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The transtheoretical model of change in adolescents: Implications for injury prevention[☆]

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Abstract

Introduction: Many injury prevention interventions require changes in human behavior to reduce self-risk or risk to others. Promising injury prevention interventions may be discarded if they lack power to create a significant difference in outcomes when judging their ability to “move a person from nonaction or negative action to positive action (safety).” The transtheoretical model of change (TMC) allows greater sensitivity in detecting along the change process where an intervention may be effective. The stages of change consist of precontemplation, contemplation, preparation, action, maintenance, and termination. Change is not viewed as an “all or none phenomenon.” **Method:** Use of the TMC was examined using a quasiexperimental, cross-over design involving high school agriculture students enrolled in 21 schools in Kentucky ($n=9$), Iowa ($n=7$), and Mississippi ($n=5$). A series of physical and narrative simulations (safety training exercises) were developed with a focus on preventing amputation, spinal cord injury, hypersensitivity pneumonitis, and noise-induced hearing loss. Contemplation and action, as part of the TMC, were measured using a 10-item, Likert-type, stages of change (SOC) instrument comprised of two subscales (reliability coefficients were .88 and .81, respectively). The final sample consisted of 790 students (373 treatment and 417 control). **Results:** There was a significant group effect for both contemplation, $F(1,732)=197.4$; $p<.0001$, and action, $F(1,730)=106.1$; $p<.0001$. A convenience sample of 29 of the participating students was selected for follow-up farm visits 1 year postparticipation. Of these students, 25 (86%) had made safety behavior changes in their farm work. **Impact on Industry:** The use of the TMC model can provide researchers with greater precision in examining intervention effectiveness in promoting change.

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1. Introduction

The transtheoretical model of change (TMC) has been widely used to explain how people initiate behavior change, progress through change, and maintain new behaviors. Although the model was originally conceptualized and developed focusing on behavioral change in adults, the TMC is equally appropriate, and valid for use with an adolescent population. Several recent studies, reviewed herein, have demonstrated that the measures and concepts of the TMC can be employed for changing risky behaviors

exhibited by adolescents. The literature did not reveal any injury prevention studies that were based on the TMC. It has been suggested that the TMC has application for the field of injury prevention. Since much of injury prevention focuses on behavior change, it is reasonable to believe the TMC might be a useful framework in injury prevention research (DeJoy, 1996).

Many unhealthy habits that people attempt to change as adults began in adolescence. While engaging in experimental behavior is considered to be the norm during the teen years, some adolescents carry these (often unhealthful) habits and behaviors into adulthood. Repeated over time, formerly experimental behaviors become habitual, and eventually become part of a person's self-image. When the behavior in question is indeed healthy (e.g., a fitness program) the results can be beneficial and lifelong. However, when the behavior in question is detrimental and/or addictive (e.g., tobacco use), the results of repeated and prolonged use can significantly decrease one's quality and

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span of life. Because adolescence is viewed as a time of transition and experimentation, the concept of change during these years is especially salient. Adolescents are under constant pressure to make decisions that may have lifelong effects, from choosing a college to initiating sexual activity. Adolescents are in the mindset of making decisions and implementing the changes that are associated with these decisions. It is quite possible that desensitization related to change (since change is such a normal part of adolescent daily life) makes the TMC, as a model for raising the awareness of or “resensitizing” the change process and an appropriate paradigm for initiating behavior change among adolescents. Additionally, there is a heightened need to prevent and end health-damaging or unsafe behaviors known to typically commence during adolescence. The opportunities to systematically teach teenagers (and raise consciousness) about the negative effects of unhealthy behaviors drop dramatically after the high school years in the literature. Thus, it is imperative to intervene while the opportunity is available and before problem behaviors become habitual.

2. Overview of the model

The TMC defines six stages of change and 10 processes of change (Prochaska, Johnson, & Lee, 1998; Fig. 1). In addition, the pros and cons of changing, self-efficacy, and temptation are central constructs of the model. The stages of change are defined as occurring over time and consist of (a) precontemplation, (b) contemplation, (c) preparation, (d) action, (e) maintenance, and (f) termination. Precontemplators are identified as people who see no problem with their current behavior and express no intention to change. Individuals in the contemplation stage convey awareness of a behavior problem, and are seriously thinking about overcoming it within the next 6 months. Preparation defines the

stage within which people are intending to take action shortly, usually in the next 30 days, and have begun to make some small behavioral changes. Action is the stage in which individuals are modifying behavior, experiences, or their environment, in the last 6 months, to change/overcome a problem. The maintenance stage involves preventing relapse and can last from 6 months to about 5 years. Termination is a stage that is often not reached by individuals who have been otherwise successful at modifying their problem behavior. Termination is the stage in which individuals express no temptations to return to their former behavior and have 100% self-efficacy. It is not necessary to reach the termination stage to successfully extinguish a problem behavior; therefore, less attention has been paid to this particular stage in the TMC.

The processes of change include five experiential and five behavioral approaches. The experiential processes of change consist of consciousness raising, dramatic relief, environmental reevaluation, social liberation, and self-reevaluation. The behavioral processes of change include helping relationships, stimulus control, counterconditioning, reinforcement management, and self-liberation. The processes of change and the stages of change are interrelated, with the processes of change acting as precursors/facilitators of stage change (Prochaska et al., 1998).

The TMC construct of decisional balance refers to the pros and cons associated with changing. Prochaska et al. (1998) examined change for 12 different behaviors and found a recurring relationship between the stages of change and the pros and cons of changing. In each study, for people to proceed from precontemplation to action, *the benefits associated with changing (pros) had to outweigh the drawbacks (cons) by a 2:1 ratio. Cons must decrease by only 0.5 SD while pros must increase by 1 SD.* Knowing this, an intervention may emphasize the positive aspects of changing rather than simply focusing on the negative effects of the undesirable behavior.

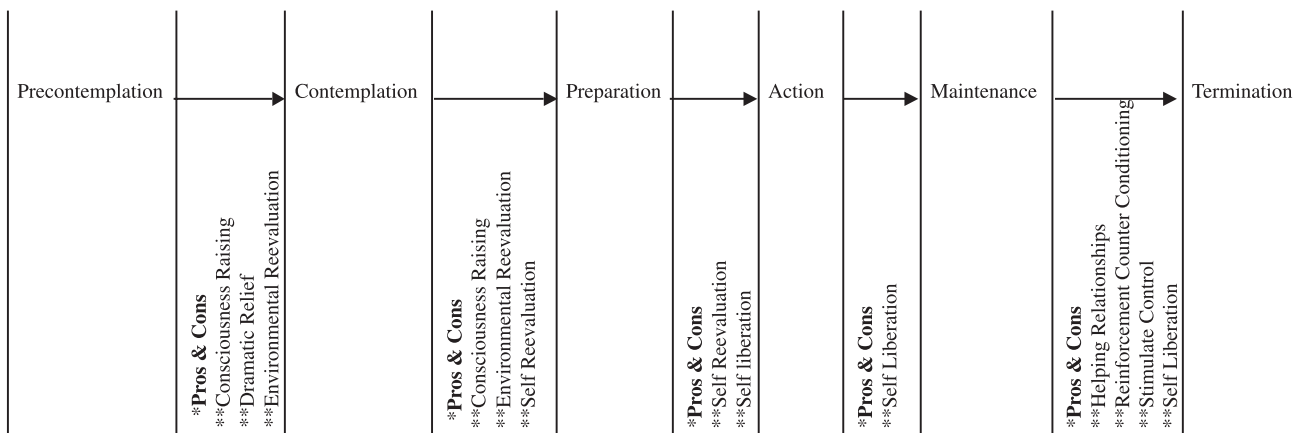


Fig. 1. Overview of TMC***. *At each stage the pros and cons of behavior change are accesses (decisional balance). **Processes of change most frequently used to process to given stage. Note the social liberation is a process of change not clearly associated greater one stage versus another. ***Individual may return to a previous stage before progressing. Figure is adapted from Reding et al. (1999). Transtheoretical individual multimedia expert systems targeting adolescent’s health behaviors. *Cognitive and Behavioral Practice*, 6, p. 146.

3. Validity of the model

There is growing validity for the stages of change component of the model in relation to physical activity and exercise. Validity testing has been limited by the use of cross-sectional studies and lack of examination of mediators and moderators of stage transition. In a meta-analysis of 91 independent samples, examining the core constructs of the TMC, results supported that core constructs “differ across stages and most changes are in the direction predicted by the theory” (Marshall & Biddle, 2001). Similar results were obtained in another study of older adults across 10 health risk behaviors (including the use of seat belts) in relation to the differences in core constructs across stages (Nigg et al., 1999).

Criticisms of the model focus on the lack of study of mediators involved in behavior change and the use of the model in mainly White populations (Andersen, Keller, & McGowan, 1999). There is less evidence that the processes of change are relevant across behaviors of interest since interactions between stage and process/es are not always evident (Nigg et al., 1999).

4. Adolescence health behavior change

Research in the area of adolescent smoking has provided data that support use of the TMC in a teenage population. In a 1998 research article, Pallonen (1998) reviewed recent studies with adolescent smokers in order to compare adolescents to adults on their progression through the TMC stages of change and their use of the processes of change as it relates to smoking cessation. Past educational interventions emphasizing individual behavior change and designed to help adolescent smokers quit have been largely unsuccessful. Attempts to keep adolescents from smoking have become more distal (such as laws regulating placement of cigarette advertising) and less focused on individual behavior change. Considering the highly addictive properties of tobacco, it seems inappropriate to address adolescent smoking from a prevention-only perspective. Pallonen compared data from three studies focusing on adolescent smoking behavior. In each study TMC measures including stages of change, processes of change, decisional balance (pros and cons of smoking), and temptations to smoke were collected.

In each of the three adolescent smoking studies examined, the adolescents divided similarly into five of the six stages of change categories, therefore supporting the assertion that the model can be applied reliably to adolescents (Pallonen, 1998). One difference between the three adolescent studies and prior studies of adult smokers was that adolescent smokers were generally less inclined to be considering quitting than adults. Almost 50% of adolescents were in the precontemplation stage; while about 40% of adults were in the precontemplation stage. As has been found in adult

samples, adolescent quit behavior was linked with theoretically appropriate stages of change. (i.e., compared with the precontemplation stage, attempts to quit in the preparation stage were two times greater, and attempts to quit were four times greater in the action stage). This finding suggests that smoking termination programs that are based on the TMC and are effective with adults, may be potentially aimed at an adolescent population with similar results.

Adolescent drinking behaviors are another area in which use of the TMC has been investigated. Migneault, Pallonen, and Velicer (1997) queried 853 vocational students in the 10th and 11th grades regarding their alcohol use. The decisional balance constructs (pros and cons) varied significantly based on the adolescent’s stage of change. The five-element stage of change measure effectively grouped students into an acquisition or cessation stage.

The TMC has also been used in studying exercise behavior of adolescents. Nigg and Courneya (1998) polled high school students regarding their exercise intentions. The researchers found their sample of adolescents to be considerably more active than prior studies using adult data. Approximately 55% of the adolescent sample was identified as being in the action and maintenance stages and less than 7% were found to be in the precontemplation and contemplation stages. Notably, adolescent’s use of the processes of change regarding exercise intentions was found to be similar to older individuals. This finding is important because it provides evidence that programs aimed at promoting exercise behavior change in adults may be equally effective when used with teenagers.

Nigg and Courneya (1998) found that the experiential processes such as consciousness raising, dramatic relief, environmental reevaluation, and self-reevaluation peaked at a later stage for exercisers (action) than for smokers (preparation). This difference may relate to the fact that exercising is a physically active behavior while discontinuing smoking involves ending a behavior that takes a certain amount of mental preparedness to proceed. Focusing on introducing adolescents to the experiential processes of change may help move adolescents from preparation to action. Similar to exercise behavior, the process of consciousness raising may be a key factor in initiating adoption of new, safety-related behaviors. How the TMC’s stages of change apply to injury prevention behavior in adolescents will follow in this article.

5. Injury prevention viewed through stages of change

The mission of the injury field is to prevent, ameliorate, and treat injury for the purpose of reducing injury-related disability and death (Institute of Medicine (IOM), 1999, p. 23). The study of injuries has progressed from viewing injury as an unavoidable occurrence amenable to only prayer and luck to a predictable event amenable to prevention. Theory provides a framework for the development and

testing of interventions. Many injury prevention interventions require changes in human behavior to reduce self-risk or risk to others. It is also well known that not all people react in the direction expected when exposed to certain injury prevention strategies. The tendency to drive faster when driving a car with automatic airbags and restraints is one example of this phenomenon. A better understanding of the stages of behavior change as one encounters injury prevention interventions would also help to explain how one adapts behavior in response to safety improvements to maintain a certain level of acceptable risk and to decrease the overall net gain from the intervention.

A national report, developed by leading experts in injury prevention and treatment across disciplines, has listed two recommendations for advancement of the field of injury science that directly relate to the use of theory. These recommendations are: (1) strengthen the capacity for translating knowledge into practice, and (2) infuse the field with a shared understanding of perspective (IOM, 1999). The use of a consistent theoretical approach would enhance translation of findings and understanding of the implications of findings. Theory would also provide a place from which to explore differences in behavioral responses to safety improvements across high-risk groups by using a consistent baseline of definitions and proposed relationships. The discovery of deviations from the baseline would promote expansion of knowledge and ultimately injury science.

Injury researchers have made strides forward in beginning to view injury as a disease. The seminal work of Dr. William Haddon provided a model from which injury prevention interventions could be derived and tested. Injury events were proposed to result from the uncontrolled release of energy. Areas of interventions were derived from this proposition and included: (a) prevent or modify energy build-up, (b) prevent uncontrolled energy release, (c) modify energy transfer, (d) improve the delivery of health services to limit disability, and (e) and to promote recovery (the sequelae of injuries is now known to be somewhat related to the phenomenon of “secondary injury” due to cellular release of energy in direct response to the initial injury event (Haddon, 1968)). Behavioral change in these identified areas may decrease the occurrence and impact of injury events. This model presented the structure for examining behavior change from a preevent, event, and postevent phase. In the 1960s, behavior change was targeted using education and persuasion. Because of the perceived failure of educational interventions, education interventions became viewed with disdain and greater emphasis was placed on environmental and mechanical (agent) factors. Yet in these earlier studies, behavior change was viewed as an all or none phenomenon. In the past, promising injury prevention interventions may have been disregarded from using this limited perspective.

The complexity of the changing process was not addressed in earlier studies. As with any nominal variable, variance is minimal, and the power to detect change is

diminished. Frequently educational interventions that target behavior change may be viewed as not effective in preventing injuries and promoting safety because they lack power to create a significant difference in outcomes when judging their ability to “move a person from nonaction to action.” However, by using the TMC, one can detect where along the change process an intervention may be effective since there are five (or six) points on a measurement scale that represent distinct but related “items” (concepts). This increased variance allows introspection into what type of interventions are capable of being effective to move a person to think about injury prevention or may be able to function as a “booster” in supporting movement from action to maintenance of hazard avoidance.

Injury prevention advocates frequently become frustrated from what is perceived as lack of change. This frustration has served as an impetus to develop “passive” interventions such as automatic restraints, where no behavior change is attempted. Yet passive interventions present their own set of problems in terms of individual rights, freedom of choice, and at times increased costs of products purchased.

The new national goals for injury prevention present injury researchers with the need for greater introspection into behavior change. *Healthy People 2010* presents us with the challenge to reduce deaths and injuries related to motor vehicles, violence, and work. The need to enhance education and community based programs as well as health communication to foster healthy lifestyles are also national goals (U.S. Department of Health and Human Services, 2000). A consistent theoretical approach would allow injury researchers to link educational interventions with behavioral change and ultimately health outcomes by identifying precursors to behavior change and developing knowledge about how certain subgroups implement the change process.

The investigators attempted to explore the behavioral change process of adolescents while testing the effects of an educational intervention designed to prevent agricultural-related injuries. The purpose of this study was not to test the TMC, but rather to determine if an intervention could move an adolescent from thinking (contemplation) to doing (action). Agricultural injury was targeted because in 1985 the injury fatality rate for farm child injuries was estimated at 13.2 per 100,000 farm child residents, with 129 injuries reported for every fatality. A decade later, the mortality rate for farm child injuries had declined by 39%; however, the morbidity rate had increased 10.7%. Thus, agricultural injury remains a health problem for children and adolescents.

6. Agricultural disability awareness and risk education (AgDARE) project

AgDARE is an experiential learning curriculum developed for high school agriculture classes. The goal of AgDARE is to decrease the agricultural-related injury rate

Table 1
Quasi-experimental crossover design for intervention

Group	Sequence of observations and treatments				
A ($n=7$ schools)	O ₁	X _n	X _p	O ₂	O ₃
B ($n=7$ schools)	O ₁	X _p	X _n	O ₂	O ₃
C ($n=7$ schools)	O ₁			O ₂	

X_n = Narrative simulation.

X_p = Physical simulation.

O₁ = first observation on dependent variables.

O₂ = second observation on dependent variables.

O₃ = on-site (follow-up) observation.

by influencing adolescents' work practices through interactive learning techniques in the form of physical and narrative simulation exercises. A description of these exercises is described elsewhere (Reed, Kidd, Westneat, & Rayens, 2001). The simulations focused on preventing four disabilities associated with farming: amputation, spinal cord injury, hypersensitivity pneumonitis, and noise-induced hearing loss, which are serious disabilities prevalent in the agricultural industry.

The project focused on high school agriculture students, particularly 9th- and 10th-graders, enrolled in 21 schools in Kentucky ($n=9$), Iowa ($n=7$), and Mississippi ($n=5$). These states were selected because of previous cooperative working relationships, cultural diversity, and differences in agricultural production and commodities. Schools in each state were partitioned by location and production, so differences between schools would be minimized. Schools were then randomly assigned to one of two treatment groups or the control group. A quasiexperimental crossover design was followed. The design contained two treatment groups (see Table 1), with replication of the intervention occurring in 14 schools across the three states. Survey assessment on the key dependent variables was conducted at three points (preintervention, postintervention, and follow-up) for the two treatment groups. One treatment group (Group A) received the narrative simulations prior to the physical simulations; the other treatment group (Group B) received the physical simulations prior to the narrative simulations. Surveys were conducted at two points for the control group.

7. Procedures

The intervention consisted of two visits to each treatment school. The visits were temporally separated across the duration of the instructional scheduling in the school. The first visit included the completion of a demographic survey that asked about the student's farm work, health and injury history, and acquaintance of a person with a disability. Students completed the Farm Safety Attitude Instrument (FSA) and the Stages of Change Pretest (SOC). For the purposes of this manuscript only the SOC measure and scores will be discussed. The research team delivered the

intervention (either physical or narrative simulations). Each of the four units was delivered in 15–30-min consecutive units. During the second visit the parallel simulations (either the physical or narrative not delivered in the first visit but addressing the same disability) were delivered in the same time frames. Students also completed the posttest versions of the FSA and SOC. Each teacher completed an information sheet that identified additional farm safety instruction, participation in other safety programs, and farm injuries or sentinel events that had occurred since the first visit. One year after treatment, AgDARE researchers and teachers made farm visits to a subset of the treatment students, where students' work behaviors were observed. Students in control schools completed pre- and posttests and the demographic survey identical to the treatment groups. These data were collected either by their teachers or by the research team in the same timeframe as the treatment schools. Control school teachers also completed the teacher information sheet.

8. Stages of change measure

It is important to note the realities of conducting an experimental design (prevention trial) in a school setting. Schools vary greatly in the organization of curriculum. Some schools use block scheduling (usually 90 min in length), while other schools use traditional scheduling (50-min class periods). Students vary greatly in their cognitive abilities and focusing skills. To minimize respondent burden and to encourage participation in the study and completion of the intervention and measures, our research team made the decision to focus on two stages in the process of behavior change, contemplation, and action. This decision was congruent with the purpose of the study, to determine if an intervention could move the adolescent from thinking about a behavior change (contemplation) to taking actions to promote safety (action), and not to test the TMC. Thus, the SOC instrument was created with these two subscales in mind.

The SOC instrument was a 16-item, Likert-type instrument ranging from *not at all true* (1) to *definitely true* (5). Possible scoring range of the SOC was 16 to 80. The SOC was written at a sixth grade reading level and took 5–10 min to complete. Psychometric properties of the instrument were examined using an iterative process in SAS for Windows, version 8.1 (SAS Institute, 1999). Items were initially subjected to principal axis factoring. A factor loading of less than .40 was used as the criterion for reducing items. Cross-loading of items on factors was also assessed using the .40 criterion. Scree plots were used to visually examine factor eigenvalues. After item reduction, principal components analysis was used with a stipulation of extracting the number of factors as suggested by interpretation of the scree plot. Both varimax and oblique rotations were considered to evaluate reduction of cross loading. At this point a final solution was derived. To assess

reliability, Cronbach’s coefficient alpha was calculated for each factor.

9. Results

The final sample consisted of 373 complete treatment data sets and 417 controls, yielding a total sample of 790. A complete data set included the demographic survey, and pre- and posttests. In addition, treatment subjects had to complete at least two units (physical and narrative simulations about the same disability) of the four units of instruction.

Treatment and control groups were compared for equivalency (see Table 2). The sample was 98% White. Students in the control group were slightly older than the treatment students (approximately 1 year older) and were more likely to be in 10th or 11th grade. Control students were more likely to be male; overall 68% of the sample was male. There was no difference between the groups on years of living or working on farms. Approximately 58% of the sample had lived on a farm, and 69% of these reported currently living on a farmstead. Three fourths reported ever working on farms, and 67% of these reported working on the farm at the time of their participation in AgDARE.

Subjects were combined into one group (treatment and control) for assessing the integrity of the SOC instrument. Factor analysis was performed on both preintervention scores and postintervention scores and both time points yielded the same factor structure. The oblique rotation provided the best solution and reduced cross loading of items. The SOC was reduced to 10 items and two factors (factor loadings .53 to .79). The contemplation subscale was reduced to six items and the action subscale was reduced to four items. Reliability coefficients were .88 and .81, respectively (see Table 3).

ANCOVA was used to determine differences between the treatment and control groups during the postintervention period, adjusting for baseline values of the corresponding scale score. Post hoc comparisons were based on Fisher’s least significant difference procedure for pairwise comparisons.

The ANCOVA models for the two SOC subscales indicated a significant group effect for both contemplation,

Table 2
Sample characteristics (n = 790)

	Treatment n = 373	Control n = 417	p value (χ^2 , df = 1)	% Overall sample
Age (mean)	14.9	16.1	$t < 0.0001$	
Gender:				
Male	236 (63.4%)	300 (71.9%)	0.11*	68
Female	136 (36.6%)	117 (28.1%)		32
Ever lived on a farm	223 (60.4%)	228 (55.1%)	0.130	58
Ever worked on a farm	227 (75.1%)	308 (74.4%)	0.829	75

Individual categories vary by response number.

* Statistically significant ($p \leq .05$).

Table 3
Revised stages of change instrument

	Oblique rotation	
	Factor	
I think about being disabled from doing farm work	0.82	0.00
I think about getting hurt while doing farm work	0.79	0.03
I think about how a disability would keep me from doing what I want to do in life	0.78	0.18
I think about how a hearing loss would make me less able to communicate	0.70	0.05
I think about the consequences of rushing when doing farm work	0.59	0.18
I think about ways to protect myself from injury and illness while doing farm work	0.58	0.22
I protect my lungs when working on the farm	0.63	0.85
I wear hearing protection when doing noisy farm work	0.72	0.74
I think about using a respirator when working on dusty jobs	0.00	0.74
I wear a seatbelt and use a tractor with a roll-over protection structure (ROPS)	0.07	0.52
Factor items % of variance	42	39
Cronbach’s α for primary loadings	0.88	0.81

Primary loadings > 0.40 in boldface type.

$F(1,732) = 197.4$; $p < .0001$, and action, $F(1,730) = 106.1$; $p < .0001$. The LS means for postintervention contemplation score, adjusted for baseline contemplation, were 3.3 and 2.3 for the treatment and control groups, respectively. The LS means for postintervention action, adjusted for the baseline value of action, were 2.8 and 2.0 for the treatment and control groups, respectively. Both of these comparisons were significant at the $p < .0001$ level. While there was some evidence to suggest that the contemplation and action subscales scores for the treatment group that received the narrative first were somewhat higher than the scores for those who received the physical simulation first, these differences were not statistically significant ($p > .2$ for the treatment group comparisons for both contemplation and action). It is for this reason that the two groups were combined for the purposes of this ANCOVA analysis.

A convenience sample of 29 (32%) students, who currently worked on farms ($n = 92$) and completed the AgDARE program, was selected by teachers and the research team for farm visits approximately 1 year after the students’ participation in AgDARE. The visited group was compared to the larger sample who completed AgDARE and reported currently working on farms. There were no differences by age or years lived and worked on farms. The visited group did include a larger proportion of females. Work exposure characteristics of the two groups at baseline were compared. The no visit sample used respiratory protection more than the visited group at baseline ($p \leq .05$). There were no other differences in exposure or safety behaviors noted.

Of visited students, 25 (86%) had made safety behavior changes in their farm work since their participation in the AgDARE program. Changes included equipment modification, installation of roll bars on tractors, use of hearing protection, respirators, communication devices, vision protection, and safety checks. Changes frequently extended to family units. Although these results cannot be statistically interpreted due to the small sample size, they help to validate self-reported behavior since students may not report accurately or may interpret intended behavior as actual behavior.

10. Discussion

By measuring the contemplation and action stages of change in our subjects, we were able to demonstrate impact of an educational intervention from a cross-sectional perspective. This finding leads us to question about the processes of change the adolescent uses who moves from thinking about being safe to initiating safety behaviors and provides a new area for intervention development, those interventions that would support the processes of change. The knowledge that the intervention was successful in promoting change allows greater confidence in subsequent testing of the present educational intervention for longitudinal impact.

The cross loading of two of the action items on the contemplation subscale presents the need for further study. It may be that in the adolescents' mind, "thinking is doing" in relation to some aspects of safety. Some of the safety practices discussed in the AgDARE program (e.g., purchasing a roll-over-protection-structure), required parental assistance for action.

The strength of an intervention may covary with the stage of change a person is experiencing, suggesting it may be more effective to use specific interventions at a given stage. The use of the TMC would allow identification of subgroups who may benefit greater from the intervention and allow treatment of the most sensitive to change. This could be critical to establishing initial efficacy of an intervention and to promote further testing. It could also prevent discarding potentially powerful interventions due to nonsignificant initial effects.

There is a great need to follow individuals through the stages of change to determine typical response curves in relation to dosing of interventions. After these responses are identified, interventions could be tailored to be more cost effective.

The processes of change used by individuals as they adopt safety behaviors and practice hazard avoidance need further clarification. These processes may vary in the degree to which they support safe actions across the lifespan and in the phase of injury prevention (e.g., pre-event, event, post-event). Decisional balance and the pros and cons of changing may need to be addressed when designing injury prevention interventions and promoting the change process.

In injury prevention, the focus is both on encouraging individuals to acquire behaviors, such as wearing a seat belt or using a child safety seat, and on cessation of behaviors (e.g., speeding while operating a motor vehicle, drinking alcoholic beverages when planning to drive). Further use of the TMC in injury prevention research would promote better understanding of the stages of change and change process and to examine if these differ when the targeted behavior change is acquisition versus cessation. In some cases of safety training, as in the AgDARE study, both are operational simultaneously. The TMC has been useful in addressing both cessation and acquisition of health behaviors in other areas of study.

11. Summary

Strategies used to promote positive health change may have relevance for injury prevention, assuming the change process in adopting injury prevention strategies is similar enough to that used in smoking cessation, drinking behaviors, and exercise adherence. The field of injury research has been criticized for not using established guidelines and criteria from which to evaluate educational interventions (IOM, 1999). The need to conduct rigorous evaluation of education intended to influence health behavior change among children and adolescents working in agriculture has been stated (DeRoo & Rautiainen, 2000; National Committee for Childhood Agricultural Injury Prevention, 1996). Most recently, the goal that young agricultural workers will receive agricultural safety training that is based upon child development principles and that interventions are matched with the diversity of the people was reaffirmed (Lee, Gallagher, Marlena, & Hard, 2002). The use of the TMC can provide researchers with greater precision in matching interventions with readiness level to change and this readiness may vary developmentally. The TMC can assist researchers in examining intervention effectiveness and long-term efficacy.

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