Safety Culture: An Integration of Existing Models and a Framework for Understanding Its Development

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Objective: This study reviews theoretical models of organizational safety culture to uncover key factors in safety culture development.

Background: Research supports the important role of safety culture in organizations, but theoretical progress has been stunted by a disjointed literature base. It is currently unclear how different elements of an organizational system function to influence safety culture, limiting the practical utility of important research findings.

Method: We reviewed existing models of safety culture and categorized model dimensions by the proposed function they serve in safety culture development. We advance a framework grounded in theory on organizational culture, social identity, and social learning to facilitate convergence toward a unified approach to studying and supporting safety culture.

Results: Safety culture is a relatively stable social construct, gradually shaped over time by multilevel influences. We identify seven enabling factors that create conditions allowing employees to adopt safety culture values, assumptions, and norms; and four behaviors used to enact them. The consequences of these enacting behaviors provide feedback that may reinforce or revise held values, assumptions, and norms.

Conclusion: This framework synthesizes information across fragmented conceptualizations to clearly depict the dynamic nature of safety culture and specific drivers of its development. We suggest that safety culture development may depend on employee learning from behavioral outcomes, conducive enabling factors, and consistency over time.

Application: This framework guides efforts to understand and develop safety culture in practice and lends researchers a foundation for advancing theory on the complex, dynamic processes involved in safety culture development.

Keywords: safety culture and behavior change, social processes, teams and groups, organizational psychology, social psychology

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Safety is a top priority in many of today's organizations. With high-profile incidents making national headlines over the years (e.g., the recent Boeing 737 MAX accidents, the Deepwater Horizon oil spill, the fate of space shuttles Columbia and Challenger, and the epic disaster at Chernobyl), concern surrounding the topic of safety and human error has been consistent in our daily lives for decades (Cooke & Durso, 2008; Dekker, 2014). Much has been learned through the tragedies that often follow, as they bring to light hidden dangers embedded within work systems. We have learned accidents are not typically due to a single misstep but to a series of failures, faulty systems, and poor organizational conditions (Perrow, 2011; Reason, 1997); researchers have uncovered ways to improve the rate of safety incidents, examined indicators of safe operations, and developed models to propose how safety-related concepts impact the organization and its members (e.g., Edmondson, Bohmer, & Pisano, 2001; Flin, Mearns, O'Connor, & Bryden, 2000; Guldenmund, 2000; Vogus, Sutcliffe, & Weick, 2010; Zohar, 2010).

Safety concerns are especially prevalent when employees encounter risky or hazardous conditions on the job regularly. The International Labour Organization (2016) estimates over 2 million workers die each year as a result of work-related accidents and illness—an astounding number of lives lost, costing nearly 4% of the world's yearly gross domestic product. The severity of these consequences makes it crucial to foster a safe work environment with employees dedicated to safety. In recent years, these trends have led organizational scientists to investigate the impact of *safety culture*. The culture of an organization is analogous to the identity of an
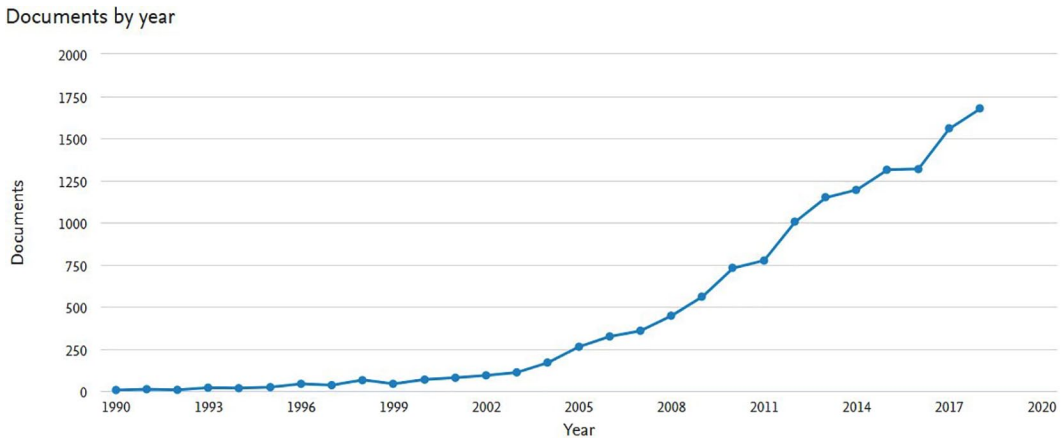
Documents by year

Figure 1. Safety culture publication rate.
A Scopus search of "safety culture" in all fields of text yielded a total of 14,159 documents, with the oldest instance in 1978, and 1,675 in the last full year (2018).

individual—it defines who they are, their values and beliefs, and guides their behaviors. Generally, organizations with safety culture operate under core assumptions that support the value and prioritization of safety (Hale, 2000).

Nevertheless, the notion of *safety culture* is elusive. It is an enigma that has plagued the literature with debate since its formal introduction after the 1986 Chernobyl disaster (Antonsen, 2009; International Nuclear Safety Advisory Group [INSAG], 1988). Deliberation has ensued over its definition, its value as a unique construct, and conceptual models with piecemeal explanations and limited utility (Guldenmund, 2000). One would think a construct of such persistent dispute would eventually assume its place in the past, rather than continue to propagate through future research; but publications mentioning "*safety culture*" show a relatively steady increase over the past two decades (Figure 1). Although the concept of *safety culture* is indeed abstract, researchers report further investigation is warranted due to safety culture being often implicated as a contributor of safety incidents across industries (Cooper, 2019) such as construction (Choudhry, Fang, & Mohamed, 2007), aviation (Edkins, 1998), maritime (Hetherington, Flin, & Mearns, 2006), and health care (DiCuccio, 2015; Lee et al., 2019). The overall message of this research is that while some interventions have been successful, the link between safety culture and safety outcomes is largely inconsistent. This may suggest the field is in need of a unifying framework that can standardize research approaches to improve our understanding of safety culture and its relationships with other variables.

Unfortunately, the aftermath of foundational debates on safety culture is a disjointed literature base with complicated conceptual models providing limited understanding to not only how safety culture impacts safety outcomes, but also how it might develop and be sustained. As a result, several reviews advanced in recent years attempt to reduce the ambiguity surrounding safety culture. Choudhry et al. (2007) reviewed the literature to clarify the nomological network around safety culture and concluded that the field suffers from a major lack of integration with models of general organizational culture and instead details a wide array of safety-related elements that do not align with traditional culture frameworks. A review of the health care literature reflects similar findings, resulting in a typology to classify all of the subdomains included in safety culture models (Sammer, Lykens, Singh, Mains, & Lackan, 2010). More recently, researchers compiled all of the various safety-related factors discussed in the literature into a single aggregated model that depicts the dynamic, cyclical nature of their relationships (Vierendeels, Reniers, van Nunen, & Ponnet, 2018).

Although previous reviews contribute a great deal of specificity to the study of safety culture, there is still a disconnect between existing models of safety culture and the traditional conceptualization of organizational culture. Moreover, it is still unclear how the factors included in these existing models might relate to the traditional conceptualization of culture. In this paper, we propose that the factors often speculated as dimensions of safety culture may actually function to support the development of safety culture over time. We present a narrative review aimed at integrating the complete spread and nature of current ideas about safety culture into a single framework that is consistent with the original concept of organizational culture while also contributing novel perspective on the social construction of safety culture development that future researchers can build from. No framework currently exists to address the complexities around the dynamic process of safety culture development. Furthermore, we leverage theory from organizational and social psychology to explain how employees might drive the development of safety culture through social identification and learning. We begin with an overview of safety culture and its conceptualization in terms of general organizational culture.

WHAT IS SAFETY CULTURE?

Research attempting to further the science struggles with shortcomings related to the definitional ambiguity of safety culture and a lack of adequate conceptual models that describe its construction and consequences (Guldenmund, 2000). Table 1 details some common definitions for safety culture. Many definitions mention shared attitudes and values related to safety (Uttal, 1983). Some include aspects of the outcomes of safety culture, such as minimizing risk or danger (Turner, Pidgeon, Blockley, & Toft, 1989) or determining organizational health and safety (e.g., Lee & Henderson, 1996). Some researchers define safety culture by describing how it might look in practice, such as Geller's (1994) definition that total safety culture exists when employees take accountability and strive for safety. Some are explicit in stating that safety culture is a component of the larger organizational culture that impacts employee

attitudes and behaviors (Cooper, 2000). Guldenmund (2000) further aligns *safety culture* with conceptualizations of general organizational culture by describing it as a three-layer construct with subconscious assumptions at the core, values at the middle layer, and behavioral norms on the surface.

As is evident in Table 1, there is no universally accepted definition of *safety culture* that captures details from all of these perspectives. Each definition differs slightly from the next, yet all share some element of abstractness. It is undoubtedly challenging to define something that cannot entirely be seen, but it is important to avoid broad definitions that serve as a "catch-all" for any safety-related phenomena. Altogether, this select set of definitions mentions values, beliefs, norms, attitudes, roles, practices, perceptions, assumptions, competencies, patterns of behavior, characteristics, priorities, and organizational features alongside employees, groups, organizations, systems, managers, customers, and members of the public. This lengthy list may signify how researchers deal with the ambiguity of *safety culture*—by amassing all potential antecedents of safety outcomes into a single construct. Such a construct would theoretically be an indicator of safety, yet its scientific and practical utility would be lost in its sheer breadth and the inability to assess all relevant factors. A prevalence of this approach may explain the lack of definitive findings about what exactly characterizes *safety culture* other than positive safety outcomes.

How do we recognize an organization with safety culture versus one without it? Relatedly, when an organization shows poor safety outcomes, what determines it to be a culture problem? This question strikes a fundamental component of *safety culture* that sets it apart from other related constructs—it is a *cultural* variable, and *culture* is socially constructed over time and "rooted in history" (Denison, 1996, p. 644). By this logic, we can answer the question of recognizing a culture problem by examining the habitual patterns or traditions that persist and evolve over time. We assert that *safety culture* has been largely presumed in the literature to describe an organization of employees as *safety-centric*, as measured by its outcomes and

TABLE 1: Definitions of Safety Culture

Citation	Definition
Uttal, 1983	Shared values and beliefs that interact with an organization's structures and control systems to produce behavioral norm
Turner, Pidgeon, Blockley, and Toft, 1989	The set of beliefs, norms, attitudes, roles, and social and technical practices that are concerned with minimizing the exposure of employees, managers, customers, and members of the public to conditions considered dangerous or injurious
Cox and Cox, 1991	Safety cultures reflect the attitudes, beliefs, perceptions, and values that employees share in relation to safety
Geller, 1994	Total safety culture (TSC) is when everyone feels responsible for safety and pursues it on a daily basis
Lee and Henderson, 1996	The safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, and organization's health and safety management (ACSNI, 1993)
Guldenmund, 2000	Those aspects of the organizational culture which will impact on attitudes and behavior related to increasing or decreasing risk
Cooper, 2000	A subcomponent of corporate culture, which alludes to individual, job, and organizational features that affect and influence health and safety
International Nuclear Safety Advisory Group, 1991	That assembly of characteristics and attitudes in organizations and individuals, which establishes that, as an overriding priority, safety issues receive the attention warranted by their significance
Wu, Lin, and Shiau, 2009	Employees imaging of safety conditions in the workplace; which images then affect organizational safety activities and safety results

indicators of safety performance. This approach has resulted in two significant problems: (1) It conceals the important fact that *culture* consists of deeply rooted patterns that evolve gradually, not a characterization of a momentary state (Denison, 1996), and (2) it obscures *safety culture* with the factors allowing it to cultivate (e.g., safety policies) and resulting from it (e.g., reporting errors), creating gaps in our knowledge of how it develops and evolves over time (Vogus et al., 2010).

As Guldenmund (2000) stresses, there is a difference between the factors that compose safety culture and the factors that are a consequence of safety culture. Furthermore, confounding safety culture with its consequences might allow us to recognize a "good" or "bad" safety culture (i.e., by observing positive or negative safety outcomes) but makes it impossible to address potential issues in the underlying culture. For instance, a health care organization might be characterized as having poor safety culture because patient mortality is consistently higher than average and nobody is reporting errors to address; this observation may indeed suggest poor safety culture, but it provides no information regarding the detrimental aspects of the culture other than the behavior it resulted in (i.e., low error-reporting). Thus, our conceptualization of safety culture (and organizational culture, in general) mirrors Guldenmund (2000), in which we describe it as a relatively stable, but malleable, characteristic that is socially constructed and reinforced by employees; and that is expressed in surface-level norms and artifacts, underlying values, and core assumptions.

On the Surface—Norms and Artifacts

The surface level of safety culture entails the visible, tangible artifacts and norms that reflect an organizational value and priority for safety. This includes factors that can be observed, such as signage, collective behavioral norms, formal or informal practices and procedures, and language patterns. Norms and artifacts are fairly easy to describe, as we can observe behavior patterns and the physical environment; however, inferring culture based on norms and artifacts alone requires some conjecture about the intent behind them (Schein, 1984).

The development of behavioral norms relies on learning from experience. As employees gain experience in their roles, they encounter series of novel situations and learn effective and ineffective strategies from their successes and failures. Job experience coincides with improved expertise, meaning solutions are not always clear in the early stages of one's career (Dörner & Schaub, 1994). Employees often take a trial-and-error approach to testing assumptions and forming routines regarding effective performance and problem-solving (Rerup & Feldman, 2011). Typically, we attempt various solutions until we find something that works, then individual norms are developed and sustained until determined no longer effective. The process of developing collective norms involves observing consequences of attempted strategies consistently that validates rather than challenges underlying assumptions about the organization. In general, effective solutions reinforce and ineffective solutions challenge assumptions (Schein, 1984).

Norms and artifacts alone do not constitute safety culture—they are what surfaces from underlying values and assumptions, or symbols. Thus, all measures are based on the speculation that these norms and artifacts do, in fact, symbolize a deeper value of safety and associated assumptions across the organization. Of course, there are reasons for them to exist other than safety culture (e.g., legislation and remnants of prior cultures that existed); therefore, artifacts and norms can only provide supporting evidence of safety culture. To understand why artifacts and norms exist involves deciphering the underlying values that precede them.

Beneath the Surface—Values

The second level of safety culture pertains to the value of safety and engaging in safety performance (Guldenmund, 2000). Values are implicit in nature, but can become explicit when expressed in attitudes and perceptions. Collective attitudes and perceptions reflecting the priority of safety are defined as *safety climate* (Zohar, 1980). It is generally understood that *safety climate* differs from *safety culture*, although many models conflate the two terms (Cheyne, Oliver, Tomás, & Cox, 2002; Clarke, 2006; Weyman, Clarke, & Cox, 2003).

This notion is not completely misguided. *Safety climate* is not *safety culture*, but it is arguably the most accessible and quantifiable proxy for assessing safety culture (albeit, a single level; Sexton et al., 2006). As widely-held attitudes and perceptions can be accessible reflections of organizational values, many researchers regard climate as an "overt manifestation of culture" (Guldenmund, 2000, pp. 221–222; Schein, 1985; Wiegmann, Zhang, Von Thaden, Sharma, & Gibbons, 2004). Some researchers have a more grim outlook, as Mearns and Flin (1999) point out in stating that many efforts to understand *safety culture* have "been reduced to the measurement of individual attitudes and practices within a hazardous work context that more closely matches the concept of 'safety climate'" (p. 6). In any case, researchers should always be clear about their conceptualizations of culture and climate to avoid construct proliferation.

Climate might play an important role in developing culture, as it arises from shared experiences of employees, and shared experiences can lead to collectively held assumptions, values, and norms (Schein, 1985). As employees experience work together, their attitudes and perceptions gradually take on similarities and prompt the emergence of *organizational climate* (Schneider, 1990). The climate developed around practices involving risk or potential danger is part of *safety climate* (Zohar, 2000). Meta-analyses show strong relationships between safety climate and workplace injuries (Beus, Payne, Bergman, & Arthur, 2010). As stated, safety *climate* and *culture* are related, but distinct, with *culture* at "a higher level of abstraction" than its more-observable reflection

in *climate* (Reichers & Schneider, 1990, p. 29). While climate refers to current thoughts and feelings that can vary day-by-day, Denison (1996) makes it clear that culture is a more stable and "evolved context." This means that safety culture is a time-based and enduring development, whereas climate is more transient and can be influenced by factors that may not influence culture. For instance, a coworker who eschews safety for efficiency may impact employee perceptions of the safety climate, but have minimal implications for the culture of the department or organization. Thus, measures of safety climate can illuminate a different story of the workplace than measures of safety culture. Likewise, efforts to develop safety culture based solely on a measure of safety climate risk being unfounded or ineffective by failing to address deep-seated assumptions at the core of culture that guide employee thoughts, feelings, behaviors, and everything they know to be true in their workplace.

At the Core—Assumptions

The innermost embedded level of culture encompasses the underlying assumptions regarding the basic nature of reality at work (Guldenmund, 2000). Assumptions are subconscious ideas about "the way things are" that permeate through every action and intention (Schein, 1984). Cultural assumptions are intangible and unspecific, and therefore, difficult to assess. Assumptions can be inferred from visible factors like behavioral norms and expressed values. Typically, assumptions that color employee perspectives and underlie their actions can only be brought into awareness through focused inquiry, such as through qualitative interviews. Essentially, this process would involve an outsider (i.e., someone who is not a part of the culture) helping to uncover assumptions with probing questions. Guldenmund (2000) adds that widely held assumptions referencing safety might be evidence of safety culture (e.g., "*it's better to be safe than sorry*" or "*making errors leads to learning*").

In summary, organizational safety culture is a socially constructed factor composed of shared (1) intangible assumptions about the nature of the workplace and its components, (2) values

about safety revealed in collective perceptions and attitudes (i.e., safety climate), and (3) collective behavioral norms and artifacts that reflect these values and assumptions. There are still meaningful questions yet to be answered to improve the practice of and theory behind developing safety culture in real-world organizations. If culture is a set of shared values, norms, and assumptions that make up an organization's context, what compels employees to adopt them? How does safety culture develop and evolve over time? Why do many safety culture initiatives often fail? Most importantly, how can we leverage this information to improve the culture of safety-critical organizations? To shed light on these critical questions, we conducted a selective review of existing safety culture models and integrated relevant theory that may explain the psychological processes underlying safety culture development.

METHOD

We conducted a literature review to identify some of the common factors in existing models and theories of safety culture across industries (e.g., health care, military, and construction). We searched the PsycINFO database using the terms "*safety culture*" and "*theory*" or "*model*" or "*framework*" in the abstract of scholarly articles and book chapters across all publication years. We reviewed the abstracts for relevance to safety culture in work organizations, and this process yielded 132 articles of which were narrowed down to 50 that met inclusion criteria. Articles were included if they contain a model, theory, or conceptualization of organizational safety culture. Our aim was to illuminate a path toward converging the wide spread of disjointed models; thus, we excluded articles that did not present a novel model or used a model we already accounted for. We also excluded articles that were not in English, focus solely on *safety climate*, or used *climate* and *culture* interchangeably. We excluded safety climate models in effort to narrow the focus of our results to understanding the core components of safety culture rather than perceptions of and attitudes toward those components. Subsequently, we supplemented the review of safety culture models with a review of safety climate models

to gauge the degree of variation between these paradigms of thought, but ultimately found minimal differences. We discuss these observations in a later section.

We began reviewing articles that met inclusion criteria by recording the factors included in each safety culture model to determine the frequency of each model component. As Guldenmund (2000) suggested, none of the models clearly defined its components as assumptions, values, or norms. Because existing models vary tremendously in their perspectives of safety culture and related variables, recording each factor in the terms used by the original authors led to a myriad of factors that required some interpretation to condense. First, we found that factors representing the same underlying construct were not always labeled in the same manner (e.g., "feeling safe to speak up" is close in meaning to "psychological safety"). It was also often unclear whether the referent of each component was the individual employee, leadership, the organization in general, or systems within the organization. Moreover, inconsistent wording and labeling of factors made it challenging to recognize whether particular models intended to describe factors that *comprise* safety culture, *impact* safety culture, or *result* from safety culture. Often, factors that simply impact safety outcomes were considered evidence of safety culture. Ultimately, difficulties equating distinct yet similar factors across models led us to take a thematic approach to distilling the long list of factors into meaningful themes that encompass related factors. Some themes are inherently broader than others (e.g., "teamwork and collaboration" is defined more generally than "leader commitment to safety"); thus, these themes represent high-level conceptualizations of broad factors that future researchers might decompose into more specific, lower-level factors. Any terminology found in original articles that was used to construct a factor is included in its discussion. As the breadth of each factor varies, we refrain from providing potentially misleading frequency counts that might be misinterpreted as an index of importance.

Importantly, the broad factors we identified do not constitute neither the collective norms/values nor the assumptions that define *safety culture.* Rather, we posit that they contribute to the gradual development of collective norms, values, and assumptions about safety, as well as represent the emergent behaviors that impact safety outcomes. Vogus and colleagues (2010) advanced a framework for patient safety that names *enabling* factors as leader actions attending to safety that provide the basis for safety culture to take root and *enacting* factors as those that translate this basis into safety practices (Singer & Vogus, 2013). Although Vogus et al. (2010) were primarily focused on leader actions, we extend this conceptualization by considering other relevant aspects that might enable safety culture. Accordingly, we propose that the dimensions described in many safety culture models (e.g., commitment to safety, teamwork, and reporting) either serve to enable employees to adopt safety behaviors, values, and assumptions that constitute safety culture at the collective level, or dimensions represent behavioral enactments of held assumptions, values, and norms. This distinction gives context to the roles potentially played by the factors outlined in existing models, allowing us to postulate how they might function to develop safety culture over time.

After identifying the scope of factors detailed in the existing models, we categorized them based on the functions advanced by Vogus et al. (2010), integrating relevant theory and prior research to support the proposed role played by each factor in the development of safety culture. We advance a simple, novel framework (Figure 2) to depict the proposed function of identified factors in the development of safety culture over time and provide a detailed explanation of theoretical underpinnings and each factor in the following sections.

HOW IS SAFETY CULTURE ADOPTED BY EMPLOYEES?

Schein (1984) states that culture is developed through learning situations where groups are faced with solving problems and avoiding negative outcomes, and further repeating successful patterns through positive reinforcement. Glendon and Stanton (2000) take a "top-down" perspective by suggesting that safety culture is shaped by the business strategy and the system in place for managing safety. Both

perspectives are worthy explanations but neither fully describes *how the employee* becomes an active agent of the culture by developing appropriate assumptions, values, and norms. We take a deeper dive into the psychological phenomena that might drive this process by borrowing from social psychology and insight on identity construction, shifting attention to how "the self" can be defined by one's organization.

Psychologists theorize that people attempt to make sense of their reality by categorizing and constructing "rules" for social groupings (Turner, 1999). Social identity theory (Tajfel & Turner, 1986) suggests that when individuals perceive they belong to a group, they reduce uncertainty around how to feel and act by iteratively developing and refining assumptions. In doing so, group members construct subconscious "prototypes" of the typical member, and assimilate to the prototype of the group(s) to which they belong (Fiske & Taylor, 1991). Hogg and Terry (2000) add, "When group membership is salient, cognition is attuned to and guided by prototypicality" (p. 126). This phenomenon explains how in robust organizational cultures with very visible indicators, employees are steered by the assumptions they deduce about the prototypical member and the behavior employees should exhibit. In modeling prototypical behavior, group member assumptions can be validated or challenged (and further refined) depending on whether expectations about behavioral outcomes were met (Schein, 1984).

Through social identification, employees redefine their self-concept and identity to be based less on idiosyncratic qualities and more on ideal group characteristics (Smith & Henry, 1996). This means that employees may be guided less by their own existing values and norms the more they recognize their group membership as central to their identity. Social identity is a component of self-concept, which defines (on a subconscious level) what a person should think, feel, and do. Individuals in the same social sphere share similar experiences and likely hold similar social identities, creating collective perspectives, expectations, thoughts, feelings, and norms (Hogg & Terry, 2000).

Research suggests that the more salient a social identity, the more an individual will adopt group values and norms (Ashforth & Mael, 1989). In addition, stability and consistency of collective values and norms in an organization (i.e., culture) allow employees to internalize them as their own (Ashforth, 1985). Thus, internalization of prototypical and collective values might be facilitated with consistent feedback that validates held assumptions and expectations. Take for example an employee who notices a norm of using handrails on the escalator and assumes this safety behavior is valued and important. The employee may be more likely to adopt this behavior and underlying values and beliefs if the assumption is consistently validated by receiving reminders from coworkers or observing an injury when handrails are not used. We posit that when such experiences of consistency are shared across the organization, and endure over time, employees may develop similar identities and collective norms, values, and assumptions about safety (i.e., safety culture).

In summary, social identification processes may explain how individuals can be shaped by the organization and what it means to be a member. Employees construct identities as members of their organization and gradually embody the supposed values, norms, and assumptions of the group, which may become collectively aligned and strengthened through shared and consistent experiences of work, rewards, and consequences. To enhance the consistency of shared experiences, organizations might employ a solid business strategy and safety management system, supporting Glendon and Stanton's (2000) assertion that these systems "trickle-down" to influence safety culture.

Understanding how employees can be defined by characteristics of their organization opens the door to theory-driven questions that address the complexities of developing safety culture. What factors influence assumptions that prototypical group members value safety? What conditions facilitate or hinder the adoption of the collective norms, values, and assumptions that define safety culture? We discuss several mechanisms to explain how employees may develop safety culture using the themes extracted from our review.
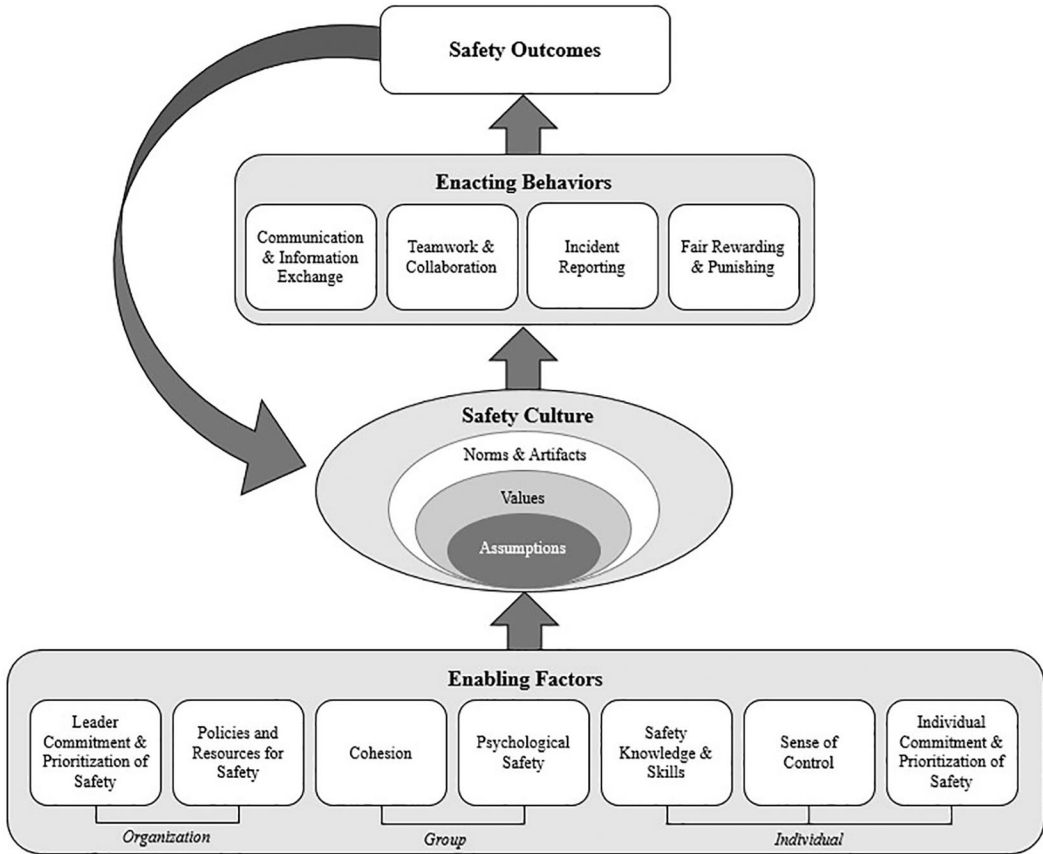
Figure 2. A framework for understanding the development of safety culture.
Enabling factors set the conditions for individual employees to adopt assumptions, values, and norms consistent with safety culture. These factors enable safety culture to develop over time as employees collectively adopt consistent assumptions, values, and norms. Underlying assumptions, values, and norms are manifested in employee behaviors, which impact safety outcomes. Employees learn from safety outcomes, such that positive outcomes validate and negative outcomes challenge underlying assumptions, values, and norms. With consistency and stability over time and across employees, safety culture is developed and reinforced.

In doing so, we highlight several enabling factors thought to allow for employees to adopt appropriate norms, values, and assumptions. We leverage and extend the framework by Vogus et al. (2010) to posit that enabling factors create a context for safety culture to develop over time. We reiterate that the factors we discuss do not define *safety culture* but rather create conditions that enable its development. We apply this perspective to the literature we reviewed to identify potentially relevant enabling factors, and present information based on the appropriate level of analysis for each factor: (1) organizational, (2) group, and (3) individual.

Organization-Level Factors

The conditions set by the organization create the context in which employees operate on a daily basis. We highlight two major organizational factors that may enable employees to adopt the values, norms, and assumptions of safety culture: (1) leader commitment and prioritization of safety and (2) policies and resources for safety.

Managerial commitment to safety is central to the expression of safety culture and was a common theme that emerged from the models in our review (Table 2). When organizational leaders are committed to safety, their attitudes and actions express the priority of safety over all other goals, including profitability (Zohar, 2008). Research suggests that employees pay attention to the actions of leaders and use them as role models for what is appropriate or expected within the organization. Brown, Treviño, and Harrison (2005) found that employees exposed to ethical leaders grow to understand appropriate conduct by using their leader as a role model. Furthermore, research finds that employees adopt safety-related behaviors from their leaders (Hofmann & Morgeson, 1999). Leaders are an important source of information when employees are searching for the expectations of their roles, mainly due to their status as rule creators and enforcers (Bandura, 1986). According to Bandura (1977), employees use social learning processes to gather information by observing the behavior of others and its consequences then developing expectations about behavioral outcomes. Moreover, researchers find that people with prestige in an organization transmit important cultural information to others by serving as role models (Chudek, Heller, Birch, & Henrich, 2012; Henrich, Chudek, & Boyd, 2015; Henrich & Gil-White, 2001). Leaders who are committed to safety may influence employees through modeling safe behaviors, attitudes, and perceptions. These leaders might also be likely to reward safe behavior and punish reckless or noncompliant behavior, guiding employee performance expectations. We propose that leaders who are committed to safety and prioritize it above other objectives will create an environment in which employees develop assumptions, values, and norms around the importance of safety.

Social learning theory explains how employees might come to adopt conduct from their leaders; but sometimes, there is no visible leader to represent the organization. In some instances, managers have limited contact with the general population of employees, so employees must rely on signals passed down through symbolic stories of leadership actions (Detert & Treviño, 2010), in addition to other signals from the organizational environment. Signaling theory (Spence, 1973) suggests that organizations attempt to communicate their values through signals that reflect them. For example, a company website with photos of a diverse work group may signal to potential applicants that the company values diversity (Miller & Del Carmen Triana, 2009). Likewise, an organization with policies and resources that support safe operations may signal the importance of safety. Research suggests that when information about the intent of the organization is limited, employees recognize signals as cues to engage in behaviors consistent with perceived organizational values (Connelly, Certo, Ireland, & Reutzel, 2011). This means, when employees do not have direct contact with organizational leadership, they may use whatever information is available to guide their actions, such as symbolic stories or safety policies.

An effective safety management system may play an important role in developing safety culture, as suggested by many of the models in our review (Table 2). A system for managing and avoiding potential risk or danger may send a signal to employees that safety is a critical consideration of the business. An especially effective component of a safety management system might be an advisory council that acts as a key resource for employees to access safety-related support and ensures the organization is up-to-date on safety knowledge and practices. Simply having an advisory council dedicated to the health and wellness of employees might relay the criticality of safe operations to mission success. Organizations might also signal the importance of safety by employing specific policies designed to reduce risk. For example, limitations on the amount of hours worked continuously may prevent fatigue and subsequent errors (Arnedt, Owens, Crouch, Stahl, & Carskadon, 2005), or allowing permissive time off to reduce stress and burnout might reduce mistakes (Nahrgang, Morgeson, & Hofmann, 2011). Policies and resources to protect employees from the negative impact of work pressures can ensure the demands of the environment are met and employees can focus on maintaining safe performance.

TABLE 2: Framework Factors and Supporting Models

Factors	References
Enabling factors	
Organization	
Leader commitment and prioritization of safety	Bentley and Tappin, 2008; Fernández-Muñiz, Montes-Peón, and Vazquez-Ordas, 2007; Fleming, 2001, Gibbons, von Thaden, and Wiegmann, 2006; Haslam, O'Hara, Kazi, Twumasi, and Haslam, 2016; Håvold, 2007, Heese, 2012; Lawrie, Parker, and Hudson, 2006; Reader, Noort, Shorrock, and Kirwan, 2015; Sexton et al., 2006
Policies and resources for safety	Bentley and Tappin, 2010; Díaz-Cabrera, Hernandez-Fernaud, and Isla-Díaz, 2007; Frazier, Ludwig, Whitaker, and Roberts, 2013; Gibbons et al., 2006; Grote, 2007; Haslam et al., 2016; Lawrie et al., 2006; Leaver and Reader, 2019; Parker, Lawrie, and Hudson, 2006; Reiman, Pietikäinen, Oedewald, and Gotcheva, 2012; Thomas et al., 2012; Wang and Liu, 2012; Wiegmann, Zhang, Von Thaden, Sharma, and Gibbons, 2004
Group	
Cohesion	Frazier et al., 2013; Geller, 1996; Goh and Ali, 2016; Heese, 2012; Kobuse et al., 2014; Lawrie et al., 2006; Liao, 2015; Mearns et al., 2013; Parker et al., 2006; Thomas et al., 2012; Verbeek-van Noord, de Bruijne, Twisk, van Dyck, and Wagner, 2015
Psychological safety	Alolah, Anthony Stewart, Panuwatwanich, and Mohamed, 2014; Bentley and Tappin, 2010; Cox and Cox, 1991; Frazier et al., 2013; Geller, 1996; Gibbons et al., 2006; Håvold, 2007; Lawrie et al., 2006; Liao, 2015; Reader et al., 2015; Schwarz and Wolfgang, 2015; Thomas et al., 2012; Verbeek-van Noord et al., 2015; Wang and Liu, 2012; Wiegmann et al., 2004
Individual	
Safety knowledge and skills	Bentley and Tappin, 2010; Dingsdag, Biggs, and Sheahan, 2008; Frazier et al., 2013; Goh and Ali, 2016; Håvold, 2007; Lawrie et al., 2006; Parker et al., 2006; Thomas et al., 2012; Verbano and Turra, 2010; Wang and Liu, 2012
Sense of control	Alolah et al., 2014; Bentley and Tappin, 2010; Cox and Cox, 1991; Frazier et al., 2013; Geller, 1996; Gibbons et al., 2006; Haslam et al., 2016; Håvold, 2007; Kobuse et al., 2014; Mearns et al., 2013; Parker et al., 2006; Verbano and Turra, 2010; Wiegmann et al., 2004
Individual commitment and prioritization of safety	Bentley and Tappin, 2010; Filho, Andrade, and de Oliveira Marinho, 2010; Goh and Ali, 2016; Jeffcott, Pidgeon, Weyman, and Walls, 2006; Lawrie et al., 2006; Mearns et al., 2013; Parker et al., 2006; Reader et al., 2015
Enacting behaviors	
Communication and information exchange	Bentley and Tappin, 2010; Díaz-Cabrera et al., 2007; Dingsdag et al., 2008; Filho et al., 2010; Frazier et al., 2013; Goh and Ali, 2016; Haslam et al., 2016; Håvold, 2007; Liao, 2015; Mearns et al., 2013; Parker et al., 2006; Reader et al., 2015; Thomas et al., 2012; Verbano and Turra, 2010; Wang and Liu, 2012
Teamwork and collaboration	Frazier et al., 2013; Kobuse et al., 2014; Leaver and Reader, 2019; Mearns et al., 2013; Queenan, Kull, and Devaraj, 2016; Reader et al., 2015; Sexton et al., 2006; Sherwood, 2015; Thomas et al., 2012
Incident reporting	Alolah et al., 2014; Bentley and Tappin, 2010; Díaz-Cabrera et al., 2007; Frazier et al., 2013; Gibbons et al., 2006; Håvold, 2007; Heese, 2012; Liao, 2015; Mearns et al., 2013; Parker et al., 2006; Reader et al., 2015; Verbeek-van Noord et al., 2015; Wiegmann et al., 2004
Fair rewarding and punishing	Díaz-Cabrera et al., 2007; Geller, 1996; Gibbons et al., 2006; Håvold, 2007; Heese, 2012; Lawrie et al., 2006; Liao, 2015; Mearns et al., 2013; Parker et al., 2006; Thomas et al., 2012; Verbeek-van Noord et al., 2015; Wang and Liu, 2012; Wiegmann et al., 2004

Note. Referenced articles include models from our review that support the factor's inclusion in our framework.

In short, employees may perceive organizational policies and resources related to safety as a signal that safety matters, and further act in accordance with this value. These actions would conceivably be reinforced (e.g., through performance outcomes, rewards, and validation), allowing for behavioral norms to develop consistent with safety culture. Accordingly, we propose that safety policies and resources create a context for the norms, values, and assumptions of safety culture to develop.

Group-Level Factors

Interpersonal and social factors of one's work group also influence the norms, values, and assumptions adopted by employees. The work group may provide a microenvironment for culture to flourish and develop through various social influences. Our review revealed two group-level factors that may enable the development of safety culture: cohesion and psychological safety.

The potential role of cohesion was revealed through models of safety culture, stressing the importance of positive relationships; group solidarity; interpersonal trust, care, and support for one another; and team commitment toward safety goals (Table 2). Establishing healthy working relationships and employing successful strategies for interacting with others may promote group solidarity, an important factor to constructing a social identity aligned with the organizational culture. Hogg and Terry (2000) suggest that the degree to which a social identity is internalized depends on group cohesion and solidarity. Cohesive groups provide clear prototypes of the ideal member and yield powerful social identities (Hogg, 1992, 1993).

Cohesion is technically defined by members' commitment to the group and its goals, as well as pride for the group's values and perceived importance of being a member (Beal, Cohen, Burke, & McLendon, 2003), but cohesive groups are also known to trust and like one another (Carron, Widmeyer, & Brawley, 1985; Shaw, 1981). Corazzini and colleagues (2014) found that poor interpersonal relationships between team members may interfere with safety initiatives and act as barriers to culture change; but cohesive groups might enable culture change to unfold through positive interpersonal relationships and social acceptance of each other's actions. Accordingly, we submit that cohesive groups share safety values, norms, and assumptions that can align to support safety culture.

Another important factor that emerged from our review was psychological safety, or the collective perception that the group is "safe for interpersonal risk taking" (Edmondson, 1999, p. 350). In other words, this means that employees assume others in their group will not embarrass, ridicule, or attack them for speaking up. Existing models of safety culture do not account for psychological safety explicitly (as the construct is fairly new), but there is certainly a theme across models regarding reporting and learning culture, sharing feedback after accidents, speaking freely about errors, and nonpunitive punishments for reporting (Table 2), all of which are likely influenced by psychological safety.

Psychological safety fosters an environment in which information can be shared freely, and employees feel comfortable reporting and discussing errors. Edmondson (1999) found that nurses were more willing to report their mistakes when they were in teams with high psychological safety. Schein (1993) notes the importance of having an environment where it is safe to practice, ask questions, and make mistakes so that errors can be detected and learning can take place. A safe team environment might encourage employees to adopt a norm of sharing errors and further enable a value for learning from mistakes. Over time, these norms and values may be reinforced such that safety culture develops (Schein, 1984).

A psychologically safe environment might also encourage a value for transparency. Transparency is the exposure of thoughts and feelings to others in a way that encourages dialogue and feedback sharing (Lipshitz, Popper, & Friedman, 2002). Practicing transparency may encourage learning in the organization such that employees develop norms of reporting errors to create learning experiences. Furthermore, transparency might work to make the norms, values, and assumptions of the underlying culture explicit; allowing employees to be confronted with their subconscious perceptions, and potentially opening the door to new social identity

construction (Ashforth, Harrison, & Corley, 2008; Pratt, 2000) and culture change (see Schein, 1984, 1993). The potential role of psychological safety and transparency in identity-forming and culture-change processes has yet to be explored in the literature, but we submit that this intersection of research areas could bring more understanding to how teams might drive individual identity and organizational culture development over time.

Individual-Level Factors

Individual-level factors are characteristics of the individual members performing the work. Individual factors vary across members of an organization and may impact the tendency for employees to adopt values, norms, and assumptions consistent with safety culture. Our review revealed three themes related to individual-level factors that may function to enable the development of safety culture over time: (1) safety-related knowledge, (2) a sense of control, and (3) individual commitment to safety.

Many of the models we reviewed consider safety-related knowledge key to safety culture by expressing the importance of employee safety knowledge and skill competence, training, and education for safety procedures, and proficiency and compliance (Table 2). For employees to engage in safe behaviors, they must have the knowledge and ability to recognize safety threats and carry out procedures to address them. This includes knowledge of hazards and the factors that can turn potentially dangerous situations into actual harm, as well as appropriate expectations and the procedures for achieving safety (Reiman, Pietikäinen, & Oedewald, 2010).

Safety-specific knowledge and expectations should also be integrated into core task duties. In other words, employees should understand how the success of their task roles depend on their role as a safe operator. Knowing what is expected in their roles may help employees recognize their responsibilities for addressing important safety issues in the organization (Reiman et al., 2010). Without the knowledge and competence to carry out their roles safely, it is unlikely for employees to develop appropriate norms that encourage safety culture. Accordingly, we propose that having the knowledge related to safe

operations within the organization and throughout task performance enables employees to develop assumptions, values, and norms that align with safety culture.

Existing models also reference the importance of employee sense of control, empowerment, personal responsibility to safe outcomes, and ability and autonomy to impact outcomes (Table 2). This theme likely emerged because employees may have less of a tendency to engage in behaviors to improve safety if they do not believe that their actions make a difference to safe outcomes. To adopt the norms and values of safety culture, individuals within an organization must assume that engaging in safe behaviors will have positive implications for safety. If employees fail to see a connection between their individual efforts to be safe and organizational safety outcomes, they might be less motivated to engage in safe behaviors.

Reiman and colleagues (2010) assert that having a sense of control over one's work enables the individual to perceive the extent of their own capabilities; whereas no sense of control may promote feelings of incompetence and helplessness. For instance, a nurse who challenges a prescriber's inaccurate dosage may observe positive safety outcomes and be more likely to repeat this behavior in the future; but if the doctor ignored the objection, the nurse may assume that nothing can be done to control the situation and avoid trying again in the future. Mallidou, Cummings, Estabrooks, and Giovannetti (2011) found that safety outcomes are directly impacted by employee sense of control. With repeated behavior over time and consistent reinforcement, this sense of control and the responsibility that comes along with it may develop a normative pattern that shapes the organization's culture. Accordingly, we propose that a perceived sense of control enables employees to adopt the norms, values, and assumptions of safety culture.

The final individual-level factor highlighted in our review is the commitment employees feel toward safety and safe working practices, and priority of safety over other goals (Table 2). Employees who are highly committed to safety have a positive attitude and motivation toward safety, and actively put in effort to engage in

safety-related matters (Guldenmund, 2007). They express this value in everything they do and prioritize safe behaviors over efficiency, speed, and all other potential goals, curtailing risk and avoiding danger wherever possible (Lawrie, Parker, & Hudson, 2006). Committed employees may serve as role models to others in their work group, sending signals as to what is expected in the organization through social learning processes (Bandura, 1977). A salient group member may galvanize social identity construction and align individual values with organizational values. When employee values align with organizational values for safety, they may be more likely to develop norms and assumptions consistent with safety culture (Ashforth et al., 2008; van Knippenberg, 2000). Furthermore, research shows that when employees self-identify with organizational values, they show high job satisfaction and performance and yield greater outcomes (Boxx, Odom, & Dunn, 1991), which may further positively reinforce safety culture.

Summary

We submit that enabling factors allow safety culture to develop over time by creating the conditions necessary for employees to develop safety-appropriate norms, values, and assumptions. Our review yielded seven enabling factors that explicate how this process may take place (Figure 2): (1) leader commitment and prioritization of safety, (2) policies and resources for safety, (3) group cohesion, (4) psychological safety, (5) safety knowledge, (6) employee sense of control, and (7) individual commitment to safety. We emphasize this is not necessarily a comprehensive list of factors that enable safety culture; rather, these are the broad factors uncovered in our review.

HOW IS SAFETY CULTURE ENACTED IN PERFORMANCE?

Enabling factors are critical, but they are not enough to develop and sustain safety culture. It is equally essential for employees to enact practices consistent with underlying values and assumptions (Reason, 1997). Many of the models examined in our review include behavioral dimensions (e.g., reporting errors) that we suggest work to translate safety culture into actions that directly impact safety outcomes (e.g., injuries, errors, and patient mortality). Singer and Vogus (2013) assert that enacting safety culture involves engaging in behaviors that prevent, respond to, or resolve threats to safety. As individual behaviors become widely adopted and routinely employed, they may eventually constitute safety culture norms. We recall that culture is an evolved construct that develops over time and stability (Denison, 1996); thus, enacting behaviors are not safety culture in definition, but a product of safety culture. A habitual pattern of enacting behaviors may become customary over time and considered a norm, yet such norms do not need to exist for these behaviors to occur and impact safety outcomes. In effect, we submit that behavioral enactments of safety culture serve two important functions: (1) to improve safety outcomes directly and (2) to reinforce safety culture over time.

Communication and Information Exchange

A great deal of models in our review include dimensions related to communicating and exchanging information effectively throughout the organization (Table 2). Communication is important because, if inhibited, it will prevent learning and growth (Argyris, 1994; Mai, McAdams, & Jolly, 1996), which is essential to developing safety culture (Reason, 1997); thus, establishing effective communication between individuals, between teams, and between management and personnel may be critical for fostering safety culture. In addition, communication breakdowns were found to cause around 70% of preventable medical errors resulting in injury or death (Baker, Day, & Salas, 2006). Moreover, miscommunications may harm situation awareness and safety by portraying inaccurate or incomplete perceptions of the environment and potential hazards (Parush et al., 2011).

When employees and leaders value and prioritize safety, they may be more likely to share relevant safety information and proactively communicate with others when safety is a concern (Mearns et al., 2013). From an organizational perspective, a well-developed safety culture would promote behaviors that prove to positively impact safety outcomes (Schein,

1984). Moreover, the factors that enable safety culture may also have positive implications for communication and information flow. For instance, meta-analyses suggest psychological safety has a positive relationship with information sharing, voice, and work engagement (Frazier, Fainshmidt, Klinger, Pezeshkan, & Vracheva, 2017). Organizations with safety culture might also be more likely to participate in debrief discussions to communicate feedback on what was done well and what can be improved (Queenan, Kull, & Devaraj, 2016; Thomas et al., 2012; Verbeek-van Noord, de Bruijne, Twisk, van Dyck, & Wagner, 2015). In summary, our review suggests that the assumptions, values, and norms of safety culture are enacted through communication and information exchange, which subsequently produce safety outcomes and reinforce safety culture.

Teamwork and Collaboration

Collaboration and teamwork behaviors also emerged from existing safety culture models as an important theme (Table 2). The literature shows consistent support for the role of teamwork in yielding positive safety outcomes (Burtscher & Manser, 2012; Flin, Fletcher, McGeorge, Sutherland, & Patey, 2003; Hughes et al., 2016; Salas & Frush, 2012; Sexton et al., 2006). Teamwork processes are the observable behaviors teams enact while collaborating toward task goals (Marks, Mathieu, & Zaccaro, 2001). Some team processes that might be particularly important to enacting safety behaviors are monitoring team progress and systems for safety threats, specifying safety goals, and providing back-up behaviors when others are in distress.

Collaboration is a term broader than teamwork, in which it can occur between individual employees, groups, departments, and across levels of analysis (Bedwell et al., 2012). When safety culture exists, employees may be more likely to collaborate to develop solutions to safety-related problems (Díaz-Cabrera, Hernandez-Fernaud, & Isla-Díaz, 2007). This is partially due to the fact that when organizations prioritize safety, they value collaboration and participation in safety efforts, encouraging employees to engage in behaviors consistent with this value.

In addition, enabling factors of individual commitment to safety and group cohesion might make employees more willing to collaborate toward a shared purpose and subsequently produce safety outcomes. Without cohesion and commitment, safety culture may not be fully developed and collaboration and safety outcomes may suffer. Accordingly, we propose that safety culture is enacted through teamwork and collaboration, which also contribute to safety outcomes and reinforce safety culture.

Incident Reporting

Organizations that developed safety culture may engage in more incident reporting. Incident reporting is a broad term that refers to notifying others when an error or near-miss occurs that has safety-related consequences. A great deal of safety culture models make mentions of reporting errors and safety incidents (Table 2), and it is also an important factor for organizational learning (Reason, 1997). Systems for reporting errors depend on the willingness of the workforce to participate. Employees may be more willing to report all mistakes and errors when there are supportive safety policies, appropriate rewards and punishments, a useable and confidential reporting system, and developmental feedback (Reason, 1997).

Employees with critical safety knowledge and skills enable safety culture to develop by recognizing the importance of safety and risk factors that may potentially jeopardize it (Reiman et al., 2010); they might also be inclined to report safety-related issues so that they do not persist, can be learned from, and are ultimately corrected. Thus, reporting errors and near-misses becomes an important part of daily work and promotes increased understanding of issues threatening safety. Overall, safety culture may promote incident reporting across the organization, which may increase positive safety outcomes and reduce negative outcomes.

Rewarding and Punishing

When employees report safety incidents, it follows that some form of disciplinary action might be taken. It is also important to reward the behaviors that we want to continue, such as incident reporting. Many existing safety culture

models suggest the importance of fair reward and punishment systems (Table 2). Bandura (1986) argues that employees learn effective behavior from the rewards and punishments of the behavior modeled by people within the organization. Employees pay attention to the behaviors that are rewarded and punished because they are salient indicators of the behaviors management expects (Kanfer, 1990; Trevino, 1992). For this reason, an effective reward and punishment system might motivate the appropriate behaviors that yield positive safety outcomes.

An effective safety-reporting system is not excessively punitive nor lenient (Reason, 1997). If blame and punishment is readily dispensed, employees may be less likely to continue reporting safety incidents. Underreporting leads to reoccurrence of errors and eliminates the potential opportunity to learn from mistakes. A "no-blame" policy is infeasible as well as undesirable, but it is also important to draw the line between acceptable and unacceptable behavior to encourage appropriate values and assumptions. By doing so, the organization establishes a *just culture*, which promotes an atmosphere of trust in which people are encouraged and rewarded for providing essential safety-related information (Reason, 1997). Perceived justice of the reporting system is a hallmark of safe organizations, and enacting fair rewarding and punishing is likely a behavioral outcome of safety culture (Dekker, 2016; Weiner, Hobgood, & Lewis, 2008).

Simply establishing fair policies for punishing unacceptable safety behavior is insufficient for developing safety culture and maintaining safety. Management must also behave in a way that addresses why the behavior occurred and how it might be prevented in the future. In this way, leaders encourage learning and growing from past mistakes, as well as willingness to receive feedback and make meaningful changes (Reason, 1997). Organizations with safety culture likely have leaders who are committed to safety; therefore, their practices for rewarding and punishing may place a priority on learning from errors to prevent future incidents.

Summary

Our review sheds light on the black box between safety culture and safety outcomes by identifying four categories of individual behavioral manifestations of safety culture: (1) communication and information flow, (2) teamwork and collaboration, (3) incident reporting, and (4) fair rewarding and punishing. We do not claim this to be a comprehensive list of behavioral enactments of safety culture, but these are the factors that emerged from our review of existing models to represent the consequences of safety culture (see Table 2 for a review of enabling and enacting factors in the framework, along with references to supporting models).

As norms associated with enacting behaviors develop over time, we expect safety culture to become reinforced through enhanced safety outcomes. Over time, certain situations might occur in which safety culture becomes diluted or deteriorated, such as membership changes, organizational restructuring, or major events that impact the industry. A single event is unlikely to impact the culture of an organization, as culture is inherently rooted in history (Denison, 1996), but sustaining safety culture requires the appropriate norms, values, and assumptions be relatively maintained throughout organizational changes. To explain how safety culture might be sustained, we leverage the framework depicted in Figure 2 to summarize how safety culture evolves over time and with interventions.

HOW DOES SAFETY CULTURE DEVELOP?

In effect, we submit that organizational safety culture is constructed and reinforced through individual employees. Figure 2 illustrates a framework detailing contextual factors conducive to safety culture and its behavioral manifestations. We classify enabling factors by their appropriate levels of analysis (Kozlowski & Klein, 2000), resulting in three categories: organizational, group, and individual factors. In line with prior work (Vogus et al., 2010), we propose that employees respond to enabling factors by collectively developing and enacting the values, assumptions, and norms of safety culture over time. Furthermore, enacting behaviors result in safety outcomes, which may positively reinforce collective values, assumptions, and norms around safety.

Figure 2 depicts two avenues through which safety culture might be influenced: through feedback provided by safety outcomes and through enabling factors. It is also important to remember that culture is engrained in the history of an organization, meaning that it is stable enough to endure most changes and it evolves gradually (Denison, 1996). Thus, we submit that improving safety culture requires three key ingredients: (1) to uphold enabling factors that create conditions conducive for safe behavior, values, and assumptions, (2) for employees to observe and learn from consistent outcomes of their enacting behaviors, and (3) stability over time to allow for the collective adoption of safety culture.

The basis of organizational culture is individual members sharing assumptions, values, and norms that result in similar thoughts, feelings, and behaviors. Ensuring that employees adopt the appropriate values, norms, and assumptions requires imparting consistent reinforcement across the organization for an extended time. Current research gives little insight as to how long it might take to form or impact culture; but Kozlowski and Klein (2000) suggest that constructs emerging from bottom-up processes, such as individual employees collectively creating safety culture, take time to manifest. For this reason, consistency and stability in reinforcing employee conduct may be particularly important to ensure employees learn the same values, assumptions, and norms relevant to safety.

As discussed, employees learn how they should behave, think, and feel by testing various approaches and repeating what they found successful or resulted in desirable outcomes (Rerup & Feldman, 2011; Schein, 1984). Desirable outcomes are learned through these trial-and-error attempts, social identity processes (Tajfel & Turner, 1986), and social learning (Bandura, 1977), and individuals begin to form values and assumptions that direct their behaviors. In Figure 2, enacting behaviors represent the underlying culture being enacted, or translated into action. The arrow from safety outcomes to safety culture represents employees learning from the outcomes of their behaviors and re-informing their underlying assumptions, values, and norms over time. With stability, consistency, and collectively

shared experiences over time, safety culture may be reinforced (Schein, 1984). Without stability and consistency, employees may receive unreliable or mixed messages and further find it difficult to discern the appropriate values, assumptions, and norms to hold.

Employees might also fail to learn as intended if situational conditions do not support the existence of safety culture. Specifically, safety culture may not be developed or reinforced if either enacting behaviors or enabling factors are not functioning properly. For instance, a particular intervention to improve safety culture might teach employees all of the correct behaviors to build collective norms and improve safety outcomes (e.g., by reporting errors and communicating); but they might not form the appropriate values and assumptions if the conditions are not met to enable their adoption (e.g., leaders are not committed and employees lack safety knowledge). Lasting change requires conditions that support the adoption and enactment of safety culture; otherwise, employees may simply learn to engage in behaviors because it is their job's duty, and fail to develop safety culture.

A Word on Safety Climate

As stated in our methodology, we intentionally excluded safety climate from our review of safety culture models. This approach allowed us to closer-approximate the conceptualization of organizational culture as an engrained construct rather than the momentary attitudes and perceptions that may or may not reflect it (i.e., climate); however, we cannot ignore the fact that many researchers have used the terms *climate* and *culture* interchangeably, and models of safety climate could hold information relevant to our review. Although *climate* and *culture* differ in their level of embeddedness and temporal dynamics, the subject of factors relevant to both concepts might be more similar than different (Rousseau, 1988). For instance, having a leader committed to safety can enable safety culture norms to develop over time, and employee *perceptions* about a leader's commitment to safety contributes to the safety climate (whether safety culture exists or not); thus, leader commitment to safety is relevant to both safety culture and safety climate.

To examine potential differences between safety culture and climate paradigms, we supplemented our review by performing an ad hoc search for safety climate models using the same procedure and criteria detailed in the "Methods" section, replacing *safety culture* with *safety climate* and categorizing model elements into the factors of the framework in Figure 2. Overall, we found the safety climate literature seems to parallel studies of safety culture in that there is no unified approach and much variation in the conceptualization, referent, and specificity of model elements.

The most substantial difference between safety culture and safety climate paradigms seems to be the emphasis on measurement. We found that nearly all articles contributing a safety climate model do so by advancing a measurement tool. This is no surprise, as climate has been regarded as a measurable aspect of culture (Murphy, Huang, Robertson, Jeffries, & Dainoff, 2018), a glimpse of culture at a given point in time, and the preferred term when psychometric measurement is involved (Seo, 2005). There is considerable overlap between climate scale dimensions and the enabling and enacting factors thought to develop safety culture over time. For example, some dimensions of safety climate outlined by Zohar (1980) include employee attitudes and perceptions about management safety attitudes and the importance of safety training resources, which our framework proposes as factors enabling the development of safety culture. This finding supports a relationship between the way researchers conceptualize culture and climate, and the relevance of research in both domains toward the same effort to understand and optimize contextual influences impacting safety in organizations.

Practical Implications

Although safety culture is an organization-level construct, we suggest it may be shaped through a "bottom-up" process in which employees develop safety culture over time by adopting consistent assumptions, values, and norms regarding safety. We identify specific mechanisms that may enable safety culture to be adopted, expressed, and permeated throughout an organization, imparting valuable insight to

guide practitioners, such as in the development of tailored interventions to strengthen safety culture and improve safety outcomes, or in diagnostic efforts to monitor and identify deficiencies in areas that can impact safety culture if they persist over time. Although more work is needed to understand how to specifically act on each component in the framework, the enabling factors we highlight can aid in establishing the conditions necessary for employees to learn together and develop safety culture; and the enacting factors explain how it is expressed in action and impacts safety outcomes. Together, this information can give direction to those interested in designing safe, effective, and efficient work systems where safety culture can thrive.

FINAL THOUGHTS AND CONCLUDING REMARKS

In this paper, we aim to provide fresh perspective by reviewing the fragmented literature base on safety culture to inform an integrative framework that organizes current information and brings much-needed clarity to our understanding of how safety culture develops. As this framework is based on a narrative review, our methodology and the resulting framework are subject to innate limitations. Reviews of this nature differ from others because the narrative drives the review process rather than the review process driving the narrative. Acknowledging this potential bias, we believe the current state of the safety culture literature benefits from exploring a new perspective that serves to unify the approach taken to discussing, studying, and implementing safety culture. In addition, we only reviewed articles meeting inclusion criteria in the PsycINFO database. Although the resulting framework may not account for every dimension included in existing models due to this limitation, we believe additional sources are unlikely to reveal substantially novel information that is inconsistent with our narrative. Moreover, the purpose of the framework is to be a first step in the right direction, or a point of departure for future investigations to build upon and create testable propositions. We encourage researchers to uncover additional enabling and enacting factors important for the development

of safety culture at all levels (i.e., organizational, group, and individual) and to explore new theoretical avenues for safety culture development brought by social psychological perspectives.

We reiterate that the resulting framework is not intended to be tested as a theoretical model but rather meant to organize the variables in the nomological network of safety culture by the proposed function they serve in its development. We note that the results of this review are intended to be somewhat high level, due to the nature of our approach and associated limitations. Specifically, we condensed the rather broad scope of factors proposed in prior work as relevant in some capacity, and fit them to a framework based in part on our interpretations of how they might function to develop safety culture as informed by related research and theory, but not on direct empirical testing that would allow for more definitive conclusions to be drawn.

The framework provided here is the first of its kind that parallels traditional conceptualizations of organizational culture and could greatly alter the way safety culture is studied and discussed to the reduce proliferation of models misrepresenting safety culture. We also contribute perspective on the social construction of safety culture, which will allow researchers to investigate new ways to develop it driven by social identification and learning. Understanding that *culture* is assumptions, values, and norms (and not commitment to safety, or safety knowledge and skills) might prompt novel research to target norm development or constructing shared values and assumptions, as well as spark new methods of measuring these difficult-to-assess pieces of culture. Our main contribution lies in crystallizing knowledge on the phenomenon of safety culture by bringing clarity to its nomological network and the mechanisms driving its ongoing development. We hope this review drives the field toward a more unified approach to studying and supporting the development of safety culture across industries.

ACKNOWLEDGMENTS

KEY POINTS

- Safety culture is a relatively stable construct consisting of collective norms, values, and assumptions that are shaped gradually over time by multilevel influences.
- We present a framework based on a qualitative review of safety culture models integrated with psychological theories and prior research to clarify the functions key factors may serve in the development of safety culture.
- We suggest safety culture development relies on three key ingredients: (1) to uphold enabling factors that create conditions conducive for safe behavioral norms, values, and assumptions, (2) for individual employees to observe and learn from consistent outcomes of their enacting behaviors, and (3) stability over time to allow for the collective adoption of safety culture behavioral norms, values, and assumptions.

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