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Validation of the group nuclear safety climate questionnaire

M. Felisa Latorre Navarro [a,*,1], Francisco J. Gracia Lerín [b], Inés Tomás [b], José María Peiró Silla [c,2]

[a] Instituto Tecnológico Autónomo de México (ITAM). Río Hondo, 1 (Ciudad de México), México
[b] IDOCAL. University of Valencia. Avda. Blasco Ibáñez, 21 (Valencia). Spain
[c] IVIE. University of Valencia. Avda. Blasco Ibáñez, 21 (Valencia). Spain

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ABSTRACT

Introduction: Group safety climate is a leading indicator of safety performance in high reliability organizations. Zohar and Luria (2005) developed a Group Safety Climate scale (ZGSC) and found it to have a single factor. *Method:* The ZGSC scale was used as a basis in this study with the researchers rewording almost half of the items on this scale, changing the referents from the leader to the group, and trying to validate a two-factor scale. The sample was composed of 566 employees in 50 groups from a Spanish nuclear power plant. Item analysis, reliability, correlations, aggregation indexes and CFA were performed. *Results:* Results revealed that the construct was shared by each unit, and our reworded Group Safety Climate (GSC) scale showed a one-factor structure and correlated to organizational safety climate, formalized procedures, safety behavior, and time pressure. *"Impact on Industry:* This validation of the one-factor structure of the Zohar and Luria (2005) scale could strengthen and spread this scale and measure group safety climate more effectively.

1. Introduction

High-risk industries increasingly pay attention to the development of "leading indicators," which are characteristics that foment safety behavior, such as safety culture or safety climate (Ashcroft & Parker, 2009).

Safety climate has commonly been measured at the organizational level (Clarke, 2006a, 2006b, 2006c; Prussia, Brown, & Willis, 2003; Smith-Crowe, Burke, & Landis, 2003; Zohar, 1980). Nevertheless, group safety climate has been shown to be a better predictor of safety (Luria & Rafiaeli, 2008) than organizational safety climate, but few scales have focused on group level safety climate (Meliá & Sesé, 2007; Zohar & Luria, 2004). In addition, none of the group level safety climate scales measure the influence of the group itself on group safety climate.

The main purpose of this study was to validate a questionnaire to measure group safety climate that can be used in future empirical research. The authors will present the argument that the assessment of group safety climate should include not only the supervisor, but also the group as a whole (i.e., work unit) as a referent in the different items. For this reason, we start by taking the Group Safety Climate scale from the Multilevel Safety Climate questionnaire (Zohar & Luria, 2005) and changing the referent in some items from the supervisor to the group. Furthermore, we adapt the scale for use in the Spanish nuclear power industry. Then we try to validate this scale by showing its internal consistency and evidence of validity based on relations with organizational safety climate, formalized procedures, safety behavior, and time pressure.

1.1. Safety climate

Safety climate has been defined as shared employee perceptions of policies, procedures, and practices that relate to the importance of safety in the organization (Luria & Rafiaeli, 2008; Zohar & Luria, 2003, 2004, 2005). Nuclear power plants are high reliability organizations with some special characteristics.

In nuclear power plants, nuclear safety is understood as "the achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards" (IAEA, 2009; pp. 2). Therefore, nuclear safety includes the protection of people and the environment from radiation risks, and the safety of amenities and actions that produce radiation risks. Although nuclear safety includes all sources of radiation, it does not consider non-radiation-aspects of safety (IAEA, 2009). In this context, group safety climate is defined as employees' shared perceptions of policies, procedures, and practices related to the importance of safety in the unit in an attempt to avoid and foresee radiation.

Nevertheless, group safety climate has been studied in other organizations where group safety climate has been understood as employees' shared perceptions of policies, procedures, and practices related to the importance of safety to the whole group. Some of these studies related group safety climate to safety outputs, such as safety behavior, and

* Corresponding author.
E-mail addresses: M.Felisa.Latorre@gmail.com (M.F.L. Navarro), Francisco.Gracia@uv.es (F.J. Gracia Lerín), Ines.Tomas@uv.es (I. Tomás), Jose.M.Peiro@uv.es (J.M. Peiró Silla).
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showed the differences between safety sub-climates in the same organization. For instance, the Health and Safety Laboratory (HSL, 2002) found the existence of subcultures and sub-climates within an organization. The results showed that differences in safety attitudes and perceptions among different units within an organization were caused by divergent management styles and levels of safety priority. Hofmann and Stetzer (1996) found that individuals within a work team had shared perceptions of safety climate. Furthermore, in their study safety climate was related to individuals' unsafe behaviors in a sample of 21 teams and 222 individuals in a chemical processing plant. Coinciding with these results, Glendon and Litherland (2001) reported differences in two dimensions of safety climate (relationships and safety rules) between construction and maintenance job categories within the road construction industry, due to variations in their work conditions. Finally, Zohar (2000) found that different perceptions of group safety climate were reported among 534 production workers in 53 groups in a metal-processing plant. Group safety climate varied between subunits, and it also predicted subunit safety records. The author developed his own group safety climate scale focused on group perceptions of supervisory actions and expectations related to safety.

According to the results, group safety climate varies within the same organization due to differences in the way management puts safety procedures and rules into practice. Nevertheless, Clarke and Ward (2006) argued that direct effects of team level processes on safety behavior could be due to their influence on team members rather than on the team leader. Therefore, safety climate could be established and maintained not only through the interaction between the team supervisor and members, but also through interactions and observations among team members.

There are three approaches to the formation of climate: the realistic approach, the leader approach, and the interactive approach. Luria (2008) differentiated between the interactive and leader approaches. The realistic approach is based on environment, since observation of context influences climate formation (Denison, 1996). The leader approach asserts that leaders create climate (Lewin, 1951) and communicate the way to act, creating consensus in their groups (Kozlowski & Doherty, 1989; Zohar, 2002; Zohar & Luria, 2004). The interactive approach is based on the creation of meaning through interactions among stakeholders (Blumer, 1969).

According to the realistic, objective approach, climate is created by a set of conditions that exist in the environment and have an impact on individuals' perceptions of this context (Denison, 1996). This approach considers the influence of the environment on employees; in other words, characteristics of the environment are perceived by stakeholders and observers, creating shared perceptions among them.

The second approach assumes that leaders create climate for several reasons. One reason is that leaders act as filters for management's decisions and attention to procedures and schedules to be fulfilled by group members. Management's messages and decisions are usually reported to employees by direct supervisors. The way supervisors inform employees has an influence on employee perceptions. For instance, fidelity or enthusiasm in communicating management's orders or decisions modifies the final perceptions and conclusions about these orders or decisions. In addition, the more concerned the supervisor is with the fulfillment of norms and procedures, the more employees will comply with these norms and procedures. Furthermore, if the supervisor rewards or punishes certain behaviors, he or she increases or diminishes perceptions about performing these behaviors, following the leader-member exchange theory (LMX; Dansereau, Graen, & Haga, 1975). Another reason leaders create climate, as Zohar and Luria (2004) explained, is that if supervisors continuously make safety procedures contingent on work pressures, employees will perceive safety as a low priority, even though safety might be a high priority for management. Finally, supervisors and other members could serve as models of the desired behavior for new members of the unit, as social learning theory asserts (Bandura & Walters, 1963). Thus, supervisor behavior functions as a model for subordinates.

The third approach is the interactive approach, which assumes that (horizontal) social group interaction creates consensus (Gonzalez-Roma, Peiro, & Tordera, 2002; Klein & Kozlowski, 2000). Blumer (1969) stated that meaning is socially constructed and develops from social interactions among group members attempting to understand the environment. Ashforth (1985) also suggested that unit members discuss their understanding of the work environment and develop a shared interpretation of the organizational context. Therefore, social interaction among group members is a way to create a common perception of safety climate in a collective process of making sense of the environment (situation, circumstances). On the other hand, one of the models that best explains the formation of safety climate is the role episode (Katz & Kahn, 1966). The role set is shaped by the supervisor, but also by group members who have expectations about the safety behavior of co-workers and transmit their expectations in order to influence their co-workers' safety behavior. Employees can perceive the degree to which safety is a priority from the supervisor, but they can also be influenced by their perceptions of their colleagues' safety judgments. Luria and Rafiaeli (2008) showed that the two referents (supervisor and unit) complement each other in forming group consensus.

The three approaches are complementary. In fact, the realistic approach suggests that leaders' and group members' behaviors are a part of the environment that is perceived by the work unit and shapes their shared perceptions, and these behaviors are especially important in the case of group or work-unit safety climate. Shared perceptions among the work unit will arise because they share the same environment, because of leader influence, and also because of group members' interactions.

Taking these three approaches into account, we validated the group level safety climate scale by Zohar and Luria (2005). The original scale is included in the "Multilevel Safety Climate Scale." The group-level safety climate scale includes a set of interactions between supervisor and group members that measure the priority of safety compared to the productivity aims of supervisory practices. Therefore, this scale is based on the leader approach. Our aim is to add the interactive approach in order to have a complete view of the formation and maintenance of group safety climate in each group. The fact is that supervisors and employees obligate and expect their colleagues to work in a safe way in risky settings, since any careless or risky work behavior can seriously affect their well-being. For example, if an employee does not follow the procedures and does not wash properly after visiting a sensitive place, he/she could contaminate not only himself/herself, but also anyone who happens to be nearby. Therefore, colleagues and supervisors do not allow this kind of behavior, and they apply group safety pressure and group safety norms in order to prevent group members' risky behaviors. The unsafe behavior of one employee in a nuclear power plant puts others at risk; therefore, the reactions of other members of the group are expected to avoid this sort of behavior.

1.2. Correlates of group safety climate

An in-depth review of antecedents and consequences of psychological, organizational, and group safety climate can be found in the four most recent meta-analyses about safety (Beus, Payne, Bergman, & Arthur, 2010; Christian, Bradley, Wallace, & Burke, 2009; Clarke, 2006c; Nahrgang, Morgeson, & Hoffman, 2011). Nevertheless, our aim is to test the validity of group safety climate and then relate this construct to some variables that have been associated with group safety climate in previous research, such as safety behavior (Hofmann & Stetzer, 1996; Zohar & Luria, 2005), organizational safety climate (Zohar & Luria, 2005), formalized procedures (Zohar & Luria, 2005), and time pressure (Hofmann & Stetzer, 1996; Prussia et al., 2003; Silla, Latorre, & Gracia, 2011).

Zohar and Luria (2005) found that group safety climate positively mediated the positive relationship between organizational safety