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Abstract

Solid waste from health services, the so-called "hospital waste", has high risks to society and the environment. Because of this, it was necessary to create legislation that would indicate a whole treatment, seeking impact resolution without losing the quality of care provided. Thus are in force the CONAMA Resolutions 358/05, RDC ANVISA 222/18 and Law 12.305 / 10 that deal with health service waste management (SSR) steps and their management, defining the conduct of SSR agents to prevent and properly treat waste with potential contamination. This requires that every institution implements these safe-conduct strategies in the handling, storage, transportation, treatment and final disposal of SSR. In this research, the steps proposed by the Health Care Waste Management Plan (PGRSS) were analyzed: (segregation, packaging, identification, internal transport, temporary storage, treatment, external storage, collection and external transportation and final disposal). in a public hospital unit, located in the city of Manaus, by observing and describing the practices performed in the unit, resulting in 8 stages out of 9, which were presented, obtained satisfactory conditions in compliance with the legislation. What needs improvement in order to meet conditions responsive to legislation is local segregation. Another issue observed was related to sustainable responsibility, which hospital unit has. When adopting sustainable practices, there should be interactions of activities and awareness of all entities, which is already observed in this specific hospital unit, with sustainable practices based on certification because it meets the importance of the relationship with the environment, seeking to obtain increasingly satisfactory results, not only to respond to the legislative condition.

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1. Introduction

Since the 1970s there have been events worldwide that aim to discuss human interference with nature, one of these events being held in Rio de Janeiro in 2012, the conference entitled Rio + 20. In addition to discussing the impacts of human actions on the natural environment, alternatives that promote the good use of natural resources in order to mitigate the impacts on the environment were discussed [1].

It is well known that the generation of waste follows the development of the world population, where the concern with the increase of this waste only occurred from the middle of the twentieth century, due to the explosion of the population level and its new consumption habits [2].

As a result of these two factors there was an increase in product consumption resulting in an incorrect disposal of products considered obsolete. The technology has brought several products, such as components and materials of difficult degradation and greater toxicity, making the decomposition process in nature difficult, resulting in more time to dispose of these residues [2].

Solid waste, according to Brazilian Standard NBR 10.004 / 87 [3], is defined as solid and semi-solid waste resulting from origin: industrial, domestic, hospital, commercial, agricultural, service and sweeping.

Among the wastes that most harm the environment, endangering natural resources, people's quality of life and the future of society, are the Solid Waste of Health Services - RSSS [4] as: services related to health care. human or animal health, health analytical laboratories, morgues, funeral homes, embalming activities forensic medicine, drugstore and pharmacies, healthcare teaching and research establishments, zoonosis center, health product distributors , mobile units, acupuncture services, tattooing and the like.

Waste is classified according to the potential risks presented to the environment and public health (Table 1). Thus, these residues are of specific importance and treatment and are managed separately, also taking into account the toxicity of the product.

Table 1- Classification of Solid Waste

	CLASS I	**CLASS II**
	DANGEROUS	**NOT DANGEROUS** A - Not inert B - Inert
DANGEROUS	For a waste to be classified as class I, it must be contained in annexes A or B of NBR 10004 or those that present characteristics: flammability, corrosivity, reactivity, toxicity and pathogenicity.	**Non-inert:** Those that do not fall within the class I - hazardous waste or class II B - inert waste classifications. Class II A - Inert waste may exhibit properties such as biodegradability, combustibility or water solubility. **Inert:** Those that do not have any of their constituents solubilized at concentrations higher than water potability standards, except for appearance, color, turbidity, hardness and taste.

Source: ABNT 10,004 [5]

Thus, as mentioned, solid health waste still has some specific characteristics, where special attention should be given. To this end, every facility that treats and offers health services produces SSRs are subject to dealing with waste management and disposal that have a great chance of harming both the environment and humans.

According to [6], health care has been updated by technological advances and, at the same time, it has increased the number of service providers, reflecting the increase in the production of SSR, ie, due to the increase in the number of healthcare providers. of health care providers solid waste tends to increase further and is yet another causative factor of existing solid health waste.

These wastes are classified according to [7] and [8] into five groups: A, B, C, D and E according to the agents present or their nature (Tables 2, 3 and 4).

SYMBOLOGY	DESCRIPTION
INFECTIVE GROUP A 	**Residues with the possible presence of biological agents that, due to their characteristics of higher virulence or concentration, may present a risk of infection. According to the hazardousness and the need for differentiated treatments, group A residues are classified into five subgroups: A1, A2, A3, A4 and A5.**
A1 - Cultures and stocks of microorganisms; wastes from the manufacture of biological products other than blood products; disposal of live, attenuated or inactivated microorganism vaccines; culture and instrumental media used for culture transfer, inoculation or mixing; waste from genetic manipulation laboratories. Residues resulting from the teaching and research activity or health care of individuals or animals, suspected or certain of biological contamination by risk class 4 agents, epidemiologically relevant microorganisms and the risk of spreading or causing emerging disease that becomes epidemiologically or whose transmission mechanism is unknown. Transfusion bags containing blood or blood components rejected for contamination or poor preservation, or expired, and those from incomplete collection. Leftovers from laboratory specimens containing blood or body fluids, containers and materials resulting from the health care process, containing free form blood or body fluids.	
A3 - Anatomical parts (limbs) of the human being; fertilization product without vital signs, weighing less than 500 grams or height less than 25 centimeters or gestational age less than 20 weeks, which has no scientific or legal value and has not been requested by the patient or family members. pathology or diagnostic confirmation.	
A4 - Arterial, intravenous and dialyzer line kits, when discarded. Air filters and aspirated gases from contaminated area; filtering membrane for medical and research equipment, among others. Remaining laboratory specimens and their containers containing feces, urine and secretions from patients who do not contain or are suspected of containing risk class 4 agents, nor have epidemiological relevance and risk of dissemination, or emergent disease causing microorganism. becomes epidemiologically important or whose transmission mechanism is unknown or suspected of contamination with prions. Waste from adipose tissue from liposuction, liposculpture or other plastic surgery procedure that generates this type of waste. Containers and materials resulting from the health care process that do not contain free blood or body fluids. Anatomical parts (organs and tissues), including the placenta, and other residues from surgical procedures or from anatomopathological studies or diagnostic confirmation. Corpses, carcasses, anatomical parts, viscera and other residues from animals not subjected to experiments with the inoculation of microorganisms. Empty or residual volume transfusion bags after transfusion.	
A5 - Highly infectious prion organs, tissues and fluids of suspected or confirmed cases, as well as any materials resulting from the health care of suspected or confirmed individuals or animals, which have had contact with organs, tissues and fluids of high infectivity for prions. Highly infectious tissues for prions are those thus defined in official documents by the competent health agencies.	

Table 2 - Classification of Health Services Waste Group A and Subgroup A1

Table 3 - Classification of Group B, C and D Health Services Waste.

SYMBOLOGY	DESCRIPTION
CHEMICAL GROUP B 	**Wastes containing chemicals that pose a risk to public health or the environment, depending on their flammability, corrosivity, reactivity, toxicity, carcinogenicity, teratogenicity, mutagenicity and quantity characteristics. Examples: Pharmaceuticals; sanitizing; disinfectants; waste containing heavy metals; laboratory reagents, including contaminated containers; image processor effluents (developers and fixers); effluents from automated equipment used in clinical analysis and other products considered hazardous: toxic, corrosive, flammable and reactive.**
RADIOACTIVE GROUP C 	**Any materials resulting from human activity that contain radionuclides in quantities exceeding the disposal limits specified by the National Nuclear Energy Commission (CNE).**
COMMON GROUP D 	**Waste that does not present a biological, chemical or radiological risk to health or the environment and can be equated with household waste. Example: Sanitary paper and diapers, sanitary pads; disposable garments, disposable caps and masks; patient food rest; material used for antisepsis and venoclysis hemostasis, gloves for procedures not in contact with blood or body fluids; serum equipment, tongue depressors and the like similar not to A1; leftover food and meal preparation, catering refuse; waste from administrative areas; sweeping waste, flowers, pruning and gardens; plaster waste from health care; animal fodder coverings with no associated biohazard; recyclable waste without associated biological, chemical and radiological contamination and animal hair.**

Table 4 - Classification of Group E Health Services Waste

SYMBOLOGY	DESCRIÇÃO
CUTTING PERFUME GROUP D 	Sharpening or scarifying materials such as razor blades, needles, scalps, glass ampoules, drills, endodontic files, diamond tips, scalpel blades, lancets; capillary tubes; micropipettes; slides and coverslips; spatulas; and all broken glassware in the laboratory (pipettes, blood collection tubes and Petri dishes) and the like.

Because of this health waste, a more consistent discussion of this problem has started in recent years, leading municipalities to implement systems for the collection and proper disposal of waste generated in their health facilities [9].

In Brazil, ANVISA and CONAMA are the bodies responsible for providing guidance on this issue. Among the resolutions that regulate waste management practices, they are in force [8], providing for the treatment and final disposal of health care waste and other measures. [7] provides for best practice requirements for general health care waste planning (PGRSS) defining the conduct of SSR officers where, as a result, the

prevention and appropriate treatment of waste with potential contamination is sought. .

Based on the guidance given by these bodies, establishments dealing with SSR should adopt policies so that the toxic waste produced is handled and disposed of so that there is no significant harm to human, health and economic development. environmental damage is as little as possible.

The article entitled "Healthcare waste and its environmental impacts: a bibliographic review" discusses the impact on the environment, gathering opinions from several authors who write about the risks that the environment is subject to when the waste Solids from health are handled and disposed of incorrectly, indicating that the main problem is the proper technical procedures for waste management, considering the type of material [10].

This waste is handled, handled inside and outside health facilities and may incur risks for those who handle it. As it is a hospital environment, the patients are the main ones affected, since they already have a compromised defense system presenting greater risk. However, persons who have direct or indirect contact, whether from within the establishment, or civilians who come into contact with the waste at the time of transport and disposal, may be subject to disease and loss of quality of life [10].].

The management and incorrect disposal of solid health waste generate chain reactions, which harms, pollutes and affects humans dependent directly on the clean and healthy environment for their maintenance [11].

The aim of this study is to verify compliance with the General Planning of Health Services Waste (PGRSS), from the management to the final disposal of the waste, observing what are the types of health waste existing in the hospital unit of Manaus, AM, Brazil. In addition to verifying the characteristics of sustainability that the hospital has, thus contributing to the environment and the welfare of the population. Waste generated in the health facility: gloves, burrows, mask, gauze, cotton, tape, needleless syringes, chemical vials (hypochlorite), lamps, anesthetic vials, expired drugs, disinfection liquid (glutaraldehyde), detergents, chemicals generated from automated analyzes, generated mercury, broken thermometers, barometers and pressure devices, plunder; Fluorescent lamps, tones, printer cartridges, expired drugs (oral / injectable solutions); General papers, empty packaging, cardboard, newspapers and magazines, medicine boxes, plastic container of peracetic acid, plastic cups, Prozime bottle, used paper towels, wet paper, toilet paper, tampons; Needles, ampoules, scalpels, scalps, syringes with needles, broken vials, broken petri dishes, suture slides, drills, lancet, broken coverslips.

2. Material and Method

2.1 Kind of study

The types of approaches adopted in the research, which made it possible to identify whether or not compliance with the stages of management of SSR in the hospital unit, were based on the descriptive method, presenting observational character. According to [12], the descriptive research exposes the facts and phenomena of reality while for [13] in the observational study one observes something that happens or has already happened.

2.2 Study area

The study was conducted at a public health hospital located in the northern region of Manaus / AM, considered the largest in the northern region with high technology. The hospital unit is a partnership of the public-private initiative, the PPP (PUBLIC – PRIVATE PARTNERSHIP). The private company responsible for the administration of the hospital won, in 2013, the public bid to build, equip and maintain the non-assistance area of the hospital for 20 years.

The Hospital had its construction and equipment completed in 2015 and since they are in operation according to the international model of PPP (PUBLIC-PRIVATE PARTNERSHIP), in compliance with contract 061/2013 between the Government of the State of Amazonas and the company. toilet. It is responsible for sterilization services, sterile materials center; food and nutrition; hospital laundry; health care clothing processing; hospital hygiene and cleaning; building maintenance; medical equipment maintenance, clinical engineering; information technology, computer science; telephony; concierge; reception and surveillance.

The hospital unit was built to meet the demand of the region, with independent structures for child and adult care, with urgent and emergency care in the medical and pediatric clinic, orthopedics and general surgery specialties. As for diagnostics, the unit has laboratory tests, x-rays, electrocardiograms and ultrasound.

The hospital unit has a total building area of 30,164 m², operating every day with adult emergency room, emergency room, operating rooms, apartments, wards and ICU. The hospital is considered a large hospital and has 312 beds.

The hospital was built with high environmental quality thinking of a sustainable construction so much that it has the AQUA-HQE - High Environmental Quality Seal which consists of a certification of sustainable construction applied in Brazil by the Vanzolini-USP Foundation.

The project includes the capture and reuse of rainwater in the use of toilets (toilet flushing) and gardening irrigation; selective waste collection; capture of natural light through the coating of the glass building; sewage treatment plant system for the preservation of natural resources. In addition, it has all environmental licenses, such as: Preliminary License (LP), Installation License (LI) and Operation License (LO) documents that allow the execution of activities observing the measures to be fulfilled, fulfilling the environmental requirements.

2.3 Data collect

To obtain the expected results, sectoral visits were carried out daily, during a 25-day period, where the steps regarding the management of the RSS developed at the Hospital were observed and described, and the waste generated by the hospital unit of each classification group, besides observing the sustainable practices performed in the hospital.

3. Results and Discussion

The legislation pertaining to the PGRSS, which provides for the procedures to be adopted by medical-hospital establishments, aims at reducing or eliminating waste production and providing the generated

waste with a safe and efficient disposal, ensuring the protection of workers and the preservation of public health. of the environment [7] [8] and [14].

In order to comply with these PGRSS procedures, it is necessary that the place containing the technical and administrative activities applicable to the management be managed by health services waste, having as responsible for this management all those who are part of the initial chain until the last one. existing step.

Each stage of handling of SSR corresponds to a specific procedure, where those responsible for waste must follow and the lack of knowledge and non-implementation of PGRSS in institutions results in greater risk for both health professionals and waste collectors. [15]

During the construction phase of the hospital, several studies were implemented. Among them, the (PGRSS) complies with regulatory laws, being updated annually, where are the waste management steps that must be met, and demonstrated through the flowchart (Figure 1).

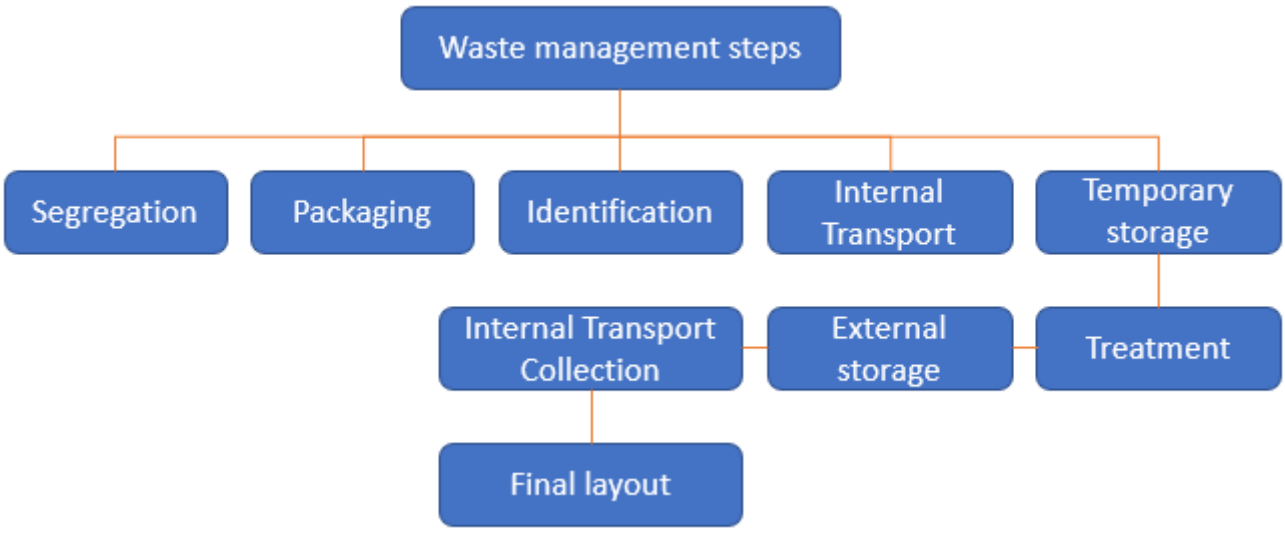

Figure 1 - Flowchart of the operation of the hospital RSS management steps according to the PGRSS. Source: Own authorship (2019).

Each step corresponds to a type of activity developed especially for the handling, treatment and transport of SSR. According to the observations made, the PGRSS steps are being completed one by one:

A. Segregation: This first part involves all individuals who are part of the institution, including patients, health professionals, service providers, and management professionals. Everyone should separate the waste, at the time of generation, according to their classification, in the bins that are specifically identified for each type of RSS.

B. Packaging: Waste is packed segregated in bags and containers according to their characteristics: physical, chemical and biological. The waste is initially packed in plastic bags of different colors, corresponding to a waste of a certain group. The white bags are for group A infectious waste, the red bag is for packing blood products in group A1 and the black bag is for common group D waste.

Group E sharps are packaged in boxes, which after reaching their use limit are placed in white bags and later passed on to container cars. The plastic containers, which receive the RSS, have a pedal-operated lid and for liquid waste the lid is threaded. Most collectors in the hospital are white and what differentiates at the time of segregation is the identification by means of a sticker on the collector lid.

C. Identification: All waste related inputs are identified with adhesive labels, examples: bags, containers, boxes, containers and waste storage locations are labeled. Fixed and printed labels and plates allow the recognition of waste by providing correct waste information using color symbols and phrases as determined by ABNT.

D. Internal Transport: performed by the cleaning staff, where the transfer is made from the generation point or temporary waste room to the waste center, in a script programmed by the waste management department, because the time cannot coincide with the food distribution. nor with the distribution of clean clothes. To meet this requirement, the hospital has three different elevators: one for the displacement of SSR, another for the displacement of people in general and the last for the transport of food.

Waste is transported by group, in specific container cars that: have wheels that do not emit much noise, cars with more than 400 liters of capacity have a bottom drain valve that facilitates cleaning, in the period in question it was necessary to change some cars collectors with broken wheels.

E. Temporary storage: The temporary storage of waste is located in points near the waste generation sectors, seeking to expedite the collection of internal areas and optimize the displacement between the generation points and the destination point. In these rooms there are collection cars for temporary storage of waste, because the waste bags cannot be directly disposed on the floor besides having a smooth and washable floor and wall.

Sanitation is performed daily under the supervision of the responsible sector. Also noteworthy is the ban on the removal of waste bags from the containers. Easy putrefying waste is collected daily and temporary storage rooms are not mandatory for all hospital complexes and can be dispensed with when the distance between the generation point and external storage justifies it.

F. Treatment: Waste generated at the hospital does not undergo treatment at the facility itself. SSRs are withdrawn by companies that have licenses for the process of: incineration, recycling and landfill [16] and [17]. The techniques used for the treatment of infectious waste and chemicals in the licensed company receive the incineration process, as a source of contamination that can cause disease and compromise the environment and public health. For common waste, those that do not present biological, chemical or radiological risks to health or the environment are removed by public cleaning or cooperatives that recycle them.

G. External storage: The hospital has a waste disposal center exclusively for the storage of waste, the areas are subdivided by waste group, identified by hanging plates according to the waste classes. Appropriate waste collection cars are placed on site, with easy access to the collection companies. The site and pickup cars are cleaned daily to prevent contamination, problems such as stench, insect flies and cockroaches providing a healthy environment for employees working on site.

H. External Collection and Transportation: The hospital has a contract with specialized companies that perform the removal of waste from the hospital to the company for treatment or final disposal. Always using the techniques that guarantee a good condition of the storage, preserving the integrity of the waste handler, the population and preserving the environment as the use of collection cars destined for each type of waste so that there is no contact with each other. This removes the risk of potential contamination.

Ordinary and hospital waste is collected daily from Monday to Saturday. As for the others like chemists, pharmacists, lamps, batteries and batteries are collected on a scheduled basis.

I. Final disposal: Waste considered infective, sharps and those containing chemical are incinerated, after the incineration process are taken to the landfill only the ashes.

Waste considered common, which is recycled, is disposed directly in the Manaus landfill and those that can be recycled, the waste cooperatives collect and dispose of for recycling. All companies providing services to the hospital have environmental licenses in accordance with the Environmental Licensing Resolution [8].

In addition to the PGRSS, some environmental studies were performed, such as: Neighborhood Impact Study (EIV); Environmental Control Plan (PCA); Environmental Management Plan (PGA); Construction Solid Waste Management Plan (PGRCC); Forest Replacement Report (RRF), which subsidized the environmental licenses of the project, which authorized the construction, installation and operation of the Hospital: Preliminary License (LP), Installation License (LI) and Operating License (LO) aiming at sustainability.

It is noticeable that since the construction there has been a concern with the environment and the surrounding population. As a hospital that includes the public-private partnership, it is managed by the private system that performs various functions, one of them being sustainability, seeking to perform activities that aim to contribute to the environment and the well-being of people.

Still in the construction phase there were studies on the flora and fauna that existed on the site and, later, there was a forest replacement contemplating the same types of trees that existed there, seeking to replace the flora that had been removed.

In October 2019, the hospital unit became the first public hospital in Brazil to have the AQUA-HQE Seal, an international certification for sustainable construction, developed from the French Démarche HQE (Haute Qualité Environnementale) Certification and applied in Brazil exclusively. Vanzolini Foundation - USP, also received the NBR ISO 9001: 2015 Seal, a standardization standard of the International Standard Organization (ISO), focused on products and services that works in the organization's quality management, focus of actions focused on customer satisfaction. / user through non-assistance services [18].

As a planned institution for sustainability, there are activities throughout the hospital that aim at sustainable construction, such as: rainwater harvesting used in the gardening service and toilets; selective waste collection, highlighting the collection of organic waste, reused for composting and the collection of edible oil collected by companies licensed to produce biodiesel; Capture natural light through the option of building using glass in multiple places so that natural light can be the largest source of light at the expense of electricity; reduction of water consumption and other practices for the preservation of natural resources, applying above all the tripod of sustainability (environmental, economic and social).

According to the results, it is observed that the stages of solid waste management of health services are put into practice by the hospital unit management company, seeking to comply with what the current legislation proposes.

Almost all steps have considerable effectiveness. However, SSR management faces difficulties in the segregation stage. Improper disposal by employees and users is the factor responsible for inefficient segregation.

Management is committed to complying with all statutory requirements by disposing of waste bins / containers, containing labels and instructing people. However, at this moment, there is the carelessness on

the part of professionals and users as they do not make the separation / segregation correctly.

Waste is often segregated erroneously, in incorrect dumps, even if they are correctly identified, thus causing a sequence of complications. With improper disposal, SSRs are intended where they should not be, as sharps going to the public landfill incurring a high risk of infection leading the company to risk being fined for improper disposal and damage to the environment through the agencies. environmental and sanitary conditions, which may result in the loss of certificates and recognition (Figure 2) [19].

Figure 2 - Waste management step

Source: Own authorship (2019).

The administrative department responsible for the management of SSR makes changes in the health unit to help the proper segregation of waste, such as placement of collectors in strategic points of the hospital, replacement of the layout of stickers, signage of collectors on the floor, realization campaigns, training on the proper disposal of waste and its importance, sectoral meetings, daily dialogues with employees informing them and removing any existing doubts.

In addition to the PGRSS document, the hospital has a PGRSS waste committee, where the committee members are professionals from the Hospital Infection Control (CCIH), Environmental Management (MA), Safety Specialist Occupational Health sector stakeholders (SESMT) and Quality. Thus, there is effective participation by the sectors involved, through reports, with the purpose of improving the waste management process.

4. Conclusion

Given the results presented, it is observed that in the hospital unit in question, we seek to comply with the largest possible number of steps in the management of SSR contained in PGRSS (8 of 9). The only step in the process that presents difficulty in compliance is segregation / disposal.

The exchange of professionals in the health unit contributes to the incorrect segregation of SSR: the bad habits of some employees acquired in other units are taken to the unit in question.

The failure that occurs in segregation influences the high cost of the weight of hospital waste, the risk of accidents with workers handling the waste, and the possibility of committing environmental crime because the waste is disposed of in landfills whereas they should receive the incineration process.

The hospital has all the necessary supplies to meet the demand for care and complies with the contract established by the Amazonas Health Secretariat SUSAM making the hospital management satisfactory with regard to the inputs intended for SSR.

The research contributes to the demonstration of a sustainable hospital, which is recognized, through international certificates, for valuing sustainable practices that aim to contribute to the environment and consequently to the well-being of the population who directly or indirectly enjoy the activities, in addition to present a PPP administration (public private partnership), fulfilling mandatory demands, by contract, generating numerous advantages or penalties in the budget, if the compliance does not occur.

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