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Applying the Consolidated Framework for implementation research to agricultural safety and health: Barriers, facilitators, and evaluation opportunities☆

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ABSTRACT

Objectives: Within agriculture, forestry, and fishing safety and health research, little progress has been made to implement evidence-based interventions into practice. Beginning in the early 2000s, much work has been done to address the leading cause of agricultural fatalities: tractor overturns. In this time a Rollover Protective Structure Rebate Program has been developed to assist farmers in installing safety equipment to prevent these fatalities. In the current study, the Consolidated Framework for Implementation Research is adapted so that it may be used to evaluate and improve the scaling up of this intervention.

Methods: Each construct specified in the Consolidated Framework for Implementation Research was incorporated into a survey, which was distributed to a 77 member Coalition of agricultural stakeholders. Stakeholders were asked to rate each construct based on how important the individual felt it was to the implementation of the National ROPS Rebate Program on a scale of 1 (not at all important) to 5 (extremely important).

Results: Using the mean score for each construct as a starting point, 23 constructs were selected for inclusion in an evaluation tool which will be used, in future studies, to evaluate the implementation of the National ROPS Rebate Program.

Conclusions: Though the Consolidated Framework for Implementation Research was designed for use in the clinical setting, this study is a first step in applying it to occupational health and safety. The insight gained through this study will provide a foundation for future work on this initiative, as well as in public health.

1. Introduction

When it comes to appropriate integration of research results in the areas of occupational safety and health, there is often a disconnect between research and widespread implementation of evidence-based practices (Howard, 2009; Fiske and Earle-Richardson, 2013; Elkind, 2007; The National Academies, 2008; Bero et al., 1998; Gagliardi et al., 2015; Glasgow et al., 2003). In this case, we consider evidence-based practices that have proven to specifically minimize injuries and mortalities in the highest risk occupational sector in the United States: agriculture, forestry, and fishing. In order to bridge this gap, methods for guiding, informing, and evaluating widespread implementation efforts are needed. Though some of the earliest implementation studies began in agricultural settings (Rogers, 2003), researchers and practitioners in this field have not yet documented active pursuit of widespread implementation of health and safety related evidence-based practices according to a literature review conducted by Tinc et al. (Tinc et al., 2017).

Though there are few documented attempts to achieve widespread implementation of evidence-based practices in the agriculture, forestry, and fishing arena, there is evidence that researchers have applied implementation models in more localized settings. Recently, the RE-AIM framework (Glasgow et al., 2001) was used to implement a farm safety program, which originated in the mid-western United States, to South

☆ The findings presented in this manuscript have not been reported elsewhere nor is the manuscript under review elsewhere. The authors have full control of the data presented and are able to make it available in aggregate form as needed.

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Carolina (Storm et al., 2016). The authors of the study suggested that while RE-AIM was useful in its original form, the study would have benefitted from tailoring the framework to their specific implementation setting (Storm et al., 2016).

Given the lack of widespread agriculture, forestry, and fishing implementation examples, the authors have looked to the realm of clinical research for guidance in examining the process of widespread implementation. Within the clinical field, much work has been done in implementation science, which is defined as "the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services (Bauer et al., 2015)." As a result, several frameworks and theories for advancing the field have been developed (Glasgow et al., 2001; Damschroder et al., 2009; Rajan et al., 2012; Kilbourne AM, Neumann et al., 2007; Nilsen, 2015; Chamberlain et al., 2011; Feldstein and Glasgow, 2008; Tabak et al., 2012; Trochim et al., 2011; Waltz et al., 2014).

One such framework is the Consolidated Framework for Implementation Research (CFIR). Like RE-AIM, the CFIR provides a framework for researchers attempting to link implementation process to outcomes and a means of evaluating implementation of evidence-based practices. The CFIR combines twenty smaller implementation theories, into one comprehensive framework (Damschroder et al., 2009). The CFIR was designed so that it could be adapted and applied in a variety of settings to encourage consistency in evaluation and reporting of translational efforts (Damschroder et al., 2009). In addition to helping users understand what works, or doesn't work, in implementation research, the qualitative-based CFIR is unique in that it also helps researchers understand why and how implementation processes work (Damschroder et al., 2009; CFIR Research Team, 2017).

In total, the CFIR contains 26 constructs (three of which include a total of 14 sub-constructs) divided into 5 domains: characteristics of individuals, inner setting, intervention characteristics, outer setting, and process (Damschroder et al., 2009). In addition, seven supplemental outcome constructs were developed to help users more fully plan and evaluate implementation efforts (Proctor et al., 2011). These supplemental outcome constructs are divided into two domains: implementation outcomes and client outcomes (Proctor et al., 2011). Fig. 1 shows the distribution of domains and constructs for both the CFIR and supplemental outcome constructs. Throughout this manuscript, both constructs and sub-constructs will simply be referred to as constructs, and discussion of the CFIR will include not just CFIR constructs but also the supplemental outcome constructs.

1.1. Research context

This paper describes our application of the CFIR to the expansion of an evidence-based Rollover Protective Structure (ROPS) Rebate Program (Sorensen et al., 2009, 2014, 2010, 2008; Tinc et al., 2015, 2016; Center, 2017), which provides financial assistance to farmers who wish to install life-saving ROPS kits on their tractors. Among US farmers, tractor overturn fatalities are the number one cause of death each year (Murphy et al., 2010); when used with a seatbelt, ROPS are 99% effective in preventing these tragic fatalities (Swenson, 2004). Though ROPS are standard on newer equipment, tractors manufactured prior to 1985 did not include ROPS and must be retrofitted (Tinc et al., 2016; ASABE, 2014). Retrofit ROPS kits are available to farmers; however, barriers to retrofitting, such as cost and sourcing difficulties, stand in the way.

The ROPS Rebate Program was launched in New York in 2006 (Center, 2017). This program is voluntary and provides farmers with assistance identifying the proper ROPS kit for their specific tractor. The Program also provides a rebate of approximately 70% of the cost of the ROPS kit, shipping, and professional installation with a cap on out-of-pocket expenses (Sorensen et al., 2008; Center, 2017). In surveys conducted with every fourth participant approximately six months after completion of the ROPS installation, 99% say that they would recommend it to another farmer (National ROPS Rebate Program, 2017). Since launching in 2006, the ROPS Rebate Program has expanded to six additional states: Vermont, New Hampshire, Massachusetts, Pennsylvania, Wisconsin, and Minnesota. To date, more than 6200 farmers have signed up for the Program and more than 2300 farmers completed ROPS retrofits in these seven states (National ROPS Rebate Program, 2017). An additional 148 farmers have inquired about the Program from other states.

In 2014, ROPS Rebate Program facilitators, who administer the ROPS Rebate Program, invited a multi-sector group of agricultural stakeholders to a two-day Future Search workshop (Tinc et al., 2015). During this workshop, the group developed a joint plan for expanding the Program into the National ROPS Rebate Program. This group, which is now known as the National Tractor Safety Coalition, continues to work together to pursue this goal. The Coalition is populated with representatives from a wide range of sectors, including equipment manufacturers and dealerships, insurance agencies, health and safety organizations, agricultural organizations, government organizations, and media outlets, as well as farmers and farm safety advocates, university-based engineers, and ROPS Rebate Program experts. Given this expansive representation, the Coalition is well-positioned to encourage the launch of the National ROPS Rebate Program (Sorensen et al., 2014; Tinc et al., 2016). The Coalition is led by a 15-member steering committee, which is representative of the Coalition at large and includes the ROPS Rebate Program facilitators.

This study was designed to examine the efficacy of the CFIR as a framework for monitoring the implementation of an agricultural health and safety evidence-based practice, i.e. the National ROPS Rebate Program. This manuscript describes the first step of applying the CFIR to agricultural health and safety implementation studies, including: (1) determining which CFIR constructs are applicable in non-clinical

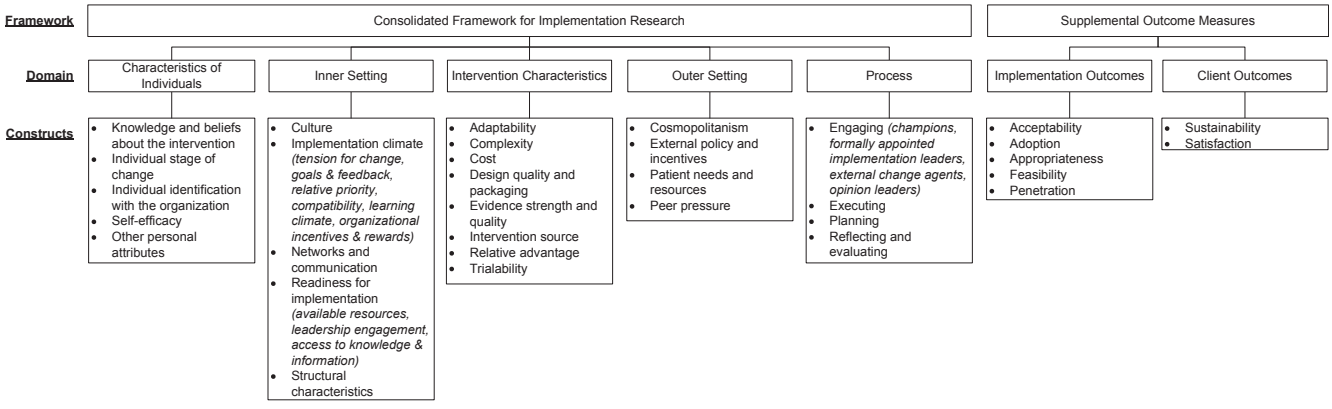

Fig. 1. Domains and constructs within the Consolidated Framework for Implementation Research (13) and supplemental outcomes (23).

settings, specifically implementation of the National ROPS Rebate Program; and (2) developing evaluation tools (including a survey and passive data collection tools) to capture useful measures of the CFIR domains over time. Useful CFIR measures would be ones that are predictive of, related to or associated with positive outcomes of the National ROPS Rebate Program implementation, such as an increase in the number of ROPS orders.

2. Methods

2.1. Survey development for construct selection

Given that a literature review did not yield any studies documenting widespread implementation efforts in agriculture, forestry, and fishing or in relation to adapting the CFIR (Tinc et al., 2017), the authors used their own understanding of implementation science and the agriculture, forestry, and fishing setting to make initial revisions to the CFIR model and its definitions (Damschroder et al., 2009) so that they could be applied to a non-clinical setting. Modifications at this stage largely involved removing clinical terminology. The CFIR was organized into a construct selection survey which asked respondents to rate each construct on an ordinal scale (from 1: the construct would not impact implementation of the National ROPS Rebate Program to 5: the construct would have a strong impact on implementation). At this stage, the survey included 43 questions directly related to CFIR constructs, which were organized into seven sections labeled with each domain name. In addition, the survey included two open-ended summary questions. In collecting information through such a survey, a wide range of backgrounds and experiences can be taken into account while narrowing the focus of the CFIR for the implementation of the National ROPS Rebate Program.

2.1.1. Validating survey questions

Ten Coalition members were invited to participate in short interviews via telephone, which served as a pilot-test for the construct selection survey. These ten individuals were selected as they represented diverse stakeholder groups as well as varying levels of involvement in the Coalition. Due to a low response rate (two respondents out of ten), an invitation to participate was extended to all Coalition members. Participants were selected on a first come-first served basis, though an effort was made to ensure that participants represented several different sectors. A total of six individuals including one state department of health employee, one university-based engineer, one insurance agent, and three agricultural safety and health professionals (with foci in both research and outreach) participated in this pilot.

Each participant was emailed a copy of the survey prior to a conference call. The survey questions were divided into six question groups, each of which contained one or two constructs from each CFIR domain. All question groups also included summary questions and the survey. Each participant was assigned a question group.

At the time of the call, the lead author used 'Think Aloud' interview techniques (Charters, 2003) to solicit information about participants' perceptions of the questions, as well as to identify any issues with understanding or responding to the questions. To achieve this, the interviewer first began with the survey introduction and instructions. Participants were asked to provide their understanding of what was being asked in the survey, as well as any comments about these sections. Next, individual questions were reviewed. The interviewer asked each participant to: (1) describe what (s)he felt each question was asking, and (2) verbally walk through the thought process used to answer each question. If a participant indicated that a question was particularly difficult to answer, they were prompted to elaborate on the "why." Interviews were not recorded; however, detailed notes were taken by the first author.

2.1.2. Development of the final construct selection survey

Once all interviews were completed, the authors used the information to develop a final version of the construct selection survey. Changes pertained to the phrasing of the instructions and questions. In addition, the domain titles were removed from the survey to reduce confusion. The final construct selection survey took approximately 15–20 min to complete and consisted of 47 questions. This included 45 questions with ordinal-scale responses and two open ended questions in which participants could further reflect on the constructs presented or provide suggestions for other factors to consider.

Each scaled question was reflective of one of the 43 CFIR constructs. Two constructs, *leadership* engagement and *formally appointed implementation leaders* were allocated two questions each to distinguish between the National Tractor Safety Coalition Steering Committee and the National ROPS Rebate Program facilitators. Participants were asked to rate (from 1: not at all important to 5: extremely important) each construct based on their opinion of how important it was to implementing the National ROPS Rebate Program. The order of these questions was randomized for each participant to reduce the impact of both response fatigue and priming bias.

2.2. Data collection

2.2.1. Survey distribution

The construct selection surveys were distributed to all 77 Coalition members (representing all different agricultural safety stakeholders) via several channels, as suggested by Dillman, et al. (Dillman et al., 2014). Initially (day 1), surveys were distributed to all Coalition members via individualized emails which contained several key components: (1) the link to the web-based survey form, (2) an explanation of the overall study and survey purposes, (3) instructions for completing the survey, and (4) information about participants rights and contact information for the research team and the Institutional Review Board.

After one week (day 8), all Coalition members were again emailed. This message largely contained duplicate content and served as a thank you to those who already responded and a reminder for those who had not. One week later (day 15), mailings were sent to non-responders. This letter contained the same information as the previous emails, as well as a hard-copy of the survey and a postage-paid, addressed return envelope. Mailing addresses were not available for five individuals; a third email request was sent to these individuals instead. Two weeks after the mailed reminders were sent (day 23), an information specialist conducted telephone follow-ups with those who had still not responded. Each individual was contacted one to two times within an one-week period, depending on whether or not the caller had been able to speak directly to the participant during the first attempt, as well as whether or not the participant had completed the survey by the second round of calls. The survey was closed five weeks after the original request was sent (day 36).

2.2.2. Institutional review

This study was reviewed and approved by the Mary Imogene Bassett Healthcare Network IRB. A waiver of written informed consent was granted by the IRB given the survey mode; instead, consent was assumed for those completing the survey. Responses from both the think aloud interviews and surveys were de-identified prior to analysis.

As thanks for their time, construct selection survey participants were given a raffle entry toward a $1000 Amazon gift card. Participants were also advised that the drawing for this raffle would take place approximately two-years later, and that additional raffle entries could be obtained through the completion of seven additional surveys (for a total of eight tickets per person), which would be distributed periodically in that time frame.

2.3. Data analysis & evaluation development

Three of the authors [blinded for review] developed a process to identify the final CFIR constructs that will be measured over the period of time that the National ROPS Rebate Program is implemented; the other authors were also asked to provide feedback when necessary. To ensure that the final set of CFIR constructs were manageable for the research team and participants, the goal was to select between 20 and 25 constructs.

To achieve this goal the following selection process was conducted:

1. Identification of the highest rated constructs within each domain, and inclusion of constructs with a rating of 4.25 or higher.
2. Individual selection of constructs: The three authors individually selected the constructs that they deemed to be important to evaluate throughout the implementation process, regardless of their rating. These lists were reflective of each individual's diverse background (public health, anthropology, and medicine) and varying experience in implementation science research and allowed for other, lower-ranking constructs to be brought in if deemed important.
3. Open discussion, achieving consensus, and final selection: The three lists were then combined and discussed in terms of the "bird's eye view" of the National ROPS Rebate Program and its implementation process, and consensus was reached in order to determine the most appropriate constructs to include in the final evaluation instrument. This includes consideration of: NIOSH and R2P Program goals; the dynamics, goals, and processes of the Coalition; and the administrative processes related to facilitation of the National ROPS Rebate Program. As a result of this discussion, some of the higher ranking constructs were excluded from the evaluation, and the authors agreed to include some of the lower ranking constructs (introduced through the individual lists). Examples are provided in the results section.

Once the final constructs were selected, the evaluation design and data collection were developed based on prior CFIR research and recommended measures (CFIR Research Team, 2017). Fig. 2 summarizes the entire construct selection process.

3. Results

3.1. Survey validation

Upon conducting 'Think Aloud' interviews to pilot test the construct selection survey, all six participants voiced the same concern with the survey: the language was too complex, which made it difficult for those unfamiliar with the concepts to answer the questions. In addition, during all interviews, participants regularly answered questions differently than how the authors had intended. Most commonly, this occurred when participants felt as if the goal of a construct had already been met. For example, participants would indicate that because *x construct* has already been achieved, it could not have an impact on implementation, even if the construct outcome had the potential to change over time. To better understand this issue, the applicable questions were rephrased and discussed. These discussions again alluded to the complexity of the language used, as well as some minor issues with the survey instructions that had not previously been detected. In developing the final construct selection survey, these issues were addressed. Because saturation was reached with these six participants no further interviews were conducted.

3.2. Survey results

The final construct selection survey was distributed to 77 Coalition members, 54 (70%) of whom responded. Respondents were representative of the nine stakeholder groups represented on the Coalition (Fig. 3).

The average rating for each construct is shown in Table 1, these scores ranged from 3.11 to 4.78. These scores are based on a scale of 1 (not at all important) to 5 (extremely important).

3.3. Construct selection

Using the process defined above, 23 constructs were selected for inclusion in the final evaluation instrument. These constructs are bolded in Table 1. Though most often the highest rated constructs (4.25 and above) within each domain were selected for inclusion, there were some exceptions, as described below:

3.3.1. Intervention characteristics

Within the intervention characteristics domain, no constructs ranking below 4.25 were included in the final evaluation instrument. Only *adaptability (4.27)* was excluded from the final evaluation instrument. This was due to the nature of the intervention; as the National ROPS Rebate Program is a scaled-up version of the evidence-based practice, i.e. the ROPS Rebate Program, rather than individually adapted programs, the authors did not feel that adaptability was relevant.

3.3.2. Inner setting

As the implementation of the National ROPS Rebate Program is a collaborative effort driven by the Coalition, seven inner setting constructs were selected for inclusion in the final evaluation instrument. *Available resources (4.67), leadership engagement (4.45),* and *tension for change (4.43)* rated above 4.25 and were therefore all included. In addition, several lower-ranking inner setting constructs were included during the construct selection process Fig. 2. These constructs included *access to knowledge and information (4.19), networks and communication*

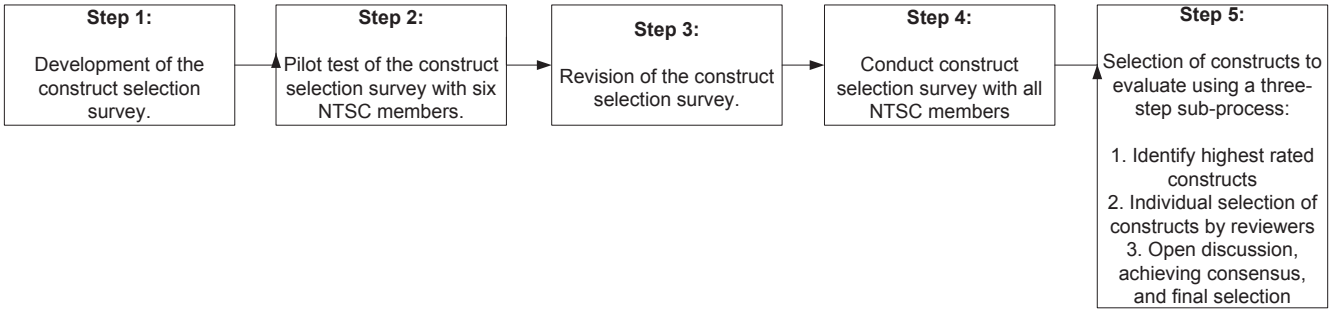

Fig. 2. Construct selection process.

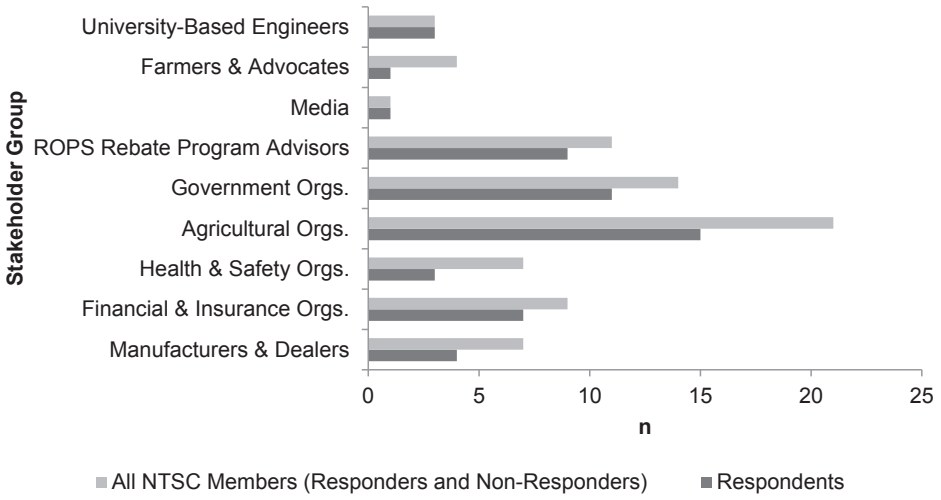

Fig. 3. All NTSC membership (n = 77) and construct selection survey respondents (n = 54) by primary stakeholder group.

(3.98), culture (3.76), and *structural characteristics (3.59)*.

As the National ROPS Rebate Program progresses, changes in the CFIR constructs will be tested for association with the change in number of ROPS shipments over time. Among other factors, change in ROPS shipments will reflect the target population's knowledge of the Program. As a result, the authors decided it was important to include *access to knowledge and information* in the final evaluation instrument, as partners within the Coalition will not be able to share information with target audiences if they do not have access to it. Similarly, the authors also decided that because the implementation is Coalition-driven and the NIOSH R2P initiative (National Institute for Occupational Safety and Health, 2015) focuses on collaborative efforts, the *networks and communications* construct should be included.

The authors believed that because implementation science is a new area for Agriculture, forestry, and fishing researchers, monitoring and evaluating *structural characteristics* (including the Coalition, as well as components such as telephone systems, databases, etc.) was necessary. By doing so, the authors will later be able to provide guidance to other researchers about the resources required for scaling up interventions.

Finally, *culture* was included as it is often a vital component of public health initiatives (May et al., 2016; Kelley et al., 2012). Though this construct was designed to evaluate stakeholder culture, the research team will be exploring how stakeholder culture reflects that of the target population (and farmers' willingness to take advantage of the Program) in subsequent interviews and passive data collection efforts.

Two constructs within the inner setting domain were excluded: *goals and feedback (4.40)* and *relative priority (4.29)*. Though both constructs are important to the implementation of the National ROPS Rebate Program, the authors decided that *goals and feedback* could be captured within the *reflecting and evaluating* construct (process), which is more comprehensive. *Relative priority* was excluded as no viable alternatives exist for the Program to be compared against.

3.3.3. Process

Two constructs in the process domain scored above a 4.25 and were selected for inclusion in the final evaluation instrument: *engaging champions (4.62), engaging formally appointed opinion leaders (4.52)*. In addition to these constructs, *engaging external change agents (4.20), engaging opinion leaders (4.18), reflecting and evaluating (4.22),* and *executing (4.15)* were also included.

The number of ROPS shipments relies heavily on the number of individuals who can be provided rebates for installation of their ROPS kits. Because rebate funding is provided by state and private donors, it is vital that external change agents and opinion leaders are engaged in implementation efforts, thus leading to the inclusion of these relevant constructs.

As described, another main component of the National ROPS Rebate Program implementation is stakeholder engagement. To help ensure that Coalition members remain active in the implementation process, the authors decided that it was necessary to allow ample opportunity for *reflecting and evaluating.* In addition, the authors believe that this construct also includes aspects of the *goals and feedback* construct (inner setting), which was excluded from the evaluation.

Executing was included in the final evaluation instrument given the possibility that a poor execution of the National ROPS Rebate Program implementation could result in lost partnerships, diminished credibility, and fewer ROPS shipments as a result. Therefore, the authors believed it was important to evaluate this construct over time.

3.3.4. Implementation outcomes

Though *appropriateness (4.60), feasibility (4.51),* and *acceptability (4.31)* all met the inclusion cutoff, *acceptability* and *penetration (4.18)* were the only implementation outcomes constructs selected for the final evaluation instrument.

Acceptability was included (rather than *appropriateness*, which scored higher) because the team felt that it better captured the ROPS intervention aspects of the target population culture, and their resulting support, (a) better than *appropriateness*.

Penetration was selected (over *adoption*) because the intent of the National ROPS Rebate Program is to scale up. Because the Program will be administered by a sole organization, rather than adopted by several organizations, *adoption* is less applicable than the reach of the program (*penetration*).

Feasibility was excluded as the authors felt that it could be better described using other constructs (such as cost, sustainability, and knowledge and beliefs about the intervention) and because the feasibility, efficacy and effectiveness of ROPS had been well established in prior research (citation).

3.4. Evaluation development

The final evaluation instrument involves a survey to be

Table 1
Mean construct ratings, where 1 = not at all important and 5 = extremely important. Bolded constructs indicate those selected for inclusion in the final evaluation.

Domain	Construct	Mean rating (n = 54)
Intervention characteristics	Cost	4.64
	Evidence strength & quality	4.63[c]
	Design quality & packaging	4.28[c]
	Adaptability[b]	4.27
	Relative advantage	4.22
	Trialability	3.77[d]
	Complexity	3.58
	Intervention source	3.11
Outer setting	Farmer needs & resources	4.78[c]
	Cosmopolitanism	4.35
	External policy & incentives	3.98[e]
	Peer pressure	3.45[d]
Inner setting	*Readiness for implementation:*	(4.44)
	Available resources	4.67[c]
	Leadership engagement	4.45
	Access to knowledge & information[a]	4.19[c] (4.05)
	Implementation climate:	4.43[d]
	Tension for change	4.40[d]
	Goals & feedback[b]	4.29
	Relative priority[b]	4.11
	Compatibility	4.02
	Learning climate	3.58
	Organizational incentives & rewards	3.98[d] 3.76
	Networks and communications[a]	3.59[c]
	Culture[a]	
	Structural characteristics[a]	
Characteristics of individuals	Knowledge & beliefs about the intervention	4.33 4.22[c]
	Individual identification with the Organization	4.09[c] 3.85
	Self-efficacy	3.80[c]
	Individual stage of change	
	Other personal attributes	
Process	*Engaging:*	(4.25)
	Champions	4.62[d]
	Formally appointed internal Implementation leaders	4.52[d] 4.20
	External change agents	4.18
	Opinion leaders	4.24
	Planning	4.22[c]
	Reflecting & evaluating[a]	4.15
	Executing[a]	
Implementation outcomes	Appropriateness[b]	4.60[d]
	Feasibility[b]	4.51
	Acceptability	4.31
	Penetration[a]	4.18
	Adoption	4.13
Client outcomes	Sustainability	4.56[c]
	Satisfaction	4.53[d]

[a] Low-ranking constructs included in the final evaluation after the review process.
[b] High-ranking constructs removed from the final evaluation as a result of the review process.
[c] One non-responder.
[d] Two non-responders.
[e] Three non-responders.

administered biannually, which can be found in Appendix A. This will be distributed to Coalition members four times, each six months apart. In addition, passive data collection systems have been set up to track project budgets (e.g. for hotline facilitation, marketing, and travel, among other items), discussions and decisions within the Coalition, and media content about the Program. At a minimum, when collecting this information; dates, partners, content, and relevant documents (such as news releases or meeting minutes) will be recorded and retained. Table 2 summarizes the constructs and their ratings and shows which evaluation methods (surveys or passive data collection) will be used for each selected construct.

Table 2
Constructs selected for the final evaluation of the National ROPS Rebate Program implementation and the data collection methods that will be used to evaluate them.

Domain	Construct	Survey	Passive Data Collection[a]
Intervention Characteristics	Cost	X	X
	Evidence strength and quality	X	
	Design quality and packaging	X	
Outer Setting	Cosmopolitanism	X	
	Farmer needs and resources	X	
Inner Setting	Leadership engagement	X	X
	Readiness for implementation		X
	Available resources	X	
	Structural characteristics		X
	Networks and Communication	X	
	Culture		X
	Access to knowledge and information	X	
	Tension for change	X	
Characteristics of Individuals	Knowledge and beliefs about the intervention	X	
Process	Engagement: Opinion leaders, Organization [blinded for review]/Steering Committee leaders, Champions, Key Stakeholders	X	X
	Executing		X
	Reflecting and evaluating	X	X
Client Outcomes	Sustainability	X	
	Satisfaction		X
Implementation Outcomes	Penetration		X
	Acceptability	X	

[a] Project budgets (e.g. for hotline facilitation, marketing, and travel, among other items), discussions and decisions within the COALITION, and media content about the Program.

4. Discussion

4.1. Applicability of the CFIR within occupational health and safety

Overall, the CFIR proved to be easily applied to settings beyond clinical research, such as the implementation of the National ROPS Rebate Program. This is evidenced by the fact that when asked if the CFIR constructs overlooked any factors that could impact implementation, no new areas were identified. Respondents often rated the constructs quite high; this likely resulted from the fact that the CFIR has been extensively tested by the developers (13) and irrelevant implementation factors have not been included.

Though the CFIR could be applied to the National ROPS Rebate Program, the process was not without barriers. One of the main barriers to adapting the CFIR to agriculture, forestry, and fishing efforts was the delineation of each CFIR domain. Having roots in clinical research, the CFIR proposes domains that fit a structure in which evidence-based practices are identified and replicated through implementation in

various healthcare facilities, sometimes with the help of an external facilitator or other partners. In this agricultural health and safety, application; however, the focus is on scaling-up an evidence-based practice nationally, rather than replicating evidence-based practices across clinical settings. As a result, it was difficult to define the inner and outer setting. Within the Coalition, there is a facilitation core, a steering committee, and a number of additional, peripheral members. Each subgroup and individual has a different level of involvement in the Coalition and the implementation process. Further, the Coalition membership is expansive, making it difficult to identify those who would clearly fall within the outer setting. In order to use CFIR in a similar fashion as it was intended, the research team opted to include the entire Coalition membership in the inner setting; however the *leadership engagement* (inner setting) and *formally appointed implementation leaders* (process) constructs were repeated to capture data specific to both the administrative/facilitation team and the steering committee.

In addition to the difficulty distinguishing between the inner and outer setting, the CFIR provides little focus on end-user culture or lifestyle, in this case, farmers. In public health endeavors, which require active engagement by the target population, this focus is vitally important to the success of programs. For the purposes of the National ROPS Rebate Program implementation studies, target population culture will be incorporated into several other constructs, including: *farmer needs and resources, culture* (inner setting)*, reflecting and evaluating,* and *satisfaction*. Though most of these provide a direct link to target population culture, *culture* (inner setting) requires a bit more thought. In developing the evaluation, the authors felt that measures of *culture* (inner setting) compared to farmers' opinions of stakeholder support, could provide some indication as to how the target population's culture is understood and responded to.

4.2. Uses of CFIR in occupational and public health implementation studies

Using the CFIR, the implementation of National ROPS Rebate Program will be monitored over an 18 month period, beginning just before the launch of the Program. Evaluation data that is collected will allow adjustments to be made to improve the implementation over time. Results of the evaluation will be compared to outcome measures, such as the number of farmers who sign up for and complete the Program. In addition, interview guides, which will be based on the results of the other data collection tools, will be developed to gather information about the constructs as they relate to the implementation effort. Interviews will take place at two time points and will serve as a method for collecting data related to constructs that were not included in other methods of data collection, should they be relevant.

In other agricultural health and safety settings, as well as other areas of occupational and public health, the CFIR can be used not only to evaluate implementation processes, but also to begin planning for implementation studies at earlier stages of research. Once additional studies have been conducted to determine the most important CFIR constructs in implementation efforts, these can be helpful issues to focus on early in the research to practice process.

Though the methods described here are specific to the National ROPS Rebate Program context, they can be easily adapted for other implementation studies within occupational or public health.

In this study, the evaluation tools requiring active participation have been (and will be, in the instance of stakeholder interviews) designed to be short and simple, while still providing ample insight. Moving forward, this brevity and simplistic nature of the questionnaire is expected to increase the response rate (Dillman et al., 2014). Additionally, this survey was designed to not only answer specific questions about the various constructs, but also establish relationships between them. For example, the survey seeks to compare stakeholders' knowledge and beliefs about the intervention, as well as their perceived role in the implementation process to their actual role and engagement level. This will be further explored in follow-up interviews.

Though the CFIR is based on qualitative research, and was designed to be used in that way, there has been additional work to develop quantitative measures of constructs (CFIR Research Team, 2017). This study included such efforts, as the final evaluation instrument includes quantitative survey questions modified from those suggested through CFIR materials (CFIR Research Team, 2017). Ideally, this will produce more diverse data, as a greater number of stakeholders will be invited to participate. This will allow the qualitative portions of the study to target specific areas of interest based on quantitative information.

4.3. Study limitations

There are two main limitations to this study. First, while the Coalition is a diverse group, some stakeholder groups are better represented than others. As a result, the number of respondents in the farmers and farm safety advocates, health and safety organizations, media, and university-based engineers groups are low and may not be reflective of the overall population of these stakeholders. Second, the construct selection process, although it was multidisciplinary, was somewhat subjective, which could be seen as a limitation. This will be addressed in later portions of the study during which quantitative measures will be captured and qualitative interviews will allow participants room to expand on constructs not selected for evaluation through this process. It is important to realize that in implementation settings, such as this, some level of subjectivity is needed, as real-world settings are used and randomized control and treatment groups are not feasible.

Finally, while the authors felt that this incentive provided for participation in this study was fair given the burden resulting from the numerous surveys in a relatively short time, the authors are aware of the seemingly high incentive that one person will receive, as well as the extended time frame between the first survey and the raffle drawing.

5. Conclusions

This study is a first step in applying the CFIR, which was designed for use in the clinical setting, to occupational safety and health initiatives. Provided that the CFIR model is tailored to the specific target population and stakeholders, as it has been here, it has the potential to significantly increase the success of agriculture, forestry, and fishing implementation efforts. Future manuscripts will demonstrate the application of the CFIR and the evaluation tools developed in this study to the implementation of the National ROPS Rebate Program.

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Appendix A. Appendix A

1. Please indicate your level of agreement with the following statements:

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
The NRRP is an acceptable response to tractor overturn fatalities.					
It is feasible to implement the NRRP.					
It is important that the NRRP is implemented now.					
The implementation of the NRRP is going well.					
The cost of the NRRP has not prevented it from being implemented in my state.					
The NRRP is sustainable.					
Once implemented, the NRRP will meet the needs of my organization's target population.					
I have the resources I need to promote the NRRP in my role.					
NRRP materials (including the website, promotional materials, and information packets) are of high quality.					
NRRP information and materials are appropriate.					
NRRP information and materials are engaging.					
NTSC updates are helpful in allowing me to reflect upon progress toward implementation of the NRRP.					
The NTSC Steering Committee is supportive of the NRRP.					
The NTSC Steering Committee encourages members to be involved in implementing the NRRP.					
Influential stakeholders (such as funders, manufacturers, or other influential individuals) are supportive of the NRRP.					
My employer encourages me to network with colleagues outside of my own setting					

In the space below, please include any further explanation of your responses that you feel we should know, especially for points that you disagreed with.

2. What do you feel your role is in implementing the National ROPS Rebate Program? (Please check all that apply)
   - ☐ Monitoring progress so that I can stay informed
   - ☐ Providing feedback about activities that others are planning and carrying out
   - ☐ Sharing promotions and materials with partners outside of the Coalition
   - ☐ Helping plan implementation activities such as events and fundraising
   - ☐ Participation in implementation events
   - ☐ Participation in fundraising
   - ☐ Other (please specify):

3. In the past six months, how often have you done each of the following?

	Not at all	1-2 times	1-2 times per month	1-2 times per week	More than 1-2 times per week
Read NTSC updates, information, or materials.					
Attended a NTSC webinar or conference call.					
Attended a NTSC in-person meeting.					
Attended an event on behalf of the NTSC or NRRP.					
Provided feedback or suggestions on NTSC activities or materials via email or one-on-one phone call.					
Provided feedback or suggestions on NTSC activities or materials during a NTSC webinar, conference call, or in-person meeting.					
Shared NRRP information or promotions with a group of individuals via social media, email distribution lists, or newsletters.					
Incorporated NRRP information into a presentation or report that you were putting together for another purpose.					
Had a conversation about the NRRP with another individual(s).					
Served as a spokesperson specifically for the NTSC or NRRP (through interviews, presentations, etc.).					
Recruited new members to the NTSC or connected NTSC members with new partners.					
Helped arrange or plan NTSC activities or events					
Submitted a funding or resource request for the NRRP.					
Met with potential funders to discuss funding the NRRP.					
Other (Please specify):					

The next two questions will be used to determine whether or not the appropriate stakeholders are involved in the NTSC and NRRP implementation.

4. Name the first three collaborators (individuals or organizations) you would go to if you needed assistance moving forward with an agricultural initiative.
   a. _____
   b. _____
   c. _____

5. Name three individuals or organizations whose support is crucial to successfully implementing the National ROPS Rebate Program:
   a. _____
   b. _____
   c. _____

Appendix B. Supplementary material

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.ssci.2018.04.008.

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