

## Exploring the Relationship between Perceptions of Safety Culture and Patient Safety Events in Inpatient Clinical Teams

\*Stephen A. Spates<sup>1</sup>, Catherine Y. Kingsley Westerman<sup>2</sup>, Leslie A. Laam<sup>3</sup>, Ryan Goke<sup>4</sup>

1. Department of Communication, Missouri State University.

2. Department of Communication, North Dakota State University, Fargo, ND, United States.

3. Department of Public Health, NDSU; Center for Biobehavioral Health, Sanford Research, Fargo, ND, United States

4. Department of Communication, North Dakota State University, Fargo, ND, United States.

ARTICLE INFO	ABSTRACT
<p><b>Article type:</b> Original Article</p>	<p><b>Introduction:</b> Inpatient clinical teams in hospitals must communicate properly to maintain a culture of safety. The purpose of this study was to understand how perceptions of patient safety culture relate to the frequency of safety events in hospitals. Predicted connections were made between elements of safety culture and safety events, using Schein's model of organizational culture as a framework.</p> <p><b>Materials and Methods:</b> The research team was able to gain access to a large sample of perceptions of safety culture from clinical teams in hospitals.</p> <p><b>Results:</b> Results showed that handoffs and transitions were a significant predictor of the reduction of safety events, whereas other predictors were not significant. Implications for communication research on clinical teams are discussed.</p> <p><b>Conclusion:</b> Implications are provided for the variables along with a discussion of the findings from the data. Practical implications for healthcare teams are also discussed for consideration of team member behaviors in the future. Suggestions for future research are identified.</p>
<p><b>Article History:</b> Received: 25 Jan 2022 Accepted: 21 Sep 2022</p>	
<p><b>Key words:</b> Clinical teams, Hospitals, Patient Safety Culture, Safety Events</p>	
<p>► <b>Please cite this paper as:</b> *Spates SA, Kingsley Westerman CY, Laam LA, Goke R. Exploring the Relationship between Perceptions of Safety Culture and Patient Safety Events in Inpatient Clinical Teams. <i>Journal of Patient Safety and Quality Improvement</i>. 2022; 10(3): 83-95. Doi: 10.22038/PSJ.2022.62858.1348</p>	

**\*Corresponding Author:**

Department of Communication, Missouri State University. E-mail: SSpates@missouristate.edu

## Introduction

Maintaining patient safety is a central pillar of organizational culture in hospital systems. Organizational culture exists as it does because members of organizations hold beliefs about what they and others in their organization value and how members of their organization should think and behave. Through their thoughts, beliefs, behaviors, and interactions, members create and maintain culture in their organizations. For example, how clinical teams in hospitals interact regarding safety creates expectations for behavior by indicating what behaviors and attitudes are valued and what behaviors and attitudes are not as important (1). This study focuses on how the safety culture of inpatient clinical teams affects safety events in hospitals. Investigating the link between these variables is rather novel. Most inferences are made with insurance claims and incident reports as supporting data. Finding a link between safety culture and safety events increases the accessibility of measurable variables before events take place. Safety events in hospitals are defined as a broad set of adverse or potentially harmful events that occur while a patient is under the care of a clinical team (2). Safety events can include everything from patient falls to medication errors to the development of pressure ulcers. Below, we will first define organizational and safety culture. Then we will describe elements of safety culture related to communication and relationships in hospitals and explain how these elements are connected to safety events in hospitals. Learning how elements of culture are linked to safety events can help hospitals understand what elements of culture are particularly influential and work to improve them when possible.

### Safety Culture in Hospitals

Organizational culture is a system of beliefs, assumptions, and behaviors that is agreed upon by people in an organization, sometimes implicitly (3). Safety culture in hospitals aligns with organizational culture but is specifically concerned with the degree to which the culture supports efforts to “[minimize] patient harm that may result from the process of care delivery” (4).

Understanding the safety culture in risky industries such as hospitals is crucial to ensure that safety is upheld. (5) model of culture provides a framework for examining culture in organizations. The model consists of three distinct but interrelated levels: artifacts, espoused values, and basic assumptions. Artifacts are the most visible level of culture; they include elements such as the architecture of the buildings, the type of office, warehouse, or factory space the organization is housed in, all the way down to what is displayed (or not displayed) in workspaces. Espoused values are stated beliefs about what is important to an organization. They are often expressed in documents such as a mission statement or policy indicating what types of behavior are expected or discouraged. The third and deepest level of culture is basic assumptions, which are cultural ideas that organization members may not even be able to articulate because they are so deeply embedded.

This study looks at safety culture via artifacts and espoused values perceived by staff in inpatient clinical teams in a large hospital system. We rely on an artifact known as the Hospital Survey on Patient Safety Culture (HSOPS) to reveal espoused values of members of inpatient clinical teams. The HSOPS is an artifact because in and of itself, it is an indicator of the value placed on safety by this hospital system. Using responses to the HSOPS, we posit links between aspects of the espoused safety culture and safety events.

In hospitals, patient safety is indicated by safety events, defined as a broad set of adverse or potentially harmful events that occur while a patient is under the care of a clinical team (2). The goal for hospitals is to have fewer safety events. The safety culture enveloping a given clinical team is likely to affect how they complete their jobs, so the occurrence of safety events depends on the safety culture.

### Safety Culture and Communication

Two facets of the safety culture that could affect safety events are communication and the relationships among members of clinical teams. First, the communication within clinical teams is crucial to limiting safety events. Communication encompasses how

the team deals with sharing information with each other and giving and accepting feedback about performance (6). A second important communication process is sharing and receiving feedback. This includes the response when a safety event or potential problem is identified. The degree to which the response invites discussion and working together to improve versus punishing people will determine the unit's ability to make improvements.

The HSOPS elicits espoused values regarding facets of safety culture relevant to communication among members of clinical teams. The degree to which these communication elements are valued should indicate the degree to which there is a safety culture that supports solving problems that may lead to safety events, ultimately reducing safety events. Below, each facet is defined, followed by a brief rationale and a hypothesis.

First, feedback and communication about error has to do with the response when a safety event occurs. Specifically, it is a question of how frequently people are informed about errors and changes made based on safety event reports, and how often errors are discussed to prevent them from happening again. Consistent with theorizing that suggests people are cognizant of how they present themselves to others (7), talking about safety events is not the most desirable activity. Reporting an error might make one or one's team look bad (8) found that physician residents and faculty felt like reporting errors was the right thing to do, whether minor or major. However, residents and faculty were still less likely to report safety events when they occurred, for minor and major events. In keeping with self-presentation concerns, anonymity when reporting safety events seems to be useful to encouraging reporting (9). Are careful to point out that MEDMARX, a system used to collect reports of medication errors in Emergency departments in hospitals across the country, is "an anonymous, confidential, de-identified...reporting program" (p. 486) (10). Applied Goffman's ideas to acute care hospital wards, combining Goffman's front and back stages with planned and ad hoc interactions. Lewin and Reeves observed both planned (e.g., meetings) and ad hoc (e.g.,

catching up in the hallway) backstage interactions occurring. Presumably, talking about error would be a backstage activity--done outside of the view of patients and their families. However, when they are "backstage," the degree of comfort a clinical team has around talking about errors and how to improve those errors is likely to affect outcomes; in particular, safety events have the potential to improve if the culture is open to talking about errors.

H1: When feedback and communication about error is rated highly by clinical staff, safety events will be fewer.

Second, communication openness is defined as how comfortable staff feel speaking up when they see potential problems. Openness is likely to create an environment where employees can share information (11). Found that when employees perceived communication openness in their supervisor, they felt psychologically safe and were more likely to use voice to help improve the organization (12). Also demonstrated that the climate of an organization affects employees' willingness to speak up. In a series of interviews of supervisors regarding dissent (13), identified a theme of supervisors rejecting dissent specifically for interviewees he identified as working in health care contexts. Garner's findings suggest a question as to whether openness will be valued in clinical teams. We expect that perceptions of openness in clinical teams have the potential to avert possible safety events.

H2: When communication openness is rated highly by staff, safety events will be fewer.

Third, handoffs and transitions refer to the movement of patients by staff, either between units or during shift changes and the degree to which these transfers occur successfully (14). Cited miscommunication or inadequate communication as a common source of errors in transitions (15). Asserts that one aspect of transitions, medication reconciliation, rests in part on a "culture of accountability" (p. e48) in order to be successful. That is, everyone involved in a transition must be accountable for completing the medication reconciliation successfully. This suggests that perceptions

of culture are important in any transition. If handoffs and transitions are highly valued events, then the extra care that staff will take to ensure they are completed properly should reduce safety events.

H3: When handoffs and transitions are rated highly by staff, safety events will be fewer. Fourth, nonpunitive response to errors is the perception of the degree to which people “get in trouble” or are blamed for mistakes they may have made, including being written up or having the mistake documented in their file. Being blamed creates defensiveness and decreases the likelihood that team members will be open to discussing and fixing errors. For example (16), found some mixed results for blame when exploring errors among teams. They noted that while blame was positively related to promoting responsibility and accountability, it may also increase defensiveness and closed-mindedness. This was especially noted when blaming was done covertly (17).

Found that doctors and nurses reported that junior staff being unfairly blamed for adverse events was seen as a barrier to reporting, along with not wanting to get into trouble, though the latter was a lesser concern. If nonpunitive response to error is widely accepted as a valued part of safety culture, it should be easier to avoid safety events.

H4: When nonpunitive response to error is rated high by staff, safety events will be fewer. Finally, frequency of events reported is how often people say “near misses” are reported as safety events. That is, when a mistake is made, but no harm is expected, how often do people on a staff say they report these safety events that did not result in harm? For example (18), found that frequency of events reported increased among Emergency Residents when proper education on reporting was provided. Gauging frequency of events is an indicator of the communication environment of a clinical team (19).

Found that when teams added reporting protocols into their everyday responsibilities, the frequency of reporting increased. In other words, the frequency of reporting became a collective interest of the entire team, allowing for reporting to be a

cultural norm. H5: When the frequency of events reported is rated highly by staff, safety events will be fewer.

### **Safety Culture and Relationships**

Relationships are a second facet of safety culture that is likely to affect the presence of safety events. These include how supported employees feel by their immediate supervisor and upper management as well as how well a clinical team works together and how well a clinical team works with those in other units.

How clinical team members perceive these different relationships is an important indicator of the safety culture. Clinical team members can have different perceptions of their safety culture depending on their interaction within, and across, different units of the hospital. If upper management and supervisors can successfully train team members to work together and communicate, it is likely to reduce the number of safety events. This can increase the perception of a positive safety culture. A reduction in safety events could also be a positive outcome of teamwork and effective communication from management.

Teamwork within units refers to how much a team supports and respects each other and the degree to which members are perceived as willing to help each other to complete their collective work. For example, (20) found that when nurses perceived teamwork within units as high, they noted an increased frequency of reporting safety events. This shows a willingness to support and help each other, even when safety events occur. Similarly, (21) found that hospital staff members were more likely to perceive handoffs as effective when teamwork within units was high. In other words, the presence of teamwork had a positive effect on how other patient safety culture actions were perceived. Therefore, if teamwork within units is perceived as high, they should experience a reduction in safety events.

H6: When teamwork within units is rated highly by staff, safety events will be fewer.

Teamwork across units refers to the coordination and cooperation perceived across different units that need to work together to care for patients (22). Found that

nurses' perceptions of teamwork across units was significantly related to their attitudes towards patient safety competency, but not their knowledge or skills. This led to suggestions that safety culture must be a priority of each individual unit in order to continue across units. Similarly, if team members perceive teamwork across units as high, they should see a reduction in safety events.

H7: When teamwork across units is rated highly by staff, safety events will be fewer.

Supervisor or manager expectations and actions promoting patient safety is defined as the degree to which supervisors are perceived as strongly supporting safety as opposed to pressuring for faster work via shortcuts or overlooking repeated patient safety problems (23).

Found that manager expectations and actions promoting patient safety had a significant negative relationship with surgical site infections (SSI). The authors noted that hospital management has an important role to play to maintain patient safety culture. Likewise, if team members perceive a high level of expectations for, and actions promoting safety culture, they should see a reduction in safety events.

H8: When supervisor or manager expectations and actions promoting patient safety are rated highly by staff, safety events will be fewer.

Management support for patient safety is the degree to which the upper management is perceived as prioritizing safety and a climate of safety rather than only being concerned with safety when an adverse event occurs. When (24) conducted a study looking at the perceptions of clinical practitioners on dimensions of patient safety in their own hospital, they noted several weaknesses. Among the nine weaknesses, management support for patient safety was one of the largest. This was noted as an area in need of improvement in order to improve perceptions of safety culture. In other words, low amounts of support from management could impact the perceptions, and ultimately, the actions of safety behaviors from clinical teams. Therefore, if team members perceive a high amount of support for patient safety, from management, they should expect a reduction in safety events.

H9: When management support for patient safety is rated highly by staff, safety events will be fewer.

## Materials and Methods

### Participants

The sample for this study consisted of 1,183 employees within 39 clinical teams across 5 Geisinger hospitals. Geisinger Health is a healthcare organization in the United States that serves more than 3 million people throughout 45 counties in Pennsylvania and New Jersey.

Geisinger includes 13 hospitals, two research centers, a health insurance plan, and the Geisinger Commonwealth School of Medicine. Clinical teams are defined by an employee's primary work location in a hospital.

This sample consists of inpatient clinical teams on medical-surgical units (29 teams, 825 respondents), intensive and specialty care units (7 teams, 268 respondents), and labor and delivery units (3 teams, 90 respondents).

Nurses, technicians, medical assistants, and unit desk clerks are linked to one hospital unit to carry out their work tasks, and these employees constitute the consistent work team for their unit, which are the teams in this sample. The sample does not include physicians, resident physicians, and mid-level clinical providers (i.e., nurse practitioners, physician assistants) because of the transient nature of their roles. Physicians and mid-level providers care for patients across inpatient units and do not spend their workday in one location with one inpatient team.

Because their roles are substantively different relative to each unit than the roles of the consistent work team, they are excluded from this sample.

Of the sample, ninety-eight percent of survey respondents indicated they have regular and direct patient contact. Forty-one percent of respondents did not report a single patient safety event over the prior 12 months, 30% reported 1-2 events, 18% reported 3-5 events, and 11% reported greater than 5 events. Characteristics of the hospitals and clinical teams are detailed in Table 1.

**Table 1:** Characteristics of Hospitals and Teams that Comprise the 1,183 Survey Respondents

Hospital	Bed size category	Teaching status	Number of inpatient teams	Total number of survey respondents	Mean (Range) of survey respondents per team
Hosp 1	<200	Non-teaching	3	67	22.3 (17-30)
Hosp 2	200-299	Non-teaching	8	194	24.3 (8-37)
Hosp 3	<200	Non-teaching	5	114	22.8 (9-32)
Hosp 4	≥500	Teaching	16	607	37.9 (16-65)
Hosp 5	200-299	Non-teaching	7	201	28.7 (12-61)

**Survey Instrument**

The AHRQ Hospital Survey on Patient Safety Culture (HSOPS) is a well-established, psychometrically validated instrument developed for hospitals to assess safety culture in their organizations (25). This instrument is the evaluation standard in patient safety. The first HSOPS was released in 2004. It is publicly available to any hospital. Geisinger Health deploys the survey in a web-based format every 2 years. Participation in the survey is voluntary and anonymous. Data used for this study were collected in October 2019. The HSOPS assesses twelve patient safety variables, each consisting of 3-4 survey items. All items on the HSOPS use a Likert scale of 1-5, where 3 is coded as a neutral response, and the other possible scores (i.e., 1, 2, 4, 5) are coded depending on the wording of the item (i.e., whether each item is reverse coded or not). The scores on the items were averaged to create composite variables for the analysis. First, an average score was calculated for individual respondents and then all respondents in each unit were averaged to create the unit level analysis (N=39).

**Primary predictor variables**

To measure feedback and communication about error, participants responded to a 3-item, five-point Likert subscale from the HSOPS (Cronbach’s alpha = .77; cf.) (25): Participants responded to items like, “We are informed about errors that happen in this unit” and “In this unit, we discuss ways to prevent errors from happening again.” Higher scores indicate the perception of a higher frequency of feedback and communication about error.

Communication openness was measured with a 3-item, five-point Likert subscale from the HSOPS (Cronbach’s alpha = .58; cf.)

(25). Participants responded to items like, “Staff feel free to question the decisions or actions of those with more authority” and “Staff are afraid to ask questions when something does not seem right.” Higher scores indicate a perception of more communication openness.

To measure handoffs and transitions, participants responded to a 4 item, five-point Likert subscale from the HSOPS (Cronbach’s alpha = .75; cf.) (25). Participants responded to items like, “Important patient care information is often lost during shift changes” and “Problems often occur in the exchange of information across hospital units.” Higher scores indicate a perception that the exchange of information is problematic.

To measure nonpunitive response to errors, participants responded to a 3-item, five-point Likert subscale from the HSOPS (Cronbach’s alpha = .75; cf.) (25). Participants responded to items like, “Staff feel like their mistakes are held against them” and “When an event is reported, it feels like the person is being written up, not the problem.” Higher scores indicate a perception that mistakes are held against staff and that staff are to blame when mistakes occur instead of the process.

To measure frequency of events reported, participants responded to a 3-item, 5-point Likert subscale from the HSOPS (Cronbach’s alpha = .0.78; cf.) (25). Participants responded to items such as “When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?” Higher scores indicate the perception that near misses are reported more frequently. To measure teamwork within units, participants responded to a 4-item, 5-point Likert subscale from the HSOPS (Cronbach’s alpha = 0.79; cf.) (25). The scale

included items such as “People support one another in this unit” and “When one area in this unit gets really busy, others help out.” Higher scores indicate a perception of stronger support and cooperation among teams within units. To measure teamwork across units, participants responded to a 4-item, 5-point Likert subscale from the HSOPS (Cronbach’s alpha = 0.68; cf.) (25). The scale included items such as “There is good cooperation among hospital units that need to work together” and “Hospital units work well together to provide the best care for patients.” Higher scores indicate a perception of stronger cooperation among teams across units. To measure supervisor or manager expectations and actions promoting patient safety, participants responded to a 4-item, 5-point Likert subscale from the HSOPS (Cronbach’s alpha = 0.70; cf.) (25).

The scale included items such as “My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures” and “My supervisor/manager seriously considers staff suggestions for improving patient safety.” Higher scores indicate a perception of stronger support and actions supporting safety from managers.

To measure management support for patient safety, participants responded to a 3-item, 5-point Likert subscale from the HSOPS (Cronbach’s alpha = 0.71; cf.) (25). The scale included items such as “Hospital management provides a work climate that promotes patient safety” and “The actions of hospital management show that patient safety is a top priority.” Higher scores indicate a perception of stronger support for patient safety from upper management.

### Outcome measure

Patient safety events are a broad set of adverse or potentially harmful events that occur while a patient is under the care of a clinical team. Although referred to as medical errors, which are defined as “an unintended act (either of omission or commission) or one that does not achieve its intended outcome” (26), most do not result in patient harm (2). This study includes all patient safety events, including safety events such as medication errors (e.g., incorrect dosage or timing of

medication, wrong patient, wrong medication), if a patient experiences a fall while in the hospital, hospital acquired infections, hospital acquired pressure ulcers, among many others. It is important to reiterate that although a patient may fall, injury or harm to the patient may not occur. The fall is still in and of itself a patient safety event. Safety events are reported through what is designed to be a mandatory reporting system. Importantly, this system collects identifiable information, so reporters are not anonymous. Although it is expected and required by policy that employees report everything through this system, there is no way of enforcing the policy. The accompanying caveat is that all safety events may not actually be reported for various reasons. Patient safety events were collected from January 2018-December 2019. This period was selected based on when the HSOPS survey was collected, Oct 2019. Organizational culture change occurs over a long period of time, and most hospitals administer the HSOPS every two years with the idea that the current response is reflective of perceptions held since the prior survey. Patient safety outcomes are measured as a rate per 1,000 patient days, which allows for standardization across teams and hospitals. The total number of patient safety events, the total number of patient-days, and the rate of patient safety events per 1,000 patient-days were included in the data set.

### Covariates

Hospital and unit characteristics may impact the associations between the primary predictor variable and patient safety events. Specifically, hospital size (defined by number of inpatient beds) and hospital teaching status are known to be associated with patient safety outcomes (27). Team characteristics such as patient care unit type are associated with patient safety outcomes, and tenure in current work unit is associated with overall perceptions of safety.

### Results

Zero-order correlations among all variables are reported in Table 2. Descriptive statistics for each variable are found in Table 3.

**Table 2: Zero-Order Correlations**

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
<i>Patient safety culture attributes</i>																		
1. Communication and feedback about error	1																	
2. Communication openness	0.62***	1																
3. Handoffs and transitions	0.35*	0.38*	1															
4. Nonpunitive response to error	0.26	0.63***	0.66***	1														
5. Frequency of events reported	0.66***	0.50**	0.25	0.34*	1													
6. Teamwork within units	0.55***	0.66***	0.57***	0.61***	0.44**	1												
7. Teamwork across units	0.35*	0.18	0.43**	0.22	0.29	0.46**	1											
8. Supervisor or manager expectations and actions promote patient safety	0.70***	0.66***	0.43**	0.57***	0.58***	0.53***	0.30	1										
9. Management support	0.74***	0.58***	0.46**	0.47**	0.49**	0.48**	0.33*	0.82***	1									
<i>Unit and hospital characteristics</i>																		
10. Safety grade	0.71***	0.78***	0.57***	0.62***	0.42**	0.77***	0.48**	0.75***	0.76***	1								
11. Tenure in unit	-0.25	-0.05	0.26	0.17	-0.19	-0.20	-0.15	0.04	0.09	-0.06	1							
12. Hospital	0.06	-0.07	-0.35	-0.32*	0.06	-0.06	-0.22	-0.18	-0.06	-0.22	-0.17	1						
13. Unit type	0.23	0.08	-0.28	0.03	0.34*	0.03	-0.17	0.25	0.19	0.05	-0.37*	0.35*	1					
14. Teaching hospital	0.04	-0.04	-0.05	-0.09	-0.11	0.06	-0.01	-0.07	0.09	-0.05	0.05	0.80***	0.20	1				
15. Hospital size	0.08	0.03	-0.28	-0.22	-0.02	0.03	-0.15	-0.15	0.03	-0.10	-0.15	0.95***	0.31	0.88***	1			
<i>Outcome, safety event variables</i>																		
16. Total safety event 2018-2019	-0.03	-0.24	-0.47**	-0.49**	-0.04	-0.21	-0.31	-0.20	-0.11	0.328*	-0.21	0.32	0.10	0.20	0.30	1		
17. Total patient days 2018-2019	0.14	-0.18	-0.47**	-0.45**	0.16	-0.18	-0.30	-0.14	0.05	-0.25	-0.32*	0.50**	0.42*	0.26	0.45**	0.80***	1	
18. Safety events per 1,000 patient-days	-0.23	-0.16	-0.08	-0.14	-0.24	-0.10	0.01	-0.08	-0.21	-0.13	0.19	-0.27	0.50*	-0.14	-0.27	0.45**	-0.11	1
Note. * p<0.05, **p<0.01, ***p<0.001																		

**Table 3: Descriptive Statistics**

Variable	Mean	Std. Dev.	Min.	Max.
<i>Patient safety culture attributes</i>				
Communication and feedback about error	3.96	0.23	3.54	4.48
Communication openness	3.66	0.23	3.19	4.21
Handoffs and transitions	3.36	0.25	2.79	3.86
Nonpunitive response to error	3.22	0.28	2.59	3.98
Frequency of events reported	3.94	0.18	3.56	4.22
Teamwork within units	3.93	0.36	2.80	4.43
Teamwork across units	3.37	0.11	3.17	3.68
Supervisor or manager expectations and actions promote patient safety	3.85	0.29	3.13	4.28
Management support	3.69	0.30	2.97	4.24
<i>Unit characteristics</i>				
Safety grade	3.86	0.36	3.00	4.47
Tenure in unit	2.35	0.45	1.62	3.67
<i>Outcome, safety event variables</i>				
Total safety event 2018-2019	300.87	169.65	21	724
Total patient days 2018-2019	12728.51	6231.52	1626	27571
Safety events per 1,000 patient-days	24.09	8.91	10.07	56.18



We first determined that negative binomial regression was the best fit for the data. Then we ran nine regressions using total safety events as the dependent variable with an exposure of patient days. Patient days refers to the number of days of inpatient services a unit provides. For example, two units with similar total patient days can vary in total patients cared for in the unit because one unit may have more patients passing through due to a short hospital stay while the other unit has fewer patients passing with a long hospital stay. Both units provide the same amount of patient care based on the measure of patient days. Patient days was included as an exposure variable (i.e., a kind of control variable) because the difference in volume of patients or beds per unit means that units

vary in the “opportunity” for safety events to occur. Each regression model included the primary predictor variable (HSOPS variable) and 7 covariates (average safety grade of unit, average tenure in work unit, hospital, patient care unit type, teaching status of hospital, hospital size, and variance of the primary predictor variable) as independent variables.

It was important to create separate models to test each hypothesis independently to avoid multicollinearity. The HSOPS variables are highly correlated and using multiple independent variables per regression model would produce unreliable beta coefficients. (27).

Results from the negative binomial regression models are displayed in Table 4.

**Table 4:** Negative Binomial Regression Analysis Results

Total safety events with an exposure variable of patient days	$\beta$	SE	z	LR Chi2(8)	Prob > Chi2	Pseudo R2
Communication and feedback about error	-0.16	0.34	-0.49	18.57	0.017	0.04
Communication openness	0.03	0.34	0.09	16.87	0.032	0.04
Handoffs and transitions	-0.81	0.30	-2.73**	25.1	0.002	0.06
Nonpunitive response to error	-0.36	0.24	-1.49	19.13	0.014	0.04
Frequency of events reported	-0.39	0.36	-1.07	20.16	0.010	0.04
Teamwork within units	-0.05	0.22	-0.24	17.41	0.026	0.04
Teamwork across units	-0.61	0.62	-0.99	17.93	0.022	0.04
Supervisor or manager expectations and actions promote patient safety	0.38	0.31	1.21	18.77	0.016	0.04
Management support	-0.20	0.26	-0.74	18.17	0.020	0.04

Each model was significant overall (Prob >Chi2 at p<0.001), yet eight of the nine did not indicate significance of the independent variable of interest. Only the model with handoffs as the predictor variable was significant in the predicted direction. Figure 1 and Table 3 provide the predicted number of safety events as the average response for handoffs increases. The negative slope in Figure 1 illustrates that as the average response regarding safety culture for handoffs increases, the number of safety events over a 24-month period decreases. Table 3.1 indicates that as the average response for handoffs increases from 3 to 3.5 the predicted number of safety events decreases by 125 (378.5-252.9) which is approximately 5 fewer events per month.

**Discussion**

A series of negative relationships were predicted between variables of the HSOPS survey and the frequency of safety events. Using Schein’s Model of Organizational Culture as an organizing framework, we argued that the patient safety culture variables that represent espoused values should predict negative relationships with patient safety events. That is, when in-patient clinical teams espouse beliefs in elements of a strong safety culture, the hospital is likely to observe a lower amount of patient safety events. Most of our predictor variables had no relationship with patient safety events. The exception was handoffs and transitions, which did have a significant negative relationship with

patient safety events. The findings are discussed below, organized by communication and relationship-based components of safety culture.

### **Communication**

Above, we argued that the communication environment constituted by the HSOPS variables included communication and feedback about error, communication openness, handoffs and transitions, nonpunitive response to error, and how often team members say near misses are reported. High scores on all of these suggest a communication environment amenable to talking about errors. We expected generally that better communication--that is, more openness, comfort with discussing errors, an expectation that error would not lead to punishments, and belief that people report near-misses would be associated with fewer safety events. What we found was that only perceptions of how handoffs and transitions are handled affected safety events.

Handoffs and transitions affected safety events by reducing them a fair amount. In fact, the perception that handoffs and transitions were handled well (e.g., by not losing information during shift changes, exchanging information effectively across units) was associated with fewer safety events over time (average margin of 128 events over 24 months, or 5.3 events/month). This is a big reduction in patient safety events and suggests that how handoffs and transitions between clinical teams are viewed by clinical team members plays an important role in reducing patient safety events. In a similar vein, (28) found that following proper procedures during handoffs and transitions led to fewer communication breakdowns and greater resilience. Completing handoffs and transitions successfully and perceiving the importance of these key moments in patient care seem to be important to ensuring patient safety.

One difference between handoffs and transitions and the other communication-related variables is that handoffs and transitions involve a specific behavior whereas the others are focused on having conversations about errors. It may be that we need to look one step further to

determine if the conversations are leading to behavioral changes, such as adjustments to procedures, that then lead to a reduction in safety events. This might seem to suggest that communication is less important; however, the scores on the communication elements are quite high, suggesting there is a fertile communication environment for corrective actions to take place. This is consistent with past work showing a link between an open communication environment and the likelihood for individuals to speak up about ways to improve the organization (11,12). If the level of comfort with talking about errors and getting feedback about errors was not as high as it appears to be in this culture, the steps to corrective action would be much more difficult. In other words, a positive communication environment is a necessary but not sufficient condition to lead to the reduction of safety events. The challenge for future research is to identify the corrective actions that result from communication about errors and determine if those are reducing safety events as we would expect.

### **Relationships**

There could be a couple reasons why these variables did not affect safety events. Teamwork within units is focused on the perception of how well members of the same clinical unit support each other, and teamwork across units focuses on how well teams from different units work together. The lack of a link in both cases might suggest that although teamwork within and across units indicates positive perceptions of those relationships, neither indicates actions taken to improve safety because of those relationships. It may be that behaviors affect safety events directly, rather than these perceptions of the relationship affecting safety events. In past work, (20) found that nurses were supportive of their team members reporting safety events, but it is not clear that the team support itself leads to a reduction in safety events.

Perceptions of managers' expectations and actions promoting patient safety, which have to do with the degree to which staff perceived their managers to support safety, did not affect safety events. The expectations of safety culture should be directly expressed

from those in leadership roles to legitimize safety's priority in the organization's culture, but it is not yet clear how those expectations link to the occurrence of safety events. Although managers were rated highly in creating patient safety culture in our data, providing support may not indicate actions are being taken to affect safety events directly (29). Studied a group of nursing managers and their staff and found that managers who committed to supporting safety culture were strong predictors of establishing a patient safety culture. This is consistent with the scores in our data showing that management support stimulates the consciousness of practicing safety, although it did not affect safety events. Management support for patient safety has to do with hospital management's apparent attitude toward safety and safety events; it also did not influence safety events. Although we expected to find an effect, some research suggests reasons why it was not present (30). Found connections between management support for safety and nurses' perception of safety were stronger as indirect than direct connections. They highlighted that communicating about safety was beneficial to safety culture when there is interaction between managers and workers. Management support, therefore, is a necessary variable to patient safety, but seemingly as an intervening variable to safety events.

### **Theoretical Implications**

In terms of Schein's model, what we are seeing is consistency between artifacts (i.e., administration of HSOPS) and espoused values of in-patient clinical team members. That is, the HSOPS suggests that this hospital system is concerned with safety, and the high scores on both communication-related elements and relational elements suggest that the inpatient clinical teams share a high concern for safety.

Further, the relational elements suggest the clinical teams believe that safety is highly valued at multiple levels of the hospital system (within teams, by supervisors/managers, and by upper administration). The picture of culture seems clear.

### **Practical Implications**

The clearest practical implication of this study is to make sure that handoffs and transitions are highly valued by all staff. Effective handoffs and transitions include verbal communication, written communication, and transfer of professional responsibility. The reduction in safety events associated with a perception that handoffs and transitions are highly valued is substantial. Hospitals must continue to explore protocols that will allow them to directly recognize and enact behaviors that reduce safety events. Safety protocols among clinical teams could see benefits in other areas such as satisfaction from patients and documented safety events.

In this study, despite the lack of a link between safety culture and safety events, scores indicated high amounts of communication messages of support and promotion of safety culture. Examining the link between the culture and specific behaviors resulting from the safety culture could help hospitals identify the missing link -- the behaviors that spring from a positive communication environment and relationships and directly affect patient safety events. Hospitals may also want to investigate the correlation between PSIs, and actual safety events reported by staff. The gap between these two could explain the lack of a direct link between the safety culture elements and safety events. Learning more about why reporting does not align with PSIs can lead to a communication solution that contributes to better, more accurate reporting of safety events.

### **Limitations**

One limitation worth mentioning is that the HSOPS is administered to employees at Geisinger on a volunteer basis every 1.5 - 2 years. It is possible that a selection bias is present; those who choose to complete the survey may be more concerned about safety and thus perceive the safety culture as stronger than it is. Those who chose not to complete this iteration of the HSOPS were still participating in patient care and thus the relationship with patient safety events

could be affected by the behaviors not only of those who complete the survey but those who did not. However, this administration of the HSOPS survey was widely completed, with an overall response rate of 73%, so it is unlikely that this kind of bias systematically affects the results.

### **Future Directions**

The purpose of this study was to use the Schein's Model of Organizational Culture as a framework to understand how perceptions of patient safety predict the frequency of safety events. Nine variables from the HSOPS survey were used to test the principles of the model using data from subcultures of a large health care organization. Results showed that handoffs and transitions were a significant predictor of the reduction of safety events, while the other eight predictors were not significant. This suggests that communication about handoffs and transitions, among clinical teams, plays a substantial role in the improvement of patient safety.

Future research should explore how all of the HSOPS elements can be directly connected to action-based behaviors or other potential intervening mediators and, subsequently, health outcomes. By exploring more direct connections between HSOPS elements and behaviors of hospital employees that affect health outcomes, like reduced safety events, we can have a clearer understanding of what elements of patient safety culture are the crucial levers to affect outcomes.

It is also possible that inpatient clinical teams are substantively different from other patient safety subcultures that could be investigated. Future research should investigate these and other subcultures in hospitals to look for links between safety culture and outcomes including both PSIs and reported safety events. Specifically, future research should continue exploring how communication and relationships might affect perceptions of safety culture and reporting behaviors in different hospital units.

### **Conclusion**

The purpose of this study was to understand how perceptions of patient

safety culture relate to the frequency of safety events in hospitals. Schein's model of organizational culture is used as a framework to make predictive connections between patient safety culture and patient safety events. Results pointed to the task of handoff and transitions as the significant predictor of safety events. As a communicative process, more research should look at how messages exchanged between unit members can influence the organizations culture of safety.

### **References**

1. Neville, B., Miltner, R. S., & Shirey, M. R. Clinical Team Training and a Structured Handoff Tool to Improve Teamwork, Communication, and Patient Safety. *JHQ* 2021; 43(6), 365-373.
2. James, J. T. A new, evidence-based estimate of patient harms associated with hospital care. *JPS* 2013; 9(3), 122-128.
3. Schein, E. H. Organizational culture. *American Psychologist*. 1990; 45(2), 109-119.
4. Singer, S. J., Gaba, D. M., Falwell, A., Lin, S., Hayes, J., & Baker, L. Patient safety climate in 92 U.S. hospitals: Differences by work area and discipline. *Medical Care*. 2009; 47(1), 23-31.
5. Schein, E. H. Organizational culture and leadership. 2010 (4th Ed.) Jossey-Bass
6. Banka, et al. Improving patient satisfaction through physician education, feedback, and incentives. *JHM* 2015; 10(8), 497-502.
7. Goffman, E. On face-work: An analysis of ritual elements of social interaction. *PJSIP* 1955; 18(3), 213-231.
8. Kaldjian, L. C., Jones, E. W., Wu, B. J., Forman-Hoffman, V. L., Levi, B. H., & Rosenthal, G. E. Reporting medical errors to improve patient safety: A survey of physicians in teaching hospitals. *AIM* 2008; 168(1), 40-46.
9. Pham, et al. National study on the frequency, types, causes, and consequences of voluntarily reported emergency department medication errors. *JEM*, 40(5), 485-492.
10. Lewin, S., & Reeves, S. Enacting 'team' and 'teamwork': Using Goffman's theory of impression management to illuminate interprofessional practice on hospital wards. *SSM* 2011; 72, 1595-1602.
11. Detert, J. R., & Burris, E. R. Leadership behavior and employee voice: Is the door really open? *AMJ* 2007; 50, 869-884.
12. Kassing, J. W. Investigating the relationship between superior-subordinate relationship quality and employee dissent. *Communication Research Reports*. 2000; 17(4), 387-396.
13. Garner, J. T. Open doors and iron cages: Supervisors' responses to employee dissent. *IJBC* 2016; 53(1), 27-54.
14. Johnson, A., Guirguis, E., & Grace, Y. Preventing medication errors in transitions of care: A patient case approach. *JAPA* 2015; 55(2), e264-e276.

15. American Pharmacists Association, & American Society of Health-System Pharmacists. Improving care transitions: optimizing medication reconciliation. *JAPA* 2012; 52(4), e43-e52.
16. Tjosvold, D., Yu, Z. Y., & Hui, C. Team learning from mistakes: The contribution of cooperative goals and problem-solving. *JMS* 2004; 41(7), 1223-1245.
17. Evans, et al. Attitudes and barriers to incident reporting: A collaborative hospital study. *BMJ Quality & Safety*. 2006; 15(1), 39-43.
18. Steen, S., Jaeger, C., Price, L., & Griffen, D. Increasing patient safety event reporting in an emergency medicine residency. *BMJ Open Quality*. 2017; 6(1), 1-5.
19. Dunbar, et al. An improvement approach to integrate teaching teams in the reporting of safety events. *Pediatrics*. 2017; 139(2), 1-10.
20. Ammouri, A. A., Tailakh, A. K., Muliira, J. K., Geethakrishnan, R., & Al Kindi, S. N. Patient safety culture among nurses. *International Nursing Review*. 2015; 62(1), 102-110.
21. Lee, S. H., Phan, P. H., Dorman, T., Weaver, S. J., & Pronovost, P. J. Handoffs, safety culture, and practices: Evidence from the hospital survey on patient safety culture. *BMC Health Services Research*. 2016; 16(1), 1-8.
22. Cho, S. M., & Choi, J. Patient safety culture associated with patient safety competencies among registered nurses. *Journal of Nursing Scholarship*. 2018; 50, 549-557.
23. Fan, et al. Association of safety culture with surgical site infection outcomes. *JACS* 2016; 222(2). 122-128.
24. Alenezi, et al. Clinical practitioners' perception of the dimensions of patient safety culture in a government hospital: A one-sample correlational survey. *JCN* 2019; 28(23-24), 4496-4503.
25. Blegen, M. A., Gearhart, S., O'Brien, R., Sehgal, N. L., & Alldredge, B. K. AHRQ's hospital survey on patient safety culture: Psychometric analyses. *JPS* 2009; 5(3):139-144.
26. Leape, L. Error in medicine. *JAMA*. 1994; 272(23), 1851-1857
27. Mardon, R. E., Khanna, K., Sorra, J., Dyer, N., & Famolaro, T. Exploring relationships between hospital patient safety culture and adverse events. *JPS* 2010; 6, 226-232.
28. Abraham, J., Kannampallil, T. G., Almoosa, K. F., Patel, B., & Patel, V. L. Comparative evaluation of the content and structure of communication using two handoff tools: Implications for patient safety. *Journal of Critical Care* 2014; 29(2), 311.e1-311.e7.
29. Feng, X. Q., Acord, L., Cheng, Y. J., Zeng, J. H., & Song, J. P. The relationship between management safety commitment and patient safety culture. *INR* 2011; 58(2), 249-254.
30. Auer, C., Schwendimann, R., Koch, R., De Geest, S., & Ausserhofer, D. How hospital leaders contribute to patient safety through the development of trust. *JNA* 2014; 44(1), 23-29.