Pergamon

Journal of Safety Research 34 (2003) 227–240

www.elsevier.com/locate/jsr

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Antecedents of injury among youth in agricultural settings: A longitudinal examination of safety consciousness, dangerous risk taking, and safety knowledge

James D. Westaby[a,*], Barbara C. Lee[b]

[a] *Program in Social–Organizational Psychology, Department of Organization and Leadership, Teachers College, Columbia University, Box 6, 525 West 120th Street, New York, NY 10027, USA*

[b] *Marshfield Medical Research Foundation, Marshfield Clinic, Marshfield, WI, USA*

Received 26 June 2002; received in revised form 18 December 2002; accepted 7 February 2003

Abstract

Problem: Injuries are the leading cause of death for adolescents in the United States. *Methods:* This study longitudinally examined three psychological mediators of injury among 3,081 youths in agricultural settings: (a) safety consciousness, (b) dangerous risk taking, and (c) safety knowledge. These variables were examined within a nomological network of contextual variables. *Results:* Cross-sectional results revealed that safety consciousness and dangerous risk taking were the strongest predictors of reported injury at Time 1 and Time 2. Safety knowledge had an unexpected negative association with injury, albeit weak. As predicted, participating in safety activities was positively associated with safety consciousness, and time spent working was strongly associated with safety knowledge. Furthermore, self-esteem had both positive and negative safety outcomes, suggesting a more complex functioning. Males exhibited fewer safety cognitions than females as predicted. Longitudinal data also revealed that injury at Time 1 and dangerous risk taking were the strongest predictors of Time 2 injury. *Impact on Industry:* Results from this study emphasize the importance of assessing dangerous risk-taking perceptions when attempting to predict future injuries.

Keywords: Youth; Agricultural settings; Safety consciousness; Risk taking; Safety knowledge

1. Introduction

Injuries are the leading cause of death and disability among young working and nonworking adults in America (Castillo, Landen, & Layne, 1994). For instance, according to the National Research Council (NRC, 1998), each year, tens of thousands of young people are seen in hospital emergency departments for work-related injuries. Youths in agricultural settings are at even higher risk of injury than youths in urban domains (Crowe, 1995), which is perhaps not surprising given that agricultural work is one of the most dangerous occupations in the United States (Murphy, 1992; National Safety Council, 2001). Hard et al. (1999) indicated that the fatality rate for young agricultural workers was 12 per 100,000 compared with the national rate of 4.4 deaths per 100,000 workers. Furthermore, a recent National Agricultural Statistics Service (NASS) report indicated that 44% of 32,800 childhood agricultural injuries in 1998 were work-related, for a rate of 1.4 serious injuries per 100 youths in agricultural settings (NASS, 1999).

How well do young workers understand and practice occupational safety? A study of 14- to 16-year-olds who incurred work-related injuries requiring emergency room visits revealed that over half the teens reported not having safety training and 19% were employed in jobs declared hazardous or prohibited for their age (Knight, Castillo, & Layne, 1995). A 1998 study of North Carolina teens found that one-third were paid for work before age 14 years and over half were injured at least once while working at a paid job (Dunn, Runyan, Cohen, & Schulman, 1998). A systematic review of 25 different farm safety interventions found minimal evidence that farm safety training reduces occupational injuries (DeRoo & Rautiainen, 2000). Of the studies analyzed for this review, most described family-based

* Corresponding author. Tel.: +1-212-678-3791; fax: +1-212-678-8303.

E-mail address: westaby@columbia.edu (J.D. Westaby).

0022-4375/$ - see front matter © 2003 National Safety Council and Elsevier Science Ltd. All rights reserved.
doi:10.1016/S0022-4375(03)00030-6

interventions, with only a few targeted solely for adolescents who work on farms.

Nonetheless, considerable research has examined the factors increasing the risk to adolescents. For example, some youths may place themselves at greater risk of injury than adults (Reason, Manstead, Stradling, & Baxter, 1990) or they may be placed in improper environments. The 1998 NRC's report from the Committee on Health and Safety Implications of Child Labor concluded the following:

> *Because so many children and adolescents participate in the U.S. work force, and undoubtedly will continue to do so, the issue is not whether they should work, but what circumstances cause working to be detrimental, what can be done to avoid those circumstances, and how working can be more beneficial. (p. 5).*

Because the behaviors leading to many injuries are often under the control of individuals (Hale & Glendon, 1987), it becomes important to understand the psychological and contextual factors mediating such behavior (Quadrel, Fischhoff, & Davis, 1993; Wagenaar & Reason, 1990). However, very little longitudinal research has examined the psychological factors underlying injuries among youths at risk in rural or agricultural areas (Gibbons & Gerrard, 1995). Therefore, the purpose of this study is to examine the role of several safety cognitions on the reported injuries of youths at potential risk. The first set of hypotheses examines the association of three types of safety cognitions with injury: (a) safety consciousness, (b) dangerous risk taking, and (c) safety knowledge. These endogenous variables are presumed to mediate the effect of time spent working, participating in safety activities, self-esteem, leadership, self-concept, and gender exogenous variables (Baron & Kenny, 1986). Fig. 1 illustrates the nomological network of relationships hypothesized in this study.

1.1. Safety consciousness

It is often assumed that safety-conscious individuals will take precautions to reduce the likelihood of injury (Conrad, Bradshaw, Lamsudin, Kasniyah, & Costello, 1996). However, little empirical research has examined safety consciousness in the psychology literature. For the purposes of this study, safety consciousness is defined as a positive attitude and awareness toward acting safely in general. The concept is thus presumed to be applicable across work and nonwork domains. Safety consciousness is conceptually different from other safety-related concepts, such as safety commitment, which assesses leaders' commitments toward promoting safety among subordinates in working contexts (Hofmann & Morgeson, 1999). In addition, safety culture (Cox & Cox, 1991), safety environment, and safety climate concepts (Hofmann & Stetzer, 1998a; Zohar, 1980) examine organizational- or departmental-level aspects of safety (Hofmann & Stetzer, 1998b; Janssens, Brett, & Smith, 1995). In contrast, safety consciousness is assessed at the individual level across work or non-work-related contexts.

This study will develop a safety consciousness scale, examine its measurement properties, and evaluate its pre-

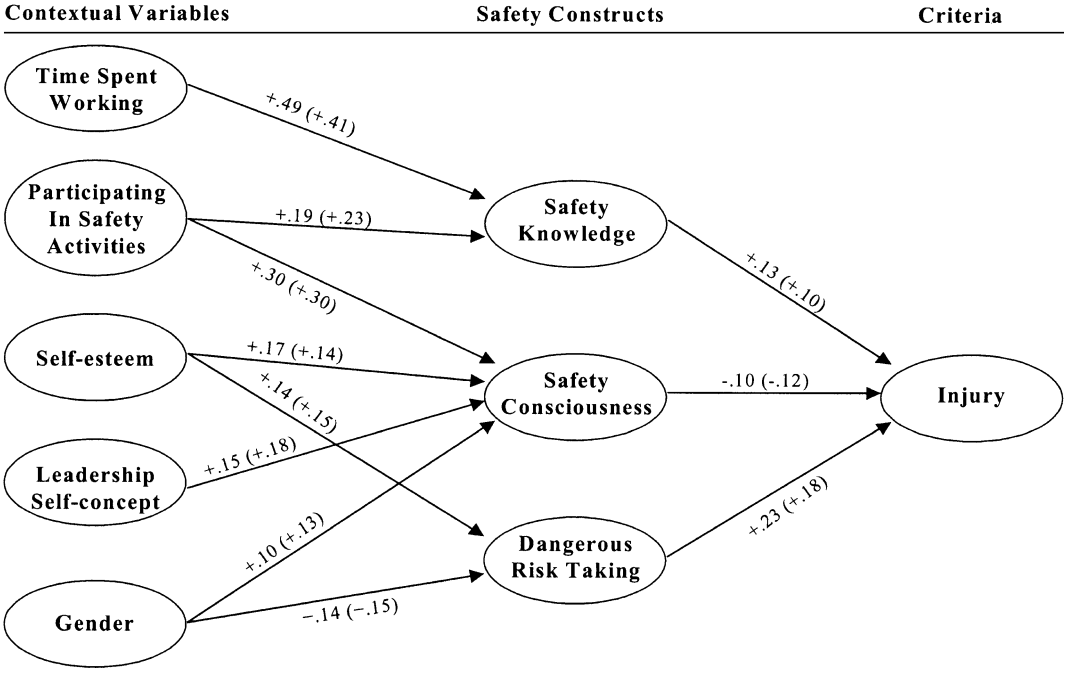

Fig. 1. Structural equation safety model with cross-sectional path coefficients at Time 1 and Time 2. Time 2 coefficients are denoted in parentheses.

dictive and construct validity within a nomological network. It is hypothesized that individuals with high levels of safety consciousness will have reduced likelihood of injury over time.

Hypothesis 1. Safety consciousness will be negatively related to injury.

1.2. Dangerous risk taking

The second safety cognition to be examined in this study is dangerous risk taking. This concept is defined as an individual's willingness to engage in activities that knowingly have elements of physical danger. Green and Brown (1977) have conceptualized that individuals often choose whether or not to expose themselves to dangerous activity. Parker, Manstead, Stradling, and Reason (1992) have also demonstrated that people's willingness to commit traffic violations is related to accidents, even after controlling for exposure, age, and gender. Thus, research suggests that individuals volitionally engage in behaviors that may be associated with greater risks (Atkinson, 1957; Slovic, 1987; Yee et al., 1995). In addition, people may invoke positive values toward dangerous situations (Fitzpatrick, 1980). For example, research has shown that dangerous situations can be associated with increased levels of group friendliness, shared feelings, and a sense of purpose and competence (Allen, 1982).

Theoretical models have also predicted the situations in which people will increase their risk. Wilde's (1985) risk homeostasis theory states that individuals compensate for increases in objective safety by increasing their dangerous behavior (Hale & Glendon, 1987; Simonet & Wilde, 1997). For example, in the context of road safety, risk homeostasis theory would predict that people would drive faster after a highway was improved, thereby increasing their risk to original levels. Wilde (1985) suggests that many engineering and policy-driven safety initiatives may not be effective because they do not influence "people's willingness to take risk." Alternatively, the theory states that educational, incentive, and enforcement initiatives may better serve as candidates for intervention. Thus, in comparison to classic engineering approaches to safety, this theory strongly endorses changing people's values toward risk. This study will examine the hypothesis that increased levels of dangerous risk taking will be associated with greater likelihoods of injury (Weinstein, Grubb, & Vautier, 1986).

The dangerous risk-taking concept may also reflect what Burns and Wilde (1995) identify as a high-risk personality (i.e., need for tension, risk, and adventure). Their research has revealed that individuals with greater need for sensation seeking (Levenson, 1990; Newcomb & McGee, 1991; Smith, Ptacek, & Smoll, 1992) and risk taking are more frequently convicted of speeding violations and other traffic violations. Heino, van der Molen, and Wilde (1996) also found that sensation-seeking tendencies were related to risky driving behavior. In addition, sensation and arousal seeking has been associated with a tendency to get involved in accidents, although this research tends to be limited to drug and traffic violations (Hale & Glendon, 1987; Schiff, 1977). Based on past theory and research, dangerous risk taking is expected to be related to injury over time. Moreover, this concept is expected to be psychologically different from safety consciousness. Several factor analytic techniques will examine the divergent validity of this concept.

Hypothesis 2. Dangerous risk taking will be positively related to injury.

1.3. Safety knowledge

Safety knowledge is also anticipated to mitigate injuries (Elkind, 1993; Runyan & Runyan, 1991). Individuals who have more information in memory about safety should be more likely to successfully navigate through potentially dangerous situations. Managers and trainers also work under the assumption that providing knowledge about safety will reduce the likelihood of injury at work (Miller & Agnew, 1973; Hofmann, Jacobs, & Landy, 1995; Reber & Wallin, 1984). In addition, empirical research has found links among safety knowledge, safety communication, and important safety outcomes (Hofmann & Morgeson, 1999; Wells, Stokols, McMahan, & Clitheroe, 1997). In line with past research and theory, it is hypothesized that safety knowledge will be negatively associated with injuries.

Hypothesis 3. Safety knowledge will be negatively related to injuries.

Because the safety cognitions illustrated above are hypothesized to be the primary antecedents of injury, these variables are presumed to largely mediate the impact of other contextual variables on injury prevention, such as participation in safety activities, self-esteem, leadership self-concept, time spent working, and gender. In this study, these contextual exogenous variables will be used to differentially predict each of the safety cognition mediators (Hansen, 1989). These hypotheses are discussed below.

1.4. Time spent working

When younger employees start employment, they inevitably become exposed to many new behaviors, some of which may not be well learned and may include elements of danger. Organizations are often aware of such conditions and act accordingly by using safety training, especially to reduce workers compensation claims (Chadd, 1994; McLain, 1995; Morgenstern, 1992; Rubinsky & Smith, 1973). Furthermore, many organizations make safety a top priority and formally communicate this information to workers during new employee orientations and

training (National Safety Council, 2001; Streff, Kalsher, & Geller, 1993). Given that many young employees may receive such training for the first time in their lives, one may expect that young working individuals will be more likely to learn safety information than individuals not working.

Hypothesis 4. Working status will be positively related to safety knowledge.

1.5. Participation in safety activities

In the public education sector, a popular strategy for raising safety awareness is to have adolescents participate in safety promotion activities, such as volunteer activities designed to teach others about safety (Aherin, Murphy, & Westaby, 1992; Elkind, 1993; Runyan & Runyan, 1991). This study examines the hypothesis that participation in such activities will be related to safety cognitions (Reber & Wallin, 1984). There are several theoretical explanations for this effect. Considerable research in the social sciences has demonstrated that experience with safety information can positively impact safety outcomes (Cooper, Phillips, Sutherland, & Makin, 1994; Hofmann & Morgeson, 1999; Miller & Agnew, 1973; Wells et al., 1997). In addition, individuals who publicly endorse their attitudes or opinions tend to have greater cognitive change than individuals who do not make public statements (Eagly & Chaiken, 1993). Thus, individuals participating in safety promotion activities should be more safety-conscious and less dangerous risk takers than individuals not participating in such activities because of involvement with safety-related information.

Hypothesis 5. Participating in safety promotion activity will be positively related to safety consciousness and positively related to safety knowledge.

The next set of hypotheses examines the impact of several contextual trait variables on safety cognitions. Although trait variables have been examined in numerous psychological studies, relatively less research has examined traits in the injury arena.

1.6. Self-esteem

The first trait examined is self-esteem. Self-esteem has been used to predict a number of criteria in social and organizational psychology (Brown & Dutton, 1995; Kling, Hyde, Showers, & Buswell, 1999; Marsh, 1986). In the accident and injury prevention literature, researchers have focused much of their attention on the changes in self-esteem after a serious injury or disability (Mayer & Eisenberg, 1982; Simon, 1971). Much less research has examined the predictive validity of self-esteem on future injuries. In this study, it is presumed that people with high self-esteem will be more likely to value their health, safety, and physical well-being than individuals with low self-esteem (Salovey, Rothman, Detweiler, & Steward, 2000). Research has shown, for instance, that high self-esteem is related to positive safety outcomes (Friedman, 1989) and behavior (McNair, Carter, & Williams, 1998). Thus, individuals with high self-esteem should be more safety conscious than people with low self-esteem. However, it is also hypothesized that self-esteem may have a risk and excitement function. In particular, people with high self-esteem may be more attracted to dangerous risk seeking given that such risk taking may have elements of excitement, thrill, and value (Baumeister, Heatherton, & Tice, 1993).

Results from a recent study showed that self-esteem had a negative relationship with self-reported driving accidents (Smith & Heckert, 1998). The proposed model in this study can provide an explanation for this finding by examining the mediational role of dangerous risk taking. Specifically, in addition to a health preservation function, the authors propose that self-esteem also has a risk and excitement function. In particular, people with high self-esteem may be more likely to engage in dangerous risk seeking behaviors given that such risk seeking may have elements of excitement, thrill, and enjoyment, which, in turn, could result in negative safety consequences (Baumeister et al., 1993). Recent studies have also demonstrated links between self-esteem and high-risk sport behavior (Gonzalez, Field, Yando, & Gonzalez, 1994; Iso-Ahola & Graefe, 1989) and sexual activity (Seal, Minishiello, & Omodei, 1997). Thus, self-esteem may have a "two-sided" effect on safety cognitions—one promoting generalized safety, while the other promoting occasional dangerous risk taking. Past research has not simultaneously examined these potential relationships.

Hypothesis 6. Self-esteem will be positively related to safety consciousness.

Hypothesis 7. Self-esteem will be positively related to dangerous risk taking.

1.7. Leadership self-concept

This study will examine the role of leadership self-concept on safety cognitions and injury. Leadership has been extensively studied in the organizational sciences (Eagly, Karau, & Makhijani, 1995; Peters, Hartke, & Pohlmann, 1985; Yukl, 1994), but relatively little research has examined the impact of leadership in the safety arena (Butler & Jones, 1979; Foushee, 1984). A recent exception to this is research demonstrating that leadership dynamics, such as those espoused in LMX theory, have an impact on accident prevention in organizational settings (Hofmann & Morgeson, 1999). However, the role of leadership self-perceptions on injury has not been examined on adolescents longitudinally and across contexts. In this study, individuals

perceiving themselves as leaders are expected to be more safety conscious because societal norms place value on leaders that are accountable for safety and health criteria (Tetlock, 1985; Yukl, 1994).

Hypothesis 8. Leadership self-concept will be positively related to safety knowledge.

1.8. Gender

Past research has shown a gender component to injury; males have had more injuries than females in work and nonwork domains (Byrnes, Miller, & Schafer, 1999; Frone, 1998). In the context of automobile accidents, controlled research has demonstrated that women have fewer serious accidents than men (McCarrol & Haddon, 1962), which may result from men's desire for greater risk taking (Cohen, Dearnaley, & Hansel, 1955). Among young agricultural workers, the National Institute for Occupational Safety and Health (NIOSH) reported that males had a fatality rate of 5–11 times greater than females (Hard et al., 1999). The 1999 National Agricultural Statistics Surveillance on nonfatal childhood agricultural injuries also indicated that males were four times more likely to be injured than females (NASS, 1999). Regional and national reports on agricultural injuries also confirm higher incidents of fatal and nonfatal injuries among males (Rivara, 1997; Stueland, Layde, & Lee, 1991; Zietlow & Swanson, 1999). This study will examine the link between gender and injury as being mediated by safety consciousness and dangerous risk taking. In line with past research demonstrating more positive values toward safety espoused by women (Crowe, 1995), we anticipate that females will be more safety conscious and have less dangerous risk-taking attitudes than males.

Hypothesis 9. Gender will be related to safety consciousness (i.e., females will be more safety conscious than males).

Hypothesis 10. Gender will be related to dangerous risk taking (i.e., females will be less dangerous risk takers than males).

1.9. Time 1 injury

Research and theory has shown that past behavioral experience and habit are powerful predictors of future behavior (Hull, 1943; Triandis, 1977). In addition, some habitually driven behaviors may override behavioral intentions. Reason has labeled this type of behavior in dangerous contexts as "absentmindedness": People suddenly realize that they are carrying out actions that they had not intended (Reason & Mycielska, 1982). His research also suggests that absentmindedness often occurs during routine behaviors that are highly automated. These automatic responses are further hypothesized to fit on a continuum of cognitive allocation, ranging from skill and habit to knowledge-based responses. Past field research has also shown that stable individual difference variables are associated with skill-based slips and errors in Reason's model (Broadbent, Cooper, Fitzgerald, & Parkes, 1982). In the context of this study, we expect that Time 1 injury will predict future injuries at Time 2 because such experience represents past behavioral experience in high exposure environments. Moreover, actuaries have consistently shown that past incidents of injury are predictive of future injuries (Elliott, Waller, Raghunathan, Shope, & Little, 2000). Insurance companies often use these findings to justify increases in insurance premiums when individuals have accidents. This study will examine the role of Time 1 injury on future injuries.

Hypothesis 11. Time 1 injury will be positively related to Time 2 injury.

2. Method

2.1. Participants

Participants were members of the National FFA (formerly known as Future Farmers of America), which is the largest youth-serving organization in the United States. The 7,300 chapters across all states and territories involve nearly 500,000 members, aged 12–21 years, of whom 27% live on farms and another 40% live in rural, nonfarm settings. The FFA's mission is to help students "develop their potential for premier leadership, personal growth, and career success through agricultural education." In 1998, the National FFA launched a new initiative, *Partners for a Safer Community*, aimed at promoting agricultural safety and health through education, community development, and youth leadership. The timing of this new program corresponded with NIOSH's evaluation initiative of agricultural safety programs directed toward youths. Researchers approached the National FFA, who agreed to facilitate access to rural-based FFA chapters to evaluate the extent to which the *Partners for a Safer Community* initiative created positive health and safety outcomes.

For generalizability, 180 of 1,565 rural FFA chapters were randomly selected from the following 10 states: California, Iowa, Kansas, Kentucky, Minnesota, Ohio, Oklahoma, Tennessee, Texas, and Wisconsin. Of these chapters, 117 (65%) agreed to participate. Each chapter was given a $100 incentive for completing instruments at each period. FFA chapter advisors and students had the right to refuse to participate at any time, without disincentive. Age was controlled for in this study through selection. Participants were all adolescents in high school. Sixty-seven percent of the sample was male and 33% were female.

The assessment instrument was administered in its entirety at two periods. Time 1 was assessed at the beginning of the academic year and Time 2 was assessed at the end of the academic year. The total number of participants assessed at Time 1 and Time 2 was 8,068 and 5,296, respectively. All scales were pilot tested in a separate study of 150 individuals, which was conducted several months before the first wave of data collection. The purpose of the pilot study was to eliminate items that poorly reflected psychological constructs, such as through exploratory factor analyses and internal consistency analyses. The following discussion describes the scales used in the final assessment instrument.

2.2. Measures

2.2.1. Exogenous variables

Gender was scored 1 for females and 0 for males. Self-esteem was assessed by the 10-item Rosenberg (1979) scale. Principal components factor analysis with varimax and oblique rotation, however, revealed a two-factor solution of items in the original scale. The two dimensions directly corresponded to the positive and negative phrasing of items. Thus, given a potential method artifact, a stronger eigenvalue, and no a priori prediction about "negative" self-esteem items on injury prevention, the five positively phrased items were used to represent self-esteem. Cronbach's alpha for the 5-item scale at Time 1 was .83 (Time 2 α=.85). Leadership self-concept was assessed by 9 items that corresponded to essential nodes in a leadership self-concept schema (Bass, 1990; Howard & Bray, 1988; Wyer & Srull, 1990): (a) I often speak up and give my opinion in groups; (b) People often ask me for advice; (c) When people are not sure what to do, I am usually the first to make a suggestion; (d) I feel comfortable telling a group of people what should be done; (e) Many people copy what I do; (f) I often become the leader in new groups; (g) People think of me as a leader; (h) I have become more of a leader in the past 3 months; and (i) I like being a leader. Respondents rated each item on a 5-point scale ranging from *strongly disagree* (1) to *strongly agree* (5) (Time 1 α=.88; Time 2 α=.90).

Time working was assessed with two measures. The first measure asked how many hours per week (on average) individuals worked when school is in session; the other question asked how many hours per week they worked (on average) during summer vacation or holidays. The items were scored on the same 9-point scale with the following descriptors: 1 = 0 hours/week, 2 = 1 to 5 hours, 3 = 6–10 hours, 4 = 11–15 hours, 5 = 16–20 hours, 6 = 21–25 hours, 7 = 26–30 hours, 8 = 31–40 hours, and 9 = more than 40 hours. The correlation between the 2 items at Time 1 was .69 (α=.80) and at Time 2 was .67 (α=.80).

Participation in safety activity was assessed by 4 items. Participants were asked the degree to which they participated in each of the following activities: (a) taken part in activities promoting health and/or safety; (b) helped teach young people about health and/or safety issues; (c) volunteered at a school or community health and/or safety event; and (d) helped to plan a community health and/or safety event. Items in this scale were anchored from *never* (1) to *very often* (5) (Time 1 α=.82; Time 2 α=.85).

2.2.2. Safety cognitions

Safety consciousness was assessed by 7 items: (a) I always take extra time to do things safely; (b) People think of me as being an extremely safety-minded person; (c) I always avoid dangerous situations; (d) I take a lot of extra time to do something safely even if it slows my performance; (e) I often find myself making sure that other people do things that are safe and healthy; (f) I get upset when I see other people acting dangerously; and (g) Doing the safest possible thing is always the best thing. Respondents rated each item on a 5-point scale ranging from *strongly disagree* (1) to *strongly agree* (5) (Time 1 α=.83; Time 2 α=.85).

The dangerous risk-taking scale was assessed by 5 items: (a) I would rather take risks than be overly cautious; (b) In the past month, I have done some exciting things that other people think are dangerous; (c) I love to take risks even when there is a small chance I could get hurt; (d) Sometimes people get on my nerves when they tell me how to act "more safely"; and (e) I value having fun more than being safe. Respondents rated each item on a 5-point scale ranging from *strongly disagree* (1) to *strongly agree* (5) (Time 1 α=.73; Time 2 α=.77).

The safety knowledge scale was based on self-reported learning across several areas pertinent to agricultural and rural domains: Participants were asked the following: "During the past 3 months, to what extent have you learned about each of the following topics?" The following topics were then listed: (a) noise-induced hearing loss; (b) chemical safety; (c) electrical safety; (d) farm machinery safety; (e) tractor safety; (f) all-terrain vehicle safety; (g) safety with horses; (h) firearm safety; and (i) handling emergencies. These categories were derived as important factors by a panel of subject matter experts in rural areas. The scale anchors for each item were *never* (1) to *very often* (5) (Time 1 α=.82; Time 2 α=.83).

2.2.3. Injury

Given that continuous or even partial surveillance of the large sample was logistically untenable over the longitudinal investigation, self-reported injury items with clear and unambiguous response formats were used (Ellitott et al., 2000). Dichotomous response options for the injury items were used, which also provided an alternative assessment method; other predictor variables, for instance, were often based upon 5-point Likert scales. This was also intended to mitigate common-method variance concerns. Participants responded to the following two measures to assess their general incidents of injury: (a) Have you been injured in the

past 3 months? and (b) Have you been hurt in an accident in the past 3 months? Response options were "no," which was scored 0 or "yes," which was scored 1. The correlation between the 2 items was .55 at Time 1 (α=.71), and .56 at Time 2 (α=.71).

2.3. Matching

Subject matter experts indicated that participant identification would likely result in biased responses given the sensitivity of reporting personal injuries. To mitigate this concern, an anonymous survey matching technique was used to track and match individual responses from Time 1 to Time 2. Thus, names were not used in the study. The matching process was based on the self-generated ID code suggested by Damrosch (1986). This process was located in the final section of the instrument. This section requested participants to provide the following information: (a) first two letters of U.S. state in which participant was born; (b) first letter of month in which participant was born; (c) first two letters of the participant's mother's first name; and (d) the number of older brothers participant has. A computer algorithm was developed to match cases at Time 1 to Time 2. Extensive quality control processes were implemented to eliminate false matches. Ambiguous matches were not included. The matching process resulted in 3,081 complete matches between Time 1 and Time 2. Data from this subset of cases were used in the following analyses. Sixteen percent of the sample was 18 years of age or older, 23% were 17 years, 27% were 16 years, 25% were 15 years, 9% were 14 years, and 1% were 13 years or younger.

3. Results

Table 1 presents descriptive statistics and intercorrelations for variables measured in the hypothesized model at Time 1 and Time 2. Intercorrelations among variables at Time 1 are presented below the diagonal and intercorrelations for Time 2 are presented above the diagonal.

3.1. Exploratory analysis

It could be argued that safety consciousness and dangerous risk taking simply represent two ends of the same continuum. This study hypothesized that safety consciousness and dangerous risk taking are different constructs. To initially test the multidimensionality and discriminant validity of these constructs, an exploratory factor analysis was conducted. The analysis was replicated with Time 1 and Time 2 data. Principal component factor analyses with oblique rotation was used to examine the factor structure of items. All safety consciousness and dangerous risk-taking items were entered into the analysis. In accord with recommendations by Ford, MacCallum, and Tait (1986), the scree plot and eigenvalues were examined to discern acceptable cut-off points. In support of a multidimensional representation of safety and risk, two factors were derived with eigenvalues greater than 1.0 in both samples. In addition, the scree plot indicated a distinct drop in variance explained between the second and third factor representations of the data. Little incremental variance was explained beyond the two-factor solution. Items loaded on hypothesized scales with factor loadings greater than .65 at Time 1 and .68 at Time 2. Moreover, there was no significant cross-factor item loading (Stevens, 1996). Results were also replicated using varimax rotation across both Time 1 and Time 2 samples. The next set of analyses more formally examines the construct validity of these constructs within the context of all hypothesized latent variables.

3.2. Confirmatory analyses

Confirmatory factor analyses were first conducted to examine the proposed measurement model. Measurement models were examined on both Time 1 and Time 2 cross-sectional data sets. Separate analyses were conducted to test the reliability of measurement models in contrast to pooling both waves of data. Sufficient power was manifest in the sample (Marsh, Balla, & McDonald, 1988) that surpassed the 10:1 ratio of observations to variables set forth by Nunnally (1978). To identify the models, error terms from the endog-

Table 1
Descriptive statistics and correlations at Time 1 and Time 2

	M	*SD*	1	2	3	4	5	6	7	8	9
1. Work status	3.81 (3.86)	2.43 (2.46)	(.74)	.13	.03	.08	−.28	.27	.01	.03	.07
2. Participating in safety activities	1.81 (2.00)	0.82 (0.90)	.06	(.44)	.03	.29	.06	.34	.34	−.07	.01
3. Self-esteem	3.88 (3.87)	0.74 (0.75)	.08	.08	(.53)	.43	.01	.12	.22	.12	−.03
4. Leadership self-concept	3.10 (3.24)	0.81 (0.82)	.08	.28	.45	(.66)	.13	.20	.28	.12	.08
5. Gender	0.33 (0.33)	0.47 (0.47)	−.25	.11	−.02	.12	(1.00)	−.09	.15	−.14	−.10
6. Safety knowledge	2.71 (2.69)	0.86 (0.84)	.29	.33	.15	.18	−.13	(.51)	.28	.04	.07
7. Safety consciousness	3.00 (2.98)	0.78 (0.77)	.05	.36	.23	.27	.13	.25	(.60)	−.41	−.15
8. Dangerous risk taking	3.24 (3.23)	0.83 (0.82)	.04	−.11	.11	.13	−.12	.03	−.42	(.52)	.18
9. Injury	0.67 (0.70)	0.40 (0.39)	.11	.04	−.01	.07	−.10	.13	−.15	.21	(.35)

N=3,081. Intercorrelations between scales for Time 1 are presented below the diagonal and above the diagonal for Time 2. Diagonal entries include the correlations between scales at Time 1 and Time 2.

enous variables were fixed at unity (i.e., 1) and all latent variables were allowed to correlate freely (i.e., free parameters). Maximum likelihood method of estimation was used. The proposed models were admissible with covariance matrices all positive definite. For Time 1, the proposed model adequately reflected the data, $\chi^2(869, N=3{,}081)=8373.92$, chi square to degrees of freedom ratio (χ^2/df) = 9.64, RMSEA (root mean square error of approximation)=.05, NNFI/TLI (nonnormed fit index/Tucker–Lewis fit index)=.97, CFI (comparative fit index)=.98, IFI (incremental fit index)=.98, and RFI=.97. These indices were used given the nature of the models examined and the number of parameters fitted (Bollen, 1989; Gerbing & Anderson, 1992; Medsker, Williams, & Holahan, 1994). Results from Time 2 data were similar: χ^2 (869, $N=3{,}081$) = 8074.04 χ^2/df = 9.29, RMSEA=.05, NFI/TLI=.98, CFI=.98, IFI=.98, and RFI=.97. Standardized fac-

Table 2
Standardized factor loadings of manifest variables in measurement models at Time 1 and Time 2

Factor	1	2	3	4	5	6	7	8
1. Self-esteem								
*x*1	.68 (.70)							
*x*2	.65 (.68)							
*x*3	.70 (.71)							
*x*4	.80 (.82)							
*x*5	.65 (.72)							
2. Leadership self-concept								
*x*1		.72 (.76)						
*x*2		.73 (.74)						
*x*3		.82 (.83)						
*x*4		.83 (.83)						
*x*5		.54 (.59)						
*x*6		.64 (.67)						
*x*7		.61 (.66)						
*x*8		.54 (.60)						
*x*9		.59 (.60)						
3. Time spent working								
*x*1			.91 (.89)					
*x*2			.75 (.77)					
4. Participating in safety activities								
*x*1				.74 (.76)				
*x*2				.82 (.82)				
*x*3				.77 (.80)				
*x*4				.62 (.67)				
5. Safety consciousness								
*x*1					.61 (.67)			
*x*2					.65 (.65)			
*x*3					.59 (.61)			
*x*4					.66 (.68)			
*x*5					.62 (.64)			
*x*6					.65 (.67)			
*x*7					.71 (.72)			
6. Dangerous risk taking								
*x*1						.56 (.58)		
*x*2						.74 (.75)		
*x*3						.44 (.51)		
*x*4						.67 (.73)		
*x*5						.58 (.59)		
7. Safety knowledge								
*x*1							.32 (.39)	
*x*2							.37 (.39)	
*x*3							.38 (.43)	
*x*4							.93 (.92)	
*x*5							.93 (.92)	
*x*6							.56 (.59)	
*x*7							.31 (.36)	
*x*8							.42 (.44)	
*x*9							.36 (.37)	
8. Injury								
*x*1								.79 (.77)
*x*2								.70 (.72)

Time 2 loadings are in parentheses. Specific items denoted by *x* correspond to the order of presentation in the Method section.

tor loadings for both Time 1 and Time 2 measurement models are presented in Table 2. Overall, very similar factor loadings were found for manifest variables at Time 1 and Time 2. Fitting additional paths did not significantly improve the fit of the model.

The second set of analyses examined the hypothesized latent variable model on cross-sectional data using structural equation modeling. Error terms for endogenous variables were set at unity (i.e., 1) with latent exogenous variables being allowed to correlate freely. Other paths were constrained in accord with the hypothesized model. Error terms for the mediator (endogenous) variables were also allowed to correlate; to note, similar results were found when the covariation of these error terms were restricted to 0. Maximum likelihood method of estimation was used. The proposed model was admissible with covariance matrices all positive definite. The proposed model adequately reflected the Time 1 data, $\chi^2(879, N=3{,}081)=8523.85$, $\chi^2/df=9.69$, RMSEA=.05, NFI/TLI=.97, CFI=.98, IFI=.98, and RFI=.97. Time 2 results were similar: $\chi^2(879, N=3{,}081)=8187.42$, RMSEA=.05, $\chi^2/df=9.31$, NFI/TLI=.98, CFI=.98, IFI=.98, and RFI=.97.

Given adequately fitting models, hypothesized path coefficients were examined. Standardized coefficients are presented in Fig. 1. All hypothesized relationships were significant and consistent at Time 1 and Time 2. The strongest associations were manifest between dangerous risk taking and injuries (Time 1 path=.23, Time 2 path=.18), working status and safety knowledge (Time 1 path=.49, Time 2 path=.41) and participating in safety activities and safety consciousness (Time 1 path=.30, Time 2 path=.30). However, the positive association found between safety knowledge and injury was the opposite of that expected (Time 1 path=.13; Time 2 path=.10). Explanations for this finding will be addressed in the Discussion section.

The final set of analyses longitudinally examined associations between endogenous variables at Time 1 and Time 2. The hypothesized model and corresponding results are presented in Fig. 2. Endogenous variables were the primary focus of the longitudinal model, especially since they were confirmed to mediate the role of other antecedent variables. In the longitudinal model, error terms between exogenous variables were allowed to correlate freely. The standard correction for attenuation formula was also applied. Results suggest that this model adequately reflected the data: $\chi^2(973, N=3{,}081)=12{,}594.74$, $\chi^2/df=12.98$, RMSEA=.06, NFI/TLI=.96, CFI=.97, IFI=.97, and RFI=.96.

An examination of path coefficients revealed strong Time 1–Time 2 reliability for safety knowledge (path=.56), safety consciousness (path=.69), and dangerous risk taking (path=.66). Injury at Time 1 was also predictive of injury at Time 2 (path=.44). Dangerous risk taking (path=.09) and safety consciousness (path = – .08) also contributed to prediction of injuries at Time 2 over and above that explained by past injuries alone; this was also confirmed with classic hierarchical regression analyses. Injuries at Time 1 were also weakly linked to safety consciousness (path = – .05) and dangerous risk taking at Time 2 (path=.07), suggesting little attitudinal change as the result of injury.

4. Discussion

The purpose of this study was to examine the antecedents of injury among youths at potential risk in agricultural settings. It was hypothesized that time spent working, participation in safety activities, self-esteem, leadership self-concept, and gender would relate to three safety cognition constructs: Safety consciousness, dangerous risk taking,

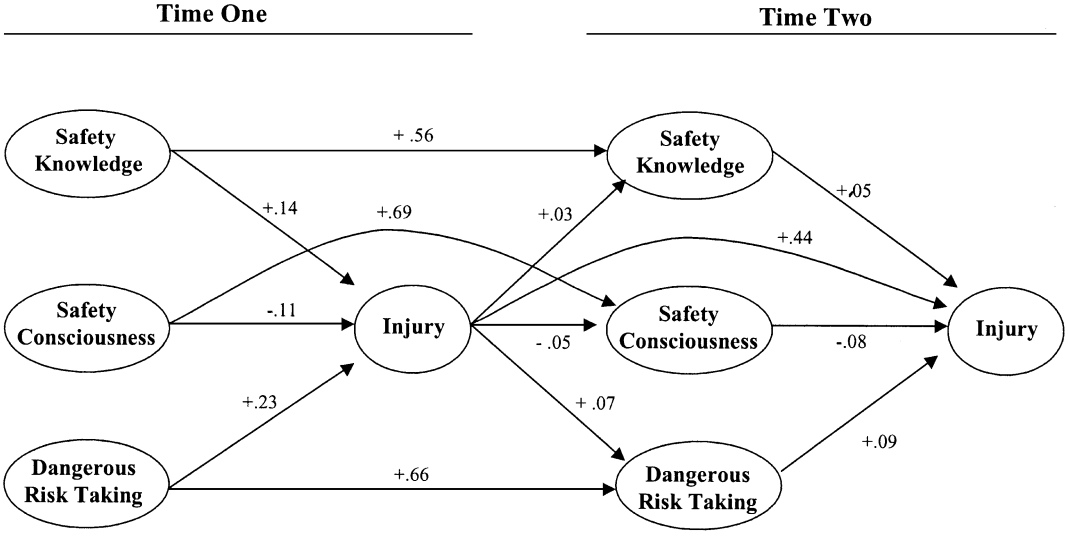

Fig. 2. Longitudinal path coefficients for endogenous variables in structural equation model.

and safety knowledge. The safety constructs, in turn, were hypothesized to provide the strongest prediction of injuries. Data from 3,081 individuals in 10 states were used to evaluate the model on young working and nonworking adults. Goodness of fit results suggest that both longitudinal and cross-sectional models adequately reflected the data.

Cross-sectional results at Time 1 and Time 2 revealed that the exogenous variables were associated with safety cognition constructs. We consider these results in turn. First, results indicated that time spent working was strongly associated with safety knowledge; higher levels of safety knowledge was manifest for working individuals than nonworking individuals. Learning new jobs and new employee orientations likely contributed to this relationship. This demonstrates a strong role that work may play on the cognitive development of safety cognitions. Second, results suggested that participating in safety activity was positively associated with safety knowledge and safety consciousness. It is likely that such activities impact the depth of processing of information, which translates into crystallized attitudes and knowledge regarding safety (Kruglanski & Webster, 1996; Westaby, 2002). These findings are also consistent with past research demonstrating that experience with attitude objects can facilitate attitude change (Eagly & Chaiken, 1993; Miller & Millar, 1996). Thus, having individuals engage in safety activities may positively impact safety cognitions and outcomes.

Third, self-esteem had a positive association with safety consciousness. Individuals with high self-esteem may value their health and well-being and thereby enact cognitions that promote such well-being (Seligman & Csikszentmihalyi, 2000). However, as predicted, we also found that self-esteem was positively related to dangerous risk taking. People with high self-esteem were more likely to hold dangerous risk-taking cognitions than people with low self-esteem. Thus, self-esteem had both positive and negative outcomes on safety mediators. Although individuals with high self-esteem may value safety in general, they may also be attracted to activities that have exciting elements of risk and danger. These risky activities, however, may increase injuries. Furthermore, it could be the case that individuals with high self-esteem may become overconfident of their skills and abilities, which could place them in high-risk activities. Future research will need to further examine the role of self-esteem on injury events.

Although the effect size was relatively weak, leadership self-concept also explained variance in safety consciousness. Thus, encouraging the youth to participate in leadership experiences may facilitate safety cognitions. Moreover, given the relatively strong association between leadership self-concept and self-esteem, increasing levels of leadership may also have positive effects on self-esteem development. Finally, gender was associated with endogenous variables. As predicted and replicating past research, males demonstrated both less safety consciousness and higher levels of dangerous risk taking than females. We now turn our attention to the predictive role of safety cognition mediators on injuries.

Safety consciousness, dangerous risk taking, and safety knowledge were hypothesized to predict injuries as well as mediate the impact of exogenous variables. These hypotheses were supported on multiple criteria: cross-sectional results at Time 1 and Time 2 and the prediction of injury at Time 2 from mediator variables at Time 1. Exogenous variables did not account for unique variance in injury beyond that explained by the hypothesized mediators.

Results indicated that each mediator was associated with injuries across the multiple criteria. First, safety consciousness was negatively related to injury. Those individuals with high levels of safety consciousness were less likely to have injuries than individuals with low levels of safety consciousness. These findings support Wilde's (1986) contention that it is important to enhance people's desire to be safe and healthy to impact prevention strategies. These results also imply that it may be beneficial to continually heighten youths' safety consciousness, such as through health and safety classes, the media, or from social pressure emanating from family and friends (Ajzen, 1991; Eagly & Chaiken, 1993; Fishbein & Ajzen, 1975). Moreover, informal communication stressing safety may be beneficial (e.g., "Be careful"). This would theoretically activate a safety consciousness prime, which in turn may help prevent individuals from deciding to pursue acts that may lead to injury.

Second, dangerous risk taking was positively associated with injuries. Those individuals that held dangerous risk-taking attitudes were more likely to report injuries than individuals without dangerous risk-taking attitudes. This variable also had the strongest association with injuries across all periods and contributed to the prediction of injuries at Time 2 unaccounted for by variables at Time 1, including past injuries. Thus, it appears that individuals with high levels of dangerous risk-taking cognitions are prime candidates for intervention.

It should be noted that the association between participating in safety activities and dangerous risk taking (e.g., $r = -.07$ at Time 2) was weaker than the association between participating in safety activities and safety consciousness (e.g., $r=.34$ at Time 2). This suggests that although safety activity programs may be effective at increasing safety consciousness, they may be less effective at providing guidance for not engaging in dangerous activities. Thus, safety campaigns that illustrate the negative consequences of contemplating dangerous risk taking may be beneficial. For instance, it may be important to compel adolescents to think for 2 seconds before engaging in an activity they know may increase their chances of physical danger (Prochaska et al., 1994). Such anticipatory thinking may make individuals reconsider the immediate activity that they are contemplating.

Results from this study also suggest that self-esteem had an indirect effect on increasing injuries through the dangerous risk-taking mediator as compared to its weaker mediated effect through safety consciousness. In other words, because

dangerous risk taking has a stronger association with injuries than safety consciousness and because self-esteem is similarly related to both mediators, the indirect effect of self-esteem appears to impact injury through dangerous risk taking. Thus, it may be important to educate individuals with high self-esteem that their dangerous risk-taking pursuits may increase their odds of injury, although they may hold higher levels of safety consciousness relative to individuals with low self-esteem.

Finally, against expectations, this study did not find a negative association between safety knowledge and injuries. Conversely, a positive association was discerned for both cross-sectional and longitudinal analyses. Those individuals that reported high levels of safety knowledge reported more injuries. This may be explained by the fact that some people are being placed in more dangerous work environments that also provide greater safety-related information.

To illustrate, first note that time spent working was positively associated with safety knowledge. Thus, the working individuals may have been learning more because they were spending more time in higher risk work environments. However, they may not have been learning enough to reduce their injury rates compared to nonworkers. The positive zero-order correlation between time spent working and injuries also supports this argument and previous research shows that working may increase injuries (Stueland et al., 1991). Pragmatically, the above results suggest that educational efforts and workplace modifications may be needed to increase the safety of adolescents at work.

This study also found several strong relationships longitudinally. First, there was strong reliability among mediator variables assessed at Time 1 and Time 2. For example, individuals demonstrating strong safety consciousness at Time 1 were also very likely to demonstrate strong safety consciousness at Time 2. Psychologically, this suggests that these variables are robust individual difference variables that may reflect strong aspects of the self-concept. Future research will need to examine the malleability of these concepts. We also found that injuries at Time 2 were predicted from injuries at Time 1. That is, those individuals who reported being injured at Time 1 were more likely to be injured at Time 2. The robust direct effect of Time 1 injury on Time 2 injury beyond that explained by safety cognitions has several implications. First, it suggests that people's habitual experience is not entirely mediated by their cognitions toward safety and risk (Triandis, 1977). For example, some individuals may have high levels of safety consciousness, but their well-learned and automated behavioral routines may lead to absentmindedness, reoccurring errors, and injuries (Reason & Mycielska, 1982). Second, young people's exposure to various injuries may remain fairly constant over time, and safety cognitions may not be at sufficient levels to prevent injuries. Finally, the relatively strong relationship between Time 1 and Time 2 injury suggests that historical and developmental factors may influence dangerous activity. Future work examining the potential development of these tendencies in childhood is needed. Finally, longitudinal results showed that dangerous risk taking contributed to the prediction of injuries at Time 2 beyond Time 1 injury alone. For instance, individuals who started to manifest higher levels of dangerous risk-taking perceptions since Time 1 who did not have accidents were more likely to have injuries at Time 2.

Data from this study also addressed the notion that injuries may increase safety consciousness and reduce dangerous risk taking in the future. Results suggested that individuals who experienced injuries at Time 1 had somewhat less dangerous risk-taking attitudes at Time 2 and had somewhat increased levels of safety consciousness at Time 2. Although the trend was in the appropriate direction, results suggest that many individuals were still holding dangerous risk-taking attitudes and lower levels of safety consciousness after they had an injury or accident at Time 1. Psychologically, this may reflect individuals' perceptions of invulnerability (Quadrel et al., 1993). Although they had an injury at Time 1, they were still likely to hold dangerous risk-taking attitudes in the future. In other words, some individuals may not be learning or changing from past injury events. Because this study did not assess invulnerability, future research linking this concept to dangerous risk taking would be fruitful. In addition, research will need to examine the role of perceived control on potentially dangerous activities (Ajzen, 1991). It may be the case that youth experience illusions of control where less control exists in reality (Svenson, 1978). Past research has also shown that individuals demonstrate overconfidence in many choice and judgment tasks (Slovic, Fischhoff, & Lichtenstein, 1984). In high-risk environments, such overconfidence may result in poor decision making, resulting in injury.

5. Limitations

There are several limitations to this study. First, this study was correlational; thus, causal inferences cannot be made. Although longitudinal data provides some tentative inferences concerning time ordering of variable associations, causal statements are premature. Second, common-method variance may have contributed to prediction across exogenous and mediator variables, although the response format for the self-reported injury criterion used a different scaling method than psychological variables. Given the nature of the problem studied (i.e., injuries across time and life domains), it was not possible to obtain objective indicators of injury on the diverse sample. However, future research could examine how the safety constructs in this study may function in more specific contexts, such as organizations with recorded injury data. In addition, future research replicating these findings in conjunction with additional concepts, such as organizational safety climate, may be fruitful. For instance, do individuals with high safety consciousness change their safety orientations when enter-

ing organizations that have low safety climates? Conversely, do such individuals have a positive impact on the safety climate of the group? This could also be moderated by leadership level. For instance, leaders with high safety consciousness and low dangerous risk seeking may have the best chance at influencing safety climates at work (Dunbar, 1975).

In summary, results from this study indicated that injuries were predicted by safety consciousness and dangerous risk-taking concepts. The antecedent variables of time spent working, participation in safety activities, self-esteem, and gender were most strongly related to safety consciousness and dangerous risk-taking mediators. Results have implications for safety training and risk management practices designed to alleviate injuries among the youth in agricultural settings.

Acknowledgements

This project was funded by the Centers for Disease Control-NIOSH Community Partners Grant No. U06/CCU512924. The authors express gratitude to Richard Berg and our project assistants at the National Farm Medicine Center, a program of Marshfield Medical Research Foundation, Marshfield, WI.

References

Aherin, R. A., Murphy, D. J., & Westaby, J. D. (1992). *Reducing farm injuries: Issues and methods*. St. Joseph, MI: American Society of Agricultural Engineers.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179–211.

Allen, V. L. (1982). *Eutropistic reactions to risks and hazards.* Presented at the 20th Annual Congress of Applied Psychology, Edinburgh.

Atkinson, J. W. (1957). Motivational determinants of risk taking behavior. *Psychological Review*, *64*, 359–372.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173–1182.

Bass, B. M. (1990). *Handbook of leadership: A survey of theory and research*. New York: Free Press.

Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1993). When ego threats lead to self-regulation failure: Negative consequences of high self-esteem. *Journal of Personality and Social Psychology*, *64*, 141–156.

Bollen, K. A. (1989). *Structural equations with latent variables*. New York: Wiley.

Broadbent, D. E., Cooper, P. F., Fitzgerald, P., & Parkes, K. R. (1982). The cognitive failures questionnaire (CFQ) and its correlates. *British Journal of Clinical Psychology*, *21*, 1–16.

Brown, J. D., & Dutton, K. A. (1995). The thrill of victory, the complexity of defeat: Self-esteem and people's emotional reactions to success and failure. *Journal of Personality and Social Psychology*, *68*, 712–722.

Burns, P. C., & Wilde, J. S. (1995). Risk taking in male taxi drivers: Relationships among personality, observational data and driver records. *Personality and Individual Differences*, *18*, 267–278.

Butler, M. C., & Jones, A. P. (1979). Perceived leader behavior, individual characteristics, and injury occurrence in hazardous work environments. *Journal of Applied Psychology*, *64*, 299–304.

Byrnes, J. P., Miller, D. C., & Schafer, W. D. (1999). Gender differences in risk taking: A meta-analysis. *Psychological Bulletin*, *125*, 367–383.

Castillo, D. N., Landen, D. D., & Layne, L. A. (1994). Occupational injury deaths of 16- and 17-year-olds in the United States. *American Journal of Public Health*, *84*, 646–649.

Chadd, C. (1994). Managing OSHA compliance: The human resources issues. *Employee Relations Law Journal*, *4*, 104.

Cohen, J., Dearnaley, E. J., & Hansel, C. E. M. (1955). Risk taken in crossing the road. *Operational Research Quarterly*, *6*, 120–127.

Conrad, P., Bradshaw, Y. S., Lamsudin, R., Kasniyah, N., & Costello, C. (1996). Helmets, injuries and cultural definitions: Motorcycle injury in urban Indonesia. *Accident Analysis and Prevention*, *28*, 193–200.

Cooper, M. D., Phillips, R. A., Sutherland, V. J., & Makin, P. J. (1994). Reducing accidents using goal setting and feedback: A field study. *Journal of Occupational and Organizational Psychology*, *67*, 219–240.

Cox, S., & Cox, T. (1991). The structure of employee attitudes to safety: A European example. *Work and Stress*, *5*, 93–106.

Crowe, J. W. (1995). Safety values and safe practices among college students. *Journal of Safety Research*, *26*, 187–195.

Damrosch, S. P. (1986). Ensuring anonymity by use of subject-generated identification codes. *Research in Nursing and Health*, *9*, 61–63.

DeRoo, L. S., & Rautiainen, R. H. (2000). A systematic review of farm safety interventions. *American Journal of Preventative Medicine*, *18*, 51–62.

Dunbar, R. L. (1975). Managers' influence on subordinate thinking about safety. *Academy of Management Journal*, *18*, 364–369.

Dunn, K. A., Runyan, C. W., Cohen, L. R., & Schulman, M. D. (1998). Teens at work: A statewide study of jobs, hazards, and injuries. *Journal of Adolescent Health*, *22*, 19–25.

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich College Publishers.

Eagly, A. H., Karau, S. J., & Makhijani, M. G. (1995). Gender and the effectiveness of leaders: A meta-analysis. *Psychological Bulletin*, *117*, 125–145.

Elkind, P. D. (1993). Correspondence between knowledge, attitudes, and behavior in farm health and safety practices. *Journal of Safety Research*, *24*, 171–179.

Ellitott, M. R., Waller, P. F., Raghunathan, T. E., Shope, J. T., & Little, R. J. A. (2000). Persistence of violation and crash behavior over time. *Journal of Safety Research*, *31*, 229–242.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.

Fitzpatrick, J. S. (1980). Adapting to danger: A participant observation study of an underground mine. *Sociology of Work and Occupations*, *7*, 131–158.

Ford, J. K., MacCallum, R. R., & Tait, M. (1986). The application of exploratory factor analysis in applied psychology: A critical review and analysis. *Personnel Psychology*, *39*, 291–314.

Foushee, H. C. (1984). Dyads and triads at 35,000 feet: Factors affecting group process and air crew performance. *American Psychologist*, *39*, 885–893.

Friedman, H. L. (1989). The health of adolescents: Beliefs and behaviour. *Social Sciences and Medicine*, *29*, 309–315.

Frone, M. R. (1998). Predictors of work injuries among employed adolescents. *Journal of Applied Psychology*, *83*, 565–576.

Gerbing, D. W., & Anderson, J. C. (1992). Monte Carlo evaluations of goodness of fit indices for structural equation models. *Sociological Methods and Research*, *21*, 132–160.

Gibbons, F., & Gerrard, M. (1995). Predicting young adults' health risk behavior. *Journal of Personality and Social Psychology*, *69*, 505–517.

Gonzalez, J., Field, T., Yando, R., & Gonzalez, K. (1994). Adolescents—perceptions of their risk-taking behavior. *Adolescence*, *29*, 701–709.

Green, C. H., & Brown, R. A. (1977). *The perception of, and attitudes towards, risk: Final report: E2, measures of safety.*

Hale, A. R., & Glendon, A. I. (1987). *Individual behavior in the control of danger*. Amsterdam: Elsevier.

Hansen, C. P. (1989). A causal model of the relationship among accidents, biodata, personality, and cognitive factors. *Journal of Applied Psychology*, *74*, 81–90.

Hard, D., Myers, J., Snyder, K., Casini, V., Morton, L., Cianfrocco, R., & Fields, J. (1999). Young workers at risk when working in agricultural production. *American Journal of Industrial Medicine Supplement*, *1*, 31–33.

Heino, A., van der Molen, H., & Wilde, G. J. S. (1996). Differences in risk experience between sensation avoiders and sensation seekers. *Personality and Individual Differences*, *20*, 71–79.

Hofmann, D. A., Jacobs, R. R., & Landy, F. (1995). High reliability process industries: Individual, micro, and macro organizational influences on safety performance. *Journal of Safety Research*, *26*, 131–149.

Hofmann, D. A., & Morgeson, F. P. (1999). Safety-related behavior as a social exchange: The role of perceived organizational support and leader–member exchange. *Journal of Applied Psychology*, *84*, 286–296.

Hofmann, D. A., & Stetzer, A. (1998a). The role of safety climate and communication in accident interpretation: Implications for learning from negative events. *Academy of Management Journal*, *41*, 644–657.

Hofmann, D. A., & Stetzer, A. (1998b). A cross-level investigation of factors influencing unsafe behaviors and accidents. *Personnel Psychology*, *49*, 307–339.

Howard, A., & Bray, D. W. (1988). *Managerial lives in transition: Advancing age and changing times*. New York: Guilford Press.

Hull, C. L. (1943). *Principles of behavior: An introduction to behavior theory*. New York: Appleton-Century-Crofts.

Iso-Ahola, S. E., & Graefe, A. R. (1989). Perceived competence as a mediator of the relationship between high risk sports participation and self-esteem. *Journal of Leisure Research*, *21*, 32–39.

Janssens, M., Brett, J. M., & Smith, F. J. (1995). Confirmatory cross-cultural research: Testing the viability of a corporation-wide safety policy. *Academy of Management Journal*, *38*, 364–382.

Kling, K. C., Hyde, J. S., Showers, C. J., & Buswell, B. N. (1999). Gender differences in self-esteem: A meta-analysis. *Psychological Bulletin*, *125*, 470–500.

Knight, E. B., Castillo, D. N., & Layne, L. A. (1995). A detailed analysis of work-related injury among youth treated in emergency departments. *American Journal of Industrial Medicine*, *27*, 793–805.

Kruglanski, A. W., & Webster, D. M. (1996). Motivated closing of the mind: "Seizing" and "freezing". *Psychological Review*, *103*, 263–283.

Levenson, M. R. (1990). Risk taking and personality. *Journal of Personality and Social Psychology*, *58*, 1073–1080.

Marsh, H. W. (1986). Global self-esteem: Its relation to specific facets of self-concept and their importance. *Journal of Personality and Social Psychology*, *51*, 1224–1236.

Marsh, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness-of-fit indexes in confirmatory factor analysis: The effect of sample size. *Psychological Bulletin*, *103*, 391–410.

Mayer, J. D., & Eisenberg, M. G. (1982). Self-concept and the spinal-cord-injured: An investigation using the Tennessee Self-Concept Scale. *Journal of Consulting and Clinical Psychology*, *50*(4), 604–605.

McCarrol, J., & Haddon, W. (1962). A controlled study of fatal automobile accidents in New York. *Journal of Chronic Diseases*, *15*, 811–826.

McLain, D. L. (1995). Responses to health and safety risk in the work environment. *Academy of Management Journal*, *38*, 1726–1743.

McNair, L. D., Carter, J. A., & Williams, M. K. (1998). Self-esteem, gender, and alcohol use: Relationships with HIV risk perception and behaviors in college students. *Journal of Sex and Marital Therapy*, *24*, 29–36.

Medsker, G. J., Williams, L. J., & Holahan, P. J. (1994). A review of current practices for evaluating causal models in organizational behavior and human resource management research. *Journal of Management*, *20*, 439–464.

Miller, G., & Agnew, N. (1973). First aid training and accidents. *Occupational Psychology*, *47*, 209–218.

Miller, M. G., & Millar, K. U. (1996). The effects of direct and indirect experience on affective and cognitive responses and the attitude–behavior relation. *Journal of Experimental Social Psychology*, *32*, 561–579.

Morgenstern, M. (1992). Workers' compensation. Managing costs. *Compensation and Benefits,* 30–38.

Murphy, D. J. (1992). *Safety and health for production agriculture*. St. Joseph, MI: American Society of Agricultural Engineers.

National Agricultural Statistics Service (NASS), Agricultural Statistics Board, U.S. Department of Agriculture (1999). *1998 Childhood Agricultural Injuries*, *8*(10–99).

National Research Council Institute of Medicine (1998). *Protecting youth at work*. Washington, DC: National Academy Press.

National Safety Council (2001). *Injury facts*. Itasca, IL: Author.

Newcomb, M. D., & McGee, L. (1991). Influence of sensation seeking on general deviance and specific problem behaviors from adolescence to young adulthood. *Journal of Personality and Social Psychology*, *61*, 614–628.

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.

Parker, D., Manstead, A. S. R., Stradling, S. G., & Reason, J. T. (1992). Intention to commit driving violations: An application of the theory of planned behavior. *Journal of Applied Psychology*, *77*, 94–101.

Peters, L. H., Hartke, D. D., & Pohlmann, J. T. (1985). Fiedler's contingency theory of leadership: An application of the meta-analysis procedures of Schmidt and Hunter. *Psychological Bulletin*, *97*, 274–285.

Prochaska, J. O., Velicer, W. F., Rossi, J. S., Goldstein, M. G., Markus, B. H., Rakowski, W., Fiore, C., Harlow, L. L., Redding, C. A., Rosenbloom, D., & Rossi, S. R. (1994). Stages of change and decisional balance model for 12 problem behaviors. *Health Psychology*, *13*, 39–46.

Quadrel, M. J., Fischhoff, B., & Davis, W. (1993). Adolescent (in)vulnerability. *American Psychologist*, *48*, 102–116.

Reason, J. T., Manstead, A., Stradling, S., & Baxter, J. S. (1990). Errors and violations on the roads: A real distinction? *Ergonomics*, *33*, 1315–1332.

Reason, J. T. & Mycielska, K. (1982). *Absent minded? The psychology of mental lapses and everyday errors*. Englewood Cliffs, NJ: Prentice Hall.

Reber, R. A., & Wallin, J. A. (1984). The effects of training, goal setting, and knowledge of results on safe behavior: A component analysis. *Academy of Management Journal*, *27*, 544–560.

Rivara, F. P. (1997). Fatal and non-fatal farm injuries to children and adolescents in the United States, 1990–1993. *Injury Prevention*, *3*, 190–194.

Rosenberg, M. (1979). *Conceiving the self*. New York: Basic Books.

Rubinsky, S., & Smith, N. (1973). Safety training by accident simulation. *Journal of Applied Psychology*, *57*, 68–73.

Runyan, C. W., & Runyan, D. K. (1991). How can physicians get kids to wear bicycle helmets? A prototypic challenge in injury prevention. *American Journal of Public Health*, *81*, 972–973.

Salovey, P., Rothman, A. J., Detweiler, J. B., & Steward, W. T. (2000). Emotional states and physical health. *American Psychologist*, *55*, 110–121.

Schiff, M. (1977). Hazard adjustment, locus of control and sensation seeking: Some null findings. *Environment and Behaviour*, *9*, 233–254.

Seal, A., Minishiello, V., & Omodei, M. (1997). Young women's sexual risk taking behaviour: Re-visiting the influences of sexual self-efficacy and sexual self-esteem. *International Journal of STD and AIDS*, *8*, 159–165.

Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology. *American Psychologist*, *55*, 5–14.

Simon, J. I. (1971). Emotional aspects of physical disability. *American Journal of Occupational Therapy*, *25*, 408–410.

Simonet, S., & Wilde, G. J. S. (1997). Risk: Perception, acceptance and homeostasis. *Applied Psychology: An International Review*, *46*, 235–252.

Slovic, P. (1987). Perception of risk. *Science*, *236*, 280–285.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1984). *Regulation of risks: A*

psychological perspective. Social science and regulatory policy. Berkeley, Ca: University of California Press.

Smith, D. L., & Heckert, T. M. (1998). Personality characteristics and traffic accidents of college students. *Journal of Safety Research*, *29*, 163–169.

Smith, R. E., Ptacek, J. T., & Smoll, F. L. (1992). Sensation seeking, stress, and adolescent injuries: A test of stress-buffering, risk-taking, and coping skills hypotheses. *Journal of Personality and Social Psychology*, *62*, 1016–1024.

Stevens, J. (1996). *Applied multivariate statistics for the social sciences*. (3rd ed.). Mahwah, NJ: Erlbaum.

Streff, F., Kalsher, M., & Geller, E. S. (1993). Developing efficient workplace safety programs: Observations of response co-variations. *Journal of Organizational Behavior Management*, *13*, 3–14.

Stueland, D., Layde, P., & Lee, B. (1991). Agricultural injuries in children in Central Wisconsin. *Journal of Trauma*, *31*, 1503–1509.

Svenson, O. (1978). Risks of road transportation in a psychological perspective. *Accident Analysis and Prevention*, *10*, 267–280.

Tetlock, P. E. (1985). Accountability: The neglected social context of judgment and choice. *Research in Organizational Behavior*, *7*, 297–332.

Triandis, H. C. (1977). *Interpersonal behavior*. Monterey, CA: Brooks/Cole.

Wagenaar, W. A., & Reason, J. T. (1990). Types and tokens in road accident causation. *Ergonomics*, *33*(10–11), 1365–1375.

Weinstein, N. D., Grubb, P. D., & Vautier, J. S. (1986). Increasing automobile seat belt use: An intervention emphasizing risk susceptibility. *Journal of Applied Psychology*, *71*, 285–290.

Wells, M., Stokols, D., McMahan, S., & Clitheroe, C. (1997). Evaluation of a worksite injury and illness prevention program: Do the effects of the REACH OUT training program reach the employees? *Journal of Occupational Health Psychology*, *2*, 25–34.

Westaby, J. D. (2002). Identifying specific factors underlying attitudes toward change: Using multiple methods to compare expectancy-value theory to reasons theory. *Journal of Applied Social Psychology*, *32*, 1083–1106.

Wilde, G. J. S. (1985). Assumptions necessary and unnecessary to risk homeostasis. *Ergonomics*, *28*, 1531–1538.

Wilde, G. J. S. (1986). Beyond the concept of risk homeostasis: Suggestions for research and application towards the prevention of accidents and lifestyle-related disease. *Accident Analysis and Prevention*, *18*, 377–401.

Wyer, R. S., & Srull, T. K. (1990). *Memory and cognition in its social context*. Hillsdale, NJ: Erlbaum.

Yee, B. W. K., Castro, F. G., Hammond, W. R., John, R., Wyatt, G. E., & Yung, B. R. (1995). Panel IV: Risk-taking and abusive behaviors among ethnic minorities. *Health Psychology*, *14*, 622–631.

Yukl, G. (1994). *Leadership in organizations*. Englewood Cliffs, NJ: Prentice Hall.

Zietlow, S. P., & Swanson, J. A. (1999). Childhood farm injuries. *American Surgeon*, *65*, 693–698.

Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. *Journal of Applied Psychology*, *65*, 96–102.