Improving the Measurement of Patient Safety: Development of a New Patient Safety Climate Survey

by

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Abstract

Improving the Measurement of Patient Safety: Development of a New Patient Safety Climate Survey

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Abstract: The purpose of this study was to develop a theoretical framework for describing the mechanisms behind the creation of a patient safety climate. This framework was used to develop a new healthcare safety climate survey that measured both aspects of patient safety and occupational safety. The psychometric properties of this survey were tested using a group of Canadian healthcare professionals. Exploratory factor analysis (EFA) indicated a four factor model of patient safety climate and a two factor model of occupational safety climate. In addition, this study also examined the relationship between patient safety and occupational safety. Correlational analyses revealed a moderate and positive correlation between patient safety and occupational safety. Overall, the results from this study offer some evidence of the good psychometric properties of the healthcare safety climate survey; however further development and validation of the instrument is necessary before drawing any conclusions.

August 25, 2008

Improving the Measurement of Patient Safety: Development of a New Patient Safety Climate Survey

In recent years the healthcare industry has been scrutinized for the number of medical error and patient injury occurrences. This criticism has come from both inside the industry, where debates over patient safety have become commonplace (Thomas, 2006) and in the public domain from various media sources. All of which has lead to the emergence of a *"patient safety movement"* (Thomas, 2006). Although the concept of patient safety has been around for as long as modern medical history, it was not until the early 1990's when a number of research studies examining the prevalence of adverse events and medical errors were published that the present day patient safety movement began (Leape, 2008). At the height of this era was the release of the groundbreaking report by the Institute of Medicine (IOM) in 1999. With the release of this report, and the Baker report (Baker, Norton, Flintoft, Blais, Brown, Jafna Cox, et al., 2004) a few years later, patient safety became a prominent concern within Canada.

There is now consensus within the international community that approximately 10% of all hospitalized patients experience a treatment-based injury, half of which are preventable (Leape, 2008). Within Canada, it has been reported that appropriately 7.5% of patients admitted to an acute care hospital in the year 2000 suffered from an adverse event, with 36.9% of these events reported as highly preventable (Baker et al., 2004). Baker and colleagues defined an adverse event has "an unintended injury or complication that results in disability at the time of discharge, death or prolonged hospital stay and that is caused by healthcare management rather than by the patient's underlying disease process" (p. 1679). The most common adverse events reported in Canada are associated with medications, infections, and obstetric traumas during childbirth (CIHI, 2007).

Although the exact statistics on the occurrence of medical errors and adverse events are often disputed (*c.f.* McDonald, Weiner, & Hui, 2000; Thomas, 2006), there is little disagreement about the severity of the consequences both for the patients and their families, as well as for the healthcare professional when they do occur.

Many of the failures in patient safety can be attributed to system problems, such as the decentralized and fragmented nature of the healthcare system (IOM, 1999). The culture within healthcare has contributed to the fragmented nature of the industry and is often seen as a potential risk factor for patients (Nieva & Sorra, 2003). Thus one common recommendation put forth to improve patient safety has been to create a culture of safety within healthcare (IOM, 1999; Nieva & Sorra, 2003; Ohlhauser & Schurman, 2001; Pronovost & Sexton, 2005; Vincent, 2005). By creating a positive and safe culture healthcare organizations can eliminate those potential risk factors to patients. However, creating a safety culture is often easier said than done. Although there is increasing emphasis on creating a positive patient safety culture as a means to decrease harm to patients, it is still unclear what is actually meant by the phrase *"safety culture"* (Fleming & Hartnell, 2007), or more importantly, how it relates to adverse events (Flin, 2007). Before we can begin to change the current culture in healthcare, we must first understand what is meant by the concept and its relationship with patient care (Vincent, 2005).

There is an ongoing discussion in the literature as to the distinction between culture and climate. Often times these concepts are used interchangeably (Cox & Flin, 1998); especially within healthcare. Most recently, Guldenmuld (2007) has suggested that culture and climate are not separate constructs, but rather different approaches used to ultimately determine the importance of safety within an organization. However, historically culture and climate have often been considered two distinct but complementary and overlapping constructs (Ostroff, Kinicki, & Tamkins, 2003). The term climate has been used to represent employees shared attitudes and perceptions of both formal and informal organizational policies, practices, and procedures, or *'the way things are around here'* (Reichers & Schneider, 1990). Culture is often described as meaning something less tangible than climate (Flin, 2007) and helps to explain why certain policies, procedures, and practices exist within an organization. According to Reichers and Schneider (1990) culture "exists at a higher level of abstraction than climate, and climate is a manifestation of culture" (p. 29). Therefore safety climate can be described as a function of the safety culture (Ostroff et al., 2003). Thus one way to start to understand the patient safety *culture* in healthcare is to measure the patient safety *climate*.

Patient Safety Climate

Patient safety climate is typically measured using quantitative methods, such as questionnaires. In recent years a number of survey instruments have been developed to assess patient safety climate (e.g. Sexton, Thomas, & Helmreich, 2000; Singer, Gaba, Geppert, Sinaiko, Howard, & Park, 2003; Sorra & Nieva, 2004; Zohar, Livne, Tenne-Gazit, Admi, & Donchin, 2007). Many of these surveys are currently in the public domain and easily accessible to healthcare organizations. The four most commonly used and recommended patient safety climate surveys are described in Table 1. The development process and psychometric properties of these surveys are reviewed below.

Table 1

Summary of Most Commonly Used Patient Safety Surveys

	SAQ	PSCHO	MSI	HSOPS
Patient Safety Factors	Teamwork climate	Unit patient safety norms	Perceived state of safety	Teamwork within units
	Safety climate	Unit recognition & support for safety efforts	Unit leadership for safety	Hospital management support for patient safety
	Perceptions of management	Senior managers engagement	Organizational leadership for safety	Supervisor/manager expectations & actions promoting patient safety
	Stress recognition	Fear of blame	Shame & repercussions of reporting	Nonpunitive response to error
	Job satisfaction	Learning	Safety learning behavior	Organizational learning/ continuous improvement
	Working conditions	Fear of shame		Feedback & communication about error
		Organizational resources for patient safety		Staffing
		Overall emphasis on patient safety		Communication openness
		Provision of safe care		Teamwork across hospital units
				Hospital handoffs & transition

(SAQ) Safety Attitudes Questionnaire (Sexton et al., 2006), (PSCHO) the Patient Safety Climate in Healthcare Organizations (Singer et al., 2007), (MSI) the Modified Stanford Instrument (Ginsburg et al., 2007), (HSOPS) Hospital Survey on Patient Safety Culture (Sorra & Nieva, 2004)

Safety Attitudes Questionnaire (SAQ). The Safety Attitudes Questionnaire (SAQ) was designed to assess frontline workers attitudes regarding patient safety (Sexton & Thomas, 2003; Sexton et al., 2006). This survey is an adaptation of the Intensive Care Unit Management Attitudes Questionnaire (ICUMAQ; Sexton et al., 2000) and the Flight Management Attitudes Questionnaire (FMAQ; Helmreich, Merritt, Sherman, Gregorich, & Wiener, 1993). The SAQ has a 25% overlap in item content with the FMAQ, which was developed to assess safety climate and teamwork within the commercial aviation industry. The reminder of the items was based on risk and quality frameworks (see Sexton et al., 2006). The initial item pool for the SAQ consisted of over 100 items. Through pilot testing the questionnaire content was decreased to 40 items assessing six factors (Sexton et al., 2006) (See table 1). In addition, the authors have included an additional 20 items that they believed were interesting and valuable to managers and hospital leaders (Sexton et al., 2006). Currently there are five versions of the SAQ representing the following clinical areas: Intensive Care Units (ICU), Labour and Delivery, Pharmacy, Operating Rooms (OR), and Ambulatory settings. Each of the clinical specific versions contains the same item content, with only minor modifications to reflect the clinical area being assessed (Sexton & Thomas, 2003). In addition, a shortened version of the survey has been developed that only includes the teamwork climate and safety climate subscales.

Several recent studies have published internal consistency results of some or all of the six climate factors (*c.f.* Bognar, Barach, Johnson, Duncan, Birnbach, Woods, et al., 2008; Huang, Clermont, Sexton, Karlo, Miller, Weissfeld, et al., 2007; Modak, Sexton, Thomas, Helmreich, & Thomas, 2007; Pronovost, Bernholtz, Goeschel, Thom, Watson, Holzmueller, et al., 2008). As can be seen in Table 2 the reported Cronbach alpha levels for the various subscales are similar for each study despite small variations in the numbers of items (e.g., ten item and six item teamwork climate scales have been reported).

Table 2

Summary of Reliabilities for the SAQ Factors

SAQ Factor	Authors	# of Items	Cronbach α's
Teamwork Climate	Huang et al. (2007)	6	.81
	Bognar et al. (2008)	10	.89
	Davenport et al. (2007)	6	.78
	Pronovost et al. (2008)	6	.82
Safety Climate	Huang et al. (2007)	7	.74
	Bognar et al. (2008)	9	.75
	Davenport et al. (2007)	7	.77
	Kho et al. (2005)	7	.51
	Modak et al. (2007)	7	.76
Job Satisfaction	Huang et al. (2007)	5	.81
	Davenport et al. (2007)	5	.83
	Modak et al. (2007)	4	.72
Stress Recognition	Huang et al. (2007)	4	.67
	Bognar et al. (2008)	4	.72
	Davenport et al. (2007)	4	.71
	Modak et al. (2007)	4	.72
Working Conditions	Huang et al. (2007)	4	.73
	Davenport et al. (2007)	4	.72
	Modak et al. (2007)	4	.68
Perceptions of management	Huang et al. (2007)	4	.72
	Davenport et al. (2007)	4	.54
	Modak et al. (2007)	4	.72

Less information is known about the factor structure of the SAQ. Sexton et al. (2006) were the first to report the results of a factor analysis. Using combined samples from three different countries, and from a number of different clinical areas, Sexton et al. reported the results of a multilevel confirmatory factor analysis (CFA) on the 40 item SAQ. Although the authors reported "*satisfactory*" results from the six factor CFA ($CFI = .90$, $RMSEA = .03$, $SRMR_{(between)} = .17$, $SRMR_{(within)} = .04$), according to the cut-off criteria outlined by Hu and Bentler (1999), the results from these model indexes do not provide sufficient evidence of a good fit between the model and the observed data. For example, Hu and Bentler suggest a good fitting model should only be reported when the CFI is approximately equal to .95. Furthermore, in order to get these model indexes the authors deleted ten items using backward elimination procedure (i.e., deleting one item at a time). By making so many modifications to their model, Sexton et al. (2006) went from a theory testing process of confirming a previously existing model of patient safety climate, back to exploratory modeling procedures. Thus, the authors claim that the "SAQ is a psychometrically sound instrument for assessing 6 safety-related climate domains" is a bit premature as they had yet to confirm the new six factor model with 30 items. Modak et al. (2007) was able to partly achieve this. Using the SAQ-A (ambulatory version) Modak et al. (2007) reported a good fit for the six factor model (30 items) ($CFI = .97$, $TLI = .98$, $RMSEA = .067$), although they had a relatively small sample size (n= 190) which can influence the stability of the covariances in which the analysis is based on (Tabachnick & Fidell, 2007).

In addition Hutchinson and colleagues (2006) examined the factor structure and internal consistency of the shortened Teamwork and Safety Climate Survey. The authors conducted both an exploratory and confirmatory factor analysis for each of the dimensions (i.e., teamwork climate, safety climate). Hutchinson et al. (2006) found a three factor safety climate scale that consisted of 1) attitudes to safety within own team/capacity to learn from errors, 2) overall confidence in safety of organization, and 3) perceptions of management's attitudes to safety. In addition a two factor teamwork climate model consisting of 1) input into decisions and collaboration with other staff, 2) information handover was also found using exploratory factor analysis on a randomly selected 50% of their sample. The authors conducted a CFA on the other half of the sample; however they were unsuccessful at confirming either model. Hutchinson et al. reported *"almost adequate"* fit with a CFI and RMSEA equal to .93 and .08 for teamwork climate and .94 and .07 for safety climate.

There is evidence that the SAQ has good internal reliability, as similar Cronbach alphas have been reported for the six factors across a number of studies and samples (see Table 2 above). However, reliability does not infer validity (i.e., the instrument measures what it is supposed to measure). Evidence that the SAQ is a valid measure of patient safety climate has not fully been established as the results from published factor analyses are mixed. This may be due in part to the lack of theoretical rationale or proper construct development for the six factors included in the SAQ. For instance, the safety climate factor has been operationally defined as "perceptions of a strong and proactive organizational commitment to safety" (p.3; Sexton & Thomas, 2003); however there are a number of items in this scale that do not seem to be linked with this definition. For example, "I know the proper channels to direct questions regarding patient safety", "I would feel safe being treated here as a patient" are items from the safety climate;

however these items seems to be assessing individual safety knowledge more so than a strong organizational commitment to safety.

Patient Safety Culture in Healthcare Organizations (PSCHO). The Patient Safety Culture in Healthcare Organizations survey (PSCHO) assesses healthcare personnel's attitudes and experiences related to working in an environment that lacks the elements of a positive safety climate (Singer et al., 2003). Similar to the SAQ, the development of this survey was guided by research on high reliability organizations (HROs), including nuclear aircraft carriers and commercial aviation (Singer et al., 2007). Also similar to the SAQ, the PSCHO was adopted from five pre-existing surveys (Singer et al., 2003), even though the authors themselves have recognized that existing safety climate surveys have discrepancies, likely due to inefficient theoretical models of safety climate (Singer et al., 2007). The initial version of the PSCHO contained 122 items assessing 16 dimensions of patient safety climate. Through a series of pilot tests; the survey was reduced to 38 items that assessed nine dimensions (Singer et al., 2007) (see Table 1).

Initial examination of the 38 item survey showed variable reliability scores for the nine subscales (Cronbach alpha ranged from .50 to .89; Singer et al., 2007). As can be seen in Table 3 one problem with determining the validity and reliability of the PSCHO is that no two studies have examined the same number of items. Furthermore, the face validity of the PSCHO has been questioned. Hutchinson et al. (2006) conducted a study to determine the usefulness of a US developed patient safety climate survey in the United Kingdom. Prior to conducting the study the authors reviewed the existing patient safety climate surveys and identified two surveys based on a number of criteria (e.g., length, availability of survey information, etc.). Hutchinson and colleagues choose to use one version of the SAQ over the PSCHO because "it contained a greater number of items that were applicable to frontline clinical teams" (p. 348).

Table 3

Summary of PSCHO Research

Authors	# of items	# of Factor	Psychometric properties
Singer et al. (2007)	38	9	EFA, principal axis factoring; Multi-trait analysis; Reliabilities range from .50- .89
Gaba et al. (2003)	94	5	EFA, principal component analysis
Hartmann et al. (2008)	42	11	Multi-trait analysis; CFA (CFI = .98, RMSEA = .065); Reliabilities range from .61- .89
Cooper et al. (2008)	36	8	EFA, principal axis factoring; Reliabilities range from .67- .84

Modified Stanford Instrument (MSI). A group of Canadian researchers have modified the PSCHO and created the Modified Stanford Instrument (MSI). Original work on this survey was conducted for a study examining an intervention designed to improve nurse leader perceptions of patient safety (Ginsburg, Norton, Casebeer, & Lewis, 2005). Exploratory factor analysis on this data yielded three patient safety climate factors: 1) valuing safety, 2) fear of negative repercussions, and 3) perceived state of safety, with reliabilities ranging from .66 to .86 (Ginsburg et al., 2005). Since then, the Modified Stanford Instrument (MSI) has been further developed by adapting a number of items from the Hospital Survey on Patient Safety Culture (Ginsburg, Tregunno, Fleming, Flemons, Gilin, & Norton, 2007).

More recently, a multi-site, multi-phase study was conducted to test the psychometrics of the MSI (Ginsburg et al., forthcoming). Using phase one data the authors found a similar three factor model as was reported by Ginsburg et al. (2005). However, the authors attempts to confirm this model using phase two data was unsuccessful, as it produced lower than acceptable fit indexes (*CFI* = *.85, GFI* = *. 91, NFI* = *.84, SRMR* = *.05, RMSEA* = *.074*). As the three factor model was not confirmed with the second phase data Ginsburg et al. (forthcoming) used exploratory factor analysis to examine other possible factor structures which produced a five factor model (see Table 1) with alpha's ranging from .69- .88. The MSI has been the only patient safety climate survey to be administered and tested on a large sample of Canadian healthcare workers. Even though the psychometrics of this survey are still being tested, it is currently being used by Accreditation Canada as part of their accreditation process for healthcare organizations.

Hospital Survey on Patient Safety (HSOPS). The Hospital Survey on Patient Safety (HSOPS) "was designed to assess hospital staff opinions about patient safety issues, medical errors, and event reporting" (p. 1; Sorra, Famolaro, Dyer, Nelson, & Khanna, 2008). The survey was developed by a private research organization under contract with the Agency of Healthcare Research and Quality (AHRQ) and has gone through an extensive scale development and validation process (Sorra & Nieva, 2004). The final version consists of 42 items assessing ten patient safety climate dimensions (see Table 1) and two outcome measures (i.e., overall perceptions of safety, frequency of event reporting). Each patient safety climate dimension is made up of three to four items each; with Cronbach alpha values ranging from .63 to .83 (Sorra & Nieva, 2004).

Item analysis, exploratory and confirmatory factor analyses, reliability, and composite and correlational analyses of the HSOPS were conducted on 1,437 staff members from 21 different hospitals in six states across the US. The 12 factor final measurement model was reported as a good fit with CFI, GFI, GFI(AGFI), and NNFI all .90 or above and a RMSEA value of .04 (Sorra & Nieva, 2004), although as indicated earlier the currently accepted cut-off value for many of these fit indexes is .95 (Hu & Bentler, 1999). In addition to the psychometric testing of this survey, benchmarking information has also been provided from 519 hospitals (Sorra et al., 2008). However there are still a number of limitations to this survey. First, even though the patient safety literature was reviewed as part of the scale development process, no strong theoretical model or rationale was developed to support the constructs measured in this survey. Furthermore, much like the other patient safety climate surveys reviewed above, there has been little evidence provided on how the patient safety climate dimensions measured in the HSOPS relate to actual patient safety outcomes.

Since the development of these surveys, there has been a number of reviews published critiquing these and other patient safety climate tools (Colla, Bracken, Kinney, & Weeks, 2005; Flin, Burns, Mearns, Yule, & Robertson, 2006; Singla, Kitch, Weissman, & Campbell, 2006). These review articles have highlighted a number of limitations with the current patient safety climate instruments; such as a lack of appropriate scale evaluation and a lack of evidence of the predictive ability of these surveys both in terms of predicting adverse events and improvements in safety perceptions. Furthermore, Flin et al. (2006) criticized the majority of current patient safety climate tools for not including an explicit theoretical background or model to support the development of the instrument. This is likely due to the fact that many patient safety climate surveys have been adapted from pre-existing measures developed and used in other industries (e.g., offshore oil, nuclear power, aviation), without any considerable thought to how the differences in the healthcare industry would influence the usefulness of the survey. The healthcare industry has a number of unique characteristics that may additionally influence safety, and ultimately the appropriateness of adapting a survey from another industry. For instance, healthcare organizations are made up of a number of professional hierarchies in both the administrative and clinical domains and there are multiple external parties (e.g. government, insurance companies) directly influencing the organizational strategies (Scheck-McAlearney, 2006).

It has also been suggested that the current patient safety climate surveys vary considerably not only in terms of their general characteristics (e.g., length, populations sampled) but also in content (i.e., the number of patient safety climate dimensions covered and the emphasis placed on each dimension) (Colla et al., 2005; Singla et al., 2006). As can be seen in Table 1, a wide range of patient safety dimensions have been previously measured. Variety can also be found when you examine the actual items from similar patient safety climate factors across the surveys. For example, senior management is a common factor across the four surveys reviewed above. Table 4 lists the individual items associated with the senior management factor for each of these surveys. This table suggests that there is a wide range of topics covered when measuring senior management's involvement in patient safety. For instance, the SAQ mainly measures management's support for employees and the extent they provide employees with the necessary information and resources, while the items from the HSOPS ask mainly about management's interest in patient safety and if a climate that promotes patient safety exists within the organization. The items from the PSCHO and MSI cover additional areas such as management's knowledge of risks and patient safety issues and the type of communication within the organization. Furthermore, the PSCHO also includes an item regarding incident reporting consequences within their management dimension of patient safety. What becomes clear by examining all the different patient safety climate factors and their individual items is that no apparent focus or direction has been applied to the development of this construct (i.e., patient safety climate). Therefore, the primary aim of this research is to develop a focused theoretical framework that describes the antecedents of patient safety climate and to develop and test a patient safety climate survey based on this purposed framework.

Table 4
Senior Management Items across Patient Safety Climate Surveys

	SAQ (Perceptions of management)	PSCHO (Senior managers engagement)	MSI (Organizational leadership for safety)	HSOPS (Management support for patient safety)
Items	Senior management of this office is doing a good job	Senior management provides a climate that promotes patient safety	Senior management provides a climate that promotes patient safety	Hospital management provides a work climate that promotes patient safety.
	The management of this office supports my daily efforts	Senior management has a clear picture of the risk associated with patient care	My organization effectively balances the need for patient safety and the need for productivity	The actions of hospital management show that patient safety is a top priority.
	I am provided with adequate, timely information about events in the hospital that might affect my work	Senior management considers patient safety when program changes are discussed	Senior management considers patient safety when program changes are discussed	Hospital management seems interested in patient safety only after an adverse event happens.
	The levels of staffing in this office are sufficient to handle the number of patients	Senior management has a good idea of the kinds of mistakes that actually occur in this facility	Senior management has a clear picture of the risk associated with patient care	
		Good communication flow exists up the chain of command regarding patient safety issues	Good communication flow exists up the chain of command regarding patient safety issues	
		Patient safety decisions are made at the proper level by the most qualified people	Patient safety decisions are made at the proper level by the most qualified people	
		Reporting a patient safety problem will not result in negative repercussions for the persons reporting it	I work in an environment where patient safety is a high priority	

Theoretical model of patient safety climate

The first step in developing any theoretical framework is to first clearly define the underlying construct. Patient safety climate can be defined as employees shared beliefs and perceptions of the value and importance of preventing patient harm as a result of the care delivery process to the organization (Mark, Hughes, Belyea, Chang, Hofmann, Jones, & Bacon, 2007; Sorra & Nieva, 2004). Central to the concept of patient safety climate is the idea of consensus among healthcare professionals' beliefs and perceptions regarding patient safety. Thus climate is in essence a measure of group consensus of employees patient safety beliefs and perceptions and as such, should be considered a social phenomenon.

Having shared beliefs among group members often serves as validation that individual beliefs and perceptions are based in reality (Wood, 2000), such that if everyone else holds the same views as I do, they must be true. Furthermore, our reaction to another's beliefs is often dependent on our perception that the majority of other group members holds the same belief and engages in similar behaviors (Cialdini & Goldstein, 2004). In fact, individuals' actions are often intensified when they learn that the beliefs associated with that behavior are shared by the majority of group members (Cialdini & Goldstein, 2004). For example, healthcare workers may be more willing to use an incident reporting system when the majority of group members hold similar positive beliefs regarding incident reporting and refer to it as a tool for learning how to improve patient safety, rather than referring to it as a way of tracking the number of incidents that occur. By referring to the incident reporting system in this manner employees are illustrating their belief that using the incident reporting system is important to improving patient safety.

The study of social influence suggests that individual's beliefs and subsequent actions are ultimately based on an individual's motivation to develop meaningful social relationships and form valid attitudes and beliefs that are based in reality (Eagly & Chaiken, 1993). Thus group consensus regarding beliefs and perceptions (e.g., patient safety climate) can be considered a function of these two motivational factors and the social influence that results from them. Normative and informational influence techniques have been particularly important concepts in understanding how consensus in groups occur (Eagly & Chaiken, 1993) and can be used to explain how patient safety climate forms. According to Deutsch & Gerard (1955) normative influence refers to "influence to conform with the positive expectations of another", while informational influence refers to the "influence to accept information obtained from another as evidence about reality" (p. 629). Normative influence is thought to be a function of individual's motivation to gain rewards and avoid punishment from others (Eagly & Chaiken, 1993) and to develop meaningful social relationships. Whereas informational influence is thought to be a function of individuals desire to form an accurate and valid interpretation of reality (Cialdini & Goldstein, 2004). There are a number of important actors within a healthcare organization that can influence the development of group consensus of employees' beliefs and perceptions regarding the importance of patient safety, using both normative and informational processes.

Colleague's normative and informational influence. As patient safety climate is a group level construct, it is likely that one of the most important factors that influence patient safety climate will be the attitudes and expectations of one's colleagues (Clarke, 2006). Colleagues can help shape patient safety climate through both normative and informational processes. As indicated above, having the same patient safety beliefs and perceptions as the majority of your colleagues provides corroboration that your beliefs and perceptions are an accurate representation of reality (informational influence). Furthermore, Mullen (2004) found that colleague's safety attitudes contributed to whether individual employees engaged in safe work practices. Colleagues can influence patient safety climate not only by their cognitions, but also through their actions.

Colleagues likely hold certain expectations about what actions their fellow group members should engage in to prevent unnecessary harm to patients. Such expectations can be communicated either verbally or more commonly through their actions and behaviors. Expectations from important colleagues can be a powerful determinant of an individual's behavior within a social setting (e.g., workplace), as individuals are motivated to develop social relationships and avoid negative consequences from others that may jeopardize the relationship (normative influence). This type of social influence has been illustrated in a number of studies. For example, interviews conducted with employees from a variety of occupational settings, including healthcare revealed that employees valued having the respect of their colleagues as a competent worker (Mullen, 2004). Moreover, Hayes, Perander, Smecko, & Trask, (1998) found that employees' compliance with safety behaviors was strongly related to their colleagues safety performance.

Despite the previous claim that earlier safety climate research lacks a strong theoretically rationale for measuring specific factors, a few key patient safety climate dimensions are beginning to emerge (Flin, 2007) and fit within the current framework of social influence. A management component of safety climate has been consistently found to be an important factor in determining employees shared beliefs and perceptions of patient safety (Flin et al., 2006) and safety in general within other industries (Guldenmend, 2000). Throughout the safety climate literature the management dimension of climate has typically been broken down into two elements, senior management and supervisor (Flin, Mearns, O'Connor, & Bryden, 2000), often representing an organizational level variable (i.e., senior management) and a group level variable (i.e., supervisor; Zohar et al., 2007).

Senior management's influence on patient safety. According to Guldenmend (2007) approximately 75% of safety climate surveys include a management component, making it the most commonly measured dimension of safety climate. A senior management component has been well supported in both the patient safety climate literature (Flin, 2007) and in safety climate research from other industries (Guldenmund, 2000). Even though this component is considered to be one of the most important patient safety climate dimensions; the understanding of the specific processes that determine how senior management influences employee's patient safety attitudes, perceptions, and behaviors has not been well established (Flin et al., 2000). Senior managers can influence healthcare workers attitudes and perceptions of patient safety in a number of ways. In the past, senior management's commitment to safety has typically been described as the mechanism in which they influence employees' safety attitudes and perceptions. Senior managers often demonstrate the importance of patient safety by sending messages that reinforce their commitment to this topic (Flin, 2007). Furthermore, senior managers can also demonstrate their commitment to patient safety through their control over organizational resources that effect employees' ability to deliver safe care to patients and through their decision-making authority (Hartmann et al., 2008). These actions from senior management demonstrate the priorities of the organization (Flin et al., 2000) and the extent to which patient safety is ranked as one of the top organizational priorities. In addition to demonstrating their commitment to patient safety, Rathert and May (2007) have argued that employees gain shared attitudes and perceptions in part through their experiences in the working environment that illustrate the behaviors that management comes to expect and support.

Supervisor's commitment to patient safety. Whereas senior managers are believed to influence employees shared patient safety beliefs and perceptions through mostly indirect ways (e.g., determining how resources are allocated), supervisors tend to have a more direct influence on frontline staff, as they tend to have more contact with the employees. This increased contact provides supervisors with the ability to continually monitor the work environment and act accordingly (Zohar et al., 2007). For instance supervisors are able to offer employees with constructive feedback on patient safety issues as they arise and on employee's safety behaviors as they are observed (Gershon et al., 2000). This attention helps to create a non-punitive work environment that enhances employee's willingness to report near misses and adverse events (Mark et al., 2007) and reinforces the importance of patient safety. In addition, supervisors are often required to explain and justify the policies and procedures created by senior management to the frontline staff and are ultimately the one's responsible for applying and enforcing these policies (Guldenmend, 2007). Thus supervisors have the ability to both positively and negatively influence employee's patient safety beliefs and perceptions as they can either reinforce the positive actions the organization is taking to enhance patient safety, or downplay and undermine these efforts (Guldenmund, 2007).

Employee's shared beliefs regarding patient safety and the behaviors that reflect these beliefs are in part the result of mainly normative influences from senior managers and supervisors. Normative influences help create subjective norms (i.e., individuals belief about whether significant others think they should engage in certain behaviors) within an organization (Eagly & Chaiken, 1993). Senior managers and supervisors are often viewed as significant others as they are perceived to be the leaders within the organization. As leaders, senior managers and supervisors influence employee behavior by demonstrating their commitment to patient safety and communicating their expectations for employees (e.g., employees should also be committed to providing safe care delivery). Senior management and supervisors also communicate what behaviors they expect from employees by either reinforcing behaviors that are congruent with their expectations or reprimanding behaviors that conflict with their expectations.

The healthcare industry is unique from other industries where safety climate has typically been examined because there are additional leaders within the work environment. In addition to senior managers and supervisors, physicians also provide an important leadership role and can influence employees' shared beliefs and perceptions of patient safety by demonstrating a commitment to providing safe treatment to patients (Singla et al, 2006).

Physician's involvement in patient safety. Physicians role within healthcare has been likened to that of a pilot within the aviation industry, as are the ones who are ultimately in charge and responsible for patient care delivery (Tamuzi & Thomas, 2006). As such, physicians have a critical role to play in patient safety outcomes (Zohar et al., 2007). Because physicians are attributed with such an essential role in patient care delivery it is reasonable to assume they would influence employees shared beliefs and perceptions about patient safety in a similar manner as senior managers and supervisors. By demonstrating a commitment to providing safe delivery of patient care, physicians are communicating their expectations for healthcare workers to also provide the same standard of care. Additionally, healthcare workers may also look at a physicians actions regarding patient safety as an indication of whether their patient safety beliefs and subsequent behaviors were valid and based in reality. Physician's beliefs and actions may be an especially significant determinant of shared beliefs and perceptions of healthcare workers in regard to patient safety when physicians act on a fee-for-service system. In these instances the physicians involvement in patient safety issues often requires extra time out of their schedules which they are not compensated for (Thomas, 2006). By demonstrating the importance of patient safety (e.g., being a champion for patient safety) physicians indicate the commitment they expect from healthcare workers in regards to patient safety.

There are a number of professional groups (i.e., senior managers, supervisors, physicians, healthcare workers) within the healthcare industry that interact with one another. It is through these interactions group members influence one another through normative and informational processes and create norms within the organization that describe the behaviors and actions that are expected from the group members. As a result healthcare workers develop shared beliefs and patterns of behaviors that are consistent with the norms of the organization. Based on the social influence framework for understanding how patient safety climate forms it is expected that:

Hypothesis 1a: Patient safety climate will fit a four factor model, representing colleague's involvement, senior management's commitment, supervisor's commitment, and physician's involvement in patient safety.

Hypothesis 1b: All four patient safety climate factors will demonstrate high internal reliability.

Hypothesis 1c: The four patient safety climate factors will predict an overall grade for organizational departments' patient safety efforts and an overall grade for the geographical regions patient safety efforts.

In addition to developing and testing a framework for patient safety climate, a secondary aim of the current research is to examine the relationship between patient safety and healthcare worker safety.

Relationship between patient safety and occupational safety

Much of the patient safety climate literature has grown out of research done on occupational safety climate. Despite this, there has been little effort to study patient safety and occupational safety together. The healthcare industry is unique from many other "*high-hazard*" industries in that it is not only patients who can be harmed, but also the healthcare workers who provide care to the patients. With many instances the harm to healthcare workers is a result of interactions with the patients (Flin, 2007). Healthcare workers face a number of occupational health and safety risks associated with patient interactions, including infectious disease, aggression and violence from patients, needlestick injuries, and musculoskeletal injuries associated with patient handling. As a result of these risk factors, healthcare workers have one of the highest rates of workplace injuries across occupations within Canada (OHSAH, 2004).

The health and safety of employees can also impact patient safety (Lin & Liang, 2007). For instance, Yassi and Hancock (2005) found that healthcare workers in facilities with high injury rates reported that they did not have enough time to work safely and provide the appropriate level of care. Whereas healthcare workers in facilities with low workplace injury rates reported the opposite (e.g., they were satisfied with the resources available to provide good quality of care to patients). Furthermore, Yassi and Hancock (2005) also described a number of organizational interventions designed to improve the health and safety of healthcare workers which were also found to improve the safety and quality of care provided to patients. This research suggests that consistent and long term improvements in patient safety will only be seen when the health and safety of the employees who care for the patients is also addressed.

One way to improve the health and safety of employees and decrease healthcare worker injuries is through developing a positive occupational safety climate. Occupational safety climate is likely to develop through the same social influences as described for patient safety climate. A positive occupational safety climate has been associated with decreased back injuries in healthcare professionals (Mark et al., 2007) and decreased incidents of exposure to blood and body fluids (Gershon et al., 2000). Specifically, Gershon and colleagues found that the most significant factor in reducing exposure incidents was senior management's commitment and support for a bloodborne pathogen safety program. Feedback and training provided by the unit supervisor was also found to be significantly related to exposure incidents. This is consistent with safety climate research in other industries which have found senior management and supervisor's commitment and leadership to be the most prominent factors influencing employee's safety behaviors and injuries (Seo, Torabi, Blair, & Ellis, 2004). A board view of safety climate (i.e., not specifying safety of whom) has been associated with both healthcare worker and patient outcomes. Hofmann and Mark (2006) found that a positive general safety climate was associated with a decrease in nurse back injuries and patient medication errors. Based on this research it is expected that:

Hypothesis 2: Patient safety and occupational safety will be correlated, such that higher levels of patient safety climate will be associated with higher levels of occupational safety climate (as measured by senior management's commitment and supervisor's commitment to employee safety)

Method

This study consisted of two phases. The first phase involved a scale development process in which a new patient safety climate survey was created based on the social influence framework of climate outlined above. In addition, a short occupational safety climate measure was also developed based on the same social influence framework for use in the subsequent phase. The second phase of this study involved testing the psychometrics of the survey developed in phase one and examining the relationship between patient safety and worker safety.

Scale Development

The test construction process described by Crocker and Algina (1986) was used as the foundation in which the current survey was developed. A review of the patient safety and safety climate literatures was conducted as the first step in operationally defining the constructs (i.e., patient safety climate and occupational safety climate). In addition, a small focus group comprised of two subject matter experts (SMEs) was conducted to identify the specific factors that influenced patient and worker safety. Next, an item pool was generated based on the information obtained from the literature review and SMEs. These items were reviewed and revised to ensure that they were comprehensive, relevant to the domain of interest, clear, and at an appropriate reading level (Crocker & Algina, 1986). Four scales, each consisting of five items was created to assess patient safety climate: 1) beliefs about colleague's involvement with patient safety issues, 2) beliefs regarding how committed senior management is to patient safety, 3) beliefs regarding how committed immediate supervisors are to patient safety, and 4) beliefs about physician's involvement with patient safety issues. Two scales, each consisting of five items was created to assess worker safety: 1) beliefs regarding how committed senior management is to employee safety, 2) beliefs regarding how committed direct supervisors are to employee safety. The final step of the scale development process included the two SMEs reviewing each scale one last time for content (including face validity), clarity, and ease of use. Once the questionnaire was developed, the patient safety climate and occupational safety climate scales were tested using a sample of healthcare professionals from a variety of occupations.

Participants

Surveys were distributed to all healthcare professionals who attended one of two professional conferences within Canada, one based in Nova Scotia and one in Saskatchewan. A total of 221 healthcare professionals were recruited for this study (181 from Saskatchewan, 40 from Nova Scotia). Conference attendees at both events were given the opportunity to voluntarily complete the survey as part of an exercise conducted by one of the conference presenters (see procedure section for a description of this exercise).

A multivariate analysis of variance was conduct to explore if there were any differences between the two samples (i.e., Nova Scotia and Saskatchewan) in terms of demographic variables available (i.e., occupational groups, management position, and tenure). The two samples did not differ in terms of tenure at their current job; however the groups did differ in terms of occupational groups (F (1, 208) = 6.43, p =.01). The sample from Saskatchewan was comprised of a higher percentage of nurse and administrative personnel (40.4% and 28.7% respectively); whereas the sample from Nova Scotia consisted of 32.5% nurses and 20.0% administrative personnel. In addition, the sample from Nova Scotia had a much higher percentage of participants who indicated they belonged to an *"other"* occupational group (47.5%) as opposed to the sample from Saskatchewan (27.5%). Examination of the qualitative responses to this question indicated that there were a number of Nova Scotian participants who were physical therapists, home support, and continuing care assistants. The two groups also differed in terms of whether participants held a management/supervisory position (F (1, 208) = 8.14, p =.005). The majority of the sample from Saskatchewan was comprised of workers who held some type of management or supervisory position (60.3%); whereas the majority of the sample from Nova Scotia was comprised of workers in non-management roles (67.5%).

Measures

Participants responded to a paper and pencil survey that consisted of the following measures:

Demographics. Participants were asked to indicate which occupational group they belonged to (i.e., Physician/Resident, Nurse, Administration, or Other). If participants chose the 'Other' category, they were also asked to specify their occupation. In addition, participants were asked to indicate if they held a management/supervisory position, and the length of time employed in their current position.

Patient Safety Climate. The patient safety climate scale was developed to assess four dimensions of patient safety climate: senior management's commitment to patient safety, supervisor's commitment to patient safety, physician's involvement in patient safety, and colleague's involvement in patient safety. Two of these subscales: senior management's commitment and supervisor's commitment to patient safety included five items each that assessed these individuals awareness of factors that may contribute to patients being harmed and the actions these individuals take to ensure patients are safe (e.g., "senior management is aware of the factors in my work environment that may lead to patients being harmed"; "my supervisor puts effort into ensuring the safe delivery of care to patients"). Participants were given the following definition of a supervisor: *"someone who directs your work"*, and were instructed to skip this section if they did not have a direct supervisor. The colleague subscale included five items that assessed how involved these individuals are in ensuring patient safety (e.g., "my colleagues encourage me to report a close call that could have harmed a patient"). Participants were provided with the following definition of colleague: *"people you work with on a frequent basis"*. Finally, the physician subscale included five items that assessed various actions and behaviors physicians display to indicate patient safety is important to them (e.g., "physicians I work with respond positively if I raised a concern about their clinical practice that may harm a patient"). If participants were physicians themselves, they were instructed to think of other physicians they collaborate with when responding to each item in this scale.

Participants rated all items using a five-point Likert-type scale (1= strongly disagree to 5= strongly agree). The reliability for the overall scale was excellent, with a Cronbach's alpha of α =.89, and all item-total correlations greater than r=.31. The internal reliability for each of the four patient safety climate subscales (i.e., senior management's commitment, supervisor's commitment, colleague's involvement, and physician's involvement) ranged from α =.78 to α =.84, with all item-total correlations greater than r = .45.

Overall Patient Safety Grade. In addition to the four patient safety climate scales developed in phase one of this study, participants were also asked to complete two items developed and adapted by Sorra and Nieva (2004), one item that asked participants to provide an overall grade for their *Department* on patient safety and one item that asked for an overall grade on patient safety for the participants *Region*. Both items are assessed using a five-point scale (A= excellent to F= failing).

Occupational Safety Climate. A short occupational safety climate scale was created to measure senior management's commitment to worker safety and supervisor's commitment to worker safety. Both subscale included five items (e.g., "senior management does not address occupational safety concerns in a timely manner"; "my supervisor puts effort into ensuring that I can work safely") which assesses the extent to which these individuals demonstrate awareness of occupational safety issues and exhibit behaviors that indicate their commitment to ensuring a safe work environment. Each item was assessed using a five-point Likert-type scale (1= strongly disagree to 5= strongly agree). Participants were provided with the same definition of supervisor and instructions in regard to skipping this section as was provided in the patient safety climate scale. The reliability for the overall scale was excellent, with a Cronbach's alpha of α =.87, and all item-total correlations greater than r =.37.

Overall grade of worker safety. In addition to the worker safety climate scale developed in phase one of this study, participants were also asked to complete two items adapted from Sorra and Nieva (2004), one item that asked participants to provide an overall grade for their *Department* on occupational safety, and one item that asked for an overall grade on occupational safety for the participants geographical *Region*. Both items are assessed using a five-point scale (A= excellent to F= failing).

Procedure

All participants were recruited as part of a conference exercise. This exercise consisted of a presentation on what patient safety culture/climate entails and the current research and practices in this area, completing the survey described above and a presentation of the survey results. All conference attendees were given an envelope that included the survey (see Appendix A) and an information sheet detailing the purpose and directions for the survey (see Appendix B) as they picked up their conference materials at the registration desk on the day of the conference. Once individuals completed the survey they were instructed to place the sealed completed survey in a drop-box located in the conference area or return it to one of the investigators. Participants were also instructed through the information sheet that completing the survey was entirely voluntary and they had the option to not complete any part of the survey they did not feel comfortable completing. This study abided by current ethical standards and was approved by the Saint Mary's Research Ethics Board (REB Certificate 08-039; see Appendix C).

Results

Despite the differences in the two samples reported above, the samples were combined to perform all analyses, in an effort to increase the overall sample size. Prior to testing any hypotheses the data was screened for data entry errors, outliers, non-random missing data, linearity, normality, and multicollinearity. Descriptive statistics and frequencies were run for each item using SPSS 14.0. No data entry errors, outliers, or major violations of the assumptions were identified. Descriptive statistics for each item are reported in Appendix D.

Missing Data

Initial screening of the data identified a number of missing data points. SPSS Missing Values Analysis was conducted to test the pattern of missing data. Fifteen items had more than 5% missing values, with percentages ranging from 1.8% to 17.6%; however Little's MCAR (missing completely at random) test was not significant (χ^2 =

1060.77, *df* = 1090, p = .73), indicating that the missing values are missing completely at random. Despite this, all items with more the 5% missing values came from three subscales: supervisor's commitment to patient safety, physician's involvement in patient safety, and supervisor's commitment to occupational safety. The instructions provided with the two supervisor's commitment sub-scales (i.e., patient safety and occupational safety) may have contributed to the large amount of missing data. For both scales, participants were instructed *"If you do not have a supervisor please skip this section"*, thus many participants left all items in both sub-scales completely blank. The majority of missing values for the physicians sub-scale may be due in part to the type of participants recruited for this study. This sub-scale asks participants to respond to items that describe their attitudes about physicians they directly work with. Participants may not have responded to these items because they did not work directly with a physician. Approximately 33.6% of participants who completed the survey were from occupations that typically do not have regular contact with physicians (i.e., administration, occupational therapy, physical therapy, and occupational health and safety personnel).

Of the 221 respondents, 77 cases (17 respondents from Nova Scotia and 60 from Saskatchewan) had at least one missing data point. Thus using the listwise deletion approach, the most commonly reported missing data technique in applied psychology research (Roth, 1994) would have resulted in a sample reduction of 34.8%; leaving only 144 cases. Therefore, data imputation was used to maximize the number of cases available for psychometric analyses. There are currently no adequate empirical guidelines for dealing with missing data (Tabachnick & Fidell, 2007; Roth, Switzer III, & Switzer, 1999). Thus, person mean insertion (PMI) was chosen as the most appropriate data imputation technique. PMI replaces the missing value with the mean of the values for all other items within the scale given by the respondent. This technique assumes the following: the item response range is the same for all items in the scale, missing items would have the same value as the mean of the non-missed items, and that each item contributes equally to the overall scale score (Hawthorne & Elliot, 2004). Downey and King (1998) argue that PMI is a reasonable estimate for missing data in attitude scales, (e.g., climate scales); as such scales are generally developed to ensure items are correlated with one another. Furthermore, in several studies (e.g., Hawthorne & Elliott, 2004; Roth et al., 1999; Downey & King, 1998) comparing various missing data techniques, PMI was one of the most highly recommended approaches. The benefit of PMI is that is has the ability to save a great deal of data, that would otherwise be deleted using listwise deletion and it acknowledges individual differences by calculating the missing value using information provided by participant (i.e., their responses to the other items in the scale).

Factor Structure and Reliability

Exploratory factor analysis (EFA) was conducted using SPSS, Version 14.0 to assess hypothesis 1(a) (i.e., the factor structure of the patient safety climate scale) and to examine the factor structure of the occupational safety climate scale as well.

Patient safety climate scale. Principal axis factoring (PAF) was performed on the 20 items from the patient safety climate scale for a sample of 171 healthcare professionals. As previous research has shown patient safety climate factors to be correlated (Sexton et al., 2006), a promax rotation was applied. Principal component analysis (PCA) was used prior to PAF extraction to estimate the number of factors and factorability of the correlation matrices. This analysis revealed a maximum of five factors with eigenvalues greater than one, accounting for 65.6% of the variance. Upon examination of the scree plot a possible four factor solution was also identified. Therefore, both a five factor and a four factor solution were tested using PAF.

The five factor solution accounted for 54.7% of the variance. Communality values ranged from .27- .78, with the majority above .40, thus indicating homogeneity among the variables. In addition, there was good fit between the original and reproduced correlation matrices, with only 12% of residual values greater than .05. Despite this, the five factor model did not result in a clear factor solution. Several items had low factor loadings (i.e., .45 or below) and several items cross-loaded (i.e., factor loadings of .32 or greater on two or more factors). Furthermore, the fifth factor in this model was comprised of four items, two reverse coded items and two items that cross-loaded with other factors.

In comparison, the four factor model accounted for just over 51% of the variance. Community values ranged from .21- .79, with the majority above .40. This model also provided a fairly good fit between the original and reproduced correlation matrices, with 20% of residual values greater than .05. Examination of the pattern matrix indicated a clearer solution than the five factor model. With a cutoff value of .32 for inclusion of an item in interpretation of a factor, one item (i.e., *"My colleagues breach care protocols due to time pressure"* (item 2) did not load on any factor and one item (i.e., *"My supervisor does not address patient safety concerns in a timely manner"*; item 11) was slightly complex. Therefore, the one item that did not load on any factor was deleted and the analysis was re-run.

The process for re-running the factor analysis with this item removed was the same as described earlier. The initial PCA revealed five factors with eigenvalues greater than one accounting for 67.5% of the variance; although the fifth factor barely met this criterion (eigenvalue = 1.02). Examination of the scree plot suggested a four factor solution was also possible. Therefore, both a five factor and four factor solution was examined by performing PAF, with promax rotation on 19 items from the patient safety climate scale. The five factor solution produced a fifth factor containing only one item; therefore this solution was not considered further as factors with only one or two items are not stable and usually not reliable (Tabachnick & Fidell, 2007). The four factor solution accounted for 52.8% of the variance. Communality values ranged from .25- .78, with the majority above .40. In addition, there was good fit between the original and reproduced correlation matrices, with only 17% of residual values greater than .05. Examination of the factor correlation matrix provided evidence for the use of promax rotation with all factor correlations above .32 (as recommended by Tabachnick & Fidell, 2007), with correlations ranging from .36- .58. The four factor model produced a clear solution with all factor loadings .45 and above on the appropriate factor; thus indicating evidence to support hypothesis 1a. The four factors that comprised the patient safety climate scale were labeled: 1) physician's demonstrated importance of patient safety, 2) supervisor's commitment to patient safety, 3) senior management's commitment to patient safety, and 4) colleague's involvement in patient safety. Factor loadings, communalities, and percent of variance are shown in Table 5. Factor loadings under .45 (20% of variance) are not included for ease of interpretability.

Table 5

Factor Loadings, Communalities (h^2), and Percents of Variance for PAF and Promax Rotation on Patient Safety Climate Items.

Items	F1	F2	F3	F4	h^2
Physicians I work with respond positively if I raised a concern about their clinical practice	.56	0	0	0	.46
Physicians do not follow appropriate patient safety care protocols	.58	0	0	0	.36
Physicians I work with are effective communicators	.76	0	0	0	.56
Physicians I work with encourages me to report patient safety occurrences	.83	0	0	0	.66
Physicians I work with takes action on my suggestions for improving patient care	.79	0	0	0	.68
My supervisor does not address patient safety concerns in a timely manner	0	.45	0	0	.43
My supervisor is aware of the factors in my work environment that may lead to patients being harmed	0	.58	0	0	.38
My supervisor puts effort into ensuring the safe delivery of care to patients	0	.90	0	0	.78
My supervisor encourages me to report patient safety occurrences	0	.72	0	0	.59
My supervisor takes action on my suggestions for improving patient care	0	.82	0	0	.68
Senior management does not address patient safety concerns in a timely manner	0	0	.69	0	.49
Senior management is aware of the factors in my work environment that may lead to patients being harmed	0	0	.45	0	.33
Senior management puts effort into ensuring the safe delivery of care to patients	0	0	.78	0	.60
Senior management encourages me to report patient safety occurrences	0	0	.71	0	.51
Senior management takes action on my suggestions for improving patient care	0	0	.68	0	.51
My colleagues would respond positively if I raised a concern about their clinical practice that may harm a patient	0	0	0	.50	.25
My colleagues expect me to report patient safety occurrences even if they seem minor	0	0	0	.80	.67
My colleagues are active participants in patient safety improvement initiatives	0	0	0	.65	.51
My colleagues encourage me to report a close call that could have harmed a patient	0	0	0	.77	.59
Percent of variance	31.8	9.4	6.8	4.8	

As a result of low sample size due to listwise deletion of those individuals who left entire subscales blank (i.e., supervisor and physician), two separate factor analyses was preformed to test the stability of the four factor solution describe above. As the majority of respondents completed all items in the colleague and senior management subscales, a factor analyses was preformed with these two subscales and each one of the subscales in which a large number of respondents did not complete any of the items (i.e., supervisor's commitment and physician's demonstrated importance of patient safety).

A PAF analysis, with promax rotation was perform on 14 items[1] from the colleague's involvement, senior management's commitment, and supervisor's commitment scales for a sample of 191 healthcare professionals. The initial PCA identified three factors with eigenvalues greater than one. The PAF analysis of three factors accounted 51.3% of the variance. Communality values for this solution ranged from .24- .74 and the original correlation matrix was reproduced with only 18% of residuals greater than .05. Examination of the pattern matrix revealed a similar solution to the original four factor solution with Factor 1 comprising of supervisor's commitment to patient safety, Factor 2 representing senior management's commitment to patient safety, and Factor 3 representing colleague's involvement with patient safety. All factor loadings were above .45 on the appropriate factors. Factor loadings, communalities, and percent of variance are shown in Table 6. Factor loadings under .45 (20% of variance) are not included for ease of interpretability.

[1] A factor analysis was initially run with item 2 included; however due to a low communality value and an inadequate factor loading (< .32), a factor analysis was re-run with this item deleted

Table 6

Factor Loadings, Communalities (h^2), and Percents of Variance for PAF and Promax Rotation on Patient Safety Climate (Colleagues, Managers, and Supervisors) Items.

Item	Factor 1	Factor 2	Factor 3	h^2
My supervisor does not address patient safety concerns in a timely manner	.52	0	0	.41
My supervisor is aware of the factors in my work environment that may lead to patients being harmed	.52	0	0	.34
My supervisor puts effort into ensuring the safe delivery of care to patients	.87	0	0	.74
My supervisor encourages me to report patient safety occurrences	.71	0	0	.56
My supervisor takes action on my suggestions for improving patient care	.87	0	0	.71
Senior management does not address patient safety concerns in a timely manner	0	.68	0	.45
Senior management is aware of the factors in my work environment that may lead to patients being harmed	0	.52	0	.35
Senior management puts effort into ensuring the safe delivery of care to patients	0	.83	0	.62
Senior management encourages me to report patient safety occurrences	0	.62	0	.47
Senior management takes action on my suggestions for improving patient care	0	.68	0	.51
My colleagues would respond positively if I raised a concern about their clinical practice that may harm a patient	0	0	.48	.24
My colleagues expect me to report patient safety occurrences even if they seem minor	0	0	.83	.68
My colleagues are active participants in patient safety improvement initiatives	0	0	.70	.54
My colleagues encourage me to report a close call that could have harmed a patient	0	0	.76	.58
Percent of variance	33.9	9.8	7.6	

A second factor analysis was performed to determine the factor solution when just the colleague's involvement, senior management's commitment, and physicians demonstrated importance scales were included. The initial PCA revealed strong support for three factors. PAF analysis, with promax rotation was performed on 14 items[2], for a sample of 182 healthcare professionals. The three factor solution accounted for 49.4% of the variance and had a clear factor structure, with all physician items loading on Factor 1, all senior management items loading on Factor 2, and all colleague items loading on Factor 3. Factor loadings, communalities, and percents of variance are shown in Table 7. The results of these two additional factor analyses provide further support for hypothesis 1a.

[2] Again, a factor analysis was initially conducted with item 2 included; however due to a low communality value and low factor loading (< .32), this item was deleted and another factor analysis was conducted

Table 7

Factor Loadings, Communalities (h^2), and Percents of Variance for PAF and Promax Rotation on Patient Safety Climate (Colleagues, Managers, and Physicians) Items.

Item	Factor 1	Factor 2	Factor 3	h^2
Physicians I work with respond positively if I raised a concern about their clinical practice	.58	0	0	.46
Physicians do not follow appropriate patient safety care protocols	.56	0	0	.35
Physicians I work with are effective communicators	.76	0	0	.56
Physicians I work with encourages me to report patient safety occurrences	.83	0	0	.64
Physicians I work with takes action on my suggestions for improving patient care	.79	0	0	.68
Senior management does not address patient safety concerns in a timely manner	0	.65	0	.41
Senior management is aware of the factors in my work environment that may lead to patients being harmed	0	.52	0	.33
Senior management puts effort into ensuring the safe delivery of care to patients	0	.75	0	.55
Senior management encourages me to report patient safety occurrences	0	.65	0	.48
Senior management takes action on my suggestions for improving patient care	0	.72	0	.50
My colleagues would respond positively if I raised a concern about their clinical practice that may harm a patient	0	0	.51	.25
My colleagues expect me to report patient safety occurrences even if they seem minor	0	0	.82	.65
My colleagues are active participants in patient safety improvement initiatives	0	0	.67	.50
My colleagues encourage me to report a close call that could have harmed a patient	0	0	.74	.56
Percent of variance	31.6	9.4	8.4	

To test hypothesis 1b, the internal reliabilities of the four patient safety climate scales was examined. All reliabilities for these four scales were good. The senior management's commitment to patient safety scale had a Cronbach's alpha of α =.80, and all item-total correlations were greater than $r = .53$. The supervisor's commitment scale had a Cronbach's alpha of α =.84, with all item-total correlations greater than $r = .52$. The colleague's involvement scale had a Cronbach's alpha of α =.78, with all item-total correlations greater than $r = .45$. Finally, the physician's demonstrated importance of patient safety scale had a Cronbach's alpha of α =.84, and all item-total correlations were greater than $r = .53$. Thus, hypothesis 1b was fully supported.

Occupational safety climate scale. PAF was also performed on the 10 items from the occupational safety climate scale for a sample of 195 healthcare professionals. As previous research has shown occupational safety climate factors to be correlated (Flin et al., 2000), a promax rotation was applied. PCA was used prior to PAF to estimate the number of factors and factorability of the correlation matrices. Examination of both the scree plot and the eigenvalues above one indicated the present of two factors, accounting for 62.1% of the variance. When the two factor analysis was re-run using PAF the percentage of variance explained decreased to 53.9%. Communality values for this solution ranged from .30- .87 and the factors performed well at reproducing the original correlation matrix, with only 20% of residuals greater than .05. Examination of the pattern matrix revealed a strong and clear factor structure, with factor loadings ranging from .51 to .96. Factor 1 comprised of supervisor's commitment to occupational safety and Factor 2 comprised of items assessing senior management's commitment to occupational safety. Factor loadings, communalities, and percents of variance are shown in Table 8.

Table 8

Factor Loadings, Communalities (h^2), and Percents of Variance for PAF and Promax Rotation on Occupational Safety Climate Items.

Item	Factor 1	Factor 2	h^2
My supervisor does not address occupational safety concerns in a timely manner	.51	0	.33
My supervisor is aware of the factors in my work environment that may lead to employee injury or ill health	.73	0	.46
My supervisor puts effort into ensuring that I can work safely	.83	0	.77
My supervisor encourages me to report safety incidents	.80	0	.58
My supervisor takes action on my suggestions for improving occupational safety	.80	0	.73
Senior Management does not address occupational safety concerns in a timely manner	0	.62	.37
Senior management is aware of the factors in my work environment that may lead to employee injury or ill health	0	.53	.30
Senior management puts effort into ensuring that I can work safely	0	.96	.87
Senior management encourages me to report safety incidents	0	.54	.36
Senior management takes action on my suggestions for improving occupational safety	0	.80	.64
Percent of variance	43.1	10.9	

Additionally, the internal reliabilities of the two occupational safety climate scales were examined. The reliabilities for both scales were good. The senior management's commitment to occupational safety scale had a Cronbach's alpha of α =.82, and all item-total correlations were greater than r = .50. The supervisor's commitment scale had a Cronbach's alpha of α =.86, with all item-total correlations greater than r = .54.

Standard Multiple Regressions

To address hypothesis 1c two hierarchical multiple regressions were conducted to examine the relationship between patient safety climate and the overall grade given by participants to patient safety in term of their a) department, and b) geographical region, after controlling for location, management position, and occupational grouping. For each hierarchical regression analysis, the control variables (i.e., location, management position, occupational group, tenure) were entered into the first step of the equation and the four patient safety climate scales were entered into the second step. After controlling for the demographic variables, patient safety climate accounted for an additional 20% of variance in the department grade given for patient safety ($\Delta R^2 = .204$, $\Delta F = 8.03$, $p < .001$) and an additional 19% of the variance in the grade given for regional patient safety ($\Delta R^2 = .194$, $\Delta F = 9.04$, $p < .001$). As indicated in Table 9, supervisor's commitment to patient safety ($\beta = .25$, $p = .002$) was the only variable that significantly predicted the overall department grade; although colleagues' involvement in patient safety did approach significance ($\beta = .15$, $p = .054$). Whereas senior management's commitment to patient safety was the only individually unique predictor of overall regional grade ($\beta = .32$, $p < .001$).

Table 9

Summary of Hierarchical Regression Analysis for Variables Predicting Patient Safety Grade

	PATIENT SAFETY GRADE			
	Overall Department Patient Safety Grade (N =167)		Overall Region Patient Safety Grade (N =164)	
Step	**β**	**ΔR^2**	**β**	**ΔR^2**
1. *Control Variables*		.14[c]		.18[c]
Location	-.25[c]		-.41[c]	
Management position	-.09		-.09	
Tenure	-.16[a]		-.06	
Occupational group				
Nurse	-.11		.03	
Administrative	-.14		.07	
Physician	-.14		.02	
2. *Predictors*		.20[c]		.19[c]
Colleagues involvement	.15		.14	
Senior management's commitment	.07		.32[c]	
Supervisor's commitment	.25[b]		.03	
Physician's demonstrated importance	.14		.10	
Total R^2		**.34**		**.37**

[a]$p < .05$; [b]$p < .01$; [c]$p < .001$

Two additional hierarchical multiple regressions were conducted to examine if the same pattern of results would be found for the relationship between occupational safety climate (i.e., senior management's commitment and supervisor's commitment) and the overall department and regional occupational safety grades, after controlling for the same demographic variables described above. As indicated in Table 10, a similar pattern of results were revealed for occupational safety. After controlling for the demographic variables, occupational safety climate accounted for an additional 22% of the variance in the department grade ($\Delta R^2 = .22$, $\Delta F = 9.58$, $p < .001$) and an additional 19% of the variance in the region grade ($\Delta R^2 = .19$, $\Delta F = 9.72$, $p < .001$). Only supervisor's commitment to occupational safety ($\beta = .42$, $p < .001$) uniquely predicting the overall department grade, whereas only the senior management's commitment to occupational safety ($\beta = .41$, $p < .001$) uniquely predicting the overall regional grade on occupational safety.

Table 10

Summary of Hierarchical Regression Analysis for Variables Predicting Patient Safety Grade

	OCCUPATIONAL SAFETY GRADE			
	Overall Department Occupational Safety Grade (N =184)		**Overall Region Occupational Safety Grade (N =185)**	
Step	**β**	**ΔR^2**	**β**	**ΔR^2**
1. *Control Variables*		.08[a]		.12[c]
Location	-.12		-.28[c]	
Management position	-.17[a]		-.12	
Tenure	-.17[a]		-.12	
Occupational group				
Nurse	-.11		-.04	
Administrative	-.01		.07	
Physician	.01		.06	
2. *Predictors*		.22[c]		.19[c]
Senior management's commitment	.11		.41[c]	
Supervisor's commitment	.42[c]		.07	
Total R^2		**.30**		**.31**

[a]$p < .05$; [b]$p < .01$; [c]$p < .001$

Relationship between Patient Safety and Occupational Safety

Several correlational analyses were conducted to test the relationship between patient safety and occupational safety (see Table 11). To address hypothesis 2, a correlation was conducted between overall patient safety and overall occupational safety. Patient safety and occupational safety was significantly correlated in the hypothesized direction (r =.67, p <.01). Furthermore, correlations were conducted between the patient safety climate subscales and the two occupational safety climate subscales, all of which were significant. Examining the pattern of correlations reveals supervisor's commitment to patient safety and supervisor's commitment to occupational safety produced the largest correlation (r =.74, p <.01). Whereas, senior management's commitment to patient safety and senior management's commitment to occupational safety was moderately correlated with one another (r =.61, p <.01), thus supporting hypothesis 2.

The correlational relationships presented in Table 11 were also used to distinguish the convergent and discriminant validity of the patient safety climate scale. The results indicates that the relationships between supervisor's commitment to patient safety and colleague's involvement in patient safety ($r = .42, p < .001$) is stronger than the relationship between supervisor's commitment to occupational safety and colleague's involvement in patient safety ($r = .28, p < .001$). This pattern of results is also found when examining the relationships between colleague's involvement in patient safety and senior management's commitment to patient safety ($r = .36, p < .001$) and senior management's commitment to occupational safety (r = .27, p < .001). Additionally, this pattern of results was also found when comparing the relationships between physician's demonstrated importance of patient safety and supervisor's commitment to patient safety

($r = .38, p < .001$) and supervisor's commitment to occupational safety ($r = .33, p < .001$). Although this pattern of results was not repeated when comparing the relationships between physician's demonstrated importance and senior management's commitment to patient safety ($r = .43, p < .001$) and senior management's commitment to occupational safety ($r = .45, p < .001$). These results provide some support for the convergent and discriminant validity of the patient safety climate scale and suggest that patient safety climate and occupational safety climate are distinct concepts.

Table 11

Means, standard deviations, and correlations among the study variables (N=165).

		M	*SD*	1	2	3	4	5	6	7	8	9	10	11
1	Occupational Group	2.79	0.87	-										
2	Management Position	0.56	0.50	-.03	-									
3	Tenure (yrs)	8.69	8.30	-.09	-.13	-								
4	Colleagues involvement in patient safety	3.81	0.69	.01	-.03	-.07	(.78)							
5	Management's commitment to patient safety	3.72	0.63	.04	.00	-.09	.36**	(.80)						
6	Supervisor's commitment to patient safety	3.96	0.66	.01	-.02	-.15	.42**	.57**	(.84)					
7	Physician demonstrated importance of patient safety	3.02	0.72	.06	-.10	-.14	.42**	.43**	.38**	(.84)				
8	Management's commitment to worker safety	3.59	0.64	.13	.10	-.20*	.27**	.61**	.43**	.45**	(.82)			
9	Supervisor's commitment to worker safety	3.92	0.63	.05	-.06	-.15*	.28**	.40**	.74**	.33**	.55**	(.86)		
10	Overall patient safety	3.62	0.51	.05	-.05	-.15	.70**	.78**	.78**	.76**	.59**	.58**	-	
11	Overall worker safety	3.76	0.55	.10	.02	-.19*	.32**	.58**	.65**	.46**	.88**	.87**	.67**	-

Scale reliabilities appear on the diagonal
*p < .05; **p < .001

Discussion

The purpose of this study was to develop and test a measure of patient safety climate that was based on a focused theoretical framework describing the specific mechanisms underlying patient safety climate formation. This study was an effort to address one of the major limitations of the patient safety climate literature (i.e., a lack of consistency in patient safety climate instruments; Singla et al., 2006). The majority of the current patient safety climate surveys measure a hodgepodge of patient safety factors of varying degrees of specificity. This amount of variation in patient safety climate factors is an indication that no clear focus or effort has been placed on properly defining and developing the construct of patient safety climate.

Based on previous definitions of patient safety climate (Mark et al., 2007; Sorra & Nieva, 2004) and organizational climate (Reichers & Schneider, 1990) ; the current study defined patient safety climate as employees shared beliefs and perceptions of the value and importance of preventing patient harm as a result of the care delivery process to the organization. Based on this definition, which highlights the aspect of group consensus, patient safety climate was described as a social process. Therefore theories and previous research on social influences were used to develop the theoretical framework that emphasizes the importance of social relationships in creating employees shared patient safety beliefs and perceptions. Specifically, normative and informational influence from individuals within ones work environment (i.e., senior managers, supervisors, physicians, and colleagues) and the development of subjective norms were described as the motivational drivers for group consensus of employee beliefs and perceptions regarding patient safety issues. It should be noted that although patient safety climate has been characterize a measure of group consensus of employee patient safety beliefs and perception, this study could not actually measure group consensus due to the method of data collection.

The results from an exploratory factor analysis (EFA) provide initial support for the theoretical framework and new patient safety climate survey. This analysis revealed a four factor model accounting for 52.8% of the variance in patient safety climate, thus supporting hypothesis 1a. The four factors were labeled as: (1) physician's demonstrated importance of patient safety, (2) supervisor's commitment to patient safety, (3) senior management's commitment to patient safety, and (4) colleague's involvement in patient safety. Furthermore, the internal reliabilities of each scale were good, thus supporting hypothesis 1b.

Contrary to previous research that suggests management's commitment is the most important factor in patient safety climate (Flin et al., 2006), the results from this study found that it was physician's demonstrated importance of patient safety that explained the most variance in patient safety climate. Physician's demonstrated importance of patient safety explained 31.8% of the variance, as compared to supervisor's commitment, which explained only 9.4% and senior management's commitment which explained even less (6.8%). These results suggest the extent to which physicians demonstrate they value and are committed to patient safety may be more important in influencing employee's beliefs and perceptions regarding patient safety issues. One likely explanation for the results of this study contradicting previous research findings is that to date, few (if any) patient safety climate surveys have measured the impact physicians can have on employee patient safety beliefs and perceptions.

In addition to developing and testing a new measure of patient safety climate, this study also examined the relationship between occupational safety and patient safety. Given the large amount of overlap in content due to the patient safety literature being developed largely from the occupational safety literature, surprisingly little research has examined this relationship. Correlational results revealed that overall patient safety was moderately and positively correlated with overall occupational safety (as measured by senior management and supervisor's commitment to employee safety). Examination of the specific factors of patient safety and occupational safety allowed us to further examine this relationship and the convergent and discriminant validity of the patient safety climate survey.

Convergent validity (i.e., theoretically similar constructs are related to one other) was partially supported. A moderate correlation was found between senior management's commitment to patient safety and senior management's commitment to occupational safety. However the relationship between supervisor's commitment to patient safety and supervisor's commitment to occupational safety was more highly correlated than expected ($r = .74$).

Simliarly, partial support for the discriminant validity (i.e., theoretically distinct constructs are not related to one other) was found for the patient safety climate survey. The relationship between colleague's involvement in patient safety and senior management's commitment to patient safety was stronger than the relationship between colleague's involvement in patient safety and senior management's commitment to occupational safety. This was also true for the relationships with the supervisor's commitment scales; although all correlations were statistically significant. The same pattern of results were found between physician's demostrated importance of patient safety and supervisor's commitment to pateint safety and supervisor's commitment to occupational safety. However, this pattern of result did not exist between physician's demostrated importance and the two senior management commitment scales, as these correlations were the same strength. The results from the convergent and discriminant validity analysis do not fully indicate that the facets of patient safety are distinct constructs from the occupational safety facets. Therefore furture research is required before we can say for certain that the patient safety climate factors found in the current study are not simply a function of the occupational group (e.g., senior manager, supervisor), but rather are a function of the level of the commitment and involvement in the different factets of safety (e.g., patient safety, staff safety).

Limitations and Future Research

There are several limitations to the present study that should be addressed and will hopefully guide future research in this area. The size of the sample recruited for this study causes several potential problems and warrants several cautions when interpreting the results presented above. A relatively low sample size is a concern when conducting factor analysis as this technique relies on estimating correlation coefficients which tend to be less reliable from small samples (Tabachnick & Fidell, 2007). Thus, a number of techniques were applied in an effort to increase the size of the study sample.

First, a missing data estimation procedure (i.e., person mean insertion) was applied to the data set, as there was a large amount of data only missing one data point per scale. Person mean insertion was chosen based on Downey and King's (1998) argument that PMI is a reasonable estimate for missing data in attitude scales, such as patient safety climate because they are generally developed to ensure items are correlated with one another. However, it was also recognized that using any missing data estimation procedure can potentially over fit the data when conducting factor analysis (Tabachnick & Fidell, 2007). To assess if this occurred in the current study a factor analysis was run on the data set before any missing data was imputed. Using a sample of 153 participants, this factor analysis showed a similar pattern of results, with one exception. The one difference between the results of this factor analysis and the one reported for the current study was that item 11 *("My supervisor does not address patient safety concerns in a timely manner")* stayed as a complex item after the removal of item 2. With this analysis, item 11 loaded on the supervisor's commitment factor at .40 and .37 on the senior management's commitment factor.

Although two samples were recruited in the hopes to be able to conduct an exploratory factor analysis on one sample and confirm it on the other, neither sample meet the minimum sample size requirements for either technique. Therefore, to conduct the EFA, both samples were pooled in an effort to meet the suggested minimum sample size requirement of 200 (ten participants per items; Everitt 1975). Combining samples with known differences (as in this case) has been cautioned against, as the samples may also have different factors (Tabachnick & Fidell, 2007). To ensure this was not influencing the result from the present study, I also conducted an EFA using just the larger sample (i.e., Saskatchewan) and found the same pattern of results. The results from both these two additional EFAs suggest that the sampling limitations had minimum effects on the results obtained. Despite this, future research should aim to recruit a more appropriate sample size and to continue to test the psychometric properties of this newly developed healthcare climate survey.

In addition to collecting data from a larger sample, further scale development of the survey should be conducted. For instance some items may need to be reworded for clarity (e.g., *"My supervisor is aware of the factors in my work environment that may lead to employee injury or ill health*"). Future research using the healthcare safety survey may also wish to modify the instructions provided for completing each scale, particularly for the senior management, supervisor, and colleague scales. Future research using not only this survey, but other patient safety climate surveys need do a better job at defining what is meant by the terms "|senior management", "supervisor", and "colleagues", as these terms could potentially mean different things to different individuals within an organization. One issue that arose in the present study was that data was collected from a number of occupational groups within healthcare organizations. As such, it was not clear when an individual within a supervisory role was completing the colleagues scale from this survey whether they were thinking of their subordinates, who they likely spend a fair amount of time with, or whether they were thinking of other supervisors. Furthermore, as not all individuals within a supervisory role left the supervisor's commitment to patient safety scale blank, it is possible that supervisors were thinking of the same individuals for this scale as they were thinking of for the senior management scale.

Furtherm scale development of this survey should also extend the occupational safety climate section by creating a colleagues involvement in occupational safety scale, as previous research as suggested that colleagues influence occupational safety as well as patient safety (Hayes et al., 1998).

One of the unique contributions of this study was the inclusion of a measure of the influence physicians can have on employee patient safety beliefs and perceptions. As indicated previously, the results of this study found that physicians may be more influential than management in impacting patient safety climate. Based on this result it is important that both future research and organizational initiatives should seek the continued engagement and participation of physicians in patient safety interventions. Future research should examine the extent that physicians can increase the results of various patient safety initiatives.

Another limitation of the current study is that the predictive validity of the patient safety climate survey could not be established as no patient safety outcome data was collected. The only information available for this study was the grade participants gave their department and region for their patient safety efforts. Although this analysis yielded interesting results (i.e., supervisor's commitment to patient safety predicted the grade given to the department and senior management's commitment predicted the grade given to the region), they are most likely inflated due to common method variance and should be interpreted with caution. Common method variance is also likely to have impacted the results reported for the relationship between patient safety and occupational safety and thus those results should also to be interpreted with caution.

The limitation of no patient safety outcome data is a common problem in patient safety climate research; partly due to the lack of meaningful data collected and the lack of researcher access to what information is collected by the healthcare organization. For example, many healthcare organizations collect patient safety information using incident reporting systems; however this does not account for the incidents not reported and may not be available to the researcher collecting climate data. There are a number of potential outcome variables that can be used to establish the predictive validity of a patient safety climate survey (e.g., healthcare workers behaviors, patient injuries, litigation costs; Flin, 2007). Future research in this area should strive to overcome this problem and find ways to gain access and measure patient safety outcome data.

The survey created and tested in the current study, was designed to assess how senior managers, supervisors, physicians, and colleagues can influence the subjective norms within a healthcare organization and the employees shared patient safety beliefs and perceptions. It is possible that additional key players within the healthcare setting may influence employee's patient safety beliefs and perceptions. For example, a key group of individuals in healthcare that was not considered in the development of this survey or the majority of previous research on patient safety is the patients themselves. This may be especially true in long term patient care settings, where contact with patients is on a more constant and continuous basis. To date, patient safety climate research has largely ignored the patient (Vincent & Coulter, 2002). Recongizing that patients have an important role to play in ensuring safe healthcare is a recent phenomenon and little is known about the role patients can play in improving the culture/climate of safety within healthcare organizations. As patients increasingly reconginze their role in patient safety they have become more aware of healthcare workers behaviors that may increase the risk to their own safety (e..g, hand hygeine, or lack of) and may come to expect and request these behaviors from the staff responsible for their care. Thus, it is possible that patients can normatively influence healthcare workers beliefs and perceptions of patient safety. Therefore, the survey developed in the current study could be further expanded to incorporate new scales that evaluate other potential influencial individuals within healthcare organizations that can help form and shape employees patient safety beliefs and perceptions.

Finally, as a secondary aim of the current study, the relationship between healthcare worker safety and patient safety was investigated through correlational analyses. This relationship has received little attention within the patient safety literature (see Yassi and Hancock, 2005 for exception). Future research should examine this relationship in more depth than was possible here. For instance, longitudinal studies are needed to examine if the rates of patient safety incidents increase as a result of increased psychosocial health problems (e.g., burnout) and safety incidents (e.g., physical strains and injuries) of healthcare workers. Also, the extent to which occupational safety climate efforts within the healthcare industry have an effect on patient safety occurrences should also continue to be examined. The results from Yassi and Hancock (2005) and from this study suggest that there is a positive relationship between worker safety and patient safety. Yet there is little known about the exact nature of this relationship. For example, Yassi and Hancock found that interventions aimed at improving the health and safety of employees also had a positive impact on patient safety. What is less clear is if patient safety interventions could have the same influence on employee safety. Furthermore, there are likely several moderator variables that influence the relationship between patient safety and worker safety.

Conclusion

Given the recent criticisms of the current instruments available to assess patient safety climate (Colla et al., 2005; Flin et al., 2006; Singla et al., 2006), regarding the large variation in number of patient safety climate factors measured and the content of these factors, it is important that new patient safety climate surveys are designed based on a strong theoretical rationale. This study developed a theoretical framework in which to measure patient safety climate and developed a patient safety climate survey accordingly. Patient safety climate was described as a social phenomenon and thus the framework described patient safety climate in terms of how other individuals within the social setting of the work environment influenced individuals' beliefs and perceptions of patient safety.

The results of this study provide initial evidence of the utility of this framework and found evidence for four patient safety climate factors with good internal reliability. The four factors described how senior managers, supervisors, physicians, and colleagues all influence individuals' patient safety beliefs. Although evidence for the discriminant and convergent validity of the patient safety climate survey were inclusive; the overall results of the initial psychometric testing of this new survey are promising. Additional scale development and evaluation is needed before any conclusions can be drawn about this survey.

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Appendix A

Healthcare Safety Climate Questionnaire

SAINT MARY'S UNIVERSITY SINCE 1802

One University. One World. Yours.

Please read the following before you fill out the survey

INSTRUCTIONS

1. Do not put your name on any part of the survey

2. Answer all the questions as completely and honestly as possible. If you are not comfortable answering a question, leave it blank and move onto the next one.

3. Place your survey in the envelope provided and either put it in the drop box or pass it to Dr. Mark Fleming when you are finished

Please Note:
Your answers will be kept confidential and you may withdraw your participation at any time. If you have any questions please ask Dr. Mark Fleming.

Thank you for your cooperation

DEMOGRAPHICS: We ask you to provide the following demographic information for descriptive purpose only. Be assured that this information will not be used to identify you.

1. Please indicate your occupational group?

Physician/ Resident ☐ Nurse ☐
Administration ☐ Other (please specify) ______________

2. Do you hold a management/supervisory position? Yes ______ No ______

3. How long have you been employed at your present job? ______

Below are a number of statements concerning your colleagues, (e.g., people you work with on a frequent basis), for each statement please circle the response that best describes the attitudes and values of the majority of your colleagues.

My Colleagues …	**Strongly Disagree**	**Disagree**	**Neither Disagree or Agree**	**Agree**	**Strongly Agree**
1. …would respond positively if I raised a concern about their clinical practice that may harm a patient	1	2	3	4	5
2. …breach care protocols due to time pressure	1	2	3	4	5
3. …expect me to report patient safety occurrences even if they seem minor	1	2	3	4	5
4. …are active participants in patient safety improvement initiatives	1	2	3	4	5
5. …encourage me to report a close call that could have harmed a patient	1	2	3	4	5

The following statements list various actions that can be exhibited by senior management. Thinking of the senior management within your organization, please rate the extent to which you agree with each statement.

Senior Management …	**Strongly Disagree**	**Disagree**	**Neither Disagree or Agree**	**Agree**	**Strongly Agree**
1. …does not address patient safety concerns in a timely manner	1	2	3	4	5
2. …is aware of the factors in my work environment that may lead to patients being harmed	1	2	3	4	5
3. …puts effort into ensuring the safe delivery of care to patients	1	2	3	4	5
4. …encourages me to report patient safety occurrences	1	2	3	4	5
5. …takes action on my suggestions for improving patient care	1	2	3	4	5

The following statements list various actions that can be exhibited by a supervisor (someone who directs your work). Thinking of your immediate supervisor, please rate the extent to which you agree with each statement. <u>If you do not have a supervisor please skip this section.</u>

My Supervisor …	**Strongly Disagree**	**Disagree**	**Neither Disagree or Agree**	**Agree**	**Strongly Agree**
1. …does not address patient safety concerns in a timely manner	1	2	3	4	5
2. …is aware of the factors in my work environment that may lead to patients being harmed	1	2	3	4	5
3. …puts effort into ensuring the safe delivery of care to patients	1	2	3	4	5
4. …encourages me to report patient safety occurrences	1	2	3	4	5
5. …takes action on my suggestions for improving patient care	1	2	3	4	5

Thinking of the Physicians you work with, please rate the extent to which you agree with each statement. <u>If you are a Physician please think of other Physicians you collaborate with when responding to each statement.</u>

Physicians I work with…	**Strongly Disagree**	**Disagree**	**Neither Disagree or Agree**	**Agree**	**Strongly Agree**
1. …respond positively if I raised a concern about their clinical practice that may harm a patient	1	2	3	4	5
2. …do not follow appropriate patient safety care protocols	1	2	3	4	5
3. …are effective communicators	1	2	3	4	5
4. …encourage me to report patient safety occurrences	1	2	3	4	5
5. …takes action on my suggestions for improving patient care	1	2	3	4	5

These questions are about overall patient safety

	A **Excellent**	**B** **Very good**	**C** **Acceptable**	**D** **Poor**	**F** **Failing**
Please give your ***department*** an overall grade on patient safety	**A**	**B**	**C**	**D**	**F**
Please give the ***Region*** an overall grade on patient safety	**A**	**B**	**C**	**D**	**F**

Workplace safety

The following statements list various actions that can be exhibited by senior management that may influence your health and safety. Thinking of the senior management within your organization, please rate the extent to which you agree with each statement.

Senior Management ...	**Strongly Disagree**	**Disagree**	**Neither Disagree or Agree**	**Agree**	**Strongly Agree**
1. …does not address occupational safety concerns in a timely manner	1	2	3	4	5
2. …is aware of the factors in my work environment that may lead to employee injury or ill health	1	2	3	4	5
3. …puts effort into ensuring that I can work safely	1	2	3	4	5
4. …encourages me to report safety incidents	1	2	3	4	5
5. …takes action on my suggestions for improving occupational safety	1	2	3	4	5

The following statements list various actions that can be exhibited by a supervisor that may influence your health and safety. Thinking of your immediate supervisor, please rate the extent to which you agree with each statement. If you do not have a supervisor please skip this section.

My Supervisor ...	**Strongly Disagree**	**Disagree**	**Neither Disagree or Agree**	**Agree**	**Strongly Agree**
1. …does not address occupational safety concerns in a timely manner	1	2	3	4	5
2. …is aware of the factors in my work environment that may lead to employee injury or ill health	1	2	3	4	5
3. …puts effort into ensuring that I can work safely	1	2	3	4	5
4. …encourages me to report safety incidents	1	2	3	4	5
5. …takes action on my suggestions for improving occupational safety	1	2	3	4	5

These questions are about overall occupational safety

	A Excellent	**B Very good**	**C Acceptable**	**D Poor**	**F Failing**
Please give your ***department*** an overall grade on occupational safety	**A**	**B**	**C**	**D**	**F**
Please give the ***Region*** an overall grade on occupational safety	**A**	**B**	**C**	**D**	**F**

Appendix B

Information Sheet

Improving the measurement of patient safety: Development of a new patient safety climate survey

Dr. Mark Fleming and Natasha Wentzell

Please carefully read this form as the information it contains may affect your decision to participate. Completing the attached survey will be taken as consent to participate in this study.

The following survey examines issues related to patient safety climate and employee safety. Patient safety climate can be defined as the shared perceptions of policies, procedures, and practices that are directed towards protecting patients from harm. The survey should take approximately 15-20 minutes to complete. You will be asked to respond to a series of statements pertaining to your attitudes and perception of your organizations patient safety climate, your perceptions of how various other individuals in your organization (e.g., senior management, your colleagues) view patient safety, and your perceptions of employee safety at your organization. This research is part of an ongoing project by researchers at Saint Mary's University in Halifax, Nova Scotia.

Should you choose to participate in this study; you will be asked to complete the attached survey. Once you have completed the survey place it in the envelope provided, seal it, and place it in the survey drop-off box located within the conference space. Alternatively, you may also place your completed survey in the provided envelope and give it directly to the principal research Dr. Mark Fleming who is also attending the conference.

Your participation is completely voluntary and you will in no way be penalized for not completing this survey. Furthermore, it should be noted that your responses will be anonymous; therefore once you have submitted your completed survey you will not be able to withdraw your information from this study. Although we encourage you to answer all of the questions, please feel free to disregard questions you do not with to answer.

Responses to the survey will be kept confidential. We will report results as group totals only and in no way will individual responses be identified and communicated to anyone.

Your participation in this project is very important to us. Should you require further information regarding the study, including a copy of the results please feel free to contact Dr. Mark Fleming, the principal investigator at (902) 420-5273 or by email at mark.fleming@smu.ca. This research has been reviewed and approved by the Saint Mary's University Research Ethics Board. If you have ethical concerns about this study you may contact Dr. Jim Cameron Acting Chair, Research Ethics Board, at ethics@smu.ca or (902) 420-5728. This research project has also been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board. Any questions regarding your rights as a participant may be addressed to that committee through the Ethics Office at (306) 966-2084. Out of town participants may call collect.

We would like to thank you in advance for your participation. Your contribution is sincerely appreciated.

Dr. Mark Fleming Associate Professor	and	Natasha Wentzell Graduate Student

Please keep this form for your own records

Appendix D

Survey Item Descriptive Statistics

Item	*M*	*SD*	*Skew*	*Kurtosis*
My colleagues would respond positively if I raised a concern about their clinical practice that may harm a patient	3.73	0.90	-0.69	0.12
My colleagues breach care protocols due to time pressure.	3.17	1.09	0.02	-1.08
My colleagues expect me to report patient safety occurrences even if they seem minor.	3.76	0.90	-0.86	0.88
My colleagues are active participants in patient safety improvement initiatives.	3.78	0.91	-0.68	0.10
My colleagues encourage me to report a close call that could have harmed a patient.	3.98	0.88	-0.77	0.24
Senior management does not address patient safety concerns in a timely manner.	3.49	0.96	-0.39	-0.57
Senior management is aware of the factors in my work environment that may lead to patients being harmed.	3.63	0.86	-0.63	-0.31
Senior management puts effort into ensuring the safe delivery of care to patients.	3.85	0.76	-0.64	0.44
Senior management encourages me to report patient safety occurrences.	4.11	0.67	-0.60	0.99
Senior management takes action on my suggestions for improving patient care.	3.52	0.83	-0.22	-0.03
My supervisor does not address patient safety concerns in a timely manner.	3.77	0.99	-0.54	-0.57
My supervisor is aware of the factors in my work environment that may lead to patients being harmed.	3.89	0.84	-1.10	1.70
My supervisor puts effort into ensuring the safe delivery of care to patients.	4.01	0.75	-0.66	0.56
My supervisor encourages me to report patient safety occurrences.	4.18	0.71	-0.70	0.71
My supervisor takes action on my suggestions for improving patient care.	3.90	0.82	-0.55	-0.01
Physicians I work with respond positively if I raised a concern about their clinical practice.	2.91	0.94	-0.15	-0.42

Physicians do not follow appropriate patient safety care protocols.	3.18	0.93	-0.17	-0.43
Physicians I work with are effective communicators.	2.84	0.99	0.08	-0.70
Physicians I work with encourages me to report patient safety occurrences.	3.07	0.91	-0.13	-0.22
Physicians I work with takes action on my suggestions for improving patient care.	3.12	0.86	-0.34	0.44
Please give your department an overall grade on patient safety.	3.65	0.74	0.05	-0.39
Please give the ***Region*** an overall grade on patient safety.	3.11	0.73	0.04	-0.21
Senior Management does not address occupational safety concerns in a timely manner.	3.38	0.92	-0.35	-0.74
Senior management is aware of the factors in my work environment that may lead to employee injury or ill health.	3.65	0.82	-0.97	0.65
Senior management puts effort into ensuring that I can work safely.	3.63	0.77	-0.61	0.34
Senior management encourages me to report safety incidents.	4.01	0.74	-0.98	2.29
Senior management takes action on my suggestions for improving occupational safety.	3.55	0.82	-0.30	0.10
My supervisor does not address occupational safety concerns in a timely manner.	3.79	0.85	-0.61	0.17
My supervisor is aware of the factors in my work environment that may lead to employee injury or ill health.	3.91	0.69	-1.00	2.39
My supervisor puts effort into ensuring that I can work safely.	3.91	0.77	-1.04	2.02
My supervisor encourages me to report safety incidents.	4.13	0.69	-0.73	1.74
My supervisor takes action on my suggestions for improving occupational safety.	3.88	0.83	-0.59	0.29
Please give your department an overall grade on occupational safety.	3.66	0.73	0.09	-0.41
Please give the Region an overall grade on occupational safety.	3.14	0.74	0.12	0.72

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