The Theory of Planned Behavior: Use and Application in Targeting Agricultural Safety and Health Interventions

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Abstract

Traditional farm safety programs rely mostly on iterations of knowledge–based components, typically lack local input into identification of issues and concerns, and are difficult to evaluate. Psychological models have been looked at as tools to address these problems. The Theory of Planned Behavior (ToPB) is a psychological model that has been used to understand behavioral beliefs and to provide a framework for using those beliefs as intervention targets. The fundamental characteristics of ToPB are reviewed. Examples of specifically stated behavioral questions are provided from ToPB application in field settings. Pertinent findings from an example study on personal protective equipment use and beliefs are summarized to illustrate advantages and disadvantages of using ToPB. ToPB can provide information useful in targeting interventions aimed at locally identified safety and health concerns. The use of beliefs identified using ToPB as intervention targets can increase the use of personal protective equipment beyond levels used prior to the intervention. And, ToPB has shown multiple correlations of 0.28 (up to 0.35 in other examples not reported) between intentions and self–reported behaviors, indicating that other contributory factors are present and need to be studied.

Keywords. **Agricultural safety, Psychology, Safety programs, Education.**

The notoriety of agricultural safety and health issues has grown in recent years from primarily an agricultural industry concern to a topic found within a broad range of both popular and academic publications. Complementing publications close to farmers, such as agricultural magazines and newspapers, are features in the popular press, such as *Good Housekeeping* (Driemen, 1992) and *U.S. News and World Report* (Tharp and Satchell, 1990). Academic publications ranging from *The Journal of Agricultural Economics* (Antle and Copalbo, 1994) to *The Journal of the American Veterinary Medical Association* (Donham and Thu, 1993) have contained articles about agricultural safety and health issues and their implications. This broad concern demonstrates the diversity of interest and the complexity of agricultural safety and health issues.

Professionals within this diverse and complex agricultural safety and health industry continue to seek effective methods to guide intervention activities. Studies that have focused on the use of models of behavior have added insight into the beliefs and intentions of agricultural workers toward specific behaviors (Aherin, 1988; Perkins et al., 1992; Debarr, 1994; Lee, 1995, Petrea, 1996; Marlenga, 1997). Historically,

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agricultural safety education programs have been knowledge–based programs designed to identify hazards and present information on how to lessen risks (Aherin, 1988, 1989; Petrea, 1996). Repetition of simple knowledge–based programs has come under criticism as not being effective for changing behaviors (Aherin, 1988; Aherin, et al., 1992; Murphy, 1992). Instead, more sophisticated efforts, based on the actual beliefs and intentions of the target population, have been encouraged (Aherin, 1988; Aherin et al., 1992; Murphy, 1992, Shutske and Ohmans, 1995; Cotton, 1997).

Psychological theories (e.g., Triandis, 1979; Ajzen and Fishbein, 1980; Ajzen, 1991; Westaby, 1995) have received attention as a means to assess local beliefs related to specific agricultural safety and health behaviors. The use of psychological theories and models has been limited primarily to assessment, with little research actually using the local beliefs elicited from targeted intervention programs as a component of the research design. The question becomes: "Will targeting local beliefs of agricultural workers enhance the effectiveness of intervention programs offered?"

The Theory of Planned Behavior, or ToPB (Ajzen, 1991), may have application in farm safety and health programming, more specifically in targeting intervention programs to a specific population for a specific safety hazard or risk. ToPB has been used within the agricultural safety setting as a mechanism to identify beliefs of identified populations toward specific behaviors (Petrea and Aherin, 1994; Lee, 1995; Petrea, 1996, 1997; Petrea and Burns, 1998; Petrea and Aherin, 1999). However, little work has been done in actually using these underlying beliefs as targets in intervention programs (Petrea, 1996).

ToPB holds that to influence intention, one must understand the beliefs that underlie the intention to perform or not to perform a specific behavior. The collected beliefs are then used in designing an intervention program aimed at addressing those salient, i.e., most meaningful, beliefs. The intervention program is intended to supply specific information and materials; address issues of attitude, social influence, and perceived control; and offer encouragement that will enhance the application of pro–safety behavior knowledge. The intervention program also addresses those salient beliefs that have a negative influence on the intention to perform the desired safety behavior. These aims are consistent with educational theory (Bloom, 1956) that indicated application of knowledge must occur for change to take place.

The Problem

Traditional farm safety and health programs have relied on awareness activities and iterations of knowledge–based components as the means to change behaviors (Aherin, 1988; Murphy, 1992). Most of these programs have been developed without consulting the target population about their concerns or the beliefs underlying their behaviors. The problems, then, are the continued high rates of preventable farm–related injuries and illnesses among a shrinking farm population and the lack of local specificity of many farm safety programs designed and offered.

The Theory of Planned Behavior is a means to address the problem of intervention (program) specificity. This article provides basic information on the application of the ToPB in eliciting beliefs and using those beliefs as targets of interventions. Specific objectives are:

1. To describe the Theory of Planned Behavior (ToPB).
2. To present an example of an intervention guided by ToPB.
3. To draw conclusions on the utility of ToPB as a means to enhance the specificity of specific intervention programs.

The Model

The Theory of Planned Behavior (figs. 1 and 2) (Ajzen, 1985, 1991) identifies *intention* as the common immediate determinant of performing a specific behavior. The components underlying intention include *attitude* (positive or negative evaluation of the behavior), *subjective norm* (the individual's perception of social pressures to perform the behavior), and *perceived control* (how much control the person perceives as having over performing the behavior). Each of these components has underlying beliefs that combine within each individual to determine the intention of performing or not performing any specific behavior.

General Terms

The following definitions were developed from Ajzen and Fishbein (1980) and Ajzen and Madden (1986):

Elicitation Study—A mailed open–ended question survey measuring advantages, disadvantages, perceptions, and barriers to performing a specific behavior.

Salient Beliefs—The primary determinant that impacts the intention to perform or not perform a specific behavior. Beliefs are identified from responses to the open–ended questions in the elicitation survey. The most commonly mentioned beliefs are then used to form semantic differential questions used in the primary survey. After analysis of primary survey responses, those beliefs that contribute most to intention are identified and used as the targets of intervention programming.

Intention—The immediate determinant of an individual performing or not performing a specific behavior; measured by survey questions and analyzed for its contribution to self–reported behavior intention, as prescribed by referenced citations.

Factors Influencing Intention

Attitude—An individual's positive or negative evaluation of performing a specific behavior, measured by an initial survey and analyzed for its contribution to intention, as prescribed by referenced citations.

Behavioral Belief—An individual's association with a behavior; measured by open–ended questions and analyzed for its contribution to the attitude factor. The behavioral belief has two components: 1) that the behavior will lead to certain outcomes which can be either positive or negative, and 2) an evaluation of those outcomes which can also be either positive or negative, dependent on the outcome being evaluated.

Perceived Behavioral Control—An individual's perception of the amount of control he/she has over performing or not performing a specific behavior, measured by the initial survey and analyzed for its contributions to intention, as prescribed by referenced citations.

Control Belief—An individual's perception of the obstacles and/or barriers to performing a specific behavior; measured by open–ended questions in an elicitation portion of the study and analyzed for its contribution to perceived behavioral control factor. The control belief has two components: 1) the person's belief as to whether he/she has control over performing or not performing the behavior, and 2) how strongly the person holds to the belief that he/she can control either performing or not performing the behavior in question.

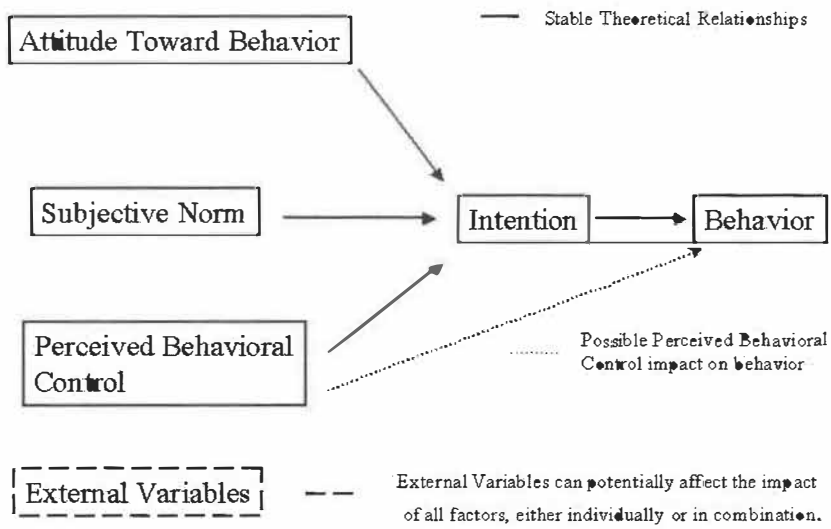

Figure 1. Simplified graphic of the Theory of Planned Behavior (adapted from Petrea, 1996).

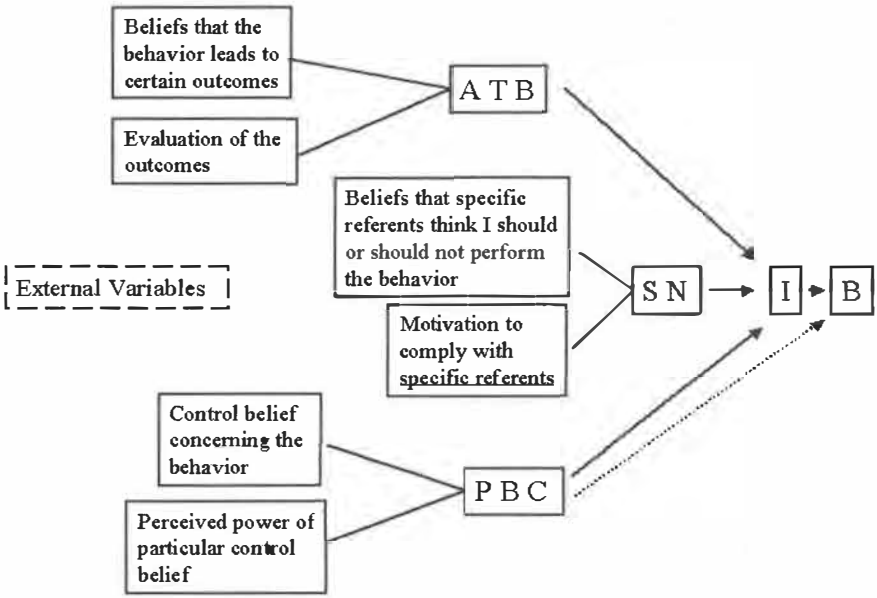

Figure 2. Components defining beliefs for primary factors in ToPB (adapted from Petrea, 1996).

Subjective Norm—An individual's perception of the social pressures to perform or not perform a specific behavior, measured by the initial survey and analyzed for its contributions to intention, as prescribed by referenced citations.

Normative Belief—An individual's perception of what another individual or group thinks; measured by open–ended questions for the elicitation study and analyzed for its contribution to the subjective norm factor. The normative belief has two components; 1) the person's belief that other individuals or organizations that are important to the person have opinions about the behavior in question, and whether those opinions are that the person should or should not perform the behavior; and 2) how motivated the person is to comply with the opinions of those important individuals or organizations.

The Theory of Planned Behavior is a revision of the Theory of Reasoned Action (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980), utilizing its basic theory while adding the perceived control component. The Theory of Reasoned Action is based on the premise that "human beings are usually quite rational and make systematic use of the information available to them" (Ajzen and Fishbein, 1980, p. 5). The ultimate goal of the theory is to predict an individual's behavior and to understand the behavior. The assumption is made that most socially relevant actions are under volitional control and that a person's *intention* to either perform, or not perform, a specific behavior is the immediate determinant of what action/inaction is taken. Knowing a person's intention should allow for accurate prediction of that person's behavior in a specific situation.

Prediction of behavior is important, as is understanding behavior. Ajzen and Fishbein (1980) emphasized the necessity to "distinguish between behaviors and occurrences that may be the outcomes of those behaviors" (p. 29). For instance, success in passing an exam may be a measure of a behavior, but it is affected by such specific actions as reading the assignments, attending the lectures, or perhaps just copying the answers to the test from someone else. Passing the exam could also have occurred simply because the test was easy. The outcome could have been influenced by a factor other than the person's own behavior.

In order to specifically define a behavior, specific criteria need to be included (Fishbein and Ajzen, 1975). Criteria include the *action* of interest, the *target* at which the action is directed, the *context* in which the action is to be performed, and the *time* at which the action is performed. Once these criteria are met, research indicated strong relationships between that behavior and intentions directed at the same target and involved in the same action (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980).

Related to the definition of the behavior is the degree of correspondence between the measures of attitude, subjective norm, intention, and behavior. Inconsistency on these measures has been found to be one of the reasons for no or low correlations between attitude and behavior (Cook and Selltiz, 1965; Wicker, 1969; Fishbein and Ajzen, 1975, 1977). Once the behavior and measures have been properly established, it is possible to further explore the determinants of the intention towards that specific behavior.

Attitude Toward Behavior

One component contributing to an individual's intention toward a behavior is personal in nature. The individual's *attitude toward the behavior* (fig. 1) is his/her positive or negative evaluation of performing the behavior. Behavior–specific attitudes are part of an individual's personal belief system. The individual's attitude is a function of the *salient beliefs* held about the behavior in question. Each of these beliefs is linked to some valued attribute. In turn, each association has a strength attached to it. Thus, the individual's attitude is determined by the total evaluation of the attributes associated

with the behavior and the strength of those associations. Each attribute evaluation is multiplied by its associated belief strength, and all products are summed. This summation provides an indirect estimate of the individual's attitude toward the behavior based on the individual's salient beliefs about the behavior. Symbolically, attitude is represented by:

$$A = b_i e_i \quad (1)$$

where

A = an indirect estimate of attitude
b_i = belief strength of attribute i
e_i = evaluation of attribute i.

The contribution of the attitude component on the individual's performance or nonperformance of a given behavior can be either positive or negative. If the summation is positive, a favorable attitude will normally be held. In contrast, if the summation is negative, an unfavorable attitude will be held.

Subjective Norm

Another component contributing to an individual's intention toward a behavior is the individual's perception of what other individuals or other groups think, that is, the perceived social pressures felt by the individual to perform or not perform the behavior. This factor is termed *subjective norm*. The beliefs underlying the subjective norm are termed *normative beliefs*. The individual will have a perception of what each individual referent or group of referents thinks about the behavior in question. This perception will be positive if the individual perceives the referent thinks the behavior should be performed. This perception will be negative if the individual perceives the referent thinks the behavior should not be performed. The individual will also have a motivation–to–comply factor associated with each referent because some referents will be more influential than others. The individual will be more motivated to comply with those referents whose influence is more valued. Symbolically, subjective norm is represented by:

$$SN = b_j m_j \quad (2)$$

where

SN= indirect estimate of subjective norm
b_j = perceived expectation of referent j
m_j = motivation to comply with referent j.

The summation of terms from all referents will again have an influence on the individual's intention of performing or not performing a specific behavior. The product of a positive referent with whom the individual is highly motivated to comply (e.g., a spouse) could be offset by a negative group of referents with whom the individual is also highly motivated to comply (e.g., co–workers). The combination of these two referents could leave the individual with little intention of performing the behavior in question.

Perceived control

The third component contributing to an individual's intention toward a behavior is *perceived control* (Ajzen, 1985, 1991). The beliefs underlying perceived control are termed *control beliefs*. This component was added to the reasoned–action components to account for the effect of factors not under the volitional control of an individual (Ajzen and Madden, 1986; Sheppard et al., 1988). Perceived control, as indicated by

the dotted line in figure 1, may override the intention to perform or not perform a specific behavior in certain situations. These situations occur when the individual perceives there is little to no volitional control over performing the behavior, such as the required use of hardhats at construction sites. In the hardhat situation, the person could have a very negative attitude toward the hardhat and a negative intention of wearing the hardhat, but regardless of the combination of these negative influences, wears the hardhat at the construction site when working because anyone working on the site is required to wear one. Perceived control is designed to represent the effect that perceived obstacles or barriers have on one's behavior. Symbolically, perceived control is represented by:

$$PCB = c_k p_k \tag{3}$$

where

PCB = indirect estimate of perceived control
c_k = control belief for k
p_k = perceived power of this particular control factor to negatively or positively influence performance of the behavior.

Thus, the Theory of Planned Behavior may be mathematically represented as follows:

$$B \sim I = f(w_1 A_B + w_2 SN_B + w_3 PCB_B) \tag{4}$$

where

B = behavior of interest
I = individual's intention of performing behavior B
A_B = individual's attitude to performing behavior B
SN_B = individual's subjective norm concerning performing behavior B
PCB_B= individual's perception of control in performing behavior B.

The weights (w_1, w_2, and w_3) are determined by the relative influence of each component on the intention to perform behavior B and are an underlying assumption of the model.

The ToPB accounts for demographic characteristics and personality traits as *external variables*. External variables, such as sex, age, educational level, and previous experience occasionally may be related to the behavior in question. However, these variables have typically not been found to be significantly related to the behavior under study. The external variables may exert an influence on particular beliefs that an individual holds or the importance the individual attaches to the attitudinal, normative, or control considerations, only indirectly affecting behavior.

In summary, the Theory of Planned Behavior shows how a specific behavior can be explained as a combination of a limited number of components. The theory utilizes intervening constructs to explain an individual's behavior ultimately in terms of that individual's beliefs toward that specific behavior. The theory assumes that the relative importance of specific components depends in part on the specific behavior under investigation. In certain situations, the social influences will predominate, while in other situations the individual's attitude toward the behavior will predominate. In other situations, the individual's perception of control will be the main influence on intention or may preclude the intention to perform or not perform the behavior.

The Example

The following is an outline of steps to use ToPB to assess beliefs of an identified population toward a specific behavior. Further, the steps include the use the beliefs elicited as targets of an intervention. A specific example from a study is used to illustrate the process.

Study Background

A census study was conducted in a nine–county pork producer association district ($\underline{N}$ = 342). The study originated and was conducted under the auspices of local community leadership groups operating in two of the nine counties. This census study consisted of two phases. Phase one utilized the Theory of Planned Behavior to elicit the behavioral intentions, and the attitudes, subjective norms, and perceived control (including underlying beliefs) of pork producers toward using respiratory protection while in confinement buildings in a specified situation. Phase two utilized the salient beliefs elicited in phase one to guide an intervention program consisting of group educational sessions and provision of a supply of two–strap toxic dust/mist respirators (dust masks). Two specific research questions were: (1) no difference would be seen between six–month intentions and self–reported behaviors (use) for any of the four quasi–experimental groups, and (2) six–month intention as assessed in the primary survey would contribute to prediction of self–reported behavior.

This entire population received a mailed questionnaire in phase one and an educational session invitation in phase two. Response rates for the surveys conducted in the study were: 80.0% for the elicitation study, 55.6% for the primary survey, 61.4% for the secondary survey, and 74.8% for the follow–up survey. Survey mailing and follow–up mailings followed Dillman's Total Design Method (Dillman, 1978). Construct and face validity (Borg and Gall, 1989) of the instruments was based on citations provided by theory developers (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980). Content validity of the open–ended questions was based on the concerns of the county leadership groups and refined by two agricultural safety and health specialists (not including the author). Reliability of the primary survey questionnaire was computed using Chronbach's Coefficient Alpha, $\underline{r}$ = 0.73, as described by Popham (1981). Eighty producers attended an educational session. One–half of questionnaire respondents who attended the educational session and one–half of questionnaire respondents who did not attend the educational session were randomly assigned to receive dust masks through the mail.

The phase one primary survey elicited salient beliefs that dust masks (a) are hot and uncomfortable, (b) help to keep dust out of lungs, and (c) are difficult to keep where needed, and that health professionals and spouses are motivating influences. Attitude and subjective norm contributed equally ($\underline{w}$ ~ 38) in the multiple correlation with intention.

Phase two findings indicated that current use of dust masks nearly doubled and that frequency of use rose from quite unlikely to neutral (neither likely nor unlikely). Research question 1 was not supported. All groups increased self–reported use over intentions. Research question 2 was supported, with the six–month intention substantially correlated with self–reported behavior, $\underline{r}$ = 0.52. The model used accounted for 28% of the variance in intention, indicating other contributing factors.

Outline of Steps Used in the Example Study

1. Topics Generated by Local, Community–Based Groups.

Respiratory protection in confinement swine facilities was identified as a potential health risk by participants (agricultural producers and health care providers) attending a county level extension meeting.

2. Elicitation Study

Open–ended questions to assess participant beliefs (pre–experimental), for example:

Attitudinal—What do you see as the advantages and disadvantages of wearing a two–strap toxic dust/mist respirator or mask every time you are in hog housing for more than fifteen minutes?

Subjective Norm—There might be individuals or groups who think you should or should not wear a two–strap toxic dust/mist respirator or mask every time you are in hog housing for more than fifteen minutes. Please list those individuals or groups that come to mind.

Control—What are the factors that could prevent you from wearing a two–strap toxic dust/mist respirator or mask every time you are in hog housing for more than fifteen minutes?

3. Primary Survey

Semantic differential questions based on the elicitation responses. This instrument asks behavioral intentions for a specific time period under specific conditions, for example:

Attitudinal—My wearing a two–strap toxic dust/mist respirator (dust mask) every time I am in hog housing for more than fifteen minutes during the next six months would keep dust out of my lungs.

Likely _____:____:_____:____:_____:___:_____Unlikely
extremely quite slightly neither slightly quite extremely

Subjective Norm—My spouse (If no spouse disregard this question) thinks I should wear a two–strap dust/mist respirator (dust mask) every time I am in hog housing for more than fifteen minutes during the next six months.

Likely _____:____:_____:____:_____:___:_____Unlikely
extremely quite slightly neither slightly quite extremely

Control—Not having a two–strap dust/mist respirator (dust mask) near the building when needed will prevent me from wearing one every time I am in hog housing for more than fifteen minutes during the next six months.

Strongly : : : : : : Strongly
Agree Disagree

Intention—I intend to wear a two–strap toxic dust/mask respirator (dust mask) every time I am in hog housing for more than fifteen minutes during the next six months.

Likely _____:____:_____:____:_____:___:_____Unlikely
extremely quite slightly neither slightly quite extremely

4. Intervention

The intervention is designed based on the results and analysis from the primary survey. Beliefs contained in the primary survey are then used as the educational/training targets for programs offered. Examples of beliefs targeted in the education/training program include:

Attitude—One belief addressed is that survey respondents report that an advantage of wearing the dust mask in the identified situation is that it keeps dust out of their lungs.

This positive belief is reinforced with pictures providing evidence of the effects of not wearing a dust mask, which are presented during the program.

Subjective Norm—Two beliefs addressed are that survey respondents report that their spouses and health professionals think they should wear a dust mask in the identified situation. These positive beliefs are reinforced by inviting spouses to the program. In addition, information on how a dust mask can prevent injury to the respiratory system is provided by a health professional during the program.

Control Belief—One belief addressed is that survey respondents report that a primary barrier to wearing the dust mask in the specified situation is not having the dust mask near the building when it is needed. The program addresses this barrier by pointing out that it is up to the individuals themselves to address this belief by placing dust masks where they are needed beforehand. Examples of available dust masks are presented during the program and locations where the dust masks can be purchased are provided.

5. Secondary Survey (if applicable)

A secondary survey assesses behavioral intentions for the same specific behavior and the same condition, but for one–half the period of time stated in primary survey. This survey is timed as an immediate assessment of the intervention program, which had been staged at the mid–point of the time period used in the original survey, and the prescribed need for a time component in the behavioral question is adjusted relative to the time left since the primary survey was mailed (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980), for example:

Intention 2—I intend to wear a two–strap toxic dust/mist respirator every time I am in hog housing for more than fifteen minutes during the next THREE months.

Always __:__:__:__:__:__:__:__ Never

6. Final Survey

The final survey contains semantic differential questions to assess self–reported behaviors during the study period for the same specific behavior and same condition, for example:

How often did you wear a two–strap toxic dust/mist respirator every time you were in hog housing for more than fifteen minutes during the last six months?

Always __:__:__:__:__:__:__:__ Never

7. Follow–Up Survey

The follow–up survey is instituted at an interval of 6 months to 1 year following the final survey to assess self–reported behavior. It contains the same questions used in the final survey.

The experimental design and experimental treatments are summarized in table 1.

Table 1. Experimental design and treatment schedule.

Group	Primary Survey Intention 1	Experimental Treatment	Secondary Survey Intention 2	Final Survey (Delayed Behavioral Performance Assessment) Behavior
1. Control	O_1	None	O_2	O_3
2. Education	O_1	Education	O_2	O_3
3. Respirators	O_1	Respirators	O_2	O_3
4. Education and respirators	O_1	Education and respirators	O_2	O_3

O_1 = Primary survey—Intention 1.
O_2 = Secondary survey—Intention 2.
O_3 = Final survey—Behavior.

Table 1 shows that the example study follows a quasi–experimental design that most nearly approximates a nonequivalent control group design (Campbell and Stanley, 1963). The design tested the intervention program's effectiveness in promoting positive self–reported behavior increases over stated intentions. Product moment coefficients of correlation (r) and multiple correlation (R^2) were used to analyze the data. Attitude and subjective norm were positively correlated with intention, having moderate correlations of 0.42 and 0.37, respectively. Control had a very small negative correlation with intention (–0.06). Intention to wear a respirator mask correlated with the self–reported behavior of wearing a respirator mask at 0.53. The one–year follow–up survey yielded a correlation of 0.48 between intention and self–reported behavior. The R^2 for the combined model (attitude/subjective norm/control) was 0.28. Other iterations of the example study yielded R^2 as high as 0.35 (Petrea, 1997a, 1998).

The Utility

The ToPB is a useful model to guide agricultural safety and health programs and research. Historically, agricultural safety and health programs have been knowledge–based, designed to identify hazards and to present information on how to lessen risks. Little was actually known about the subjects of the programs. The ToPB adds sophistication to the programs by basing intervention on the actual beliefs and intentions of the target population. Intervention can be targeted to a specific population for a specific hazard or risk. The program designer or researcher has more useful information (i.e., attitude, subjective norm, and perceived control) about the target population and about the effect of attitude, subjective norm and perceived control on the intention to perform a safety behavior. In addition, intention to perform a safety behavior can be correlated with self–reported performance of the target behavior not only after the program is completed but also at some future time for extended follow–up.

Reviewing the previously presented example, attitude and subjective norm correlated with intention to perform a safety behavior at 0.42 and 0.37 respectively. Control did not yield a correlation of any practical significance. Intention to perform the safety behavior correlated with actual self–reported behavior at 0.53. Armed with this information, which was previously unavailable for simple knowledge–based programming, interventions can be targeted to effect specific attitudes and subjective norms of the program participants. For example, if perceived control had been a critical variable, then the program could be directed to enhancing the perceived control of the participant.

The ToPB gives the program planner/researcher more information. More information means more targeted planning and programming. While the multiple correlation, $R^2 = 0.28$, is lower than one would like in trying to influence specific behaviors by targeting underlying beliefs, the example study is one of the few that has used ToPB in this manner. More importantly, there remains little in the way of comparisons (i.e., other psychology models being used to identify targets of interventions) to provide insight on how to improve such endeavors. Nevertheless, the ToPB is a useful tool for the agricultural safety and health professional.

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