

An Investigation into the Relationship between Perceptions of Safety Climate and
Organizational Justice

by

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Abstract

“An Investigation into the Relationship between Perceptions of Safety Climate and
Organizational Justice”

By Bernadette Gatien

To date the relationship between perceptions of safety climate and organizational justice does not appear to be empirically tested. There are no known studies that examine the relationship of distributive, procedural, informational and interpersonal justice on perceptions of safety climate. To address this gap in the literature I conducted three separate studies. In study one I test a structural model examining the relationship between four justice factors, safety climate, safety behaviours and incidents. In study 2 I tested the same proposed structural model using a different sample of workers. In the third study I tested the longitudinal effects of organizational justice on perceptions of safety climate using a general sample of employed people from the province of Nova Scotia Study. Overall results indicated a complicated relationship between organizational justice and safety climate in that procedural justice was the only consistent predictor of safety climate perceptions in all three studies. Overall the findings of all three studies provide empirical support for the relationship between justice and safety climate, safety behaviours and incidents. These results address the current gap in the literature and make a significant contribution to what we know about the antecedents of perceptions of safety climate.

April 16 2010

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An Investigation into the Relationship between Perceptions of Safety Climate and Organizational Justice

Over the course of my PhD program, I was fortunate to have the opportunity to do some consulting work with a large Canadian construction-based company. The project in which I was involved in required that I spend a great deal of time travelling to different bases of this company located across Canada and the U.S. While on these travels, I spoke with hundreds of employees about the current state of safety within their organization. Before long, I noticed that employees from a number of different bases in a number of different locations complained about the drug and alcohol testing policy their organization had recently implemented. Employees consistently complained about unfair policies. Regardless of the severity of an incident and where you were working in relation to the base location, if an incident occurred you were to freeze the incident scene and head to the company clinic for a drug and alcohol test. Interestingly, most employees felt the policy could be very useful and did not want to see it completely eliminated. However, the employees did complain about a lack of fairness in how the policy was implemented.

Employees felt that not every incident required a drug and alcohol test. For instance, if an operator broke a windshield wiper or a headlight while scraping ice in -35 degree Celsius weather, that operator was technically required to report that as an incident and have a drug and alcohol test. If an operator was in the middle of the woods lifting a derailed train and broke a taillight, the operator was to report that as a safety incident and was supposed to freeze the scene and go for a drug and alcohol test. This

was not practical under these conditions. Many times it would take a crane operator several hours of travelling through the woods to get to a train derailment and in their words, to stop a job for a broken tail light was “ridiculous.” Furthermore, employees had heard that in other bases supervisors did not force the older, more senior operators to go for testing but forced the younger, less senior operators to go. Employees felt this was unfair and was not effective in dealing with the current drug problem in that industry.

Every time this issue came up I asked employees how they dealt with it especially in situations where they were located in the middle of the woods and it was not practical to stop a job and go for a test. Most, if not all employees, told me they simply stopped reporting minor safety incidents. If they broke a taillight or a windshield wiper they would just leave it or report it to the mechanic who would hopefully fix it without officially reporting it. To them, this was a practical solution to the problem of an unfair policy and procedure. However, they also told me it was not a foolproof solution. In some cases the incidents would seem minor until the work conditions or work situation changed. If, at the beginning of a shift, one employee broke a windshield wiper scraping ice on a cold but sunny morning and did not report it, did it put the operator who got in that crane the next day, drove down the road and needed the wipers in a very unsafe situation? Where did all these unreported safety incidents leave unsuspecting operators and mechanics?

After speaking with employees about this policy I started hearing more and more about incidents going unreported and in some situations the incidents, while not severe, could have had very serious consequences. I started to question the relationship between

safety and organizational justice and after my travels I approached my supervisor and started conducting a literature search on the topic of justice and safety. I came up empty handed and so, I began my PhD dissertation.

Literature Review

A significant portion of what we have learned about occupational safety has come from organizational disasters and at the cost of those who have been injured or killed as a result. In 2008, 29 Nova Scotians were killed at work – a rise of 15 people over the number killed at work one year earlier (NWISP, 2008). Last year, 10% of Nova Scotia's workforce covered under worker's compensation were injured (NSWCB, 2009). Buske (1997) reported that over a five-year time span (1990-1995), the average number of injuries reported each year was approximately one million in Canada and that the national average cost for compensating each occupational injury is \$6,020 with Ontario paying the most (\$7,870) followed by Quebec paying \$6,520 and Newfoundland paying \$6,070. In the United States the Bureau of Labour Statistics reported that between 1992 and 2008, approximately 101,014 employees were fatally injured at work. The industries with highest fatality rate per 100,000 full-time workers were agriculture, forestry, and fishing and hunting (29.4%). Mining was next with an 18% fatality rate followed by the transportation and warehousing industry with the third highest fatality rate (14.2%).

Taking into consideration Canadian and American occupational injury and fatality statistics and the number of organizational disasters over the last 100 years, it is clear that safety is an area that many employees, employers, governments, organized labourers and organizations struggle to manage. In previous years, safety research focused more on understanding the role of technical failures in causes of workplace accidents and organizational disasters (Wiegmann, Zhang, von Thaden, Sharma, Gibbons, 2004). Investigators and researchers are now focusing more on the role of sociotechnical factors

such as organizational culture and climate (Wiegmann et al., 2004). Research and experience now tells us sociotechnical factors are more often the cause of organizational disasters than technical failures (Flin, Mearns, O'Connor, & Bryden, 2000). One of the more established sociotechnical factors is safety climate. Researchers have put a great deal of effort and time into studying the impact of safety climate and the extent to which it predicts workplace accidents and injuries.

What is Safety Climate?

Safety climate as a concept stems from the organizational climate literature produced during the 1970s. Organizational climate was first introduced to social psychology researchers in the 1950s by Kurt Lewin who investigated the occurrence of different social climates that emerged as a result of various leadership styles (Lewin, 1951). In the years following Lewin's work, researchers focused their efforts on understanding the influential psychological factors that affect employee behaviour. This included factors like employee attitudes and perceptions (Ostroff, Kinicki & Tamkins, 2002). At this time, organizational climate researchers differed in their approach resulting in various definitions, theoretical frameworks, and measurement tools.

Organizational climate is often defined as the shared perceptions employees develop about their organization (Reichers & Schneider, 1990). Organizational climate researchers typically structure their research around the idea that organizational climate is a multi-dimensional construct (e.g., Zohar 2000). This means that organizational climate is either very broad in scope and deals with management-based features of the

organization (i.e., organization-wide policies and procedures), or it is very narrow in scope and is based on a specific facet of the organization (e.g., policies and procedures around customer service or safety) (Guldenmund, 2000). A primary example of facet organizational climate is safety climate. Safety climate is a concept centered on the idea that employees within an organization develop perceptions of the safety-related policies and procedures. Those perceptions then guide and influence how that individual is going to react and behave in reference to the safety rules and procedures (Neal & Griffin 2006).

Over the last 20 years, a significant number of research studies investigated the effect of safety climate on safety performance and safety outcomes using various conceptualizations, definitions, samples, and methodologies. Unfortunately, this resulted in an “obscure conceptual landscape” (Flin, 2003). To start, early researchers did not follow the advice of James and Jones (1974) who stated that researchers should spend more time on organizational climate theory and construct development rather than focusing on the psychometric and methodological properties of the safety climate construct. The concentration on the measurement and predictive validity of safety climate is partly due to the significant number of high profile organizational disasters (i.e., Chernobyl, Piper Alpha, and Westray Mine) wherein safety climate was judged to be a causal factor. Incidents such as the Westray Mine explosion in 1992 influenced researchers, practitioners, and in particular, government-based safety officials into investigating the specific organizational factors that contributed to the disasters. This meant that their investigations went beyond enquiring into what “human errors” caused the disaster. Consequently, there are now more studies on the measurement and

predictive validity of safety climate and few studies on the development of a strong theoretical framework that explains how safety climate is developed or created within an organization.

In 2000, Guldenmund completed a summary of the research conducted on safety climate and the various perspectives, definitions and measures of safety climate used until 1997. In his review, Guldenmund identified more than 14 different studies, each using a different conceptualization and definition of either safety climate or safety culture. Furthermore, a number of these studies had unique perspectives and developed tailored safety climate measures that specifically met the needs of the research context. Guldenmund's review shows the level of complexity surrounding safety climate as a construct. Despite its complexity and the confusion associated with it, there is agreement around when the concept was first studied. In 1980, Zohar conducted a study that influenced and became the basis for a number of research studies investigating the conceptualization, structure and predictive validity of safety climate.

Zohar's (1980) definition, which is now one of many, defined safety climate as employee's shared perceptions about safety within their workplace. Zohar focused on exploring how people perceive the safety policies and procedures and the extent to which these perceptions are common among employees. In his study, Zohar investigated the dimensions of safety climate through the development of a 40-item safety climate survey. The impetus for developing the scale was that safety climate perceptions are one basis people use to influence or guide their behaviours and because of this, there is a need for

industries and researchers to understand the specific mechanisms that work to influence the climate-behaviour relationship (Zohar, 1980).

Zohar concluded that safety climate is comprised of eight influential dimensions: management attitudes towards safety, importance of safety training, effects of safe conduct on promotion, level of workplace risk, effects of required work pace on safety, safety officer status, effects of safe conduct on social status and status of safety committee (Zohar 1980). Brown & Holmes (1986) attempted to replicate Zohar's safety climate factor structure and were unsuccessful at replicating all eight of the dimensions. They concluded that safety climate is made up of the following dimensions: management's concern for employee wellbeing, management's response to their level of concern for employee wellbeing and level of physical risk. In a similar study, Dedobbeleer and Béland (1991) tested the factor structure proposed by Brown and Holmes (1986) and found that a two-factor safety climate model was more appropriate. Cooper and Phillips (2004) modified Zohar's 1980 scale and conducted a pre-test, post-test intervention study and tested the factor structure of the scale. They hypothesized that the factor structure of their adapted safety climate measure would be consistent across time. Only 28 of Zohar's original items were used in their newly developed survey. Items that were excluded or modified included the items tapping into employees perceptions of managerial behaviours and actions. Cooper and Phillips modified these items to reflect managerial attitudes and then distributed the surveys to employees of a packaging production plant. Results of their study supported their hypothesis in that a similar two-factor structure was found in their pre-test and post-test data. The authors described the

factors as those that directly affect employee safety climate perceptions (e.g., management attitudes towards safety, work pace) and those that affect their perceptions indirectly (e.g., importance of safety training, social status and promotion). In another study investigating the factor structure of safety climate, Cheyne, Tomas, Cox and Oliver (2003) investigated employee safety climate attitudes at different levels of the organization and found that the factor structures for managers, supervisors and employees were very similar, however, the relationships between the different factors for each of the groups reflected significant differences in perceptions, intensity, and how the factors are related within each group or level of employees. These studies and others show not only the level of complexity but also the specific nature of the research environments in which these measures are applied.

Much of the research on this topic, including some of the studies mentioned above, were the result of industry-specific and funded research projects (e.g., Mearns, Flin, Gordon, O'Connor, & Whitaker, 2000) meaning investigators had to meet the specific demands of the research environment. Many of these demands limited the available sample characteristics and data collection timeframe, and forced researchers to be selective about their chosen research methodologies and statistical analyses (Guldenmund, 2000). These demands and limitations also meant that researchers developed customized safety climate measurement tools (e.g., Flin et al., 2003) to suit their research context, work environment, and work industry, and rarely used existing validated measures (Seo, Torabi, Blair & Ellis, 2004). Consequently, multiple different safety climate surveys with different conceptualizations and factor structures were

created resulting in theoretical and conceptual confusion in an already difficult-to-follow body of research.

One study that attempted to clarify the confusion is Flin, Mearns, O'Connor and Bryden (2000) who conducted a thematic analysis of 18 different safety climate studies and summarized the common features and factors among these 18 research studies and their various definitions, dimensions and measurement scales. The authors concluded that there are five common dimensions of safety climate, three of which are core themes. The first theme to emerge was "management," referring to perceptions of management attitudes and behaviours in relation to safety. The second theme to emerge from nearly every survey the authors examined was "safety systems," which encompasses various aspects of an organization's safety management system (e.g., safety committees, safety policies and procedures). The third theme was based on "risk" and how people perceived and analyzed risk and risk-taking behaviours. The fourth theme was "work pressure," which refers to peoples' work pace and workload, and the balance between that and production. The fifth and final theme to emerge from the studies included the level of knowledge, skills, and abilities of workers (Flin et al., 2000). This study helped to provide some clarity as to the nature of safety climate attitudes.

In summary, safety climate is a concept rooted in the organizational climate literature and is often defined as the perceptions or attitudes employees have about various aspects of the health and safety within an organization, perceptions that the employees use to guide their safety-related behaviours (Guldenmund, 2000). Taking into consideration many of the studies on the factor structure of employee safety attitudes, it is

typically composed of five main or key dimensions such as management commitment, safety systems, risk, work pressure, and employee knowledge skills and abilities (Flin, et al., 2000).

How is Safety Climate Conceptualized and Measured?

As demonstrated in the above section, there are a number of different perspectives and approaches applied to the conceptualization and measurement of safety climate. Safety climate surveys typically tap into employee perceptions along the various dimensions or factors that are based on previous research. Additionally, safety climate measures and the items within them target specific levels of a hierarchy of an organization, (groups) or specific aspects of the organization (e.g., safety systems). The target of a safety climate survey refers to whether the measure asks employees about their perceptions of senior management, supervisors or a particular working group (e.g., department) or system. Specifically, the measure gathers information around how those individuals behave or systems work with respect to the key dimensions (e.g., how a senior manager handles production pressure or how a supervisor or department handles risk). Safety climate measures targeting senior managers might ask respondents to rate a statement indicating senior managers' level of commitment to safety (e.g., Zohar, 2008). Surveys evaluating supervisors include items such as, "Whenever pressure builds up, my supervisor wants us to work faster, rather than by the rules" (Zohar, 2000). Conceptualizing safety climate as a feature of the organization that influences employee behaviour is advantageous to some researchers interested in making comparisons of

safety climate perceptions between various work units (e.g., departments), senior individuals and even industries (Zohar, 2008). Further to this, surveys that measure different hierarchical levels of the organization allow researchers to assess and compare the various safety climate perceptions (e.g., differences between senior managers and front-line supervisors).

Safety climate, like organizational climate, can be viewed as an individual or group level variable. Safety climate as an individual level variable refers to an individual employee's perception of the work environment while the group level refers to the shared perceptions of a group of employees (Neal & Griffin, 2006). The level of analysis applied to a study depends on whether a researcher views climate as an individual level or group level variable. Researchers investigating organizational or group level climate do not focus on individual perceptions and typically investigate the extent to which individuals have shared perceptions (e.g. Zohar 2000). They do this by specifying a particular unit of analysis and aggregating the data to that particular unit (e.g. department or organization) (Neal & Griffin 2006).

Safety climate as an individual level variable (also referred to as psychological climate) describes how an individual perceives the current state of safety; it is an individual perception of the safety climate and not a measure of the shared view of safety climate. Individual level climate is interested in the relationship between individual perceptions of safety climate and behaviours. It is based on the idea that individuals' develop their own specific perceptions of safety climate which implies that one employee's perception of their supervisors' commitment to safety could be entirely

different than another employee's perception of the organization, supervisor, system or process. This means that various individuals could have completely different evaluations when compared to their co-workers within or outside of that persons working group or unit. The conceptual basis behind psychological climate is that it is concerned with how the organization, supervisor or system or process impacts the individual and influences their perceptions, feelings, attitudes and behaviours towards the organization (Neal & Griffin, 2006). Individual level or psychological level climate is the more common level of analysis used in safety climate research studies (e.g. Neal, Griffin & Hart, 2000; Rundmo, 2000; Niskanen, 1994; Cox & Flin, 1998; Mearns et al., 2003; Kelloway, Mullen & Francis, 2006; Barling, Loughlin & Kelloway, 2002; Griffin & Neal 2000; see Johnson 2000 for more references) and the choice of the level of analysis is determined by the researchers' interests. However, more confusion is added to the concept because in many situations group/organizational level safety climate and individual level safety climate are measured using the same surveys and it is the aggregation of data that differentiates the conceptualizations.

Like many of the researchers who take the perspective that safety climate is an individual level construct, I too am interested in perceptions of safety climate and conceptualize safety climate as an individual level construct developed as a result of that person's personal interaction with various work place characteristics and people within their workplace. A number of researchers have shown that there is a significant predictive relationship between individual perceptions of safety climate and safety performance (Griffin & Neal, 2000; Neal Griffin & Hart 2000) and in the context of my research I

believe the appropriate level of analysis is at the individual level and not at the group level. I am interested in the individual perceptions of safety climate and how these perceptions influence individual safety compliance and safety participation behaviours and number of incidents. Measuring safety climate at the group level and aggregating the data would not allow me to draw conclusions about individual perceptions of safety climate. Furthermore, I am interested in linking perceptions of safety climate to organizational justice which is an individual level variable. Conceptualizing safety climate as a group level variable would not allow for an appropriate comparison between the perceptions of safety climate and organizational justice.

Safety Climate and Safety Outcomes

Safety climate research is a primary example of a psychosocial concept being applied to the occupational safety research domain. Safety climate is of interest to those within various industries including transportation, offshore oil, construction, and medicine because it is related to safety outcomes (Mearns, Whitaker & Flin, 2003). Typically, incidents are caused in part by human error (Wallace, Popp & Mondore, 2006) which includes unsafe behaviours, however, these unsafe behaviours are not always attributable to mistakes or noncompliance and often can be the result of the work environment (Wallace, Popp & Mondore, 2006).

A significant amount of progress has been made in terms of understanding the relationship between safety climate and safety performance. Researchers investigated

which aspects or characteristics of a work environment are related to safety performance and found that safety climate is an important and influential factor. Many of the safety performance (outcome) variables used in these studies include: unsafe behaviours, safety activity involvement, “micro-accidents”, percent safe behaviours and near miss data, and overall organization safety performance (Clarke, 2006).

In a small number of studies, researchers found no relationship between safety climate and safety performance (Glendon & Litherland, 2001), however, this appears to be atypical. For instance, Cooper and Phillips (2004) did not expect to find a significant relationship between safety climate and safety performance, however, their results showed a significant predictive relationship between employee perceptions of workplace risk, management attitudes and actions towards safety, work pace, importance and the percent of safe behaviours exhibited by employees. Time one results demonstrated that perceptions of training importance, perceived effects of safe conduct on social status, promotion and perceptions of the safety officer’s status were directly related to the percent of safe behaviours demonstrated by individual employees (Cooper & Phillips, 2004).

Other studies found similar results. Wills, Watson, and Biggs (2006) investigated the relationship between perceptions of safety climate and work-related driving behaviour in a sample of 329 Australian government and private sector employees. Perceptions of safety climate were significantly correlated with overall driver behaviour as well as driver distraction, self-reported traffic violations, driver error, and pre-trip vehicle maintenance. Some aspects of safety climate were more predictive of certain driver behaviours (e.g.,

work pressure best predicted driver distraction, safety rules best predicted traffic violations) and the authors indicated that researchers and change interventions should focus attention on specific features of safety climate in order to modify specific behaviours (changing driver distraction by improving work pressures; Wills et al., 2006). In another study, Mearns et al. (2003) examined the relationship between safety climate and accidents on offshore oil rigs. Results showed that there was partial support for the relationship between employee ratings on elements of the Offshore Safety Questionnaire (e.g., satisfaction with safety activities, perceived management commitment to safety) and the frequency of general unsafe behaviours (self report), as well as accidents recorded by a formal accident reporting system.

Zohar (2000) also demonstrated support for the relationship between safety climate and micro-accidents in a manufacturing plant. For this study, Zohar developed a new group level safety climate scale that tapped into supervisor expectations and actions. Results from the plant with the lower safety climate also revealed a higher number of accidents. In another study Nielsen, Rasmussen, Glasscock and Spangenberg (2008) examined the relationship between safety climate perceptions and accidents in two identical manufacturing plants and found a significant relationship between employee perceptions of safety climate and the number of accidents. The connection between perceptions of safety climate and safety performance is an important piece of information that employers, employees, safety practitioners, and researchers should know about, however, it is also important that we understand *how* safety climate influences safety

performance. What specific employee and employer factors work together to influence this relationship?

Neal and Griffin (1997) took their research one step further than previous studies and examined the mechanisms that influenced the relationship between perceptions of safety climate and performance. Drawing upon Borman and Motowidlo's (1993) work on contextual versus task-based performance, Neal and Griffin (1997) examined the extent to which accidents are influenced by the task-related safety behaviours (safety compliance) and the contextual safety behaviours (safety participation). Neal and Griffin based their theory on Borman and Motowidlo's previous job performance theories wherein knowledge and motivation were two key factors responsible for individual differences in job performance. They defined safety compliance as the behaviours mandated or specifically required to complete a task safely (i.e., following of procedures) while defining safety participation as the safety behaviours that are not required for a task but still support core safety activities (Neal & Griffin, 1997). Results of their study showed that safety knowledge and motivation are key factors that mediate the relationship between safety performance and safety climate.

Neal, Griffin, and Hart (2000) explored the mediated relationship between perceptions of safety climate, safety compliance, and safety participation similar to their 1997 study. Safety performance and compliance behaviours should be the result of one having the knowledge to engage in that behaviour and having the motivation to do so, which is influenced by individual characteristics such as ability and personality, as well as other factors such as safety climate. Using a sample of 525 hospital employees, Neal,

Griffin and Hart tested a model wherein the impact of safety climate on safety performance was influenced or mediated by the employees' knowledge of how to comply with safety procedures and the motivation to engage in the non-required safety behaviours (participation). Using structural equation modelling, the data fit the proposed model and revealed that safety knowledge and motivation were significant predictors of self-reported safety compliance and safety participation behaviours. These results supported their theory that there are other factors that influence the safety climate/safety outcome relationship. Their results highlight the point that while safety climate is an important factor that influences organizational safety, we must also consider the role that knowledge and motivation plays in that relationship.

The practical implications of these studies rest with organizations that participate in safety climate assessments. Measuring perceptions of safety climate allows the supervisors, managers and leaders to gain insight into how their employees view them and the company. This means that managers, supervisors and employees are the major stakeholders of this research and have the most to gain (Cooper & Phillips, 2004). In particular, supervisors should have a vested interest in this as they are one of the most influential factors upon employee behaviour (Flin, 2003).

What we can learn from all of the previous research is that safety climate is an important factor when it comes to operational safety and we must consider the knowledge and motivation one has to work safely and how those two factors influence an employee's behaviour. Furthermore, it is also important to consider the role the supervisors have on the development of employee safety climate perceptions because

employees must often rely on their supervisors to make judgements about their organization and how it handles various aspects of their organization's safety climate (e.g., commitment, production pressure) (Flin, 2003).

Supervisor-Employee Relationship

There is limited research on the specific nature of the relationship between safety climate, supervisors and safety performance, however, the research that does examine the relationship between these three aspects supports the idea that supervisors are one of the most influential factors on employee behaviour. As Zohar (2008) pointed out, supervisors are responsible for executing the policies and procedures developed by senior managers and this creates the opportunity for a supervisor to create a discrepancy between the messages senior managers intend to send and the message employees receive.

One of the key aspects of a manager's or supervisor's behaviour that influences an organization's safety record is the nature and extent of a supervisor's interaction with his or her subordinates (Bentley & Haslam, 2001). Bentley and Haslam's Royal Mail post office study had three main goals: to determine "desirable" management safety practices of the mail delivery office manager; to investigate whether the use of the above-mentioned safety practices differed between high and low accident postal offices; and finally, to determine whether an intervention aimed at managers would influence the postal delivery officers. The results of their study found that delivery office managers from low accident offices had improved performance in terms of safety communication and accident investigations. Results of their study also highlighted that a supervisor's

impact on his or her subordinates was based on his or her own attitudes and actions, and that a management-based intervention could influence postal delivery officers' safety behaviours. Overall, the results of their study showed that supervisors are a significant influential factor in the safety performance from high and low accident Royal Mail postal offices.

An entire domain of research exists on how leadership influences employee behaviour, but only a small amount of this research discusses the relationship in a safety context and specifically looks at the relationship in terms of safety performance (e.g., Flin, 2003). Flin (2003) used a 360-degree feedback approach and examined senior managers' perceptions of their own commitment to safety as well their subordinates' perceptions of their supervisors' level of commitment to safety. Supervisor perceptions of themselves and employee surveys were compared and the researchers discussed with the supervisors who how their employees viewed them and how those perceptions were different than their own perceptions of themselves. The results of the study and the workshop wherein they discussed the results of the survey were enough to prompt supervisors to alter their safety-related behaviours. Unfortunately, this study did not explore how these changes in behaviour affected employee safety behaviours or safety performance.

Hofmann and Morgeson (1999), however, explored the relationship between supervisor behaviour and how it influenced employee behaviours using the social exchange theory. Social exchange theory stipulates that employees feel obligated to reciprocate high quality interactions on behalf of a leader. They based their study on the

idea that employees will feel obligated to reciprocate safety behaviours when they encounter high quality leader member exchanges and perceived organizational support. Hofmann and Morgeson explored how the quality of leader member exchange and the perceived level of organizational support relate to safety commitment and safety communication of manufacturing plant employees. Previous work in this area showed that high quality leader member exchanges (e.g., recognizing employee potential, understanding employees' job problems and needs) positively impacted employee communication and commitment, and Hofmann and Morgeson expected similar results in their study. They expected that high-quality exchanges and perceived level of organizational support would be related to safety communication and safety commitment which would negatively predict the number of accidents in a commercial heating and manufacturing plant. The findings of this study indicated that perceived level of organizational support was significantly related to safety communication and leader member exchange was significantly related to safety communication, safety commitment, and accidents. In other words, results showed that safety commitment and communication mediated the relationship between perceived level of organizational support, leader member exchange and accidents. Employees who reported higher quality leader member exchanges and perceived organizational support were more likely to engage in safety-related communication (e.g., raising safety concern). Additionally, employees who had higher quality leader member exchanges also received higher supervisor ratings of safety commitment. This study, however, does not take into consideration the role of safety climate perceptions.

In a different study exploring the relationship between supervisors and employee behaviours, O'Dea and Flin (2001) investigated the extent to which supervisor experience and style of leadership influenced employee safety attitudes and behaviours. Results showed that while experience was not an influential factor in employee safety attitudes, the style of leadership managers used predicted their ability to motivate employees and influence safety climate perceptions. Results of the study also showed that offshore installation managers identified participation, communication, involvement, empowerment, and building open and honest relationships as important safety leadership behaviours. Unfortunately, despite managers' knowledge of best practices, they also reported difficulty implementing those best practices.

In 2002, Zohar conducted a study that specifically investigated supervisor behaviours and employee safety behaviours. This intervention study explored how supervisors' interactions with subordinates influenced group level safety climate. The objectives of Zohar's study were threefold. The first objective was to determine if improving supervisor behaviours resulted in better frontline safety performance records. The second objective was to determine if improving supervisor behaviours would result in a higher group level safety climate among frontline employees. The third objective was to determine whether improving supervisors' specific behaviours would increase the occurrence of a safety-related behaviours (e.g., earplug use) Zohar (2002a).

Results indicated that changing the group level safety climate of frontline employees occurred by increasing the safety monitoring behaviours and interactions of the frontline supervisors. In essence, the employees' perceptions of the group level safety

climate changed as a result of changing how the supervisors behaved and interacted with them. Zohar (2002a) found that effective supervisors were those who monitored employees through direct observations and promptly communicated with employees regarding the consequences of those observed behaviours.

It is evident from the research that the impact of a supervisor on employee behaviour plays a significant role in understanding employee behaviours especially in a safety context. There are different perspectives on this. Hofmann and Morgeson (1999) would argue it is about the quality of the relationship between a leader and an employee. Zohar might argue something different and say that it is more about specific discretionary behaviours (e.g., monitoring and feedback) and if you change a supervisor's behaviours in these areas you will influence employee safety behaviours. A common element among these different perspectives is that a leader maintains an element of control by making important decisions around the implementation of policies and procedures and is largely responsible for conveying information (Zohar, 2008, Hofmann & Morgeson, 1999).

Supervisors are often left to consider the current work environment, context, and the situational factors when determining which policies will be applied, to whom they will apply, and how they will be implemented (Zohar 2008). In my current studies, I question whether there are other factors closely related to both leadership and the discretionary supervisor behaviours that can influence safety climate and safety-related behaviours. I am specifically talking about non-safety specific discretionary behaviours demonstrated by a supervisor (who may or may not actively engage in a particular leadership style (e.g., transformational). I believe that it is these supervisor behaviours

that influence the development of an employee's safety climate perception which the employee then uses to guide his or her choice in safety-related behaviours.

While the above-mentioned studies provide evidence supporting the influential nature of supervisors, there is only a small amount of research that attempts to understand the mechanisms an employee uses to develop his or her own safety climate perceptions which are known to be predictive of employee safety behaviours. Hofmann and Morgeson's (1999) study does shed some light on this; however, they do not take into consideration perceptions of safety climate and do not consider other important safety behaviours such as safety compliance. The overall lack of research in this area reveals a significant gap in the safety climate literature. Approximately 40 years passed from the time the first safety climate study was published to the first study on safety climate antecedents. Researchers spent very little time understanding the development of safety climate perceptions. In particular, very few research studies have investigated the antecedents that trigger employee safety climate perceptions (Barling, Loughlin & Kelloway, 2002).

Antecedents of Safety Climate

In reviewing the small number of studies exploring the possible antecedents of safety climate perceptions, it is apparent that leaders and their behaviours play a significant role in the development of employee safety climate perceptions and subsequent safety-related behaviours. There are different perspectives when it comes to the specific antecedents of safety climate; however, the common element that can be

drawn from these studies is that supervisors and leaders influence safety climate perceptions. Some research (e.g., Hofmann & Morgeson, 1999; O'Dea & Flin, 2001) suggested that it is the quality of the relationship between a supervisor and subordinate, while others have suggested that it is the specific leadership style or leadership behaviours that work to influence a subordinate (e.g., Zohar, 2008).

Many of the studies investigating antecedents of safety climate targeted factors such as supervisor training, leadership training or goal setting. For instance, Barling, Loughlin and Kelloway (2002) investigated the extent to which employee leadership perceptions predicted employee safety climate perceptions. Specifically, they tested the extent to which safety climate perceptions are a function of safety specific transformational leadership. Employees from the restaurant industry completed questionnaires assessing their perceptions of safety specific transformational leadership, safety climate, safety consciousness, injuries and safety-related events. Structural equation modelling results showed that a fully mediated model best fit the data and best explained the nature of the relationship between safety-specific transformational leadership and safety-related events and injuries, compared with non-mediated and partially mediated model. The nature of the relationship between safety climate and outcomes is such that safety specific transformational leadership affects outcomes by working through employee safety climate perceptions first. The authors concluded that safety-specific transformational leadership predicted injuries through safety climate. In other words, safety specific transformational leadership is an antecedent to safety climate which is predictive of important safety outcomes (Barling, Loughlin & Kelloway, 2002).

Mullen and Kelloway (2009) conducted a leadership training intervention study based on the idea that leaders who are trained in safety-specific transformational leadership principles will positively influence their employee safety climate perceptions, safety-related events and injuries. Furthermore, Mullen and Kelloway expected this relationship to occur above and beyond leaders in a control group and a group of leaders who received general transformational leadership training. One group of nursing supervisors received safety-specific leadership training while a separate group of nursing supervisors received general transformational leadership training. A third group of nursing supervisors did not receive training for the purposes of control group comparison. The results showed no difference between the training groups prior to the training sessions. Post training results showed that the training had a significant multivariate effect such that safety-specific transformational leadership ratings were higher in the safety specific transformational leadership group than the remaining two groups. Employees whose supervisor participated in the safety-specific transformational leadership training reported higher safety climate perceptions than employees in the control group; however, they were not significantly higher than those within the general transformational leadership group.

In another study, Kelloway, Mullen and Francis (2006) found comparable results, and also replicated the results found in Barling et al (2002). In this study, the authors examined whether safety-specific transformational leadership and safety-specific passive leadership are distinct leadership concepts. Additionally, the authors investigated the effect of safety-specific transformational and safety-specific passive leadership training

on safety-related outcomes including perceptions of safety climate, safety-related events and injuries. A total of 158 participants completed a survey rating their perceptions of safety-specific transformational leadership, safety-specific passive leadership, safety climate, safety events and injuries. Results of the study showed that the two leadership constructs are separate and do not overlap. Results also showed that safety-specific transformational leadership is directly related to perceptions of safety climate perceptions and indirectly related to safety-related events. Injuries were predicted by safety-related events supporting the proposed model that safety specific transformational leadership influences safety outcomes by working through safety climate perceptions and involvement in safety-related events. The authors also found that safety-specific passive leadership accounted for more variance than safety-specific transformational leadership in the safety consciousness, safety climate, safety-related events and injury variables. However, the safety-specific passive leadership negatively affected safety consciousness and safety climate perceptions. Safety specific passive leadership was also related to an increase in the number of safety-related events. The results of this study showed the importance of considering the positive relationship between safety specific transformational leadership and also highlighted the importance the incremental influence safety-specific passive leadership can have on important organizational level variables (Kelloway Mullen & Francis, 2006).

The common element in all of the above studies is the focus on leadership as an antecedent to safety climate. The contribution these studies make to the gap in our understanding of how safety climate perceptions are developed and what factors predict

or influence the development of safety climate perceptions is an important one. However, more research needs to be conducted on other possible antecedents of safety climate. To date, there is little research in this area, demonstrating that more research is needed in order that we might better understand the factors that influence climate.

One possible predictor that has yet to be explored within the safety climate literature is the possibility of organizational justice. Organizational justice is influential in many important areas. Organizational justice is an important predictor of many factors that could be related to, or influence, safety. For instance, organizational justice is related to employee psychosocial health (Eloviano, Kivimäki, Vahtera, 2002), and employee theft (Greenberg, 1990); as well as distress and employee behaviour (Ledebor, Awotunde, and AbdulSalaam-Saghir, 2008). These studies support the need to conduct research that helps us to better understand the various areas through which unfair treatment, and in particular, the unfair treatment on behalf of supervisors, affects employees. There are currently a growing number of research studies investigating the relationship between organizational justice and health but I was unable to find any research investigating the impact of justice on employee safety or safety climate. Health and safety go hand in hand in organizations further supporting the purpose of investigating organizational justice and safety.

Organizational Justice

What is organizational justice? Organizational justice is a multidimensional social construct that explains how we perceive fairness in the workplace. Specifically,

there are three main dimensions of organizational justice. Researchers refer to one dimension as distributive justice and is defined as the perceptions people develop and have of the fairness or equity of organizational outcomes, such as pay or promotions (Colquitt, Conlon, Wesson, Porter, Ng, 2001). Early research in this area focused primarily on what influenced people's perceptions regarding the distribution of rewards and incentives (Colquitt, et al., 2001). This type of justice is based largely upon Adam's (1965) equity theory which states that people are not necessarily concerned with the absolute level of an outcome but whether the outcome was fair or equitable relative to the individual's inputs (Colquitt et al., 2001). Unfortunately Adam's equity theory received significant criticism as it was unable to explain other aspects of an individual's justice perceptions (Cohen-Charash & Spector, 2001). Researchers began investigating what other factors influenced an individual's perception of fairness within the workplace including perceptions around the implementation of policies and procedures.

In 1975, Thibault and Walker investigated the idea of 'process' within the context of dispute resolutions in legal situations. Thibault and Walker's control model of organizational justice and their research applying this model initiated the concept of procedural justice (Blader & Tyler, 2005). The premise behind the control model of justice is that people will view a procedure as fair to the extent that they have some control over how it was implemented. When people have less control over the actual outcome, the next best thing is fairness of the process. In other words, the idea is that people will relinquish some control over a particular decision/outcome so long as they are able to maintain control over the process (Thibault & Walker, 1975). This is known as

the “fair process effect” and it was this idea that prompted research investigating the notion of procedural justice and how it affects employee performance.

Van den Bos, Lind, Vermunt and Wilke (1997) conducted a seminal study on process fairness and based it on one particular theory. Their perspective was that people use their fairness judgements as a decisional heuristic. Fairness heuristic theory is grounded in the idea that people are often in situations where they must cede to an authority figure (i.e., supervisor) which opens up the opportunity for that authority figure to exploit the subordinate individual. Consequently, people are often unsure about the relationship they have with that authority figure and in order to compensate for this uncertainty, people use fairness judgments as a decisional heuristic of whether that authority figure is legitimate and is sincerely invested in the wellbeing and management of employees. The subordinate individual then uses this judgement to guide his or her behaviour (Blader & Tyler, 2005). Using an experimental approach, Van den Bos et al. (1997) demonstrated that people, who were not aware of the lottery outcomes of other participants, used their judgements of how fairly the procedures (used to determine lottery allocation) were implemented as a way of establishing whether the outcomes they received were fair. In their study, Van den Bos and colleagues argued that people often use available information from their environment (e.g., how fairly the procedures are being implemented) to make a decision about whether they can trust the authority figure with whom they are interacting. Thus, when an individual receives an outcome and cannot judge the relative fairness of it (due to a lack of knowledge about other people’s outcomes), he or she will use his or her procedural justice perceptions to determine

whether it was distributed fairly and whether the authority figure is trustworthy. If the subordinate deems the supervisor as trustworthy, then the employee is more inclined to behave in a positive manner either accepting or rejecting his or her supervisor's requests or demands (Blader & Tyler, 2005).

Other experimental studies confirming the validity of the fairness heuristic theory include Lind, Kulik, Ambrose, and de Vera Park, (1993); Tyler and Lind, (1992); Lind, (2001). These studies helped researchers to understand the process of fairness in a general context and researchers then extended this research to an organizational context. Other studies that have furthered our understanding of fair process have employed other theories such as the social exchange theory.

Research conducted on the fair process effect within an organizational context was first introduced by Leventhal in 1980. Leventhal developed the idea of procedural justice which asserts that employees within organizations develop fairness perceptions around how policies and procedures are implemented within their organizations. According to Leventhal's research, in order for a procedure to be perceived by an employee as fair it must meet six conditions or expectations. First, the application of the procedure by the authority figure must be implemented consistently across employees and time. In other words, if an employee were to view a rule or procedure being applied to them and not a co-worker, or if the rule applied on one day and not the next, the employee might view this as unfair. Second, in order to be perceived as fair, the rules and procedures must be free from bias and have some means of dealing with flawed or inaccurate decisions. This sets the stage for the following condition which stipulates that

a procedure must be based on accurate information. The fourth condition states that rules and procedures should follow ethical standards and morality, and lastly, rules and procedures must take into consideration the opinions of those who will be affected by them (Leventhal 1980). Following Leventhal's work, a number of researchers demonstrated that procedural justice perceptions played a key role in understanding distributive justice perceptions, however, procedural justice did not completely explain people's fairness perceptions. This sparked research that investigated the quality of interactions between those implementing policies and procedures and those on the receiving end of those policies and procedures. This research created a new type of organizational justice known as interactional justice.

One of the first empirical research studies on interactional justice was conducted by Bies and Moag (1986) who investigated the extent to which interpersonal treatment received from an authority figure affects how people perceive the fairness of organizational policies. A significant debate within the literature is whether interactional justice is an extension of procedural justice and not a standalone dimension of organizational justice. A number of research studies to date have found that while procedural and interactional justice perceptions are closely related, they are disparate constructs (Colquitt et al., 2001). Jerald Greenberg's (1993) perspective on interactional justice is that it is not only separate from procedural justice, but it can be separated into two related but distinct dimensions: interpersonal and informational justice. Interpersonal justice is operationalized as the extent to which people are treated with dignity and respected by either a third party or an authority figure. Informational justice is centred on

the quality of information and explanations people are provided with regarding organizational procedures and distribution of outcomes (Greenberg, 1993). Interpersonal justice acts upon an individual's reaction to a particular outcome while informational justice acts upon a person's reactions to a procedure (Greenberg, 1993). In summary, interactional justice is an extension of procedural justice and relates directly to the interpersonal behaviours and the information about policies and procedures communicated by an authority figure. Greenberg and Colquitt (2005) recommend that procedural justice be measured separately from interactional justice and that interactional justice should be measured as two separate constructs consisting of interpersonal and informational justice (Greenberg & Colquitt, 2005).

Link Between Organizational Justice and Attitudes and Behaviours. There is a substantial amount of research that supports the influential relationship between organizational justice and various organizational attitudes and behaviours. A number of different studies have determined that all four types of justice are related to important organizational behaviours. For instance, Hopkins and Weathington (2006) found a direct relationship between distributive justice and turnover intentions, in addition to a direct relationship between procedural justice and organizational satisfaction and affective commitment. In another study, Rahim (2000) found that three types of justice were positively related to a cooperative management styles. In yet another study, Kickul, Lester and Finkl (2002) found a significant interaction between procedural justice, promise breaking and job satisfaction, intentions to leave and citizenship behaviours.

Greenberg and Colquitt (2005), in publishing *The Handbook of Organizational Justice*, reviewed many of the studies on the relationship between organizational justice and job-related attitudes and performance outcomes. In general, results of these studies show that procedural justice is related to task performance and compliance, while interactional (informational and interpersonal) justice is related to management trust, job performance, and workplace incivility (Greenberg & Colquitt, 2005). In 2001, Colquitt and colleagues conducted a meta-analysis summarizing some studies looking at the relationship between fairness and organizational outcomes. Results of their meta-analysis confirmed that organizational justice is related to management trust, job satisfaction, outcome satisfaction and organizational commitment (Colquitt et al., 2001). Given the numerous organizational behaviours and attitudes to which organizational justice is linked, it is reasonable to assume a possible relationship between organizational justice and safety-related attitudes.

Link between Organizational Justice and Leadership. At this point, it is important to consider the relationship between organizational justice and leadership to provide support for investigating the impact of justice on safety. This is of particular importance because there is a significant relationship between leadership and subordinate behaviour and fairness. While some leadership researchers might argue that some leaders are by definition (i.e., transformational) fair (e.g., Mullen & Kelloway, 2009), and therefore leadership and justice are overlapping constructs, there is research to support that they are related but different constructs. For instance, DeCremer, van Duke and Bos (2007)

conducted a study investigating the impact of organizational justice and transformational leadership. Correlational results of the study indicate significant and moderate correlations between the organizational justice constructs and transformational leadership. For example, the correlation between distributive justice and transformational leadership was .19 and the correlation between procedural justice and transformational leadership was .29 which is not high enough to be considered multicollinear (Meyers, Ganst & Guarino, 2006). Additionally, studies also show that leaders with different leadership styles focus on different aspects of organizational justice (Tatum, Eberlin, Kottraba & Bradberry, 2003). In Tatum et al. (2003) transformational leaders focused on the social aspects of fairness while transactional leaders¹ focused more on the structural component of organizational justice. Thus, building on previous research I believe the four organizational justice factors are separate from leadership wherein an individual in an authority position – whether it is a leader, a manager or a supervisor – does not need to engage in a particular leadership style to be considered fair, nor would that person be considered transformational just because they behave in a fair manner. Research does support the idea that the two are related, but not the same. It is my view that organizational justice and leadership are complementary constructs.

Safety Climate, Organizational Justice Connection. Individual or psychological safety climate is centered on the idea that employees develop perceptions of safety based on factors like the extent to which employees perceive the manager's, supervisor's or

¹ Transactional leaders are characterized by a leadership style the behaviour -reward transaction between subordinates and individuals in charge (see Barling, Christie & Hopton, in press for a full review).

safety systems (e.g., lock out procedures) are committed to safety (Guldenmund, 2000).

Drawing upon the safety climate literature and the organizational justice literature, there appears to be a connection between safety climate and procedural, interpersonal and informational justice perceptions.

Procedural justice focuses on the implementation of policies and procedures while one aspect of safety is about the relative priority and commitment to safety which includes the safety policies and procedures. Thus, I believe that a supervisor sends a message about the priority of safety by the way he or she implements rules and procedures. While safety climate is about more than just rules and procedures, it is one important element and a supervisor has a responsibility to implement the rules and procedures handed down by key decision makers and stakeholders. This means it is the supervisor who is responsible for communicating the tone of any messages and thus conveys the basic assumptions of the organization (e.g., production comes before safety). Supervisors are often the only representative employees have of the upper members of the organization who develop and hand down policies and procedures. Additionally, supervisors are often the only person to communicate with employees about their performance and determine the consequences or outcomes of poor performance. It is up to the individual supervisor to determine which discretionary behaviours (i.e., fairness) they will use when allocating rewards, implementing procedures, interacting and communicating with employees even when handling safety issues. Procedural justice is about the fair implementation of procedures and safety climate deals with employee perceptions of the safety commitment of those procedures and their willingness to

comply with them (safety compliance). Procedural justice was related to rule compliance in Colquitt's construct validation study (2001) which is important to consider from a safety perspective given that occupational health and safety is largely about complying with the safety rules and procedures outlined by the organization or occupational health and safety legislation. We also know from previous research (e.g., Neal, Griffin & Hart, 2000) that safety compliance is directly related to incidents.

The items used in some of the safety climate surveys and the items in Colquitt's (2001) organizational justice measures also appear to have a logical relationship. For instance, Zohar's group level climate items tap into safety behaviours like using explanations and providing verbal praise ("says a good word") (Zohar, 2000, pg 591). Some of Colquitt et al.'s (2001) interpersonal and informational justice items include behaviours like providing reasonable explanations and being respectful and refrained from using improper remarks. The apparent connection between organizational justice and safety climate behaviours supports the idea of a potential relationship between justice and safety. The lack of research investigating the relationship between justice and safety lends support to conducting research in this area.

In this dissertation I propose to investigate the extent to which organizational justice predicts safety climate by drawing upon the social exchange theory of organizational justice. The social exchange theory is based on the idea that an individual engages in a give-and-take exchange with another individual and the fairness of this exchange is perceived as warranting reciprocation; it is primarily about the give and take between two people in a relationship. The fundamental concept behind this theory

stipulates that when one person engages in a positive manner towards another (e.g., fair treatment) the employee will value that fair exchange and reciprocate the behaviour (Blader & Tyler, 2005). In other words, this theory suggests that when a supervisor is fair to employees with respect to the allocation of rewards, the implementation of rules and procedures in addition to engaging in fair communication and interpersonal behaviours, the employees will deem those behaviours as deserving of reciprocation and engage in behaviours that include compliance and extra role behaviours (Blader & Tyler, 2005). The social exchange theory has been applied in various studies to explain various employee behaviours such as cooperation (e.g., Cropanzano & Prehar, 2000; Rupp & Cropanzano, 2002) and counterproductive work behaviours (Fodchuck, 2007). Neal and Griffin (2006) suggest that the social exchange theory is one possible theoretical framework that helps to explain why employees engage in safety-related behaviours. Hofmann and Morgeson (1999) also contend that employees who work for organizations that are concerned about safety reciprocate with safety rule compliance behaviours.

Building upon this theory, I believe it is possible for fair reward allocation, fair implementation of rules and procedures as well as fair communication and interpersonal treatment to have an impact on an employee's safety climate perceptions which influences their propensity to reciprocate with safety-related behaviours. For example, if the supervisor engages in the fair implementation of a rule, treats the employee with respect, and provides sufficient information about that rule or procedure, then the individual will value that fair treatment influencing his or her perceptions of safety climate (i.e., supervisor commitment to safety), thus obligating him or her to reciprocate

by following safety-related behaviours such as safety participation and safety compliance. I expect that all four justice factors have a significant relationship with safety climate because it is the supervisor who is primarily responsible for the allocation of rewards, implementation of procedures, and interpersonal interaction with employees. The supervisor also controls the information employees receive from upper management.

Supervisors are the mechanism by which managers, administrators, CEOs and presidents communicate messages and decisions, allocate resources, and implement rules and procedures, all of which are large components of safety. Supervisors are largely responsible for the process of implementing safety policies and procedures that are brought down upon them by “the organization,” thus it is reasonable to expect that supervisors will have the greatest impact on employee justice perceptions. Employees are more likely to perceive rules and procedures as fair as long as they meet the six criteria as outlined by Leventhal (1980). If the supervisor implements rules and procedures according to the six criteria, an employee will likely perceive they are being treated fairly, thus positively influencing their safety climate perceptions. Conversely, if a manager or supervisor is not implementing procedures consistently across time and employees, then the employees’ perceptions of procedural fairness will be negatively influenced in such way that it will influence the employees’ perceptions of supervisor concern and commitment to safety (safety climate). In summary, I am proposing that safety climate is the link between the four organizational justice factors and employee behaviour. If a supervisor is inconsistent in the application of rules and behaviours, employees will perceive that the supervisor is not truly committed to the rules, including

the safety rules, thus affecting their safety climate perceptions. Therefore, they will be less likely to engage in an exchange behaviour such as following those rules.

Some researchers have already alluded to a relationship between organizational justice and safety, albeit on a theoretical basis only. Weiner, Hobgood, and Lewis (2008) proposed a model that questions the extent to having a “just culture” influences safety incident reporting. Specifically, Weiner et al. (2008) proposed the idea that health professionals’ perception of the fairness around incident reporting results in both affective and behavioural reactions. Specifically, they theorized that health professionals’ perceptions of justice may influence supervisor trust and their level of obligation to follow reporting procedures, which could influence future reporting behaviour (Weiner Hobgood, & Lewis, 2008). The authors hypothesized that justice perceptions could influence a health professional’s willingness to engage in unrewarded safety participation behaviours such as quality improvement activities (Weiner, Hobgood, & Lewis, 2008). The basic principle that fair exchanges results in reciprocation is the framework the authors use to explain how justice perceptions can influence employees’ compliance with safety rules and procedures and as well their safety participation. Weiner Hobgood and Lewis proposed that the perceptions of fairness will then influence the number of incidents and injuries they are involved in. Weiner, Hobgood and Lewis propose a significant relationship between justice and safety but do not collect data and do not test their theory. Thus, the goal of my research is to expand upon what is currently known and explore the relationship between justice and safety in an applied context.

Current Studies

The main purpose of my research study is to address the gap in the safety climate literature and examine other organizational factors that influence the development of safety climate perceptions beyond leadership. Only a small number of research studies on the antecedents of safety climate exist and many of those studies examined the impact of specific styles of leadership including transformational (Zohar 2002), safety specific transformational (Barling, Loughlin & Kelloway, 2002), and passive safety leadership (Kelloway, Mullen, & Francis, 2006). One issue with these studies is the majority look only at a specific leadership style or specific supervisor behaviours as antecedents, and do not consider other possible antecedents such as organizational justice. While previous studies do provide important insight the potential exists for other factors possible antecedents including those which are not specific to safety (e.g., organizational justice) is supported by Griffin and Hart (2000) who indicated that there are possible general organizational climate factors that can influence employee safety climate and safety behaviours. Thus, it is also possible that there are general organizational factors such as organizational justice that influence perceptions of safety climate.

I attempt to narrow the gap in the safety climate literature by exploring whether general supervisor behaviours influence safety climate perceptions. I expect that perceived supervisor fairness when allocating rewards, interacting with employees, implementing rules and communicating information influences the relationship between safety climate and safety participation and compliance. Thus, supervisors first influence employee perceptions of safety climate, which goes on to influence employee safety

participation and compliance, which is then directly related to the number of incidents.

Given the influential nature of supervisors on how organization policies and procedures are implemented and their influence on employee behaviour, it stands to reason that there are other general supervisory practices and behaviours such as fairness that have a significant impact on how employees perceive the entire state of the organization including safety.

Neal, Griffin and Hart (2000) claim that interventions geared towards improving the general organizational climate could also positively impact safety climate. I believe that general supervisor behaviours will predict employee safety climate perceptions which predict employee safety participation and compliance. Furthermore, I believe fairness is a discretionary behaviour that a supervisor personally chooses to consider and demonstrate in his or her actions. This portion of my theory is supported by Zohar's work which indicates that supervisors have discretion over how and when organization policies and procedures are to be implemented (Zohar 2008). Additionally, I believe that this discretionary behaviour of fairness is one possible mechanism employees use to determine the quality of the relationship they have with their supervisors and that employees use this as a proxy measure for the level of commitment and consideration an organization as a whole has towards safety (safety climate).

Another discretionary behaviour supervisors' have control over when implementing rules and procedures is the quality of interaction between themselves and their subordinates. I expect that employees use their perceived fairness when interacting with their supervisor as a qualitative measure. Factors that influence the quality of

supervisor and employee interactions in other research domains such as job performance have found that fairness plays a significant role (e.g., Cropanzano, Prehar & Chen, 2002). Previous literature on organizational fairness tells us that when supervisors engage in behaviours associated with being fair, employees respond in a positive manner (Greenberg & Colquitt, 2005).

I propose to explore the relationship between organizational justice and safety in three separate studies. In the first study, I aim to explore whether organizational justice is predictive of safety climate perceptions, whether safety climate perceptions predict safety participation and safety compliance, and whether they go on to predict safety incidents. Specifically, I test a structural model that connects organizational justice with safety climate, safety behaviours and safety incidents. Furthermore, I believe that each individual dimension of organizational justice is an important predictor of safety climate. Consistent with previous research, I also expect to find a significant predictive relationship between safety climate, safety behaviours and incidents.

In the first study, I test this structural model on a sample of participants from a large private sector organization I test the full proposed structural model in the second study on the basis of confirmation of the full model. I wanted to test whether the full proposed relationship between organizational justice and perceptions of safety climate exists within a different sample of employees from a different organization. Given that the relationship between justice and safety climate is believed to be untested I felt a more conservative approach was to test the full structural model to further test the relationship between organizational justice and perceptions of safety climate. In the second study, I

explore whether the proposed structural model will be confirmed in a different sample of participants from a smaller public sector organization. I test the full proposed structural model in the second study on the basis of replication. Finally, in study 3, I investigate the longitudinal effects of organizational justice and safety climate to determine if there is an effect of justice and climate over time. In this third study I will attempt to confirm the relationships found between organizational justice and safety in Study 1 and 2 and will also test whether organizational justice is a specific antecedent to safety climate over time.

Study 1

The purpose of this study was to explore the extent to which organizational justice predicted safety climate and safety behaviours. Most of the current organizational justice literature currently supports the use of a four-factor justice framework containing distributive justice, procedural justice, informational justice, and interpersonal justice (Greenberg & Colquitt, 2005). Greenberg and Colquitt (2005) recommended measuring interactional justice as two separate constructs, however, there is some research to support the use of a three-factor structure (e.g., Ambrose, Seabright, Schminke, 2002; Cohen-Charash & Spector, 2001) and as such, I will conduct a confirmatory factor analyses to determine if the data best supports a four-factor or a three-factor solution.

Hypothesis 1. Procedural, distributive, interpersonal and informational justice are empirically distinct constructs and support the use of a four-factor solution.

The main goal of this study is to test a model (see figure 1) using structural equation modelling to determine whether distributive, procedural, informational and interpersonal justice significantly predict employees' perceptions of safety climate which mediates the relationship between safety compliance and participation. This model is based on my second hypothesis:

Hypothesis 2. Safety climate mediates the relationship between the four organizational justice factors and safety participation, and safety compliance behaviours, which predict safety incidents.

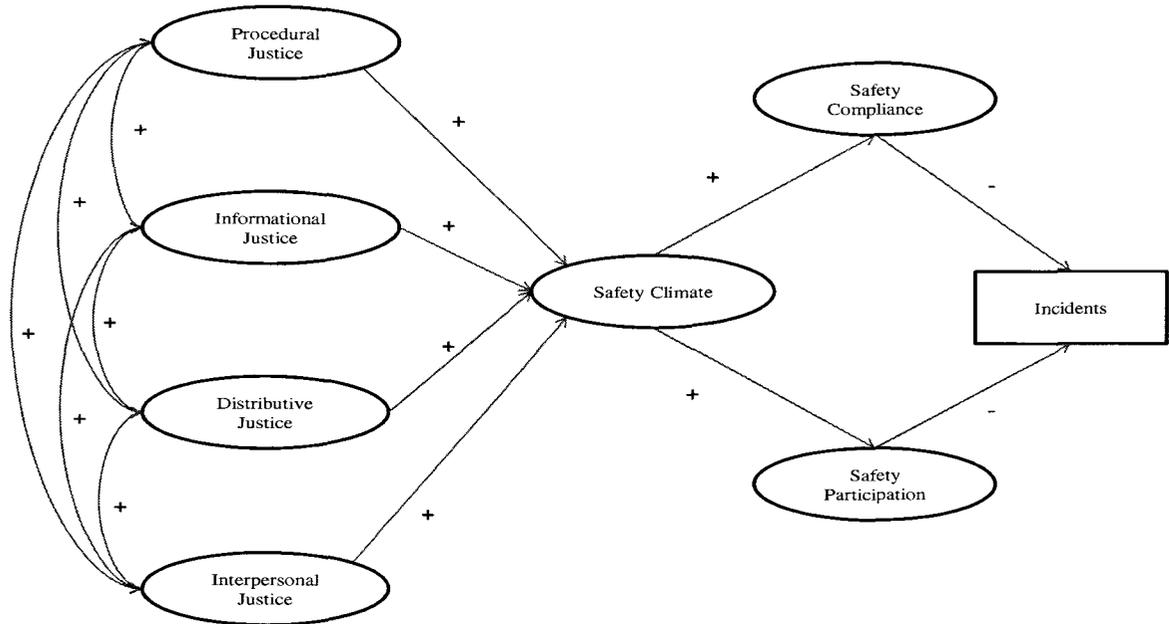
Methods

Participants and Procedure.

Approximately 650 employees from a large, privately owned Canadian construction-based company were asked to complete an employee perception survey. A total of 342 of those employees complete and returned the surveys (approximate participation rate is 52 %²). The survey included measures of distributive, procedural, interpersonal, and informational justice; safety climate, safety participation, and safety compliance; as well as safety incidents and various demographic variables. Prior to completing the survey, participants read, signed, and returned informed consents. Each individual was provided with business reply postage paid envelope in which they could return their survey anonymously.

² Participation rate is approximate due to the large number of contract employees that may or may not have been on the worksite at the time the survey was distributed. Extras surveys were left for those not present at that time, however, not all unused surveys were returned or completed.

Figure 1 Proposed Structural model linking organizational justice and perceptions of safety climate



**Note: PJ = Procedural Justice; IFJ = Informational Justice; DJ = Distributive Justice; INJ = Interpersonal Justice*

The majority of participants were male (M = 292, F = 49, Unidentified = 1). All participants held jobs in a variety of positions including crane operators (N = 160), mechanics (N = 24), administrative, managerial and support staff (N = 158). The average number of hours worked per week was 51 (M = 51.24, SD = 12.61) and the average number of years employed was six (M = 6.07, SD = 7.45) years. Analyses were conducted on a final N of 325 as 16 of the respondents held senior management positions and were not eligible to be included and were consequently removed from the analyses.

Measures

I computed variable scores such that higher scores on the scale indicated agreement with the item and low scores indicated disagreement with the item with the exception of the safety incidents scale. Lower scores on this scale indicated a lower frequency of occurrence. A list of scale items is provided in Appendix A. All scales items were rated on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree).

Safety Climate. I used Zohar and Luria's (2005) 16 unit-dimensional scale to measure group safety climate perceptions (perceptions based on actions of direct supervisor) (α .95). Examples of items include, "My supervisor says a good word whenever he sees a job done according to the safety rules," and, "My supervisor seriously considers any worker's suggestions for improving safety." I chose this scale based on my proposed theoretical relationship between safety climate and organizational justice. I believe that the relationship largely (but not exclusively) exists via the supervisor thus I chose a safety climate scale that specifically targeted supervisors.

Procedural Justice. I used Colquitt's (2001) 7-item measure to evaluate procedural justice (α .92). Example items of procedural justice include, "The procedures are free from bias," and, "I can appeal the outcome of procedures."

Distributive Justice. I used Colquitt's (2001) 4-item measure to evaluate distributive justice perceptions (α .96). Examples items of distributive justice include, "The rewards I receive reflect the effort I put into my work," and, "The rewards I receive are justified given my performance."

Interpersonal Justice. I used Colquitt's (2001) 4-item scale to evaluate interpersonal justice perceptions (α .93). Example items include, "My supervisor treats me in a polite manner" and, "My supervisor treats me with dignity."

Informational Justice. I used Colquitt's (2001) 5-item scale to evaluate informational justice perceptions (α .91). Examples of informational justice include, "My supervisor communicates details in a timely manner," and, "My supervisor would give me reasonable explanations."³ Colquitt's scales were chosen on the basis that the relationship between safety climate and organizational justice is believed to exist via the supervisor and Colquitt's justice items specifically target supervisory behaviours in a way that aligns with Zohar and Luria's (2005) safety climate scale.

Safety Compliance. I used Neal, Griffin and Hart's (2000) 4-item scale to evaluate safety compliance behaviours (α .84). Examples of these items include, "I use all the necessary safety equipment to do my job," and, "I use the correct safety procedures for carrying out my job."

Safety Participation. For this scale I used Neal, Griffin and Hart's (2000) 4item safety participation scale to evaluate safety participation behaviours (α .86). Example items include, "I put in extra effort to improve the safety of my workplace."

Safety Incidents. I adapted Barling, Loughlin and Kelloway's (2002) 11-item scale in order to make the items more applicable to this sample's industry (α .79)

³One item from this scale was inadvertently omitted from the survey. It is expected that the omission of this item did not have a significant impact on results as it was worded in a very similar manner to another item in scale in the same scale. The item omitted asked participants to rate the extent to which their supervisor "provides thorough explanations regarding decision making procedures" which is very similar to the item asking participants to rate the extent to which their supervisor "gives me reasonable explanations regarding decision-making procedures"

Example items include, “In the past four months how many times have you . . . had something fall on you, slipped on a slick surface.”

Results

Prior to testing the hypotheses, I examined the data for outliers, data entry errors, non-random missing data, and violations of assumptions including non-linearity, non-normality, and multicollinearity. I also examined frequencies and descriptive statistics and did not find any serious violations of assumptions. For the basic analyses, I dealt with missing data using listwise deletion at the item level such that if any value on any variable was missing it was removed from the analyses. For the Structural Equation Modelling (S.E.M) analyses, AMOS handled missing data by calculating means and intercepts; I used listwise deletion when calculating descriptive statistics. Scale descriptive statistics are presented in Table 1.

Hypotheses Testing

Hypothesis 1: Test of Justice Factors (Confirmatory Factor Analysis). My first hypothesis proposes that procedural, distributive, interpersonal and informational justice are empirically distinct constructs, and would reflect a better fitting model than a three-factor justice model wherein interpersonal and informational justice are combined into one factor. Some previous studies found high intercorrelations between interpersonal and informational justice constructs resulting in the two factors being combined into one interactional justice factor (Colquitt & Shaw, 2005) and as such, in this study I test the fit of both models. A three-factor model, combining informational and interpersonal justice into one factor was compared to a four-factor model using a confirmatory factor analysis approach (CFA) (using AMOS Graphics, Version 7). I used maximum likelihood

estimation and assessed the fit of the models by examining the fit indices provided in AMOS including the Comparative Fit Index (CFI), Normed Fit Index (NFI) both ranging from 0 to 1, and values above .90 indicate good fit (Kelloway 1995); and the Root Mean Squared Error of Approximation (RMSEA)

which ranges from 0 to 1, and values less than .08 are considered acceptable, and values above .10 are considered unacceptable (Meyers, Gamst, & Guarino, 2006).

To compare the three-factor and four-factor models it is recommended that the chi-square value and the degrees of freedom of the larger model are subtracted from the chi-square value and degrees of freedom from the smaller model (Tabachnick & Fidell, 2001). Results show that the proposed four-factor structure is a better fitting model $\chi^2(146) = 360.23, p < .001$; CFI = .96; NFI = .94; RMSEA = .07; PCLOSE = .00 (see table 2 for standardized parameter estimates) than the alternative three factor model $\chi^2(149) = 614.80, p < .001$; CFI = .90; NFI = .89; RMSEA = .10, PCLOSE = .000. I conducted a chi-square difference test (see table 3) and the result was significant indicating that a four-factor model (larger model) should be retained in subsequent analyses; results supported hypotheses one. Additionally, I tested the possibility of a one-factor justice solution, and results showed poor fit to the data, thus a four-factor model was retained.

Table 1: Scale Means, Standard Deviations, Correlations and Reliabilities

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Safety Climate	5.02	1.00	(.95)							
2. Safety Participation	5.40	1.00	.44**	(.86)						
3. Safety Compliance	5.87	.835	.44**	.52**	(.84)					
4. Procedural Justice	4.86	1.14	.64**	.45**	.46**	(.92)				
5. Distributive Justice	4.18	1.58	.57**	.36**	.31**	.59**	(.96)			
6. Interpersonal Justice	5.81	.994	.47**	.18**	.26**	.37**	.43**	(.93)		
7. Informational Justice	5.42	1.15	.57**	.22**	.32**	.48**	.48**	.76**	(.91)	
8. Safety Incidents	1.36	.384	-.30**	-.27**	-.27**	-.37**	-.29**	-.26**	-.21**	(.70)

Note ** Correlation is significant at the 0.01 level (2-tailed).
Scale reliabilities presented along diagonal in parentheses
Listwise N=278

Hypothesis 2: Establishing Model Validity: Test of the mediational model. The purpose of this study was to determine whether safety climate perceptions mediate the relationship between distributive, procedural, informational, interpersonal justice, safety participation and safety compliance which were then expected to predict safety incidents. Due to the high number of items within the safety climate scale, I parceled items. Little, Cunningham, Shahar & Wildaman,(2002) advocate item parceling when the number of parameters to be estimated is high, when the number of indicators (observed variables) per factor is high and when the sample size is low. I constructed parcels using the item to factor approach for the safety climate and procedural justice scales, both of which are unidimensional. To develop the parcels, I conducted an exploratory factor analysis using principal axis factoring. The first parcel contained the two items with the highest factor loadings and the two items with the lowest factor loadings. I constructed the remaining parcels using the same method. I placed the following two highest loading items and the following two lowest loading items together. The safety climate scale contained four parcels with four items in each parcel. Parceling items in this manner produces item parcels with similar factor loadings and similar contributions (Little et al., 2002). The remaining scales were not parceled as the number of items in those scales was low (less than 7). See Appendix B for item parceling breakdown.

As recommend by Byrne (2008), prior to investigating the structural model I first tested the fit of the measurement model (see figure 2 in Appendix C). Results of the measurement model indicated good fit to the data. $\chi^2(272) = 439.00, p < .001; CFI = .98;$

NFI = .94; RMSEA = .04; PCLOSE = .93 All parameter estimates were significant and each item loaded on its respective factors (see table 4).

Table 2 Standardized Parameter Estimates of 4 factor organizational Justice CFA

Variable	Distributive Justice	Procedural Justice	Informational Justice	Interpersonal Justice
The rewards I receive reflect the effort I put into my work	.90			
The rewards I receive are appropriate for the work I do	.93			
The rewards I receive reflect what I have contributed to the organization	.94			
The rewards I receive are justified given my performance	.69			
I am able to influence the outcome of the procedures		.72		
The procedures are applied consistently		.80		
The procedures are free from bias		.86		
I can appeal the outcome of the procedures		.82		
The procedures are based on accurate information		.80		
The procedures uphold ethical and moral standards		76		
Treat me in a polite manner.			.87	
Treat me with dignity.			.97	
Treat me with respect.			.94	
Refrain from improper remarks			.72	

Variable	Distributive Justice	Procedural Justice	Informational Justice	Interpersonal Justice
or comments.				
Be candid in communication with me.				.83
Give me reasonable explanations.				.88
Communicate details to me in a timely manner.				.85
Tailor communication to meet my needs.				.82

Table 3: Chi-square difference test for Justice Confirmatory Factor Analyses

Model	χ^2	df	CFI	NFI	RMSEA	PCLOSE	χ^2_{diff}	Δdf
1. Three factor justice model (Interpersonal and Informational Justice combined)	614.80	149	.90	.89	.10	.000		
2. Four factor justice model Difference between model 1 and model 2	360.23	146	.95	.94	.07	.000	254.57	3

Given the good fit of the measurement model, I proceeded to test the structural model. The proposed structural model hypothesized that the relationship between procedural and informational justice and safety behaviours (safety participation and compliance) is mediated by safety climate. I tested three competing models: a fully mediated, a partially mediated, and a non-mediated model. Results of the fully mediated model show good model fit, $\chi^2(286) = 544.96$, $p < .001$; CFI = .97; NFI = .93; RMSEA = .05, PCLOSE = .24 (See figure 3 in Appendix C). Contrary to what I expected, interpersonal justice was not a significant predictor of safety climate perceptions but all remaining parameter estimates were significant. I also tested a competing model wherein the relationship between justice and safety behaviours is partially mediated by safety climate (see figure 4 in Appendix C). Results of the partially mediated model also showed good fit to the data, $\chi^2(278) = 494.49$ $p < .001$; CFI = .97; NFI = .94; RMSEA = .05; PCLOSE = .58. A non-mediated model (see figure 5 Appendix C) was also tested wherein the direct paths between the organizational justice factors and safety participation and safety compliance were tested and results indicated adequate fit to the data $\chi^2(282) = 714.04$, $p < .001$; CFI = .94; NFI = .91; RMSEA = .07; PCLOSE = .00 (see table 5 for fit indices for competing structural models).

Table 4 Standardized Parameter Estimates of Measurement Model

Variable	DJ	PJ	INFO J	INTERJ	Safety Climate	Safety Compliance	Safety Participation
The rewards I receive reflect the effort I put into my work	.90						
The rewards I receive are appropriate for the work I do	.93						
The rewards I receive reflect what I have contributed to the organization	.93						
The rewards I receive are justified given my performance	.92						
Procedural Justice Parcel 1		.89					
...I am able to express my views and feelings during those procedures.							
... The procedures are free of bias.							
Procedural Justice Parcel 2		.87					
...I can appeal the outcome of the procedures.							
...The procedures uphold ethical and moral standards							
Procedural Justice Parcel 3		.93					
...I am able to influence the outcome of the procedures							

Variable	DJ	PJ	INFO J	INTERJ	Safety Climate	Safety Compliance	Safety Participation
... The procedures are applied consistently.							
... The procedures are based on accurate information			.87				
Treat me in a polite manner.			.97				
Treat me with dignity.			.95				
Treat me with respect.			.73				
Refrain from improper remarks or comments.							
Be candid in communication with me.				.83			
Give me reasonable explanations.				.89			
Communicate details to me in a timely manner.				.83			
Tailor communication to meet my needs.				.81			
Safety Climate Parcel 1							.88
... makes sure we follow all safety rules (not just the most important ones)							
...emphasizes safety procedures when we are working under pressure							
...insists we wear our protective equipment even if it's uncomfortable							

Variable	DJ	PJ	INFO J	INTERJ	Safety Climate	Safety Compliance	Safety Participation
... refuses to ignore safety rules when work falls behind schedule							
Safety Climate Parcel 2					90		
...discusses how to improve safety with us							
...uses explanations (not just compliance) to get us to act safely							
...says a good word to workers who pay special attention to safety							
...makes sure we receive all the equipment needed to do the job safely							
Safety Climate Parcel 3					.94		
...spends time helping us learn to see problems before they arise							
...frequently checks to see if we are all obeying the safety rules							
...is strict about working safely when we are tired or stressed							
...insists that we obey safety rules when fixing equipment or machines							
Safety Climate Parcel 4							91
...frequently talks about safety issues throughout the work week							

Variable	DJ	PJ	INFO J	INTERJ	Safety Climate	Safety Compliance	Safety Participation
...reminds workers who need reminders to work safely							
...frequently tells us about the hazards in our work							
...is strict about safety at the end of the shift, when we want to go home							
I use all the necessary safety equipment to do my job						.79	
I use the correct safety procedures for carrying out my job						.83	
I ensure the highest levels of safety when I carry out my job						.81	
I promote the safety program within the organization							.77
I put in extra effort to improve the safety of the workplace							.90
I voluntarily carry out tasks or activities that help improve workplace safety							.79

*Note: DJ = Distributive Justice, PJ = Procedural Justice, InterJ = Interpersonal Justice, InfoJ = Informational Justice

Table 5 Fit Indices for Structural Models

Model	χ^2	<i>df</i>	CFI	NFI	RMSEA	PCLOSE
Measurement model	439.00	272	.98	.94	.04	.93
Fully mediated model	544.97	286	.97	.93	.05	.24
Partially mediated model	494.49	278	.97	.94	.05	.58
Non mediated model	714.04	282	.94	.91	.07	.00
Trimmed partially mediated model	500.16	285	.97	.94	.05	.65

A chi square difference test was performed to determine if the partially mediated or the fully mediated model should be retained. Results indicated a significant difference between the two models (see table 6). The partially mediated model was deemed the best fitting model based on the fit indices and the chi-square difference tests, however, some of the regression paths in the partially mediated model were not significant. A chi-square difference test also tested whether the non-mediated and partially mediated models were significant different. Results indicated there was a significant difference between them and the partially mediated model should be retained ($\chi^2_{diff}(4) = 219.55, p < .001$).

Table 6: Fit Indices and Chi-square difference test of Nested Models

Model	χ^2	<i>df</i>	CFI	NFI	RMSEA	PCLOSE	χ^2_{diff}	Δdf
1. Fully mediated model	544.97	286	.97	.93	.05	.24		
2. Partially mediated model	494.49	278	.97	.94	.05	.58		
Difference between model 1 and model 2							50.48	8

The direct path between distributive justice and safety compliance and safety participations were not significant; the paths between informational justice and safety compliance and safety participation were not significant, and the paths between interpersonal justice and safety compliance and safety participation were not significant. Additionally, the path between interpersonal justice and safety climate was not significant. Based on these results, I tested a trimmed model, wherein the non-significant paths were deleted, and compared it to the original, partially mediated model. The trimmed model provided better fit to the data based on the fit indices, however, the chi-

square value was slightly higher than the partially mediated model $\chi^2(285) = 500.16$, $p < .001$, CFI = .97; NFI = .94; RMSEA = .05; PCLOSE = .65 All paths between factors were significant (see figure 6 Appendix C). I conducted a chi-square difference test between the partially mediated and the trimmed model and results showed a significant difference, thus, the more parsimonious trimmed model was retained (see table 7 for chi-square difference results). All parameter estimates of the trimmed model were significant. Additionally, the squared multiple correlations indicate that organizational justice explains 55% of the variance in safety climate; safety climate explained 32% of the variance in safety compliance and 30% of the variance in safety participation. Safety compliance and participation explained 8% of the variance in incidents. For the indirect effects please refer to Appendix D

Table 7: Chi-square difference tests for Mediated Models

Model	χ^2	<i>df</i>	CFI	NFI	RMSEA	PCLOSE	$\chi^{2\text{diff}}$	Δdf
1. Trimmed, partially mediated model	500.16	285	.97	.94	.05	.65		
2. Partially mediated model	494.49	278	.97	.94	.05	.58		
Difference between model 1 and model 2							5.67	7

Given that self report was the only method of data collection, it is important to consider the possibility of common method bias. I attempted a test for common method variance however; the model would not run as it was under-identified. I also attempted to compare an eight-factor model to a one-factor model; however, the model was also

under-identified. I conducted an exploratory factor analysis (Harmon's single factor test) (Podsakoff et al., 2003) and results showed an 8 factor solution with eigen values greater than 1. These results indicate that despite the possibility of monomethod bias I was still able to obtain a multifactor solution.

Discussion

The purpose of this study was to examine the relationship between justice and safety climate, safety related behaviours and incidents. Consistent with hypothesis 1, I found that organizational justice is best evaluated as a four-factor solution and not a three-factor solution. To test the proposed structural model, I tested four alternative models. First, I tested a fully mediated model which stipulated that the influence of distributive, procedural, and informational and interpersonal justice on safety compliance and participation works directly through the individual's safety climate perceptions. This model suggests that an individual's distributive, procedural interpersonal and informational perception influences employee safety behaviours by first affecting their safety climate perceptions. This model would support the possibility that there are general supervisor behaviours that can influence safety. Results of this model indicated good fit to the data however; a partially mediated model was tested in order to investigate the possibility that justice is directly related to safety behaviours. Results of the partially mediated model indicated significantly better fit to the data, however, some of the direct paths between justice and safety climate were not significant. I also tested a non-mediated model and found it indicated poor fit to the data. Finally, I tested a trimmed, partially mediated model wherein I removed all non-significant paths from the partially mediated

model. Only the direct path between procedural justice and safety compliance and participation remained. A chi-square difference test indicated there was no significant difference between the two models, suggesting I retain the more parsimonious model (trimmed model).

The results of this study partially support my theory that organizational justice is an important component of safety. They indicate that general procedural justice perceptions significantly predict safety climate and safety related behaviours directly, which then predict safety incidents. My initial hypothesis was that the relationship between the four justice factors and safety behaviours would be fully mediated by perceptions of safety climate; however, results show that only the relationship between distributive and informational justice, and safety compliance and participation is fully mediated. The results of this study also suggest that interpersonal justice was not a significant predictor of safety climate perceptions, safety behaviours or safety compliance. The relationship between procedural justice and safety compliance and safety participations is partially mediated, meaning procedural justice directly influences safety behaviours. In addition, this study also supports my theory that there are general aspects of the leader and subordinate exchange that affect employee behaviours and organizational safety performance (incidents). These results have implications for a number of stakeholders including employees, supervisors, and organizations. Knowing the specific relationship characteristics that influence employee perceptions, and knowing how general supervisor behaviours positively influence those safety climate perceptions and safety-related behaviours, would be helpful information for supervisors and

managers, especially when implementing difficult or unfavourable policies and procedures (e.g., drug and alcohol testing).

O'Dea and Flin (2001) concluded from their study that managers are aware of their role in influencing employee safety and believe that good quality and open relationships with subordinates is the best way to promote safety. However, the results of their study also demonstrated that less experienced managers and those with a directive style of leadership overestimated their ability to influence their subordinates. The results of my study demonstrate that one important component to a good quality relationship between supervisors or managers and their employees is fairness. Moreover, these results support the possibility that there are significant predictors of perceptions of safety climate that are not being considered in both current safety climate research and organizational justice research. Researchers interested in investigating the predictors of safety climate should take into consideration other possible predictors to safety climate that go beyond just leadership style. It may be of equal or more importance to consider the quality of supervisor behaviour (fair implementation of procedures) in order to appreciably affect individual safety climate perceptions, safety behaviours and incidents. The results of this study show that it is important for supervisors to understand the extent to which general supervisor behaviours significantly influence and, in part, drive their subordinates' safety perceptions and their safety behaviours as well as their involvement in incidents. If you treat an individual fairly when implementing rules and procedures then you may have a significant and positive influence on your employees' perceptions of safety climate, thus influencing their willingness to engage in safe behaviours. This provides an important

piece of information that is currently missing from both safety climate literature as well as the organizational justice literature, which has primarily focused on its relationship to health and not safety (e.g., Eloviano Kivimäki, Vahtera, 2002)

The current research study contributes to knowledge by adding to the theoretical frameworks within the safety research domain in addition to the organizational justice domain. This study addresses the lack of research available on the possible predictors of safety climate. This study will add to the organizational justice literature by further establishing the role that organizational justice has in organizations and the extent to which it can directly affect important behaviours like safety participation and safety compliance, which then predict incidents. This study has significant practical implications for organizations seeking to improve group level safety climate as it will provide insight into how employees develop perceptions of their organization. Organizations will be knowledgeable of potential factors under their control that influence employee perceptions of them and how they behave.

Limitations

Limitations of this study include the issue of that common method variance is partly responsible for the results, however, this could not be tested in AMOS as the model was under identified and would not allow the program to run. Also, the data in this study is nested which indicates the possibility that the correlations between the predictors and criterions are inflated due to significant group differences. Typically this would be handled using a hierarchical linear modelling however limitations of sample size did not allow for this type of analysis. I conducted a mixed model analysis to determine whether

significant group difference affected the impact of the relationship between justice and safety. Results show that while there were significant groups it did not change the overall result. The relationships between justice and safety climate remained the same. Thus this is addressed as general limitation and will be further addressed in study three wherein the data is not nested and the relationship between organizational justice and safety climate is maintained.

Additionally, the measures included in this study were self reported and subject to social desirability. Furthermore, it is possible that the results of this study are not representative of a wider selection of employees' job types and industries, thus, study 2 will test the same proposed structural model in a different organization.

Study 2

Given the relative novelty of the research in this area, I attempted to confirm the results of study 1 in a different sample of working individuals from a different organization. The main goal of this study was to replicate and examine the predictive validity of my proposed structural model. In this study, I attempted to confirm the relationships between distributive, procedural and informational and interpersonal justice. I tested the same model proposed in study 1 (see Figure 1) which hypothesized a predictive relationship between distributive procedural, interpersonal and informational justice and safety behaviours (safety compliance and participation which predicts incidents), which are mediated by safety climate perceptions. The purpose of testing the full structural model was to determine if the model could be fully replicated.

Again, I proposed that, for example, if a supervisor applies a rule or procedure consistently across employees and over time, then an employee will perceive that as fair which will positively influence his or her perceived safety climate which will influence his or her safety participation and safety compliance behaviours.

My hypothesis is as follows:

Hypothesis 1. Distributive, procedural, interpersonal and informational justice significantly predict safety climate perceptions which then predict safety compliance and safety participation behaviours which predict incidents.

Method

Participants and Procedure

A sample of 209 employees from a large public sector transportation based organization volunteered to complete an employee perception survey. I distributed approximately 700 surveys, (participation rate of 29%). The survey included the same measures from study 1: distributive, procedural, informational and interpersonal justice, and safety climate, as well as a number of demographic variables. Prior to completing the survey, participants read an information letter describing the purpose of study. Each participant was provided with a survey package containing an information letter, a survey and a prize sheet. Participants were compensated for their time with \$100 if they were the first or tenth person in their area to return a survey. All other participants were compensated by having their names entered to win a separate \$100 cash prize. Participants signed and returned a survey and prize form to imply consent. Each individual was provided with a self addressed stamped envelope in which they could return their survey anonymously.

The majority of participants were male (M =199, F = 9, Unidentified = 1). All participants held jobs in various positions including operator (N = 71), crewman or labourer (N = 106), or maintenance worker (N =5), administrative and managerial support staff (N =23). Five participants did not respond. The average number of hours worked was 45 (M = 45.91, SD = 5.76) and the average number of years employed was 14 (M = 13.77, SD = 11.25) years

Measures

All items were rated on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). A list of all scale and their respective items is provided in Appendix A.

Safety Climate. I used Zohar and Luria's (2005) 16 item uni-dimensional scale to measure group safety climate perceptions (perceptions based on actions of direct supervisor) (α .94). Examples of items include, "My supervisor says a good word whenever he sees a job done according to the safety rules," and, "My supervisor seriously considers any worker's suggestions for improving safety."

Procedural Justice. I used Colquitt's (2001) seven-item measure to evaluate procedural justice (α .91). Example items of procedural justice include, "The procedures are free from bias," and, "I can appeal the outcome of procedures."

Distributive Justice. To measure this I used Colquitt's (2001) four-item distributive justice measure (α .97). Examples items of distributive justice include, "The rewards I receive reflect the effort I put into my work," and, "The rewards I receive are justified given my performance."

Interpersonal Justice. I used Colquitt's (2001) four-item scale to evaluate interpersonal justice perceptions (α .94). Example items include, "My supervisor treats me in a polite manner," and, "My supervisor treats me with dignity."

Informational Justice. I used Colquitt's (2001) five-item scale to evaluate informational justice perceptions (α .92). Examples of informational justice include, "My supervisor communicates details in a timely manner," and, "My supervisor gives me reasonable explanations."

Safety Compliance. To measure this I used Neal, Griffin and Hart's (2000) four-item safety compliance behaviours scale (α .84). Examples of these items include, "I use all the necessary safety equipment to do my job," and, "I use the correct safety procedures for carrying out my job."

Safety Participation. I used Neal, Griffin and Hart's (2000) four-item safety participation scale to evaluate safety participation behaviours (α .86). Example items include, "I put in extra effort to improve the safety of my workplace."

Safety Incidents. I adapted Barling, Loughlin and Kelloway's (2002) 11-item scale in order to make the items more applicable to this sample's industry (α .79). Example items include, "In the past four months how many times have you . . . had something fall on you, slipped on a slick surface."

Results

Prior to testing the hypothesis, I examined the data for outliers, data entry errors, non random missing data and violations of assumptions including non-linearity, non-normality, and multicollinearity. I examined frequencies and descriptive statistics and found no serious violations of assumptions. I used listwise deletion to handle missing data. See table 8 for descriptive statistics including means, and scale reliabilities.

Table 8 Scale Means, Standard Deviations, Correlations and Reliabilities

Scale	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Safety Climate	5.41	1.02	(.94)							
2. Safety Participation	5.63	.818	.36**	(.76)						
3. Safety Compliance	5.94	.816	.53**	.53**	(.86)					
4. Procedural Justice	5.11	1.12	.61**	.29**	.41**	(.91)				
5. Distributive Justice	4.37	1.68	.40**	.30**	.34**	.60**	(.97)			
6. Interpersonal Justice	5.76	1.18	.53**	.18**	.22**	.51**	.42**	(.94)		
7. Informational Justice	5.56	1.18	.62**	.15**	.31**	.60**	.45**	.85**	(.92)	
8. Incidents	1.42	.410	-.28**	-.17*	-.34**	-.37**	-.21**	-.17*	-.17*	(.81)

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

* Correlation is significant at the .01 level (2-tailed).

Scale reliabilities presented along diagonal in parentheses

Listwise N = 203

Hypothesis Testing

Hypothesis: Test of mediational model of justice and safety climate. As recommended by Byrne (2009), the measurement model (see figure 7 Appendix C) was examined prior to the structural model. Item parceling was performed on the safety climate scale to maintain consistency throughout both studies. Parceling was conducted using the same EFA technique and the same parcels were created. The measurement model indicated adequate but not ideal fit to the data, $\chi^2(272) 588.79 =, p < .001$; CFI = .94; NFI = .90; RMSEA = .07, PCLOSE = .00. To improve the measurement model, I examined the standardized parameter estimates all of which were significant and did not support deleting items or parcels (see table 9). While the fit was not optimal, it was deemed to be acceptable. I proceeded to test the proposed structural model on the basis that it was adequate enough given the relatively low sample size and complexity of the model.

Similar to study 1, I tested four competing models (see table 10 for fit indices). First, I examined a fully mediated model (see figure 8 in Appendix C). Results of the model indicated adequate fit to the data, $\chi^2(286) 662.20 =, p < .001$; CFI = .93; NFI = .88; RMSEA = .08, PCLOSE = .00. Standardized parameter estimates showed that interpersonal justice and distributive justice were not significant predictors of safety climate; additionally, safety participation was not a significant predictor of safety incidents. A partially mediated model (see figure 9 in Appendix C) was tested to determine the possibility that organizational justice is directly related to safety behaviours. Results of this model indicated similar fit to the fully mediated model with a

minor increase in NFI and CFI as well as and a smaller chi-square value, $\chi^2(278) 627.20$, $p < .001$; CFI = .94; NFI = .89; RMSEA = .08, PCLOSE = .00. A non-mediated model (see figure 10) was tested and indicated poorest model fit $\chi^2(282) 775.26$, $p < .001$; CFI = .91; NFI = .86; RMSEA = .09. PCLOSE = .00. Because the partially mediated and non mediated models are nested I tested to determine which of the two best fit the data. I conducted a chi-square difference test which showed that the partially mediated model was significantly different and best fit the data. Consequently, this model was retained and the non mediated model was rejected. To determine whether the fully mediated or the partially mediated model should be retained, a chi-square difference test was performed comparing the two models. Results indicated that the partially mediated model should be retained (see table 11). The standardized parameter estimates of the partially mediated model indicated that the path between informational justice and safety compliance was not significant, the path between distributive justice and safety compliance was not significant, and the paths between interpersonal justice and safety compliance and safety participation were not significant.

Table 9 Standardized Parameter Estimates of Measurement Model

Variable	DJ	PJ	INFOJ	INTERJ	Safety Climate	Safety Compliance	Safety Participation
The rewards I receive reflect the effort I put into my work	.88						
The rewards I receive are appropriate for the work I do	.90						
The rewards I receive reflect what I have contributed to the organization	.97						
The rewards I receive are justified given my performance	.95						
PARCEL 1							.91
...I am able to express my views and feelings during those procedures.							
... The procedures are free of bias.							
PARCEL 2							.75
...I can appeal the outcome of the procedures.							
...The procedures uphold ethical and moral standards							
PARCEL 3							.94
...I am able to influence the outcome of the procedures							
... The procedures are applied consistently.							
... The procedures are based on accurate information							.86
Treat me in a polite manner.							.98
Treat me with dignity.							.96
Treat me with respect.							.79
Refrain from improper remarks or comments.							
Be candid in communication with me.							.80
Give me reasonable explanations.							.89

Variable	DJ	PJ	INFOJ	INTERJ	Safety Climate	Safety Compliance	Safety Participation
Communicate details to me in a timely manner.			.91				
Tailor communication to meet my needs.			.88				.91
PARCEL 1							
... makes sure we follow all safety rules (not just the most important ones)							
...emphasizes safety procedures when we are working under pressure							
...insists we wear our protective equipment even if it's uncomfortable							
... refuses to ignore safety rules when work falls behind schedule							
PARCEL 2							.92
...discusses how to improve safety with us							
...uses explanations (not just compliance) to get us to act safely							
...says a good word to workers who pay special attention to safety							
...makes sure we receive all the equipment needed to do the job safely							
PARCEL 3							.94
...spends time helping us learn to see problems before they arise							
...frequently checks to see if we are all obeying the safety rules							
...is strict about working safely when we are tired or stressed							

Variable	DJ	PJ	INFOJ	INTERJ	Safety Climate	Safety Compliance	Safety Participation
...insists that we obey safety rules when fixing equipment or machines							
PARCEL 4							
...frequently talks about safety issues throughout the work week					.88		
...reminds workers who need reminders to work safely							
...frequently tells us about the hazards in our work							
...is strict about safety at the end of the shift, when we want to go home							
I use all the necessary safety equipment to do my job						.81	
I use the correct safety procedures for carrying out my job						.94	
I ensure the highest levels of safety when I carry out my job						.82	
I promote the safety program within the organization							.60
I put in extra effort to improve the safety of the workplace							.86
I voluntarily carry out tasks or activities that help improve workplace safety							.74

Table 10 Fit indices for structural models

Model	χ^2	<i>df</i>	CFI	NFI	RMSEA	PCLOSE
Measurement model	588.79	272	.94	.90	.08	.000
Fully mediated model	662.20	286	.93	.88	.08	.000
Partially mediated model	627.21	278	.94	.89	.08	.000
Non-mediated model	775.26	282	.91	.86	.09	.000
Trimmed partially mediated model	647.41	287	.93	.89	.08	.000

Table 11 Chi-square difference test between fully mediated model and partially mediated model

Model	χ^2	<i>df</i>	CFI	NFI	RMSEA	PCLOSE	$\chi^{2\text{diff}}$	Δ <i>df</i>
1. Fully mediated	662.20	286	.93	.88	.08	.000		
2. Partially mediated	627.21	278	.94	.89	.08	.000		
Difference between model 1 and model 2							34.99	8

Additionally, the path between procedural justice and safety participation was not significant. The model was trimmed (see figure 11 in Appendix C) and retested with the non-significant paths removed. Results indicated a slight decrease in model fit χ^2 (287) 647.41 =, $p < .001$; CFI = .93; NFI = .89; RMSEA = .08, PCLOSE = .000 and as such, a chi-square difference test was performed. Results of the chi-square difference test indicated there was no significant difference between models at the .001 p value; so I

kept the more parsimonious model (see table 12). The fit of this trimmed model was not optimal; however, I concluded it was the best possible model after taking into consideration the model complexity, sample size and the modification indices which did not provide support for the deletion of paths or items. It is also important to note at this point that the path between informational justice and safety participation is negative, which indicates the possibility of suppression as the correlation between the two is significant and in a positive direction. I removed this path from subsequent analyses. The squared multiple correlations indicate that organizational justice explains 55% of the variance in safety climate. Safety climate explained 37% of the variance in safety compliance and 20% of the variance in safety participation. Safety compliance and participation explained 12% of the variance in incidents. For the indirect effects please refer to Appendix D

Table 12 Chi- square difference test between partially mediated and trimmed model

Model	χ^2	<i>df</i>	CFI	NFI	RMSEA	$\chi^{2\text{diff}}$	Δdf
1. Trimmed model	647.41	287	.93	.89	.08		
2. Partially mediated model	627.21	278	.94	.89	.08		
Difference between model 1 and model 2						20.2	9

Discussion

The purpose of this study was to test the predictive validity of my proposed structural model. I tested the measurement model first, which resulted in acceptable fit to the data. I could make no modifications to improve the fit of this model any further. The final model in this study indicated that safety climate partially mediated the relationship between procedural justice and safety participation and compliance, and that safety climate also partially mediated the relationship between informational justice and safety participation. The initial structural model was only partially supported and the partially mediated model wherein only two of the four justice factors accounted for a significant amount of the variance in the prediction of safety climate perceptions. Specifically, I found that procedural and informational justice were significant predictors of safety climate, but distributive and informational justice were not significant predictors of safety climate perceptions. Interestingly, distributive justice directly predicted safety participation but safety participation did not predict incidents. Interpersonal justice did not predict safety climate or safety behaviours.

The results of this study provided some further support for my theory that organizational justice is an important variable that influences employee safety climate perceptions. The results of this study showed that employees' perceptions of informational justice predicted their safety climate perceptions, but did not directly influence their compliance with safety rules. Procedural justice influenced not only their safety climate perceptions but also their safety compliance behaviours, but did not predict whether the employees engaged in safety participation behaviours. These results show

that the fairness around general rules affects the way an employee views perceptions of safety climate which affects their compliance with rules and procedures. Interestingly, in this study, safety participation did not predict safety incidents, however, safety compliance behaviours did, which suggests that the efforts employees exert on promoting safety do not have a direct effect on whether they are involved in safety incidents.

The results of this study support the theory that supervisor behaviours with respect to the fair implementation of policies and procedures and the quality of the information communicated to their employees have a significant impact on employee safety climate perceptions. If a supervisor implements rules and procedures fairly and provides the employee with appropriate and timely information about those rules and procedures, the employee might view this as a behaviour they value which influences their safety climate perceptions and their propensity to engage in a reciprocal act (i.e., safety compliance or participation). Looking at these results from social exchange theory, an employee might use his or her fairness judgements (which are based on supervisor behaviours) as an indicator of whether the supervisor is truly concerned for his or her safety (safety climate), which can then lead to an expected reciprocal action such as rule compliance. This lends support for my theory of how safety climate perceptions are developed and what impact that has on employee safety behaviours and incidents.

Contrary to what I expected, interpersonal justice was not a significant predictor of safety climate perceptions. It is reasonable that this resulted from the wording of the items which are very broad in nature (i.e., “my supervisor treats me with respect”), consequently making it difficult for an individual to define “respect” in a behavioural

context, and across all possible interactions and situations.. Distributive justice was not a significant predictor of safety climate perceptions and it is possible that the distribution or allocation of rewards is often not completely decided upon or under the control of a direct supervisor, making it difficult for an employee to develop a fairness judgement that would support the development of a safety climate perception.

The goal of this study was to attempt to validate and further test the proposed structural model and to address a gap in the safety climate literature which does not investigate other possible predictors of safety climate perceptions. More research needs to be conducted on the mechanisms that influence safety climate perceptions safety behaviours and incidents. There is limited current research which supports that leadership, specifically transformational leadership is an important contributing factor; however, this research does not take into consideration other possible factors, such as justice, which we know predicts perceptions in a number of other areas and outcomes. The main goal of this study was to address this gap in the safety climate literature and determine whether there are general organizational factors, in particular general leader or supervisor behaviours such as the fair implementation of procedures, which contribute to the prediction of safety climate perceptions.

The results of this study and study 1 show that there is an important link between organizational justice and safety climate, however, the relationship appears to be very complex in nature. Specifically, how procedures are implemented and the fairness of the information that is provided contributes significantly to how an employee interprets and makes sense of their work environment, but the impact of distributive justice and even

more so, the impact of interpersonal justice, is questionable. In this study, procedural and informational justice offer make a unique contribution to what we currently know about the predictors of climate. This study deepens our understanding of the fundamental factors between a supervisor and employee that influence employee perceptions and behaviours. To date, most of the research is focused on how a particular style of leadership influences safety climate (e.g., Barling, Loughlin & Kelloway, 2002) or how safety-specific leader behaviours (not related to a particular leadership style) influences safety climate perceptions (e.g., Zohar, 2002). The results of this study, however, show that the influence on safety climate perceptions goes beyond a leadership style or simply focusing attention on safety matters – there is also a fundamental relationship factor (fairness) between a subordinate and supervisor that is important.

Study Implications

This study has implications for both science and practice. This study makes a significant contribution to the safety climate literature in that it provides a framework for how safety climate perceptions are developed. The results of this study underline some of the specific mechanisms that employees use to make judgements about their work environment and whether their employer is legitimate. It is possible that how fairly an employee is treated is an antecedent to the development of their safety climate perceptions on the basis that fairness provides them with a basis for the reciprocation of behaviours. If the rules and procedures are not implemented fairly (e.g., consistently across time and employees), then an employee may feel that his or her supervisor is not concerned with their wellbeing and does not value their relationship. An employee who

perceives the give and take relationship between them and their supervisor is not based on fair treatment and implementation of procedures may not feel the supervisor does not truly value safety or is concerned for their well being thus influencing whether an employee will reciprocate the exchange with safety behaviours. . This study extends the current safety climate literature by providing a theoretical framework outlining possible antecedents that influence safety which are not safety specific and based on leader behaviours.

In summary, the results of this study support my hypothesis that there is a significant predictive relationship between organizational justice and the development of safety climate perceptions. In study 3 I investigate whether the relationship between procedural and informational justice and safety climate is maintained over time.

Limitations

This study contained a number of limitations. First, in this study I relied on self-reported data which is susceptible to social desirability and respondents not being completely truthful. As well, there is the possibility of monomethod bias. Similar to study one, I attempted to address the issue of monomethod bias; however, the common method variance model was under-identified and would not allow for me to obtain a solution in AMOS. I conducted an exploratory factor analysis (Harmon's single factor test) (Podsakoff et al., 2003) and results showed an 8 factor solution with Eigen values greater than one. These results indicate that despite the possibility of monomethod bias I was still able to obtain a multifactor solution thus minimizing any possible impact. Similar to

study one this data was also nested creating the possibility of group differences inflating to correlations between my predictor and criterion variables. Typically this would be handled using a hierarchical linear modelling however limitations of sample size, group n's did not allow for this type of analysis, furthermore the validity of inferences in HLM must be critically evaluated when sample sizes and group n's are small (Raudenbush,& Bryk, 2002). I conducted a mixed model analysis to determine whether there were significant group differences affecting the impact of the relationship. Results show that while there were significant groups it did not change the overall result. The relationships between justice and safety climate remained the same.

Ideally to test the extent to which my proposed structural model generalized across samples I would have tested the invariance between the models in Study 1 and Study 2. Unfortunately a test of invariance could not be performed due to the number of constraints that would need to be imposed on the model in order for AMOS perform the analyses. Consequently this is regarded as a general limitation. One of the more pressing limitations with this study and study 1 was the reliance on cross sectional data. Cross sectional data is susceptible to problems such as recall bias. I attempted to handle this by asking participants to recall events (i.e., incidents) from a specific timeframe (e.g., last four months). Cross sectional data only captures attitudes and perceptions at one point in time and does not take into consideration whether those attitudes and perceptions are held over time. In study 3 I investigated whether the impact of organizational justice and safety climate is maintained over time.

Study 3

The purpose of this study was to determine if the impact of organizational justice on safety climate is maintained over time. I expected that the relationship between organizational justice perceptions would have influence across time. Specifically, I tested whether procedural, distributive, informational and interpersonal justice at time 1 was predictive of safety climate perceptions at time 2. I believe if a supervisor engages in fair behaviours it is predictive of his or her employee safety climate perceptions at a later date. My hypothesis is as follows:

Hypothesis: Distributive, Procedural, Informational and Interpersonal Justice at Time 1 predicts Safety Climate at Time 2.

Methods

Participants and Procedure

In this study, I used data collected as part of larger longitudinal study investigating the impact of work stress on a representative sample of Nova Scotia workers from various good producing industries including, agriculture/forestry/fishing/hunting (N = 38); manufacturing (N = 36); mining/oil and gas extraction (N = 8); construction (N = 26). I included a total of 108 participants, the majority of which were male (M = 84, F = 24,) with a mean age of 49. The average number of hours worked was 45 (M = 45.31, SD = 12.42), with 81 participants working full time and 27 participants working part time.

To assess the relationship between the four justice factors and safety climate, I conducted cross lagged regression analysis. I first tested an autoregressive model

suggesting that each variable at time 2 was predicted by that same variable at time 1 (e.g., Justice time 1 predicts Justice at time 2). The autoregressive model also tested the intercorrelations between each justice and safety climate variable at time 1 and all of the errors at time 2. Next, I tested a cross lagged model by estimating a model that included cross lagged effects between the four organizational justice factors and safety climate (e.g., procedural justice at time 1 predicts safety climate at time 2 and safety climate at time 1 predicts procedural justice at time 2). Data was collected over four month time frame.

Measures

Procedural Justice. Colquitt's (2001) seven-item measure evaluated procedural justice (time 1 α .90; time 2 α .93). Example items of procedural justice include, "The procedures are free from bias," and, "I can appeal the outcome of procedures."

Distributive Justice. Colquitt's (2001) four-item measure evaluated participants' distributive justice perceptions (time 1 α .94; time 2 α .95). Examples items of distributive justice include, "The rewards I receive reflect the effort I put into my work," and, "The rewards I receive are justified given my performance."

Interpersonal Justice. Colquitt's (2001) four-item scale measured interpersonal justice perceptions (time 1 α .93; time 2 α .96). Example items include, "My supervisor treats me in a polite manner," and, "My supervisor treats me with dignity."

Informational Justice. Colquitt's (2001) five-item scale evaluated informational justice perceptions (time 1 α .92; time 2 α .92). Examples of informational justice include,

“My supervisor communicates details in a timely manner,” and, “My supervisor gives me reasonable explanations⁴.”

Safety Climate. Three items from Zohar’s 1980 safety climate scale measured perceptions of safety climate in this study (time 1 α .83; time 2 α .86). Participants ranked each item using a 7-point Likert style scale (e.g., “I am kept informed about health and safety issues that affect me”). I did not test safety compliance and safety participation because they were not measured in this study

⁴ The item that was omitted in the previous surveys in error was also omitted from this study for consistency purposes.

Results

The results of the cross lagged regression analysis indicated that organizational justice impacted safety climate perceptions over time. Table 13 provides the means, standard deviations and intercorrelations for each of the scales included in this study. For this analysis, I tested three competing models (see table 14 for fit indices). First, I tested an auto regressive model, followed by a cross lagged model, and finally, a trimmed cross lagged model.

The autoregressive model (see figure 12 in Appendix C) provided adequate fit to the data $\chi^2(21) = 55.08$ $p < .001$; CFI = .96; NFI; .93; RMSEA = .12, PCLOSE = .00. The RMSEA does indicate relatively poor fit, however, this sample is small in size (N = 108). All autoregressive relationships were significant. Procedural justice at time 1 predicted procedural justice at time 2 ($\beta = .56$, $p < .001$); distributive justice at time 1 predicted distributive justice at time 2 ($\beta = .70$, $p < .001$); informational justice at time 1 predicted informational justice at time 2 ($\beta = .47$, $p < .001$); interpersonal justice at time 1 predicted

Table 13: Descriptive statistics and intercorrelations for justice and safety climate scales

Variable	M	SD	1	2	3	4	5	6	7	8	9	10
1. Procedural Justice t1	4.03	1.29										
2. Distributive Justice t1	3.55	1.65	.71**									
3. Informational Justice t1	4.76	1.38	.51**	.41**								
4. Interpersonal justice t1	5.08	1.37	.43**	.31**	.86**							
5. Safety Climate t1	4.80	1.50	.59**	.49**	.32**	.27**						
6. Procedural Justice t2	4.04	1.29	.71**	.60**	.43**	.39**	.53**					
7. Distributive Justice t2	3.55	1.65	.61**	.75**	.35**	.30**	.40**	.68**				
8. Informational Justice t2	4.78	1.47	.50**	.47**	.55**	.48**	.42**	.59**	.53**			
9. Interpersonal justice t2	5.14	1.44	.43**	.34**	.53**	.58**	.40**	.51**	.39**	.85**		
10. Safety Climate t2	4.80	1.44	.61**	.54**	.38**	.36**	.70**	.70**	.53**	.56**	.55**	

Table 14. Fit indices of competing models

Model	χ^2	<i>df</i>	CFI	NFI	RMSEA	PCLOSE
Autoregressive model	55.08	21	.96	.93	.12	.00
Cross lagged model	18.67	13	.99	.98	.06	.32
Trimmed model	22.41	17	.99	.97	.06	.41

interpersonal justice at time 2 ($\beta = .53$, $p < .001$); safety climate at time 1 predicted safety climate at time 2 ($\beta = .58$, $p < .001$). Results of adding the cross lagged effects to the model (see figure 13 in Appendix C) provided good fit to the data $\chi^2(13) = 18.67$, $p > .05$; CFI = .99; NFI; .98; RMSEA = .06, PCLOSE = .32. The cross lagged effects indicated that only procedural justice was a significant predictor of safety climate over time ($\beta = .20$, $p < .05$). Distributive, interpersonal and informational justice at time 1 did not predict safety climate at time 2. The non-significant paths were trimmed from the model and indicated good model fit $\chi^2(17) = 22.41$, $p > .05$; CFI = .99; NFI; .97; RMSEA = .06, PCLOSE = .41 (See figure 14 in Appendix C). The final model showed that procedural justice was a significant predictor of safety climate over time, however, the results also indicated that safety climate at time 1 was a significant predictor of procedural, informational and interpersonal justice at time 2. This suggests that procedural justice has an impact on safety climate perceptions but also that safety climate perceptions influence procedural, informational and interpersonal justice perceptions. A chi-square difference test was performed and indicated there was no significant difference between the full cross lagged model and the trimmed model, thus, the more parsimonious trimmed model was accepted as the final and best fitting model (see table 15).

Table 15 Chi square difference between cross lagged and trimmed model.

Model	χ^2	df	CFI	NFI	RMSEA	PCLOSE	$\chi^{2\text{diff}}$	Δ df
1. Trimmed model	22.41	17	.99	.97	.06	.41		
2. Cross lagged model	18.67	13	.99	.98	.06	.32		
Difference between model 1 and model 2							3.74	4

It was not possible to test for group differences in the current sample as it was a general sample of employees from all over Nova Scotia. The positive relationship between procedural justice and safety climate found in this study helps to reduce the possible influence of group differences in the previous two studies. If group differences were the main contributing factor in the relationship between justice and safety climate in the previous samples, then it would imply that a weak or no relationship might exist in a general sample of employees.

Discussion

The purpose of this study was to test the relationship between organizational justice and safety climate across time and the results show that there is a significant predictive relationship. My hypothesis was partially supported in that procedural justice perceptions at time 1 predicted safety climate at time 2. These results suggest that a supervisor who behaves in a fair manner with respect to implementing the procedures sends a positive message about the safety climate, thus influencing the employees' evaluations. This also provides more insight into the complexity of the relationship

between justice and climate by showing a reciprocal relationship between safety climate and justice. In this sample, procedural justice was an antecedent to safety climate and safety climate positively predicted procedural, interpersonal and informational justice perceptions. A supervisor who implements procedures fairly influences employees' safety climate perceptions; however, employees' safety climate perceptions also influence the employees' perceptions of how fairly the rules and procedures are implemented, the fairness of the information that is communicated, and their perceptions of how fairly they are treated on an interpersonal level.

Distributive, interpersonal, and informational justices were not significant antecedents of safety climate over time. I expect that one reason for this is that employees primarily use their procedural justice perceptions to help develop and support their perceptions of safety climate within their organization. Employees often view safety in terms of the rules and procedures as evidenced by their behaviours (safety compliance) (Neal, Griffin & Hart, 2000). These procedures can include rules they are expected to follow on a daily basis (e.g., wearing personal protective equipment; using proper safety protocols) and I expect that it is the fair implementation of these procedures that is a significant contributor to the message managers and supervisors send about their commitment to safety. If a manager is inconsistent in the implementation personal protective equipment rules (i.e., forcing one individual to wear it and not another, or making it mandatory for a job on one day and not on the same job a day later), then it sends a message to the employee about the level of commitment they truly have towards safety.

This does not imply that the other three justice factors are not important as the results of this study show there is an important reciprocal relationship. Furthermore, the previous two studies showed that in certain samples distributive justice and informational justice can impact safety climate (Study 1) and that distributive and informational justice can directly influence safety participation behaviours (Study 2). Based on these results, it is possible that distributive and informational justice have differential effects in a general sample of employees versus an organization-specific sample, and this is an issue that future research should address.

Overall, the results of this study contribute a great deal about the relationship between organizational justice and safety climate. This study extends my previous two studies by showing that the relationship between justice and safety climate is one that is held over time and that procedural justice is an important antecedent of safety climate. This study also shows that safety climate perceptions influence organizational justice over time which potentially helps to clarify why the structural models in Study 1 and Study 2 were not fully supported; it is possible that the employees' safety climate perceptions were influencing their organizational justice perception. The reciprocal relationship between justice and safety climate found in this study raises the possibility that safety climate influences organizational justice perceptions first. While this is possible in this study I used a general measure of organizational justice and it would be unlikely that perceptions of safety climate would first influence an individual's general perception of fairness. This would mean that a person's perception of safety climate would influence their perception of fairness in general. This study shows a need to further

examine the possibility of reverse causality as well the need to further examine the differential effects of at least three, if not all four, justice factors on safety climate.

Study Implications

As with Study 1 and Study 2, this study has implications for science and practice. First, this study makes a significant longitudinal contribution to what is currently known about the relationship between justice and safety climate. To my knowledge, no empirical research exists on the specific relationship between organizational justice and safety climate, and the results of this longitudinal study create a significant starting point for further research. This helps to answer a question Study 1 and Study 2 could not – does the relationship between justice and safety climate hold over time? The answer is yes. This adds significantly to the framework for understanding how safety climate perceptions are developed and what the long-term antecedents are. As with the previous two studies, this study supports that procedural justice is an important mechanism employees use to make judgements about the safety climate within their work environment. This study shows that there is an important link between how fairly an employee is treated and the development of his or her safety climate perceptions. If the rules and procedures are not implemented fairly (e.g., consistently across time and employees) then an employee may feel his or her supervisor is not truly committed to safety and is demonstrating a lack of concern for their well-being. This perception likely influences the employee's safety behaviours and involvement in safety-related incidents. This study extends the current safety climate literature by adding reliability and validity to the organizational justice safety climate relationship. It adds to my proposed framework that justice is an antecedent to safety climate which does not have to be specific to safety in order to influence safety behaviours and workplace incidents. In

summary, the results of this study support my hypothesis that there is a significant longitudinal relationship between organizational justice and the development of safety climate perceptions.

Limitations.

As with the previous two studies, this study is not without its limitations. This study contained a relatively small sample size and also included self-reported measures of organizational justice and safety climate. Additionally, the safety climate measure I used in this study was not the same safety climate measure I used in Study 1 and 2. This data set was collected as part of a larger study that was occurring at the same time as study 1. Direct comparisons between the safety climate measures from Study 1, 2 and 3 should be made with caution. A test of the full structural model was also not possible in this study as safety participation and safety compliance were not included in the survey.

General Discussion

Taking into consideration all three of my studies, I have made several important contributions to knowledge. In study 1, I investigated the predictive relationship between the four types of organizational justice and perceptions of safety climate. I tested the factor structure of organizational justice and found that it was best represented by a four-factor framework including distributive, procedural, informational and interpersonal justice. This is supported by a number of studies (e.g., Greenberg & Colquitt, 2005). Paramount to this, I found that my proposed structural model was partially supported in that a significant relationship was found between distributive, procedural and informational justice and safety climate perceptions. Results also showed that the relationship between procedural justice and safety participation and compliance is partially mediated by safety climate. This indicates that there is a direct relationship between procedural justice and following rules and promotion of safety within the workplace.

The results of study 2 also show that there is a significant partially mediated relationship between procedural justice and safety climate as well as a partially mediated relationship between informational justice and safety climate. To my knowledge, no current research has empirically investigated the relationship between organizational justice and safety, and this study provides enough support to further test the relationship as was the purpose of my second study. In my section study, I tested my full structural model in a different sample of employees and found similar results, but the model was not fully supported nor was it completely replicated.

Similarities between study 1 and 2 include the partially mediated relationship between procedural justice and safety compliance, and the direct relationship between informational justice and safety climate. In study 1, distributive justice was a significant predictor of safety climate but was not in study 2. In study 2, I found there was a partially mediated relationship between safety participation and informational justice, however, in study 1 this relationship was fully mediated by safety climate. Because of the possibility of sample specific effects and due to the limitations associated with cross sectional study designs, I examined the longitudinal effects of justice and safety climate in Study 3. The results support my previous results in that procedural justice was found to be a significant predictor of safety climate over time and that safety climate is a significant predictor of procedural, informational and interpersonal justice perceptions.

The results of Study 1 and 2 demonstrated the possibility of sample specific effects as distributive justice was not consistently a predictor of safety climate across both studies. The sample in Study 1 included a large private (national) company and Study 2 included a large public organization. It is possible that organizational justice affects public and private sector organizations differently and future researchers should address this. But study 3 provides some insight in that sample-specific characteristics may not be the entire issue. In study 3, I found a reciprocal relationship between organizational justice and safety climate which could explain why the full structural model was not supported or replicated in Study 2. Study 3 supports the possibility that the difference in results between Study 1 and 2 is potentially the result of safety climate influencing justice perceptions and not the nature of the sample.

The differences between the justice and safety climate relationship found in the three studies do not negate the consistent findings from all three studies. There are two very important and consistent findings from all three studies:

1. Procedural justice was a significant predictor of safety climate
2. Interpersonal justice was not a significant predictor of safety climate.

This suggests that procedural fairness plays a significant role in the development of an employee's safety climate perceptions. These results help to close the gap in our understanding of safety climate antecedents. We now have a starting point for future research on the justice safety climate relationship. A small number of studies have investigated the antecedents of safety climate from a safety specific perspective (e.g., Zohar, 2002; Barling, Loughlin, & Kelloway, 2002) and found positive effects, but I am only aware of two studies that has investigated the impact of safety climate antecedent that is not specific to safety (Mullen & Kelloway 2008; Zohar 2002/) and the results from all three of my study suggest safety climate researchers are missing an important theoretical component.

My research supports the development of a stronger theoretical framework highlighting possible general predictors of safety climate perceptions. Supervisors and managers are an important factor in understanding employee safety behaviours (e.g., Zohar, 2002) and the results of my study highlight the possibility that manager and supervisor behaviours do not have to be related to safety to have an impact on safety. Researchers investigating the predictors of safety climate should expand their criteria and framework to include general organizational factors that are not focused on safety (i.e.,

quality of general supervisor behaviours). My results show the possibility that it is not just the safety-specific behaviours a supervisor engages in that are important but it is also the general supervisor behaviours that matter as well. Supervisors and managers should also consider how their behaviours around being fair impact safety. If a supervisor implements general organizational rules and procedures (e.g., following payroll procedures fairly or work scheduling procedures) then the employee is likely to perceive that in a positive manner and thus use that perception to make a judgement about the safety climate of the organization. In terms of how this affects behaviours, there are at least two possible justice frameworks that could be at work. The first is the social exchange theory, wherein behaviours are influenced by the quality of exchanges between a supervisor and subordinate. I expect that fairness is one measure of quality of exchange which an employee then uses to influence his or her behaviours (e.g., rule compliance). Future research needs to specifically look at which justice framework applies best in a safety context.

Up to this point, the relationship between justice and safety appears to be untested. This is a significant gap in the safety climate and organizational justice literature. Safety climate research tends to focus on what it predicts resulting from a need to determine the specific causes of various highly consequential organizational disasters (e.g., Piper Alpha). This meant that there was minimal effort spent on understanding how or what factors employees use to develop their safety climate perceptions. In other words, researchers immediately understood that safety climate was an important reliable and valid construct as demonstrated in Zohar's (1980) first study, however, there was little

focus on how employees develop those perceptions, perceptions which predict employee safety compliance and participation behaviours (Griffin & Neal, 2000). Most researchers in this area focused more on determining what safety climate predicted and not what predicted safety climate perceptions. Along with a few other researchers (e.g., Kelloway, Mullen & Francis, 2008), my study helps to close this gap in our knowledge by showing there is a significant and long-term impact of justice on safety climate perceptions.

The results of my studies also address a current gap in the organizational justice literature. Organizational justice researchers spent a significant amount of time on understanding the relationship between justice and various employee behaviours (e.g., sabotage) and organizational outcomes, and very little time looking at employee safety behaviours and organizational safety outcomes (i.e., incidents). I was only able to find one theoretical paper hypothesizing the relationship between organizational justice and safety incident reporting (i.e., Weiner, Hobgood, & Lewis, 2008). The results of this study make a significant contribution to our knowledge in this area in addition to a contribution to the safety climate literature.

Final Conclusion.

My studies provide theoretical and empirical support for the hypothesis that organizational justice and in particular procedural justice may be acting as an antecedent to the development of safety climate perceptions. In addition this study lends support for the development of a stronger safety climate framework that includes general supervisory behaviours as mechanisms by which employee develop safety climate perceptions

General Limitations

There are several limitations of the present studies that could be addressed in future research. Self-reported data is susceptible to under reporting as a result of social desirability. This threatens the internal validity and therefore should be taken into consideration. Another possible limitation is the high intercorrelation between the interpersonal and informational justice factors in all three studies. In study 1, the correlation between interpersonal and informational justice was $r = .763$ indicating that the two constructs share 58% of the variance. In study 2, the zero order correlation between the two factors was $r = .845$, indicating they share approximately 71% of the variance. However, the confirmatory factor analysis supports the four-factor model over a combined three-factor model. This supports maintaining the two as empirically distinct constructs as suggested by Greenberg and Colquitt (2005) and decreases the impact of this limitation.

Another possible limitation in my studies involves the possibility of common method bias. In all three studies, the data for all measures was obtained from one source (subordinates). All of the variables in survey are likely to share some common method variance, which could have inflated the actual relationships between the outcomes and the predictors or antecedents. (Podsakoff et al., 2003). An attempt was made to account for this in study 1 by having each item load on a common method factor, however, the model was under identified and AMOS would not allow the model to run. Another significant limitation is the response rate, in particular for study 1. There was a lack of

management support for the project and thus employees were often resistance or complacent about returning a survey.

Finally, given the nature of the data, it is possible that there are group effects by location. In study 1, individuals were located within various bases across Nova Scotia, while in Study 2 individuals were located within various bases across Canada. However, given the significant unequal response rates and base size (some bases $N = 80$ other bases $N = 5$) it would be difficult to determine if significant statistical results were a function of the significant unequal sample sizes or existing group differences. Study 3 helps support the idea that group differences may not be a critical limitation as the relationship between justice and climate was maintained in a general sample of employees from across the province.

Future Research

There are several questions stemming from my research that call for further investigation. First, prior to this study the relationship between organizational justice safety climates appeared to be untested. More research needs to be conducted using the same safety climate scales and organizational justice measures in order to further validate the proposed structural model. This will lend support to the reliability and validity of the proposed relationship between justice and safety. Second, more research needs to be conducted with larger sample sizes from organizations in various industries, settings and cultures. This will increase the level of generalizability which has implications in research and practical settings. Third, future researchers should investigate the possibility of

implementing justice training interventions in a safety context. Justice training interventions have proved successful in other areas and should be tested in the current context (e.g., Greenberg, 2002). Fourth, the current studies did not include a measure that specifically examined the underlying organizational justice framework that supports the relationship. In future work it would be beneficial to include items that tap into the social exchange theory to determine if there is one specific theory that explains the mechanism(s) that work to create or influence the relationship between organizational justice and safety. Knowing this information would provide practitioners and researchers with critical information that would expand their current knowledge as well as their ability to apply this theory in a work setting. Future researchers should also closely examine the possibility of safety-specific organizational justice. This was not tested in the current studies on the basis that it is doubtful that supervisors treat fairness differently in a safety context, however, it is possible that the type of industry (i.e., high reliability) could change supervisors' organizational justice behaviours. Future researchers should include more objective indicators of safety compliance, participation and involvement in safety incidents in order to avoid the limitations with self-reported data. There is also the possibility that there are alternative models that may provide better fit to the data. These alternative models could include other safety factors that have influence safety behaviours and incidents (e.g., risk, production pressure) and should be addressed in future work.

Future research should also take into consideration the possibility of moderators between organizational justice and perceptions of safety climate. For instance it is

possible that co-worker relationships could moderate the relationship between organizational justice and perceptions of safety climate. This is of particular importance with respect to procedural, interpersonal and informational justice. If a one employee perceives they are being treated less fairly than their co-worker this could have an impact on co-worker relations and thus create tension among the employees thus influencing their working relationship. Other possible moderating variables including job security, group cohesion, trust and leadership should also be examined to determine their role in the relationship between organizational justice and perceptions of safety climate. In addition to investigating whether leadership is a potential moderator, future research in this area should address the question of whether or not organizational justice predicts safety climate perceptions above and beyond safety-specific transformational leadership. This would provide more insight into whether a safety specific style of leadership has a greater impact on perceptions of safety climate.

References

- Adams, J. S. (1965). Inequity in social exchange. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 2, pp. 267-299). New York: Academic Press.
- Ambrose, M.L., Seabright, M.A. & Schminke, M. (2002). Sabotage in the workplace: The role of organizational injustice. *Organizational Behaviour, and Human Decision Processes*, 89, 947-965.
- Arbuckle, J. L. (2006). Amos (Version 7.0) [Computer Program]. Chicago: SPSS.
- Barling, J., Loughlin, C., & Kelloway, E. K. (2002). Development and test of a model linking safety specific transformational leadership and occupational safety. *Journal of Applied Psychology*, 87, 488-496.
- Bentley, T. A., & Haslam, R. A. (2001). A comparison of safety practices used by managers of high and low accident rate postal delivery offices. *Safety Science*, 37, 19-37.
- Bies, R. J., & Moag, J. F. (1986). Interactional justice: Communication criteria of fairness. In R. J. Lewicki, B. H. Sheppard, & M. H. Bazerman (Eds.), *Research on Negotiations in Organizations* (Vol. 1, pp. 43-55). Greenwich, CT: JAI Press.
- Blader, S. L., & Tyler, T. (2005). How can theories of organizational Justice explain the effects of fairness. In J. Greenberg, & J. Colquitt (Eds.) *Handbook of Organizational Justice* (pp. 329-353). Mahwah, N.J.: Lawrence Erlbaum Associates

- Brown, R. L., & Holmes, H., (1986). The use of factor analytic procedure for assessing the validity of an employee safety climate model. *Accident Analysis and Prevention, 18*, (6) 455-470.
- Byrne, B. (2010). *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming*. 2nd Edition. Routledge.
- Buske, L. (1997). The cost of occupational injuries. *Canadian Medical Association Journal, 156*, 1360.
- Borman, W. C., & Motowidlo, S. J. (1993). Expanding the criterion domain to include elements of contextual performance. In N. Schmitt & W. C. Borman (Eds.), *Personnel selection in organizations* (pp. 71–98). San Francisco: Jossey-Bass.
- Cheyne, A., Tomás. J. M., Cox, S., & Oliver, A. (2003). Perceptions of safety climate at different employment levels. *Work and Stress, 17*, 21-37.
- Clarke, S. (2006). The relationship between safety climate and safety performance: A meta-analytic review. *Journal of Occupational Health Psychology, 11*, (4), 315-327.
- Cohen-Charash, Y., & Spector, P.E. (2001). The role of justice in organizations: A meta-analysis. *Organizational Behaviour and Human Decision Processes, 86*, 278-321.
- Colquitt, J. A., Conlon, D. E., Wesson, M. J., Porter, C. & Ng, K. Y. (2001). Justice at the Millennium: A meta- analytic review of 25 years of organizational justice research. *Journal of Applied Psychology, 86*, 425 – 445.

- Colquitt, J. & Shaw, J. C. (2005). How should organizational justice be measured? In J. Greenberg, & J. Colquitt (Eds.) *Handbook of Organizational Justice* (pp. 113-152.). Mahwah, N.J.: Lawrence Erlbaum Associates
- Cropanzano, R., & Prehar, C. A. (2001). Emerging justice concerns in an era of changing psychological contracts. In R. Cropanzano (Ed.), *Justice in the workplace: From theory to practice* (Vol. 2, pp. 245-269). Mahwah, NJ: Lawrence Erlbaum.
- Cropanzano, R., Prehar, C., & Chen, P. (2002). Using social exchange theory to distinguish procedural from interactional justice. *Group & Organization Management*; 27, 324-351.
- Cooper, M. D. & Phillips, R. A. (2004). Exploratory analysis of the safety climate and safety behaviour relationship. *Journal of Safety Research*, 35, 497-512.
- Cox, S. J., & Cheyne, A. J. T. (2000). Assessing safety culture in offshore environments. *Safety Science*, 34, 111-129.
- Cox, S. J. & Cox, T. (1991). The structure of employee attitudes towards safety: a European example. *Work and Stress*, 5 (2), 93-106.
- Cox S. J., & Flin, R. (1998). Safety culture: Philosopher's stone or man of straw. *Work and Stress*, 12, 189-201.
- Cullen, W. Douglas, Lord (1990). *The Public Enquiry Into The Piper Alpha Disaster*. Department of Energy: HMSO. London.
- DeCremer, D., van Duke, M., & Bos, A. E. R. (2007). When leaders are seen as transformational: The effects of organizational justice. *Journal of Applied Social Psychology*, 37, 1797-1816.

- Dedobbeleer, N., & Beland, F. (1991). A safety climate measure for construction sites. *Journal of Safety Research*, 22 (2), 97-103.
- Eloviano, M., Kivimäki, M., & Vahtera, J. (2002). Organizational justice: Evidence of a new psychosocial predictor of health. *American Journal of Public Health*, 92, 105 – 108.
- Flin, R. (2003). “Danger-men at work” management influence on safety. *Human Factors and Ergonomics in Manufacturing*, 13, 261-268.
- Flin, R., Mearns, K., O’Connor, Bryden, R. (2000). Measuring safety climate: Identifying the common features. *Safety Science*, 34, 177-192.
- Forret, M., & Love, M.S. (2008). Employee justice perceptions and co-worker relationships. *Leadership and Organization Development Journal*, 29, 248-260.
- Glendon, A. I. & Litherland, D. K., (2001). Safety climate factors, group differences and safety behaviour in road construction. *Safety Science*, 39, 157-188.
- Greenberg, J. (1990). Employee theft as a reaction to underpayment inequity: The hidden cost of pay cuts. *Journal of Applied Psychology*, 75, 561-568.
- Greenberg, J. (1993). The social side of fairness: Interpersonal and informational classes of organizational justice. In R. Cropanzano (Ed.), *Justice in the workplace: Approaching fairness in human resource management* (pp. 79-103). Hillsdale, NJ: Erlbaum.
- Greenberg, J. (2002). Losing sleep over organizational injustice: Attenuating insomniac reactions to underpayment inequity with supervisory training in interactional justice. *Journal of Applied Psychology*, 91, 58-69.

- Greenberg, J., & Colquitt, J. (2005). *Handbook of Organizational Justice*. Mahwah, N.J. : Lawrence Erlbaum Associates
- Griffin, M. A., & Neal, A. (2000). Perceptions of safety at work: A framework for linking safety climate to safety performance, knowledge and motivation. *Journal of Occupational Health Psychology, 5*, 347-358.
- Guldenmund, F. W. (2000). The nature of safety culture: A review of theory and research. *Safety Science, 34*, 215-257.
- Hale, A. R. (2000). Culture's confusions. Editorial. *Safety Science, 34*, 1-14.
- Hofmann, D. & Mark, B. (2006). An investigation of the relationships between safety climate and medication errors as well as other nurse and patient outcomes. *Personnel Psychology, 59*, 847-869.
- Hofmann, D. A., & Morgeson, F. P. (1999). Safety-related behaviour as a social exchange: The role of perceived organizational support and leader-member exchange. *Journal of Applied Psychology, 84*, 286-296.
- Hopkins, S. M., & Weathington, B. L. (2006). The relationships between justice perceptions, trust and employee attitudes in a downsized organization. *The Journal of Psychology, 140*, 477-498.
- Huang, Y., Ho, M., Smith, G., & Chen, P. (2006). Safety climate and self reported injury: Assessing the mediating role of employee safety control. *Accident Analysis and Prevention, 38*, 425-433.

- International Atomic Energy Agency (1986). Summary report on the post accident review meeting on the Chernobyl accident. International Safety Advisory Group. Safety Series 75-INSAG-1.
- James, L. & Jones, A. (1974). Organizational climate: A review of theory and research. *Psychological Bulletin*, 12, 1096-1112.
- Johnson, S. E. (2007). The predictive validity of safety climate. *Journal of Safety Research*, 38, 511-521.
- Kelloway, E. K. (1995). Structural equation modelling in perspective. *Journal of Organizational Behavior*, 16, 215-225.
- Kelloway, E. K., Mullen, J. & Francis, L. (2006). Divergent effects of transformational and passive leadership on employee safety. *Journal of Occupational Health Psychology*, 11, 76-86.
- Kickul, J., Lester, S., & Finkl, J. (2002). Promise breaking during radical organizational change: Do justice interventions make a difference? *Journal of Organizational Behavior*, 23, 469-488.
- Leventhal, G. S. (1980). What should be done with equity theory? In K. J. Gergen, M. S. Greenberg, & R. H. Willis (Eds.), *Social exchange: Advances in theory and research* (pp. 27-55). New York: Plenum.
- Lewin, K. (1951) *Field theory in social science; selected theoretical papers*. D. Cartwright (ed.). New York: Harper & Row.

- Lind, E. A. (2001). Fairness heuristic theory: Justice judgments as pivotal cognitions in organizational relations. In J. Greenberg & R. Cropanzano (Eds.), *Advances in Organizational Justice* (pp. 56–88).
Stanford, CA: Stanford University Press.
- Lind, E.A., Kulik, C., Ambrose, M., & de Vera Park, M. (1993). Individual and corporate dispute resolutions: Using procedural fairness as a decision heuristic. *Administrative Science Quarterly*, 38, 224-251.
- Lind, E. A., Kulik, C. T., Ambrose, M., & de Vera Park, M. V. (1993). Individual and corporate dispute resolution: Using procedural fairness as a decision heuristic. *Administrative Science Quarterly*, 38, 224–251.
- Little, T. D., Cunningham, W. A., Shahar, G., & Widaman, K. F. (2002) To parcel or not to parcel: Exploring the question and weighing the merits. *Structural Equation Modeling*, 9, 151-173.
- Marshall, K. (1996). A job to die for. *Perspectives on Labour and Income*, 8, 26–31.
- Mearns, K., Flin, R., Fleming, M. T. & Gordon, R. (1998). Measuring safety climate on offshore installations. *Work and Stress*, 12, 238-254.
- Mearns, K., Whitaker, S., & Flin, R. (2003). Safety climate, safety management practice and safety performance in offshore environments. *Safety Science*, 41, 641-680.
- Meyers, L.S.; Gamst, G. & Guarino, A. J. (2006). *Applied Multivariate Research: Design and Implementation*. Sage Publications. Thousand Oaks: California.
- Mullen, J., & Kelloway, E. K. (2009). Safety leadership: A longitudinal study of the effects of transformational leadership on safety outcomes. *Journal of Occupational and Organizational Psychology*, 82, 253-272.

- Neal, A., & Griffin, M. A. (1997). *Perceptions of safety at work: Developing a model to link organizational safety climate and individual behaviour*. Paper presented to the 12th Annual Conference of the Society for Industrial Organizational Psychology, St. Louis, MO.
- Neal, A., Griffin, M. A., & Hart, P. M. (2000). The impact of organizational climate on safety climate and individual behaviour. *Safety Science*, 34, 99-109.
- Nielsen, K.J., Rasmussen, K., Glasscock, D., & Spangenberg, S. (2008). Changes in safety climate and accidents at two identical manufacturing plants. *Safety Science*, 46, 440-449.
- Niskanen, T. (1994). Safety climate in the road administration. *Safety Science*, 17, 237-255.
- National Work Injury Statistics Program. (2008). Summary Table of Accepted Time-loss Injuries/Diseases and Fatalities by Jurisdiction. Retrieved from <http://www.awcbc.org/en/nationalworkinjuriesstatisticsprogramnwisp.asp>
- Nova Scotia Worker's Compensation Board (2009). Annual Report. Retrieved from http://www.wcb.ns.ca/app/DocRepository/5/About/Review/Reports/WCB_AR_08_web.pdf
- O'Dea A., & Flin, R. (2001). Site managers and safety leadership in the offshore and gas industry. *Safety Science*, 37, 39-57.
- Oliver, A., Tomás, A., & Meliá, J. (1993). A second cross validation of the organizational safety climate of Dedobbeleer and Béland: Confirmatory adjustment of

unifactorial, bifactorial and trifactorial models. *International Journal of Methodology and Experimental Psychology*, 14, 59-73.

Ostroff, C; Kinicki, A., Tamkins, M. (2002). Organizational Culture and Climate. In Handbook of Psychology, 12, Eds. Borman, Ilgen, & Klimoski.

Pidgeon, N. & O'Leary, M. (2000). Manmade disasters: Why technology and organizations (sometimes) fail. *Safety Science*, 34, 15-30.

Podsakoff, P. M., MacKenzie, S. B. & Podsakoff, N. P., & Lee, J-Y. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88, 879-903.

Rahim, M.A.(2000). Managing Conflict in Organizations (3rd ed.). Westport, CT: Wuorum Books

Raudenbush, S.W. & Bryk, A. (2002). Hierarchical Linear Models: Applications and data analysis methods. Thousand Oaks: Sage Publications.

Reichers, A. E. & Schneiders, B. & (1990). Climate and culture: An evolution of constructs. In B Schneider (Ed.), Organizational climate and culture (pp.40-84). San Francisco: Jossey-Bass.

Roberts, D. (1995). Development and evaluation of a safety culture survey for occupational safety. Unpublished doctoral dissertation, Virginia Polytechnic Institute. (UMI No. 9528611).

Rundmo, T. (2000). Safety climate, attitudes and risk perceptions in Norsk Hydro. *Safety Science*, 34, 47-59.

- Rupp, D. E., & Cropanzano, R. (2002). The mediating effects of social exchange relationships in predicting workplace outcomes from multifoci organizational justice. *Organizational Behavior and Human Decision Processes*, 89, 925–947.
- Seo, D., Torabi, M. R., Blair, E. H., & Ellis, N. T. (2004). A cross-validation of safety climate scale using confirmatory factor analytic approach. *Journal of Safety Science*, 35, 427-445.
- Silva, S., Lima, M., & Baptista, C. (2004). OSCI: An organizational and safety climate inventory. *Safety Science*, 42, 205-220.
- Tabachnick, B., & Fidell, L. (2001). *Using Multivariate Statistics*, Fourth Edition. Needham Heights, MA: Allyn & Bacon
- Tatum, B. C., Eberlin, R., Kottraba, C., & Bradberry, T. (2003). Leadership, decision making and organizational justice. *Management Decision*, 41, 1006-1016.
- Thibaut, J., & Walker, L. (1975). *Procedural justice: A psychological analysis*. Hillsdale, NJ: Erlbaum.
- Thibaut, J., & Walker, L. (1978). A theory of procedure. *California Law Review*, 66, 541–566.
- Tyler, T. R., & Lind, E. A. (1992). A relational model of authority in groups. In M.P. Zanna (Ed.) *Advances in Experimental Social Psychology* (Vol., 25, pp 115-191). San Diego, CA: Academic Press.
- Van den Bos, K., Lind, E. A., Vermunt, R., & Wilke, H. A. M. (1997). How do I judge my outcome when I do not know the outcome of others? The psychology of the fair process effect. *Journal of Personality and Social Psychology*, 72, 1034-1046.

- Van den Bos, K., Lind, E. A., & Wilke, H. A. M. (2001). The psychology of procedural and distributive justice viewed from the perspective of fairness heuristic theory. In R. Cropanzano (Ed.), *Justice in the workplace (Vol. 2): From theory to practice* (pp. 49–66). Mahwah, NJ: Erlbaum.
- Van den Bos, K., Wilke, H.A.M., & Lind, E. A. (1998). When do we need procedural fairness? The role of trust in authority. *Journal of Personality and Social Psychology, 75*, 1449-1458.
- Wallace, J. C., Popp, E., & Mondore, S. (2006). Safety climate as a mediator between foundation climates and occupational accidents: A group-level investigation. *Journal of Applied Psychology, 91*, 681-688.
- Wiegmann, D., Zhang, H., von Thaden, T. L., Sharma, G. , & Gibbons, A. (2004). Safety culture: An integrative review. *International Journal of Aviation Psychology, 14*, 117-134.
- Weiner, B. J., Hobgood, C., & Lewis, M. A. (2008). The meaning of justice in safety incident reporting. *Social Science & Medicine, 66*, 403-413.
- Wills, A. R., Watson, B. & Biggs, H. C. (2006). Comparing safety climate factors as predictors of work-related driving behaviour. *Journal of Safety Research, 37*, 375-383.
- Yule, S. (2003). Senior management influence on safety performance in the UK and US energy sectors. Doctoral thesis, University of Aberdeen, Scotland.

- Zhang, H., Wiegmann, D., von Thaden, T. (2002). Safety culture: A concept in chaos. Proceedings of the 46th Annual Meeting of the Human Factors and Ergonomics Society. Santa Monica, Human Factors and Ergonomics Society.
- Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. *Journal of Applied Psychology*, 65, 96-102.
- Zohar, D. (2000). A group level model of safety climate: Testing the effects of group on micro- accidents in manufacturing jobs. *Journal of Applied Psychology*, 85, 587-596.
- Zohar, D. (2002a). Modifying supervisory practices to improve subunit safety: A leadership based intervention-model. *Journal of Applied Psychology*, 87, 156-163.
- Zohar, D. (2002b). The effects of leadership dimensions, safety climate and assigned priorities on minor injuries in work groups. *Journal of Organizational Behavior*, 23, 75-92.
- Zohar, D. (2008). Safety climate and beyond: A multi-level multi-climate framework. *Safety Science*, 46, 376-387.
- Zohar, D. & Luria, G. (2005). A multilevel model of safety climate: Cross-level relationships between organization and group-level climates. *Journal of Applied Psychology*, 90, 616-628.

Appendix A

Study 1 Employee Perception Survey Scales and Items

Safety Climate

1. Makes sure we receive all the equipment needed to do the job safely.
2. Frequently checks to see if we are all obeying the safety rules.
3. Discusses how to improve safety with us.
4. Uses explanations (not just compliance) to get us to act safely.
5. Emphasizes safety procedures when we are working under pressure.
6. Frequently tells us about the hazards in our work.
7. Refuses to ignore safety rules when work falls behind schedule.
8. Is strict about working safely when we are tired or stressed.
9. Reminds workers who need reminders to work safely.
10. Makes sure we follow all the safety rules (not just the most important ones).
11. Insists that we obey safety rules when fixing equipment or machines.
12. Says a “good word” to workers who pay special attention to safety.
13. Is strict about safety at the end of the shift, when we want to go home
14. Spends time helping us learn to see problems before they arise.
15. Frequently talks about safety issues throughout the workweek
16. Insists we wear our protective equipment even if it is uncomfortable.

Safety Participation

1. I promote the safety program within the organization
2. I put in extra effort to improve the safety of the workplace
3. I voluntarily carry out tasks or activities that help improve workplace safety

Safety Compliance

1. I use all the necessary safety equipment to do my job
2. I use the correct safety procedures for carrying out my job
3. I ensure the highest levels of safety when I carry out my job

Procedural Justice

1. I am able to express my views and feelings during those procedures.
2. I am able to influence the outcome of the procedures.
3. The procedures are applied consistently.
4. The procedures are free of bias.
5. I can appeal the outcome of the procedures.
6. The procedures are based on accurate information.
7. The procedures uphold ethical and moral standards.

Distributive Justice

1. The rewards I receive reflect the effort I put into my work.
2. The rewards I receive are appropriate for the work I do.
3. The rewards I receive reflect what I have contributed to the organization.
4. The rewards I receive are justified given my performance.

Informational Justice

1. Be candid in communication with me.
2. Give me reasonable explanations.
3. Communicate details to me in a timely manner.
4. Tailor communication to meet my needs.

Interpersonal Justice

1. Treat me in a polite manner.
2. Treat me with dignity.
3. Treat me with respect.
4. Refrain from improper remarks or comments.

General Transformational Leadership

1. Communicates a clear and positive vision of the future
2. Treats staff as individuals, supports and encourages their development
3. Gives encouragement and recognition to staff
4. Fosters trust, involvement and cooperation among team members
5. Encourages thinking about problems in new ways and questions assumptions
6. Is clear about his/her values and practices what he/she preaches
7. Instils pride and respect in others and inspires me by being highly competent

Study 3 Employee Survey ItemsSafety Climate

1. Health and Safety issues are a priority in my workplace
2. The health and safety problems in my workplace are serious
3. I am kept informed about health and safety issues that affect me
4. My organization has an effective approach to dealing with health and safety issues

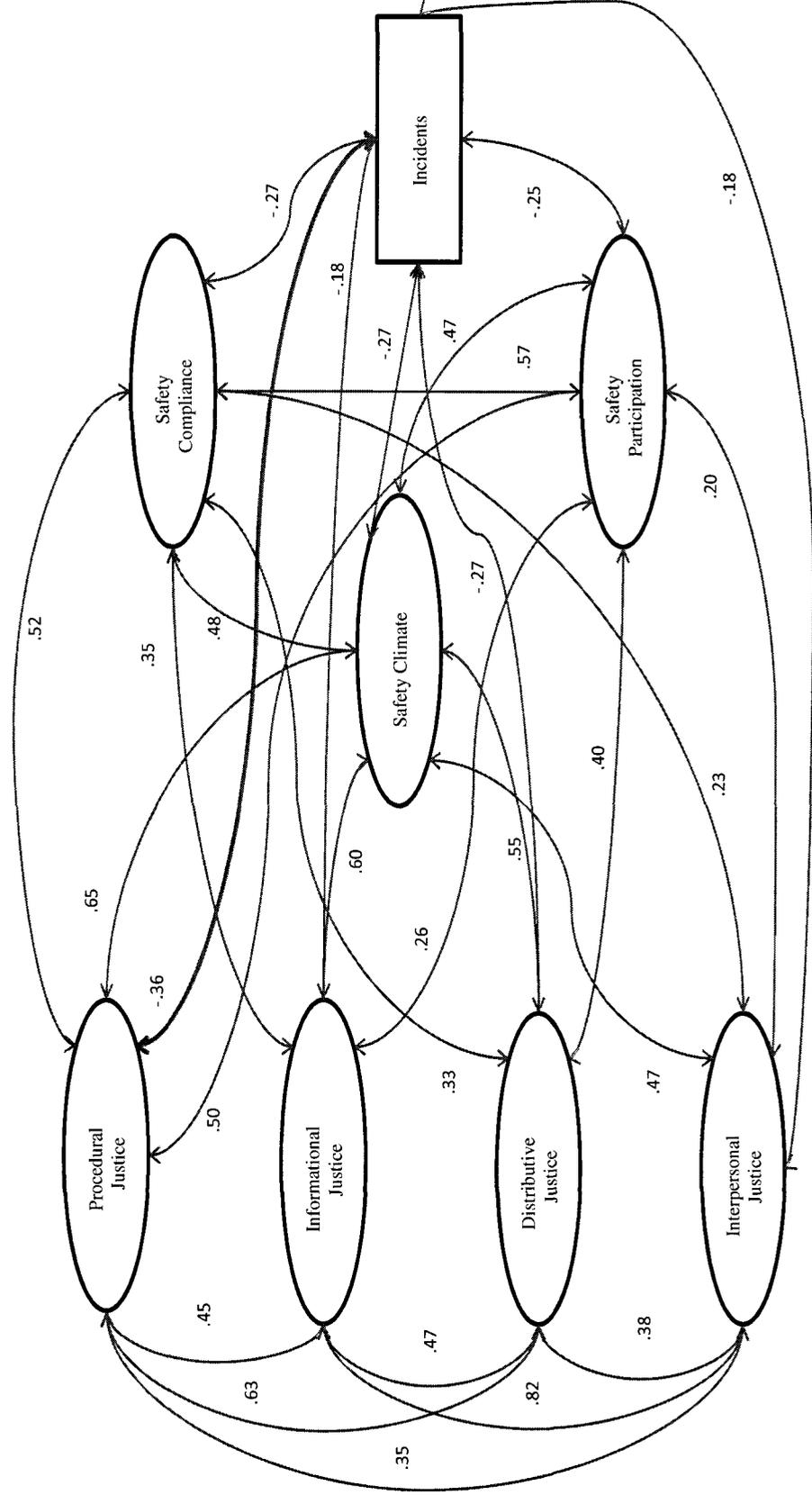
Appendix B

Breakdown of Item Parcelling

Factor (construct)	Parcel	Item
Safety Climate	Parcel 1	My direct supervisor
		... makes sure we follow all safety rules (not just the most important ones)
		...emphasizes safety procedures when we are working under pressure
		...insists we wear our protective equipment even if it's uncomfortable
		... refuses to ignore safety rules when work falls behind schedule
		...discusses how to improve safety with us
		...uses explanations (not just compliance) to get us to act safely
		...says a good word to workers who pay special attention to safety
		...makes sure we receive all the equipment needed to do the job safely
		...spends time helping us learn to see problems before they arise
		...frequently checks to see if we are all obeying the safety rules
		...is strict about working safely when we are tired or stressed
Procedural Justice	Parcel 4	...insists that we obey safety rules when fixing equipment or machines
		...frequently talks about safety issues throughout the work week
		...reminds workers who need reminders to work safely
		...frequently tells us about the hazards in our work
		...is strict about safety at the end of the shift, when we want to go home
		The procedures are free from bias
		I am able to express my views and feelings during those procedures
		I can appeal the outcome of the procedures
		The procedures uphold ethical and moral standards
		The procedures are based on accurate information
		I am able to influence the outcome of the procedures
		The procedures are applied consistently
Procedural Justice	Parcel 1	I am able to express my views and feelings during those procedures
	Parcel 2	I can appeal the outcome of the procedures
	Parcel 3	The procedures uphold ethical and moral standards

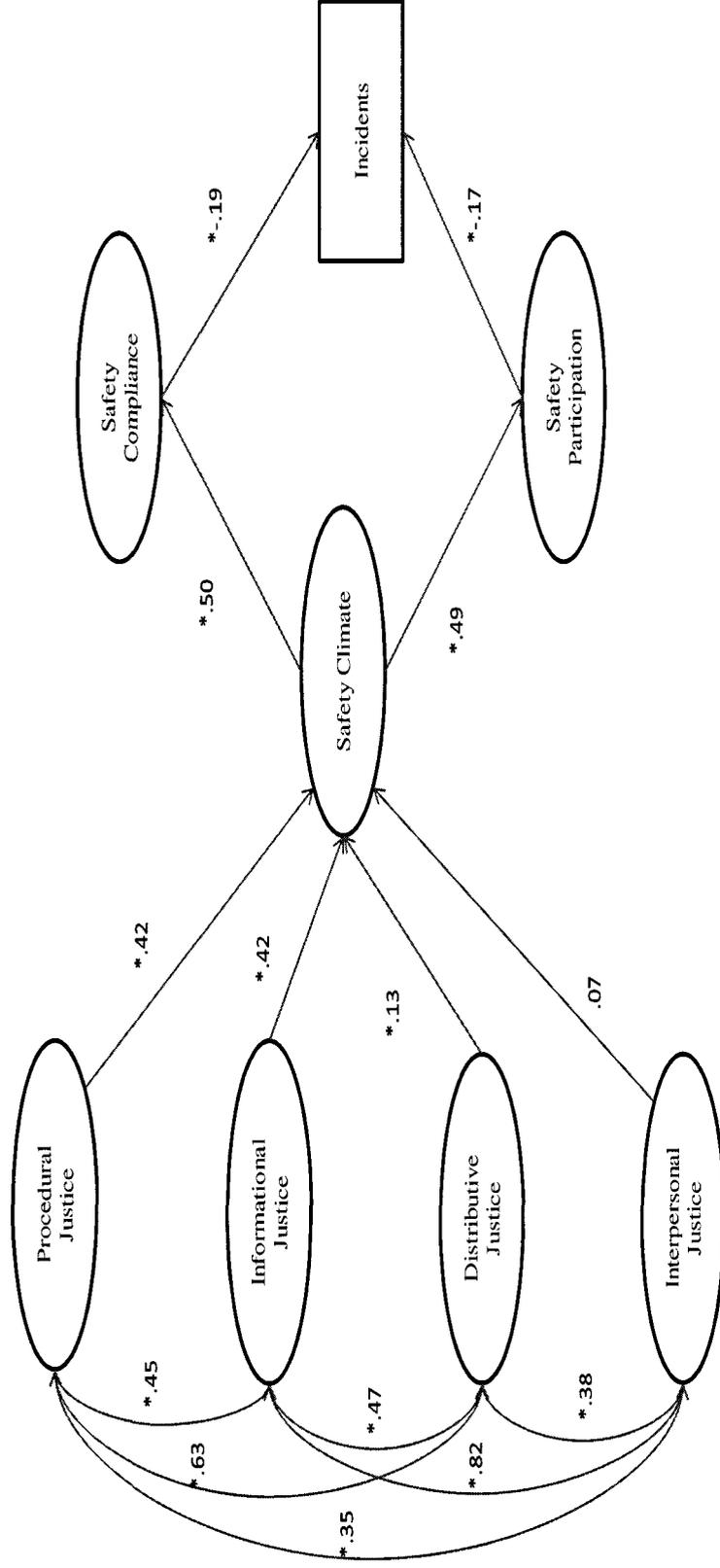
Appendix C

Figure 2 Study 1 Measurement model



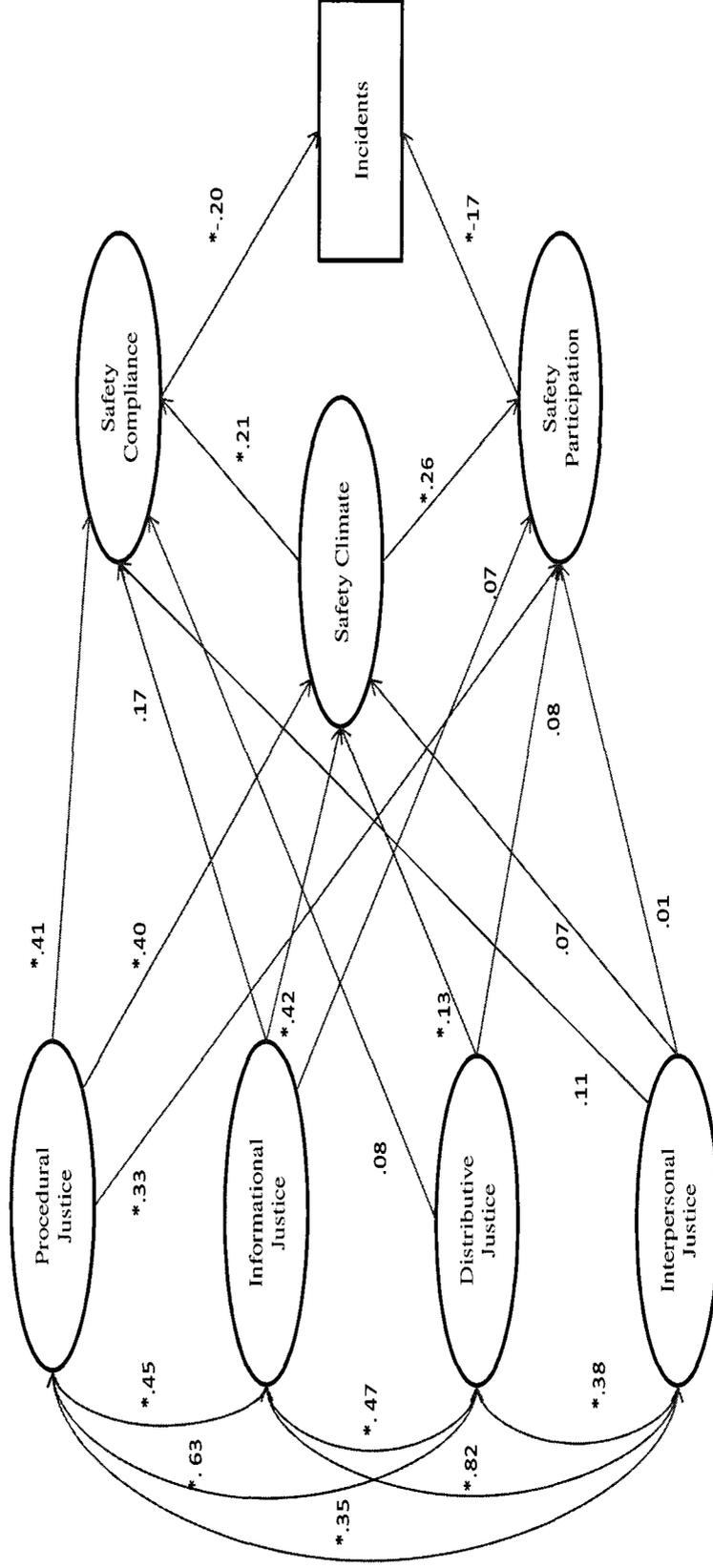
*Note: All estimates are significant at > p.05.

Figure 3: Study 1 Fully mediated model



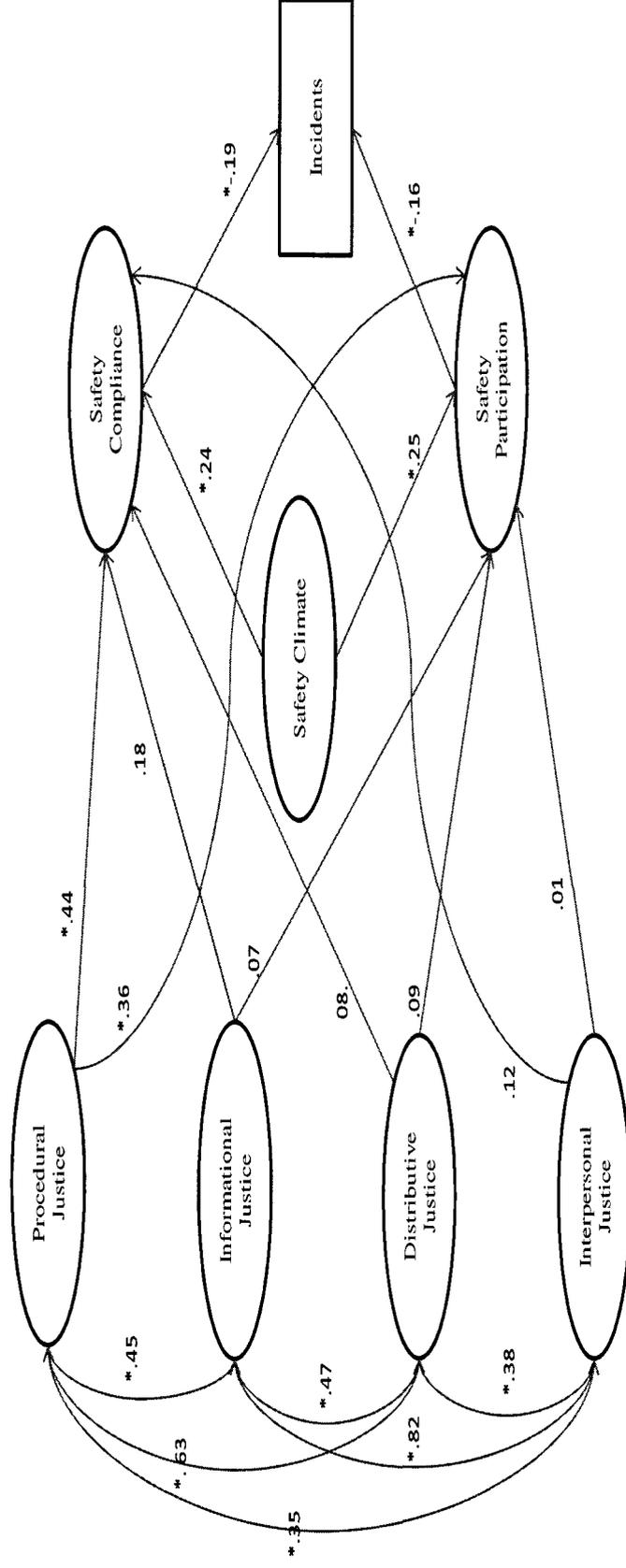
Note: Significant paths are denoted with *

Figure 4: Study 1 Partially Mediated Model



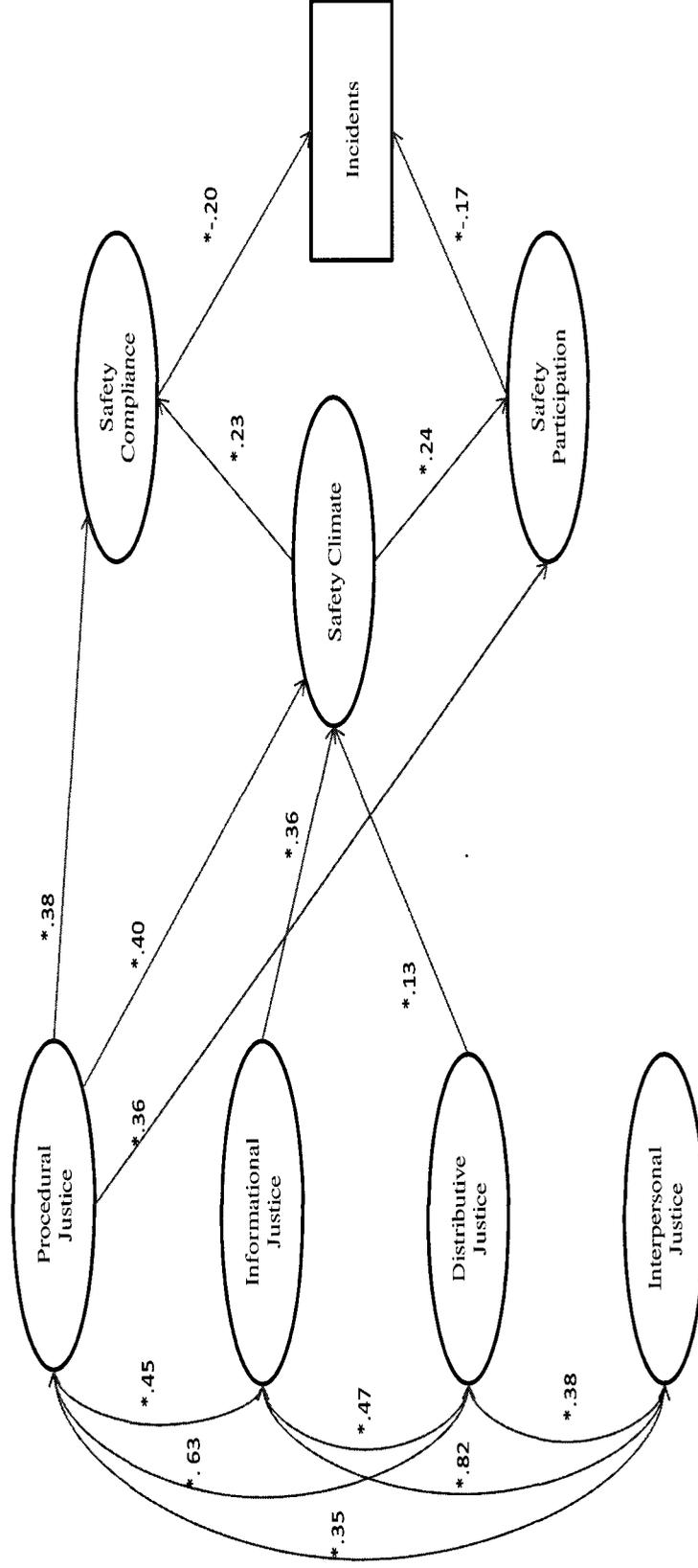
Note: Significant paths are denoted with *

Figure 5 Study 1 Non mediated model



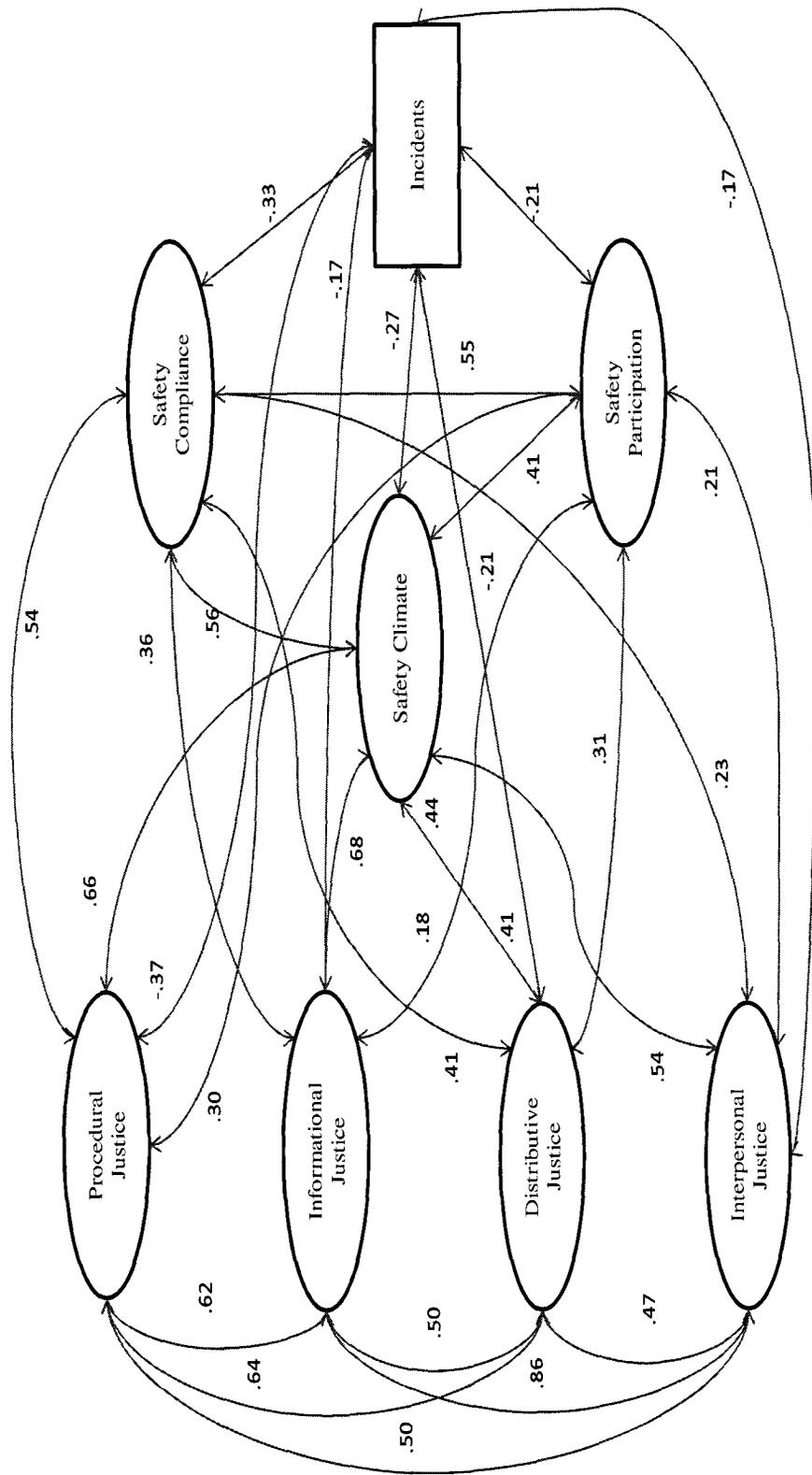
Note: Significant paths are denoted with *

Figure 6 Study 1 Trimmed partially mediated model



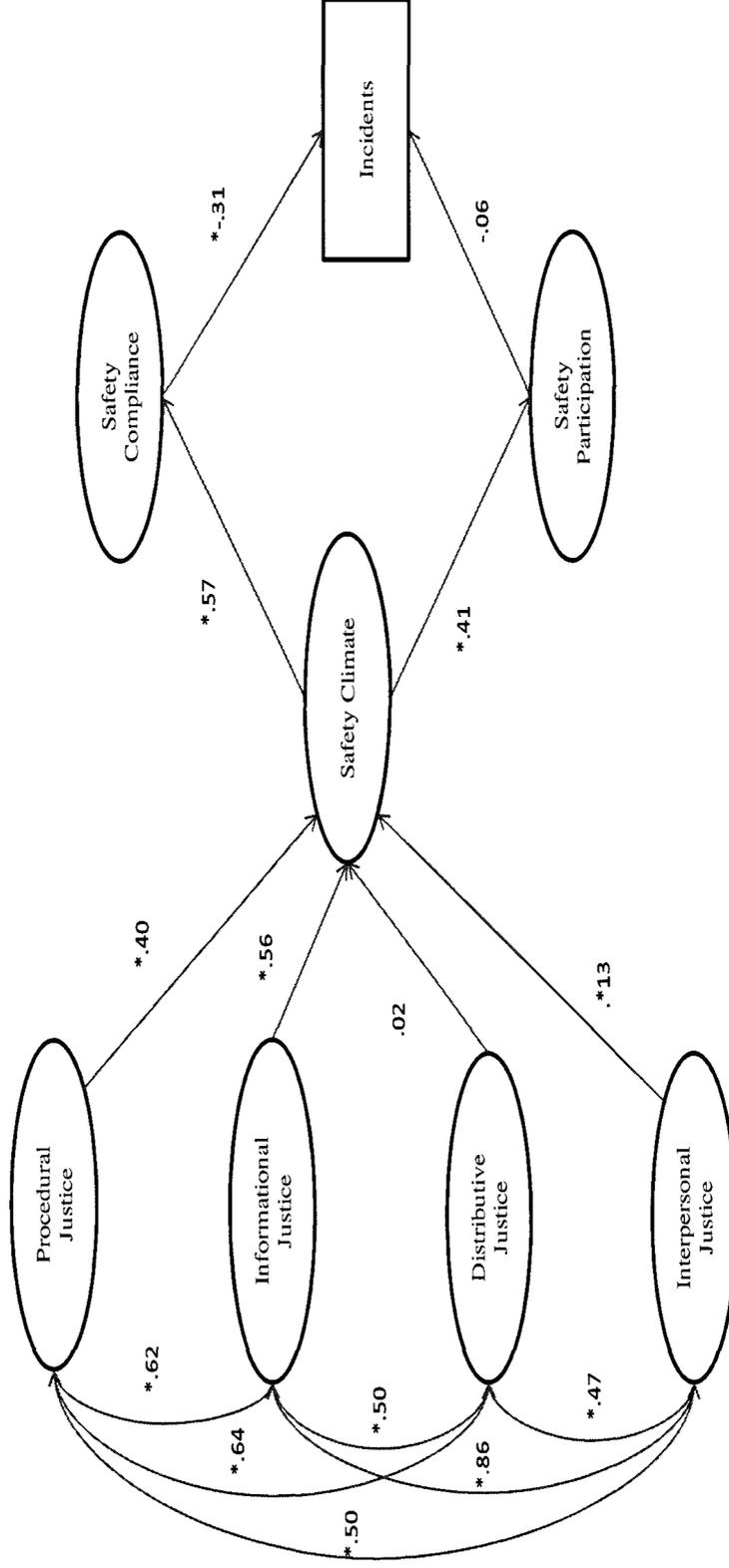
Note: Significant paths are denoted with *

Figure 7 Study Measurement Model



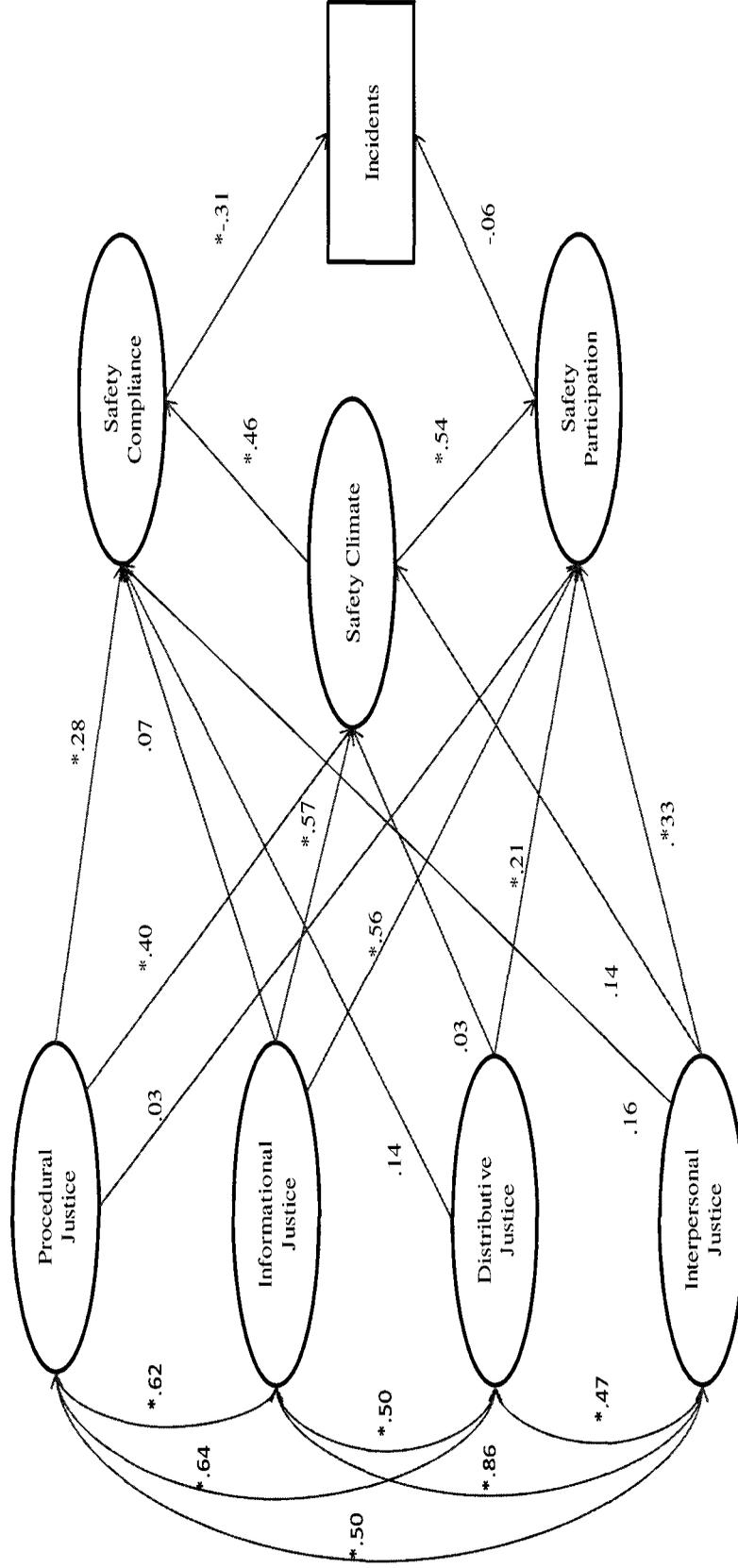
Note: All parameter estimates are significant at $p > .05$

Figure 8 Study 2 Fully mediated model



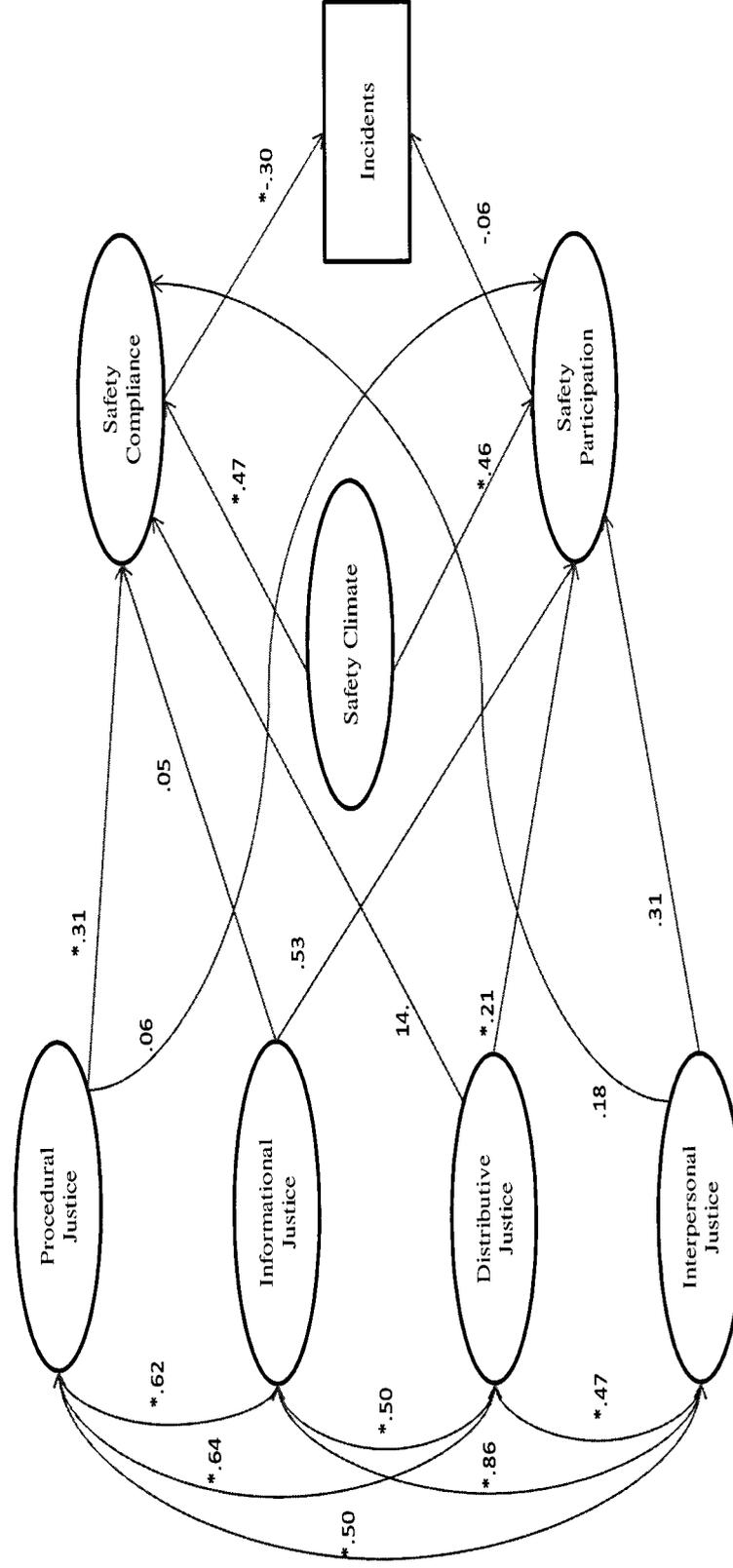
Note: Significant paths are denoted with *

Figure 9 Study 2 Partially Mediated model



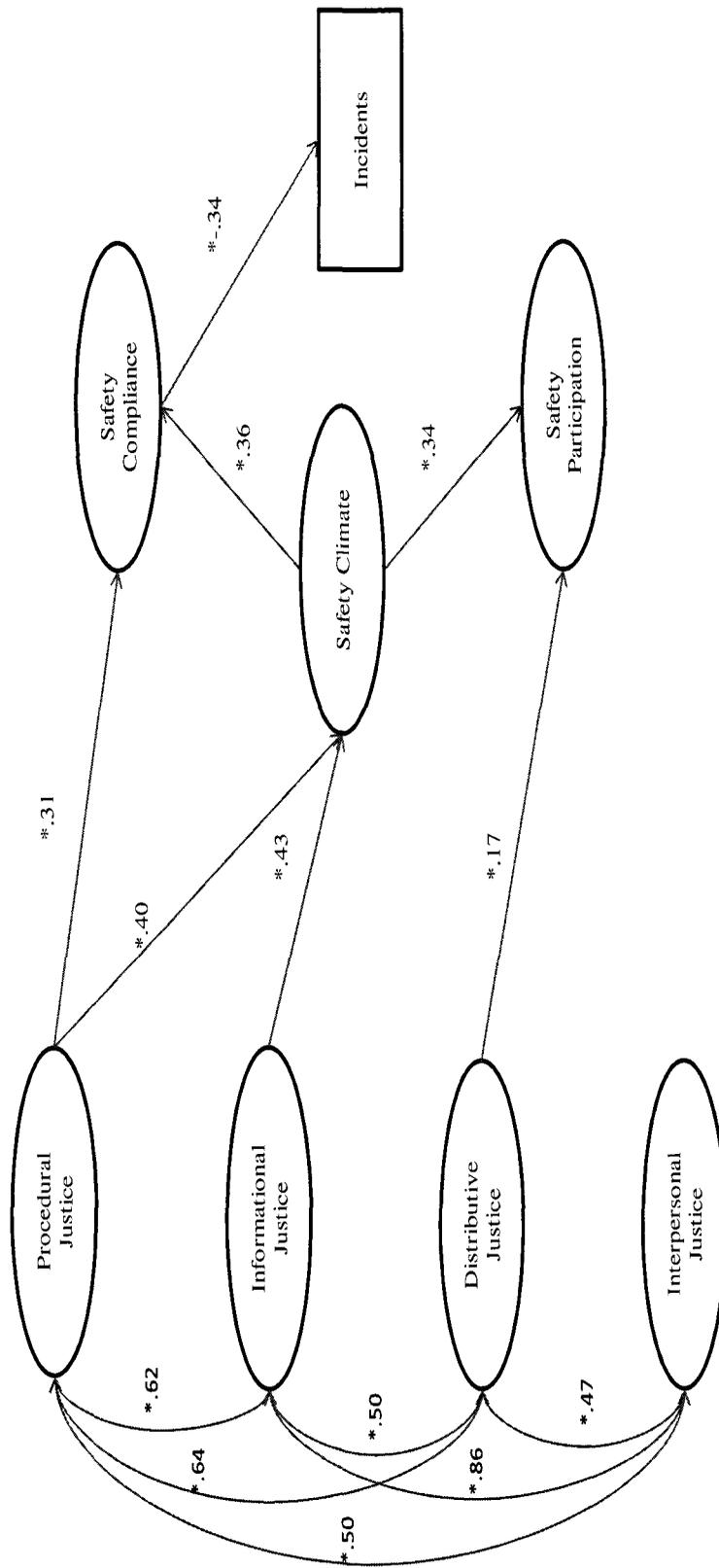
Note: Significant paths are denoted with *

Figure 10 Study 2 Non-mediated model



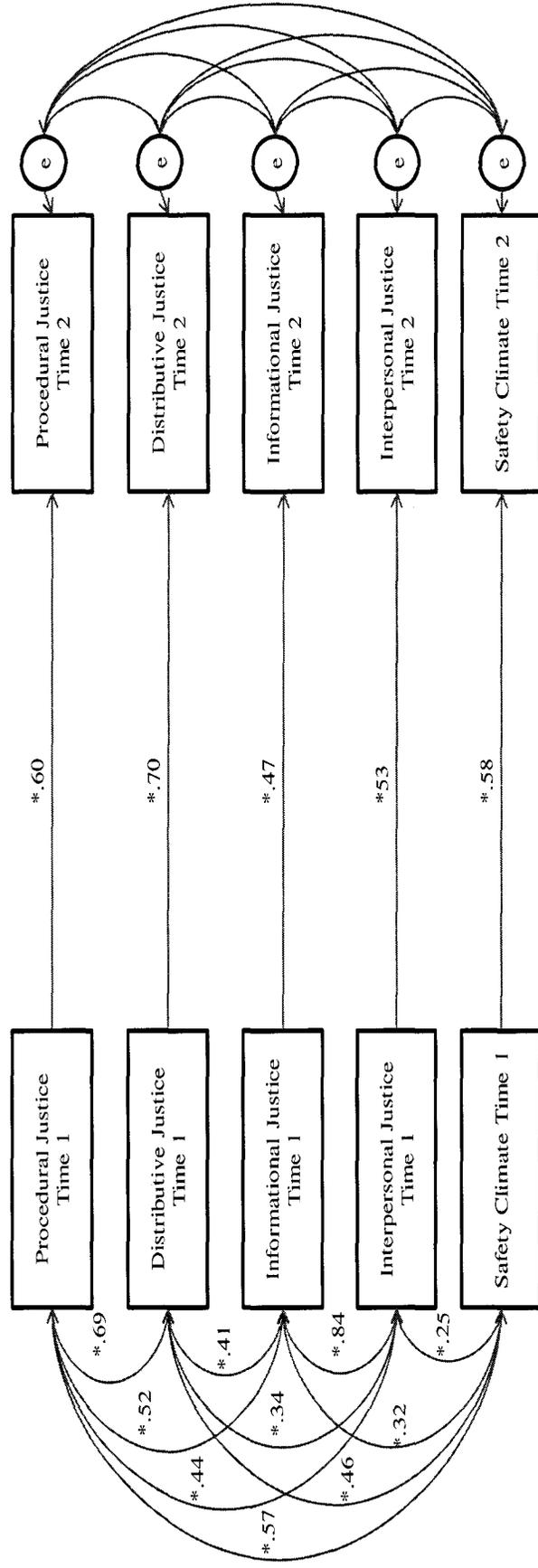
Note: Significant paths are denoted with *

Figure 11 Study 2 Trimmed partially mediated model



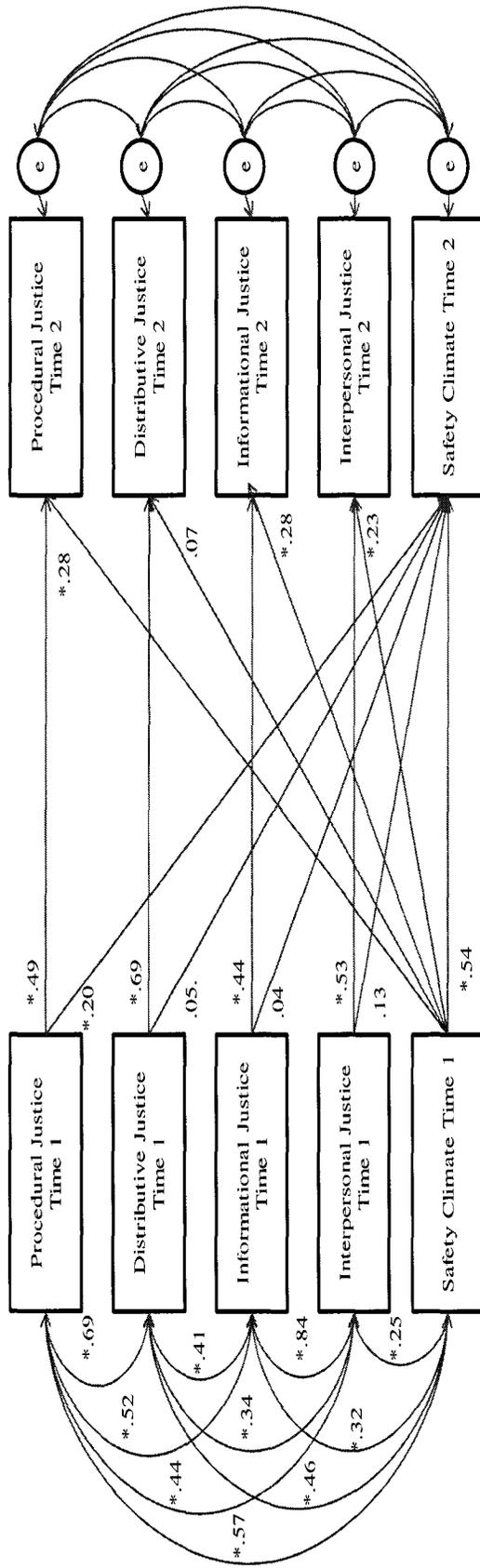
Note: Significant paths are denoted with *

Figure 12 Study 3 Auto regressive model



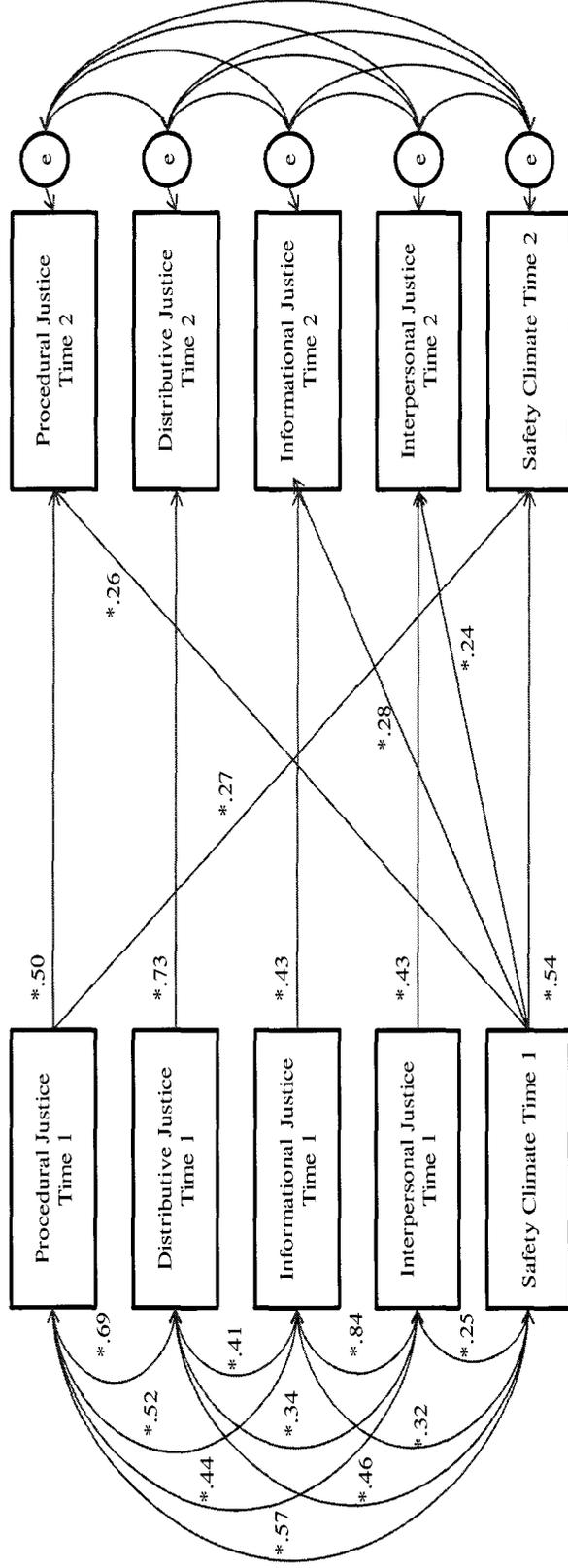
Note: Significant paths are denoted with *

Figure 13 Study 3 Cross-lagged effects model



Note: Significant paths are denoted with *

Figure 14 Study 3 Trimmed Cross-lagged model



Note: Significant paths are denoted with *

Appendix D

Study 1 Table of Significant Indirect Effects.

	Procedural Justice	Distributive Justice	Informational Justice	Interpersonal Justice
Safety Compliance	.071	.017	.068	.000
Safety Participation	.078	.019	.075	.000
Safety Incidents	-.060	-.003	-.012	.000

Study 2 Table of Significant Indirect Effects

	Procedural Justice	Distributive Justice	Informational Justice	Interpersonal Justice
Safety Compliance	.099	.000	.131	.000
Safety Participation	.091	.000	.120	.000
Safety Incidents	-.054	.000	-.023	.000



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