

ARTICLE

Between the Craft and the Mud: An Analysis of the Work and Health Relationship of Firefighters in the Breach of the Córrego do Feijão Dam—Brumadinho/MG

Hugo Santos^{1*}  Simone Oliveira¹  Sergio Portella² 

1. National School of Public Health, CESTEH-FIOCRUZ, Rio de Janeiro, RJ 21041-210, Brazil

2. Fiocruz Strategy for the 2030 Agenda, EFA-FIOCRUZ, Rio de Janeiro, RJ 21041-210, Brazil

Abstract: Faced with the rupture of the Vale S.A. tailings dam that hit the city of Brumadinho (MG), the article sought to better understand the organisation of work of military firefighters who participated in the search and rescue operation and the relationship between work and health present in this scenario. This is qualitative research with a focus on the subjective production of the speeches of seven firefighters who were interviewed individually with a semi-structured script, using as a basis of analysis the ergological perspective and the productions of the psychodynamics of work. The firefighters experienced a scenario with risks of injury, contamination, and even death. In the interviews, they showed that the more than twelve hours of work were responsible for sleep problems during and after the performance, as well as the food provided and the lack of time for physical exercise proved to be aggravating factors for their health. Working in the tailing's mud combined the development of musculoskeletal problems and anxiety, due to the possibility of contamination by metals present in the mud. The work relationships show a high degree of trust and recognition between the firefighters and the affected population, which helped in the motivation and continuation of the operation until the present moment. The work in this operation that gained national prominence was responsible for the feeling of pride and for feeling more capable and prepared to act in other disasters. This research is expected to broaden the discussion about the work-health relationship of military firefighters exposed to disasters, as well as serve as a subsidy to encourage the creation of public policies focused on the health of these workers.

Keywords: Brumadinho; Firefighters; Disasters; Ergology; Rescue Work; Occupational Health

1. Introduction

Over the years there is a considerable increase in disasters causing deaths, damage to the environment, and de-

struction of both the public and private sectors. According to the report 'The Human Cost of Disasters 2000-2019' by the UN Office of Risk and Disaster Reduction, disasters of natural origin have doubled in the last twenty years ^[1].

*Corresponding Author:

Hugo Santos,

National School of Public Health, CESTEH-FIOCRUZ, Rio de Janeiro, RJ 21041-210, Brazil;

Email: hugogama.psi@gmail.com

Received: 18 November 2022; **Revised:** 10 December 2022; **Accepted:** 30 December 2022; **Published Online:** 5 January 2023

Citation: Hugo Santos, Simone Oliveira, Sergio Portella. Between the Craft and the Mud: An Analysis of the Work and Health Relationship of Firefighters in the Breach of the Córrego do Feijão Dam—Brumadinho/MG. *Journal of Psychological Research*, 2022, 4(2), 5266. <https://doi.org/10.30564/jpr.v4i4.5266>

DOI: <https://doi.org/10.30564/jpr.v4i4.5266>

Copyright © 2022 by the author(s). Published by Bilingual Publishing Co. This is an open access article under the Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) License. (<https://creativecommons.org/licenses/by-nc/4.0/>).

In this way, the dangers of the development model that aims to extract natural resources without limits, mark a lifetime of future uncertainties that threaten a multitude of people around the world. These threats are aggravated depending on the degree of vulnerability in which each individual finds himself.

This life of future uncertainties, unfortunately, became a reality on 25 January, 2019 in Brazilian history, mainly, in the lives of the citizens of the municipality of Brumadinho due to the rupture of dam B1 in the district of Córrego do Feijão. The dam, managed by the company VALE S.A., dumped about 12 million cubic metres of mining tailings that hit homes, cars, trees, rivers, and animals, leaving 272 people dead and more than 24,000 directly affected ^[2].

The collapse was considered an industrial, humanitarian and environmental disaster, and also the biggest workplace accident in Brazil. Near the dam that broke, administrative buildings and operational areas full of employees were affected by the tailings. One of the first buildings to be destroyed was the company restaurant, where—due to the time of the rupture (12:28:20 am)—contained many employees. The safety sirens, which should have alerted the population and the workers, were not activated ^[2].

Immediately after the dam rupture, the mining company was fined R\$250 million by the Brazilian Institute for the Environment and Renewable Natural Resources (Ibama). With this fine, the company totals the amount of R\$350.7 million in fines added to those of the rupture of the Fundão dam of the Samarco company (also managed by VALE S.A.) that affected districts of the municipality of Mariana in 2015 considered the country's greatest environmental tragedy that contaminated the Rio Doce and its tributaries and killed 19 people. Ibama claims that the fines stem from 25 open lawsuits and the mining company appealed all of them.

Despite the constant occurrence of these disasters and the various warnings from different entities about the need to improve inspections and dam safety, the Dam Safety Report ^[3] warns that, since the collapse of the VALE S.A. dam that hit Brumadinho, the inspections carried out at dam sites in Brazil have fallen by more than 90%. This data goes against any and all disaster risk prevention policies and reinforces the finding that lessons have not been learned by the Brazilian State and mining companies.

In these extreme situations, and due to the conditions in which the enterprise was carried out, without any inclusion of the internal and surrounding populations, in its economic planning of overexploitation of minerals, the health sector and Civil Defence receive a great increase in immediate demand, with firefighters and other rescue professionals moving all over the nation and must also be considered affected by the disaster process. Workers who

leave their families, their cities, and their routines to work in remote places, with ad-hoc timing and without basic infrastructure to support and receive them.

At the beginning of the operation in Brumadinho, military firefighters, a category of worker in disasters that stands out for their performance in search and rescue, had an exhausting work routine, with days exceeding fourteen hours of work, contamination with metals in the mud, poor quality of food and sleep, besides the impossibility of physical preparation before arriving ^[4].

In the social imagination, the firefighter is considered a hero, due to their hard work and dedication to save lives. However, the reality of their daily work presents demands like any other activity, which are intensified by the exposure to different risk situations, work pace, added to the rigidity of military discipline that often presents itself as an obstacle to making decisions that require quick answers. Due to the vision of heroes created by society for military firefighters, there is a tendency to think that these workers only have the mission of caring, not discussing their needs and whose health can be compromised and in need of attention ^[5]. In emergency and disaster scenarios, all health risks are amplified and, therefore, greater attention should be directed to the victims, but also to the exposed professionals.

With regards to the health of emergency and disaster workers, the focus on the work-health relationship of firefighters has been rarely discussed in academia and in national literature as a whole. Among these studies, many only focus on pathological indicators and/or physical consequences and few focus on the work activity ^[5]. This scenario points to the need for research that follows this bias, in the search for understanding the work processes in disasters, based on the perspective of workers.

This research is anchored in Worker's Health, seeking to understand the work-health relationship of firefighters in the Brumadinho operation. From the reports of these professionals, it sought to describe the process and organisation of work; identify possible health risks and the defensive strategies used by them.

2. Work-health Relationship

The field of Occupational Health is the result of a patrimony accumulated in the scope of Collective Health, with roots in the Latin American Social Medicine movement and influenced by the Italian Workers Movement. In this way, Worker's Health, unlike Occupational Medicine and Occupational Health, prioritizes the analysis of the work process and its relationship with the health-disease process, breaking with the hegemonic conceptions, uni or multicausal, that disregard the social and historical dimension of work in the relationship with health/disease. The subjective experience of the workers and their participation in the anal-

ysis/intervention as subjects of their health is prioritized, relativizing the hegemony of quantitative methods for the association of cause and effect. Therefore, it is necessary the integration of different disciplines to understand the dynamics between individual and collective subjects and their relationship with the health-disease process^[6,7].

Work clinics^[8] have presented themselves as an important ally for the analysis of the work process and its relationship with health, from the activity approach. In this case, the concept of activity originates in ergonomics in French-speaking countries, coining the concepts of prescribed work (task) and the real work (activity). Therefore, for the analysis of the speeches given by these workers, as a basis we took the ergological perspective to understand the activity highlighting the production of Psychodynamics of Work (PDT) with regard to defensive strategies and recognition of the work.

The ergological perspective is an analysis tool proposed by the French philosopher Yves Schwartz that focuses on the activity point of view. For Schwartz (2000), activity always has—on the one hand—its describable character as protocols and norms to be followed, and on the other hand, the experiences themselves and their encounters and challenges of realisation^[9].

Thus, all productive activity can be approached in two ways: First we consider the task, defined previously, where the worker must put it into practice (alone or with his or her colleagues) in such a way that intellectual activities are developed with the intention of producing effective results; and the second perspective is how the work situation is dealt with, first of all, as a moment of life, what the worker is experiencing at that moment and the changes pertinent to their life, both personal and professional.

To treat the work situation as a moment of life requires a continuous and permanent learning of work situations, of the debates of norms that circulate the spaces of know-how and of values that indefinitely renew the activity in order to promote situated changes. In this way Ergology is presented as “[...] a project of better knowing and, above all, of better intervening on work situations to transform them” (p. 31)^[10].

Therefore, to comprehend someone’s work activity, according to Duraffourg (2021), it is necessary to promote an empathic attitude and a positive look toward the worker who is inserted in this universe of work (a universe of relationships and norms). This empathic attitude must occur at the detriment of the obsession with problems and their solutions that, many times, lead to decisions that are only remedial and pathologizing^[11].

In order for the analysis of the work-health relationship not to have a pathologizing character, Canguilhem (2009) states that something can only be conceptualised as sick

when the body as a whole is considered and, mainly, when the individual’s experience and opinion about his or her “problem” is taken into account. For the author, health is not a state, but rather a process of social, psychic, and biological adaptation in the face of the infidelities of the environment that are experienced^[12].

Following this perspective, an individual’s life becomes a constant struggle to build, in the face of an unfaithful environment, the capacity to use his or her potential and even manage to overcome difficulties and institute new ways of living and new norms. Canguilhem will call this vital phenomenon “normativity”. “The normal man is the normative man, the being capable of instituting new norms.” (p. 54)^[12].

Associated with the ergological perspective we summoned the scientific approach of Psychodynamics of Work (PDT) developed by psychoanalyst Christophe Dejours in order to contribute to the analysis of the activity of firefighters. In dialogue with the ergological perspective, work environments, according to PDT, are permeated by unexpected events and there is always a discrepancy between what is prescribed and what is real, and to work is to fill this gap^[13].

To deal with these work influences, the worker develops defences that Dejours (2004) defined as individual and collective defensive strategies that have the objective of adaptation, enabling the worker to dominate and minimise the awareness of suffering. According to Dejours (1999, p. 18), “if suffering is not always followed by decompensation, it is because the subject develops sufficient defences against suffering^[14].”

Another important factor that can contribute positively to the worker’s health is recognition which, according to Dejours (1999), follows the dimensions of promoting sense of work through the observation (by others and by the worker’s contribution to the organisation of work) of its value, associated with gratitude. This recognition goes through judgments about its utility (economic, social, or technical) and its beauty (conformity to the rules and originality)^[14].

3. Methodology

The present research is qualitative in nature and proposes to understand the work-health relationship with a focus on the subjective experience of the military firefighters who worked in the search and rescue operation of the 272 victims in Brumadinho, MG.

To approximate these experiences, individual interviews were conducted with seven firefighters, six males and one female. The inclusion criteria consisted in being a firefighter and having worked in the search operation carried out in Brumadinho. About the functions performed, three acted only in the operational, two in the adminis-

trative, and two in both functions at different times. The ranks of the participants were: One corporal, four lieutenants, and two majors. The ranks and the time of performance are highlighted in the speeches of these workers.

The purpose of the interviews was: To know the process and organisation of the firefighters' work in the rescue operation in Brumadinho; the activity of these professionals in this scenario; to identify the debate on standards and the renormalization mobilised; to identify the possible risks of work to health, as well as the defensive strategies used by these workers.

Participants were contacted by e-mail or communication app message with an invitation to participate in the research. Due to the Covid-19 pandemic, the interviews occurred through the Zoom platform and lasted an average of 60 minutes, during the period of June to July 2020. The interviews were recorded and transcribed.

We establish a dialogic relationship, following the questions of a pre-established script, however, not being restricted to it. The main issues addressed were: The first moments of the performance in the operation; the organisation of work; the different work relationships; the difficulties encountered at work; and the perception of health of these firefighters.

To help analyse the interviews, the NVivo 12 software was used, which allowed the creation of categories and organisation of the statements. Then, we proceeded to systematisation and thematic categorisation based on content analysis^[15]. The interpretation, through the construction of categories, according to Minayo (2010), covers grouping elements that interrelate to establish classifications. That is, organising the analysis by categories means grouping elements, ideas or expressions around a concept.

The categories created and used in the organisation of the speeches were: 1. when they heard about the disaster, 2. when they were invited to work, 3. when they arrived at the site, 4. their working hours in the first month and in the following months, 5. their functions, separated by area of activity (administrative and operational), 6. work relations with colleagues on the same team, superiors, professionals from other sectors, affected people, and with Vale S.A., 7. work conditions and environmental infidelities, 8. defensive strategies, 9. renormalizations, 10. recognition, 11. care, and health complications.

The material was interpreted in the light of the theoretical framework of Worker's Health, Psychodynamics of Work and the ergological perspective, contributing to the production of senses and meanings.

4. Results & Discussion

According to the Military Firefighters' Statute, the

military firefighters are responsible for the prevention and extinction of fires, search and rescue services, and for providing assistance in cases of floods, landslides or catastrophes. According to the same Statute, the career of military firefighters is divided into two distinct groups, with different ranks and degrees: The Officers, who start as Soldiers and go up to Sub-Lieutenants; and the Officers, who start as Second Lieutenants and can reach the rank of Colonel.

Regarding the functions of each rank, the Military Firefighters Statute assigns to the officers the responsibility of leadership, organisation, and command functions of units and rescue teams. The Sub-Lieutenants and Sergeants are responsible for assisting and complementing the Officers' activities. Corporals and Soldiers, on the other hand, are considered, essentially, to be field workers.

The areas of performance are divided into administrative, with day shifts of six hours a day, with responsibilities for internal services of approval and release of security projects for residences, stores, among others; and operational, with work schedules of 24 hours on, 72 hours off and duties previously mentioned in the Firefighters' Statute.

In order to produce a general understanding of the experiences of these workers in the search and rescue operation in the city of Brumadinho, initially apprehend with the research participants how was this first contact with the news of the event, their convocation to act and their arrival at the site of the disaster.

4.1. First Moments of the Operation

Because an occurrence can happen at any time, one never knows if the professionals will be available or for how long they will be away from home. The firefighters' work definitely does not involve any sense of routine, which in itself provides constant invasions of their personal lives.

All of them presented in their speeches the readiness and desire to act immediately in the operation and, according to their reports, this desire was also very present in their colleagues. The WhatsApp application was the initial and main means of transmission of information and where they received the news of the rupture.

However, this sense of responsibility for the fulfilment of their duties also contributes to the constant invasions of the boundaries of their professional lives into their personal lives, where they are frequently taken away from their family and rest spaces. Some were on vacation and reported learning about the event while travelling with their families, which made them decide to cancel their trips.

"In the case of Brumadinho it was no different. I also had some personal things to do, naturally, five days. I didn't even know that it would be five days, I went without knowing when I would

return. I didn't go 'Thursday you are there', I just went. I just picked up my disaster kit and went." (Cab. G.—8 working days).

The operation carried out in Brumadinho had repercussions at a national level and had an extreme impact on the state of Minas Gerais. The feeling of having participated in an operation of such proportions was a great source of pride for the firefighters and the response of the community to the work done was of utmost importance for the motivation of these workers and even for their health.

According to Dejours (2004), recognition can manifest itself in a symbolic order, in most cases represented by gratitude for the service rendered, or in a material order (a fair salary, bonuses)^[13]. In the case of the work of the firefighters in Brumadinho, we can highlight a great symbolic order represented, mainly, by the gratitude from the people affected and of Brazilian society as a whole.

Criteria such as years of work and experience were taken into consideration to select the firefighters who would act due to the large number of requests for volunteering. Being chosen to act among so many firefighters, especially at the beginning of the operation, brought positive feelings such as: Recognition, appreciation, and pride to these professionals.

Besides those who could not act immediately in the rescue and search for victims, I had the opportunity to interview and know, in detail, the first moments of the firefighters' actions through the words of Major C., a helicopter pilot who, within 16 minutes of the confirmation of the tragedy, was flying overhead.

"It was a Friday; I was on pilot duty at the air operations battalion. [...] it was around lunchtime, I was having lunch [...] then the barracks bell rang [...] I interrupted my lunch and walked to the operations room [...] the history that came to us was of a dam breaking, [...] at first he thought it was a prank call and when the caller answered, he spoke in a desperate crying voice and informed us that everything in front of him had been washed away by the mud and immediately I determined the necessary steps for the activation of the aircraft [...] About 16 minutes later we were already flying over the area and it was possible to get an idea. There is a mountain range that divides Belo Horizonte from Brumadinho and as soon as we crossed the mountain range, we saw that the dam had really burst [...] The bridge where the train passed had been taken by the mud, a derailed wagon, some vehicles overturned in the mud, little trace of a residence, in some places we could only

see the roof of the buildings and the mud was running slowly. The first association we made was with Mariana in 2015, when the dam was breached." (maj. C.—22 working days).

Rescues of live victims, unfortunately, occurred only on the day of the incident. As the disaster of the Córrego do Feijão dam collapse produced high levels of burial due to the dumping of mining tailings, the chances of finding victims still alive the next day were very low. Only Maj. C., among the interviewees, had rescued people alive and could describe the two rescue processes in detail.

"As we were flying low over the ground to try to visualize someone, it was very difficult to distinguish what was a person and what was mud, because everything became monochromatic and, at a certain moment, residents began to gesticulate to the aircraft [...] then we saw two young men approaching a person in the mud [...] and this was the first victim we could visualize who needed immediate help. Their assistance was complicated because of the time spent in that maneuver, they needed to maintain the most precise point possible to avoid hitting the people who were disembarking, so that the operational crew could work more easily [...]. They used a piece of equipment that is a safety gus, went under her armpit and managed to remove it." (Maj. C.—22 working days).

"We also had P. who was rescued, I landed in a corn field, disembarked from the aircraft and turned off the aircraft and went to her with the other 2 crew members to immobilize and prepare her for boarding and take her to the doctor and nurse for a better evaluation." (Maj. C.—22 working days).

Regardless of the "miraculous character" of finding victims alive in the days after the incident, the firefighters spared no efforts in organising the operation and in the search for the missing people. This organisation had to be immediate, and the very next day, firefighters from different parts of the country were already in the city ready to act.

The firefighters that were initially sent in were faced with roads blocked by mud, with air access being the most viable. The difficulty of mobility and response by land routes promoted other problems to be solved, such as a large number of helicopters circulating in the airspace of the city of Brumadinho, as there were not enough helipads, besides the lack of equipment for air control. These are important factors to be discussed when preparing and investing in disaster risk prevention policies in municipalities and states, especially those that already present clear

risks or frequent experiences.

The firefighters' operation in Brumadinho presented different renormalizations, in the light of ergology, to deal with the infidelities of the environment. It is important to understand that it is not possible to completely apprehend what constitutes the activity of work, because there is always an unpredictability, especially in the work of firefighters in emergencies and disasters. This unpredictability, or infidelities of the environment according to Canguilhem (2009), reinforced by the ergological perspective^[10], by stating that the environment is never identical, is necessary to understand the work of firefighters and exposure in disasters.

Facing these difficulties instigates a debate on standards in order to promote quick and intelligent solutions. In this first difficulty, the firefighters occupied a soccer field where they marked and organised the aircraft landing site. About the lack of air operations infrastructure, through communication with the control tower of Belo Horizonte's airport, the firefighters managed to source portable equipment that solved the initial problem, until an official radio structure was established.

At first the firefighters used churches and a college to establish their operational bases. As the operation progressed, they built a base very close to the broken dam and named it Bravo base. It was a base strategically designed to keep the firefighters close to the site of operation, since access was not simple and demanded a lot of time and effort from these workers.

"The conditions were very simple, we slept in a church. There was a Catholic church that was the logistical base, then there was the Evangelical church where we slept, and then there was the Jehovah's Witness church where we washed our clothes. Everybody got together, it was really cool. I felt a lot of good there, you know? Despite the very heavy scenario, but a feeling of help." (Cab. G.—8 working days).

As in the daily work, they were organised in two areas of action: One operational and the other administrative, besides the division of the work sites into hot, warm, and cold areas. The operational team is responsible for the search and rescue of victims and worked directly in the place where the tailings went through (hot area). The administrative firefighters were responsible for the development of strategies, organisation and coordination of the teams and worked in both areas, but were more connected to the cold area, which was the operations centers; and the warm area, where the bodies and body remains were taken to be identified.

At the beginning of the operation in Brumadinho, the firefighters' work routine started at four o'clock in the

morning and ended at eleven o'clock at night, having four to five hours of sleep. In addition to the unpredictability of what they would encounter in the field, the return schedule was also uncertain, with some workers being earlier and others later due to the complexity of the situation^[4].

"Every day was a different schedule, for example, there were some days that the army aircraft left us in the field, some days it was firefighter aircraft, other days it was on foot. Then, if you were close to the base, you would come back quickly, if you were far away, the helicopter would be delayed because of something, then you would stay there until almost nightfall." (Lt. D.—50 working days).

Due to the high demand that these professionals faced, a weekly rotation was established. The firefighters would arrive on a Thursday to relieve those who were already working there and leave on the Thursday of the following week, these rotations were repeated until the end of the operation. The firefighters who had been working could be called back to work again.

The weekly rotation was presented as a strategy of care and a concern with the exhaustion of workers, which does not reduce the experience of seven exhausting days of work, but rather prevents its continuity. Through the speeches of the firefighters, we can perceive days of work with a high workload, accumulation of demands and high level of responsibility, factors that studies have associated with the overload of mental effort^[17,18].

This extensive and intense routine with high workload was associated with unregulated sleep that remained for some time after exposure to the disaster. According to Santos et al (2018), extensive work schedules provide difficulties in social, personal, and health relationships with self-care and can be associated with inappropriate health behaviours such as alcoholism, smoking, sleep disorders, and musculoskeletal diseases^[19].

Together with the long working hours, there is the experience of working in the field of disasters, which makes military firefighters even more vulnerable to the multiple situations that produce high levels of stress^[20]. Different studies point out that the experience of extreme situations is enough to negatively influence the worker's health and work performance^[20, 21, 22], highlighting the prolonged exposure as an aggravating factor for negative health effects^[23].

In a survey of 11,701 firefighters exposed to the World Trade Center (WTC) disaster in 2001, 4,269 (36.5%) were at high risk for Obstructive Sleep Apnea (OSA), although 828 (7%) reported receiving a medical diagnosis for OSA^[24]. Other research also warns of immediate increases in the occurrence of musculoskeletal, psychological, respiratory, fatigue and sleep problems in firefighters following disaster

exposure^[25, 26, 27].

4.2. The Performance of the Operational Firefighter

In the first days of the search, the firefighters reported the ease of finding bodies and how the strategy was organised. Access by land was initially unviable, so helicopters flew over the site and, when a body was identified, the location was plotted using GPS. Later, the helicopters took teams of three to four firefighters to the marked places; they left them there to prepare the bodies and, possibly, identify new ones.

“It was so much that people would even say, without any pejorative sense at all, you would walk in the field and you would trip over a body, it was a lot of bodies everywhere. You would look like, ‘what is this here?’ It is a body. So, the search activity was even easy in the beginning, because it was a lot of people, a lot of scattered bodies” (Lt. D.—50 days in the field).

The firefighters reported that often the GPS location did not offer a very precise position, thus hindering the work of those who had been sent to collect the bodies. In order to solve this problem, they used white marked pipes stuck in the mud near the body. Some aircraft were assigned to fly closer to the mud in order to position these pipes and facilitate the work of locating the bodies by the teams that would later pass by to collect them.

This demonstrates the great complexity behind the work of these professionals and the extreme need for very well coordinated work. This coordination was only possible due to the strong dedication of these workers to finding the victims, which was fundamental to the success of the mission.

The main objective of the firefighters, regardless of their function, was to find the missing victims, mentioned as the biggest motivation for their work by all the interviewees. The firefighters, in their speeches, expressed the importance of finding the bodies for the grieving process of the families, which proved to be a reinforcer in the motivation of these workers.

These issues refer to what Dejours (1992) will call symbolic satisfactions which, according to the author, “[...] is the qualitative experience of the task. It is the meaning, the significance of work that matters in its relations with desire.” (p. 62)^[28].

“I really wanted to stay, but there was no option. This was the feeling, because it is that thing of ‘just one more, just one more body, just one more person’, and this was very latent, not only for me but also for some other soldiers who had the same feeling. We wanted to be there to comfort a family, to close a cycle for

that family.” (Cab. G.—8 days in the field).

Not all firefighters coped well when they came across the bodies or remains of victims, there were reports of professionals who asked to step away from the operation in order to protect themselves. When questioning them about these encounters and how they dealt with them, the separation of work life and personal life was a factor highlighted by some. Keeping the memory of these experiences within the work environment and avoiding commenting on the subject in external places were strategies mentioned.

On the other hand, other firefighters report that talking with family, friends, and co-workers about their experiences in the operation was an important factor that helped them cope with anxiety and assisted in the process of re-signification.

During the search process, at certain times the firefighters needed to move through mud that was not completely solid, besides representing a risk for these professionals due to the possibility of developing musculoskeletal problems, because of the great physical effort, there was the possibility of contamination with the metals present in the tailings. A strategy used was the use of wooden tarps that were placed at strategic points over the mud to facilitate the movement of these professionals, allowing access to risk locations.

The firefighters carried these boards with them in the helicopter and used them when they found a body in an area where the mud was totally unstable. The body would be surrounded by these wooden boards, each fireman would stand on one, and the helicopter would leave them there while they prepared the body for transport.

The firefighters who worked in the operational area searching the tailings were affected by muscle pain or even developing more serious problems due to the irregularities of the mud and many hours of standing on this surface, without any previous exercise. An important factor to note was the great demand for physiotherapeutic care.

In the case of Lieutenant G., he talks about how the work in the field affected his health when he developed plantar fasciitis due to hours of working standing in the mud. The Lieutenant reports that this problem affects him to this day with pain and physical restrictions. Despite his desire to return to work in the operation in Brumadinho, due to his physical condition, he was ordered to work in the administrative area of the operations command.

“In my case my right leg developed tingling, it was muscle fatigue, this I felt for two weeks after my return and I thought it was fatigue. Until it got to a point where the right leg didn’t feel anything anymore, but the left leg, I don’t

know if you have ever felt a muscle stretch, it felt like it was tearing. So, every time I put my foot on the floor, I started to feel this. [...] After doing some exams the problem was identified. It is an inflammation that occurs in this fascia, right, in this membrane that is between the skin. [...] I can't do physical activity, right, I can't run because it can aggravate it, it can injure even more, aggravate the situation even more, so I was suspended from physical activities." (Lt. G.—118 days in the field).

The risk of developing musculoskeletal problems is very present in the work of firefighters, especially in emergencies and disasters. About 18% of the firefighters who were exposed to the WTC disaster were affected by musculoskeletal problems while in the El Al Flight 1862 air disaster in Amsterdam about 54% of the exposed firefighters had complaints related to musculoskeletal symptoms^[29, 30].

There were working areas where the mud was very wet and these workers had to crawl to reach certain places. Although they used protective equipment in order to reduce skin contact with the tailings, contact was inevitable due to the irregularities present in the mud. It is possible to see in footage and photographs, available on the Internet, the work of firefighters and how the tailings came into contact with the neck, nose, mouth, and eyes of these workers.

The toxic content present in the mud was also a fearful factor for the firefighters due to possible contamination. This fear was not restricted to the individual, but also of contaminating their families when they returned home. Some firefighters reported needing to stay isolated after the operation until the tests indicated that there was no risk of contamination. In addition to spending days away from their families and friends, this isolation continued even after they returned home, further affecting their emotions.

Exposure to this contaminated mud can trigger allergic skin reactions, burning sensations, and discomfort. In a survey with the riverside population of Colatina/ES, Rocha et al (2016) identified a significant increase in the incidence of diarrhea, fever, and skin diseases in the population^[31]. The firefighters who were exposed to this mud undergo decontamination monitoring with a forecast of 20 years of follow-up. This data, to date, is kept confidential by the health board of the Military Fire Department of Minas Gerais.

This work of searching for victims in the midst of a catastrophic scenario full of risks made some firefighters realise the value of their work and understand that few people could be doing the same as them. This feeling of recognition was an important factor in motivating and fulfilling the work of these professionals.

"I think the feeling I had was that I could do something that almost nobody else could do. Like Spiderman, 'with great powers come great responsibilities', there I didn't feel like Spiderman, I felt more like Mud-Man. So, I felt I was part of a minority there that was actually making a difference in the whole scenario and that weighed a lot, that we carried with a lot of responsibility, but also with a lot of pride." (Cab. G.—8 days in the field).

To achieve recognition it is necessary, according to Dejours (2004), "to bear witness to your experience of working, to make visible the discoveries of your intelligence and your know-how is the means of obtaining recognition from others." (p. 33)^[13]. In view of Corporal G.'s speech, we could observe the importance of recognising the relevance of his work.

4.3. The Performance of the Administrative Firefighter

On the other hand, we have the firefighters who worked in the operations center developing strategies and coordinating teams that worked in the field. For those professionals who had the opportunity to participate in both areas, it was possible to talk about the differences and challenges encountered.

Broadening the knowledge about the disaster; having a closer relationship with the people who were affected; knowing the region and understanding it holistically; working on the morale of the teams; and constantly developing search strategies were issues raised by these firefighters as the main characteristics of the administrative work and what differs from the operational work.

Some firefighters were able to experience the change of functions and reported that, when they were operational, they didn't have much knowledge about the work that was being done, becoming aware of it only when they started their work in the operations center. This issue was observed by Lieutenant C. as a problem that needed to be solved.

"I was able to get to know the operation as a whole, because generally those who are in the victim search area have a more directed vision and this was one of my concerns when I arrived there because I saw that many people had a very segmented vision. [...] So we gathered all 140 military personnel and gave them a general briefing about the operation: 'you are going to look for a victim there because of this, because with the crossing of data there is the possibility of having a victim there'. It was a very

important job of planning and intelligence.” (Lt. C.—60 days in the field).

The development of strategies is a very vast area that covers the entire operation in order to deal with the difficulties presented, for example: how to deal with the families and pass on concise information and comfort them; where to search for the victims; organise the work and worry about the safety of the firefighters; deal with other sectors; organise the information that comes from everywhere; obtain knowledge and study the terrain.

Faced with so many complex functions, managing people has proven to be a very difficult task for firefighters. The demand for the development of new strategies and results and having to deal with different subjectivities in which each one presents his/her own specific issues and way of facing situations was a source of greater suffering for these professionals.

Thus, the firefighters who held this leadership position mobilised their subjectivities to deal with the different subjectivities that coexisted in the same work environment and needed to make choices that coincided with the operation and with what was best for theirs and other firefighter teams. Schwartz and Durrive (2021) will call this mobilisation “dramatics of the use of self” that refer to work situations where there is always a destiny to be experienced and this destiny will be determined by choices^[10].

“There were cases of victims and very sad situations, when the firefighter found himself in certain situations, he was emotionally shaken and asked to be removed. There have also been cases of indiscipline, where we had to take action on the part of the operation’s command; this also affects you. [...] A person runs away from the proposed path, you end up having to take a more drastic attitude, so this also affects your morale for a while, but then you realise that it was the best option and you get back on track again.” (Lt. C.—60 days in the field).

Lieutenant C. points out a difference in the physical and emotional stress among the firefighters who worked in different areas, emphasising the emotional stress suffered by the firefighters from the administrative area where they were under constant pressure to develop more strategies and need to deal with different people in different situations. The use of self for oneself and for others implies making choices and the officers who held management positions were constantly faced with the pressures of the dramatic use of self.

“The people who worked in the field searches, we noticed that they were more physically tired, the people who worked in the

planning part had a little less physical wear, but on the other hand, the emotional wear was greater, because they were under pressure all the time, you have to develop the operation, you feel responsible for the efficiency of the operation.” (Lt. C.—60 days in the field).

These pressures occurred at different times with different intensities, since the operation presented several phases and along with them their changes in the work that directly influenced the morale of the troop. The mobilisation of the use of self was constant, due to the new risks that arose over time.

4.4. The Course of the Operation

In analysing the working conditions of the firefighters, we also observed the differences in the injuries present at the beginning of the operation and during its course. The firefighters who worked in the first days after the dam broke faced more precarious working conditions than those who arrived later with structured bases and more organised work processes.

Several studies have discussed the level of exposure of firefighters to disasters as a risk to their physical and mental health, especially when they act in the first moments of the critical event, which has far greater negative health effects than firefighters who act later^[32, 33, 34, 35].

Subsequently, the goal was set to excavate three metres deep of the entire territory invaded by the mud. Even with this goal, there were places where a large concentration of tailings settled and some firefighters were directed to these areas in order to dig and find what they called the “zero pit”, which would be the original level without dumped tailings.

“In the first phase the mud was very liquid, so what was done in the beginning? Surface search with aircraft, with dogs, sweeping the ground, lots of amphibious machinery, and then the mud was hardening, so new strategies were created. [...] In the fourth phase, we were digging deeper and making folds in the earth [...]. A machine came, dug the soil, left the soil in a corner and turned it over two or three more times, then another machine came, took the same tailings, sieved it to really verify. It is like looking for a needle in a haystack, there are a lot of things to look for, you have to have a very good intelligence work. [...] In the fifth phase, for example, there were more superficial excavations of up to 3 meters, but longer, because the rainy season was forecast and this would disturb the search in the tailings. During

the excavation, when the tailings became too wet, it would hinder the sieving. [...] To have an idea, there were tailings that were more than 15 meters long, so we had to dig 15 meters to get to what we called the zero pit, which was the previous terrain, and then we were sure that we had searched completely there and that there would be no victims in that square meter.” (Lt. C.—60 days in the field).

The search work required a lot of attention and focus from the firefighters who were there, because they had to keep an eye on the tailings that were being turned over to find, sometimes, small remains that could identify a victim. Because it was an open-air job, the firefighters were exposed to sunlight for hours, which was difficult for them to keep their attention on their work task.

The constant state of alert was represented, by these workers, as a source of stress, influencing negatively their health. The association of the prolonged state of alert with increased stress and physical and mental exhaustion of firefighters was also made by other studies^[36, 37]. González (2006) points to the relationship between this state of alertness with the development of sleep disorder, fear of getting sick, irritability and other negative ways of influencing the health of workers^[36].

Spending hours sifting through the mud and not finding a body or the remains of a victim was presented as a reason for sadness, demotivation, and even guilt. Frustration is directly reflected in the production of recognition that, according to Dejours (2011), “is led to doubt the relationship he maintains with the real, to doubt himself [...]” (p. 64)^[38].

“One of the things that made me sad and demotivated was when, in a whole day, you couldn't find anything, an important segment in the case a tooth, a hair, a thing that would help to identify. [...], but there is the emotional part, if I didn't find anything I would be sad thinking about what I did wrong, what I can do to improve.” (Lt. C.—60 days of acting).

“The biggest problem that we faced there during the weeks was the frustrations of the troops in not finding what they were looking for. So sometimes the professionals would go there, spend a week there and find nothing.” (Maj. P.—205 days in the field).

In order to deal with this new problem, the administrative firefighters spread posters with pictures of the victims still missing, who were referred to as “jewels”, throughout the operation bases and the search teams. Moreover, every time a victim was found and identified, the news spread. They made a point of congratulating everyone, because it was the joint work that made this identification possible.

The cooperation that is established in the activity contributes to provide the feeling of self-realisation that, in turn, strengthens this collective^[13].

4.5. The Multiple Labor Relationships

Regarding the strengthening of this work collective, the different relationships established by the firefighters with their professional colleagues, superiors in command, other sectors acting in the scenario, the affected population and even with VALE S.A., demonstrated an important role for the success of the operation.

It is emphasized that “[...] we understand by work relationship all the human ties created by the organisation of work” (p. 75)^[28], understanding that “[...] the quality and dynamics of relationships within work collectives have considerable, if not decisive, weight in the effects of work on health.” (p. 87)^[14].

Paying attention to and caring about the condition of one's colleagues, with the same degree of importance that one should have for the emergency and possible victims, has been shown to be an important defensive strategy. First as support and emotional control of the team and, second, by observing how their colleagues deal with the adversities of the operation, the firefighter ended up absorbing these ways of coping and felt safer in case it happened to him.

Due to the high physical risk of the profession, firefighters always act in teams and are ready to act cooperatively with their colleagues. This practice also serves as a defence mechanism against the psychosocial risks of the job. The amount of time that firefighters from the same team have worked together has been shown to strengthen trust and has promoted a good relationship between colleagues and superiors.

The trust that superiors convey to their teams has also been shown to be extremely important to the work effectiveness relationship. When trust becomes reciprocal, a good working relationship is established between superior and subordinate. The freedom to work, arising from this trust, becomes something positive even for the strict standards of militarism.

According to the firefighters interviewed, the trust present in the different relationships was an important factor that positively influenced the health of the workers. This result dialogues with studies that link trust at work with the development of the activity, spontaneous cooperation, safety, and workers' mental health^[22, 39, 40].

In order to reinforce the importance of developing trust at work, Dejours (2004) states that the collective field of work, sustained on the basis of trust, offers favourable conditions for subjective mobilisation and promotes spon-

taneous cooperation^[13].

“From the beginning, Colonel A. and Colonel P. were in charge of the technical part of the project. The guys are too good, they are very good. So, we had working conditions” (Lt. D.—50 days in the field).

The firefighters’ contact with the affected population took place in several ways. At the beginning of the operation, this contact, most of the time, occurred only by exchanging glances or a celebration with applause, which was enough for them to feel the expectations placed on their work.

The firefighters reported contact with children, and both experiences were recounted with happiness and excitement. The tributes paid by them proved to be a factor that positively influenced their motivation to work in this operation.

“This little girl had an envelope in her hand, a small envelope, right [...] She looked at it and gave me this envelope. [...] She said in the letter ‘thank you firefighter for finding my father’.” (Lt. G.—118 days in the field).

Although the firefighters’ relationship with the families was positive in different situations, in later moments this relationship presented itself a little more complex. The firefighters had to deal with families receiving false news about missing family members who were supposedly found; the anguish of family members receiving small remains of their loved ones and; the long duration of the search and whether the firefighters would continue until they found the last missing person.

In order to deal with these issues, during the course of the operation, meetings were organised with family members and professionals from other sectors every Wednesday, in order to share information about the operation and keep family members informed about what had been found and what was being done. Groups of official press releases were also created by the fire department to prevent the spread of false news.

The concern in passing the clearest information possible and being ready to receive the doubts of family members and other people affected by the disaster, resulted in a closer relationship between the firefighters and the families and a greater trust in their work. This process of social interaction and sharing of information with the public, along with flexibility to meet different demands, is linked to what different studies point to as aspects of a highly trusted organisation^[41, 42].

Additionally, the firefighters’ relationship with the company Vale S.A., which provided support for the work of these professionals. The company guaranteed whatever was necessary for the execution of their work, such as

quality equipment and infrastructure. Many agree that, in terms of support and infrastructure, the operation in Brumadinho was unique and they lacked nothing.

4.6. The Duty Accomplished

Finally, we sought to understand the firefighters’ overall view of acting in the disaster where many brought up the issue of learning and how they feel more prepared to act in emergency and disaster scenarios.

“The face, I’m proud. I am proud that I was useful, I did my job, but we did more than just our job. We did much more than our obligation there. We are still doing it. So, this is a reason for pride, yes. The family feels proud. In fact, I managed not to bring negative things into my life because of the operation.” (Lt. D.—50 days in the field).

The feeling of accomplishment was present in the speech of most of the firefighters interviewed and proved to be an excellent ally in facing adverse situations at work. The military model makes workers see their work as a mission that must be successfully completed in order to serve the population and, in the case of the Brumadinho operation, this model presented itself as a way to minimise the suffering caused by the burden exerted on these professionals and the adversities of the environment to which they were exposed.

This result is in agreement with Breda and Drumond (2020), as they concluded that the collective defensive strategy of facing the work as a mission, focusing on meeting the needs of the population, demonstrated its character of minimising the suffering generated by the load demanded of these professionals^[27]. For the authors, transforming the work into a mission is interpreted as a way for the firefighter to do what was proposed without questioning, taking away the place of desire in the decision-making process aiming at the conclusion of the task.

The same result also dialogues with the findings of Oliveira’s (2019) thesis on the work of firefighters in the disaster caused by SAMARCO S.A. in the municipality of Mariana in 2015, where the author highlights commitment to the mission and pride in being part of the organisation as key points in building trust and meaning of work. It was also noted an expressed willingness of the firefighters to exert considerable effort on behalf of the organisation and its values, due to a strong belief in and acceptance of the institution’s goals^[43].

It is important to emphasise the several risks present in the organisation of work and, in the case of the operation in Brumadinho, however, this model appeared in a way to alleviate the damage of these risks to the health of these

workers. The full awareness of the risk involved in their work, which often involves acts of heroism and bravery, was an important factor for the recognition of these workers. These findings are in line with the findings of other studies ^[43, 44].

The firefighters stated that the experience of working in the Brumadinho operation made them feel more confident in performing their tasks and more prepared to act in disaster scenarios.

Finally, it is important to highlight this hero figure carried by these workers that, no matter how much recognition and pleasure it may provide, it is clear all the suffering behind all the work performed, and there is a risk of these sufferings being made invisible by an ideal of hero that does not weaken. Facing this risk of being invisibilized, labor clinics are an important tool to bring light to the experiences of these workers and further promote health care policies for firefighters.

5. Conclusions

The dam collapse had great national repercussions and was reported by major national and international media outlets, highlighting the work done, especially that done by the firefighters who worked directly in the rescue and search for victims. Working in this event produced a feeling of pride in all the firefighters interviewed, with great recognition, engagement and commitment to the corporation.

Working in a catastrophic event always permeated with uncertainty made the firefighters reaffirm the value of their activity, when they concluded that they were the only ones who could do it. Along with this, the motivation to find the victims valued the meaning in work, which tended to strengthen resilience to the psychosocial risks of exposure to this scenario.

The more than twelve hours of work per day, with only three to five hours available for sleep, contributed to the fact that sleep remained unregulated for some time after their duties. The diet and the lack of time to exercise (related to the risk of musculoskeletal problems) were also signalled by the firefighters as poor conditions to work and their health.

This exhausting work promoted greater physical and mental wear on operational firefighters. Standing for long periods in the mud was the greatest cause of musculoskeletal problems, while those who had to crawl had greater anxiety about the toxicity of the mud. The continuous hours of work in direct sunlight also presented physical and psychosocial risks to these workers.

As for the firefighters who worked in the administrative area, the emotional stress was due to the pressure to develop strategies and deal with the morale of the troop. The

operation presented different phases that always demanded new strategies to search for victims, and these different phases influenced the morale of the troop. Thus, the firefighter who occupied this leadership position needed to mobilise his subjectivities to deal with different individuals who presented different issues and ways of thinking about the situation.

These risks to the health of the firefighters also varied between the different phases of the operation, but showed greater intensity in the firefighters who were exposed to the first moments of the disaster.

A strong working collective was identified between the firefighters and the different sectors that enabled the effectiveness of the operation and a greater support network for the risks of the job. The defensive strategies of seeing the work as a mission; observing the emotions of colleagues at work; learning how each one of them dealt with situations; and talking about the experience of working in the operation, evidenced good instruments that the firefighters used to better deal with the suffering arising from the risks present at work.

The organisation of the work evidenced mechanisms that encouraged freedom and confidence in the firefighters' work, allowing a free process of renormalization in a work environment full of unpredictable risks. All the firefighters stated that working in the operation made them feel more confident and better prepared to act in other disaster occurrences.

Based on this work, we believe that the topic of disasters and the health of firefighters in these scenarios is still in the process of consolidation. Therefore, there is a need to produce research focused on the health of these workers and to use it in order to increasingly improve public policies and better develop disaster response activity, especially when faced with the scenarios pointed out in relation to climate change. However, for public policies to be truly effective, it is necessary to overcome the centralizing approach and empower local agencies, making them active agents of disaster risk reduction.

Thus, we believe that the greatest contribution that this research has offered is in encouraging reflection on the issue of disasters and the performance and health of workers in these scenarios, in order to guide the planning and implementation of public policies, performance and risk manuals, emphasising the reflection capacity and experience of the firefighters themselves.

Conflict of Interest

We confirm that neither the manuscript or any significant part of it is under consideration for publication elsewhere or has appeared elsewhere in a form that could be

interpreted as predating or duplicating the same work.

Funding

This research received no external funding

References

- [1] United Nations Office for Disaster Risk Reduction (UNDRR), 2019. Human cost of disasters: An overview of the last 20 years 2000-2019. United Nations: New York. pp. 30.
- [2] Ragazzi, L., Murilo, R., 2019. Brumadinho: a engenharia de um crime (Portuguese) [Brumadinho: The engineering of a crime]. Belo Horizonte: Letramento. pp.256.
- [3] National Water and Basic Sanitation Agency, 2022. Dam Safety Report 2021 [Internet]. Ministry of Regional Development [Accessed 2022 Sep 22]. Available from: <https://www.snisb.gov.br/relatorio-anual-de-seguranca-de-barragem/2021>.
- [4] Brazilian Sleep Association, 2019. Sleep of Heroes: Brumadinho Case Highlights Sleep Deprivation of Firefighters [Internet]. SONO. 17 [Accessed Dec 30]. Available from: <https://absono.com.br/wp-content/uploads/2021/02/revista-sono-edicao-17-2019.pdf>.
- [5] Oliveira, M., Oliveira, S., 2020. The human face of the hero: Analysis of the health-disease process of firefighters from virtual communities. *Interface: Communication, Health, Education*. 24, 1414-3281. DOI: <https://doi.org/10.1590/Interface.190252>
- [6] Minayo-Gomez, C., Thedim-Costa, S., 1997. The construction of the field of worker's health: Paths and dilemmas. *Rio de Janeiro*. 13, 21-32.
- [7] Laurell, A., Noriega, M., 1989. Processo de produção e saúde : trabalho e desgaste operário (Portuguese) [Production process and health: Work and worker fatigue]. São Paulo: Hucitec. pp. 99-144.
- [8] Bendasolli, P., Soboll, L., 2011. Clínicas do trabalho: novas perspectivas para compreensão do trabalho na atualidade (Portuguese) [Work clinics: new perspectives for understanding work today]. São Paulo: Artesã. 2, 304.
- [9] Schwartz, Y., 2000. The ergological paradigm or a philosopher's profession. Octarès Éditions: France.
- [10] Schwartz, Y., Durrive, L., 2021. Trabalho e Ergologia: conversas sobre a atividade humana (Portuguese) [Work & ergology: Conversations about human activity]. Rio de Janeiro, Eduff. 3, 378.
- [11] Douraffourg, J., 2021. O trabalho e o ponto de vista da atividade (Portuguese) [Work and activity point of view]. In: Schwartz, Y., Durrive, L., 2021. Trabalho e Ergologia: conversas sobre a atividade humana (Portuguese) [Work & ergology: conversations about human activity]. Rio de Janeiro, Eduff. 3, 378.
- [12] Canguilhem, G., 2009. The normal and the pathological. Princeton University Press :New Jersey.
- [13] Dejours, C., 2004. Subjetividade, trabalho e ação (Portuguese) [Subjectivity, work and action]. *Prod*. 14(3). DOI: <https://doi.org/10.1590/S0103-65132004000300004>
- [14] Dejours, C., 1999. Conferências brasileiras: identidade, reconhecimento e transgressão no trabalho (Portuguese) [Brazilian conferences: identity, recognition and transgression at work]. São Paulo, Fundap.
- [15] Bardin, L., 2016. Análise de conteúdo (Portuguese) [Content analysis]. São Paulo.
- [16] Minayo, M., 2010. O desafio do conhecimento: pesquisa qualitativa em saúde (Portuguese) [The challenge of knowledge: qualitative health Research]. São Paulo, Hucitec.
- [17] Carvalho-Freitas, M., Bentivi, D., Ribeiro, E., et al., 2022. Psicologia organizacional e do trabalho: perspectivas teórico-práticas (Portuguese) [Organisational and Work Psychology: Theoretical and Practical Perspectives]. *Vetor*.
- [18] Guimarães, L., Freire, H., 2004. Sobre o estresse ocupacional e suas repercussões na saúde (Portuguese) [On occupational stress and its repercussions on health]. In: Guimarães, L., Grubits, S., 2004. Série saúde mental e trabalho (Portuguese) [On occupational stress and its repercussions on health]. São Paulo, Casa do Psicólogo. 2.
- [19] Santos, L., Ascari, T., Sá, C., Ascari, R., 2018. Qualidade de vida de bombeiros militares atuantes nos serviços operacional e administrativo (Portuguese) [Quality of life of military firefighters working in operational and administrative services]. *Revista de Enfermagem da UFSM*. 8 (4), 674-687. DOI: <https://doi.org/10.5902/2179769230564>
- [20] Lima, E., Assunção, A., Barreto, S., 2015. Transtorno de estresse pós-traumático (TEPT) em bombeiros de Belo Horizonte, Brasil: prevalência e fatores ocupacionais associados (Portuguese) [Posttraumatic stress disorder (PTSD) in firefighters from Belo Horizonte, Brazil: prevalence and associated occupational factors]. *Brasília*. DOI: <https://doi.org/10.1590/0102-37722015022234279288> DOI: <https://doi.org/10.6084/m9.figshare.11609556>
- [21] Monteiro, J., Maus, D., Machado, F., et al., 2007. Firefighters: A look at quality of life at work. *Psicol. Cienc. Prof*. 27(3), 554-565.
- [22] Souza, K., Azevedo, C., Oliveira, S., 2017. The dy-

- namics of recognition: Strategies of the military firefighters of Rio de Janeiro State. *Rio de Janeiro*. 41, 130-139.
- [23] Franco, M., 2010. Shaken minds: Daily exposure to disasters amplifies feelings of stress and distress, making emergency workers ill. *Rio Grande do Sul*. 23, 24-32.
- [24] Webber, M., Lee, R., Gustave, J., et al., 2011. Prevalence and incidence of high risk for obstructive sleep apnea in World Trade Center-exposed rescue/recovery workers. *Sleep Breath*. 15(3), 283-294.
- [25] Dirkzwager, A., Yzermans, C., Kessels, F., 2004. Psychological, musculoskeletal, and respiratory problems and sickness absence before and after involvement in a disaster: A longitudinal study among rescue workers. *Journal of Occupational and Environmental Medicine*. 61(10), 870-872.
- [26] Morren, M., 2005. The health of volunteer firefighters three years after a technological disaster. *Journal of Occupational Health*. 47(6), 523-532.
- [27] Morren, M., 2007. The influence of a disaster on the health of rescue workers: A longitudinal study. *CMAJ*. 176(9), 1279-1283.
- [28] Dejours, C., 1992. The madness of work: Labour psychopathology study. *Revista Psicologia e Saúde em Debate*. 8(2).
- [29] De la hoz, R., Shohet, M., Chasan, R., et al., 2008. Occupational toxicant inhalation injury: The World Trade Center (WTC) experience. *International Archives of Occupational & Environmental Health*. 81(4), 479-485.
- [30] Huizink, A., Slotje, P., Witteveen, A., et al., 2006. Long term health complaints following the Amsterdam air disaster in police officers and fire-fighters. *Journal of Occupational and Environmental Medicine*. 63(10), 657-662.
- [31] Rocha, M., Moraes, L., Almeida, L., et al., 2016. Impact of the dam failure in Mariana—MG on the health of the riverside population of the city of Colatina—ES. *Revista Eletrônica Tempus*. 10(3). DOI: <https://doi.org/10.18569/tempus.v10i3.1902>
- [32] Banauch, G., Dhala, A., Alleyne, D., et al., 2005. Bronchial hyperreactivity and other inhalation lung injuries in rescue/recovery workers after the World Trade Center collapse. *Crit Care Med*. 33(1), S102-106. DOI: <https://doi.org/10.1097/01.ccm.0000151138.10586.3a>
- [33] Cohen, H., Zeig-Owens, R., Joe, C., et al., 2019. Long-term cardiovascular disease risk among firefighters after the World Trade Center disaster. *JAMA Network Open*. 2(9).
- [34] Kwon, S., Crowley, G., Mikhail, M., et al., 2019. Metabolic syndrome biomarkers of World Trade Center airway hyperreactivity: A 16-year prospective cohort study. *Int. J. Environ. Res. Public Health*. 47(6), 523-532. DOI: [doi:10.3390/ijerph16091486](https://doi.org/10.3390/ijerph16091486)
- [35] Webber, M., Glaser, M., Weakley, J., et al., 2011. Physician-diagnosed respiratory conditions and mental health symptoms 7-9 years following the World Trade Center disaster. *American Journal of Industrial Medicine*. 54(9), 661-671.
- [36] Gonzáles, R., Beck, C., Donaduzzi, J., et al., 2006. O estado de alerta: um exploratório com o corpo de bombeiros (Portuguese) [The state of alert: an exploratory with the fire department]. *Rio de Janeiro, Esc Anna Nery R Enferm*. 370-377. DOI: <https://doi.org/10.1590/S1414-81452006000300003>
- [37] Souza, K., Velloso, M., Oliveira, S., 2012. A profissão de bombeiro militar e a análise da atividade para compreensão da relação trabalho-saúde: revisão da literatura (Portuguese) [The military firefighter profession and activity analysis for understanding the work-health relationship: A literature review]. *Acidentes, Doenças e Adoecimentos Relacionados ao Trabalho*. 2. Available from: http://www.proceedings.scielo.br/scielo.php?pid=M-SC0000000112012000100021&script=sci_arttext.
- [38] Dejours, C., 2011. Work psychopathology—work psychodynamics. *Laboreal*. 7(1).
- [39] Brito, J., 2008. The real work. *Rio de Janeiro*. 2, 440-445.
- [40] Ruiz, S., Araújo, A., 2012. Health and safety and subjectivity at work: The psychosocial risks. *São Paulo*. 37, 170-180.
- [41] LaPorte, T., Consolini, P., 1991. Working in practice but not in theory: Theoretical challenges of “high-reliability organisations”. *Journal of Public Administration Research and Theory: J-PART*. 1(1), 19-48. DOI: <https://doi.org/10.1093/oxfordjournals.jpart.a037070>
- [42] Weick, K., Sutcliffe, K., 2007. *Managing the unexpected: Resilient performance in an age of uncertainty*. GetAbstract: Luzern, Switzerland.
- [43] Oliveira, L., 2019. *The construction of trust in the face of destructions caused by an extreme event: A study on the response of the military fire department of Minas Gerais in the SAMARCO S.A. disaster* [PhD thesis]. Getulio Vargas: Getulio Vargas Foundation, São Paulo School of Business Administration.
- [44] Lee, S., Olshfski, D., 2002. Employee commitment and firefighters: It’s my job. *Public Administration Review*. 62(s1), 108-114. DOI: <https://doi.org/10.1111/1540-6210.62.s1.19>