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Development and validation of a multi-level air freight handling safety climate scale

Matthew D. Roberts
Air Force Institute of Technology

Matthew A. Douglas
Baylor University

Robert E. Overstreet
Iowa State University, reo1@iastate.edu

Jeffrey A. Ogden
University of North Texas

Christine M. Schubert Kabban
Air Force Institute of Technology

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Abstract

Safety is of critical importance in many industries. One of the more dangerous environments in industry, and the military, is air freight handling, where the fatal injury rate has consistently been higher than the national average. Nonetheless, peer-reviewed safety research that is focused on air freight handling is practically non-existent. Therefore, research that helps academicians and managers better understand safety climate and its potential influence on employee attitudes and behaviors is vitally important. To address these concerns, we develop and validate an air freight handling-specific safety climate scale capable of capturing employees' safety climate perceptions at the organization and group levels. We also found that, in general, measurement scale dimensions in this context are like those in other high-risk, transportation-related contexts, and that the nomological network may be converging on a cross-context set of safety climate dimensions. The resultant scale can be used to investigate safety climate's relationship with various employee attitudes, safety and operational behaviors in this high-risk environment.

Keywords

Air freight handling, Air cargo mishaps, Air transportation safety, Safety, Safety climate

Comments

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Development and validation of a multi-level air freight handling safety climate scale

Matthew D. Roberts [a,*], Matthew A. Douglas [b], Robert E. Overstreet [c], Jeffrey A. Ogden [d], Christine M. Schubert Kabban [e]

[a] *Department of Operational Sciences, Air Force Institute of Technology, 2950 Hobson Way, Wright Patterson AFB, OH 45433, USA*
[b] *Hankamer School of Business, Baylor University, Waco, TX 76798, USA*
[c] *ISU College of Business, Iowa State University, Ames, IA 50011, USA*
[d] *UNT College of Business, University of North Texas, Denton, TX 76203, USA*
[e] *Department of Mathematics and Statistics, Air Force Institute of Technology, Wright Patterson AFB, OH 45433, USA*

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ABSTRACT

Safety is of critical importance in many industries. One of the more dangerous environments in industry, and the military, is air freight handling, where the fatal injury rate has consistently been higher than the national average. Nonetheless, peer-reviewed safety research that is focused on air freight handling is practically non-existent. Therefore, research that helps academicians and managers better understand safety climate and its potential influence on employee attitudes and behaviors is vitally important. To address these concerns, we develop and validate an air freight handling-specific safety climate scale capable of capturing employees' safety climate perceptions at the organization and group levels. We also found that, in general, measurement scale dimensions in this context are like those in other high-risk, transportation-related contexts, and that the nomological network may be converging on a cross-context set of safety climate dimensions. The resultant scale can be used to investigate safety climate's relationship with various employee attitudes, safety and operational behaviors in this high-risk environment.

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1. Introduction

The importance of safety cannot be understated in any industry, and the air freight handling industry is no different. The U.S. Office of Personnel Management (2009; pg. 178) defines the occupation as:

> . . .jobs involved in loading, placing, securing, and unloading air cargo in the air terminal and on the aircraft when such work includes responsibility for maintaining the proper weight and balance of the loaded aircraft, positioning cargo based on destination and priority of shipment, and insuring that incompatible cargoes are not loaded in the same aircraft.

These duties are conducted by "air freight handlers," and collateral duties can include operating vehicles (such as forklifts, aircraft loading equipment, stair trucks, and general purpose vehicles); guiding or "spotting" vehicles and loading equipment; manual and mechanical lifting and maneuvering of aircraft freight (i.e., baggage, pallets, containers, vehicles,

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* Corresponding author.
E-mail addresses: matthew.roberts@afit.edu (M.D. Roberts), Matthew_A_Douglas@baylor.edu (M.A. Douglas), reo1@iastate.edu (R.E. Overstreet), jeffrey.ogden@unt.edu (J.A. Ogden), christine.schubert@afit.edu (C.M. Schubert Kabban).

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equipment); assisting and briefing passengers on safety and emergency procedures; as well as opening/closing aircraft doors and hatches. These duties are often conducted in small teams.

Air freight handlers are exposed to multiple potential hazards, to include vehicle and equipment accidents that could result in aircraft, vehicle, or equipment damage, or personal injury and death; bodily injury associated with lifting and maneuvering heavy items; bodily injury associated with operating in confined spaces; hearing loss associated with long term exposure to loud noises; and injury occurring from exposure to toxic chemicals. One of the gravest dangers faced by personnel in this industry is the operation of forklifts and aircraft loading equipment. Across all industries, nearly 100 workers are killed each year while operating forklifts, and another 95,000 workers are injured (Lu & Yang, 2010). Dangers are exacerbated when one considers that most of air freight handlers' duties take place at a busy airport with moving vehicles and aircraft, or inside tight quarters, such as a warehouse or an aircraft cargo or passenger hold. As a result, this high-risk industry has had a fatal injury rate consistently higher than the national average for all industries (United States Department of Labor, 2004).

The dangers of this profession were never more apparent than on February 17, 2013 when a U.S. Air Force (USAF) air freight handler was killed in a workplace accident on Joint Base Andrews, Maryland. According to the official investigation, two air freight handlers were in the process of moving a piece of equipment into a warehouse storage location. In order to accomplish this, three vehicles had to be moved. One individual operated each vehicle while the other individual used spotting procedures to safely guide the vehicle operator. While backing up the third vehicle, the vehicle operator lost sight of the spotter and accidentally pinned him between the vehicle and the warehouse wall, leading to his death (USAF Ground AIB Report, 2013). The investigation cited improper spotting procedures as a primary cause of the accident, as the vehicle operator is required to stop the vehicle any time he or she loses sight of the spotter. Altogether, the air freight handling field provides a unique context in which to study safety, and the continued study of safety-related events and their predictors could help reduce occupational injuries (Barling, Loughlin, & Kelloway, 2002).

Safety-related events, such as close calls and near misses, directly predict occupational injuries, and these safety-related events can be minimized when employees perceive that a high level of safety climate exists in their organization (Barling et al., 2002). Safety climate refers to the perceptions that employees have of the value their organization places on safety versus other factors (such as productivity; Zohar, 2010). The relationship between safety climate and safety-related outcomes is well documented, and research has shown that safety climate is a robust predictor of safety performance (de Koster, Stam, & Balk, 2011; Kelloway, Mullen, & Francis, 2006; Podsakoff, MacKenzie, Moorman, & Fetter, 1990; Zohar, 2010; Zohar & Luria, 2005).

Therefore, we propose that continued safety climate research, particularly in the air freight handling context, is an important next step to better understanding the safety climate concept and reducing safety-related incidents in high-risk industries. Air freight handling safety research is currently unexplored territory. Although research has been conducted in air, rail, and truck transport safety, the authors could not find any research that specifically addressed air freight handling safety. Furthermore, while it could be argued that consensus has been reached as to safety climate's relationship with safety performance, Zohar (2010) stresses the need for creating industry-specific safety climate scales in order to capture context-dependent perceptions of safety climate. Factors that are important for safety in one industry, such as nursing, may be different from factors in other industries, such as air freight handling. Therefore, the purpose of this research is to develop and validate an air freight handling-specific safety climate scale and lay the foundation for future safety climate research in this industry, and beyond.

2. Conceptual development

Overall approaches to safety exist along a continuum from engineered designs to human behaviors. Engineering approaches focus on making safer equipment and infrastructure, while safety management systems focus on managing and controlling risk, proactively detecting and correcting safety issues, analyzing safety-related data, and measuring safety performance to support resource allocation and decision-making (USDOT, 2018). Additionally, the human behavioral (or human factors) approach is focused on individual differences and initiatives to help employees make better safety-related decisions (Hofmann, Burke, & Zohar, 2017). Much progress in improving safety performance has occurred along the entire spectrum, particularly in the behavioral realm.

Human error is a major cause of accidents in industrial organizations (Flin, Mearns, O'Connor, & Bryden, 2000). Reason (1990), in his famous "Swiss Cheese" model, proposed that accidents and incidents occur as a series of errors. That is, organizational influences, unsafe supervision, preconditions for unsafe acts, and unsafe acts align to result in a mishap or accident. This model has been a prevalent foundation of risk management and proactive safety programs, particularly in civil and military aviation (Belland, Olsen, & Lawry, 2010; Edkins, 1998). In the current study, we focus on organizational and supervisory aspects of the model. That is, organizational and supervisory safety management practices, policies, and procedures, often enacted in a safety management system, represent latent conditions in which employees operate. The organization's safety climate is indicated by employee perceptions of existing conditions (Zohar, 2010), and the focus on these organizational factors has resulted in a litany of research into the way managers can develop safe climates within their organizations.

The safety climate concept has been extensively explored across a wide variety of industries, to include manufacturing, energy production, and health care, to name a few (Christian, Bradley, Wallace, & Burke, 2009). Additionally, safety climate has been studied in transportation contexts, to include trucking (Douglas & Swartz, 2009), rail (Morrow et al., 2010), and aviation (Fogarty & Shaw, 2010). In certain cases, the terms "safety culture" and "safety climate" have been conflated, but in this study we prescribe to the argument that culture and climate are two distinct concepts (Cooper, 2000; Mearns & Flin, 1999). That is, safety culture represents an organization's values, beliefs, and underlying assumptions. Safety climate, on the other hand, is an indicator of the underlying safety culture of a work group or organization at a moment in time (Flin et al., 2000). Specifically, safety climate represents employees' perceptions of the emphasis placed by management on safety issues relative to other factors (e.g., productivity; Zohar, 2010). Therefore, we frame our study around these conceptualizations of culture and climate, and focus herein on safety climate. We also develop the arguments that the measurement of safety climate continues to evolve. That is, researchers have formulated multiple generic and industry-specific safety climate scales and have conceptualized safety climate at multiple levels within an organization (e.g., individual, work group, and organization; Christian et al., 2009; Zohar, 2010). Following the conceptual development section, we transition to the development of a safety climate scale for the air freight handling industry.

2.1. Understanding safety climate

An organization's commitment to safety is important to safe operations. The safety climate concept posits that employees, through daily interactions and social exchanges with leadership and managers, can gain a sense of the importance that their organization places on safety (Williams et al., 2011). For instance, Kath, Magley, and Marmet (2010) state that perceived management attitudes about safety, a key component of safety climate, can be considered a signal to employees that safe behaviors at work are an employee obligation. Perceptions of safety climate influence behavior-outcome expectancies (i.e., beliefs), which subsequently influence behavior (Zohar, 2003). In other words, when an employee feels the organization places a high value on safety, a higher safety climate is achieved, and employees behave more safely (Barling et al., 2002; Zohar, Huang, Lee, & Robertson, 2014). Overall, researchers have found that higher safety climates generally result in a positive influence on safety behaviors and a decrease in safety incidents (e.g., Cucuruto et al., in press; Swartz & Douglas, 2009; Fogarty & Shaw, 2010; Griffin & Neal, 2000; Morrow et al., 2010; Zohar, 2003; Zohar & Luria, 2005; Zohar et al., 2014).

Over the years, the general definition of safety climate has remained intact as employees' perceptions of the value an organization places on safety versus other factors (such as productivity), as seen through the organization's policies, procedures, and practices (Huang et al., 2013a; Zohar, 2010). However, researchers have not been consistent in how safety climate is operationalized and measured. One potential reason for this approach is that leading safety climate scholars have encouraged the development of industry- and level of analysis-specific scales (Zohar, 2010). These tailored scales can provide more detailed information to practicing managers, which could lead to improved safety and outcomes.

2.1.1. Safety climate across transportation contexts

As previously mentioned, one of the major strengths of the safety climate concept is that it has been shown to be a robust predictor of safety outcomes across a wide variety of industries (Zohar, 2010). To our knowledge, safety climate studies in the air freight handling industry do not exist. However, studies in other related transportation industries (i.e., truck, rail, and aviation) have provided a solid foundation for the current study. Employees in many transportation areas operate vehicles, work around heavy machinery, work in tight quarters, and are often under pressure to work quickly and efficiently to meet operational requirements. Therefore, we narrow our focus in this section to review safety climate studies in the transportation context. Researchers in transportation have used different safety climate dimensions across studies, as well as generic and context-specific measurement scales, to provide evidence of safety climate's impact on safety outcomes.

For example, in the trucking industry, Crum and Morrow (2002) highlighted the impact of a motor carrier's support for safety in mitigating truck driver fatigue. Motor carrier support for safety, demonstrated through voluntary attendance at safety and training meetings, assistance with loading and unloading, and company policies to minimize nighttime driving, reduced drivers' perceptions of fatigue as a problem. Similarly, drivers' perceptions of a weak safety climate and pressure from dispatchers to drive while tired were associated with driver fatigue and safety incidents (Morrow and Crum, 2004). Swartz and Douglas (2009) found that carriers' supportive practices, such as safety communication and investment in safety training, were negatively related to drivers' intentions to commit unsafe acts. Finally, Zohar et al. (2014) revealed truck driver perceptions of safety climate (i.e., carrier support for safety and dispatcher practices) influenced self-reported safety behaviors and hard braking incidents.

In the rail industry, Morrow et al. (2010) found that rail worker perceptions of safety climate (i.e., management attitudes toward safety, coworker safety, and work-safety tension) were positively associated with compliance behavior. Perceptions of work-safety tension had a stronger association with safety behavior than management or coworker commitment. More recently, Curcuruto et al. (in press) utilized Zohar and Luria's (2005) generic multi-level safety climate scale (MSC) to evaluate the impact of rail workers' safety climate perceptions on safety compliance and participation. Their results revealed single-factor organizational-level safety climate construct (management commitment) and a two-factor group-level safety climate construct (consisting of communication and monitoring safety initiatives), both of which were positively related with safety compliance and participation behavior.

Finally, in the aviation maintenance industry, Fogarty (2004) found that management's commitment to safety, appropriateness of training, and availability of resources had links to safety outcomes. They posited that unfavorable organizational conditions (i.e., poor safety climate) could place pressure on technicians. When the technicians began to succumb to the pressure, errors were more likely to occur. Later, Fogarty and Shaw (2010) expanded their focus and found that technicians' perceptions of safety climate (i.e., management attitudes to safety) did in fact directly influence individual attitudes towards safety, violation intentions, and actual violation.

These studies show that, even in the transportation context, researchers have often evaluated safety climate in organizations in various ways. However, prominent safety climate dimensions have included management commitment (or attitudes) to safety through enacted policies, procedures, and monitoring; safety communication and training; and the reduction of safety-productivity tension associated with supervisor practices. The actions associated with these dimensions can occur at different levels of the organization (i.e., organization or work group), as will be described in the next section.

2.1.2. Safety climate as a multi-level construct

Safety climate has a hierarchical structure, consisting of multiple levels of analysis. Studies have shown that employees develop level-specific climate perceptions because they are simultaneously members of the organization and work group(s) within that organization (e.g., Christian et al., 2009; Hofmann et al., 2017; Zohar & Luria, 2005). The multi-level framework is characterized by including a different referent object for each level of safety climate (i.e., organization leadership for organization-level safety climate and work group supervisor for group-level safety climate). Because of differences across contexts and industries, researchers have investigated safety climate perceptions at the individual and cross-level perspectives (e.g., Huang et al., 2013b). That is, when perceptions are shared, they can be aggregated, and researchers can conduct cross-level analyses. Sometimes, however, perceptions are not shared across individuals (likely due to various working conditions), they cannot be aggregated, and thus researchers must evaluate psychological safety climate using individual perceptions of a referent group (i.e., the organization or a work group). Either way, measures that include both organization and group-level targeted items can provide a more comprehensive, nuanced understanding of safety climate within an organization (Huang et al., 2013b).

The safety climate concept has received much attention over the years. This attention has led to a variety of safety climate dimensions and measurement scales across a litany of industries. Leading scholars have encouraged the continued development of industry-specific, multi-level safety climate measures (Hofmann et al., 2017; Zohar, 2010). Therefore, in this study, we develop an air freight handling safety climate scale to provide a proactive information gathering tool for air freight managers to assess safety climate within their organizations and take required action.

3. Methods

An exploratory sequential mixed methods research design (Creswell, 2014) in three studies was used to develop and validate the air freight handling safety climate scales. A qualitative inquiry was performed first, using Creswell's (2014) six-step process for qualitative data analysis. This process consisted of a review of the relevant literature, semi-structured interviews, and site visits to gather raw data. Once completed, interviews were then transcribed and coded to uncover relevant safety climate themes for this context. Finally, overall themes from the literature and qualitative inquiry were used to develop a series of measurement scales.

Air freight handlers residing in USAF organizations were the target participants for this research effort. In the first study, 4 site visits and 23 semi-structured interviews were conducted and analyzed to develop an initial set of 62 items for organizational-level safety climate (OSC) and 76 items for group-level safety climate (GSC). The new survey instrument was pilot tested in the second study. In this second study, the safety climate scales were further reduced to 14 items for OSC and 10 items for GSC by analyzing the inter-item correlations and performing an exploratory factor analysis. Finally, a third study was conducted to validate the scales (Campbell & Fiske, 1959; Hinkin, 1998; Schwab, 1980).

3.1. Study 1: Qualitative inquiry – instrument development

3.1.1. Phase 1: Item generation

Phase 1 was conducted to generate an initial pool of organization and group safety climate measurement scale items relevant to the air freight handling domain. The scale items were developed through a combination of a literature review, site visits, and semi-structured interviews. Previous safety-related meta-analyses and safety climate empirical research in various military and civilian high-risk professions to include transportation (air, rail and truck) and manufacturing were examined to identify potential broad dimensions of safety climate for the air freight handling environment. These contexts were deemed most appropriate given the nature of the duties required in each of these contexts. The review resulted in 10 possible safety climate key words (see Table 1). Of note, these key words were not intended to be all inclusive and were not deemed level-specific from the beginning. The key words served as a foundation for the interview protocol and qualitative analysis (Miles, Huberman, & Saldana, 2014). The resulting interview protocol can be found in Appendix A.

A total of 23 air freight handling subject matter experts were interviewed from 3 large USAF organizations: two east coast (n = 6; n = 8) and one west coast (n = 9). Participants included organization leaders, first-line supervisors, safety managers, and air freight handlers. Each participant was asked to provide information regarding safety-related decisions they make, disconnects encountered between making safe decisions and performing operational tasks, consequences of making safe or unsafe decisions, safety policies that help or hurt one's ability to make safe decisions, supervisor and leadership practices regarding safe behavior, etc. Once no new information was uncovered from the interviews, data saturation was reached, and

Table 1
Safety climate key words and references.

Reference	Dimension									
	Management commitment	Safety priority	Safety proactivity	Work pressure	Safety communication	Safety systems	Safety policies and procedures	Worker involvement	Competence/ Training	Risk
Christian et al. (2009)	X			X		X				X
Evans, Glendon, & Creed (2007)	X				X				X	
Fogarty (2004)		X							X	
Fogarty & Shaw (2010)	X									
Hahn & Murphy (2008)	X				X			X		
Hofmann, Morgeson, & Gerras (2003)	X									
Huang et al. (2007)	X								X	
Huang et al. (2013a)	X	X	X							
Huang et al. (2013b)	X		X		X				X	
Kath et al. (2010)	X				X					
Mearns et al. (2003)	X			X	X		X	X	X	
Morrow & Crum (2004)		X						X		
Morrow et al. (2010)	X			X				X		
Fernandez-Muniz et al. (2012)	X			X	X					
Seo, Torabi, Blair, & Ellis (2004)	X							X	X	
Swartz & Douglas (2009)			X							
Zhou, Fang & Wang (2008)	X					X	X	X	X	X
Zohar (2002)		X	X							
Zohar & Luria (2005)	X	X	X							

no additional interviews were conducted (Miles et al., 2014). The interviews were then transcribed using a professional transcription service and analyzed to identify dimensions of safety climate for air freight handling.

Qualitative analysis of the interview data was conducted in two cycles. For the first cycle, provisional coding was conducted using the predetermined start list of safety climate key words identified above. Elaborative coding was used for the second cycle of coding. In elaborative coding, the goal was to deductively identify and refine the safety climate constructs (dimensions) from previous studies and inductively identify other important dimensions (beyond the original key words; Saldaña, 2012). This cycle of coding also allowed for the identification of nuance associated with the level of analysis (organization- or group-level) for each dimension. For example, "safety briefings" was a topic that came up more frequently than other topics in the interviews. Moreover, in this context, safety briefings are routinely conducted by a team leader, shift foreman, or shift supervisor, not by organizational leadership. Safety briefings also represent "safety communication," which is a prevalent safety climate dimension in previous research. Therefore, "safety briefings" was selected as a dimension for scale development with the referent level of analysis deemed to be the work group level.

The qualitative analysis ultimately resulted in multi-dimensional organization- and group-level safety climate constructs (OSC and GSC, respectively). For OSC, the potential sub-dimensions included management commitment to safety, safety policies and procedures, safety training, and vehicles and equipment. For GSC, the potential sub-dimensions identified were management commitment to safety, work pressure, safety briefings, safety communication, and coworker support. Coded text from each dimension and previous safety climate measurement scales revealed a pool of 138 potential scale items. Some scale items drawn from the literature were common across studies with only minor differences in wording, and those scale items were consolidated to represent a single measure where appropriate. Additionally, other items were not context relevant, and those items were removed from the list. The process of consolidation and elimination produced a final list of 107 potential scale items. Of the 107 items, 26 scale items were drawn directly from previous studies and 81 items were developed from the qualitative analysis for the current context. In total, there were 49 items for organization safety climate: 21 items for management commitment to safety, 9 items for safety policies and procedures, 9 items for safety training, and 10 items for vehicles and equipment. A total of 58 items remained for group safety climate: 24 items for management commitment to safety, 10 items for work pressure, 6 items for safety briefings, 7 items for safety communication, and 11 items for coworker support.

3.1.2. Phase 2: Item review

Thirteen judges with varying backgrounds, but related areas of expertise including aircraft maintenance, logistics readiness, cargo movement, passenger movement, and air freight handling reviewed the 107 scale items. Three of the judges were professors with doctoral degrees related to logistics and supply chain management, two of the judges were doctoral candidates in a logistics program, and one of the judges was a master's student in logistics and supply chain management. The remaining judges were practicing managers of different levels in air freight handling. Their review maximized content validity of the scale and evaluated the items for clarity and conciseness (DeVellis, 2010).

A preliminary survey was sent to each judge to review. The survey included each safety climate scale item organized by construct and dimension (e.g., organization safety climate – management commitment to safety). The judges were instructed to provide feedback on whether the questions were clear, whether the questions were reflective of the dimensions they were intended to measure, and whether the questions were relevant to air freight handling. Because of the feedback, 34 items were removed. The 31 remaining scale items for OSC consisted of: 11 items for management commitment to safety, 6 items for safety policies and procedures, 7 items for safety training, and 7 items for vehicles and equipment. The 42 remaining scale items for GSC were broken down as: 12 items for management commitment to safety, 7 items for work pressure, 5 items for safety communication, 10 items for safety briefings, and 8 items for coworker support. Of note, management commitment at the organizational-level represents general support by upper management of safety over operational performance. Management commitment at the group-level represents specific actions taken to enforce safety policies and procedures and correct unsafe behavior.

3.2. Study 2: Instrument refinement – pilot study

Invitations went out to 723 air freight handlers from three large USAF air freight handling organizations to participate in the pilot survey. We received 168 responses (response rate of 23.2%). Although lower than response rates reported in other safety climate studies, this response rate is typical of military samples, which tend to range from 12 to 28% (Miller & Aharoni, 2015). The average age of the respondents was 28.7 years (SD = 6.8) and the average years of work experience was 10.1 years (SD = 8.9). To assess the characteristics of the sample relative to the population of air freight handlers, a comparison was made with regard to job-level and age distribution (see Table 2). A difference of proportions test was conducted using an $\alpha = 0.05$ level of significance, and no significant difference was found between the sample and population proportions. Because the responses by job category and age compare favorably to that of the air freight handler population, it was concluded that a representative sample was achieved.

The pilot survey included the 31-item OSC scale, the 42-item GSC scale, and demographic questions. For the safety climate scales, respondents indicated on a 7-point Likert scale (strongly disagree to strongly agree) the extent to which they agreed or disagreed with the statements. Each air freight handler was sent an introductory e-mail explaining the research, and that e-mail was followed up with an official survey invitation e-mail that included a web link to the online survey. A reminder e-mail was sent out one week after the official survey invitation e-mail, and a final e-mail was sent one week later

Table 2
USAF air freight handler sample and population comparison (pilot study).

	Population	Sample
Number	4530	168
Age	27.6	28.9
SD	6.4	6.3
	Population	Sample
Line workers	51.3%	46.2%
First line supervisors	39.4%	41.9%
Second-line supervisors	9.3%	11.9%

in accordance with accepted survey protocol (Fink, 2012; Neuman, 2011; Salant & Dillman, 1994). No individual identifier was collected for this study to help provide anonymity to respondents. It has been shown that anonymous surveys aid in lowering social desirability bias (Joinson, 1999).

Although 168 responses were received, any survey with more than 50% missing values in either of the safety climate scales was excluded from the analysis. This resulted in a final sample of 165 responses for OSC (22.8% response rate) and 150 responses for GSC (21.4% response rate). A non-response bias test was conducted to compare responses of early and late respondents. Groups were separated into those that responded to the first e-mail versus those that responded to follow-up e-mails. A *t*-test analysis was used to determine if there were statistically significant differences between responses of the two groups. Results showed that there was a significant difference in responses for three variables (GSB5, $p = 0.016$; GSB6, $p = 0.004$; GCS7, $p = 0.022$) for early versus late respondents. Based on the above results, it was concluded that non-response bias was not a major concern in this study.

3.2.1. Phase 1: Item selection process

Prior to conducting the factor analysis, inter-item correlations of the safety climate scale items were examined, and problem variables were removed (Hinkin, 1998). Measurement scales should be comprised of highly correlated items because low correlations indicate items may not be measuring the same construct (Churchill, 1979; DeVellis, 2010). Therefore, any OSC item that correlated <0.4 with all other OSC scale items was deemed a problem variable and subsequently deleted from the analysis (Kim & Mueller, 1978). The same procedure was used for the GSC scale items. This process resulted in the removal of 6 OSC scale items and 4 GSC items, leaving 25 and 38 items per scale, respectively.

3.2.2. Phase 2: Preliminary factor analysis

Because of the exploratory nature of this study, and because OSC, GSC, and their sub-dimensions are related, principal axis factoring with an oblique rotation was used (Kline, 2011). Furthermore, because OSC and GSC are expected to be related,

Table 3
EFA results for organization-level safety climate scale.

	Factor			
	F1	F2	F3	F4
F1: Safety training (CA = 0.885)				
OT1	**0.87**	–	–	–
OT2	**0.73**	–	–	–
OT3	**0.65**	–	–	–
OT4	**0.74**	–	–	–
OT5	**0.72**	–	–	–
F2: Management commitment to safety (CA = 0.875)				
OMC1	–	**0.73**	–	–
OMC2	–	**0.94**	–	–
OMC3	–	**0.78**	–	–
F3: Vehicles and Equipment (CA = 0.859)				
OVE1	–	–	**0.86**	–
OVE2	–	–	**0.55**	**–**
OVE3	–	–	**0.75**	**–**
F4: Safety policies and procedures (CA = 0.815)				
OSP1	–	–	–	**0.72**
OSP2	–	–	–	**0.84**
OSP3	–	–	–	**0.66**
Eigenvalues	6.84	1.54	1.25	1.01
Percentage Variance	48.83	10.97	8.95	7.18
Cumulative Variance	48.83	59.80	68.74	75.92

Note. Only factor loadings over 0.3 are shown.

a separate factor analysis was performed for each construct. The exploratory factor analysis (EFA) was used as an item-reduction technique and to address the dimensionality of the organization and group-level safety climate scales. Rules used for the factor analysis were: factors with eigenvalues greater than 1 were retained, items with loadings <0.40 or cross-loadings within 0.20 of a significant loading were removed from the analysis, and items with communalities <0.50 were removed from the analysis (Hinkin, 1998). This process was repeated until a clear factor structure matrix was obtained. The factor loadings, eigenvalues for the factors, percentage of explained variance by the factors, and internal reliability statistics are shown in Tables 3 and 4. This process resulted in a 14-item, four-factor solution for OSC (management commitment to safety, safety policies and procedures, safety training, and vehicles and equipment). A 10-item, three-factor solution was obtained for GSC (commitment and support, work pressure, and safety briefings). A list of the organization and group-level safety climate items can be found in Appendix B. All factors for organization and group safety climate displayed adequate internal reliability with Cronbach's α scores above 0.7 (Nunnally, 1978).

3.3. Study 3: Instrument validation study

To validate the new safety climate scales, we invoked an independent sample from 19 USAF organizations. These organizations consisted of 13 continental United States (CONUS) and six overseas organizations. None of the organizations in the pilot study were included in the validation study data. In total, 1733 air freight handlers were invited to participate in the web-based survey, and 260 responses were received (15.0% response rate). While lower than preferred, this response rate was also within the normal range of military studies (Miller & Aharoni, 2015). Furthermore, Miller and Aharoni (2015) found that junior military members (i.e., line workers) respond to surveys at a much lower rate than mid-level and senior military members. This phenomenon was true in the current study, as line workers were under-represented (see sample to population comparison in Table 5).

The average age of the respondents was 28.7 years (SD = 6.3), and the average years of work experience was 10.98 years (SD = 8.1). To assess the characteristics of the sample relative to the population, a comparison was made with regards to job category and age distribution (see Table 5). The sample was overrepresented by first line supervisors ($p < 0.001$) and under-represented by line workers ($p < 0.001$). No difference in age between the survey sample and population was identified. Therefore, we recommend caution when attempting to generalize these findings.

The same survey administration procedures used in the pilot study were once again used for the validation study. Although 260 responses were received, 13 responses were deleted due to unengaged respondents. The unengaged respondents were identified due to answering all questions as a "7", including the items that had been reverse coded. No issues were found with missing responses in this study. This resulted in a final sample of 247 responses (14.3% response rate). A non-response bias test was conducted to compare responses of early and late respondents. Once again, groups were separated into early and late responders based on those that responded to the first e-mail versus those that responded to follow-up e-mails. A t-test analysis was used to determine if significant differences existed between the two groups. For the early versus late respondents, results showed that there was a significant difference in responses for only 1 out of 15 variables (OVE2, $p = 0.009$). Based on the above results, it was determined that non-response bias was not a significant concern in this study.

The survey included the 15-item OSC scale, the 10-item GSC scale, a 5-item self-reported safety behavior scale (Mearns, Whitaker, & Flin, 2003; Mearns, Hope, Ford, & Tetrick, 2010; Rundmo, 1996; Rundmo, 2000), two questions addressing the

Table 4
EFA results for group-level safety climate scale.

	Factor		
	F1	F2	F3
F1: Commitment and support (CA = 0.886)			
GMCS1	**0.80**	–	–
GMCS2	**0.77**	–	–
GMCS3	**0.79**	–	–
GMCS4	**0.80**	–	–
F2: Work pressure (CA = 0.815)			
GWP1	–	**0.90**	–
GWP2	–	**0.76**	–
GWP3	–	**0.61**	–
F3: Safety briefings (CA = 0.868)			
GSB1	–	–	**0.79**
GSB2	–	–	**0.80**
GSB3	–	–	**0.78**
Eigenvalues	5.12	1.53	1.00
Percentage Variance	51.24	15.31	10.00
Cumulative Variance	51.24	66.55	76.55

Note. Only factor loadings above 0.3 are shown.

Table 5
USAF air freight handler sample and population comparison (instrument validation study).

	Population	Sample
Number	4530	260
Age	27.6	28.8
SD	6.4	6.0
	Population	Sample
Line workers	51.3%	36.4%
First line supervisors	39.4%	53.5%
Second-line supervisors	9.3%	10.1%

frequency of injuries and near misses (Goldenhar, Williams, & Swanson, 2003; Iverson & Erwin, 1997), and demographic questions.

Although the pilot study resulted in a 14-item OSC scale, one of the items was found to be a double-barreled question. This item, OT1, was divided into two questions (see Appendix B), which resulted in the 15-item OSC scale. For the safety climate and safety behavior scales, respondents were asked to indicate on a 7-point Likert scale the extent to which they agreed or disagreed with the statements (strongly disagree to strongly agree).

To validate the safety climate measurement scales, several approaches were used. First, a series of confirmatory factor analyses (CFA) were performed to assure factor structure validity of the newly developed safety climate scales. Separate CFAs were performed and interpreted for both the pilot survey and validation survey data. In addition to the χ^2 test statistic, the quality of model fit was assessed using the standardized root mean square residual (SRMR), comparative fit index (CFI), goodness of fit index (GFI), normed fit index (NFI), and root mean square error of approximation (RMSEA). For CFI, 0.95 or greater is evidence of approximate fit (Hu & Bentler, 1999). For GFI and NFI, 0.90 or greater is evidence of approximate fit (Bentler & Bonnet, 1980; Joreskog & Sorbom, 1982; Kline, 2011). An SRMR under 0.08 signifies an acceptable fit (Hooper, Coughlan, & Mullen, 2008; Kline, 2011). Finally, an $\text{RMSEA} < 0.05$ is evidence of a good model fit; $0.05 < \text{RMSEA} < 0.08$ indicates a reasonable model fit; and an $\text{RMSEA} > 0.10$ indicates a poor model fit (Browne & Cudeck, 1993; Hair, Black, Babin, & Anderson, 2010). Next, discriminant validity was demonstrated performing the Fornell and Larcker (1981) test. Finally, criterion-related and incremental validity were analyzed separately by performing multiple regressions to investigate the relationship between safety climate and self-reported safety behavior.

3.3.1. Phase 1: Dimensionality

A series of CFAs using maximum likelihood estimation was performed to cross-validate the organization and group-level safety climate scales that were obtained through the pilot study EFA. Separate CFAs were performed on the pilot study data ($n = 165$ for OSC; $n = 150$ for GSC) and on the validation study data ($n = 247$ for both organization and group-level safety climate). For both the pilot study data and validation data, three models were assessed with each level of safety climate, and the results are displayed in Table 6. First, a correlated four-factor organization-level safety climate model (and three-factor

Table 6
CFA results for organization and group-level safety climate.

Models	Fit indices							
	X^2 (df)	X^2/DF	*p*-value	GFI	CFI	NFI	SRMR	RMSEA (90% CI)
A. Org-level safety climate								
Pilot study (n = 165)								
Model 1: Four-factor	139.44 (71)	1.96	***	0.89	0.95	0.91	0.05	0.08 (0.06, 0.10)
Model 2: Single-factor	157.54 (67)	2.35	***	0.88	0.93	0.89	0.07	0.09 (0.07, 0.11)
Model 3: 2nd order hierarchical	144.82 (73)	1.93	***	0.89	0.95	0.90	0.06	0.08 (0.06, 0.10)
Validation study (n = 247)								
Model 1: Four-factor	198.78 (82)	2.42	***	0.90	0.95	0.91	0.06	0.08 (0.06, 0.09)
Model 2: Single-factor	229.94 (83)	2.77	***	0.88	0.93	0.90	0.06	0.09 (0.07, 0.10)
Model 3: 2nd order hierarchical	209.48 (84)	2.49	***	0.90	0.94	0.91	0.06	0.08 (0.07, 0.09)
B. Grp-level safety climate								
Pilot study (n = 150)								
Model 1: Three-factor	55.64 (30)	1.86	***	0.94	0.97	0.94	0.04	0.08 (0.04, 0.11)
Model 2: Single-factor	43.33 (26)	1.74	0.01	0.94	0.98	0.95	0.04	0.07 (0.03, 0.10)
Model 3: 2nd order hierarchical	55.64 (30)	1.86	***	0.94	0.97	0.94	0.04	0.08 (0.04, 0.11)
Validation study (n = 247)								
Model 1: Three-factor	41.20 (30)	1.37	0.08	0.97	0.99	0.97	0.04	0.04 (0.00, 0.07)
Model 2: Single-factor	55.75 (29)	1.92	0.02	0.96	0.98	0.95	0.04	0.06 (0.04, 0.09)
Model 3: 2nd order hierarchical	41.20 (30)	1.37	0.08	0.97	0.99	0.97	0.04	0.04 (0.00, 0.07)

Notes: $p < 0.001$.

group-level safety climate model) based upon the pilot study EFA was assessed. Next, a one-factor, unidimensional model was assessed for both the organization and group-level safety climate scales to determine if single latent variables would be best in analyzing the new safety climate scales. Finally, 2nd order hierarchical models were assessed in which the factors found during the pilot study EFAs were modeled as reflective indicators for the higher-order safety climate scales.

For OSC, all three models fit the data reasonably well with GFIs and NFIs near or above the 0.90 threshold, CFIs near or above the 0.95 threshold, SRMRs under 0.08, and RMSEAs showing good or reasonable model fit. However, the 2nd order hierarchical model and the correlated four-factor model consistently had the best model fit across all fit indices, while the unidimensional model failed to meet the minimum fit indices threshold for GFI and CFI. For GSC, once again all three models fit the data reasonably well with GFIs and NFIs well above the 0.90 threshold, CFIs well above the 0.95 threshold, and SRMRs well below acceptable levels of fit thresholds. Once again, the 2nd order hierarchical model and correlated three-factor model consistently displayed the best model fit ($\chi^2 = 41.20$, df = 30, p-value = 0.08; GFI = 0.97; CFI = 0.99; NFI = 0.97; SRMR = 0.04; RMSEA = 0.04, 90% CI (0.00, 0.07)). These findings were consistent across both the pilot and validation studies. These findings offer support for the construct validity and dimensionality of the safety climate scales created during the pilot study.

3.3.2. Phase 2: Discriminant and criterion-related validity assessment

Discriminant validity, the extent to which a measure does not correlate with an unrelated measure, was investigated by performing the Fornell and Larcker (1981) test. Discriminant validity is supported if the square root of a constructs average variance extracted (AVE) is greater than the correlations between that construct and other constructs under investigation. Results of the Fornell and Larcker (1981) test show that the square roots of all constructs' AVEs were greater than any correlation between constructs (see Table 7). This result provides evidence of discriminant validity of the scales.

Criterion-related validity, the extent to which a measure correlates with another theoretically related measure, was examined by performing an OLS regression analysis to assess the relationship between the safety climate dimensions and self-reported safety behaviors. Safety research has shown that safety climate is related to safety performance across a wide range of industries and has been implicated as a key factor in promotion of injury-reducing behavior (Barling et al., 2002; Fogarty & Shaw, 2010; Griffin & Neal, 2000; Huang, Chen, DeArmond, Cigularov, & Chen, 2007; Huang et al., 2013a; Kelloway et al., 2006; Zohar, 2002). Therefore, evidence of criterion-related validity would be demonstrated if there is a positive relationship between the safety climate dimensions and self-reported safety behaviors.

The individual safety behaviors construct was used in this study because it provides a measurable criterion for researchers, and it is more closely related to psychological factors than actual accidents or injuries (Christian et al., 2009). Safety behavior was measured using a five-item scale intended to assess behavioral patterns that involve breaking rules and taking chances in core activities (Mearns et al., 2010). This scale has been found to be reliable across different industries with a Cronbach's α ranging from 0.74 to 0.86 (Mearns et al., 2003; Mearns et al., 2010; Rundmo, 1996, 2000). This scale includes questions such as "I ignore safety regulations to get the job done" and "I take shortcuts which involve little or no risk." For the analysis, these items were reverse coded to represent positive safety behavior.

Means, standard deviations, Cronbach's α's, and Pearson correlation coefficients were calculated using SPSS and individual-level data. As shown in Table 7, all constructs displayed sufficient internal reliability with Cronbach's α's above 0.70 (Nunnally, 1978). To test the criterion-related validity of the organization and group-level safety climate dimensions, the data collected from all organizations (n = 318) that participated in the validation study were used for the regression analyses.

Of note, given the validation results, self-reported safety behaviors were regressed on individual perceptions of the organization and group-level safety climate dimensions (versus global OSC and GSC scales). Results are presented in Table 8. Individual perceptions of OSC and GSC dimensions explained 28.9% and 26.8% of the variance in self-reported safety behaviors, respectively. For OSC, the management commitment, safety policies and procedures, and vehicles and equipment dimensions were positively related to safety behaviors. Safety training, on the other hand, was not related to self-reported safety behaviors. For GSC, the commitment and support and work pressure dimensions were positively related to self-reported

Table 7
Means, standard deviations, Cronbach's α's, and correlations.

Construct	*M*	*SD*	α	AVE	1	2	3	4	5	6	7	8
1. Management commitment	5.77	1.13	0.80	0.58	**0.76**							
2. Safety policies & procedures	5.57	1.20	0.78	0.57	0.52	**0.75**						
3. Safety training	5.26	1.25	0.91	0.63	0.45	0.62	**0.79**					
4. Vehicles & equipment	4.99	1.47	0.83	0.62	0.47	0.49	0.61	**0.79**				
5. Commitment & support	6.01	0.90	0.89	0.61	0.40	0.47	0.58	0.47	**0.78**			
6. Work pressure	4.78	1.45	0.79	0.58	0.52	0.35	0.40	0.36	0.44	**0.76**		
7. Safety briefings	5.58	1.07	0.72	0.50	0.40	0.44	0.58	0.40	0.62	0.31	**0.71**	
8. Safety Behaviors	5.49	1.26	0.91	0.67	0.39	0.53	0.40	0.35	0.48	0.44	0.38	**0.82**

Notes. Org-level safety climate consists of management commitment, safety policies & procedures, safety training, and vehicles & equipment. Grp-level safety climate consists of commitment & support, work pressure, and safety briefings.
Square root of AVE shown on diagonal in bold. $p < 0.001$ for all correlations.

Table 8
Criterion-related validity regression analyses (n = 318).

DV: Safety Behaviors	R^2	F	B(SE)	*p*-value
OSC regression	0.298	34.64		<0.001
(Constant)			1.93(0.33)	<0.001
OMC (Management commitment)			0.14(0.06)	<0.05
OSP (Safety policies & procedures)			0.40(0.07)	<0.001
OT (Safety training)			0.01(0.06)	=0.82
OVE (Vehicles & equipment)			0.10(0.07)	=0.05
GSC regression	0.268	39.60		<0.001
(Constant)			1.55(0.40)	<0.001
GMCS (Commitment & support)			0.41(0.09)	<0.001
GWP (Work pressure)			0.22(0.04)	<0.001
GSB (Safety briefings)			0.10(0.07)	=0.14

Table 9
Incremental validity regression analyses (n = 318).

DV: Safety Behaviors	R^2	F	B(SE)	*p*-value
Model 1	0.272	119.69		<0.001
(Constant)			2.52(0.29)	<0.001
OMC (Management commitment)			0.54(0.06)	<0.001
Model 2	0.291	66.10		<0.001
(Constant)			2.52(0.29)	<0.001
OMC (Management commitment)			0.18(0.06)	<0.01
OSP (Safety policies & procedures)			0.45(0.06)	<0.001
Model 3	0.300	46.31		<0.001
(Constant)			1.94(0.33)	<0.001
OMC (Management commitment)			0.14(0.06)	<0.05
OSP (Safety policies & procedures)			0.41(0.06)	<0.001
OVE (Vehicles & equipment)			0.11(0.05)	<0.05

safety behaviors, while the safety briefings dimension was not related. These findings support the criterion-related validity of some of the safety climate dimensions in this context. These results and their implications are further discussed below.

3.3.3. Phase 3: Incremental validity

Haynes and Lench (2003; pg. 457) define incremental validity as "the degree to which a measure explains or predicts some phenomenon of interest, relative to other measures." As previously mentioned, safety climate researchers have encouraged the development and use of industry-specific safety climate measures (Zohar, 2010). Therefore, we also assessed the incremental criterion-related validity of the air freight handling industry-specific dimensions.

Of the final validated dimensions in the air freight handling safety climate scale, only one dimension was deemed context-specific, vehicles and equipment (OSC). We argue this dimension represents a unique aspect of the air freight handling context. Vehicles and equipment of all types are an important part of the daily duties of an air freight handler, whereas vehicles and equipment may not be as important to the daily duties of a manufacturing line worker, for instance. We understand other contexts may share vehicles and equipment as an important dimension, but here we seek to determine if this dimension provides additional safety-related information to managers in this context.

To determine the relative importance of the vehicles and equipment dimension, we conducted a stepwise regression of the validated OSC dimensions. Three models revealed the relative impact of each dimension (see Table 9). As can be seen, the relative impact of the vehicles and equipment dimension on self-reported safety behaviors was a 1% increase in explanatory power. These results reveal that while this dimension may provide some context-specific information to managers, the impact this dimension has on safety behaviors may be limited.

4. Discussion and implications

The purpose of this study was to develop a reliable and valid air freight handling safety climate scale. The newly developed scale represents a multi-dimensional, multi-level framework by separating the safety climate scale into perceptions of organization- and group-level constructs, as recommended by Zohar (2010). Results from this study provided initial evidence of the reliability and validity of the newly developed safety climate measure. However, more work must be done to evaluate the measures on a broader scale. Hereafter, we discuss the value of the scale, present the research and managerial implications of the study, identify the limitations of the study, and provide recommendations for future research.

4.1. Value of the air freight handling safety climate construct

The value of research in the air freight handling context cannot be understated. First, the validated scale can serve as a leading indicator for safety behaviors in the air freight handling industry (Christian et al., 2009). As such, this information can help leaders institute proactive mechanisms to mitigate unsafe behavior, and perhaps prevent future mishaps. Next, the new safety climate construct may be able to help differentiate between low and high-performing organizations when it comes to creating a climate of safety. Leaders can look to the high-performing organizations to discover potential best practices that can be instituted throughout the industry. Also, the safety climate scale can help diagnose organizations with low perceived safety climate and identify ways to help improve this climate. For instance, one can look to see which dimension of organization or group-level safety climate needs improvement, and a plan can be tailored specifically for that organization to address its issue(s). Finally, the air freight handling safety climate scale can be used to identify disconnects between the organization-level safety climate and group-level safety climate. Since supervisors may have discretion in how they implement top management's safety policies, and because individual differences between group-level supervisors exist, organization's safety policies may be executed differently by each workgroup (Zohar, 2008). Therefore, if the organization-level safety climate is found to be much higher than the group-level safety climate in an organization, it could be indicative of the group-level managers not fostering the same level of commitment to safety as the organization's leaders. This phenomenon could also signify that group-level supervisors have misunderstood safety policies and procedures. This scenario could signal the need for leadership at all levels to come together and ensure unity of effort throughout the organization.

4.2. Research implications

This research makes several important contributions to the safety climate body of knowledge. First, although current safety climate research is robust, no effort had been expended to explain safety climate in the air freight handling industry. This industry is characterized by dangerous work where accidents can have far-reaching implications, and safety issues in this arena need to be addressed. This paper addresses Zohar's (2010) call for industry-specific safety climate scales and serves as the initial study on the predictors of safety performance in the air freight handling industry.

Various safety climate dimensions that were found to be important in the air freight handling industry (specifically, management commitment to safety, supervisor/coworker commitment and support, safety policies and procedures, and work pressure) are also important across most industries (Flin et al., 2000), to include transportation (air, rail, and trucking; Fogarty & Shaw, 2010; Morrow et al., 2010; Swartz & Douglas, 2009). Perhaps more importantly, these dimensions were all found to be positively related to self-reported safety behaviors, which has also been noted in other similar contexts (Cucuruto et al., in press; Crum & Morrow, 2002; Fogarty, 2004; Fogarty & Shaw, 2010; Morrow & Crum, 2004; Morrow et al., 2010).

This study's results get to the heart of safety climate in that, just like their counterparts in other industries, air freight managers must enact visible, effective safety management systems (through formal policies and procedures; Fernández-Muñiz, Montes-Peón, & Vázquez-Ordás, 2012). Many studies focus on the impact of management commitment to safety and safety systems on safety behavior, but fewer studies have focused on the nature of the enacted organizational safety policies and procedures. Our study reveals that safety climate research in this context should consider not only the existence of safety policies and procedures, but also how easy the policies and procedures are to understand and follow.

Extending this line of thinking, in our experience in this industry, we have seen disconnects between what exists on paper (as formal policies and procedures at the organizational level) and what happens on the flight line (at the workgroup level). That is, policies and procedures exist at the organization-level; however, group-level managers (supervisors) have the authority to use discretion in implementing those policies and procedures. This phenomenon provides further evidence for researchers to take a multi-level perspective to safety climate, particularly in the current context.

Additionally, the current study reveals how the safety climate construct can represent or measure, at various points in time, employee perceptions of the safety management system. For example, if individual employees don't perceive safety policies and procedures are enacted and enforced by supervisors and coworkers daily, safety can be compromised (Zohar, 2008). With the right safety policies and procedures in place, line supervisor and coworker actions to monitor safety performance and hold employees accountable seem to be more important in influencing safety behavior than organizational management's implicit support for safety. Actions taken by personnel that air freight handlers work for (and with) daily will represent which safety policies and procedures are enacted. For example, the air freight handling industry is a high-pressure industry whereby an aircraft's on-time takeoff is all important. Supervisors must be cognizant of the messages they are sending to employees that may signal, for instance, an on-time flight is more important than the safety of the air freight handlers. This pressure could lead to unsafe behaviors, and perhaps errors and mishaps (Fogarty, 2004).

Additionally, three more context-focused dimensions (i.e., safety training, vehicles and equipment, and safety briefings) were identified in the qualitative phase of the study. Of these three dimensions, however, only the "vehicles and equipment" dimension was found to influence self-reported safety behaviors. This finding is consistent with our expectations in this context, as safe, operational vehicles and equipment are essential to safe and efficient aircraft loading and unloading. Moreover, the requirement for good vehicles and equipment came up frequently during the interviews.

We did find the lack of relationship between the other two dimensions (safety training and safety briefings) and safety behaviors to be surprising. The interviews revealed that safety briefings are given frequently throughout the day in the air freight handling industry. For example, safety briefings are given at the beginning of each shift and prior to loading cargo onto an aircraft, at a minimum. We equated this to consistent safety communication, which has been important in past safety climate research in transportation contexts (Cucuruto et al., in press; Morrow et al., 2010; Swartz & Douglas, 2009). However, recent research has revealed safety communication may be distinct from, but related to, safety climate. That is, solid top-down and bottom-up safety communication may enhance perceptions of safety climate (Huang et al., 2018). Safety briefings in this context provide air freight handlers with important safety information, while also providing a forum for them to bring up or discuss important safety issues with a supervisor. Therefore, we conducted a post hoc regression analysis to further evaluate the potential relationship between safety briefings and the other group-level safety climate dimensions. Regression results revealed that safety briefings positively influence perceptions of group-level safety climate dimensions (see Table 10). Specifically, safety briefings may enhance perceptions of commitment and support while easing perceptions of work pressure. Safety climate researchers should continue to consider the impact of safety communication in future research, perhaps taking these nuanced results into consideration when determining the content of the safety climate construct.

Overall, measurement scale dimensions in this context are like those in other high-risk, transportation contexts, and we argue the nomological network may be converging on a cross-context set of safety climate dimensions. Recent studies have achieved success in creating generic, multi-level safety climate scales (e.g., Huang et al., 2017; Lee et al., 2014). The primary advantage of these scales is that managers can use the short scales to quickly and frequently collect valid, actionable safety climate data (Hahn & Murphy, 2008). We agree there is a managerial need for this type of scale. However, we note that the scale developed in the current study was only 25 items, and 16 out of the 25 scale items contained context-specific language for the air freight handling industry. While there were some issues with the criterion-related validity of the dimensions, we argue context-specific information can still be used by managers to address important safety-related issues in their organizations. We discuss some of the managerial implications in the next section.

4.3. Managerial implications

From our study (and personal experience), we found managers of air freight handlers face multiple challenges in a fast-paced, high-risk context, and they need tools to help them focus their valuable time in areas that will provide the most impact. For example, many managers already attempt to administer safety surveys annually or bi-annually to gauge the safety climate of their organizations. However, the surveys they use are not based on rigorous construct/scale development procedures, they are very long, and the results are not necessarily tied directly to safety outcomes (i.e., safety attitudes, incidents, close calls, etc.). The surveys can also overlap with other (largely unrelated) organizational climate surveys that are also administered annually or bi-annually. Surveys are often administered to the entire organization during a single administration period. As a result, survey fatigue is a real thing that managers face.

We argue that air freight managers could use the newly developed survey in their daily efforts. For example, because the survey is relatively short in length, managers could administer the new safety climate survey to smaller groups at more frequent intervals as a proactive measure (versus waiting for an incident to happen). In this light, managers could gain an in depth understanding of the impact an individual's safety climate perceptions may have on his or her safety decision-making process. Or, they could simply identify the potential problem areas within their organizations and workgroups and focus their efforts on improving areas that may have the most impact on broader safety outcomes. That is, survey results could be used to see which safety climate sub-dimension plays the largest role in influencing employee safety behaviors in their respective organization. This information could allow managers to focus their efforts on improving specific areas to have the biggest impact on safety behaviors.

Additionally, safety climate survey results could be compared over time to determine if actual improvement or deterioration is occurring and adjustments can be made accordingly. The safety climate scores could serve as a gauge to see if safety climate improvement initiatives are successful or not. These actions would likely improve the safety climate, showing personnel that management and supervisors are serious about safety and are being proactive to avoid incidents.

Table 10
Post hoc regression analyses (n = 318).

Model 1 DV: GMCS (Commitment & support)	R^2	F	B(SE)*	*p*-value
	0.38	195.33		<0.001
(Constant)			3.30(0.20)	<0.001
GSB (Safety briefings)			0.49(0.04)	<0.001
Model 2 DV: GWP (Work pressure)	R^2	F	B(SE)*	*p*-value
	0.08	29.20		<0.001
(Constant)			2.71(0.39)	<0.001
GSB (Safety briefings)			0.37(0.07)	<0.001

Furthermore, if managers do not want to administer surveys because of survey fatigue or other issues, they can use the information from this study (and the survey content) to understand the most important focus areas for safety at the organizational and workgroup levels. For instance, from the beginning, researchers have shown that improvement in management attitudes and commitment towards safety are mandatory prerequisites for improving the safety in an organization (Zohar, 1980). By understanding the management commitment to safety sub-dimension for organization-level safety climate and the commitment and support sub-dimension for group-level safety climate, leaders can perhaps qualitatively assess employee perceptions of leadership commitment to safety at the current time and in the future.

Finally, it was found that organization and group-level safety climate perceptions exist for air freight handlers, and that perceptions of organizational safety policies and procedures, management commitment to safety (at both the organization and group levels), and supervisory work pressure were related to self-reported safety behaviors. This signals to managers that it is not only important for direct supervisors to be better leaders that display a sincere commitment to safety and reduce work pressure, but also that organizational leaders may have to examine the organization's formal policies and procedures to ensure they are straight-forward, non-contradictory, and help establish an environment that does not subjugate safety to operational performance.

5. Limitations and future research

Although this research provides numerous contributions to theory and practice, it is not without key limitations that must be acknowledged. First, USAF air freight handlers were used as the sample for this study, and this may impact the generalizability of the findings. Since the intent of this research was to create an air freight handling industry-specific safety climate scale, this limitation must be addressed. We first clarify to the reader that the military context we were studying represents the standard military airport, not tactical (austere) combat operations (i.e., delivering special operators like Navy SEALS to direct combat operations). We agree that air freight handling processes/procedures during tactical operations can be different. However, that was not the focus of our study, as we interviewed/surveyed personnel conducting day-to-day, global cargo and personnel movement operations that are very similar to commercial airport operations. These operations make up the majority of U.S. military air freight and passenger handling operations. In this context, the duties required of USAF air freight handlers were identified and compared to the duties of civilian air freight handlers, and these duties were found to be similar. In fact, in our experience, it is common for ex-military personnel to be recruited by and work in civilian air freight handling organizations because of their high level of proficiency and familiarity with commercial air freight handling processes/procedures. Additionally, many organizational features in our sample are not exclusive to the military. Many organizations have employees that must engage in high-risk and stressful activities and have employees that must work directly with others in a team setting (Dvir, Eden, Avolio, & Shamir, 2002). That said, one could argue there are important differences in the hierarchical structures of military and civilian organizations. This difference reveals an interesting future research opportunity focused on how organizational differences (such as hierarchy) affect safety attitudes and outcomes in organizations. In the end, safety is of vital importance to both military and civilian organizations, and previous safety and leadership research in both military and civilian contexts suggests studies in both contexts can provide useful information (Fogarty, 2004; Zohar & Luria, 2004; Zohar & Tenne-Gazit, 2008). Even so, follow-on studies that include civilian air freight handlers should be conducted.

A second limitation of this study arises due to using self-reported measurement scales in the survey. By using self-reported measurement scales, common method bias may be a concern, and some have noted that it may be a major threat to reliability and validity (Roxas & Lindsay, 2012). To address this potential limitation, this study used several common method and social desirability bias minimization and detection techniques. First, an anonymous, web-based survey was chosen for this research because research shows they may result in lower social desirability bias (Joinson, 1999). A non-response bias test was also performed. Finally, Harmon's one factor test was performed to determine if common method variance was an issue in the study (Podsakoff & Organ, 1986). If common method variance were a serious issue, one would expect a single factor to emerge from a factor analysis. The test led to six factors with eigenvalues greater than one being extracted with factor 1 accounting for 38% of the variance. Although results of these analyses suggest that common method bias was not a concern in this study, future studies should incorporate operational safety metrics and observed safety practices as outcomes.

The creation of the air freight handling safety climate scale also has important implications for future research. First, using the newly created scale, studies can be undertaken to determine how safety climate is created within the air freight handling environment. In addition to how safety climate is created in this industry, mediating and moderating variables can be examined to discover what variables play a role in translating safety climate to safety behaviors.

In conclusion, the air freight handling industry is a high-risk environment with unique safety challenges. As researchers and practitioners, it is our duty to develop better methods to help reduce safety incidents throughout the industry. It has been shown that relying on safety recommendations is not enough to prevent future accidents (NTSB, 2015), and that a climate of safety can help reduce accidents and injuries (Zohar, 2010). The goal of this research was to develop and validate an air freight handling-specific safety climate scale that encompassed both the organization and group level practices to better understand how safety climate is developed and perceived in this environment. Although more research is required, this study provides a solid foundation for future safety research in the air freight handling industry.

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Appendix A. Safety climate interview protocol

Leadership/safety officer interview script

1a. Talk to me about the most common safety-related decisions air freight handlers make. Are there ever disconnects between what they know is the right thing to do and what they feel they need to do to get the job done?

1b. Can you provide me an example of one of those situations in which an air freight handler experienced a disconnect and had to make a difficult decision? What was the outcome? How do you think the outcome affected his/her future decision-making?

1c. How do you think the air freight handlers made the decision? In other words, what things did he/she consider when making the decision?

2. What are some of the consequences (positive and negative) you think air freight handlers consider when determining whether or not to make a safe decision?

3a. Think about the daily practices supervisors and leaders use to ensure air freight handlers perform their duties (i.e., task assignment; allotted time to complete the task; follow-up). What are some issues or things, with respect to those practices, that impact (either help or hurt) their abilities to make safe decisions?

3b. Think about the safety policies and procedures air freight handlers must abide by every day (PPE, HAZMAT use, TO use, etc.). What are some issues or things, with respect to the policies, that impact (either help or hurt) their abilities to make safe decisions?

3c. Think about the enforcement of the policies and procedures (leadership presence, QA, inspections, etc.). What are some issues or things, with respect to enforcement, that impact (either help or hurt) air freight handlers abilities to make safe decisions?

4a. How responsible do you feel an individual is for their safety at work, and in what ways?

4b. How responsible do you feel supervisors and leaders are for an individual's safety at work, and in what ways?

Line worker interview script

1a. Talk to me about the most common safety-related decisions you make. Are there ever disconnects between what you know is the right thing to do and what you feel you need to do to get the job done?

1b. Can you provide me an example of one of those situations in which you (or a fellow freight handlers) experienced a disconnect and had to make a difficult decision? What was the outcome? How did the outcome affect your (or the other person's) future decision-making?

1c. How did you make your decision? In other words, what things did you consider when making the decision?

2a. What are some of the consequences (positive and negative) you consider when determining whether or not to make a safe decision?

2b. What are some of the consequences (positive and negative) you consider when determining whether or not to make an unsafe decision?

3a. How responsible do you feel for your safety at work, and in what ways are you responsible?

3b. How responsible do you feel your supervisors and leaders are for your safety at work, and in what ways?

4a. Think about the daily practices supervisors and leaders use to ensure you perform your duties (i.e., task assignment; allotted time to complete the task; follow-up). What are some issues or things, with respect to those practices, that impact (either help or hurt) your ability to make safe decisions?

4b. Think about the safety policies and procedures air freight handlers must abide by every day (wear PPE, HAZMAT use, TO use, etc.). What are some issues or things, with respect to the policies, that impact (either help or hurt) your ability to make safe decisions?

4c. Think about the enforcement of the policies and procedures (leadership presence, QA, inspections, etc.). What are some issues or things, with respect to enforcement, that impact (either help or hurt) your ability to make safe decisions?

Appendix B. Safety climate scale items

Organization-level safety climate (OSC)

Sub-dimension: management commitment to safety

OMC1. Top management in my organization (squadron-level leadership) places safety over mission accomplishment.

OMC2. Top management in my organization (squadron-level leadership) does not mind if an aircraft is delayed if it is due to safety.
OMC3. Top management in my organization (squadron-level leadership) is strict about working safely even if work falls behind schedule.

Sub-dimension: safety policies and procedures

OSP1. Current Safety rules are easy to understand.
OSP2. Current safety rules help keep me safe (e.g., double hearing protection, use of spotters).
OSP3. Current safety procedures reflect how the job is actually performed.

Sub-dimension: safety training

OT1. My organization provides thorough training on every piece of equipment and vehicle we use. [*]
OT2. Training is received in a timely manner when new procedures are introduced.
OT3. My organization provides realistic training that prepares us for the high-stress environment we operate in.
OT4. Training is received at regular intervals to refresh and update knowledge.
OT5. There is an effective training program for all new employees.

[*] OT1 was deemed a double barreled question and subsequently broken into separate questions for equipment and vehicles for the validation study.

Sub-dimension: vehicles and equipment

OVE1. The vehicles we are provided are in good working order.
OVE2. We are provided the appropriate vehicles to get the job done in the safest manner.
OVE3. The vehicles we are provided are maintained to the highest safety standards.

Group-level safety climate (GSC)

Sub-dimension: management commitment and coworker support

GMCS1. My work-shift supervisor (e.g., shift foreman, shift lead for flight or section if in an AMS) enforces safety rules and procedures (use of spotters, chocking vehicles, seat belt use, etc.).
GMCS2. My work-shift supervisor (e.g., shift foreman, shift lead for flight or section if in an AMS) quickly corrects any unsafe behavior, even if it did not result in an accident.
GMCS3. Coworkers in my workgroup ensure everyone uses the appropriate safety equipment for the job (e.g., hearing protection, gloves, and fall protection).
GMCS4. Coworkers in my workgroup expect other workers to behave safely.

Sub-dimension: work pressure

GWP1. I am encouraged to work faster, rather than by the rules whenever workload builds up.
GWP2. I feel rushed to complete a task if I am behind schedule.
GWP3. Punishment for missing a schedule of event (e.g., delaying an aircraft) is more severe than punishment for working unsafely.

Sub-dimension: safety briefings

GSB1. Recent safety-related events (e.g., injuries and accidents) are incorporated into safety briefings.
GSB2. Personal experiences are used to help strengthen safety briefings.
GSB3. Safety briefings are engaging enough to keep members of my workgroup interested.

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