



Safety Concerns in a Portuguese Chemical Industry: A Workers' Perspective

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Abstract. The literature on occupational safety shows that the main safety concerns focus on physical, interpersonal and organizational aspects. Plus, there are studies that indicate experience and knowledge transmission as important aspects for the preservation of health and safety at work. A case study was conducted, in a Portuguese chemical industry, to identify workers' concerns on safety at work, and, to understand whether experience or knowledge transmission are considered in these concerns. Data was collected through the Technique of Free Association with 43 workers. A descriptive analysis and content analysis of the data were carried out. Results allow the identification of seven types of safety concerns (some are common concerns) and show that workers' experience and knowledge transmission are, in fact, considered as a concern. This underpin the originality of this study and contribute to complement occupational safety perceptions, particularly in studies in industries considered dangerous, such as chemical industry.

Keywords: Safety concerns · Workers' perspective · Chemical industry · Free association technique · Work experience · Knowledge transmission

1 Introduction

To investigate and take action in the field of safety at work implies involving workers, knowing their professional context, their activity and working conditions, and their perceptions.

If we focus on the perceptions and concerns, in particular, about safety, we know that these emerge according to the individuals, the contexts where they work, the sectors of activity [1]. The literature on this topic shows that there are several studies on workplace safety concerns carried out in different professional sectors. We highlight, for instance, studies from health, services, and industry. These studies indicate that the main safety concerns, from workers' point of view, focus on aspects such as: exposure to chemical products, musculoskeletal problems (provoked by working conditions and interactions with clients/patients), falls, burns, painful postures, the absence/lack of appropriate personal protective equipment, absence/lack of concern of managers with occupational safety issues (e.g., [2–4]). It is clear that these concerns focus on a more

physical, interpersonal or organizational level. Some of these aspects (e.g., exposure to chemical products; risk of major environmental accidents) are particularly critical in industries where the activity involves a considerable risk for workers, but also, to a large extent, for the environment and the surrounding community (high-risk industries), such as the chemical industry [5].

To complement this reading, there are also other studies, that do not explicitly focus on the study of safety concerns, mas that point out aspects such as experience and knowledge transmission as elements to be considered in these issues of safety and health at work. For example, studies that consider knowledge transmission as a priority in occupational health and safety programs or interventions, assuming it as a way to enhance safety awareness and safety behaviors between workers, and supporting the production of materials such as safety and health guides for action (e.g., [6, 7]) or for the production of safety knowledge assuming this knowledge as mediators of safety and safety performance (e.g., [8]). With regard to experience, both the production and sharing of knowledge imply its mobilization, which contributes to the construction of security perspectives, through the knowledge acquired over time of situations and possible risks in activity [1].

Despite the fact that there are numerous works on occupational safety and the impact of the lack of safety in work and health of individuals, reference should be made to the fact that very few studies were found that address, in specific, the safety concerns that workers in high-risk industries have, and none that spontaneously mention the concerns of workers in terms of the knowledge transmission or experience, thus revealing that there is still space for reflection and empirical studies on this subject/sector.

With this background, it was conducted a case study in a Portuguese high-risk industry – a chemical industry -, in an exploratory and contextualized way, taking in consideration that the company was focused on understanding the safety of its workers, resulting from the transformations experienced over many years (e.g., aging workforce and at the same time concerns with rejuvenating the teams; technical changes in the equipment's; work accidents). Thus, our goal was to identify the concerns that workers have on safety at work and to understand whether experience and/or knowledge transmission are considered in workers' safety concerns spontaneously.

2 Method

2.1 Context and Participants

The study was conducted in a Portuguese chemical industry, more specifically in the operational areas of the company (company that produces organic and inorganic materials), within the framework of a training program aimed at exploring the issue of safety in the operational teams. The company wanted to understand the existing safety problems in their context and develop safety actions with their workers. This company, with vast years of existence, has an average age of roughly 49 years.

The participants of the study were 43 workers (of about 100 from the operational areas): 36 from the two operational factories, which assume the function of industrial chemical technicians (responsible, in rotation, for the control of the automation of the production process in the control room and the external supervision of production and

quality control) or maintenance operators (responsible for the maintenance of the factories equipment's); and 7 from support areas, such as Process Engineering, Projects, Health and Safety at Work. The participants have between 23 and 65 years old and a seniority in the company and function between 1 and 45 years.

2.2 Techniques and Procedure

The data collected correspond to the spontaneous verbalizations of the participating workers, expressed through the registration of expressions or words. These data were collected within the framework of collective training sessions aimed at exploring the issue of safety at work (roughly 10 workers per session).

To collect the data, it was applied the Technique of Free Association (TFA). This is a technique, common in the field of social representations, which consists in the production of words or expressions according to an inducing stimulus [9, 10]. The TFA was chosen to allow participants to share their concerns, in an anonymous and spontaneous registration, in the form of short expressions or words, without giving any conscious guidance to their thoughts, thus allowing to collect spontaneous speech.

To apply the technique, it was presented the following stimulus to the workers: "what concerns do you have when you think about safety in this company?". Then, workers had to registered in individual and anonymous papers, words or expressions related with the stimulus.

After the registration and gathering of the data, a group reflection on the contributions was carried out in the sessions in order to enhance also the collective reflection. This was important to share different and common perceptions and to promote the debate on the issue of safety at work.

A descriptive analysis and content analysis of the data were carried out. With regard to the descriptive analysis, it was analyzed the fluidity, amplitude and richness/homogeneity of the semantic material. The fluidity allows us to know the ease with which the participants expressed themselves regarding the stimulus (expressiveness), and corresponds to the total number of words/expressions associated to the inducing question. The amplitude indicates the number of different meanings, and corresponds to the number of different significations. And, richness/homogeneity allows us to obtain information about the integration of information (greater or lesser integration) and whether the participants resort to a common dictionary (thus suggesting the sharing of one or several representations). The former, corresponds to the ratio between amplitude and fluidity, and varies between 0 and 1, whereas there is use of the same semantic universe the closer the value is to 0 (cutting point 0,5).

Regarding the content analysis, this consisted in the manual identification of categories of concerns, by exploring the main themes found in workers' registers, and the quantification of expressions/words registered by the participants.

3 Results

Based on the descriptive analysis, a total of 74 expressions/words (fluidity) and 47 different expressions/words (amplitude) were identified (each participant wrote at least 1

expression/word and 3 on average). This indicates that workers could easily express their concerns and that these have a variability associated. In relation to richness/homogeneity of data, a value of 0.6 was found, showing that workers share some common concerns and a common 'dictionary' to describe them, although there are some that are not shared by all, as we will show next, based on the content analysis.

With the content analysis, it was identified seven types of safety concerns. We present them, in a descending form, in relation to the number of expressions/words associated to the categories: 1) environmental and industrial concerns (e.g., "product leakages", "risk of exposure to chemicals", "danger/risk of explosion"; "industrial accident", "be careful with spills and leaks that occur regularly", "impact on the environment and nearby population"); 2) the lack of knowledge transmission between colleagues and awareness of workers' experience (e.g., "discussion between workers of technical problems", "workers experience", "communication/knowledge sharing", "need for more awareness on knowledge"); 3) compliance with safety standards (e.g., "use of individual protection equipment", "checking safety demands before work to be done", "need for more safety standards", "comply with company's safety standards"); 4) the conditions and organization of work (e.g., "work permits", "organization of work", "lack of monitoring in the facilities interventions"); 5) the conditions of the facilities (e.g., "aging or degradation of installations", "installations that are not prepared to work safely"); 6) health and well-being at work (e.g., "falls", "work accidents", "concern about the well-being of all"); 7) how to proceed at work (e.g., "habituation leads to carelessness", "hurry leads to accident").

The two types of safety concerns most mentioned were related with environmental and industrial issues (25 expressions/words) and the concerns related with the lack of knowledge transmission between colleagues and awareness of workers' experience (13). The less mentioned, and therefore less shared concern, was about aspects related to how to proceed at work (2). Between these two 'poles', are the issues related to the compliance with safety standards (11), the conditions and organization of work (9), the health and well-being (7) and the conditions of the facilities (7).

Has we mentioned, the richness/homogeneity of data show that there are some concerns that are shared and other that are not shared by all. The first ones, correspond to the majority of the categories, and the point of view with which they are expressed by workers is shared. Those that are not shared by all correspond, in particular, to the category "Compliance with safety concerns", where word/expressions differ in terms of content (meaning different points of view). While some workers recognize as a concern that compliance with the existing safety standards and the use of the personal protective equipment are important, others consider that there are not enough safety standards, or that the use of the personal protective equipment is sometimes a constraint to perform all tasks.

The results show that the safety concerns of the participants do not focus on one category only (e.g., physical, interpersonal or organizational), but on different dimensions related with work including knowledge transmission.

4 Discussion

The empirical data allowed us to discuss on a few topics. With this study, we realize that some of the safety concerns of the chemical industry participants reinforce the safety concerns evidence from previous studies (e.g., [2–4]), for example, health issues, working conditions, or compliance with safety standards. This indicate that there are aspects related to work, health and safety that are shared in different work/sector of activities, even if in multiple ways or with different reasons.

Some other concerns have also emerged, such as the issues of how to proceed at work (even if barely mentioned) and the issues of the importance of knowledge transmission between colleagues and the awareness of workers' experience. Regarding, in particular, this last point, the results allowed us to respond to our goal, reveling that the experience and knowledge transmission are considered as safety concerns in this particular context. Although we know that these concepts are studied and valued for the preservation of health and to take action in safety issues, pointing to the importance of participation and recognition of workers and their experience in safety processes [11–14], no references to experience or knowledge transmission as explicit safety concerns have been express in studies around this topic. In our study they were considered spontaneously by some workers, which is new data for studies on safety concerns. Besides, they were the second most mentioned concern, indicating that, although they are relatively fewer in number compared to the environmental and industrial concerns, the workers are more aware and concerned with these aspects than with other typically more recurrent issues (e.g., working conditions or health), meaning that it is, in fact, something that worries these workers, due to the fact that, in their view, it has a potential impact on their safety. In other words, we can understand that knowledge transmission and the valorization of experienced workers are important for the pursuit of work activity in safety.

The safety concerns found in this company are related with the personal experience of participants with their work activity, but also with the fact that their workplace corresponds to a company with an aging workforce and a high-risk activity that can impact the workers themselves, but also, as we perceived, the environment and the surrounding community. In a context like this one, and considering the safety concerns identified, the investment in learning, in the sharing of knowledge between workers, in the recognition and mobilization of workers' experience, and in the working conditions are, without a doubt, fundamental for the accomplishment of a work in safety.

5 Conclusion

In this study, we explore the safety concerns of workers in a Portuguese chemical industry.

We have shown that the safety concerns in this industrial company are related with work activity, health and well-being, work conditions and organization, issues beyond the physical work context (industrial and environmental concerns), highlighting, as well, concerns related with the importance of experience and transmission of knowledge.

The results obtained with this study can be the starting point for joint reflection with company leaders and the Human Resources team, in order to promote awareness about the main concerns of these workers with regard to safety issues, and to define actions

that can meet these concerns. Since this study focused only on the perspective of the operational workers, perhaps it would be interesting to know, too, the safety concerns of some key players in the company (e.g., production leaders, managers, responsible for management, human resources, health and safety). Thus, as leads to future research, we suggest the development of a similar study with these interlocutors, making an intersection with the workers' perceptions.

In addition to the potentiality of results for joint reflection, the safety concerns of these chemical workers can be indicators of some aspects/concerns present in other chemical companies or perhaps in other professional contexts of the industrial sector (even though they are data from a case study, and therefore cannot be generalized), thus indicating the originality of this study, the relevance of the theme at the present time lived globally, and the contribution to complement occupational safety concerns, particularly in studies in high-risk industries.

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