

Hazardous Work, Fear of Injury, and Safety Voice:  
The Role of Invulnerability Among Young Workers

By

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## Abstract

Young workers are more likely than older workers to sustain an injury in the workplace, but it is not clear why this is the case. One perspective is that young workers feel impervious to physical danger at work, blinding them to potential hazards, dampening their motivation to speak up about potential hazards, or both. The current paper investigates in 2 studies the role of invulnerability in predicting young workers' intentions to speak up about hazardous work (safety voice). I propose a moderated-mediation model in which perceptions of hazardous work are related to safety voice intentions via fear of injury, and that higher perceptions of invulnerability buffer (a) the extent to which potential hazards generate fear of injury and (b) the extent to which fear of injury motivates safety voice intentions. In Study 1, I randomly assigned participants ( $n = 115$ , aged 15-25) to either an unsafe or safe scenario depicting working conditions in an industrial kitchen. Participants with lower perceptions of invulnerability reported higher safety voice intentions across all levels of fear of injury. Participants with higher invulnerability perceptions reported as high safety voice intentions only when fear of injury was high, and reported much lower safety voice intentions than those with low levels of invulnerability when fear of injury was low. Study 2 replicates this model using three waves of field data from Manitoba young workers ( $n = 67$ ), each of whom kept the same job throughout the 2012 summer vacation. Overall, the results from the two studies suggest that young workers who perceive themselves as invulnerable to physical injuries at work are less likely than their more vulnerable counterparts to speak up about safety concerns especially when the work environment is not particularly hazardous.

*Keywords:* fear, injuries, invulnerability, safety, voice, young workers

### Hazardous Work, Fear of Injury, and Safety Voice:

#### The Role of Invulnerability Among Young Workers

Statistics indicate that young workers (15-24 years old) are 50% more likely to sustain an injury at work than their older counterparts are (Breslin et al, 2003; Breslin & Smith, 2005), with young males being four times more likely than older males to sustain an injury at work (Breslin, Koehoorn, Smith, & Manno, 2003). According to researchers and government safety councils, young workers as a group possess many characteristics that put them at a high risk of injury, including relative inexperience, limited knowledge of their rights and responsibilities, and their eagerness to please adult co-workers (McCloskey, 2008). Other research has shown that young workers are at a heightened risk of injury due to their anatomical, physiological, and psychological characteristics (e.g., Alsop, Gifford, Langley, Beg, & Firth, 2000; Anderson, Hannif, & Lamm, 2011; Windau & Meyer, 2005). Furthermore, young people are at a greater risk of harm from exposure to hazardous substances, and can develop cumulative trauma disorders due to rapid growth and development of musculoskeletal systems and organs (Linker, Miller, Freeman, & Burbacher, 2005). While the occupational health and safety literature includes extensive research on injury rates, safety climates, and management strategies (Lavack et al., 2008), there exists a gap in the literature on how invulnerability affects young workers' occupational safety.

Teenagers and young adults are more likely than adults to believe that they are invincible and that they will not get hurt when taking risks (Lapsley, Aalsma, & Halpern-Felsher, 2005) because of perceived invulnerability to injury, harm, and danger (Lapsley & Hill, 2010). While the broader literature on the relationship between invulnerability and risk-taking has produced

inconsistent results, there is a gap in the literature on the relationship between invulnerability and preventative behaviors such as safety voice (i.e., speaking out and challenging the status quo with the intent of improving the safety of the work situation; Tucker, Chmiel, Turner, Hershcovis, & Stride, 2008).

The present study includes a review of the extant literature on workplace injuries and safety voice, and examines the relationship between young worker invulnerability and safety voice through the development of a model about the perceptions of safety, and safety voice mediated by the fear of injury, and moderated by invulnerability. I present results from two studies.

### **Theoretical Background**

The literature on heightened young worker injury rates can be confusing, as researchers attribute the high injury rates of young workers to many different factors. Breslin et al. (2007) conducted a systematic review of the literature on factors associated with young worker (non-agricultural) injury, finding that job and workplace factors (e.g., hazard exposure and perceived work overload) significantly affected work injury. The systematic review identified a list of factors lacking in the extant research: safety training, supervision, physical and cognitive development, intervention studies, and the social environment of the workplace. Evidently, there is no single factor that explains heightened young worker injuries.

Some researchers posit that risk-taking and injuries are a consequence of adolescent immaturity, as adolescents may experience heightened vulnerability for risky behavior due to delayed cognitive development: the temporal gap between puberty (impels adolescents toward

thrill seeking) and the slow maturation of the cognitive-control system (regulating impulses; Steinberg; 2004, 2007). Recent research found a positive correlation between the tendency to engage in risky activity and white matter growth in the cerebral cortex (Berns, Moore, & Capra, 2009), while other research has failed to show that insufficiently developed cortical functions (i.e., used to counter increased activation during adolescent impulsivity and risk taking) explains the rise in adolescent sensation seeking (Romer et al., 2011), and validation for higher sensation seeking in adolescence than in adulthood (Arnett, 1996). Sensation seeking may help to explain reckless behaviour from a developmental approach, as reckless behavior can provide the intense stimulation that people high in sensation seeking desire (Arnett, 1996), yet other researchers posit that young people are not able to accurately assess risks (Cohn, MacFarlane, Yanez, & Imai, 1995).

There exists a significant amount of literature on adolescent and young adult risk perception (e.g., Cohn et al., 1995; Flynn, Slovic, & Mertz, 1994; Gustafson, 1998; Lapsley et al., 2005; Reyna & Farley, 2006), which investigates the ways which individuals assess risky encounters (Mbaye & Kouabenan, 2013). According to Kahneman, Slovic, and Tversky (1982), individuals make probabilistic judgements based on heuristics which can result in both reasonable and erroneous judgements. Perceived seriousness, perceived probability, and perceived vulnerability appear to have the most significant impact on protection motivation (Weinstein, 1993). Understanding how young workers assess risks and hazards is essential to reducing young worker injury rates.

However, for accurate risk assessment to reduce injury rates, young workers must be aware of how to raise concerns about unsafe work conditions, and must feel comfortable and

confident enough to voice concerns to others. When confronted with hazardous work conditions, workers of any age may comply with requests from managers or co-workers and perform tasks they perceive to be unsafe. Alternatively, some workers quit unsafe jobs and search for new employment that offers safer work conditions. The current study examines an alternative response to hazardous work, namely safety voice, which involves making suggestions about how to improve safety (Tucker et al., 2008; Tucker & Turner, 2011).

### **Safety Voice**

Voice serves as a transmission mechanism for employee concerns and complaints into possible solutions to organizational problems (Zhou & George, 2001), and is a form of organizational citizenship behaviour that emphasizes constructive challenge to improve a situation as opposed to merely criticize the situation (Van Dyne & LePine, 1998). Employee voice is often directed to human resources departments, a union representative, an organizational expert, or a supervisor (e.g., Botero & Van Dyne, 2009; Bowen & Blackmon, 2003; Detert & Trevino, 2010; Rusbult et al., 1998; Travis et al., 2011). Safety voice shares similarities with general employee voice (e.g., LePine & Van Dyne, 2001), and involves speaking out and challenging the status quo with the intent of improving the safety of the work situation (e.g., to motivate action to make procedures, situations, and processes safer; Tucker et al., 2008). To reduce the high injury rates suffered by young workers, safety education programs recommend that young workers report injuries and hazards to managers or supervisors (e.g., Kosny, 2005) even if they do not have suggestions for improvement.

Building on the workplace safety literature and the gap on young worker safety and safety voice intentions, I propose that young worker invulnerability affects safety voice. That is, young workers that do not believe they will get hurt are less likely than others to voice safety concerns. Adolescent invulnerability is thought to play a major role in risk-taking behaviour (Goldberg, Halpern-Felsher, & Millstein, 2002), and the tendency for young workers to view themselves as unique and immune to the consequences that might befall others (Millstein & Halpern-Felsher, 2002) may decrease young worker safety voice.

### **Perceptions of Invulnerability**

The developmental approach to risk-taking considers willingness to take risks as both a normal developmentally appropriate exploratory behavior and a negative outcome of cognitive development (i.e., specifically of egocentrism), where risk-taking is considered deliberative (i.e., it is a decision about how to act, and the risk is weighted against other factors; Greene et al., 2000). Elkind (1967) posits that invulnerability is a negative by-product of the changing mental system and his theory is a cognitive account of adolescent development and describes adolescence as a time of perceived invulnerability to risk and danger (Barry, Pickard, & Ansel, 2009). Elkind's (1967) theory includes two constructs: the imaginary audience, and the personal fable. The imaginary audience is characterized by the adolescent's assumption that everybody else shares his/her preoccupation with his/her personal appearance and behaviour, and is used to explain a variety of phenomena that have to do with reactions to feelings of being constantly evaluated and judged by peers. Several characteristics that accompany imaginary audience tendencies could also affect adolescent risk-taking behaviour (e.g., heightened adolescent self-consciousness, flamboyant behaviour, and concern with shame; Lapsley, 1993). The personal

fable, on the other hand, posits that adolescents tend to view themselves as invulnerable, unique, and immune to the consequences that might befall others (Millstein & Halpern-Felsher, 2002), and invulnerability can culminate in a conviction that death will happen to others, but not to themselves (Elkind, 1967), which often yields a sense of speciality commonly associated with behavioural risk-taking (Alberts et al., 2007).

Researchers have found that when compared with their parents, teenagers minimize the harm associated with periodic involvement in health-threatening activities, and many researchers and child development texts attribute adolescent risk taking to feelings of invulnerability (Cohn et al., 1995). Adolescents are disproportionately represented in the majority of risk-taking categories (e.g., automobile driving, illegal drug use, sex without contraception, and minor criminal activity) when compared with members of other age groups (Arnett, 1992). Research has shown that young drivers perceive less risk in tail gaiting, speeding, and driving at night than do older drivers; and some researchers have attributed the high accident rates sustained by youths to the failure to perceive dangerous situations rather than to a desire to pursue risks (e.g., Finn & Bragg, 1986; Jonah, 1986; Matthews & Moran, 1986). Other research has found that some adolescents may evaluate a situation in a way that justifies taking risks (Fischhoff, 2008).

Risk perceptions can be biased, resulting in distorted risk assessments, and biases can result in underestimating or overestimating risks (Mbaye & Kouabenan, 2013). Research has found that young people take bigger risks, view themselves as invulnerable or immortal, and are unrealistic about their own mortality (e.g., Loughlin & Frone, 2004; Smith, 2004), which helps to explain why young workers often disregard company policies, take shortcuts, and ignore hazards (Dehaas, 1996; Beharie, 2003; Lavack et al., 2008).

Greene et al. (2000) analyzed adolescent self-report data to assess the predictive power of egocentrism in adolescent risk-taking behaviour, finding that a high personal fable score was a key component in the explanation of most risk-taking behaviour. Research has also shown measures of invulnerability to be inversely associated with adolescents' perceived risk aversion intentions (e.g., Greene, Rubin, & Hale, 1995; Greene, Rubin, Walters, & Hale, 1996). In other words, adolescents that score high in invulnerability typically report low risk aversion intentions. One perspective is that adolescents can be "blinded" by perceptions of invulnerability that accompany feelings of uniqueness. Instead of exhibiting risk behaviour due to judgement errors, young workers may ignore health messages because they may not recognize risks that are apparent to others (Yates, 1992). Furthermore, young workers may fail to recognize that a risk judgement is required, and therefore may feel that the health messages are directed at others and not at them (Greene et al., 2000). Numerous researchers (e.g., Alberts et al., 2007; Greene et al., 2000; Hudson & Gray, 1986; Lapsley, FitzGerald, & Rice, 1989) have found significant co-variation between personal fable and risk-taking, which strengthens the relevance of cognitive-social immaturity to the risk-taking behaviours of adolescents.

Young people with high levels of invulnerability often do not realize the need to assess the known hazards of a situation, or often do not assess the hazards of the situation because they believe that harm will befall others, but not themselves. Young workers that do not believe they could sustain an injury are unlikely to use safety voice either because they do not detect a possible physical hazard, do not connect the perception of risk with the potential to mitigate it with safety voice, or both. As a result, based on the extant workplace safety literature, perceptions

of invulnerability in the context workplace safety put young workers at a heightened risk of sustaining an injury.

### **Fear of Injury**

The majority of the literature on invulnerability and decision-making is concerned with risk perception. However to investigate the relationship between the work environment and the role of invulnerability, it is important to understand the extent to which young workers fear injury in the workplace. Fear is classified as a state of being apprehensive or scared when presented with real or potential threat (Gullone & King, 1997). Perceptions of physical safety at work and threats to this safety are multi-faceted: some people view a safe work environment as one that is void of major injuries or accidents, regardless of measures or precautions that are taken. To others, the same work environment might be deemed unsafe due to lacking precautionary measures or safety equipment.

The extant occupational health and safety literature highlights the link between the work environment, injury, and stress, and the potential confounding factors in the relationship (Johnston, 1995). Risks and hazards at work affect burnout, engagement, and safety outcomes (Nahrgang, Morgeson, & Hofmann, 2011), and within both sports and work settings, fear of physical injury is a source of worry, and can even be a reason for leaving a sport (Chase, Magyar, & Drake, 2005) or work organization (e.g., Wood, Nadershahi, Fredekind, Cuny, & Chambers, 2006). There exists very little research on fear of injury as a construct, as the majority of extant research measures fear of injury indirectly, or integrated with fear of illness (Thibodeau, Fetzner, Carleton, Kachur, & Asmundson, 2013).

### Hypotheses

Safety voice is an essential component of workplace safety, with environments conducive to voice enabling safer workplaces (Tucker & Turner, 2011). Individuals that do not believe they will sustain an injury are unlikely to voice safety concerns to others. Therefore, the relationship between invulnerability and safety voice can provide one approach to understanding the predominantly high injury rates found among samples of young workers. Based on the research presented above, I propose that in the face of unsafe work conditions, young workers who believe they are invulnerable are both less likely than those who perceive themselves as vulnerable to (a) perceive an unsafe work environment as worrisome, and (b) in the face of that worry, less likely to voice safety concerns. This relationship will be exaggerated in the case of safe work conditions, as the cues of physical risk are less salient, and the resulting need to raise concerns about safety are less relevant.

Building on the extant invulnerability and safety voice literatures, I therefore propose that individuals' safety voice intentions are moderated by their level of perceived invulnerability. Under safe work conditions, the means of safety voice intention will be similar for individuals that believe they are invulnerable and for individuals that perceive themselves to be vulnerable. Under unsafe work conditions, however, workers that believe they are invulnerable are less likely to voice safety concerns than workers that believe they could sustain an injury in an unsafe workplace. I argue that perceptions of invulnerability likely decrease overall fear of injury.

*Hypothesis: Fear of injury mediates the relationship between the perceived hazards of the work environment and safety voice intentions; the mediation depends on the perceived invulnerability of the respondent (moderated-mediation, see Figure 1), such that (a) the relationship between a physically hazardous work environment and fear of injury will be*

*lower among those with higher invulnerability perceptions; and (b) the relationship between fear of injury and safety voice intentions will be lower among those with higher invulnerability perceptions.*

### **Study 1**

#### **Method**

Undergraduate students aged 18-25 ( $M = 20.66$  years, 42.6% male) enrolled in an introductory marketing course ( $n = 115$ ) at a Canadian university received course credit for participating in the research subject pool. I administered a scenario study using between-subjects design with random assignment. The on-line experiment included two restaurant scenarios developed by Tucker and Tucker (2013b), as well as survey items designed to assess the study variables. Scenario studies place participants in a realistic situation to elicit feedback about their attitudes and behavioural intentions based on the information in the scenario (Karren & Barringer, 2002). Participants first completed the items designed to assess their invulnerability before reading one of two realistic job scenarios (i.e., “unsafe” vs. “safe” workplace) describing a commercial kitchen to which they were randomly assigned. The kitchen scenarios were based on descriptions of restaurants provided by teenaged restaurant workers who participated in a focus group study, in which they were asked to describe differences in the quality of safety conditions and common injuries in a restaurant environment (Tucker & Turner, 2013a). It was this information that was used to develop scenarios describing an unsafe and a comparatively safe kitchen environment.

The unsafe restaurant kitchen scenario described salient physical hazards (e.g., grease and other liquid spills) that put participants at risk of slips, trips, and falls; improper labels on chemical containers; and accounts of workers sustaining injuries (see Appendix A). In contrast,

the safety restaurant scenario described a kitchen where grease and liquid spills are quickly mopped up; chemical containers are properly labeled; and no injuries have been observed during the employee's one-month tenure at the job (see Appendix B). After reading their assigned scenario, participants completed items designed to assess fear of injury, safety voice intentions, and realism check items.

## Measures

**Perceptions of invulnerability.** I used two items ( $\alpha = .56$ ) from the danger invulnerability sub-scale of the Adolescent Invulnerability Scale (see Appendix C; Duggan, Lapsley, & Norman, 2000), which captures adolescents' sense of indestructibility and propensity to take physical risks (e.g., "Safety rules do not apply to me."). Participants rated items on a five-point Likert-type scale ranging from (1) *strongly disagree* to (5) *strongly agree*.

**Fear of injury.** Fear of injury was measured ( $\alpha = .95$ ) with two items ("I fear that I could have an accident at this job" and "I fear that I could get hurt at this job") using a 5-point Likert-type scale from 1 (*strongly disagree*) to 5 (*strongly agree*).

**Safety voice intentions.** Safety voice intentions ( $\alpha = .91$ ) were assessed using Tucker and Turner's (2011) safety voice scale to assess behavioral intentions of young workers to speak up to supervisors and co-workers about safety hazards at work. The scale consists of six items (see Appendix D) rated on a five-point Likert-type scale ranging from (1) *very unlikely* to (5) *very likely*. Example items include "I speak to co-workers at risk and encourage them to fix safety problems" and "I tell my supervisor about the consequences of dangerous working conditions."

**Realism check.** To assess the realism of the scenario, participants were asked, “Overall, how realistic do you think this situation was?” The scale ranged from 1 (*not realistic*) to 10 (*very realistic*).

## Results

I first conducted a manipulation check to ensure that the participants perceived the two scenarios as equally as realistic. Both the unsafe ( $M = 6.94$ ,  $SD = 2.06$ ) and safe scenarios ( $M = 7.03$ ,  $SD = 2.00$ ) were scored as highly realistic and there was a non-significant difference on realism between the two scenarios ( $t[131] = 0.26$ ,  $p = .80$ ). I then used Model 58 in the PROCESS macro (Hayes, 2012) implemented in IBM-SPSS Version 19. This macro allowed me to analyze whether fear of injury mediated the relationship between perceived physical hazards and safety voice intentions, while simultaneously testing moderated pathways in which (a) perceived physical hazards and invulnerability interacted on fear of injury, and (b) fear of injury and invulnerability interacted on safety voice intentions. I used bootstrap confidence intervals from 5000 resamples to verify the nature of the conditional indirect effects. Descriptive statistics and intercorrelations for the study variables appear in Table 1.

In the first regression, perceptions of physical hazards ( $B = 1.55$ ,  $p < .001$ ; Table 2, mediator variable model) predicted fear of injury, such that those reading the unsafe scenario reported higher fear than those reading the safe scenario did. In the second regression, fear of injury did not predict safety voice intentions ( $B = .11$ ,  $p = .09$ ), and perceived safety of the work environment had no direct effect on safety voice intentions ( $p = .78$ ). Fear of injury did not mediate the relationship between perceived safety of the work environment (i.e., both the safe

and unsafe scenario) and safety voice intentions. Invulnerability did not predict co-worker safety voice intentions ( $B = -.12$ ,  $p = .17$ ), but, as hypothesized, the interaction between fear of injury and invulnerability was significant ( $B = .17$ ,  $p = .012$ ; see Figure 2). The full model explained 9.8% of the variance in safety voice intentions. The interaction between the perceived safety of the work environment and invulnerability was not significant ( $B = .03$ ,  $p = .91$ ).

I assessed the conditional indirect effect of the perceived physical hazards on safety voice intentions through fear of injury at five levels of invulnerability (10th, 25th, 50th, 75th, and 90th percentiles) by running a 95% bias-corrected bootstrap confidence interval (see Table 5). The indirect effect was positive, such that as invulnerability increased, that is, as participants reported higher invulnerability, the stronger the effects of fear of injury on safety voice intentions. No indirect effect was found for those participants reporting invulnerability below the 75<sup>th</sup> percentile.

## Discussion

The purpose of this study was to examine the relationship between invulnerability and safety voice at work to provide information for both the design of young worker safety campaigns and for organizations. Recent research investigating invulnerability and risk-taking at work has shown a weak negative relationship ( $r = -.11$ ) between invulnerability and precautions taken (i.e., workers that scored the highest on invulnerability reported taking fewer precautions at work; Mbaye & Kouabenan, 2013). Based on these findings, I proposed that in unsafe work environments, individuals higher in invulnerability would have lower safety voice intentions than individuals lower in invulnerability, and that, in contrast, under safe work conditions, invulnerability would not play a role in predicting safety voice. The scenarios administered to

participants in this study were designed to signal a stark contrast in objective risk of physical injury, and necessarily reflect extremes encountered in real organizational settings.

In part contrast to the hypothesis, invulnerability had a moderating effect only on the pathway between fear of injury and safety voice intentions, and not the relationship between perceptions of physical hazards and fear of injury. That is, invulnerability played no role in the extent to which ‘objective’ safety hazards generated fear of injury. Young workers high in invulnerability seemed to register real threats to their personal safety in the same way those low in invulnerability did. However, where invulnerability did have a contingent role was the extent to which fear of injury translated into safety voice intentions. In particular, young workers who scored above the seventy-fifth percentile in invulnerability registered a weaker relationship between fear of injury and safety voice intentions *under safe conditions*. In other words, young workers who perceived themselves to be at the risk of injury, even when faced with relative safe work conditions, were motivated to speak up safety concerns to co-workers. The hyper-invulnerable did not, suggesting that invulnerability may serve to muffle the link between reactions to potential physical risk (i.e., fear of injury) and safety voice intentions when the objective environment indicates work is relatively safe.

Fortunately, this is not the case when the objective environment signals that work is relatively unsafe. In situations in which fear of injury was high, safety voice intentions of participants higher in invulnerability were on average equal to those of participants lower in invulnerability (see Figure 2). In other words, in an unsafe work environment in which the fear of injury is high, young workers regardless of invulnerability elicit similar safety voice intentions. In

situations with lower fear of injury, participants higher in invulnerability elicit much lower safety voice intentions.

### **Limitations**

As with all research, it is worth pointing out a number of limitations with this research. First, while I was able to assess the realism of the scenarios, this research could be strengthened by including a manipulation check assessing the safety of the scenarios (e.g., “Overall, how safe do you think this situation was?”). Participants reported the fear of injury in response to the scenario they read, which was an indirect method of assessing the perceived safety of each scenario (see manipulation check used in Tucker & Turner, 2013b), but modeled in this study as a psychological mechanism by which physical hazards are related to safety voice intentions. Participants presented with the unsafe scenario reported more fear of injury than participants presented with the safe scenario, which supports the notion that the participants were able to differentiate between safety conditions across the two scenarios

A second limitation of this research was that participants were undergraduate students, and therefore the resultant model can only be generalized to this limited population. The participants were taking a summer marketing course, and therefore will not be representative of university students from other faculties, nor of the typical university student that takes courses during the regular sessions. In addition, the summer classes often have a high percentage of students from overseas, and therefore a lower likelihood of English being their primary language.

Finally, this experiment was conducted in the lab to explore issues of internal validity, and therefore suffers from limited external and ecological validity. In the next study, the role that

fear of injury plays in determining safety voice intentions will be examined using participants working in a range of organizations. What I am attempting to do with Study 2 is constructive replication with a methodological extension: replication of the model found in Study 1, but using working participants surveyed across multiple time points.

## Study 2

Study 2 aims to replicate Study 1 in the field using participants working in a range of organizational settings. While the results from Study 1 provide useful insight into the relationship between young worker invulnerability and safety voice, the generalizability of the model is limited because of the artificial setting in which Study 1 participants were embedded. Study 2 uses field data which serves to increase both the external and ecological validity of this research. This study is also strengthened by a longitudinal (3-wave) design.

## Method

**Participants.** High school students ( $n = 182$ ) aged 15-20 were recruited from across the province of Manitoba. Interested high school principals were contacted and asked to identify suitable grade 11 and 12 classes. As part of a larger data collection for a project on young worker safety, I then visited classrooms at two high schools, explaining the research study to potential student participants and offering them the opportunity to participate in exchange for \$10 per completion of multiple (up to 12) monthly surveys. Participants either had a job at the time of recruitment, or indicated that they would be getting a job once school ended and summer holidays began. Data are restricted to the first three waves of this larger data collection effort. Only those participants (i.e.,  $n = 65$ , 44.6% male,  $M$  age = 17 years,  $SD$  age = 1.05 years) that

completed all three waves of data collection, and stated that they had not changed jobs throughout the data collection, were included in the analysis.

**Research design and procedure.** On-line surveys were completed outside of school hours and took approximately 15 minutes to complete. Participants received a check in the mail every three months for up to a maximum of \$30 (i.e., \$10 per survey completion).

## Measures

**Perceptions of physical hazards.** I measured perceptions of physical hazards at each of the first three waves of data collection by creating a composite score of (a) frequency with which the respondent was asked to do dangerous work tasks in the last four weeks (i.e., “How many times in the past month were you asked to do a task at your main job that you thought was dangerous?” with categorical answers ranging from never to five or more) and (b) frequency of minor injuries (e.g., burn or a scald, fractured bone) sustained in the last four weeks (i.e., “In the last month, how many times have these things happened to you at your main job?” with categorical answers ranging from never to more than five times). Frequency of dangerous work tasks and frequency of minor injuries were both standardized and then summed. As this is a formative index and not a reflective scale score, usual indicators of reliability (e.g., Cronbach’s alpha) are not appropriate (Frone, 1998)

Scales for *invulnerability* (measured at Time 1), *fear of injury* (measured at Times 1, 2, and 3), and *safety voice intentions* (measured at Time 3) were the same as Study 1.

## Results

Like with Study 1, I used Model 58 in the PROCESS macro (Hayes, 2012) implemented in IBM-SPSS Version 19 to test the moderated mediation model and conduct bootstrap resampling to assess the conditional indirect effects. Descriptive statistics and intercorrelations appear in Table 3.

In the first regression, perceived physical hazards ( $B = .55, p < .004$ ; Table 4, mediator variable model) predicted fear of injury, such that those participants reporting higher perceived physical hazards reported higher fear than those reporting lower perceived physical hazards. In the second regression, fear of injury did not predict safety voice ( $B = .07, p = .76$ ), and perceived physical hazards had no direct effect on safety voice ( $p = .20$ ). Fear of injury did not mediate the relationship between perceived physical hazards and safety voice. Invulnerability did not predict co-worker safety voice ( $B = .11, p = .75$ ), but, as hypothesized, the interaction between fear of injury and invulnerability was significant ( $B = .91, p = .01$ ). The full model explained 10.9% of the variance in safety voice. The interaction between the perceived physical hazards and invulnerability was not significant ( $B = -.13, p = .52$ ).

I assessed the conditional indirect effect of the perceived physical hazards on safety voice through fear of injury at five levels of invulnerability (10th, 25th, 50th, 75th, and 90th percentiles) by running a 95% bias-corrected bootstrap confidence interval (see Table 6). The indirect effect was positive, such that as invulnerability increased, that is, as participants reported higher invulnerability, the stronger the effects of fear of injury on safety voice intentions. No indirect effect was found for those participants reporting invulnerability below the 90<sup>th</sup> percentile.

## **Discussion**

The purpose this second study was to replicate Study 1 in the field using participants working in a range of organizational settings. Since Study 1 was conducted in the lab, Study 2 aimed to increase the generalizability of the findings by replicating the model in the field using a sample of young workers. The findings of Study 2 mirrored those of the first study such that when fear of injury is high, young workers report speaking up about safety regardless of how invulnerable they believe they are. In situations where fear of injury is low, the highly invulnerable do not report the need to exhibit safety voice, while those scoring lower in invulnerability maintain voice intentions that are similar to those in unsafe work environments.

**Limitations.** While Study 2 replicated Study 1 in the field, it still had limitations. One limitation was the small sample size. While close to two hundred students were recruited to take part in the study, only 65 participants were working the same job at each of and across the three waves of data collection. Future research could attempt to replicate this model using a larger sample to ensure that statistical power is not constraining parameter estimates.

Since the surveys were completed outside of a lab setting, and participants were compensated for their participation, it is difficult to assess the concentration of the participants while completing the surveys. It is possible that the participants were motivated by the money they received for participating, and completed the surveys while distracted (e.g., watching television). Future research could extend this research using focus groups with the young workers (e.g., Tucker & Turner, 2013a) to more accurately assess the hazards experienced by the young workers, and their behavioral responses to unsafe work.

Finally, the majority of the participants were just starting their summer jobs at the onset of this study, and therefore they may not have completed their job training and begun to gain a nuanced understanding of their work environment and their supervisors. That is, participants may not have worked at their jobs long enough to feel comfortable voicing safety concerns to co-workers or supervisors, and therefore this research could be strengthened by extending the longitudinal design to investigate changes in perceived physical hazards and safety voice over a time period longer than three months.

### **General Discussion**

The purpose of these two studies was to examine how young worker invulnerability affects employee safety voice. The first study showed that participants, regardless of invulnerability, reported high safety voice intentions when they perceived the work environment to be unsafe. In situations eliciting low fear, participants low in invulnerability reported high voice intentions similar to those in high fear situations, while the highly invulnerable reported lower safety voice intentions (see Figure 2 and Figure 3). In other words, in safe environments the highly invulnerable don't see the need to speak up proactively about safety concerns, but when push comes to shove and the highly invulnerable are confronted with unsafe environments, they tend to voice safety concerns at a much higher frequency, very similar to those low in invulnerability. Study 2 replicated the model in the field by showing that the participants that are at the most invulnerable are unlikely to use employee safety voice when the work environment lacks salient hazards.

While invulnerability moderated the relationship between fear of injury and safety voice, it did not moderate the relationship between the perceived physical hazards in the work environments and fear of injury. The lack of an interaction at this stage of the model may be due to several different factors. In Study 1, while the unsafe scenario was developed based on the descriptions of unsafe work by young workers (Tucker & Tucker; 2013b), the scenario may have been described as so unsafe that even the hyper-invulnerable may have recognized the scenario as unsafe, therefore eliciting high fear of injury similar to the participants lower in invulnerability. Similarly, in Study 2, the lack of an interaction may have been affected by the types of jobs worked by the young workers, and the fear of injury expected in jobs typically worked by young people (i.e., service industry). To investigate this further, it would be useful to include a sample of workers from many different sectors of industry in hopes of garnering more variance in fear of injury.

It is also important to note that social desirability may have affected the extent to which invulnerability moderated the relationship between perceived physical hazards and fear of injury. Perhaps when prompted, the invulnerable participant reports fear of injury to be perceived as aware of their work environment. As is discussed in the limitations of this research, invulnerability was operationalized using two items, decreasing the likelihood that the items in fact capture the concept of invulnerability, and therefore may weaken the role of invulnerability as a moderator in this model.

Taken together, the results of this research can have significant implications on safety training and prevention strategies designed to reduce young worker injuries. While invulnerability only moderated the relationship between the perceived physical hazards of the

work environment and safety voice for those participants that were in the highest quantile of invulnerability, the findings of both studies can increase awareness of how the perceived physical hazards of a work environment can affect safety precautions taken by young workers.

### **Practical Contributions**

These findings have implications for young worker safety training. In “safe” workplaces (i.e., low perceived physical hazards), where the fear of injury is low, young workers that believe they are invulnerable are less likely to voice proactive safety concerns than young workers that are lower in invulnerability. Young workers should be made aware that a work environment can become unsafe very quickly. Injury may be imminent when fear of injury is low, as workers often maintain a false sense of security that puts them at risk of sustaining an injury. This research can be applied by organizations to enhance the design of workplace safety campaigns, and to aid in the design of safety messages and training programs to reach invulnerable young workers that do not elicit safety voice when work situations are safe (i.e., an environment where immediate hazards are not salient). Workplace safety programs should provide young workers with examples of how their lives could be changed after sustaining an injury at work, essentially reminding them that they are in fact vulnerable to injury even if the work environment lacks any salient injuries or obvious hazards.

### **Theoretical Contributions**

Invulnerability is often incorrectly associated with recklessness. A contribution of this study is the finding that even though young workers may believe themselves to be invulnerable, they may not elicit reckless behaviour. In both studies it was shown that in work environments

(i.e., both in the lab and in the field) where the fear of injury is high young workers actually have high safety voice intentions, contradicting the common notion that invulnerable young people are reckless.

This research highlights the subjective nature of classifying a work environment as either safe or unsafe. For the purpose of Study 1, a safe work environment was defined as an environment in which safety precautions were followed, and there were no recent accidents, close calls, or injuries. However, a “safe” workplace can become “unsafe” very quickly, and therefore it is important that managers and subordinates alike are aware of the dangers at work, even when hazards are not salient. Situations that seem safe but are actually quite hazardous does not necessarily increase feelings of invulnerability. For an individual to feel invulnerable, they must first identify a situation as hazardous, but believe that they would not get hurt, whereas others may. Therefore in hazardous environments void of accidents, individuals may experience an optimism bias or heightened situational invulnerability. However, a more plausible explanation is likely that in high risk environments lacking recent accidents or injury, individuals likely perceive the environment as safe, and disregard any thoughts of the potential accidents or injuries, as they lack recent memories of the negative consequences (i.e., injuries) in the environment. This false sense of “safety” can inhibit safety behaviors (e.g., wearing personal protective equipment). When people of all ages feel as though they are unlikely to be hurt, or that an environment is safe, they are unlikely to spend time or energy to take safety precautions.

### **Limitations**

A limitation of this research, and of the majority of research on voice (e.g., Farrell & Rusbult, 1992; Leck & Saunders, 1992; Rusbult et al., 1998; Saunders et al., 1992) is that actual voice behaviour is not observed; instead, self-reported frequency or intentions/likelihood of engaging in voice behaviours are assessed (LePine & Van Dyne, 1998). Scenario studies ask respondents to report their behavioural intentions in a given situation, and therefore it is possible that participants may indicate that they would, for example, speak up, when in a real workplace they would remain silent (Tucker & Turner, 2013a). Generalizing data based on intentions and assuming that they represent actual voice behavior is problematic (LePine & Van Dyne, 1998), Study 2 asked participants to report the frequency to which they exhibit safety voice at their main job (not just their safety voice intentions), and therefore it is vital to remember that self-reported data is not always accurate. Social desirability bias may also have affected participants' reported safety voice behaviors, and therefore future research would benefit by observing actual voice behaviour in the workplace.

Unfortunately the design of this study was not conducive for investigating alternative approaches to adolescent risk-taking behavior (i.e., learned behavior or personality trait). Perhaps a longitudinal design would highlight any changes in risk-taking behavior over time, strengthening claims of risk-taking as a learned behavior or personality trait. Also, there are many factors that affect the propensity to voice, and this research was limited to participants reporting their safety voice intentions, and self-reporting their safety voice behaviours. Both studies could be strengthened by asking participants about how open to voice they perceive their supervisors to be, and for reasons that affect their propensity to exhibit safety voice.

While the face validity of the items (e.g., “Safety rules do not apply to me”) seems to be tapping into invulnerability, it is possible that the highly invulnerable participant may agree that safety rules apply to them but still disregard hazards. To better operationalize invulnerability, future research should use a more comprehensive, multi-item scale of perceived invulnerability developed specifically to investigate invulnerability in work environments.

Also, the model used in the studies only worked for those participants that were the most invulnerable, and thus the importance of these findings may be questioned, as the model only worked for the hyper-invulnerable (see Table 5 and Table 6).

### **Future Research**

Future research should investigate the relationship between invulnerability and safety voice across both experience and age. Currently, there is a gap in the literature on age and experience and safety voice, and a study assessing both invulnerability and safety voice with a sample including participants of different age groups and experience levels could improve the effectiveness of safety campaigns. A longitudinal study assessing potential variance in safety voice over time could also include a measure of invulnerability to investigate any trends over time, and to investigate the possibility of invulnerability changing in different environments and states.

In addition, future research could investigate other potential antecedents of safety voice such as narcissism (Aalsma et al., 2006), pervasive optimism bias (Lapsley et al., 2005), and pro-social motivation (Grant, 2008). Aalsma et al. (2006) found a positive correlation between narcissism and invulnerability. Narcissism characteristics include a positive, inflated, and agentic

view of the self, and a self-regulatory strategy to maintain and enhance this positive self-view (Campbell, Goodie, & Foster, 2004). Similar to young people with personal fable tendencies, narcissists believe they are special and unique (Emmons, 1984), and that they are entitled to more positive outcomes in life than are others (Campbell, Bonacci, Shelton, Exline, & Bushman, 2004). The relationship between invulnerability and optimism bias is still unclear in the literature, and therefore future research could investigate the two constructs relative to young worker safety outcomes.

Future research could also investigate the relationship between safety voice and prosocial motivation, which is the desire to expend effort to benefit others (Grant, 2008). Simply telling young workers that they should comply with safety regulations, or stating that certain behaviors or environments are dangerous are not effective mediums to reach young workers high in invulnerability. Instead, organizations may be better off presenting safety-related information to this cohort in a way that highlights concern for the safety of others. Speaking up about safety concerns on behalf of co-workers may increase the safety voice intentions of the highly invulnerable. Invulnerable workers may not believe they could be hurt, but may speak up for the benefit of co-workers. In other situations, individuals may exhibit safety voice to supervisors or co-workers on behalf of co-workers that do not feel comfortable voicing their concerns. Alternatively, safety voice may be elicited on behalf of co-workers that are unaware of the safety concern or the safety voice being elicited. It is possible that highly invulnerable participants had high safety voice intentions in unsafe work environments due to beliefs that the situation was unsafe for others, yet not for themselves.

The factors that affect safety voice directed at supervisors require additional research. An interesting approach would be to manipulate both supervisor openness, and supervisor support in the safe and unsafe work conditions. The current study assumes that in the safe scenario the participants will generalize the supervisors' high levels of communication (and low levels of communication in the unsafe scenario) to high supervisor openness and support (and low supervisor openness and support in the unsafe scenario), however the assumption is not validated, and therefore additional research is needed.

### **Conclusions**

Young workers often work in unsafe work conditions, and are often exposed to a high level of occupational risk, making them a vulnerable target group that is injured at work at a rate that is much higher than that of any other age group (Sargeant & Tucker, 2009). Voicing concerns about dangerous work is an important part of changing hazardous work environments. The current findings revealed that when the fear of injury at work is high, young workers have high intentions to voice safety concerns. When the fear of injury is low, invulnerable young workers are less likely to voice safety concerns than are young workers that believe they could suffer an injury at work. These findings can serve as a starting point for research involving invulnerability and behavioural responses to workplace hazards and this research can be used to train managers that when hazards and danger is not salient, and when injuries are low, invulnerable young workers are unlikely to voice safety concerns.

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Table 1

*Means, Standard Deviations, and Intercorrelations between Study Variables (N = 115).*

	M	SD	1	2	3	4
Safe/Unsafe	.50	.50				
Fear	3.26	1.27	.61**			
Invulnerability	2.07	.77	-.10	-.02		
Safety Voice	3.82	.76	.10	.15	-.15	

*Note.* 0 = unsafe scenario, 1 = safe scenario.

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Table 2

*Regression Results for the Conditional Indirect Effect of the Safe/Unsafe Work Environment on Safety Voice via Invulnerability.*

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	<u>Dependent variable model, DV: Fear of injury</u>			
Constant	.001	.096	.011	.99
Safe/unsafe environment	1.55	.19	8.02	<.001
Invulnerability	.066	.13	.53	.60
Safe/unsafe environment x invulnerability	.029	.25	.11	.91
	<u>Dependent variable model, DV: Safety voice intentions</u>			
Constant	3.85	.06	59.88	<.001
Safe/Unsafe Environment	-.05	.16	-.28	.78
Invulnerability	-.12	.08	-1.37	.17
Fear of injury x invulnerability	.17	.07	2.56	.01

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Table 3

*Means, Standard Deviations, and Intercorrelations between Study Variables (N = 65).*

	M	SD	1	2	3	4
Perceptions of physical hazards	.03	.90				
Fear	2.25	1.12	.36**			
Invulnerability	1.60	.73	.31*	.10		
Safety Voice	3.40	1.86	-.08	-.10	.70	

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 4

*Regression Results for the Conditional Indirect Effect of Perceived Physical Hazards on Safety Voice via Invulnerability.*

	<u>Dependent variable model, DV: Fear of injury</u>			
Constant	.02	.14	.16	.87
Perceived physical hazards	.55	.18	2.97	.004
Invulnerability	-.09	.21	-.43	.67
Perceived physical hazards x invulnerability	-.13	.20	-.65	.52
	<u>Dependent variable model, DV: Safety voice</u>			
Constant	3.36	.21	15.64	< .001
Perceived physical hazards	-.37	.28	-1.31	.20
Fear of injury	.07	.22	.31	.76
Invulnerability	.11	.34	.32	.75
Fear of injury x invulnerability	.91	.36	2.52	.01

Table 5

*Conditional Indirect Effects of the Safe/Unsafe Scenario on Safety Voice at Values of Invulnerability*

Mediator	Invulnerability	Effect	Boot SE	BootLLCI	BootULCI
Fear	-1.1087	-.1143	.1641	-.3934	.2816
Fear	-.6087	.0119	.1273	-.1972	.3048
Fear	-.1087	.1404	.1115	-.0720	.3745
Fear	.3913	.2713	.1253	.0005	.5073
Fear	.8913	.4045	.1724	.0427	.7345

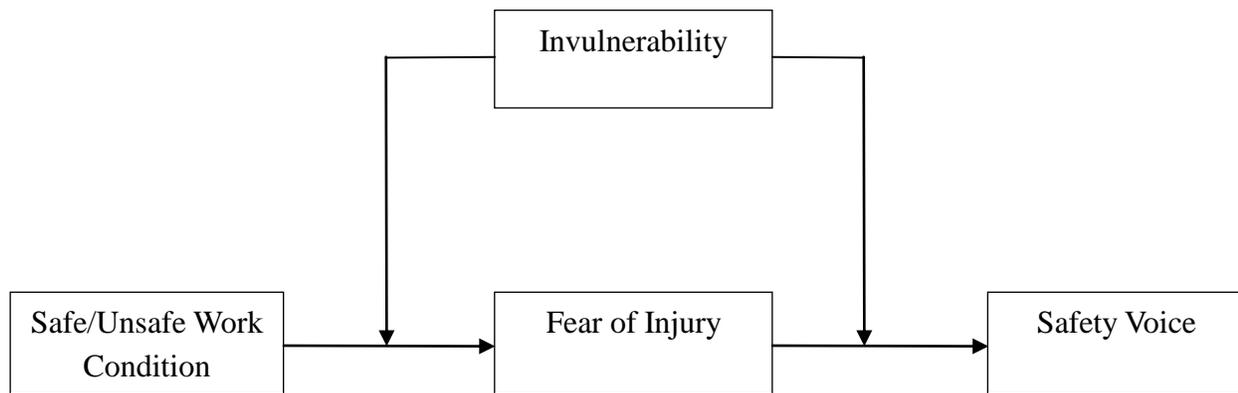
*Note.* Values for quantitative moderators are 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> percentiles. Boot = bootstrapping. LL = lower level. UL = upper level. CI = confidence interval.

Table 6

*Conditional Indirect Effects of the Perceived Physical Hazards on Safety Voice at Values of Invulnerability*

Mediator	Invulnerability	Effect	Boot SE	BootLLCI	BootULCI
Fear	-.5758	-.2826	.2464	-.9033	.0286
Fear	-.5758	-.2826	.2464	-.9033	.0286
Fear	-.0758	-.0012	.1419	-.3487	.2263
Fear	.4242	.2225	.1617	-.0715	.5690
Fear	.9242	.3887	.2645	.0437	1.0977

*Note.* Values for quantitative moderators are 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> percentiles. Boot = bootstrapping. LL = lower level. UL = upper level. CI = confidence interval.



*Figure 1.* Model of proposed hypothesis.

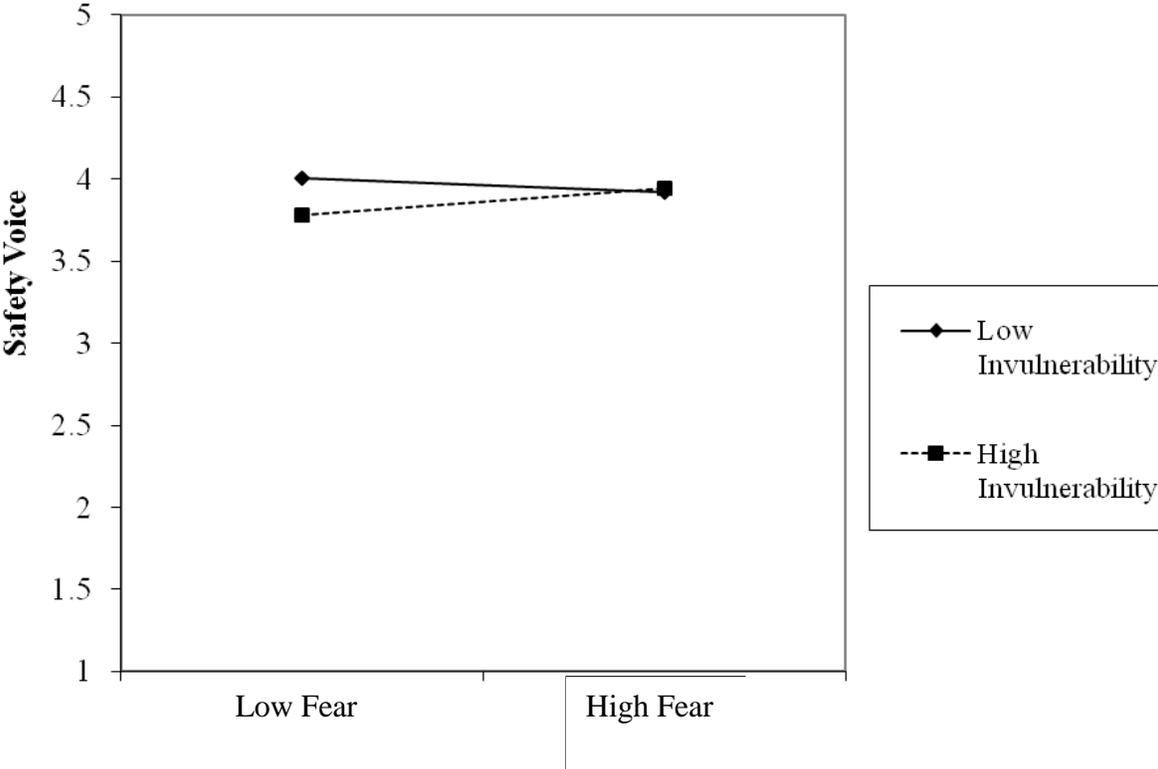


Figure 2. Interaction between fear of injury and invulnerability on safety voice intentions.

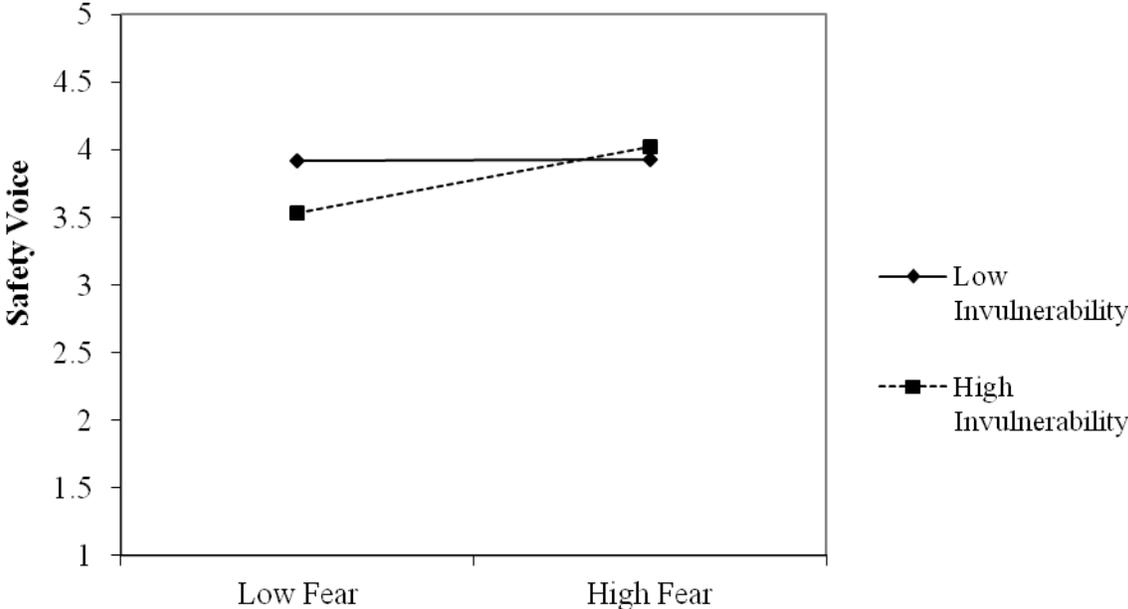


Figure 3. Interaction between fear of injury and invulnerability on safety voice behavior.

Appendix A  
Unsafe Restaurant Scenario

Please try to imagine yourself in this situation...

You're one month into a new job at a restaurant. You work in the restaurant's kitchen. In the past month, you've noticed that your coworkers and shift managers do not put much effort into keeping the kitchen clean. Much of the time they do not follow safe work practices. Employees who were hired in the past month received no training about how to do their jobs or about hazards in the kitchen.

In the last month, you've noticed that spills of oil and other liquids are frequently not mopped up, protective equipment (e.g., gloves, oven mittens, eye protection) is not available when you need it, and boxes and crates are often left out where people walk. Further, all cleaning chemicals are improperly labeled.

Your coworkers and shift manager rarely communicate about potential hazards in the kitchen. For example, they usually do not let you know when liquid or food is spilled on the floor, or when they're walking behind you carrying a hot tray.

Several people have been hurt in the last month. Recently, someone slipped on grease on the floor, fell backwards and hit their head on a fryer. This person needed stitches at the hospital. The most common injuries, which occur often, are burns and cuts to fingers and arms, and bruises from contact with equipment. Most of these injuries required first aid attention. People sometimes slip on wet floors and someone fell while trying to get around crates at the back of the kitchen.

With this job you're getting the hours you want - not too many and not too few hours. And you're satisfied with your hourly wage and the discount that you get on restaurant food.

Appendix B  
Safety Restaurant Scenario

Please try to imagine yourself in this situation...

You're one month into a new job at a restaurant. You work in the restaurant's kitchen. In the kitchen, your coworkers and shift managers keep things clean and follow proper work practices even during the busy lunch and dinner hours. Like all new employees, you received mandatory training during your first month on the job. With this training you know how to do your job and about hazards in the kitchen.

In the past month, you've noticed that spills of oil and other liquids are quickly mopped up, that protective equipment (e.g., gloves, oven mittens, eye protection) is available when you need it, and that boxes and crates are never left out where people walk. Further, cleaning chemicals are properly labeled.

Your coworkers and shift managers always communicate concerns about hazards in the kitchen. For example, they let you know whenever liquid or food is spilled on the floor, or when they're walking behind you with a hot tray.

In the past month, you have not had any accidents, close calls, or injuries at this job. Aside from occasional minor burns to fingers, no one has been injured since you started working at the restaurant. Further, no one has slipped or fallen in the past month.

With this job you're getting the hours you want - not too many and not too few hours. And you're satisfied with your hourly wage and the discount that you get on restaurant food.

Appendix C

Danger Invulnerability Items

Safety rules do not apply to me.

It is not necessary for me to worry about being injured or harmed.

Appendix D

Safety Voice Items

Putting yourself in the position of the person in this scenario, how likely are you to do each of the following at this job?

Speak to co-workers at risk and encourage them to fix safety problems.

Talk to the owner about safety concerns.

Tell my supervisor about hazardous work.

Tell my supervisor about the consequences of dangerous working conditions.

Group together with co-workers and take safety concerns to the supervisor.

Remind co-workers to take precautions.