Journal of Agromedicine

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/wagr20

Understanding Trends in PTO Shielding Using Kelman's Processes of Change

Pamela J. Tinc, Megan M Goodspeed & Julie A. Sorensen

To cite this article: Pamela J. Tinc, Megan M Goodspeed & Julie A. Sorensen (2021) Understanding Trends in PTO Shielding Using Kelman's Processes of Change, Journal of Agromedicine, 26:2, 193-198, DOI: 10.1080/1059924X.2020.1795030

To link to this article: https://doi.org/10.1080/1059924X.2020.1795030

JOURNAL OF AGROMEDICINE
2021, VOL. 26, NO. 2, 193–198
https://doi.org/10.1080/1059924X.2020.1795030

Taylor & Francis
Taylor & Francis Group

Understanding Trends in PTO Shielding Using Kelman's Processes of Change

Pamela J. Tinc, Megan M Goodspeed, and Julie A. Sorensen

The Northeast Center for Occupational Health and Safety: Agriculture, Forestry, Fishing

ABSTRACT

Background: Kelman's Processes of Change suggest that individuals participate in behaviors for one of three reasons: because it is required (compliance), because the behavior allows them to maintain a particular social status (identification), or because the behavior aligns with the individuals core beliefs (internalization). This study aims to assess the utility of this model in understanding farmers' attitudes and behaviors regarding power take-off (PTO) shielding to prevent entanglements.

Methods: Surveys collected data on 673 farmers' attitudes and behaviors related to PTO shielding in 14 highly agricultural counties of New York. Participants were classified based on Kelman's Processes of Change.

Results: In total, 59.44% of participants could be classified into one of the three Kelman categories based on both attitude and behavior. Of these participants, 18% were classified in the compliance phase, 3% in identification, and 79% in internalization. Of participants who did not display appropriate shielding behavior, 77% still reported having internalized the importance of PTO shielding.

Conclusions: Two main challenges occurred in using Kelman's Processes of Change to assess PTO shielding behaviors among farmers. First, the attitude and behaviors of participants were not always reflective of one another, and second, participants tended to have difficulties distinguishing their primary motivations for PTO shielding (compliance, identification, or internalization). Though participants can be classified based on Kelman's Processes of Change and researchers can benefit from a more in-depth understanding of motivations related to changing safety behaviors, this study indicates that there are challenges in accurately assigning individuals to their appropriate "change" classification.

KEYWORDS
Power take-off (PTO); behavior change; attitude change

Background

Though many behavior change theories exist, the vast majority of these models do not delve into what motivates individuals to change their behavior. Kelman's Processes of Attitude Change, on the other hand, have been used to describe key motivational factors behind attitudes, and thus behaviors. The theory suggests that human beings adopt behaviors for one of three reasons attributed to their attitude toward the behavior: compliance, identification, or internalization. Compliance is the idea that a person partakes in a behavior, not because they necessarily believe it is the right thing to do, but because they feel it is required. Individuals who fall within the identification category adopt behaviors because valued "others" do it and it allows them to develop or maintain their social status. Finally, internalization occurs when the behavior is in line with the individual's core beliefs. In achieving internalization of behaviors, the assumption is that safer behaviors will then be more sustainable over the long-term. Understanding how to move a person from simply complying with a health behavior to really internalizing that behavior allows for the development of better interventions with longer-lasting impacts.

Though first developed in the 1950 s, applications of Kelman's Processes of Change theory could not be identified within the field of occupational safety. This manuscript seeks to fill this gap by exploring the utility of Kelman's Processes of Change as it applies to the prevention of a common agricultural injury: power take-off (PTO) entanglements.

CONTACT Megan M Goodspeed megan.goodspeed@bassett.org Northeast Center for Occupation Health and Safety: Agriculture, Forestry, Fishing, Cooperstown, NY, USA

Contract grant sponsor: National Institute for Occupational Safety and Health, Grant # 2U54OH007542.

The agriculture sector is among the most dangerous in the US with annual fatality rates of 24.0 per 100,000 workers.[1] This is compared to the all-worker fatality rate of 3.5 per 100,000 workers .[1] In addition to high fatality rates, the agricultural workforce also faces high rates of non-fatal injuries: 5.0 reported injuries per 100 workers compared to 3.1 per 100 workers across all industries .[2] Power take-off (PTO) entanglements are among the most common sources of farm injury, with 60% resulting in non-fatal injuries .[3] Of this 60%, approximately 2/3 result in amputations .[3] In addition to the physical and emotional burden placed on victims and their families, PTO entanglements also result in unnecessary burden on health systems. Approximately 40% of all agriculturally related medical expenses are incurred from PTO entanglements .[4]

Despite these statistics, PTO entanglements can be prevented through the use of PTO shields. Such shields can be placed over the PTO to protect workers from coming into contact with the rotating shaft, thus reducing the risk of catching clothing, hair, or limbs on the driveline and becoming entangled. The larger study in which this manuscript is embedded aims to increase the use of properly maintained PTO shields on agricultural equipment, thus reducing the risk of injuries and fatalities.

To encourage this behavior change, seven pilot interventions based on Cialdini's Principles of Influence are being implemented in seven highly-agricultural counties in New York State. Interventions in six of these counties are focused on a particular Principles of Influence strategy, while the seventh county is implementing an intervention based on community recommendations). These Principles of Influences, and their relative hypotheses are presented in Table 1.[5] Each Principle of Influence strategy can be aligned with one of the three motivational drivers outlined in Kelman's Processes of Attitude Change (compliance, identification, or internalization). Given these hypotheses, it should be possible to evaluate the outcome of the Principles of Influence campaign in a way that measures not only change, but the motivation for change. This paper aims solely to assess the utility of applying Kelman's Processes of Attitude Change for this purpose.

Table 1. Kelman's processes of change levels and the influence strategies that are predicted to result in each.

Kelman Process	Applicable Influence Strategies
Compliance	**Authority**: Authority figures promote the behavior. **Reciprocity**: An incentive is received in return for participating in the behavior. **Scarcity**: Limited time or availability offers are used to promote the behavior.
Identification	**Liking**: Individuals who are likeable or similar to the target population promote the behavior. **Social Proof**: The behavior is socially accepted within the community.
Internalization	**Consistency**: The behavior aligns with core beliefs.

Methods

Study population

The National Agricultural Statistics Service Agricultural Census[6] was used to identify the fourteen NY counties with the greatest number of farms. Farmers in each county were randomly selected for inclusion in the study from a contact list of farm operators provided through Farm Market iD .[7] This database of agricultural contacts is developed using multiple public and private data sources and is updated quarterly (Personal communication with Doug Ronk, Farm Market iD, February 28, 2018).

Survey development

The research team worked together to determine a series of relevant questions and a coding scheme to classify participants into the three Kelman categories. The survey instrument was developed to capture several pieces of information, including PTO shielding behaviors, attitudes toward shielding, and the presence of any influence strategies already in the community. Several questions on the survey instrument were designed to establish the current state of PTO driveline shielding on the farm and attitudes regarding PTO driveline shields:

(1) Have you made a point to check your PTO driveline shields in the last six months?
(2) If you checked your PTO drivelines shields, did any need to be replaced?
(3) If any of your PTO driveline shields needed to be replaced, did you replace them?
(4) Do you feel PTO shielding is important?

(5) Why do you feel PTO shielding it important?

Participants could select yes or no for questions one through 4. Question five asked participants to rank reasons that PTO shielding is important in their decision to maintain proper PTO shielding. These responses allowed researchers to assign the respondents to a Kelman Processes of Change category. The response options to question five were as follows:

- I feel it is required to shield PTO drivelines (compliance);
- My family or friends feel it is important to shield drivelines (identification); and
- I truly believe it is important to shield PTO drivelines (internalization).
- Other (please describe)

Surveys were pilot tested with ten farmers using a Think Aloud strategy.[8] Think Aloud interviews provide space for the participant to discuss his/her thought process in answering a question. Thus, it provides greater insight than traditional means of piloting survey questions and allows the researcher to better understand how questions should be formulated to gather information accurately. Feedback from the Think Aloud interviews was used to finalize the survey instrument.

Survey collection

Surveys were first distributed to participants via mail. Up to seven telephone calls (two morning, two afternoon, two evening, and one weekend) were made to non-responders. Several rounds of mail surveys and follow-up calls were conducted in order to obtain an adequate sample size to compare the counties included in this study. In August 2017, February 2018, and October 2018 surveys were distributed to 770, 1,398, and 784 randomly-selected farmers, respectively. Follow-up continued until July 2018 when the study was halted for the growing season. Due to the nature of the contract with Farm Market iD, we were required to cease contact with non-responders after a period of one year. Thus, when the study resumed in October 2018, 193 individuals from the first two mailings were excluded, despite not having completed the contact protocol. Because the interventions were scheduled to launch in January 2019, non-responders who were mailed a survey in October 2018 were not followed up with via telephone, as this method had proven time-consuming and unproductive. Instead, survey reminders were distributed to these individuals along with a 5 USD gift card in December 2018.

Prospective participants were excluded from the study if they 1) did not intend to continue farming for at least two years, or 2) did not have PTO-driven equipment on their farm. All survey participants were entered in a raffle for a 1,000 USD Tractor Supply gift card. This study was approved by the Mary Imogene Bassett Hospital Institutional Review Board.

Kelman classification

Classification into a Kelman process (compliance, identification, or internalization) first required that individuals engaged in the behavior – proper PTO shield maintenance. Participants who had reported proper maintenance of their PTO driveline shielding (i.e. shields were checked and damaged or missing shields were replaced) and indicated that PTO shielding is important were classified into one of the three Kelman Processes (compliance, identification, or internalization) based on their responses to question 5. For participants who selected "other" for this question and provide free-text responses, responses were discussed by the study team who, by consensus, classified free-text responses into one of the three categories described by Kelman or into a "non-Kelman" category. For example, several participants described the impact that PTO entanglement fatalities have had on their families as a reason for shielding. These responses were thus classified as internalization. Alternatively, some individuals provided responses that could not be categorized using the Kelman processes. For example, rather than providing a reason for believing that PTO shielding was important, participants shared their beliefs about regulating shielding.

Participants were classified as "non-Kelman" if they reported improper shield maintenance (i.e. they did not check their PTO drivelines at all or

identified damaged or missing PTO shields but had not replaced them by the time of the survey). Participants could also be classified as "non-Kelman" if they 1) reported proper maintenance of PTO shields but indicated that PTO shielding is not important; or 2) reported a reason for believing that PTO shielding is important that did not fit within the Kelman classifications.

Results

In addition to the 193 individuals who did not complete the protocol due to the reasons listed previously, contact protocols were incomplete for an additional 788 individuals. This was because the minimum number of surveys needed in each county had already been collected prior to completing the call protocol for these individuals.

Of those 1,971 individuals for whom the contact protocol was completed, 813 could not be reached, 143 refused participation, and 342 were ineligible. Thus 673 participants completed surveys and are included in the results.

Table 2 shows the number of participants classified under each Kelman category. As is demonstrated in the Table, roughly 10% of participants replaced missing or broken PTO shielding because they felt it was required, while very few respondents replaced PTO shielding because others feel it is important (less than 2%). Just under half of respondents replaced PTO shielding because it aligns with their core beliefs. For those who were classified as "non-Kelman," respondents were further stratified based on the reason they could not be classified. As can be seen, 39 individuals could not be classified, as they did not respond to one or more of the applicable questions.

Table 2. Kelman classifications for all participants (n = 673).

Classification	Frequency	Percent
Compliance	72	10.70
Identification	13	1.93
Internalization	315	46.81
Non-Kelman	234	34.77
Improper shield maintenance	*228*	*97.44*[a]
Proper shield maintenance; Shielding is not important	2	*0.01*[a]
Reason for shielding does not fit within Kelman Processes	*4*	*0.02*[a]
Could Not Be Classified	39	5.79

[a]Percent based on total number of non-Kelman classifications (n = 234)

Table 3. Distribution of reasons for believing shielding is important for those who did not demonstrate proper shield maintenance but did report that shielding is important (n = 218).

Classification	Frequency	Percent
Compliance	25	11.47
Identification	14	6.42
Internalization	169	77.52
Unable to classify	10	4.59

Though the primary purpose of this study was to change behaviors, this is often easier to do if attitudes regarding the behavior can be shifted. As shown in Table 2, 228 participants reported improper shield maintenance; however, only 10 of those individuals also reported that PTO shielding is not important. Table 3 highlights the Kelman Processes of Change attitudes reported by the 218 participants who reported that PTO shielding was important but had not reported appropriate shielding behaviors.

Discussion

By documenting respondents' behaviors and then classifying their attitudes into the three Kelman categories, it became clear that attitude and behavior are not always aligned. To account for this, the conservative approach was taken to classifying participants. That is, if participants did not participate in the desired behavior (proper maintenance of PTO shielding), they were automatically placed into the non-Kelman category (97.44% of non-Kelman classifications). Despite this, approximately 77% of these individuals also reported internalizing PTO shielding as important, despite the fact that their actual behavior did not reflect this belief. This disconnect between farmers' actions and beliefs has been identified in other assessments of risk behaviors on farms .[9,10] In particular, D. Murphy's book on health and safety in the agriculture industry, refers to this form of cognitive dissonance as, the "farm safety-risk paradox," .[11]

The results of this particular study suggest one of two things. First, it could suggest that participants responded to the survey in the socially desirable way, [12] which is to say that shielding is important, even if they do not believe that. Though this is a possibility, if this were the case, it would also be considered socially desirable to

report having maintained PTO shielding as well. However, reported shielding rates (59.44%) on these NY farms are consistent with those reported in a 2015 study of PTO shielding practices among dairy and livestock farmers in New York. In the 2015 study, 1,470 farm implements were visually inspected and the research team found that approximately 57% of PTO shields were properly maintained .[13] Given these results, it is not likely that social desirability bias is a factor in reporting attitudes and behaviors related to PTO shielding in this particular study.

Instead, it is more likely that these findings confirm prior research (and a primary hypothesis of the overall study) that has identified several logistical barriers to PTO shielding, including cost, sourcing, and shield design.[14] Thus, while farmers are aware of the importance and need for PTO shielding, they may not have the resources, particularly time and money, to take corrective steps. Similar intervening factors have been identified in other research focused on understanding farmer's risk behaviors and beliefs.[15]

In addition to the disconnect between attitude and behavior, there is also the challenge of an individual being able to pinpoint their primary reason for partaking in a behavior, particularly if there are multiple relevant factors. Thus, ranking the reasons for installing a PTO shield may have been challenging. In initially completing the survey, many individuals ranked multiple reasons as most important for shielding and needed to be followed up with via telephone for clarification. Even in the final results, 38 of the 39 surveys that were marked as incomplete and thus could not be classified were marked as such because of the challenges farmers had with ranking responses to this question. In addition, four remaining participants described the importance of PTO shielding, but provided reasons that did not correspond with any of the Kelman categories.

Though Kelman's Processes of Attitude Change is a step in the right direction for understanding why individuals change behaviors, this study has demonstrated that there are clear challenges in both collecting and appropriately classifying data on behavioral motivations. When they can be accurately discerned, participants' attitudes and behaviors allow them to be classified using Kelman's Processes. However, there remains the challenge of understanding how attitudes and behaviors are linked, and why individuals don't always participate in behaviors that they have internalized as important (25% of the sample in this study).

A primary challenge in applying Kelman's Processes in this setting is the quantitative nature of the study. Although a quantitative assessment was necessary for measuring change over time, a qualitative approach may be more informative. In this case, participants could be asked to elaborate further on why they choose to maintain proper PTO shielding (or not), providing greater insight into the question of compliance versus identification versus internalization. Though not developed or analyzed using the Kelman Processes, qualitative interviews with 38 New York farmers highlighted three primary motivators for maintaining proper PTO shielding: safety culture and the environment that the farmer exists in, personal stories about close calls or PTO entanglements, and the protection of others who may be working around PTO drivelines .[14] These themes appear to align with the primary motivational constructs in Kelman's Processes of Change: identification (safety culture) and internalization (personal stories and protection of others), lending support for this assumption. Similarly, this study highlighted several barriers to maintaining PTO shielding,[14] which can help decipher the disconnect between attitude and behavior and also offers solutions for increasing PTO shielding rates.

Limitations

One major limitation of this study is that it is based on self-reported data. This presents several potential issues. First, this study is subject to recall bias, in that participants were asked to report on actions they took in the past. To help address this, the survey specifically asked participants to reflect on only the prior six months, rather than a longer time frame. Second, because this study relies on self-reported data, there is a potential for selection bias in that participants actively choose to participate. This could mean that respondents may have attitudes and behaviors related to this topic that

are different from non-respondents. While true, comparisons to prior studies have demonstrated similar outcomes at least in terms of behavior.

Similarly, a third limitation to this study is the potential of the survey instrument itself to influence survey responses and a level of social desirability bias. For example, participants may be more likely to respond with the socially accepted response that they were engaging in PTO shielding behaviors and felt they were important. In terms of behavior, comparisons to prior studies indicate that social desirability biases were limited, if at all present. However, more research is needed to further explore attitudes toward PTO shielding to understand if social desirability played a role in responses to attitude-based questions.

Finally, due to challenges collecting survey data, not all farmers responded during the same six month period. Thus, issues such as seasonality may have impacted the results of this study. For example, farmers who responded to the survey in early spring and therefore reflected on the winter months may have been more likely to report proper shield maintenance, as this is when equipment maintenance is typically done.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the National Institute for Occupational Safety and Health [2U54OH007542].

ORCID

Megan M Goodspeed http://orcid.org/0000-0002-2397-0451
Julie A. Sorensen http://orcid.org/0000-0002-8787-3837

References

1. Bureau of Labor Statistics. *Census of fatal occupational injuries charts, 1992-2017 (final data)*. 2019 https://www.bls.gov/iif/oshwc/cfoi/cfch0016.pdf Accessed September 20, 2019.
2. Bureau of Labor Statistics. *Industry injury and illness data - 2017*. 2016 https://www.bls.gov/iif/oshsum.htm Accessed February 13, 2019.
3. Beer SR, Field WE. Analysis of factors contributing to 674 agricultural driveline-related injuries and fatalities documented between 1970 and 2003. *J Agromedicine*. 2005;10(3):3–19. doi:10.1300/J096v10n03_02.
4. Narasimhan G, Crowe TG, Peng Y, et al. A task-based analysis of machinery entanglement injuries among Western Canadian farmers. *J Agromedicine*. 2011;16(4):261–270. doi:10.1080/1059924X.2011.584043.
5. S C, Cialdini R. *The Uses (And Abuses) of Influence, in Harvard Bussiness Review*. Harvard, MA: Harvard University; 2013:76–81.
6. *National Agricultural Statistics Service, Census of Agriculture, 2017*. United States Department of Agriculture; 2017.
7. Farm market iD. *Farm Market iD*. 2019 https://www.farmmarketid.com/ Accessed February 13, 2019.
8. Charters E. The use of think-aloud methods in qualitative research: an introduction to think-aloud methods. Brock Edu. 2003;12(2):68–82.
9. Sorensen J, May J, L. Jenkins P, et al. Risk perceptions, barriers, and motivators to tractor ROPS retrofitting in the New York state farm community. *J Agric Saf Health*. 2006;12(3):215–226. doi:10.13031/2013.21229.
10. Donham K, Thelin A. *Agricultural Medicine: Occupational and Environmental Health for the Health Professions*. Hoboken, NJ: Wiley-Blackwell; 2006.
11. Murphy D. *Looking beneath the Surface of Agricultural Safety and Health*. St. Joseph, MI: American Society of Agricultural Engineers; 2003.
12. Bou Malham P, Saucier G. The conceptual link between social desirability and cultural normativity. *Int J Psychol*. 2016;51(6):474–480. doi:10.1002/ijop.12261.
13. Chapel DB, Sorensen JA, Tinc PJ, et al. Validation of self-reported power take-off shielding using on-site farm audits. *J Agric Saf Health*. 2015;21(2):95–104. doi:10.13031/jash.21.10724.
14. Weil R, Mellors P, Fiske T, et al. A qualitative analysis of power take-off driveline shields: barriers and motivators to shield use for New York state farmers. *J Agric Saf Health*. 2014;20(1):51–61. doi:10.13031/jash.20.10425.
15. Elkind PD. Perceptions of risk, stressors, and locus of control influence intentions to practice safety behaviors in agriculture. *J Agromedicine*. 2007;12(4):7–25. doi:10.1080/10599240801985167.