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OPERATIONS MANAGEMENT AND HEALTH SUPPLY CHAIN IN EMERGENCY: TRAGEDY CASE STUDY IN SANTA MARIA

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ABSTRACT

This study examines of operations and supply chain management of healthcare in light of the factors of management information systems to improve the quality of care in cases of urgency. The methodology used is based on a qualitative and exploratory procedure and interview techniques through case study of fire occurred and what became known as "Tragedy in Santa Maria / RS." The paper proposes a model for the management of operations and supply chain in urgent situations. The model is exemplified in the case of chemical pneumonia (contamination with cyanide gas), and burns.

Keywords: operations and supply chain management of healthcare, health management, emergency management, Tragedy in Santa Maria.

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1. INTRODUCTION

Materials, logistics, human resources, and finance are critical to the activities of attention and excellence in operations and chain - replacing the organization in health. The absence and irregularity of supply have negative impacts on the performance and quality of health services. (INFANTE and SANTOS, 2007). In this sense, it is said that operations management and supply chain health is a service industry, where the patient is part of the production process, because instead of going to a store to buy a finished product the patient seeks help and becomes part of the process until the end of treatment. (ARONSSON, ABRAHAMSSON and SPENS, 2011).

In the management of operations and the supply chain of health, the information systems are not considered as positive, since they need to count on the collaboration of all the health team. Doctors and nurses need to spend time to insert data into the information system, a time that could be used for better treatment and follow-up of patients. In this sense, the information systems used by physicians (substituting electronic medical records for medical records) in consonance with other entities involved in the health care supply chain would help to improve care, standardized and timely information, since there is interconnectivity and the history of each patient, reduction of medical errors and also of costs. (Menachem et al., 2007).

There is a major gap in the management of the supply chain and the supply chain, especially in cases of urgency where the demand for medicines must be supplied immediately and all the time directed to the treatment of patients. Even with more time to dedicate to patients due to the adoption of new technologies, improvements in the health supply chain depend on how the logistics aspects are treated and also on the corporate context. The adoption of a new approach in hospitals through a repositioning of the logistics systems in front of the corporate strategies in the efficiency of the movements in the supply chain allows the formation of strategic alliances between companies. Strategic alliances seek to include suppliers in the management of operations and supply chain of health through the formation of partnerships in business logistics and based on the value and use of a particular medicine and considering its capacity of supply, time and integration between companies. (SHAH, 2008).

2. METHODOLOGY

The present study aims to analyze the management of operations and the supply chain of health in light of the factors of management of information systems for the improvement of quality in cases of emergency care. As methodology is used the qualitative approach and exploratory procedure. in order to increase the knowledge of WHY using the techniques of case study and the interview applied to the fire occurred in a house of events in the city of Santa Maria / RS, known as the "Tragedy in Santa Maria". From the case study we suggest a generic model that covers operations and supply chain management in emergency situations. This model is applied by way of illustration for reception and treatment of patients in cases of chemical pneumonia (contamination by cyanide gas) and burns.

The improvement of operations in a health supply chain for the provision of patient care services occurs when demand is variable and unpredictable and the work is distributed among different organizations in order to standardize operations and medicines used to reduce risks, repetition of operations and consequently the time of patient care, which can be facilitated by the creation of a control model for the management of operations and the supply chain of health. (SHAH et al., 2008).

The bibliographic research provides subsidies for the development of the model in cases of urgent care. In order to collect data, an interview was conducted with professionals from the academic area directly involved in operations management and the health supply chain, at the time of the tragedy. The interview contributes to the applicability of the model, coined by bibliographic research.

3 THEORETICAL REVIEW

Health care is becoming increasingly important in the world. Improvements in the area of health research, as well as the adoption of models for the management of information related to operations management and supply chains need to be prepared by professionals to use new tools aimed at improving quality and decrease in the time of patient care, especially in cases of urgency.

The supply chain defines the integration of the functions of purchase, production, sales and distribution of a certain company in order to reduce inventories. Its management understands the relationships among those involved in order to integrate the main aspects of the business by synchronizing the flow of materials and adding value to the production chain. (BALLOU, 2006).

The pursuit of efficiency in operations management and the supply chain involves suppliers and customers of diverse purchasing power and their improvement must be made in the long term with suppliers and customers. The integration of this productive chain requires logistic interaction and can count on appropriate techniques and tools for the supply chain in each case. (YUKIMITSU, 2009).

Scope in Supply Chain Management must understand certain processes and meet well defined scopes. According to Lambert, García-Dastugue and Croxton (2008), the processes are inter-functional and between the different layers, that is, they depend on a well-prepared team and a coordination between companies including customer and supplier relationship management, customer service management, demand management, order fulfillment, production flow management, product development and marketing and return management. Inter-organizational coordination should ensure good relationships between companies in meeting demand and effectively reconcile existing offerings, including flows of materials to be improved, information and financial aspects. (MENTZER, STANK and ESPER, 2008).

As in Production Engineering, the supply chain related to the health care sector is focused on improving operations management and the health supply chain. One of the most used techniques is the operational research in the search of the optimization of the levels of inventories associated to methods of optimization of the processes of purchase. (VRIES and HUIJSMAN, 2011).

Promises for efficient operations and supply chain management now encompass information systems that dramatically reduce the costs of the health supply chain and improve quality levels in patient care. (VRIES and HUIJSMAN, 2011).

Quality can be understood as the set of strategic and dynamic tools that recognize the continuous changes in the expectations of those involved in the processes. (LEONARD & McADAM, 2003). Its complexity means that each organization needs to develop its own system, taking into account the type of business, product, process and risk involved. Certification models such as ISO, ONA's (National Accreditation Organizations) can be adopted and adapted to the reality of each company.

The application of operations management and health supply chain practices refers not only to physical assets, such as drugs, pharmaceuticals, medical devices and health aids, but also to the flow of patients. (Beier, 1995).

Patient logistics is an emerging field of study because its supply chain encompasses all planning and control decisions based on the needs of patients seeking to adjust supply and

demand along the health care supply chain, the variability and complexity of hospital demand. Service providers should seek to optimize the information, materials and finances involved in procuring and circulating goods and services from the supplier to the end user in order to improve clinical outcomes and control costs. (VRIES and HUIJSMAN, 2011).

The optimization of information systems applied to electronic patient records is a challenge to be overcome. Those involved need to be held accountable for the active participation of operations management and the supply chain in order to integrate the use of technologies along the supply chain of health care. (VRIES and HUIJSMAN, 2011). Ilie et. al. (2009) point out the complexity of the systems in relation to EMRs (Electronic Medical Record), where clinical workflows are directly impacted by the need to use a computer or data insertion technology . The insertion of data and the need for learning of the operator delay the patient care, as the doctor will waste time filling all the data requested by the system. The security of the system adopted is "necessary" to the creation of users and passwords and the periodical exchange of this data for the sake of patient data security may make clinical work difficult, since doctors will need to memorize long passwords, usually alphanumeric passwords that periodically.

It is known that there must be a distinction between patient flows and supply chains related to physical goods and products, since patients need multiple health care necessitating an interdisciplinary approach to the service chain and quality, while the traditional analysis the chain of products used can be made through the industrial approach, ie supported by information technology manage and control the practices of the supply chain. (VRIES and HUIJSMAN, 2011).

In the midst of so many aspects to observe, it is still necessary to deal with medical failures. For Aronsson, Abrahamsson and Spens (2011) the reason for several medical failures may be the lack of internal integration where there are failures in communication and lack of formalization for certain decisions.

Hospitals are increasingly "departmentalized", which highlights the need for operations management and the supply chain, with a view to separating them according to the development of the activities. Designing operations and supply chain management of complex activities such as the provision of emergency products depends on a structure based on existing data up to a certain period. This systematics allows us to organize work in the supply chain in order to meet the demands of a given group of patients faster and less redundantly. Bottlenecks caused by delays, unavailability of time, delayed arrival of patients and incorrect preparations to receive patients are the result of poor discipline and management and can be reduced. (SAHA et al., 2009).

For Aronsson, Abrahamsson and Spens (2011), health care supply chains can be characterized by large waiting periods for the uncertainties of individual functions and the difficulty in predicting the time of certain procedures. The organization of health care management and chains and the lack of adequate records hinder the systemic vision, the adoption of a global strategy and also strategies according to each department, making overall performance difficult due to the difficulties of dealing with procedures highly standardized and with those with great variation in the degree of variability and complexity.

In urgent cases small details may be important. The supply chain in the health area has different levels and their needs may be occasional. It is important for physicians and staff to understand the effects of accessibility to a physician's decision to use electronic medical records (EMR), this should be facilitated by providing sufficient computers and facilitating physician operations to register on the computer every time the use and seeking acceptance of technology.

Another aspect is flexibility in managing operations and supply chain health in search of better utilization of materials and skilled manpower as well as the workflow of nurses and teams

being in line with medical needs. Finally, there is a need, in urgent cases, to seek a network of references that can be complemented by the help of information technologies in partnership with medical teams. (SMITH-DANIELS, 2009).

An example of how to deal with uncertainties is envisioned by Aronsson, Abrahamsson and Spens (2011) and comprises the preparation of the operating room to another area where patients are prepared by a specialized team in advance. The operations and supply chain management, previously integrated, are now divided and this systematics (specialized team and preparation of the packeties in advance) can be used both for urgent cases and simple consultations, both using the same resource as it is the case of cardiologists who standardized care protocols based on references in the medical literature and provide the same training and preparation for institutions wishing to be a member of the local health care network. The partnership between hospitals allows patients to be treated by specialties. Your data remains with you (via a printed form) so that the next professional to be consulted knows the individual's clinical trajectory and does not repeat any process. (SHAH, et al., 2008). Both the variability and complexity of operations management and the supply chain as well as the availability of beds and specialists could improve patient care in many cases in history.

4 CASE STUDY OF THE TRAGEDY IN SANTA MARIA

The tragedy in Santa Maria, which occurred at an events house on January 27, 2013, caused two hundred and forty-two fatalities and left about 120 injured. (ILHA, 2013). Of these, about 90% were mechanically asphyxiated. For survivors there is a risk of chemical pneumonia due to exposure to cyanide gas from dense smoke formed by toxic gases from the foam used in sound insulation. (G1, 2013)

Cyanide gas, the same used in the Nazi gas chambers, during World War II was the main cause of the death toll. Cyanide gas (which arose from the burning of materials used in the acoustic coating) coupled with the soot produced in the fires and carbon monoxide culminated in the rapid death of people who could not get to the door. (CAPRIGLIONE, 2013)

Cyanide or cyanide gas is present in numerous home and industrial activities. However, its exposure is risky, although the body is able to synthesize and eliminate it through the urine. Depending on the amount, it can cause death, because it hinders the oxygenation of the cells causing respiratory and cardiac arrest. (REMIÃO, 2004).

Smoke when aspirated follows the same path as the air causing the airways to be damaged and the body tries to combat the toxic air. The body releases enzymes and proteins in order to detoxify the body and end up also attacking already damaged lung cells. The excess of enzymes and proteins ends up breaking the wall of the alveoli, responsible for gas exchange, which allows the lung to be flooded by blood. The estimate of a cardiorespiratory arrest is five minutes. (SPAZZINI, 2013).

Amid the chaos of the rescue and the solidarity of people who even died trying to save other people, even after leaving the scene of the fire, there is still a complex situation related to the chain of health care.

It is known that, especially in inner cities, that hospitals are not prepared to receive a large number of fire victims or any tragedy that requires the care of many people. The main reasons are: the lack of skilled people available, the absence of medicines and materials and the variability and complexity of processes and operations that could be integrated by an information system, for example. In the case of the health teams of Santa Maria-RS (firemen, doctors and hospitals), it is known that there was no available antidote (hydroxocobalamin) necessary to treat

cases of intoxication by hydrocyanic gas (which could have a stock preventive measure provided by the Ministry of Health. Such medication arrived days after countries such as the United States. The rapid formation of a specialized team is not fast as they ask for urgent situations.The high amount of patients arriving was not expected, as in the case of Tragedy in Santa Maria.Another aspect is that there was not a fur bank available to treat the most severe cases of burns, which were sent to Porto Alegre - RS (BARROS, 2013).

Regarding operations management, there was no criterion that defined where the ambulances that were going to the hospitals should go, the notices were transmitted from hospital to hospital so that the entire existing car was made available in search of the victims.

The victims' recovery had a first screening in the case of ambulances. Only living people were taken. In cases of victims driven by cars, taxis and vans, a team of people would be required to check vital signs of patients before any action is taken. The absence of a team to receive a large number of patients in cases of emergency caused an overcrowding of the nearest hospital: Astrogildo Hospital of Azevedo that had a small emergency staff. As the people arrived, the staff eventually had to select who would receive the first aid and treatments, since it would not be possible to attend all. People were no longer attended because of the lack of specialized professionals, and many patients were intubated by nurses (a procedure that could only be performed by a doctor), since the doctors on call were busy trying to save more lives. The lack of professionals to care for patients who continued to arrive had the ambulances pick up patients alive to take them to other hospitals: SAMU Hospital (former Santa Casa Hospital), University Hospital, Brigade Hospital and Hospital São Francisco .

As soon as the corridors were released, the military brigade, using one of its animal transport trucks, began to collect the dead taking them to the other bodies removed from the nightclub in the Municipal Sports Center (CDM) - Farrezão, where the recognition of bodies by the relatives of the victims would begin in the afternoon.

In the morning and afternoon of January 27, 2013, the transfer of the most serious patients began, especially the cases involving burns that were preferably taken to the Hospital de Pronto Socorro (HPS) in Porto Alegre - RS by means of aircraft and helicopters (journey estimated at forty minutes). Hospitals in the interior of the state also provided beds, which contributed to the quality of patient care. At this point in time, there were specialist professionals from all over the world to help.

The processes involve individuals, procedures, resources and technology being coordinated activities of different approaches. Operations and supply chain management must meet customer expectations in the development of a product or service through specifications that will guide the expected standard. It is known that controlling all activities can bureaucratize a company, even in the face of the importance of activity records, definition of procedures and norms in order to control and solve problems (OLIVEIRA et al., 2008).

In the face of this and the difficulties imposed by urgent situations, a model has been developed that can be modified according to each emergency situation. Being in the case of Tragedy in Santa Maria used as basis for cases where there is contamination by cyanide gas and burns. The developed model covers operations and supply chain management for the reception and treatment of patients in cases of inhalation of toxic smoke and / or chemical pneumonia (contamination by hydrocyanic gas with symptoms occurring after a certain time in relation to the moment of exposure) and burns.

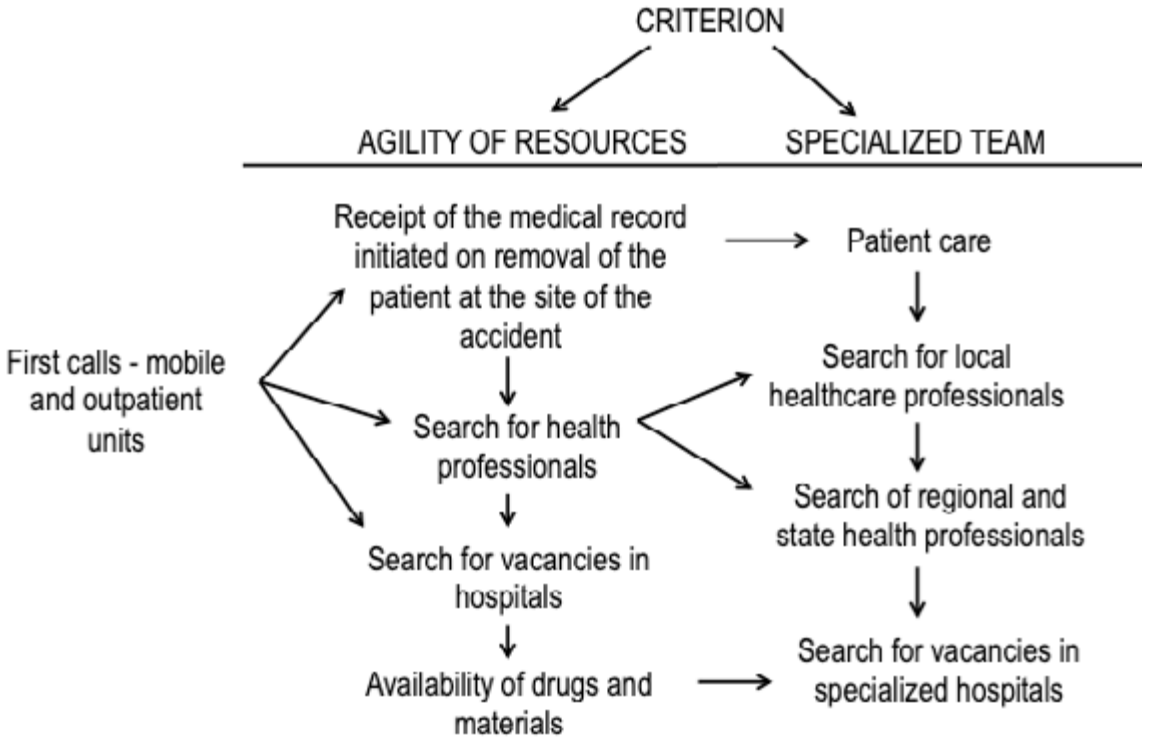

Figure 1: Organization chart came from where? of activities - Model of care in cases of urgency.

The proposed model is generic and meets the criteria: resource agility and specialized teams. The agility of resources presupposes the receipt of medical records that are initiated in the removal of the patient, the search of health professionals, the search for vacancies in hospitals and the availability of medicines and materials to meet the demand. The specialized team includes patient care, the search of health professionals at the local, regional and state level as well as the search for vacancies in specialized hospitals, as shown in Figure 1.

The applicability, in the case of the Tragedy in Santa Maria, is divided in three because? Organizational charts: one that addresses operations and supply chain management in cases where the handling of cases of toxic smoke contamination is performed by the mobile service units, the second that covers cases that are taken directly to hospitals and require care of outpatient work teams (to check vital signs and other initial procedures) and the third that guides the operations in cases of burns.

According to Figure 2, the management of operations and processes can be approached by listing a step-by-step standardized care for patients and the same in all hospitals. In the case of the fire in Santa Maria two cases were verified: burns and cyanide poisoning that can culminate in chemical pneumonia in a few days. When called, the mobile outpatient service verifies the availability of vacancies and requests the preparation for receiving patients by providing information about the course and estimating the number of people who will seek medical care (can be done through information technology or up to even a phone call). This contact should initiate a search for specialized professionals and on-callers to issue alerts to other hospitals in the city and region to prepare their teams for the emergency situation. It is also possible, from this contact, to assist the health teams in the preparation of materials needed to care for victims of chemical smoke intoxication and burns. After removal of live persons from the scene of the incident, patient care should be initiated: verification of vital signs, provision of artificial ventilation or humid oxygen.

Care is taken on arrival at the hospital, where a medical record is delivered to the patient followed with a description of the procedures performed up to then. According to the model, the hospital is responsible for following the process rather than repeat operations already performed by the mobile service unit. Removal of clothing is required to prevent skin contamination and drug treatment is started while checking for upper airway edema (if patient intubation is required), if it should go to observation (receiving oxygen) or even to the operating room.

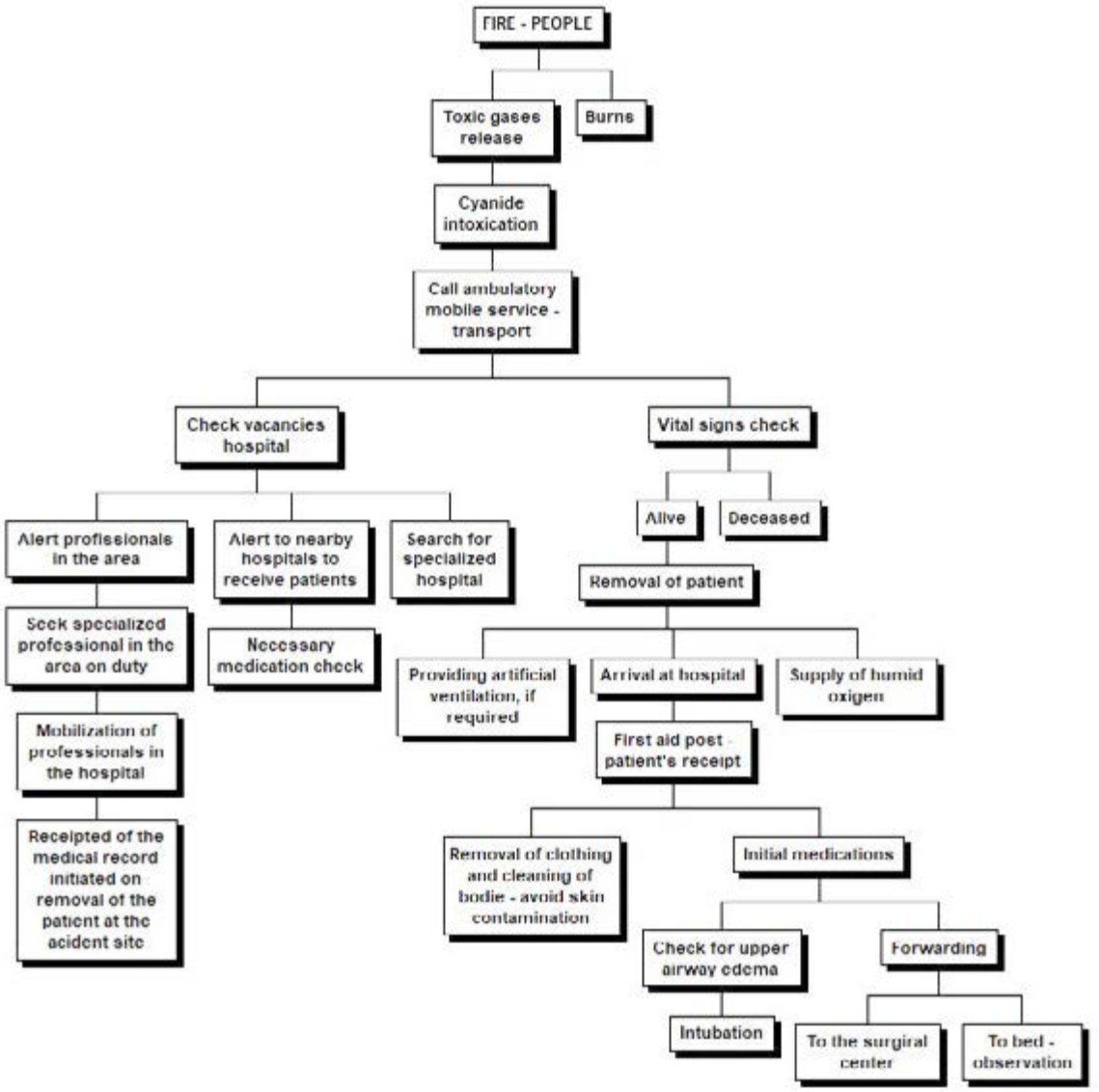

Figure 2: Organization chart of activities - cases attended by the Mobile Assistance Units.

In Figure 2, cases where people were taken to hospitals with the help of cars, taxis and vans and would need the services of a care team for the initial checks the suggestion of an organization chart of operations starts in the ambulatory service (which already knows if there are vacancies or not in the hospital and in case there is not already the ambulance ready for referral), where the patient is received and the vital signs are verified. The procedure is the same beginning with the removal of the clothes to avoid skin contamination, supply of artificial ventilation or humid oxygen as well as the initial medications must be given. Afterwards, there is edema in the upper airways (in which case intubation is necessary) and the referral to the surgical center, if applicable, or bed for observation. As can be seen in Figure 3.

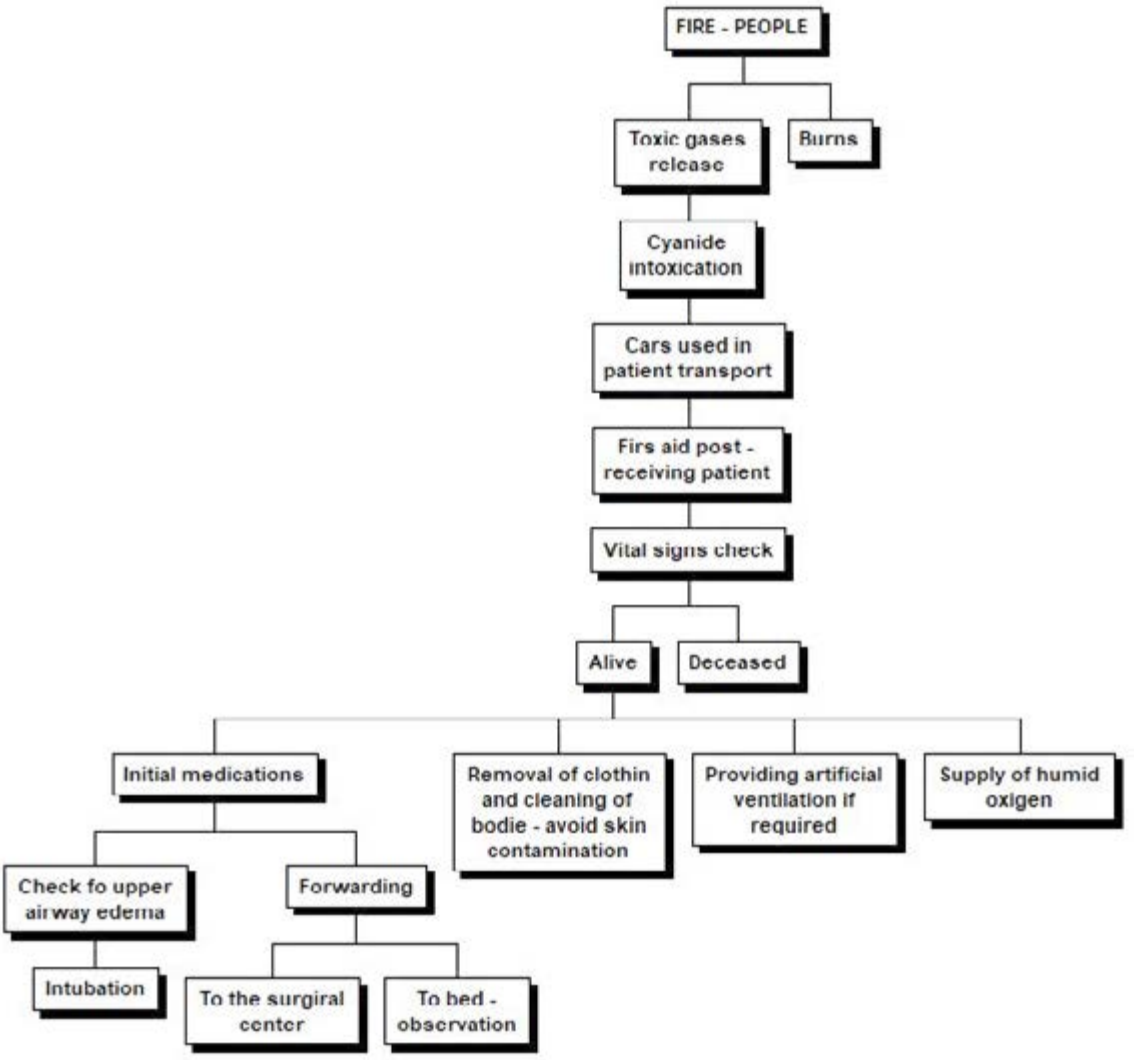

Figure 3: Organization chart of activities - cases taken directly to hospitals (cars, among others).

In cases where burns occur in addition to cyanide gas intoxication, the organization chart of poisoning operations is complied with at the same time as the treatments required for burns are given at the same time, and the search is initiated, in cases where the need is verified by the skin banks, which in the case of Rio Grande do Sul is concentrated in Porto Alegre. Removal of patients is done after this initial treatment with the guarantee of preservation of life so that the trip becomes possible.

The variability and complexity of processes necessitate the creation of a communication channel in favor of better care and the qualification of the health services, so that both the patient goes through the supply chain better and develops, from the records history, a reliable chain capable of efficiently predicting the demand for drugs and materials.

The generic model developed can be deployed to serve in several cases of urgency, where the need for specialized teams and the agility in the provision of resources are the main resources in the care. The basic objective of the generic model (Figure 1) is to provide patient care with quality and agility, avoiding the repetition of procedures through the records in the various care locations and in urgent cases to enable the organization and search of health professionals and supplies.

5. FINAL CONSIDERATIONS

Operations and supply chain management is guided by customer satisfaction, by improving the quality management system by collaborating with production planning and control, improving information systems between sectors that involve people and facilitating management and efficient maintenance of production (OLIVEIRA et al., 2008).

Procedures do not always occur as planned, as there is a great dependence on the context and available knowledge. Therefore, due to the amount of information produced by the records, it is not always easy to make decisions without resorting to the information systems that store and manipulate these data (FONSECA, 2009).

Operations and supply chain management tend to organize the company and facilitate the reduction of failures. Records are important allies to avoid repetition of procedures and errors related to lack of information. However, the use of many records and the formalism imposed by standardized information systems can make processes difficult and overlook the potential of people and the use of their creativity.

Organizations' awareness in the use of a differentiating potential of their employees does not encode their activities in relation to the variability and the complexity of processes, making possible the execution of some manual tasks using simple techniques instead of standardized processes (FONSECA, 2009).

In the case of emergency calls in Santa Maria related to the fire at the event house, especially in cases of fire, where many people needed medical attention, it is essential to develop an operations plan and a system of cooperation between mobile units and hospitals. Many lives could have been saved if there were people available, sufficient beds or a system that would allow checking the availability of beds in the hospitals of the city and surrounding areas and specialized personnel to contact in cases of large-scale tragedies, that is, a emergency for tragedies.

The suggestion of a model for operations and supply chain management in cases of urgency, especially in the care of victims of cyanide gas poisoning and burns, is only one way of integrating the operations of various specialties and forming health services (such as mobile service units) and the hospitals involved.

The applied model is divided in three stages, using the same scope of the generic model that is based on the agility of resources and the specialization of the health teams and applicable in the various emergency situations. It is known that this study has many limitations on the lack of access to official documents. Much information is tied to the media, however, information on operations and supply chain management in hospitals is sensitive information, as many link patient data. In this way, an interview was conducted with a professional in the academic area involved in operations management and the supply chain. It is known, however, that conducting a larger number of interviews would bring greater reliability in relation to the data collected, which becomes an opportunity for future research.

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