - Two sample *t*-tests compared scores between groups
  - Paired sample *t*-tests compared scores within groups

results

- population sample
- behaviors
- knowledge
- attitudes
- crop yields
- chemical contamination

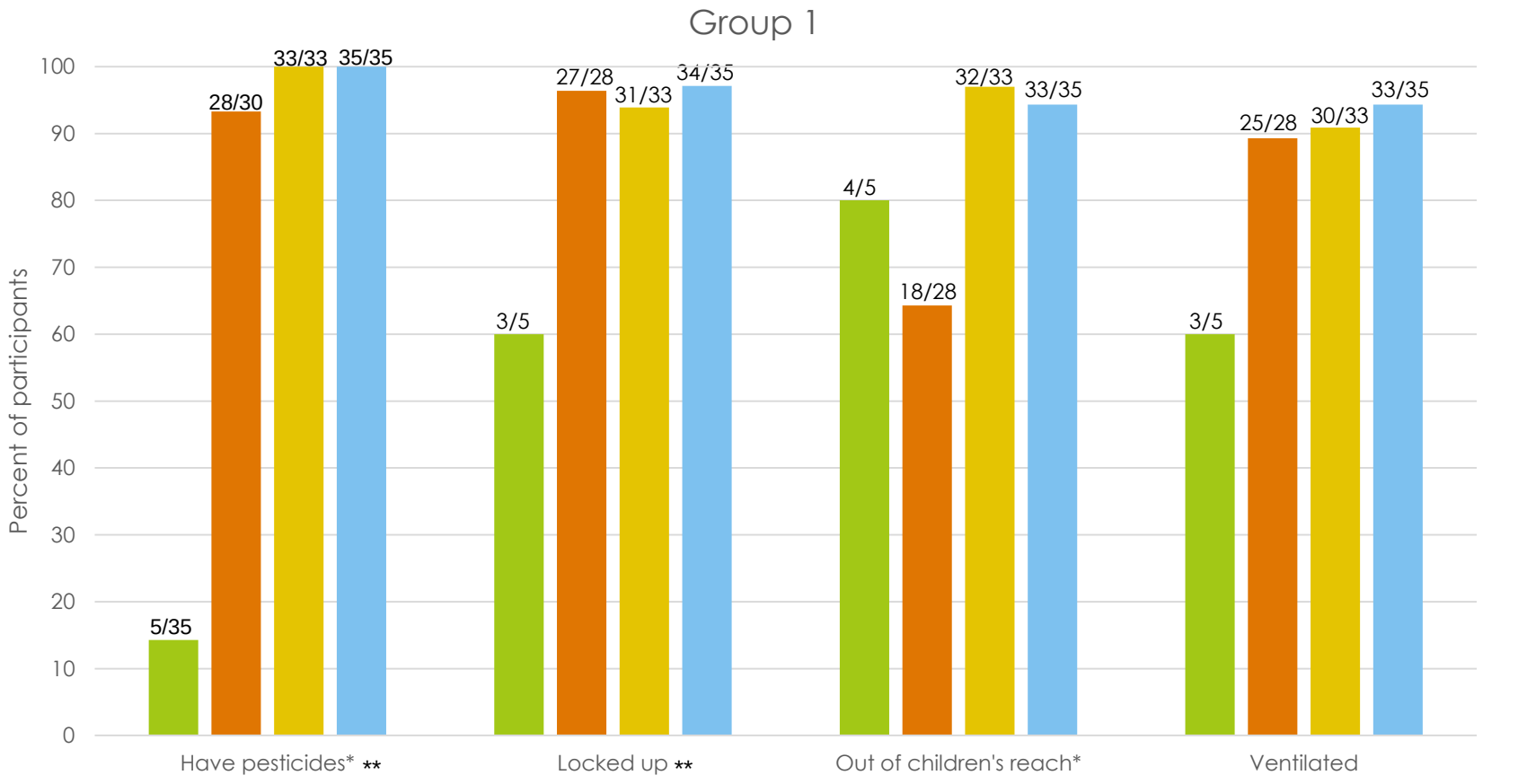
population sample

Chapter	Farms N (%)	Model Farmers	Group 1	Group 2
Upper Fruitland	318 (40%)	2	20	20
Hogback and Shiprock	438 (54%)	3	30	30
Cudei	47 (6%)	1	10	10
Total	803	6	60	60

safety and storage behaviors

early intervention farmers

* Significant across years
** Significant between 2008 and 2009

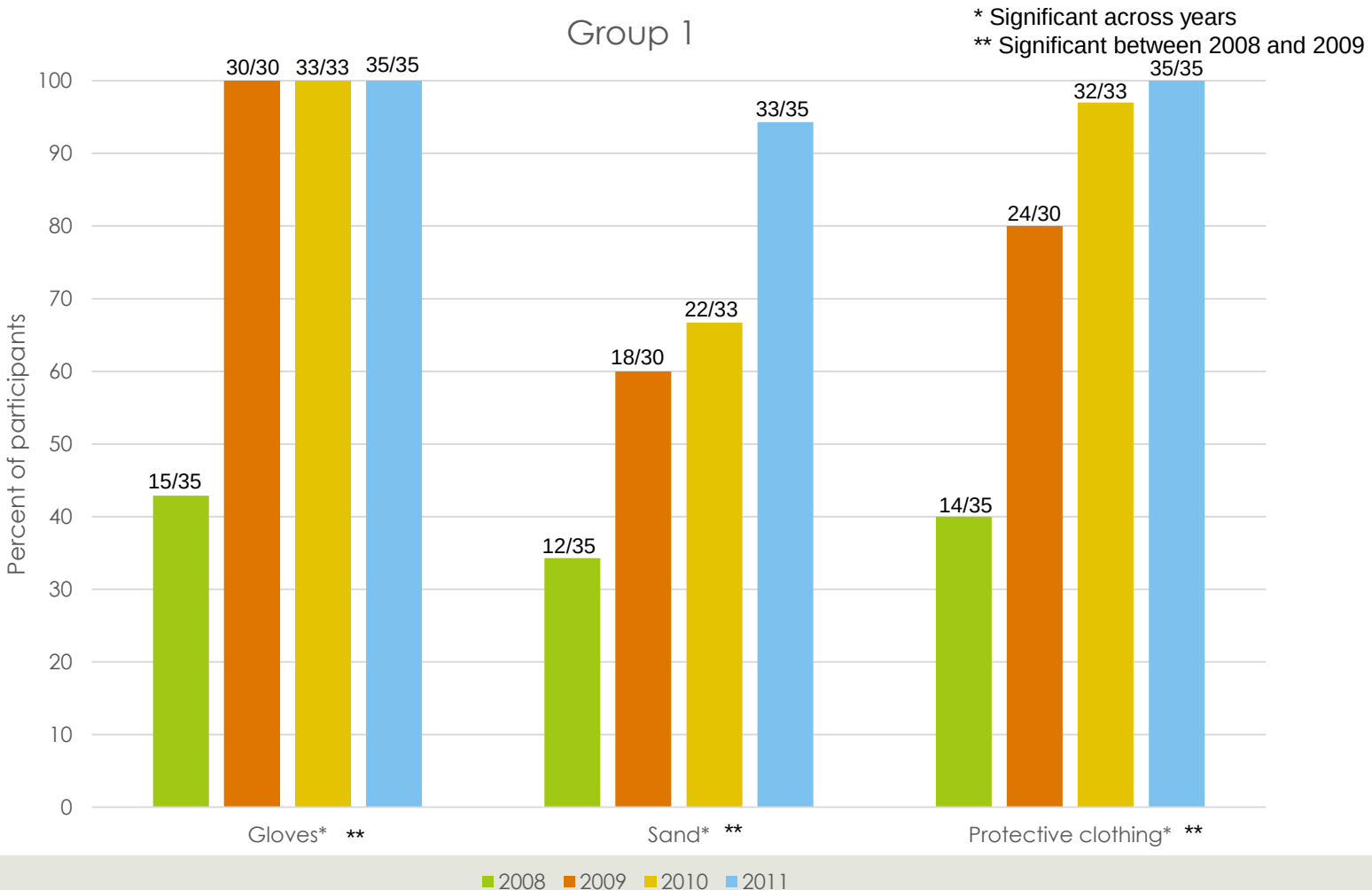


safety and storage behaviors

delayed intervention farmers

safety and storage behaviors

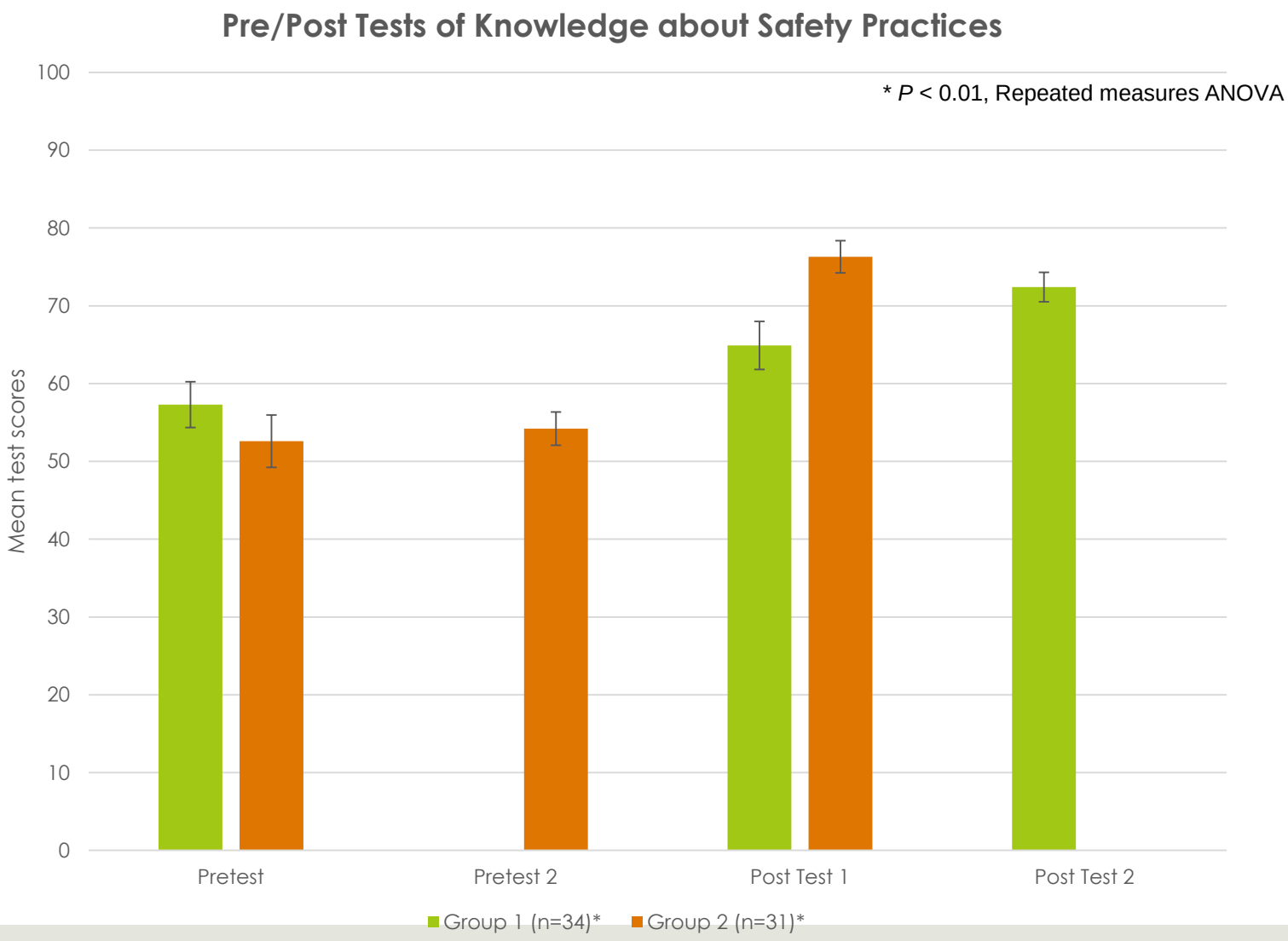
early intervention farmers



safety and storage behaviors

delayed intervention farmers

knowledge about safety practices



knowledge about safety practices

- At baseline there were **no significant differences** between early (Group 1) and delayed (Group 2) intervention groups in mean scores
- Early intervention group **mean scores significantly increased** from pre-test scores to first post-training scores and to final training scores
- **Mean change in scores** was significantly greater in Group 2 (23.7 [SD 15.4]) than Group 1(15.2 [SD 16.1])

Group	Pretest	Pretest 2	Post Test 1	Post Test 2
Group 1 (n=34)	57.3 (± 17.2)		64.6 (± 18.0)	72.4 (± 11.0)
Group 2 (n=31)	52.6 (± 18.8)	54.2 (± 11.9)	76.3 (± 11.5)	
	NS ($p \leq 0.38$)		$p < 0.001$	$p < 0.001$

effects of training type

No significant differences in knowledge scores were found among individuals based on training type

Group		Trained Model Farmer + Workshops	Trained Model Farmer No Workshops
Group 1	Pre-test	58.7 (± 16.4)	47.8 (± 22.3)
	Post-test	63.1 (± 17.0)	60.0 (± 19.0)
	Final Post-test	75.6 (± 3.2)	70.54 (± 11.4)
Group 2	Pre-test 1	64.6 (± 17.8)	50.0 (± 17.8)
	Pre-test 2	59.6 (± 10.0)	54.3 (± 11.6)
	Post-test	78.6 (± 12.1)	76.0 (± 11.3)

attitudes towards IPM

37. Integrated pest management techniques **work well with** the other methods I use for farming.

38. It is **simple to watch** others applying pesticides.

39. It is **easy for me to try** using pesticides.

40. Pesticide application is **too complicated for me** to learn to do it correctly.

41. Pesticide application is **better than other methods** I have used to kill weeds, insects, and gophers.

42. I know other **farmers who agree** that using pesticides is a good thing for our farms.

43. Other farmers think that using pesticides **does not fit with the traditional ways** of farming.

44. Farmers **spend time talking about** using pesticides with other farmers.

45. Using pesticides will make **my farm more productive**.

46. There is someone **I can go to for help** or to ask questions about using pesticides on my farm.

change in attitudes

Group		Changes Across Years 2008-2011	
			p
Group 1	Compatibility	12.61	< 0.005
	Relative Advantage 1 *(better than other methods)*	10.79	< 0.005
	Relative Advantage 2 *(makes my farm more productive)*	15.54	< 0.001
	Social Network Practices 2 *(other farmers think using pesticides does not fit with traditional ways)*	6.48	< 0.05
	Social Network Communication *(there is someone I can go to for help or to ask questions)*	15.39	< 0.001
Group 2	Compatibility	11.60	< 0.005
	Social Network Practices 1 *(I know farmers who agree that using pesticides is good for our farms)*	6.52	< 0.05
	Social Network Practices 2 *(other farmers think using pesticides does not fit with traditional ways)*	6.71	< 0.05

crop yield, chemical contamination and injury

- Corn yields increased by **59.13%** on average
- Alfalfa yields increased by **44.66%** on average
- No chemical contamination was detected over 8 samples (Sept/March each year)
- No pesticide-related injuries/exposures during project period

conclusions

- An intervention based on behavior change theory can impact knowledge, attitudes and behavior
- Significant positive changes were seen in pesticide use, storage behaviors, safety equipment and application equipment
- Significant positive changes were seen in knowledge
- The addition of external workshops as a training method did not improve farmer knowledge
- Attitudes about communication channels were significantly changed during the study
- Attributes of the intervention: **Relative Advantage**, **Compatibility**, **Social Network Practices** and **Social Network Communication** were significantly improved during the study
- Crop yields increased significantly in intervention periods
- No chemical contamination occurred

manuscripts

- Helitzer D, Willging C*, Hathorn G, and Benally J*. "Building Capacity of Community Stakeholders to Prevent Agricultural Injury: A Case Example with Navajo Farmers and Ranchers. *J of Agricultural Safety and Health*, 2009, 15(1): 19-35, PMID 19266882.

- Helitzer D, Willging C*, Benally J*, and Hathorn G. Logic Models for Occupational Injury Intervention Planning and Evaluation. *Public Health Reports*, July/August 2009; 124:4, PMID 19618808.

- Helitzer DL, Gilmore K, Benally J. Children's Safety on Native American Farms: Information and Recommendations. *Journal of Agromedicine* 2012, 17(2): 251-258. DOI: 10.1080/1059924X.2012.658011 PMID: 22490038

- Helitzer DL, Hathorn G, and Benally J, Ortega C. A Culturally Relevant Model Program to Prevent and Reduce Agricultural Injuries. *Journal of Agricultural Health and Safety* 2014; 20(3):175-198 PMID 25174150

for more information

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