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Systemic relations among the variables involved in occupational accidents of the nursing team in a psychiatric hospital

Ruan Eduardo Carneiro Lucas [a,b,*], Carmen Elena Martinez Riascos [a], Diego Luiz de Mattos [c], Rafael Ariente Neto [a], Paula Machado de Sousa Carneiro [c], Giselle Schmidt Alves Díaz Merino [a,d], Eugenio Andrés Díaz Merino [a]

[a] Production Engineering Department, Federal University of Santa Catarina (UFSC), Campus Universitário Trindade, 88040-970 Florianópolis, SC, Brazil
[b] Production Engineering Department, Federal University of Rural da Amazônia, Campus Parauapebas, 68515-000 Parauapebas, PA, Brazil
[c] ALGORITMI Research Centre, School of Engineering, University of Minho, 4800-058 Guimarães, Portugal
[d] Desing Department, State University of Santa Catarina, Campus Florianópolis, 88035-901 Florianópolis, SC, Brazil

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ABSTRACT

Background: The occupational activities carried out in hospital environments pose occupational risks to professionals. In psychiatric hospitals, due to the characteristics of the patients treated, professionals are also subjected to other risks, such as physical aggression.
Objective: This research aimed to identify the systemic context, highlighting the cause-and-effect relationships that culminate in occupational accidents that occurred with the nursing staff in a psychiatric hospital in Brazil.
Methods: The current study is an applied research and was divided into three stages. First, the collection of data related to the case study was made and accidents were analyzed and occupational hazards were identified. In the second stage, from the collected information, occupational safety indicators were defined. Lastly, in the third stage, the qualitative aspect of System Dynamics was applied to perform the systemic analysis and to identify how the different variables were related.
Results: The results showed that physical aggression was the main cause of accidents. Regarding safety indicators, while both the level of use of Personal Protective Equipment (PPE) by professionals and the high level of PPE protection were positive aspects, the level of training of professionals to use PPE was a negative aspect. The Causal Link Diagram (CLD) showed that the perception of risk influenced the level of use of PPE and those organizational measures influenced the accident rate.
Conclusion: In conclusion, the systemic analysis of the system dynamics can optimize the diagnostic process of occupational accidents in psychiatric hospitals, and especially help to identify the cause and effect among the variables involved.

Introduction

The International Labor Organization (ILO) estimates that every year about 374 million workers are victims of non-fatal accidents at work and 2.78 million people die due to occupational accidents or diseases (2.4 million of them due to illnesses, and 378,000 due to accidents) in the world (ILO, 2020).

In Brazil, 4,503,631 accidents were reported at the National Institute of Social Security between 2012 and 2018, according to the Occupational Safety and Health Observatory (OSHO, 2020). Among these, 1,709,905 resulted in sick leave, 1,099,846 of which due to accidents, 581,870 due to illnesses, and 10,323 due to other causes. Likewise, around 16,455 accidents with fatal victims were registered in the same period, which demonstrates that the situation in the country demands attention.

The Occupational Health and Safety Observatory also identified that hospital care activities had about 378,305 notifications of occupational accidents in the INSS between the years 2012 and 2018, thus becoming the first placed in this category among all labor segments (OSHO, 2020). Among these activities is the role of nursing technicians. This

* Corresponding author at: Production Engineering Department, Federal University of Santa Catarina (UFSC), Campus Universitário Trindade, 88040-970 Florianópolis, SC, Brazil.
E-mail addresses: ruaneduardo94@gmail.com, ruan.eduardo@ufra.edu.br (R.E.C. Lucas).

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professional has direct contact with patients during most of the work period and, among the occupations in different sectors, was the second with the highest number of notifications, accumulating 174,253 cases. Regarding nurses, the records indicated 37,868 notifications.

Regarding psychiatric hospitals, the activities performed by nursing teams have peculiar characteristics (for example, a different type of patient), which expose professionals to different occupational risks (Basfr, Hamdan, & Al-Habib, 2019). Aggressive patient behavior and accidents involving aggression, for example, are common (d'Ettorre & Pellicani, 2017; Kibunja, Musembi, Kimani, & Gatimu, 2021). However, there is under reporting in relation to this aspect due to the fear of nursing professionals by having their competence questioned or being identified as the cause of the disorder, which leads them to avoid reporting these accidents (Alhassan & Poku, 2018).

When analyzing the scientific literature, it is observed that occupational accidents present multi-causality as a characteristic, as they usually reflect failures in a system that is composed of the interaction between factors inherent to individuals, work, and organizational context (Khanzode, Maiti, & Ray, 2012). These multiple causes, according to Shin, Lee, Park, Moon, and Han (2014), originate from unsafe acts, unsafe conditions or, in large part, from the combination of these two elements.

In the context of hospital environments, it can be observed that occupational accidents and health and safety problems do not happen exclusively due to the specifications of the tasks performed by the nursing staff, but due to a series of variables that may be interconnected, such as: accidents with materials (e.g.: sharps, improper disposal) (dos Santos, Vilela, Cardoso, de Andrade, & Maeda, 2017); organizational agents (e.g.: planning, working process) (dos Santos et al., 2017); cultural factors (Myers, Schoenfisch, & Lipscomb, 2012); and ergonomic factors (Camino López, Fontaneda, & González Alcántara, 2021; Engkvist, 2004).

Thus, due to the multiple causative factors, which are established by the cause-and-effect relationships among different variables, occupational accidents are understood as the result of complex relationships in a dynamic system. Systemic modeling methods have already been used in other sectors to investigate causal relationships in work accident events in complex systems, as, for example, in the works developed by Woodcock, Drury, Smiley, and Ma (2005) and Shin et al. (2014). Among these modeling methods is the System Dynamics (SD), which seeks to understand the relationships that exist among the system elements and simulate their behavior within a time horizon (Mattos, Ariente Neto, Merino, & Forcellini, 2019; Sterman, 2000).

Given the above context, the central problem of this research is the peculiarities of the activities carried out by the nursing teams in a Brazilian psychiatric hospital, and with the existence of multiple causes in a complex context, which can lead to limited interpretations of causal relationships, making it difficult to define actions that would aim to reduce accidents and illnesses in such teams. Thus, the aim of this study is to identify the systemic context, highlighting the cause-and-effect relationships culminating in occupational accidents occurred with the nursing staff in a psychiatric hospital in Brazil.

This work is important due to the current need to understand occupational accidents as a complex system, as they have multiple causative variables, which requires the use of systemic analysis (Jiang, Fang, & Zhang, 2014; Mohammadfam, Ghasemi, Kalatpour, & Moghimbeigi, 2017). To develop it, System Dynamics (SD) was used, consisting in an approach already used in other studies (Jiang et al., 2014; Shin et al., 2014), who analyzed work accidents in civil construction. However, no scientific evidence of the application of this approach to investigations carried out in psychiatric hospitals was identified. The present study was limited to: the nursing team of a psychiatric hospital located in southern Brazil; the sample was limited to the nursing team professionals; and the use of the Causal Link Diagram (CLD), which is the quantitative aspect of SD.

This topic is important, as it shows how health professionals are exposed to occupational risks and, mainly, to work accidents. These accidents impact the well-being, health and social life of these professionals. Therefore, the results of this study may be important for the management of occupational risks in psychiatric hospitals.

Methodology

The current study is an applied research and was divided into three stages. First, the collection of data related to the case study was made and accidents were analyzed and occupational hazards were identified. In the second stage, from the collected information, occupational safety indicators were defined. Lastly, in the third stage, the qualitative aspect of System Dynamics was applied to perform the systemic analysis and to identify how the different variables were related. These stages are detailed below.

Stage 1: case study data collection

The research focused the nurse team activities of a psychiatric hospital located in the southern region of Brazil. The sector chosen for analysis was intended for patients with severe mental disorders and the nursing team was composed of professionals with technical and higher education. Due to the type of patient, it was a sector susceptible to accidents.

To understand the situation, 10 visits were made. These observational analyses were performed to provide researchers with consistent knowledge of working conditions. In parallel, important information was also obtained for the development of this study, which will be presented below.

To analyze the multiple causes of occupational accidents an analysis of the records of accidents occurred between the years 2011 and 2018 was carried out. The document used for analysis was the Notice of Work Accident (NWA). The extracted information (profession and causative agent) was tabulated and stored in Microsoft Excel Software.

Unstructured interviews were also carried out with the nursing manager, and with the President of the Internal Accident Prevention Commission (IAPC), with the aim of obtaining more information about work accidents and occupational risks. To facilitate understanding, the information collected was divided into three groups.

The first refers to general organizational factors and encompassed: identification of activities that had the Standard Operating Procedure (SOP), including existing risks and necessary equipment; activities that had the SOP being updated or structuring process; and activities that only had the described SOP, without identifying the existing risks and necessary equipment.

The second refers to Personal Protective Equipment (PPE) and covered: days in which risky activities were carried out without the use of PPE; occupational diseases in which the use of PPE did not minimize its incidence; accidents in which the use of PPE had no effect; occupational hazards of each activity that had specified PPE; level of training to use PPE; availability of resources to purchase PPE; available stock of each PPE; quality of PPE storage; and quantity of professional trained to verify the use of PPE.

The third group refers to individual factors and encompassed: employees who used PPE during their occupational activities; employees who used PPE properly; employees who participated in training about the use of PPE but used it wrongly; and employees who did not participate in the use of PPE training due to the absence of substitutes in their workplace.

To support the data collection, an online exploratory questionnaire was developed and applied, using Google Forms. The questionnaire allows to identify the sociodemographic characteristics of the nursing staff and to know their occupational risk perception. The questions applied are presented in Table 1.

Ethical approval was obtained from the Human Research Ethics Committee of the Federal University of Santa Catarina (n° 2.595.066).

Table 1
Proposed questions.

Questionnaire section	Question
Section 1	What is your email address?
Section 2	Do you agree with the Free and Informed Consent Form (FICF)?
Section 3	What is your gender?
	How old are you?
	What is your weight?
	What is your height?
	Are you a practitioner of physical activities?
	Are you smoker?
	Do you have a chronic or degenerative disease? Which?
	What is your marital status?
	Do you have children?
Section 4	What is your work schedule?
	What is your education level?
	What is your assignment?
	What is your professional time?
	Working time at psychiatric hospital?
	Describe your activities throughout the working day?
	Do you take breaks during your workday?
	Is there an appropriate place to rest?
Section 5	Indicate the physical hazards you believe you are exposed to.
	Indicate the chemical hazards you believe you are exposed to.
	Indicate the biological hazards you believe you are exposed to.
	Indicate the ergonomic hazards you believe you are exposed to.
	Indicate the risks of accidents you believe you are exposed to.

Stage 2: occupational safety indicators

To facilitate the understanding of the safety conditions, indicators were constructed, with the participation of the IAPC President, and the nurse team chief. For this, the MCDA-C methodology was applied, which involves, in a participative way, the people responsible for decision making in complex, conflicting and uncertain contexts (Ensslin, 2000). Decision making is systematized in three phases: structuring the problem; appraisal; and recommendations (Ensslin, 2000).

The development of the MCDA-C structuring phase basically consists of three steps: organizational context (the soft approach to structuring); construction of a family of Fundamental Points of View (FPVs); and the construction of indicators (descriptors with ordinal scales for measurement).

The structuring phase begins with a meeting to identify the actors, with them proceeding to the definition of the Primary Assessment Elements (PAEs). These PAEs make it possible to establish action-oriented concepts, defining the preferred or desired direction. Likewise, indicating a psychological opposite (minimum acceptable result) (Marafon, Ensslin, de Oliveira Lacerda, & Ensslin, 2015). These elements are grouped by areas of strategic concern or interest (represented in cognitive maps). Then, the Strategic Objectives linked to each of these Concepts were identified.

For each one, the ordinal scale was defined, which allowed the measurement of the level of compliance, and two reference levels were defined, dividing the scale into three possible performance levels: compromising, market, and excellence. The generated indicators were tabulated and stored using Microsoft Excel Software.

Stage 3: System Dynamics

System Dynamics (SD) seeks to understand the relationships that exist among the system elements and simulate their behavior within a temporal universe. These elements interact with each other through feedback loops or cycles, in which the change in a variable affects other variables, including the variable that originates the action in the cycle (Coyle, 1996; Sterman, 2000).

These feedback cycles, also called links or loops, cause the system to grow, decrease, oscillate, or remain in equilibrium (Coyle, 1996; Sterman, 2000). Influence in the system can happen through reinforcement mechanisms (R), in which the result of relationships amplifies the state; and/or through balancing mechanisms (B), in which the result of the relationships does not change the state.

DS is divided into three phases (Coyle, 1996; Sterman, 2000), which are: (a) Conceptual Definition: seeks to describe the system from a conceptual qualitative model. Also called Causal Link Diagram (CLD), it uses arrows and lines to detail the relationships among variables; (b) Structural Description: it uses mathematical modeling to develop the Stock and Flow Diagram (SFD), which includes all the necessary variables to numerically describe the relationships pointed out in the previous phase; (c) Quantification or prospecting uses the mathematical calculations of the second phase to produce computer simulations. At this stage, it is possible to have a prospect of the system's behavior and, based on that, develop more accurate diagnoses.

The joint analysis of information on (i) multiple causes of accidents obtained from official records (NWA), (ii) identification of occupational risks from on-site observations, structured interviews, and perception of the nursing staff, and (iii) construction of safety indicators, served as support for the development of the Causal Link Diagram (CLD).

This qualitative diagram, developed in the Vensim PLE Software version 8.1.0, indicated how the variables involved in the "work accident" system was related, thus providing a systemic analysis of the object of study. This paper was limited to the CLD, not covering the Flow and Stock Diagram, which is the quantitative aspect of System Dynamics.

Results

The occupational accidents characteristics of the Psychiatric Hospital between 2011 and 2018, the nursing team's perception related to occupational risks, occupational safety indicators and, finally, the Causal Link Diagram (CLD) are presented below.

Panorama of occupational accidents occurring in the psychiatric hospital

A total of 167 accidents was registered between the years 2011 and 2018. In the first place, with the highest number, were the physical aggression events by patients (biting, slapping, punching), 65 cases (n = 39 %). In the second place, mechanical accidents due to falls, 61 cases (n = 36 %). As a result, accidents that happened during the journey in a vehicle, outside the hospital, totaling 18 cases (n = 11 %). Followed by reports of needle stick accidents, in which there is a risk of contagion with pathological agents, 16 events (n = 10 %). The events in fewer

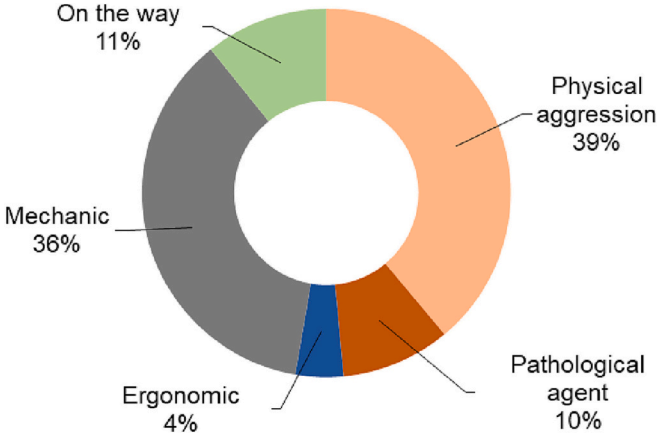

Fig. 1. Type of accidents reported between 2011 and 2018.

number refer to ergonomic accidents, physical overload, or inadequate posture when performing the activity, 7 cases (n = 4 %). Fig. 1 shows the number of accidents, according to their typology.

Perception of occupational hazards

The perception of 14 professionals from the nursing team was analyzed, which represents 56 % of the total number of professionals in the study area (n = 25). The perception of occupational hazards was subdivided into Physical, Chemical, Biological, Ergonomic, and Accident groups, which are presented in Fig. 2 highlighted by the colors blue, gray, green, purple, and orange, respectively.

All professionals (n = 14) who answered the questionnaire realize that in their occupational activities they are exposed to the risk of virus infections, stressful situations, and physical aggression. In addition, 13 of them (92.9 %) indicated that they perceived the presence of smoke and bacteria, and 11 professionals (78.6 %) indicated the presence of protozoa. In turn, 10 of them (71.4 %) consider they are exposed to noise; 8 (57.1 %) exposed to fungi; 7 (50 %) indicated the perception of chemical compounds in general and inadequate physical arrangement during the execution of occupational activities.

Occupational safety indicators

The occupational safety indicators were subdivided into three groups: (i) standard operating procedure (SOP); (ii) organizational measures, and (iii) level of use of personal protective equipment. The indicators of the first group, as shown in Table 2, indicated, for example, that none of the activities had the detailed Standard Operating Procedure and with the occupational risks and the necessary PPE described.

The second group of indicators refer to some organizational measures. Table 3 shows, for example, that: (i) in a period of six months, 80 % of the PPE delivered correctly protects against occupational risks; (ii) 35 % training was carried out for each PPE; (iii) there was 90 % of inventory available for each PPE; (iv) there was no person trained to verify the level of protection of PPE and (iv) only 40 % was verified the comfort level of the PPE.

The indicators in the third group refer to the level of use of PPE. Table 4 shows, for example, that: (i) in a period of one month, 70 % of employees used PPE during their occupational activities; (ii) within a month, 40 % used PPE properly during occupational activities and; (iii) 50 % of workers participated in the training, but used the wrong PPE.

Table 2
SOP indicators.

Indicator	Description	Temporality (months)	Results (%)
SOP described	Occupational activities that have a written Standard Operating Procedure (SOP) including identified risks and PPE	12	0
SOP in update	Standard Operating Procedure in updating process that are including occupational hazards, prevention activities and written PPE	12	10
Activities without SOP	Occupational activities without described Standard Operating Procedure	12	0

Causal link diagram

After knowing the context regarding work-related accidents in the nursing team, which was presented in the previous items, it became possible to identify the causal relationships. For this, Fig. 3 shows how the variables involved in the context of occupational accidents are related.

Thus, six loops were identified. The first (called R1) indicates that the perception of risk by professionals influences the level of attention to perform the task, which influences the level of tension during the daily workday, which influences occupational risks, which finally, it influences the risk perception.

The second loop (called B1) indicates that the professionals' risk perception influences the PPE use level, which influences the number of professionals who use PPE properly, which influences the number of accidents.

The third loop (called B2) indicates that the control of occupational risks influences the exposure to occupational risks, which influence the number of accidents, which influence the efficiency of organizational measures.

The fourth loop (called B3) indicates that the number of physical aggressions influences the risk of accidents, which influences the occupational risks, which influences the number of accidents, which influences the control measures for unexpected patient behavior, which ultimately influences physical aggression.

The fifth loop (called B4) indicates that the unexpected behavior of patients influences the number of aggressions, which influences measures to control unexpected behaviors, which ultimately influence the

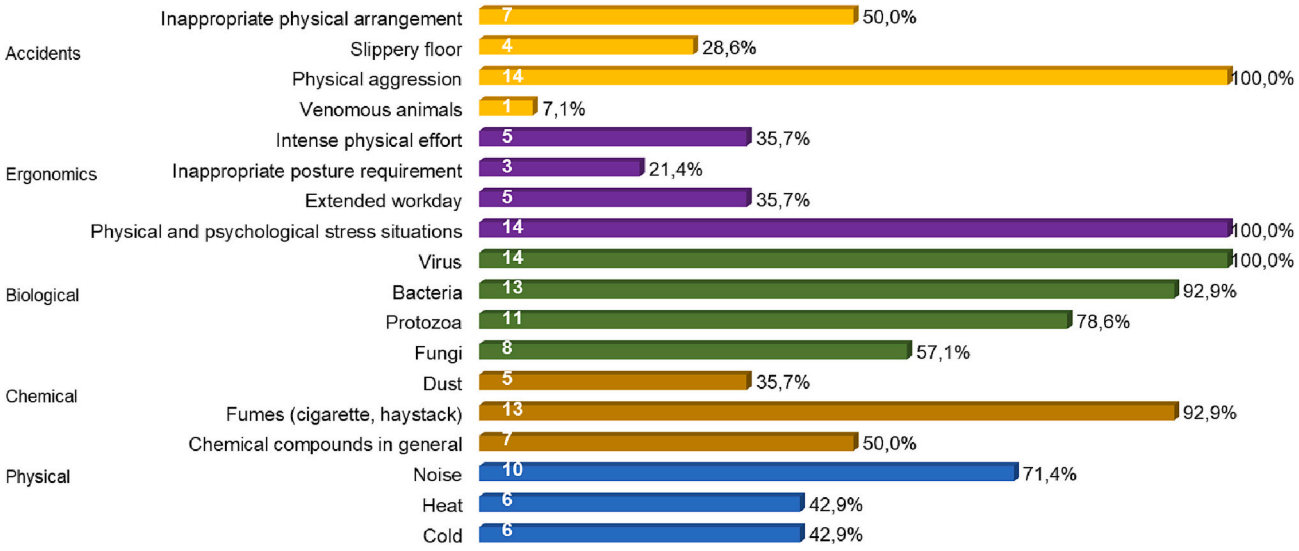

Fig. 2. Risks perception.

Table 3
Organizational indicators.

Indicator	Description	Temporality (months)	Results (%)
PPE delivered	Delivered PPE that correctly protects from the risks of occupational activities	6	80
Training 1	Defined training for each PPE vs required training	6	75
Training 2	Training performed for each PPE as required	6	35
Training 3	Training included in the schedule vs training required for each PPE	6	60
Availability	Availability of resources to buy PPEs	6	75
Stock	Available stock for each PPE	3	90
Storage	Quality of PPE storage (Heat, humidity, ventilation, weight)	1	Adequate
Inspection	Number of people trained to verify the level of protection of PPE materials, according to the risk of the activity	6	0
Technical specification sheet	PPE that has a technical specification sheet to assess effectiveness	6	30
Protocols	Defined protocols to validate PPEs	6	20
Comfort level	Comfort level PPE was checked last semester	6	40
Comfort check	When was the last comfort check in the use of PPE performed?	6	Only when received
PPE search	When the PPE survey is carried out according to occupational activity	6	60

Table 4
Use of PPE indicators.

Indicator	Description	Temporality (months)	Results (%)
Use of PPE	Employees who use PPE during occupational activities	1	70
Proper use of PPE	Employees who properly use PPE during occupational activities	1	40
Training for the use of PPE	Workers who participated in training but misuse PPE	3	50
Lack of training to use PPE	Employees summoned who do not participated in the required training, for each PPE, because they do not have a substitute in the workplace	3	60
Checking the status of the PPE	Times the worker checks the status of the PPE before using it	1	30

unexpected patient's behavior.

Finally, the sixth loop (called B5) indicates that training for the use of PPE has an influence on the level of use, which influences the number of professionals who use them properly, which influences the professionals' perception of risk, which influences the level of professional's attention, which influences the need for control measures, which ultimately influence training for the use of PPE.

Discussion

As mentioned, between 2011 and 2018, 167 occupational accidents were reported in the psychiatric hospital. The greatest number of accidents, 39 % (n = 65), came from physical aggression. This result is in line with other studies (Bilici, Sercan, & Tufan, 2013; Isaak et al., 2017; Kelly, Fenwick, Brekke, & Novaco, 2016; Siao et al., 2010), which found many accidents arising from patient aggression.

Regarding the nursing team, 44 % (n = 11) of the team suffered an accident resulting from physical aggression. This corroborates that these professionals are the most susceptible to this type of accident. Other results are similar, Siao et al. (2010) found that 36.8 % of the nursing team professionals suffered some type of physical aggression. Zeng et al. (2013) found that 82.4 % of nurses in a psychiatric hospital reported exposure to at least one type of violent act in the past 6 months. Kocabiyik, Yildirim, Turgut, Turk, and Ayer (2015), in turn, found that 73 % of health professionals in a psychiatric hospital had already been subjected to this type of occurrence.

Inserted in this context, it is also important to highlight the existence of a possible under reporting of aggressions. Situations that were considered "mild" by professionals, such as minor aggressions or scratches, were not reported to the safety team. This may reflect some factors, for example: fear of punishment; fear of liability for negligence or lack of an official channel to report incidents (Alhassan & Poku, 2018; Niu et al., 2019).

The presented context, which is commonly observed in psychiatric hospitals, creates a favorable scenario for the omission of physical aggression situations (Alhassan & Poku, 2018; Niu et al., 2019). With this, there is now a limitation of information, a fact that is also pointed out in the scientific literature (Iennaco, Dixon, Whittemore, & Bowers, 2013). In this regard, the biggest challenges to understanding acts of physical aggression in psychiatric hospitals include, for example, the lack of available information and the reluctance of victims to report situations (Iennaco et al., 2013). In addition, the lack of organizational support for health professionals in psychiatric hospitals can also be associated with the occurrence of accidents (Basfr et al., 2019).

The definition of safety indicators allowed for a better understanding of the existing context in the psychiatric hospital. Among the positive aspects, the following stand out: (i) in the period of six months, 80 % of the PPE delivered correctly protected against occupational risks, and (ii) in the period of one month, 70 % of the employees used PPE during their occupational activities. On the other hand, the following negative aspects were observed: (i) none of the activities had the detailed standard operating procedure with the existing risks, and PPE described; (ii) on 73 % of the days, in a period of one month, biological risk activities were carried out without the use of PPE; iii) only 35 % of training was carried out for the PPE; (iv) lack of trained person to verify the PPE protection level; and (v) only 40 % of professionals used PPE properly during occupational activities within a month.

These indicators show that there are safety aspects that demand attention in this psychiatric hospital. For this, it is necessary that some organizational measures are adopted, such as, for example, increasing the volume of training or appointing a professional to verify the PPE protection level. These organizational strategies enable risk mitigation and help professionals regarding decisions to be taken in unsafe conditions (Scozzafave, Leal, Soares, & Henriques, 2019; Tziaferi et al., 2011).

Greater organizational involvement with safety policies, especially in psychiatric hospitals, has been highlighted in the literature. Mentioned, for instance, the need for basic measures (e.g., alarms); defined protocols for patient care (e.g., control and containment procedures) and specialized training (e.g., coping strategies and conflict resolution) (Niu et al., 2019).

In addition, control measures must be developed to identify the events that occur in psychiatric hospitals, their characteristics, the necessary interventions and the results and sequel of these situations for patients and workers (Iennaco et al., 2013). This informational management, associated with a shared management method, which inserts professionals in the decision-making process, enables the development of more effective measures (Iennaco et al., 2013; Isaak et al., 2017; Scozzafave et al., 2019).

The context observed in the psychiatric hospital was summarized in the Causal Link Diagram. The development of the qualitative aspect of System Dynamics allowed, among other things, to understand that the perception of risk on the part of professionals influences the PPE use

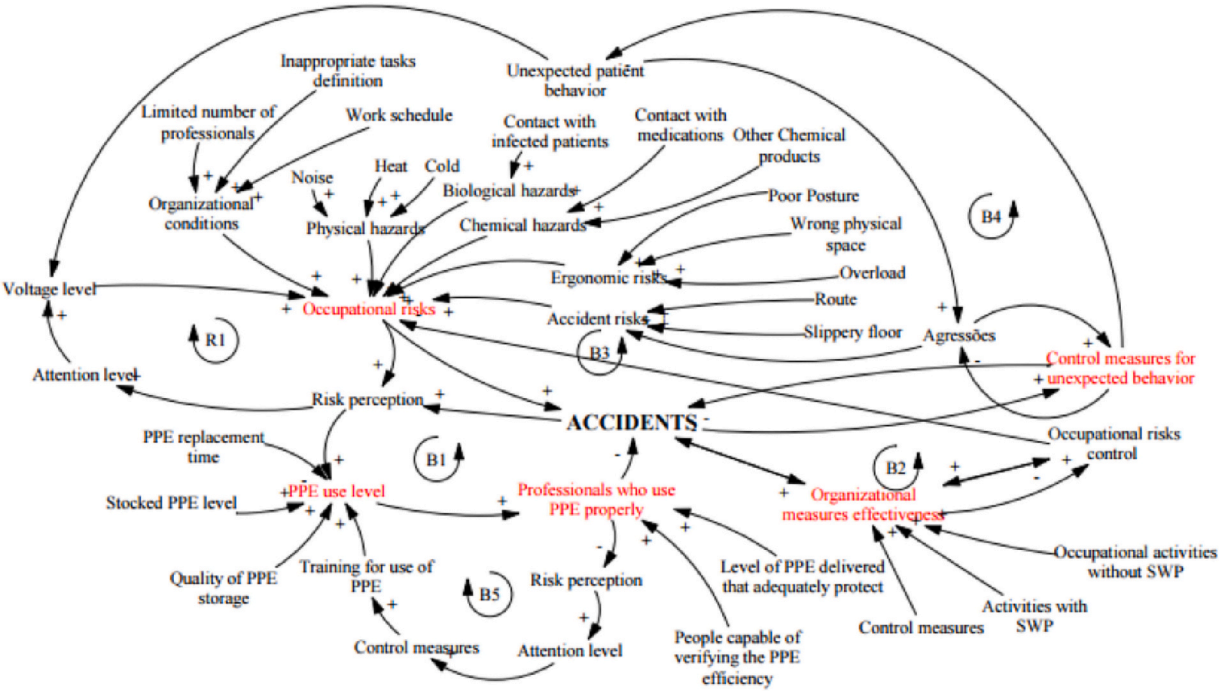

Fig. 3. Causal link diagram.

level, which influences the number of professionals who properly use the PPE, which influences the number of accidents.

This result is also highlighted in the literature, because, as the professional perceives that the activity can compromise their health and well-being, they look for protection mechanisms (Blando, O'Hagan, Casteel, Nocera, & Peek-Asa, 2013). If the activities that can result in a recurrence of physical aggression to professionals, they also externalize a psychological mechanism of self-defense, resulting from the fear of interaction with patients (Kindy, Petersen, & Parkhurst, 2005; Pekurinen et al., 2017).

The qualitative aspect of System Dynamics also allowed us to understand that the control of occupational risks influences the exposure to occupational risks, which influences the number of accidents, which influence the efficiency of organizational measures. This reiterates the importance of preventive organizational policies in psychiatric hospitals, which requires the commitment of managers, minimizing occupational risks, expanding the level of training for the use of PPE, and defining protocols for patient care (for example, control and containment) (Isaak et al., 2017; Niu et al., 2019).

Conclusion

The results showed that the accidents were caused by different factors (for example, sharp objects, accidents on the way or ergonomic problems), however, the main one was physical aggression. However, a network of complex relationships was identified that influences the accident's occurrence and is often difficult to understand due to the various interrelationships of the system elements. Safety indicators showed some positive aspects, such as the PPE use level by professionals and the PPE protection high level. On the other hand, they also indicated that organizational measures are needed, for example, increasing the professional training level to strengthen the proper use of PPE and designating a person in charge to verify the PPE protection level.

About professionals, it was identified that the perception of occupational risk influenced the PPE use level and, indirectly, influenced the number of individuals who correctly used the PPE. Thus, as professionals glimpsed the risks, they used more PPE.

Regarding the organization, it was identified that the effectiveness of organizational measures was associated with the control of occupational risks. Which for this type of environment goes through defined protocols for patient care (for example, control and containment procedures, transportation, and medication), specialized training (e.g., coping strategies, communication skills, conflict resolution and self-defense) and more consistent information management.

From these results, it is suggested that the managers of psychiatric hospitals should keep the nursing staff trained and qualified to deal with patients who have severe mental disorders. Nurses should be aware of control, containment, transport and medication protocols. In addition, they must be trained in coping strategies, self-defense and conflict resolution. These measures can mitigate accidents, which are mostly caused by unexpected patient behaviors.

Thus, given the gap identified by the lack of studies that use systemic analysis to analyze the safety conditions in hospital environments, this work contributes to the scientific literature as it analyzed occupational accidents that occurred in a psychiatric hospital from the Dynamics of Systems, which allowed the identification of cause-and-effect relationships among the variables involved. This form of analysis allowed a more precise understanding of all the factors involved in occupational accidents.

As this work was limited to the qualitative aspect of System Dynamics, the possibility of developing a study with the quantitative aspect of System Dynamics is cited for future work. In this case, using the Flow and Stock Diagram to simulate different scenarios for the number of accidents or absences in a psychiatric hospital.

Declaration of competing interest

The authors declare no competing interest.

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