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Editorial

IPH Magazine reaches its 18th edition, once again providing vital space for new perspectives on various subjects, reflecting the current situation in the field of healthcare architecture and engineering. This edition also marks the first time the content will be available in three languages, as beyond English and Portuguese it will also be published in Spanish from now on. This is an important step, loaded with symbolism, and should further increase the impact and scope of this important publication, allowing more readers to enjoy its content, and more Spanish-speaking authors to contribute to our next editions.

This issue begins with an article by Venezuelan researchers Sonia Bello and Valentina Moya, who deal with the theme of Therapeutic Gardens. At a time of rediscovery and revaluation of old design practices, and with the resignification of the presence of nature in healthcare settings, the authors propose a reflection on how gardens have increasingly become an integral part of hospital environments, rehabilitation centers and nursing homes. The concepts of biophilia and evidence-based design are discussed by the authors, with emphasis on their application in the conception of healthcare spaces.

In the second article, Prof. Elza Costeira presents a reflection on Hospital da Lagoa, in Rio de Janeiro, an iconic design by Oscar Niemeyer and Hélio Uchôa. In addition to highlighting aspects of its architecture, representative of the modern movement, the author observes how the building has been able to absorb new technologies over decades to then develop an analysis emphasizing the need for valorization and

conservation of its original characteristics, aiming to ensure the continuity of its use and conservation.

Architect and Civil Engineer Ramon Sousa presents a part of his final civil engineering course thesis in the following article, which discusses a very important and current theme concerning the planning and execution of civil works in hospitals during its regular operation. As the author points out, this is a delicate activity that requires a lot of attention and a multidisciplinary look. The article presents a checklist with critical points and proposes an array of risks, aiming to demonstrate the actions that can be taken to mitigate difficult situation by professionals involved in the various phases of hospital renovations.

The next two contributions arrive from Uniceub, University of Brasília, and both are related to the effects of Covid-19 pandemic. In the first article, the researchers use the Spatial Syntax theory to analyze the relationship between the network of federal highways and the spread of the virus throughout the country during the initial phase of the pandemic. The authors' main argument is that studies featuring the Spatial Syntax approach can collaborate to mitigate the effects of future pandemics. In the second one, the authors propose a reflection about the impact of Covid-19 pandemic on architecture and urbanism, more specifically in relation to housing features. Based on their own experiences and perspectives, the authors identify potential social implications that should significantly alter the current urban and architectural contexts.

Finally, architect Bruna Magalhães writes about her experience in the application of vinyl flooring on a Hemodynamics Unit, located in a hospital in Salvador, BA. After researching the normative aspects and the best installation practices with manufacturers, the author describes the process through which the researched unit went through, discussing some of the lessons she has learned.

The diversity of themes and approaches observed in the current edition shows IPH Magazine remains firm in its mission to provide authors and researchers in general with an open and democratic platform where they can share their studies and experiences with society. We renew our invitation for all those who produce technical and scientific knowledge concerning health settings and infrastructure to collaborate with IPH Magazine by sending articles for the next editions.

Enjoy your reading!

Prof. Arch. Marcio Nascimento de Oliveira

The therapeutic garden

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Abstract

This article discusses the effects of gardens on health and satisfaction of users in hospital environments. Based on a literature review, a selection of studies was carried out to highlight the most relevant concepts, and that have contributed to deepen the understanding of therapeutic gardens, presenting some examples of projects that incorporate these concepts and the theories that underpin them. This document is part of a more comprehensive research that aims to identify the implications, benefits, and therapeutic possibilities of the use of gardens in health centers in order to establish concepts of projects to be applied in a case study of nursing homes.

Keywords

therapeutic garden, biophilia, evidence-based design, gardens in health centers.

Introduction

Gardens have been an integral part of hospitals, nursing homes, rehabilitation centers, nursing homes and nursing homes that care for the elderly. Thanks to important advances in medicine, technological innovations, economic, social, and cultural changes in care for the population, health facilities have varied their infrastructure, also modifying the design of its outdoor spaces. Nowadays, there is a growing interest of doctors, architects, and researchers in the humanization of health centers, introducing new variables and research focused on rethinking how the design of health center environments influences patient recovery and the well-being of the team. One of the environments that has aroused much interest in this aspect is the introduction of landscaped spaces, both inside and outside hospitals, nursing homes, rehabilitation centers and residences for the elderly. The concepts of biophilia, evidence-based design and therapeutic gardens stand out among the most used ones in the area of space design intended for health services.

Biophilia

The need of human beings to connect with the nature and be in contact with other animal or plant organisms is called biophilia, word that comes from Greek, *bios*, life, and *philia*, love. It literally means “to love life”.

The term was defined by Erich Fromm, German psychoanalyst, in “... *passionate love for life and the whole living, the desire for growth and development in a person, a vegetable, an idea or a social group*” (Fromm, 1973, p. 261).

Later, Edward Osborne Wilson (Wilson, 1984), an American biologist, deepens the concept of biophilia and formulates a theory. According to Wilson’s theory, people need to have contact with nature, which is critical to psychological development. It states that throughout the millions of years in which *Homo sapiens* related to its surroundings it has been developed a deep and congenital emotional need to be in close contact with the rest of living beings, plants, or animals. The satisfaction of this vital desire has the same importance as establishing relationships with others. Just as we feel good about socializing, we find peace and refuge when we go to a forest or a beach, look at green walls, or when we are with our pets.

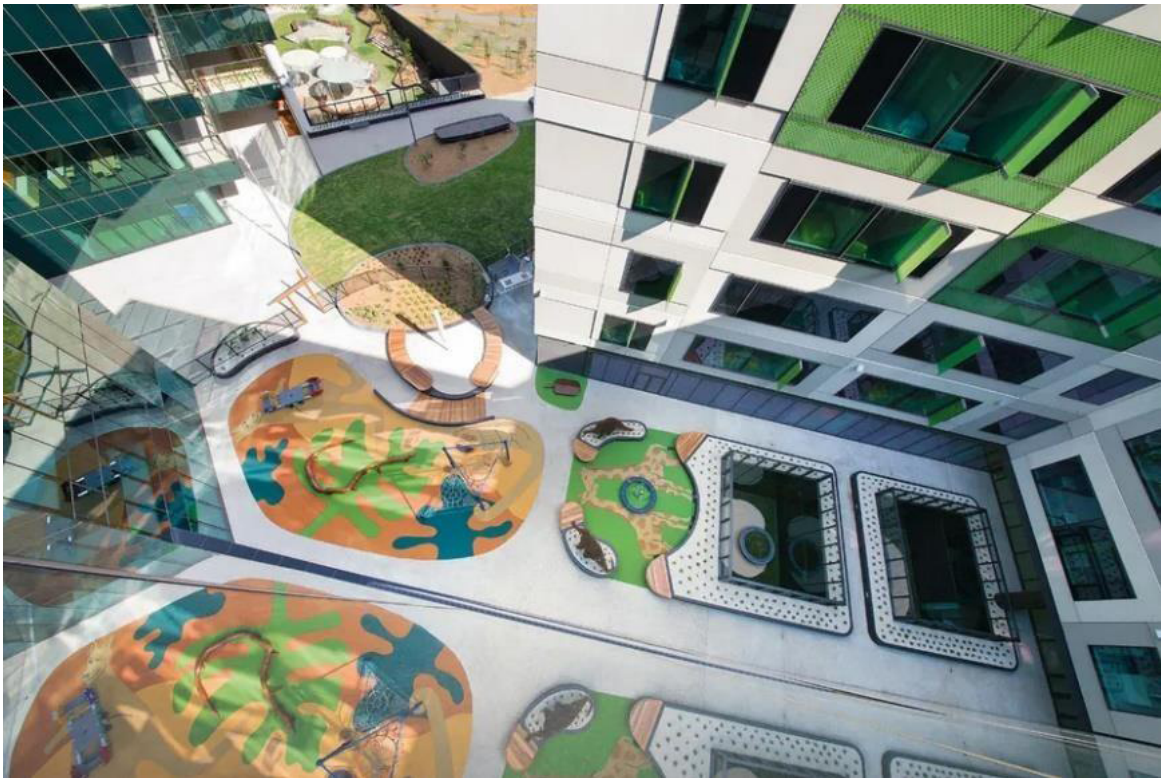
Howard Frumkin¹ (Frumkin, 2017) and Roger Ulrich² (Ulrich, 2001), among others, referred to E. O. Wilson in their studies and to the theory of biophilia as one of the main ones that support the related benefits between health and nature. Recently, in the field of architecture, the

¹ Professor of Environmental and Occupational Health Sciences at the University of Washington School of Public Health.

² Professor, Department of Architecture and Center of Sanitary Architecture, Chalmers Technological University.

biophilia project is discussed, considered as a sustainable design strategy that seeks to reconnect human beings with their natural surroundings.

An example of the application of biophilia concept in architecture to improve health of the sick is the Royal Children's Hospital, designed by Billard Leece Partnership and Bates Smart (Bull, 2012), in Melbourne, Australia, located in a green surrounding (Picture 1). Today, it has become a reference in the provision of health services aimed at children. The principles used were: evidence-based design, family-centered design, sustainable design, introduction of daylight and nature in the work and sanitary surroundings, gathering of clinical, research and education facilities.



Picture 1. Play space, designed by Fiona Robbe, landscape architect, Royal Children's Hospital. Source: Gollings, Jhon (2012) (Photography). <https://architectureau.com/articles/new-royal-childrens-hospital/#>

The patient rooms are separated into three areas (clinic, patient, and family), responding to the emotional needs of children. Each child can customize their space (Picture 2), as well as views of the inner courtyards or the Royal Park, which improves patient's experience and recovery rates, which has been proven in different studies. They also ensure shorter hospital stays for patients hospitalized in rooms overlooking nature, unlike patients in other types of rooms (Bates Smart, 2019).



Picture 2. Patient room, Royal Children's Hospital. Source: McGrath, Shannon (Photography). <https://www.indesignlive.com/the-peeps/bates-smarts-mark-healey-healthcare-design>

Another example is Khoo Teck Puat hospital, located in Yishun, Singapore (Picture 3), opened in June 2010. The architectural project was in charge of CPG CONSULTANTS PTE LTD, and the landscaping was conceived by PERIDIAN ASIA PTE LTD, which holds a LEAF certification (Linking environment and Farming) and has already won several awards. It was created under the concept of hospital in a garden, focusing on sustainability through three key principles: (I) to elaborate gardens in a practical and self-sufficient way; (II) to create natural gardens with people in mind; and (3) to implement the landscape and ecological characteristics efficiently in the use of resources and energy (National Parks Board Greenroofs.com, 2020). In this way, by being able to maximize the creation of therapeutic green spaces and to offer high-quality environments, architecture can link indoors and outdoors, providing the view of the gardens from different angles.



Picture 3. Benches in the open space of Khoo Teck Puat Hospital. Source: <https://www.ur.gov.sg/ms/OurFavePlace/events/bench/locations/khoo-teck-puat-hospital>

Evidence-based design

The notion of *evidence-based design* (EDB) is essential for the development of spaces intended for health. It is proposed that to create spaces for people with special needs, which require a design for specific results, the project should be based on solid research and updated. According to the Center for Health Research, EDB defines itself as “...the process of basing decisions concerning the built environment on credible research to achieve the best possible outcomes”³ (The Center for Health Design, 2018).

During the last 30 years, a number of researchers have elaborated several works linked to the area of sanitary project, open spaces in the surroundings of health and restorative landscapes. Roger Ulrich is one of the most cited international researchers in this area. He began his career in 1979 as an assistant professor, researching environmental aesthetics, where he discovered that most landscapes of nature produced positive emotional states and helped relieve stress. His studies are still being implemented by design professionals and managers of medical care centers.

³ It is the process of basing decisions on the environment built on a reliable search to achieve the best results. The use of quantitative and qualitative research to design surroundings that facilitate health and improve results.

In 1984, Ulrich (Center for Health Systems and Design, Texas A&M University) presented a significant study on the positive influence that landscapes have on health outcomes. Patients recovering from gallbladder surgery were analyzed. Some stayed in rooms overlooking the trees and had fewer complications, used smaller doses of painkillers, and returned to their homes more quickly, compared to patients who had the view of a wall.

Ulrich and his colleagues carried out some researches and proved the "Theory of stress reduction", which demonstrates that five to seven minutes in contact with nature or looking at a natural landscape can:

- Reduce physiological indicators of stress.
- Improve the mood.
- Help recovery.

From 1991 to 1999, Ulrich presents "A theory of supportive gardens" (Ulrich 1991, 1999), which began in a previous conceptual work aimed primarily at architectural and interior design aspects of health facilities, but which has been modified and updated to focus directly on gardens. It shows that the ability of gardens to have healing influences comes largely from their effectiveness in facilitating health recovery and facing stress.

Ulrich proposes that gardens are important stress-attenuating resources for patients and professionals, in addition to bringing improvements in clinical outcomes, patient satisfaction and the cost of care, as long as they fulfill the following guidelines:

- Create opportunities for physical movement and exercises.
- Offer opportunities for decision making, having privacy, and experiencing the sense of control.
- Provide settings that encourage people to get together and experience social support.
- Provide access to nature and other positive distractions.

The theory also argues there is a necessary condition for the four features above mentioned to be effective: the garden should convey a sense of security. If the design or characteristics of a garden produce feelings of insecurity or even risk, it is likely the environment will have a stressful influence, rather than a restorative one. And many patients, visitors and staff will prevent people undergoing medical treatment from feeling psychologically vulnerable.

At the same time, in 1995, a research concerning gardens in hospitals was published: *"Gardens in healthcare facilities: uses, therapeutic benefits and design recommendations"* (Cooper & Barnes, 1995), from University of California, Berkeley⁴, which studied four gardens in hospitals located in the San Francisco Bay Area, California.

Interviews, behavioral mapping, and visual analysis were elaborated. It was discovered that stress reduction, including mood recovery, was the most important category of benefits enjoyed by almost all garden users: patients, family members, and employees. According to these studies, the traditional elements of gardens, such as lawns, trees, flowers, and water elements are appreciated: 90% of garden users experienced a positive change of mood after spending some time outdoors.

In 2008, the "Theory of the Restoration of Concentration" was proposed, which proves that exposure to nature restores concentration capacity after concentrated efforts that create mental fatigue. This theory was developed by Rachel and Stephen Kaplan (Pati and Barach, 2008) colleagues and alumni of University of Michigan. A study was conducted with 32 patients in two Atlanta hospitals after a 12-hour shift. Sixty per cent of those with access to nature improved their vigilance or remained the same, and those without access to nature or without a view of natural landscape decreased 67% in surveillance. This research concludes that improving restorative quality of recess areas can lead to reduced stress and better patient care.

In 2015, a scientific study was initiated in Japan to investigate the decrease in depressive symptoms and increased memory performance in elderly adults, it was called *"Effects of exercise and intervention on brain and mental health in older adults with mild memory problems and depressive symptoms"* (Makizako et al., 2015).

Initially, the trial was conducted for 20 weeks, with 90 adults over 65 years old living with memory problems and depressive symptoms. Participants were randomly assigned to perform three experiments: exercise, horticultural activity, and educational control group. They conducted a combined program of exercises and horticultural activities during 20 weekly sessions of 90 minutes each. Participants in the exercise group practiced aerobic exercises, muscle strength training, postural balance training and double task training. The horticultural activity program included activities related to culture, such as cultivation in the field and harvesting.

Preliminary results observed antidepressant effects among old people with mild depressive symptoms and clinically significant symptoms of depression, suggesting the prescription of structured exercises

⁴ It is the first systematic evaluation after the occupation of the outer space of hospitals.

with mixed elements of resistance and strength training adapted to individual capacity. The results of horticultural activity showed reductions in agitation levels, it was considered to be necessary to carry out well-designed intervention studies to examine the effects of horticultural activity on brain and mental health (e.g., depressive symptoms, cognitive function and brain volume) in non-demented adults at increased risk of dementia.

What is a therapeutic garden?

It is a delimited garden space intended for a given population with a specific purpose. The design of the physical aspects and the activities to be developed in the garden are based on medical research. It is recommended to be designed by a specialized multidisciplinary team, as it is a meeting point between medicine and design. The purpose of the therapeutic garden is to offer its users (patients, visitors, residents, employees) a place that contributes to improve their physical, psychological, social and spiritual needs, as well as helping them keep in touch with reality and providing well-being.

For Naomi Sachs⁵, the definition of “healing garden”, “restorative landscape” or “landscape for health” is that of any wild or projected space, large or small, that favors health human well-being (Sachs N. , 2016). Sachs proposes that private residential gardens can also be healing gardens, although there is a distinction to be made between curative gardens for all and curative gardens for people who have compromised health.

⁵ Naomi A. Sachs, PhD, MLA, EDAC, Assistant Professor, Department of Plant Science and Landscape Architecture at the University of Maryland and Founding Director of the Therapeutic Landscapes Network (www.healinglandscapes.org)



Picture 4. Joel Schapner Memorial Garden, Cardinal Cook Hospital, New York City. Source: Bruce Bruck (Photo) <https://dirtworks.us/portfolio/joel-schnaper-memorial-garden/>

The former are designed to help healthy people stay healthy. It works like some kind of preventive medicine. However, in health facilities, the design process should be carried out with the greatest attention, taking into account users, and giving preference to evidence-based projects (Sachs N., 2018).

In order to provide therapeutic benefits, the garden needs to meet a number of features such as: (I) a wide variety of plants that are distinguished by the changes of season; (II) views of the sky; (III) small lakes of water and trees that can attract wildlife; (IV) scheduled activities, such as horticultural or rehabilitation therapies, ensuring universal accessibility; (V) well-defined perimeters, so users can focus their attention on the components of the garden, that means the functional organization should be clear and simple with an orderly structure of the circulation to facilitate orientation and mobility user.

Benefits of being in contact with nature

There are many benefits of being in contact with nature, including physical, psychological, social and personal aspects. Spending only 90 minutes a day in a wooded area reduces depression, and spending one day in nature in a recurring way improves the immune system.

Experts have recorded great benefits in the use of gardens, parks and green spaces, both inside and outside health environments, such as: stress reduction, sleep improvement, anxiety and depression reduction, associated with increased happiness, reduced aggressiveness, reduced behavioral disorder symptoms, decreased blood pressure, improved recovery of surgeries, improvement of overall health, increased life expectancy in older adults, if they have access to parks and nature, improvement of quality of life in chronic or terminally ill patients, besides helping patients to evoke their own healing capabilities (Frumkin, 2017).

Design strategies for a therapeutic garden

Ulrich proposes four design guidelines for conducting a therapeutic garden: exercise, sense of control, social support, access to nature and other positive distractions in "A Theory of Supportive Garden Design" (Ulrich, 2001). In addition to these basic guidelines, the author's observation on hospital gardens in the United States, Australia, Canada and the United Kingdom highlights the need to consider that, in order to be used and reach its full potential, it must possess the following qualities: visibility, accessibility, familiarity, tranquility, comfort, and art without ambiguities.

Clare Cooper Marcus, in her article "*Healing Gardens in Hospitals*" (Cooper, 2007), describes some essential design elements and environmental qualities that a therapeutic garden should have, and describes the precedents used by designers of contemporary healing gardens, including those for medical diagnosis, where a number of pathology design recommendations have been proposed. On the other hand, the American Society of Landscape Architects (ASLA) and the American Horticultural Therapy Association contributed to the development and understanding of the elements for the design of therapeutic landscapes, approving the document "*Therapeutic Garden Characteristics*" (Hanzen, n.d.), which serves as a reference for medical professionals and landscape scholars in relation to well-being. The combination of these fundamental elements represents current practices for therapeutic gardens.



Picture 5. Gardens at Centro Sociosanitario Geriátrico Santa Rita/Manuel Ocaña. Source: De Guzmán, Miguel (2009). <https://www.plataformaarquitectura.cl/cl/626312/centro-sociosanitario-geriatrico-santa-rita-manuel-ocana>

Conclusions and Recommendations

The following table, taken from our bibliographic review, summarizes the design strategies for creating a therapeutic garden.

Scheduled activities	Promote activities that bring special populations, families of patients and residents of the community near the garden. Activities that may occur outdoors can be active or passive, for an example, contemplation, rest, meditation, praying, waiting room, rehabilitation exercises, food, reading, walking, hiking, gardening, horticultural therapy, ecotherapies.
Universal accessibility	Adapt the garden environment to provide accessibility, facilitate gardening tasks, improve visitors' experience by allowing them to be in contact with plants. Paths must be wide enough, paving joints should not be high and must be narrow enough not to hold a cane.
Well-defined perimeters	The edges of the spaces and special areas of activities within the garden should be well demarcated so that the user can focus his attention on the components of each zone within the garden. Gardens that have areas with clearly defined functions and include direction and location indicators allow users to behave and use the space more independently
Adhering of plants and interactions between people and plants	Provide varied plant material with distinct changes in leaves, colors, textures and shapes, so people can experience planting, growing and flowering seasons. Provide routes with open and closed views, to generate experiences of different spaces with surprise elements.
Beneficial and supportive	Create outdoor play areas that allow people to walk, relax or rest in shaded spaces, whether with protective structures such as pergolas or with plants, offer personal comfort and shelter to garden users, provide support settings such as handrails, frequent presence of seats with armrests and backrests.
Creating recognizable places	Therapeutic gardens are simple, unified and easy-to-understand places. The functional organization should be clear and simple, favoring relationships, an orderly structure of circulation, continuity and clarity of paving will facilitate mobility and user orientation.
Water devices	The placement of water devices attracts wildlife and are increasingly used in health facilities as they can serve as reference points, guidance elements, as well as function as positive distractions that reduce stress.
Medical diagnoses	A therapeutic garden can bring benefits to many categories of users, so it is advisable to know the medical needs of users and their caregivers so that it is possible to create spaces that can function as a means of treatment and meet the needs of users as appropriate.

Table 1. Recommendations for the design of therapeutic gardens.

Some special recommendations for the design of outdoor spaces in nursing homes, rehabilitation gardens for people who have suffered cardiovascular accidents and gardens for patients with Alzheimer's disease.

Residences for the elderly	A front garden on the ground floor is recommended to socialize with neighbors and a back garden for privacy.
	Create transition spaces between the inside and outside to allow the patient's vision to adapt.
	Include devices for exercise, because prescribing exercises helps reduce depression and improve mood.
	It includes horticultural activity as it provides mental well-being, gardening helps promote teamwork, improves self-esteem and self-confidence.
Rehabilitation gardens for people who have suffered cardiovascular accidents	Create surfaces with varied slopes, which provide a space to learn to walk again.
	Use gardeners at different heights with varied edges to sit and tilt.
	Include variety of plants labeled for color and shape recognition, reading.
Gardens for patients with Alzheimer's disease and other forms of dementia	It is important that design and maintenance are sustainable.
	Providing a well-planned space from the start, a simple route system with a single gateway and exit can help users feel comfortable with the use of space and minimize the potential of disorientation and anguish.
	Use plants that can evoke childhood memories, since long-term memory is less impaired.
	Provide different spaces within the garden, a quieter area, with soft colors and another area with plants that stimulate the senses.
	They should be located in a closed and protected area, as patients tend to roam. The garden fence should be made of shrubs so that the residents do not have the feeling of being closed.
	Consulting with staff and patients using the facility helps determine many key aspects to meet their needs, and promotes a sense of ownership and control.

Table 2. Recommendations for the design of gardens for the rehabilitation of special pathologies.
Source: Cooper, (2007), Healing Gardens in Hospitals.

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Hospital Sul América and the modern design in health architecture

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Abstract

In this article, we present the Hospital da Lagoa, in Rio de Janeiro, aiming to highlight its architecture as a representative of Brazilian heritage modern hospital. Designed by Oscar Niemeyer and Hélio Uchôa, this hospital configured a model of care of its time, evidencing the forms of illness, treatment, and cure. With an architecture able to absorb new technologies, meant a pioneering approach to environmental comfort and humanization, incorporating tile panels of Athos Bulcão and gardens of Burle Marx. Observing its characteristics as a place of memory of health and modern architecture, we will use guidelines indicated by Gonsales (2008), taking three interdependent dimensions for analysis: the representation of modernity, the conservation of original characteristics and authenticity in its preservation, aiming at its continuity of use and conservation.

Keywords

modern architecture, hospital architecture, health memory.

Introduction

When dealing with issues that involve the preservation of architectural works of the Brazilian modern features, we find an important collection to be studied and protected: it is the preservation of hospital buildings that emphasize, alongside the search for the establishment of innovative and affirmative architecture of the premises of modern men, a model of hospital care at the time of its conception, evidencing the forms of illness, treatment, and cure.

In this sense, we develop in this work a reflection on the preservation of Hospital da Lagoa, former Hospital Sul América, designed by Oscar Niemeyer and Hélio Uchôa, which had its work completed in 1959, highlighting its role as a significant example of the memory of Brazilian health architecture.

The original project of the hospital repeats the partnership of these architects, initiated in the Pavilion of Ibirapuera Park, located in São Paulo, and uses the same modernist canons for its modeling and implementation. The work developed for seven years, until 1959, having faced a series of difficulties and obstacles to its completion, as Lauro Cavalcanti (1999, p.179) states. One of the obstacles to the implementation of the hospital was the occupation of the land chosen for its construction by a slum of about 1,000 residents, known as Favela da Hípica, which was eventually removed from the site, as well as others that were on the shores of the Lagoa.

Another difficulty that ended up causing delays in the construction of the hospital was the nature of the land, swampy and difficult to stabilize, as is usually the entire surroundings of the Lagoa. The first surveys required extra care in the preparation of the structural project, which even included the construction of an underground pavement.

The building of Hospital Sul América, of Larragoiti Foundation, was acquired in 1962 by the former Institute of Retirement and Pensions of Bankers, after authorized by president João Goulart. On the occasion, it was called Hospital dos Bancários, integrating the health care support, promoted by the class union.

In November 1966, "all institutes that served private sector workers were unified in the National Institute of Social Security (INPS) (OLIVEIRA, 1985). The Hospital was later integrated into the network of the now discontinued National Institute of Social Security Medical Assistance (INAMPS), which then had its health care network transferred to the management of the Ministry of Health. It was listed in 1992 by the State Institute of Artistic and Cultural Heritage - INEPAC. Subsequently, it had its name updated to Hospital da Lagoa or Hospital Federal da Lagoa,

from 2005 on, when it returned to federal management after just over five years of municipal administration, from 1999 to 2005.

In this reflection, we intend, by observing the state in which Hospital da Lagoa is currently located and the actions for the conservation of its modern characteristics, to collaborate for a better understanding of the issues that involve the preservation of modern buildings of health, in the face of the necessary and constant technological updates of its construction equipment to meet the health care guidelines of the present and the future. From the constant adoption of new diagnostic and therapy procedures, which we observed in the development of medical practice, we believe it is fundamental to analyze how the constructive premises of the modern movement may have facilitated the updating and necessary reforms that impacted this important project throughout its life.

The representation of modernity

The first dimension for the analysis of the importance of the architecture of Hospital da Lagoa, as an example of the modern movement, capable of preservation and conservation, is its degree of representation of architectural modernity, that is, of the characteristics that make it a model of modern architecture for health.

In this sense, it is not possible to deny, first of all, the importance of visits to Brazil by the Franco-Swiss architect Le Corbusier in 1929 and 1936, which contributed to the diffusion of modern principles of architectural design, used to design and build new buildings in Brazil. The innovative ideas presented by the controversial architect came to meet the concern of Brazilians, who had started to employ formal aesthetic and modern conceptions in their projects.

Hospital da Lagoa followed this trend of innovation in Brazilian architecture and, in addition to having incorporated into the project the Corbusier's principles, included new approaches in the field of medicine and hospital administration, as recommended by Ernesto de Souza Campos in his book on the conformation of hospitals. As we can see in a report in "O Globo" newspaper, of 7/29/57, the hospital would be destined to house what was most current in medical care, in addition to the modernist aspects of architectural representation.

By the end of next year, the South America Hospital will be inaugurated in this capital, which, with its 230 beds, will be one of the most modern in the world, endowed with facilities that represent the latest achievements, both for the architectural aspect (Oscar Niemeyer and Hélio Uchôa's project) and for the planning of medical and administrative services and for the selection of equipment. (O GLOBO, 1957, p.38)

The issues of modernity that were sought to be printed to the hospital building at the time of the conception of Hospital da Lagoa point to the positioning of architects and designers in the face of new constructive characteristics that exalted the new times and new citizens, who could enjoy the most advanced medical technology available, sheltered in a revolutionary and transformative construction in their premises of implementation, methods, guidance and morphology.



Picture 1. Model of Hospital da Lagoa. Source: *L'Architecture d'Aujourd'hui*, 1955.

At the time, the establishment of hospital architecture was seen as a field to be studied, as an interest emerged from architects in deepening their knowledge in relation to the guidelines recommended by other countries, referring to the hospital project. The public investments in the health area made during the first government of Getúlio Vargas (1930-1945) were very relevant, with the construction of hospitals, health unities and buildings across Brazil, and with the creation of technical offices in state agencies. Later, in the 1950s, with the creation of the Ministry of Health, the need for a greater professional qualification was felt, as observed by the researcher Ana Albano Amora:

The trajectory of many of these professionals indicates a dedication to the construction of a specific subfield of the activity, which culminated in the realization of the Hospital Planning course, held by the IAB of São Paulo, in 1953. (AMORA, 2011).

In this sense, we can mention as determinant the institution of the first course of Brazilian Hospital Architecture, an initiative from architect Jarbas Karman, who had just completed his course in Hospital Architecture at Yale University, USA, in 1952, when he also took a course on hospital infection taught by Professor Carl Walter, in Kitchener, Ontario, Canada (CYTRYNOWICZ, 2014). As a pioneer of the subject in Brazil, Karman set up and ministered with some colleagues, among them illustrious architect Rino Levi, the first course in Hospital Architecture of Brazil, within the framework of IAB, in São Paulo, in 1953.



Picture 2. Photo of the 1st Course of Planning of Hospitals, IAB and IPH, February 1953. Source: IPH Collection.

In 1954, Jarbas Karman compiled a book, where he published the oral lectures of the course from previous year. Its publication was carried out by the Hospital Planning Commission of IAB of São Paulo, which included architects Amador Cintra do Prado, Jarbas Karman, and Rino Levi. Karman then founded the Brazilian Institute of Hospital Researches (*Instituto de Pesquisas Hospitalares* – IPH) and served as maintainer of the first course of Hospital Administration in Latin America, where he was director and holder of the Chair of Hospital Architecture (CYTRYNOWICZ, 2014). Regarding the objectives of the course, Karman said:

Within its activities, it would cover the entire hospital field of the country. It would be our center of hospital knowledge and information. Its objectives were: 1- To conduct hospital research; 2- To provide close technical assistance to hospitals, in order to raise their level and enable them to combat or prevent diseases more effectively and safely; 3- Plan the coordination of hospitals; 4- Develop teaching and disseminate knowledge in the hospital field (IAB, 1954, p.418).

Before that, specifically in 1943, we found an important document that outlines the field of research and studies of the conformation of hospitals not by engineers and architects, but by doctors and hospital administrators, through the realization of the first Course of Organization and Hospital Administration. This course, taught by physician and engineer Ernesto de Souza Campos¹, gave 25 physicians the title of Specialist, configuring the training of the first specialists in South America in this field of knowledge, according to Dr. Theóphilo de Almeida, director of the Division of Hospital Organization of the Ministry of Health, in 1943:

Comprising the training of the specialist, the planning of buildings and facilities, the selection of equipment, the rules of organization and operation, the economic-financial regime, social, legal, cultural, religious and recreational assistance, the study of standardization in general, specific legislation, professional and associative cooperation or classes; covering, in this case, the entire field of medical and social assistance in the community, both for patients, and of all classes, as well as for the indigent, and social misfits, here is, in summary, a whole program, which is also the very purpose of the Division of Hospital Organization, a specialized federal agency for coordination, cooperation, guidance and control of the activities of this sector, in the permanent service of the national organization (CAMPOS, 1944, p.3).

The concern with functional aspects, combined with the search for the formal aspects of modern architecture, gave rise to a series of hospital projects, from 1930 to 1940, when the implantation in vertical blocks began to predominate, amid examples of pavilioned morphology, to express a new conception of medicine. This period was marked by the rationality coming from the canons of modernism, which influenced the discussions about the most appropriate architecture to express modern men, who were born in the scenario of Brazilian urban life.

¹ Physician and engineer Ernesto de Souza Campos, author of the book *History and Evolution of Hospitals*, was the minister of Health In 1946 and also co-author of the project for Hospital das Clínicas in São Paulo and Bahia.

Sweeping diseases through preventive and curative actions and promoting habits considered hygienic, controlling the care of adults with the body and preventing future generations against diseases were ideas expressed in the principles of the discipline of hygiene, which seemed implicit in this public health policy articulated to the idea of modernization (AMORA , 2012, p.53).

Hospital da Lagoa presents the use of modern premises for its architecture, as intended by its creators: the entrepreneur Antônio Larragoiti Júnior, the doctors Leonídio Ribeiro and Félix Lamela, responsible for the programming and design of medical services, and the managers of the SulAmérica Foundation, Health Insurance National Company.

Besides the establishment of pioneering healthcare services for the period, it was intended to mark the construction of former Hospital Sul América, designed to assist employees of Larragoiti Foundation and Banco Lar Brasileiro, not only with the most innovative medical technique, but also with an architecture that would translated the modernity and the advancement of the then Federal Capital in health architecture. As we can see in the newspaper article of the time:

An initiative of the Larragoiti Institution that will place the country among the highest standard of medicine – for the first time the Diagnostic Institute for the periodic review of the human organism will work – the recovery room next to the operating room is an innovation in modern hospital technique (The GLOBE, 1957, p. 38).

The architectural issues were faced by establishing a pioneering project for their time, showing the use of the main characteristics of modernism, which had been demonstrated in the building of the Ministry of Education and Health, former Capanema Palace, or Gustavo Capanema building, considered one of the main examples of the new Brazilian architecture, and which featured prominently in the exhibition *Brazil Builds*, held at MoMa in New York, in 1943.

The project included details such as the free plan, the independent structure – which conforms, on the ground floor, to “V” pillars, a characteristic of the architect in this period – the prediction² of a roof garden (which has never been implanted) and the use of aesthetic elements from modernism, such as the panels of the west façade worked in *cobogós and brises-soleil*.

² “V” pillars at Hospital da Lagoa appear in other Niemeyer projects from this period, as in the Palace of Agriculture, in Ibirapuera (1951), in São Paulo, and in the project for an apartment building in Hansaplatz (1955), in Berlin.



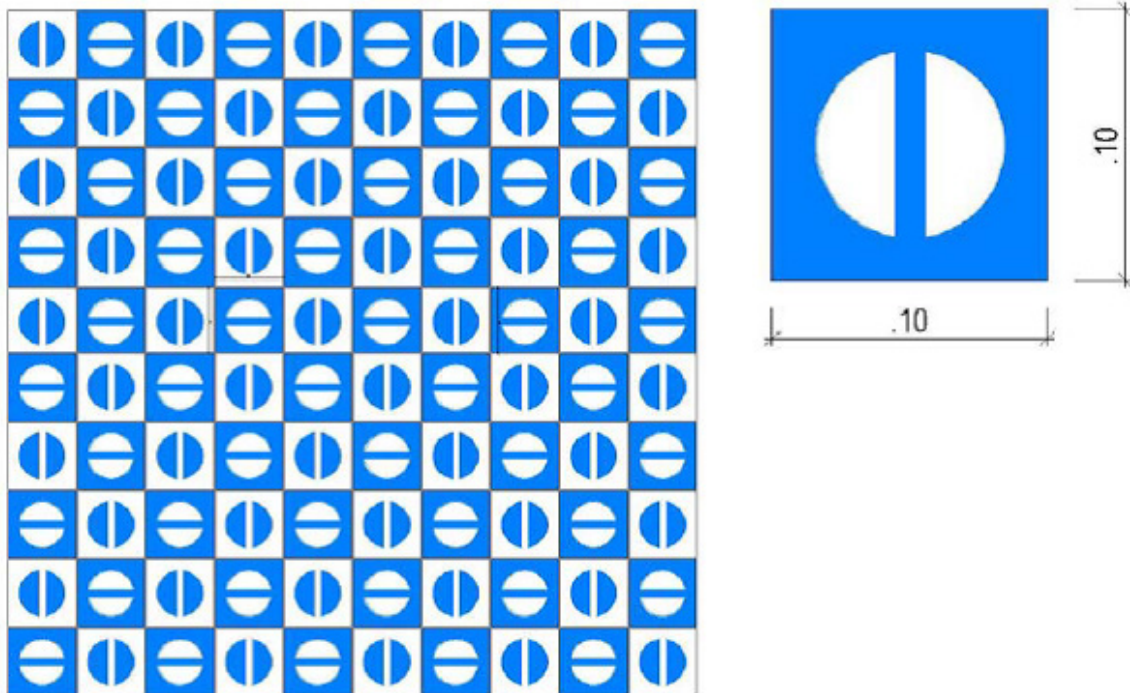
Picture 3. Model of Hospital da Lagoa. Source: *L'Architecture d'Aujourd'hui*, 1955.

As Gonsales (2008) mentions, we can consider that the conception of Sul América Hospital incorporates at its core the expression of modernism, when we observe the novelties of medicine contemplated in its program, the careful choice of the place of its implementation, taking advantage of the view of Lagoa Rodrigo de Freitas, and the option for the use of concepts of the new architecture, as signifiers of an affirmation of pioneering, marking the work as a kind of “modern monument” to be appreciated and enjoyed as a national landmark of architecture and advancement of medicine.

This dimension is indicated by the degree of presence in a potentially patrimonial asset of those fundamental characteristics of architectural and urban modernity that represent the essence of the object in a normative and universal sense (GONSALES, 2008, p.3).

The observation of the architectural conception used in the project, the particularities of the program, and the constructive technology employed points to the “degree of modernity” and the historical importance of the work (GONSALES, 2008). And we found in Riegl considerations concerning an architectural work with “intentional rememorate value” or “novelty value”, with which we can establish reflections on the conservation of the Hospital (RIEGL, 2014).

Still seeking its brand as a building that housed the most recent achievements of society at that time, it was foreseen, in its architecture, the use of works of art translated in the panels of tiles signed by Athos Bulcão, besides gardens designed by Roberto Burle Marx, a prominent Brazilian personality in translating modernism into landscape projects.



Picture 4. Tiles panel of Hospital Sul América and one of the modules that compose it.
Source: ASTORGA, 2010.

The conservation of the original design

From the observation of the original design of the hospital, we can observe how the institution could preserve the building conceived by architects Niemeyer and Uchôa, under some structural premises at the time but that, today, no longer meet the requirements of healthcare architecture, considering the series of norms that have impacted and changed significantly hospital projects since the 1990s, according to Célia Gonsales:

The historical importance given to a building is part of a feedback process. The results of artistic, historical and scientific research create a corpus that indicates and sustains an object as a “monument”. The results will be more consistent as they identify that architecture or urban space with a more evident modern structure or scheme, those objects that present a real use of modern apriorism (GONSALES, 2008, p.11).

In this sense, we are faced here with the difficulties inherent to the conservation of original projects of health buildings. If, on one hand, we have to consider the end-activity of these institutions, on the other, we can imagine a series of misunderstandings and ignorance of the functions that were part of the necessary program, which initially shaped the distribution and hierarchy of environments, as well as infrastructure and technical spaces that supported the original design of the hospital. Fernando Diniz Moreira presents a concern regarding this issue:

Our societies have not yet consolidated the idea that modern architecture is a cultural product and must be protected for future generations. The recognition of a building as a cultural good of a community takes some time. Many modern buildings are at risk of mischaracterization or demolition, but many of them have not yet had their values recognized by society (MOREIRA, 2010, p.155).



Picture 5. East façade of Hospital da Lagoa. Source: Rio de Janeiro - NEMS, 2012.

We consider that, despite interventions and remodeling added to the original project, we have its integrity guaranteed from the continuity of the use of its environments, which, although updated in the function and contemporary premises of health care, were able to keep the characteristics of its location and its dimensions in relation to the initial project. As points out Ana Albano Amora:

The preservation of part of this heritage, especially public buildings, is being guaranteed by the use. However, the Project Inventory of Health Cultural Heritage can be a step towards the use of the inventory instrument as a safeguard mechanism according to the Federal Constitution. This constitutes an advance for the set of preservation actions in the various governmental agencies (AUGUSTINE and AMORA, 2009).

Specifically, in the case of Hospital da Lagoa, which has become a copy of the memory of the practice of medicine, the study of its conservation should be considered within a specific field of knowledge, exercised in the search for the proper ordering and implantation of the object on canvas, as in several projects of conservation of specimens of modernism.

As Riegl (2014) shows us, in every attempt to intervene for the conservation of an architectural object, we must imbue ourselves with accurate critical judgment and enable us to make specific choices to achieve the intended preservation. These choices are evidenced in the article by Cunha and Kodaira (2009) about the challenges presented for the restoration of modern architecture, treated, in general, as a question of architecture and not always as an action of the field of restoration. The authors point out that:

Even though it is a relatively new fact in the field of preservation, it is already possible to identify some trends in the face of interventions in architectures related to the modern movement: a first trend is the (pseudo) philological restoration, aiming to recover the original characteristics of the work; a second posture, similar in principle to the first, would be the reconstruction to the same as destroyed works; a third possibility is the updating or even technological-constructive correction of the monument (CUNHA and KODAIRA, 2009, p. 8).

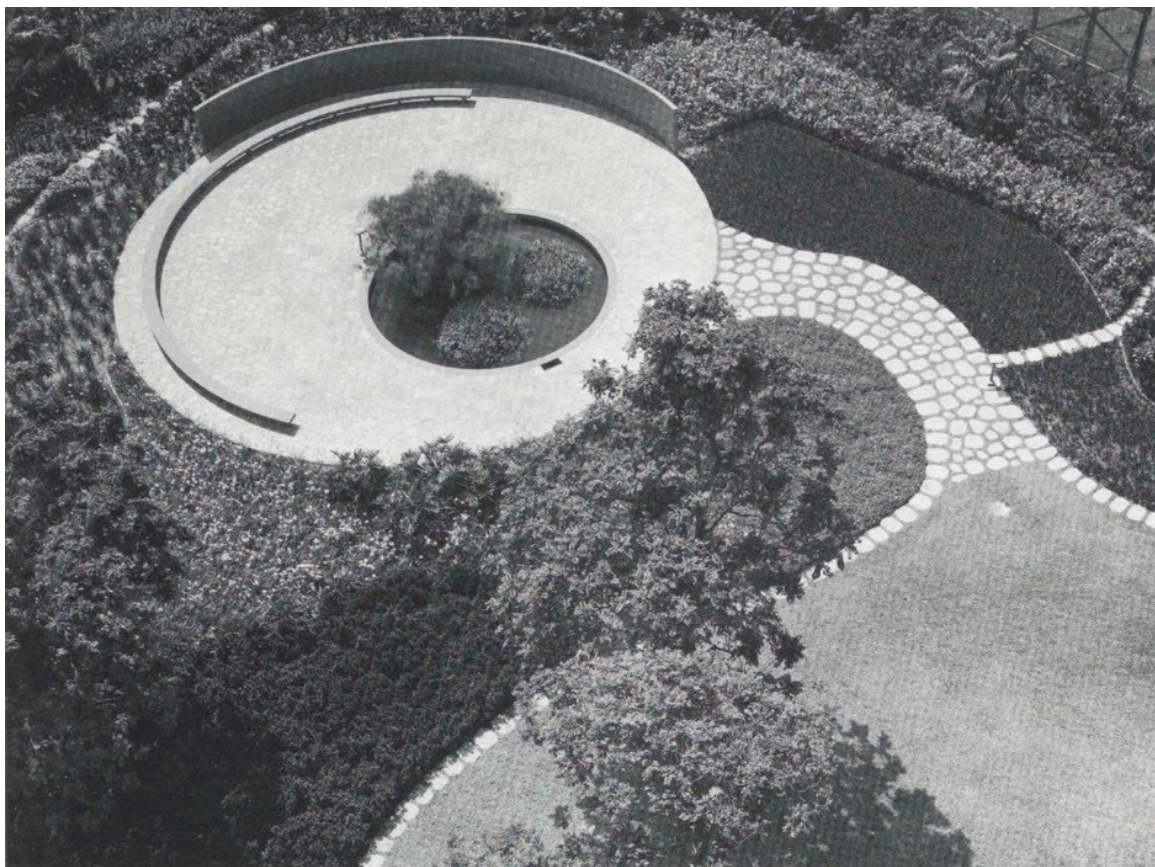
However, still in Riegl (op. cit), we can imagine the difficulty in the choices of what to preserve and how to do it, imbuing ourselves with a critical spirit that directs decision-making, when technology is incorporated. The updating of hospital buildings cannot wait for the discussion on how we can preserve the premises of modernity in the face of the arrival of new technical and scientific elements.

In 2010, a survey of the façades of the hospital was made for its recovery, after which a document was prepared: Basic Project for the Restoration of Hospital da Lagoa. After updating its facilities, to welcome new diagnosis and treatment equipment, or in order to meet Health Surveillance requirements, the hospital was able to develop these actions, accompanied by a thorough conservation work (GARRO, 2010).



Picture 6. Outpatient Block, Hospital da Lagoa. Source: NEMS, Rio de Janeiro, 2016.

Hospital da Lagoa also underwent an attempt to restore and revitalize its gardens, with an original project authored by landscape architect Roberto Burle Marx, using the existing documentation. Documents were collected from the depositary office of the landscape projects and architect Haruyoshi Ono, his collaborator. The work began, but due to some changes in the direction of the hospital, besides some difficulties its management was going through, it was postponed.



Picture 7. Garden of Hospital da Lagoa, by Burle Marx, 1955. Source: Adams, MoMA, 1991.

Authenticity in preservation

With the statements mentioned above and observing the concepts recently discussed about the conservation of modernism monuments, especially in the case of health institutions, such as Hospital da Lagoa, we were faced with the issue of the authenticity in the choices of the interventions the building went through. To illustrate this discussion, we turn, once again, to Célia Gonsales:

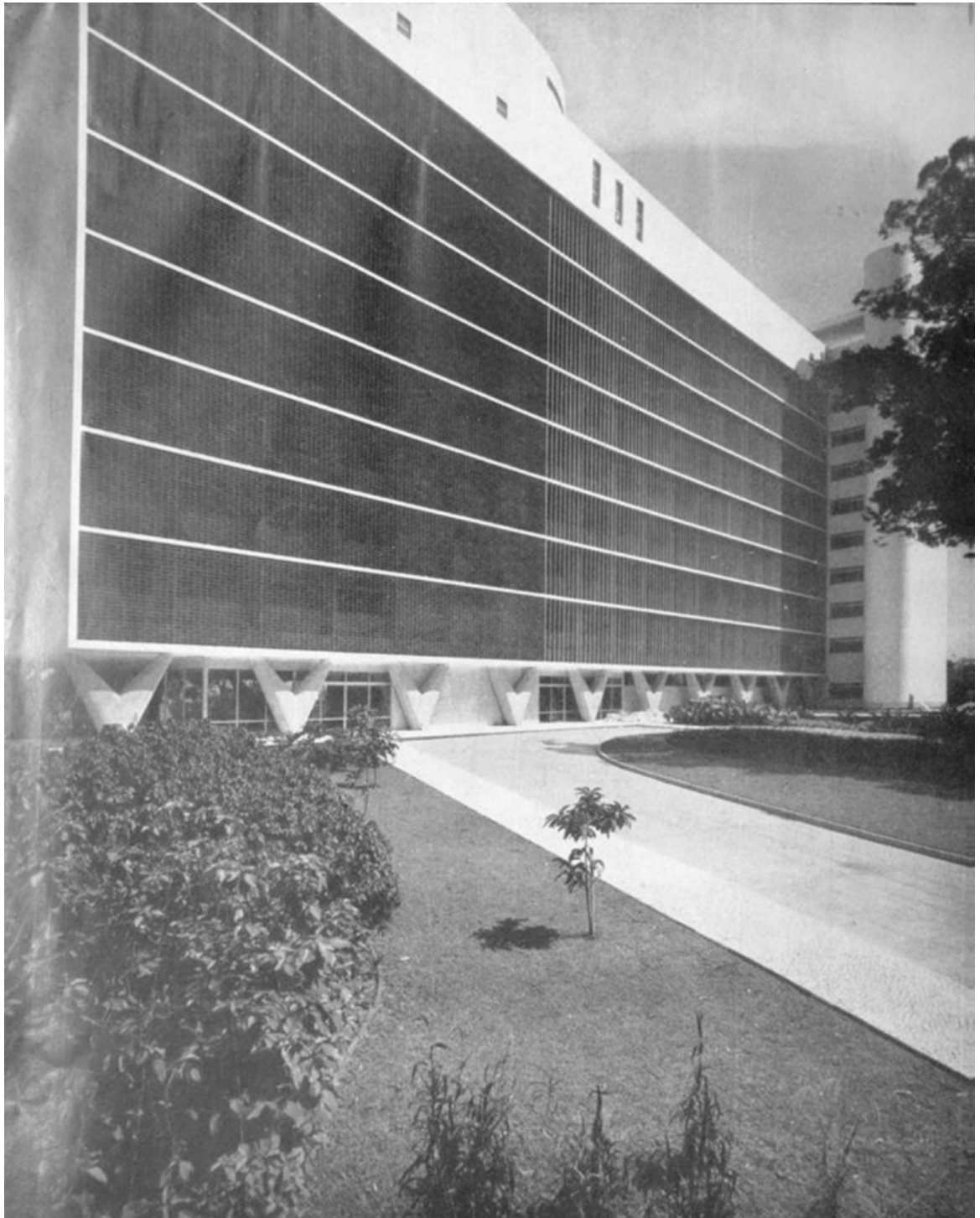
The authenticity in relation to architectural monuments always contains an idea of the passage of time, the recognition and valorization of the object through the marks obtained in its historical development. Modern architecture in general is not efficient in this respect and this explains in some way its particularity in addressing this theme. (GONSALES, 2008 , p.13)

Thus, there are difficulties in temporal distancing, present in ancient monuments, in which it is not necessary to assume a posture of reflection and search for values dear to cultures or the history of art and architecture. In the case of modern buildings, we do not yet have, for the most part, the passage of time to impress a remote aspect, which induces us to seek its representativeness and value in the passage of years and in

the symbolic construction of its presence in the landscape of the city. And, even more serious, the passage of time in modern buildings denotes, most of the time, only a lack of proper conservation of the building.

As we have discussed, it is in the verification of the equation of the fundamental issues of modernity in a work of architecture that can be the secret of its acceptance by the community and thus its true authenticity (GONSALES, 2008, p.13).

We may, then, assess that authenticity, in the case of modern architectural structures, should be linked to cultural factors that the work represents. Reflections on the issues of conservation and restoration of modern monuments require the establishment of choices and clear positioning of what should be erased and what should be maintained, with the analysis of the functions developed there, in order to ensure the continuity of use. There must be a search for ensuring the quality of interventions, so that it can be configured, however updated in the technology offer, copies of the testimony of illness and healing of the time of its conception, its design technique and the temporal translation of its implementation and relationship with the city, so that they can characterize a testimony of the memory of health.



Picture 8. West façade of Hospital da Lagoa. Source: Módulo, Revista de Arquitetura e Artes, 1959.

Final considerations

Health buildings, and, in particular, modern buildings, such as Hospital da Lagoa, studied here, may have their preservation corroborated by the strong connection, in their programs and their implementations, with the public health policies of the time of their conception, which reinforces what was mentioned in this article about the choices and knowledge of the history of the building in addition to the premises used in the interventions of updating through time.

It is important to highlight that the hospital presented here was included in the list of architectural works to be protected and filed under the inventory of health buildings, in Docomomo International's *Homework*, in 2012, which addressed modern Brazilian hospital architecture, its hospitals and sanatoriums.³

Even with the numerous problems surrounding the conservation and maintenance of Hospital da Lagoa, its architectural structure remains a landmark of modern architecture and an example of the application of its concepts and typology in the conformation of complex buildings, such as a hospital institution, challenging the passage of time and the impact of successive technology incorporations.

For such reasons, we consider Hospital da Lagoa a fundamental testimony of the history and articulated development of medicine and architecture, evidencing the arrival of new times and the establishment of modern man reasoning and image. In addition, we recommend the analysis of the restoration and preservation actions it went through recently become the object of study and reflection to point out guidelines for the conservation of these and other examples of the memory of health practices in Rio de Janeiro.

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³ The documentation work of Hospital da Lagoa in partnership with Docomomo International has its record (Plug report) prepared by researchers Ana Albano Amora, Inês Andrade and Renato da Gama-Rosa Costa (DOCOMOMO, 2012).

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Recommendations for planning and carrying out renovation works in functional hospitals

Author

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Abstract

Planning renovation works in operational hospital environments is a complex activity, which requires careful and a multiprofessional knowledge that goes beyond engineering, entering the spheres of nursing and medicine. With this article, we try to contribute to the dissemination of good practices in this field, through a methodology aimed at generating planning recommendations. During the investigation of the minimum care necessary for the planning and execution of renovation works and expansions of hospitals in operation, a checklist of points of attention and risk matrix was elaborated, demonstrating some actions that can be taken to mitigate critical points and guide construction staff with little experience in works within healthcare facilities. The study was based on a bibliographic survey and on an analysis of relevant standards and legislation. At the end, a number of actions are recommended for the various professionals involved in the planning and execution of works in hospitals, including the Hospital Infection Control Commission, patient-safety teams, suppliers and other workers of healthcare facilities, in order to avoid harm to patients and health organization as a whole.

Keywords

hospital planning, renovation works, risk matrix.

1 INTRODUCTION

According to Mattos (2019, p.19), the construction industry has been one of the productive branches that have presented the most significant changes in recent years. The intense competitiveness and globalization of markets, the demand for more modern goods, the increase in the emergence of new technologies, the change in the degree of demand of customers and the reduced availability of financial resources for the realization of enterprises have made business organizations realize that investing in process management and control is indispensable, because without this mechanism the enterprises lose sight of their main indicators: time, cost, profit, return on investment and cash flow.

In the case of investments in Health Care Facilities (EAS), mainly in renovations and expansions of hospitals that are in operation and cannot stop their operations, it is necessary to apply planning tools that help reduce their impacts, which can range from safety of patients, decrease in hospital unit revenue, dissatisfaction of building users, poor application of investments, among other risks inherent to the absence of a correct and continued planning.

This research aims to contribute to the dissemination of good practices, guidelines and minimum care that are necessary for the planning and execution of renovation works and expansions of hospitals in operation, through the preparation of a checklist of points of attention and a matrix of risks, demonstrating some actions that can be adopted to mitigate critical points and guide the teams of professionals working withing healthcare facilities.

2 LITERATURE REVIEW

2.1 Project lifecycle

Um empreendimento de engenharia deve ser desenvolvido seguindo uma sequência lógica de desenvolvimento do produto final, executando as fases do ciclo de vida desse empreendimento em tempo factível, para alcançar os objetivos traçados para cada fase, gerando produtos que serão dados predecessores para fases sequenciais (MATTOS A. D., 2019, p. 27).

As distintas fases de um empreendimento, desde sua concepção até a execução, são apresentadas na imagem abaixo, na qual são indicados os marcos que os profissionais do setor utilizam para aferir a evolução do projeto e da construção. Por exemplo: anteprojeto, projeto básico e projeto detalhado (SBCC: Grupo de Trabalho GT 4, 2012, p. 17).

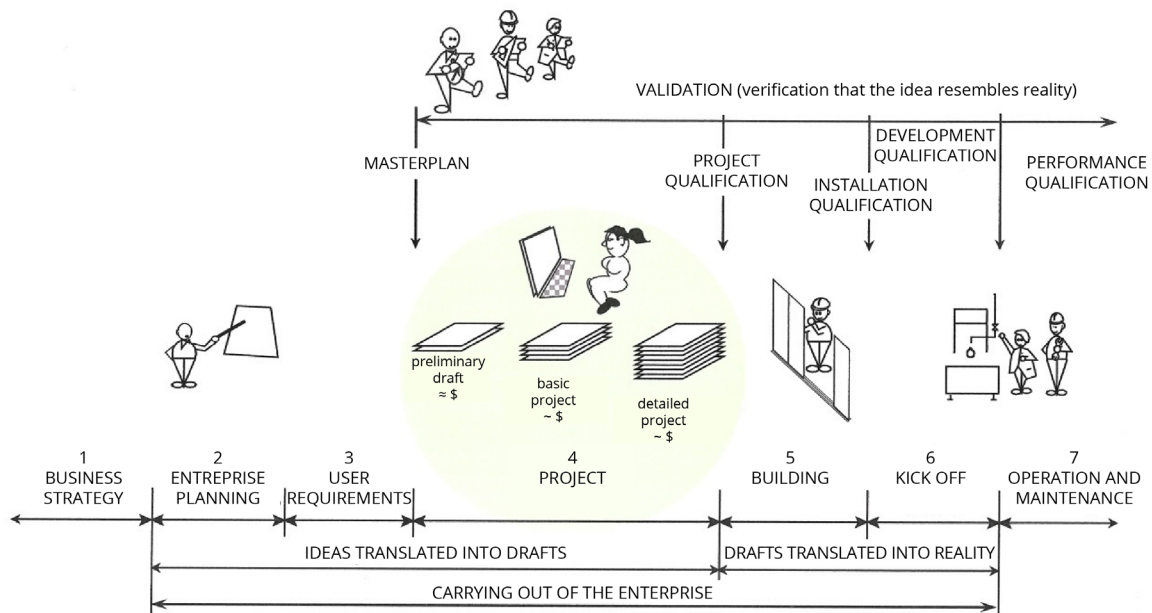


Image 1. The project in the business life cycle. Source: SBCC - Working Group, GT 4, 2012. (translated)

The intervention stages include: elaboration of the Strategic Masterplan, the Hospital Physical Masterplan, Management of the Building Documentation, and the Planning and Elaboration of Projects, reaching the Contingency Plan and the Execution of the work itself, from which the Commissioning takes place, followed by further steps after the execution, such as the elaboration of As Built projects and the Manuals of Use, Operation and Maintenance, as we will see in the following points.

2.2 Strategic master plan

In the strategic scope, any investment action in a health enterprise, whether a renovation or an expansion, should be the result of strategic planning, since "healthcare buildings are living organisms in constant adequacy to the strategy of the companies which occupy them" (BROSS, 2013, p. 196).

The core of strategic planning is how to answer the following questions: What to do to achieve the objectives set by the institution? How to develop the steps, aiming to achieve the desired purpose? When to trigger actions in this direction? How to generate a favorable future with the objectives outlined? (PEREIRA & GALVÃO, 2005, p.73).

The core of strategic planning is the first step towards the elaboration of a Master Plan, clearly establishing the reason for the existence of the

healthcare facility, because all institutions must initially have a reason for being, an objective or an institutional mission, which is a kind of operational summary of its nature and its central values, synthesized from the following points: what it does, why it does it, where it does it, for whom it does it, and how it does it (BADERMANN DE LEMOS, 2017, p. 9).

2.3 Hospital Physical Masterplan

Also in the planning context, the hospital physical masterplan aims to diagnose the existing physical infrastructure and define its potential for use, for a long period, and should be flexible enough to adapt to the needs of future change, in a structured enough way for financial decisions to be made, also providing for the needs of reforms and expansions according to the execution in phases, in order to organize circulations and connections with new works, demonstrating the sectorization of the units and the changes envisaged in each stage (MENDES, 2018, p. 90).

In this context, the hospital physical masterplan becomes an indispensable part in the planning of the organization, being fundamental for the physical-functional reorganization of an existing hospital and, in the development of an architectural project of a new hospital, serving as a device for defining the types of interventions to be proposed, based on the existing capacity of the existing physical infrastructure and the perception of projections care demands (LEMOS, 2017).

The absence of medium and long-term planning will result in invisible pseudo savings, which will affect the future performance of the institution and, when it cannot be directly measured, for example, may prevent a new imaging diagnostic unit from being deployed in the hospital as a result of the recent implementation in the same location, a warehouse and a laundry unit (MADRIGANO, 2006, p. 9; CARVALHO, 2014, p. 65)

2.4 Document management of the building

Another essential item for planning and executing renovations and expansions in healthcare facilities is the document management of physical infrastructure. Particularly in health buildings, it is essential to keep projects constantly updated and compatible (BITENCOURT & COSTEIRA, 2014, p. 46), and this care with the document management of the building is not only a good practice, but a matter of safety of the patient and users of the building.

The availability of the project on site is mandatory, as provided for in RDC No. 189/ANVISA, which establishes in Article 5th that “ the owner must keep filed in conjunction with the project approved by

Sanitary Surveillance in the topics related to complementary projects of structures and facilities, when it fits, as provided for in item 1.3 of the resolution" (ANVISA, RESOLUTION - RDC No. 189, 2003), summing up this determination through RDC No. 63 of 2011 in Article 23rd which says:

"...the health service must keep available, according to its type of activity, documentation and registration referring to: I - Basic Architecture Project, approved by the competent Sanitary Surveillance." [...] VII - Preventive and corrective maintenance of the building and its facilities" (ANVISA, RESOLUTION-RDC No. 63, 2011).

2.5 Planning and projects

After having defined which works and renovations will take place in the healthcare facility with the respective physical-functional programs of all units/environments to be deployed and/or renovated, the institution can start the development of technical architectural and engineering projects safely (MADRIGANO, 2006, p. 69).

After defining the scope of the project, the feasibility studies for the project are initiated. This is the phase when investors study its feasibility and make the estimative of costs, as noted by Nascimento (2015):

"The great importance of a cost estimate lies in making feasibility analyses of the project, allowing choices of alternatives to be adopted in the detailing stage of the projects, without fixing the high burden of preparing a budget" (NASCIMENTO, 2015).

It is observed that the advantage of conducting a good feasibility study is clear when compared to the possible costs of making changes during the phases of design and construction.

Another point to be taken into account before the decision-making, during planning and designing phases, is related to hospital infection control, which can be carried out through studies of the risk control, aiming to integrate infection control and epidemiology into the planning process of hospital infrastructure projects and enabling, through this planning tool, the early mapping of risks to patients, as well as the identification of possible interruptions of essential services for patients (COUTO, R.C, 2009, p. 363).

Therefore, an inadequate analysis of the risks of dissemination of hospital infection will possibly result in failure in the definition of precautionary barriers to control hospital infection in the area of the work and in its immediate surroundings. The lack of financial resources for the correct sealing of passage areas, with the installation of sidings and other

elements, can cause problems during the execution of the work, which can be avoided if such elements are foreseen since the phase of project development (PADULA, 2017).

2.6 Contingency Plan

Concomitantly with the planning of architectural and engineering projects, the elaboration of the contingency plan aims to map the risks involved in the execution of the work, as well as to define people who will be responsible for acting before, during and after its execution.¹

According to Padula (2017), Ribeirão Preto Medical School's Hospital das Clínicas, University of São Paulo HCFMRP – USP, outlined a contingency plan encompassing several actions to predict, avoid or mitigate risks, as well as to improve the understanding of all parties involved in the project of the work or renovation (PADULA, 2017).

1 Contingency: it is the situation of uncertainty regarding a given event, phenomenon, or accident, which may or may not occur, for a given period of time. [...] So, the objective of a contingency plan is to enable preparedness and response to be effective, protecting the population and reducing damage. According to Normative Instruction No. 02, of December 20 2016, Contingency Plan is the document that registers the planning elaborated from the perception of the risk of a certain type of disaster and establishes the procedures and responsibilities (Brazil. Ministry of National Integration. National Secretariat of Protection, 2017, p. 21).

Item	Share	Objective
1	Appointment of the Project Administrative Manager	Represented by a technical advisory server, this professional is assigned to all projects where there is the possibility of direct or indirect interference in care, its main tasks are: to give science to all areas involved in the project; to participate and monitor the entire process of planning and execution of the work, in order to ensure, before the Engineering Division, that the contractual requirements with the expected quality are met; establish the systematized monitoring of the work or renovation, in order that potential setbacks or deviations from compliance with the actions provided for in the Manual are identified in advance and reported to the Administration.
2	Manual of Planning and Monitoring of Works	Describe the attributions and actions to be developed by each of the areas involved in the construction projects.
3	Risk Assessment	Bring more clarity to the definition of the barriers of precautions against hospital infection to be used in each work. Make possible the specification and prior allocation of the necessary financial resources to be foreseen in the budget worksheet of the work.
4	Preparation of two checklists verification and the Term of Responsibility	Form to be delivered to the company that is the winner of the execution of the work. Developed from the content of the Monitoring Manual, these instruments aim to give science and systematize the evaluation of compliance with actions, which ensure the quality and safety of the performance of the care activities of the area under construction, and those of its surroundings.

Table 1. Actions adopted by HCFMRP - USP for contingency of works. Source: PADULA, 2017 - adapted by the author.

It is observed that the strategy adopted by HCFMRP-USP gave great importance to the concepts about flows in the preparation and approval of projects of renovation works, in addition to considering the regulations and good practices adopted by the organization for the execution of the works and their respective phases; the obligations of the contracted company; the particularities for carrying out works with the hospital

in operation; greater understanding and commitment of the parties involved, during the execution of the work with regard to the risks of hospital infection; better control of access of people in the work; improvement in signalization, hygiene, transportation, disposal of debris and implementation of protective barriers in the area under construction (PADULA, 2017).

2.7 Execution of the work

When carrying out works in functional hospitals, it will not always be possible to carry out construction or renovation activities as planned and within the desired time, which is why it is essential to plan them in advance to reduce their interference in daily hospital activities. It should be taken into account, in this process, that there are still few companies specialized in hospital works, which is why it must be ensured that it is clearly transmitted to all the actors in the construction all information concerning hospital environment specific standards and rules (ANVISA, HOSPITAL SAFETY) .

In this context, some ABNT rules already bring some points to be followed regarding good practices in the execution of hospital works, such as:

- **NBR7256 of 03/2005** - Air treatment in healthcare facilities - Requirements for design and execution of facilities.
- **NBRISO14644-4 of 04/2004** - Clean rooms and associated controlled environments - Part 4: Design, construction and start-up.
- **NBR12188 of 03/2016** - Centralized systems for the supply of medicinal gases, gases for medical devices and vacuum for use in health services.
- **10/2017 NBR 13587** - Health Service - Oxygen Concentrator System (SCO) for use in centralized medicinal oxygen system - Requirements.
- **NBR16651 of 04/2019** - Fire protection in health care facilities (EAS) - Requirements.

Based on these regulations, we highlight on Table 2, below, some of the main points of attention related to protocols to be adopted during the execution of works and renovation in healthcare facilities and controlled environments:

Item	Regulation	Standard of the work
1	NBR7256 of 03/2005 - Air treatment in health care facilities (EAS) - Requirements for design and execution of facilities	6.3.7 Construction [...]
		6.7.3.7 - Maximum care must be taken during assembly to keep the inner surface of the ducts clean; the ducts must be manufactured in a clean environment, carefully cleaned internally, capped on both sides and taken to the assembly site where they will be opened on one side and connected to the stretch already installed, and so on. It should be ensured that internal cleaning of the installed ducts is maintained.
2	NBR12188 of 03/2016 - Centralized systems for the supply of medicinal gases, gases for medical devices and vacuum for use in health services	4.11.1.13 Before installation, pipes, valves, joints and connections must be properly cleaned of oils, greases and other combustible materials, according to CGA G-4.1.
		4.44.1.14 After cleaning, special care should be taken when stocking and handling this material in order to avoid recontamination prior to final assembly.
		4.11.1.15 Pipes, valves, joints and connections shall be closed, buffered or sealed to prevent foreign objects from penetrating them until the moment of final assembly.
		4.11.1.16 During assembly, segments that have remained incomplete must be closed or buffered at the end of the working day.
3	NBR16651 04/2019 - Fire protection in healthcare facilities - Requirements	4.11.1.17 The tools to be used in the assembly of the plant and terminal distribution network must also be free of oil and grease.
		11 Requirements for renovation and expansion
		11.3 General requirements 11.1.3 The intervention phases shall be properly planned in order to avoid obstruction of emergency exits. If the original emergency exits are temporarily obstructed during the intervention, alternative escape routes and exits should be provided for each phase of the intervention.

Table 2. Points of attention in ABNT concerning specific standards for healthcare facilities. Source: ABNT- adapted by the author.

2.8 Commissioning

The commissioning phase is the result of an entire process, which aims to ensure that the systems and components of a building or industrial plant comply with the requirements and operational needs of the customer, concerning its design, installation and testing of operation. (SGS, 2018)

In this context, ABNT standards provide for some points of attention to be followed regarding the commissioning of the healthcare facility physical infrastructure, such as:

Item	Regulation	Regulation highlights concerning the commissioning of the work
1	NBR7256 of 03/2005 - Air treatment in healthcare facilities - Requirements for design and execution of facilities	7. Commissioning of facilities [...] 7.4 Site delivery report A report detailing the procedures adopted, with the record of the results of all tests and measurements performed, should be prepared in accordance with ABNT NBR 10719. The report shall certify that the installations have been designed and executed in accordance with the requirements of this Standard and shall be approved by the supervision of TAB Services and supervision agents.
		5 Test for commissioning of the installation of the centralized system. [...] 5.1 After the installation of the centralized system, the network must be cleaned with medicinal air and tests shall be carried out in accordance with 5.1.1 to 5.1.10. [...] 5.1.10 These tests shall be carried out in the presence of a representative of the health service, who shall sign the test report together with the assembler and shall keep, in its archives, the updated designs and designs of the gas and vacuum distribution networks.
2	NBR12188 of 03/2016 - Centralized systems for the supply of medicinal gases, gases for medical devices and vacuum for use in health services	

7 Final check	
3	7.102 In addition to the requirements contained in Section 7 of ABNT NBR 5410:2004, the facilities covered by this Standard shall be subject to verifications a) to e) below. Checks must be carried out prior to installation and replacement of the installation, i.e., after deployed and after any change or repair: NBR13534 of 01/2008 Low voltage electrical installations - Specific requirements for installation in health care facilities (a) functional testing of supervisory insulation devices of medical IT schemes and acoustic and/or visual alarm systems; (b) measurements to verify that the additional equipotentialization meets requirements 5.1.3.1.101 and 5.1.3.1.102; (c) verification of the conformity of additional equipotentialization with the requirements of 5.1.2.1.103; (d) verification of compliance with rules 6.6.6 relating to security services; (e) measurements of the leakage current in the secondary circuit and in the transformer housing of the medical IT scheme.

Table 3. Points of attention in ABNT concerning specific standards for healthcare facilities.
Source: ABNT, adapted by the author.

It is observed that commissioning must be carried out in all phases of the enterprise, from the project phase to the delivery of the enterprise, being generally executed in the construction and assembly phase, thus avoiding failures and difficulties in the operation and maintenance of industrial plants after the complete installation (SGS, 2018).

2.9 As built and Manuals of Use, Operation and Maintenance

The quality of the technical documentation, elaborated during the phases of design and execution of the work, and its direction to elucidate issues related to the stages of conservation, use and maintenance, and the operation of the equipment in a systematized way, in the form of manuals, has been an instrument to improve communication in the process (ABNT, 2011).

With regard to As built project, NBR14645-3, of 12/2005, establishes the minimum requirements of which systems and building elements should be characterized throughout the execution of the work and after its completion, so that the owner of the building can have the record of the systems that composes its physical infrastructure (ABNT, 2005).

With regard to the building manuals, NBR 15575-1:2021 establishes it is up to the builder and developer to prepare the manual for the use, operation and maintenance of the building, also following the requirements set out in ABNT NBR 14307, which details the warranty deadlines applicable to the various construction systems (ABNT, 2021).

All this pack of documentation on the physical infrastructure of the hospital will serve as a basis for future maintenance and conservation actions of the building, as well as for possible further interventions for renovations and expansions, assisting in the identification and mitigation of risks, as well as saving time during the decision-making phases of projects (BITENCOURT & COSTEIRA, 2014, p. 46).

3 Methodology

To achieve the overall objective of this research, we framed the following strategy:

- To assess, through a bibliographic survey, what are the good practices adopted for planning and execution of works in operational hospitals;
- To prepare a checklist with the main points of attention to be observed when planning works in healthcare facilities;
- To validate the checklist with points of attention, after being verified with experts and companies that plan and carry out works at healthcare facilities;
- To develop a risk matrix² risks based on the checklist, demonstrating the actions to be taken to prevent and mitigate negative events during expansion and renovation works in healthcare facilities.

During the bibliographic survey, we referred to references of planning and control of works, such as those from Aldo Dórea Mattos (MATTOS A. D., 2019), as well to *Guia para Projetos de Áreas Limpas*, by Brazilian Society of Contamination Control - SBCC (SBCC: Working Group GT 4, 2012), which addresses the planning of works in controlled environments. Based on these literatures, the general scope of the checklist was elaborated.

2 [...] the risk matrix is a tool that allows managers to measure, evaluate and order risk events that may affect the achievement of the objectives of the unit. [...] A risk matrix is a tool that qualitatively classifies impact and probability weights. [...] In general, risk events located in the quadrants defined as high risk and critical risk are generally considered indicative of the need for stricter controls, while risks located in the small and moderate risk quadrants would be indicative of more moderate controls. It also points out that in some cases there would be no need to implement controls and/or even remove controls (MINISTRY OF PLANNING, DEVELOPMENT AND MANAGEMENT, 2017).

During the literature review, we also consulted other authors and technical standards of ABNT that approach generally or specifically themes related to: Strategic Masterplan; Hospital Physical Masterplan; Building Management Documentation; Planning and Projects; Contingency Plan; Work Execution; Commissioning; As Built; and Manuals of Use, Operation and Maintenance; all topics related to the planning and execution of works in healthcare facilities, as shown in Image 10.

We also highlight that regarding the Contingency Plan, we referred to bibliographic sources in the area of nursing and infectology, since this theme is transversal to health care activities and physical infrastructure of healthcare facilities.

Therefore, once the macro themes of the check list were structured, we consulted in the bibliographic references the points considered to be more relevant to be observed in the act of planning and carrying out works in a functional hospital and, then, we sought advice from professionals working in the planning and/or execution of hospital works, in order to validate whether the themes identified as a point of attention are relevant.

Once the checklist was validated, we framed a risk matrix, pointing out the impacts and actions to be carried out in order to mitigate or avoid damage, during the planning and execution of works, being consulted a specialist in risk management to guide the model adopted.

As for the methodology adopted for the elaboration of the risk matrix, we used as a reference the Risk Matrix Guide of the Ministry of Planning, Development and Management; and as a scope of this matrix, the macro divisions proposed in the points of attention checklist.

4 Result and discussion

Based on the research carried out, it was found that, in order to plan a health enterprise, design it and, in particular, carry out works in operational hospitals, it is necessary to have a multidisciplinary team including engineers, architects, healthcare professionals, administrators, suppliers and other necessary actors.

In addition, it was observed that, in order to obtain good results in the execution of works in a hospital environment, it is essential to have a well-organized health institution, with business strategy, risk assessment, hospital physical master plan, infection control plan, contingency plan, building document records and well-designed architectural and engineering projects.

Based on the macro steps defined, the checklist and the risk matrix were elaborated, with points of attention that must be assessed during the planning and execution phase of works in operational hospitals. Such points were validated with experts from the field; the checklist began at the macro stage of Strategic Masterplan, then we developed the risk matrix, highlighting the relevance of the points of attention raised (see Tables 4 and 5).

Item	Stages	Items to verify	Yes	No	Not applicable	Observations
1	Strategic Masterplan	Does the institution have its own Strategic Masterplan?				
		Does the institution has its own Risk Management Plan?				

Table 4. Checklist: Point of attention - Strategic Masterplan. Source: from the author himself.

Risk 1: Lack of Lack of a Strategic Masterplan			Critical Risk
Probability (P): Level of impact – 4 – High		P x Average (I) =	16
Id	Damage	Impact	Level of impact (I)
1	Hiring of projects and building works with lacking viability studies	The contractor party's expectations are not fulfilled	Level 4: High
2	Shutdown of projects and building works already initialized	Friendly or litigious contract breach. Payment of the project and the execution that will not be used	Level 3: Moderate
3	Increased costs and deadline is postponed for the conclusion of the work hired	Contract addendum concerning deadline and costs	Level 3: Moderate
4	Organization loses income	Client evasion and increased levels of dissatisfaction among building users	Level 4: High
Id	Preventive Action	Professional in charge	
1	Hire projects and building works that follow the Strategic Masterplan	Institution's Director Board	
2	If the project and the building works are not following the Strategic Masterplan, consider the possibility of reviewing it	Institution's Director Board and further institution's managements	
Id	Corrective Action	Professional in charge	
1	Do not proceed with the hiring of projects and building works that are not aligned with the company's Strategic Masterplan	Institution's Director Board	
2	Assess the impacts of a shutdown of projects and building works	Institution's Director Board and further institution's managements	
3	Begin the elaboration of a Strategic Masterplan and verify deadline for its conclusion	Institution's Director Board and further institution's managements	
4	Verify if the projects and the building works meet the guidelines in the Strategic Masterplan being framed	Institution's Director Board and further institution's managements	

Table 5. Risk Matrix - Risks1 and 2: lack of strategic planning. Source: from the author himself

Based on the points of attention exposed in the checklist and the risk matrix, it was observed that, without proper strategic planning for decision making, to know when and how to start an investment in renovation and expansion works in the hospital, with or without a risk management policy, with an established committee and with elaborate risk map, the decision to be taken³ becomes fragile and, consequently, the feasibility study of the inaccurate undertaking, which may cause conflicts and complications in the participation of the actors of the work, “[...] the future is uncertain and cloudy when senior management seems to start each day with a blank sheet of paper, without a planned continuity of actions” (PEREIRA & GALVÃO, 2005, p. 74).

As for the hospital physical masterplan, it was verified that it is a very effective strategic tool for forecasting future investments in health organization works, which contributes to mitigate risks in the institution’s investments and stakeholders. From this context, the main points of attention were described in the checklist and in the risk matrix for the Hospital Physical Masterplan.

Thus, it is concluded that, while the costs of renovation are high, especially in long-time neglected buildings, and as there is usually little resources available, there is a willingness to spend first on aesthetic work, but it is essential that the most critical interventions are made before cosmetic work (MENDES, 2018, p. 100) , so the hospital physical masterplan will be the basic tool to prevent resources from being applied in works that are actually pseudo savings.

As for the building management documentation, it was noticed throughout the research that this should be the basis for planning future works in a hospital unit, and that the projects as built and the manual of use, operation and maintenance will directly impact both the management and technical decision-making and the phase of implementation of the business strategy. Thus, the inexistence of such physical infrastructure documentation may imply the following problems: [...] “carry out operations in the various facilities without an accurate mapping of their distribution; [...] depend on the memory of former employees or exchange complete systems of facilities for lack of a correct survey of their distribution” (BITENCOURT & COSTEIRA, 2014, p. 46).

3 O mapa de riscos deverá ser atualizado continuamente, pois, com o avançar do projeto, alguns riscos podem ser eliminados com a conclusão de determinadas atividades, outros riscos podem ser reduzidos e novos riscos podem surgir. Portanto, o gerenciamento de riscos é uma atividade que deve ser encerrada somente após a conclusão dos projetos” (BARRAL, 2021).

Once established what to do, why doing it, where to do it and for whom to do it, comes the part of planning and elaborating architecture and engineering projects, which will fit the what to do, and should be developed within the technical premises of the various technical regulations of ABNT and ANVISA, following the basic stages of project development: preliminary study; preliminary project; basic project; and executive design. Such stages are defined in NBR16636 - Preparation and

development of specialized technical services of architectural and urban projects.

With regard to the contingency plan, during the bibliographic review, it was identified as an essential macro step, since the planning phase serves to map the inherent risks, such as those related to hospital infection associated with the work being carried out. It is at this stage that decisions are made for possible relocations of patients, partial or total interruptions of care services.

As for the point of execution of works in functioning hospitals, little was found of specific engineering literature on the subject, being more addressed in the field of nursing and infectious diseases, besides in some specific norms of ABNT, that deal with building systems of healthcare facilities and, occasionally, in other standards that deal with buildings in general.

It was also verified, throughout the research, that the issues related to patient safety and hospital infection control are intrinsic to the work, so such precautions do not affect only patients, but the system of the land. In addition, it was found that the main measures related during the execution of the work are related to precautions related to construction sites.

As for the stages as built and manual of use, operation and maintenance, it was observed that such documentation is essential for the final phase of the work, and should be carried out and updated throughout the execution of the work to maintain the traceability of what is being built and acquired.

With regard to commissioning, throughout the research, it was observed that it is not enough to build the work, but it must also be tested and validated in order to be verified whether the construction was carried out according to the project requirements, assessing safety through tests and reports that will attest the building can be put into use and operation.

All these steps aim to avoid economic damage to health organizations, material damage to buildings and its users and, consequently, damage to the health of patients, who seek hospital buildings to heal themselves.

5 Final considerations

The initial impression on the subject led us to believe it would be a simple task to sum it up, however when researching it more thoroughly, a range of essential information was observed that would not fit in

the few pages that an article supports, especially when considering the multidisciplinary nature of the theme.

It is notorious that, in hospitals, as well as in healthcare facilities in general, works are very common, and most of these places are always under renovation, in search of better serving the user getting more market share in the health market. Thus, it is recommended to all professionals involved in the planning and execution of works in hospitals that faithfully follow the provisions of the established technical standards, as well as seek to include, throughout the entire planning of such works, health professionals, patient safety teams, suppliers, and others hospital workers to avoid or minimize harm to patients and to the health organization as a whole.

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How spatial syntax can help mitigate the effect of future pandemics in Brazil

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Abstract

The main objective of this study was to establish the relationship between the spread of Covid-19 in Brazil and federal highways. The spatial syntax, a field of study of urbanism, was used to analyze the space and its relationship with people, being the level of integration of the pathways the dominant factor. In this research, the level of integration of the highways was allied to the density map of those infected with the virus, thus allowing us to analyze the relationship between the two. The development of this work occurred through the case study during the months of January, February and March of 2020, in Brazil. The study was done horizontally, because only the repetition of the facts could confirm or not a pattern of behavior. The number of infected and spatial characteristics were considered as primary data, and the overlap of these allowed us to establish the relationship between the parties. The study found that the most affected regions were those with more integrated highways. The proposed guidelines aim at the optimization of human and economic resources.

Keywords:

spatial syntax; Covid-19; strategies against the pandemic; federal highways; preventive lockdown.

Introduction

The first half of 2020 will forever be marked in history: the first pandemic in the digital age. The application of georeferencing and technology has never been given so much importance, which allows us to know the exact location of an event, and all its effort so much has been directed to Covid-19. Knowing where it all started and how is its scattering pattern are frequent news in the newspapers. Perhaps the biggest question is how to eliminate the coronavirus, and here it is worth mentioning that the effort is multidisciplinary, but, regardless of the field of study, there are two main approaches: prevention and combat.

The combat has not been done only by those who are in the day to day dealing with the problem on the front line, being necessary to highlight the heroic acts of health professionals, but also by those who have made their contribution from within their laboratories, through research that allows a better understanding of this phenomenon and understanding of the disease. The situation that the world goes through is that of war, and victory is only possible when the enemy is understood. The search to understand the enemy has included professionals from the biological and health sciences, who seek to understand how the virus works, how its life cycle works, and other fronts; mathematicians and statisticians, who seek to form models that can predict the behavior and dispersion of the virus; psychologists, psychiatrists and sociologists, who seek to understand the effects of this social isolation in the human psyche; and so many other professionals. Geologists and urban planners have studied the georeferenced data collected that allow the study of the phenomena that, together with other fields of study, make it possible to understand patterns that can help in preventing the spread of this disease.

The Theory of Spatial Syntax was proposed by Bill Hillier and his collaborators at the University of London in the early 1980s (SABOYA, 2007). And although it is still considered to be something new scientifically, it is used with great effectiveness as a project tool of new cities and in the understanding of behavioral patterns. This branch of urbanism establishes that a phenomenon will only occur if it is possible that the agent can reach its destination, thus creating an event. The concept of social isolation¹, or even lockdown², has the same principle: once people stop interacting, the virus will not be able to spread, because the means of transmission has been eliminated.

It was possible to determine where it all started, Wuhan, China. As, today, much more than “where it began”, society wants to know how it spreads and how we can combat it. The search for the vaccine or the medicine that will fight this virus is of great help, but it solves just the current problems. A new virus may not be defeated by the coronavirus vaccine or by the

1 Social isolation: stay far enough away from other people so the coronavirus – or any pathogen – can't spread. That's why establishments, schools and universities were closed, and events ended up cancelled.

The Ministry of Health recommends keeping a distance of 2 meters away from other people (UNIFESP, 2020).

2 Lockdown - Mandatory measurement – It uses the state force. Lockdown means, specially, to cease dislocations. The idea is to prevent people flow and, therefore, prevent them to meet. One of its consequences is economic shut down (UNIFESP, 2020).

Covid-19 medicine, but it will exploit the same weaknesses found by this virus, spreading with the same ease. Despite the importance of a solution to the current pandemic, research should also analyze the factors that led to the successful dissemination of Covid-19. This work aims to contribute to future planning to avoid the situation currently experienced.

Development

Understanding the pattern of disease dispersion will allow knowledge and implementation of practices that prevent future pandemics. The spatial syntax is dedicated to the study of phenomena that occur due to the displacement through terrestrial pathways, allowing factors related to configuration to be measured mathematically and visualized in a clear, objective and impersonal way (SIQUEIRA, 2020). About the use of spatial syntax, Siqueira (2020, p. 36, highlights of the author) says:

When we look at the road system, we realize that some streets intersect; in this region where the roads intersect we call “knot”. The theory of knots dates back to the end of the 19th century (ROSA 2012, p. 80) and studies topology, that is, studies the structure of objects without worrying about size, shape or geometry. From this information, we can then create a map that encodes the number of knots of each pathway. This map helps us understand how many other streets it interacts with. Reiterating what Saboya (2007) said about Spatial Syntax and the integration of pathways: “of the possible measures of syntactic analysis, the main one is the so-called integration”. It is useful in predicting pedestrian and vehicle flows and understanding the logic of localization of urban uses and social encounters.

Although the virus initially spread through air passengers, once these passengers reached their destination, the spread of Covid-19 was made among people in their places of residence: homes, neighborhoods, cities and states. This work aimed to study land routes (main means of contact between cities), evaluating the relationship between federal highways in Brazil and the spread of the virus. Data on the evolution of the virus were made available by the Ministry of Health, which, in partnership with the Federal University of Rio Grande do Sul (RS. UFRGS, 2020), with ArcGIS software, developed the Coronavirus Panel, with all cases confirmed in Brazil between February 26 and April 30, 2020.

The study related the map created by UFRGS with the axial map³ federal highways, where the integration was evaluated to determine this relationship. The axial map was generated from the drawing of the highways (Map 1) in AutoCad software, and its analysis, in the Depthmap software. The criterion adopted was to observe in a visual way the relationship between the two maps, looking for situations in which the facts were repeated and could establish a pattern. The virus

3 Map axial: is the form of configurational representation that reveals the accessibility of the existing plot through a chromatic scale, grayscale or line thickness. This accessibility may or may not correspond to actual flows, with a view to the convergence of different variables (including paving types, the existence of magnets, political crises, etc.). (MEDEIROS, 2006, p. 507).

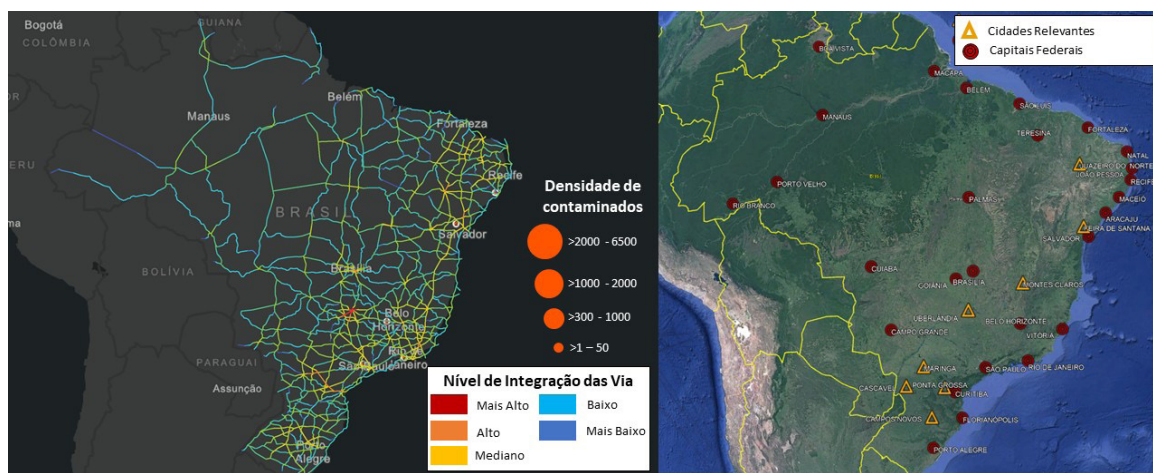
behaves dynamically, so the study evaluated the maps mentioned also dynamically, evaluating the dispersion per fortnight. The month of February 2020 was evaluated as a whole, because no relevant change was identified in this period.



Map 1. Federal Highways of Brazil. Source: BRASILINFRA (2020).

4 Integration: possible measures of syntactic analysis, the main one is the so-called "Integration". It is useful in predicting pedestrian and vehicle flows and understanding the logic of localization of urban uses and social encounters (SAVOY, 2007).

The axial map was studied with a focus on the integration⁴ of one road with the other, that is, the existing facility to reach a certain location (Map 2). The integration map encodes each pathway by color, and its performance is demonstrated from the warmest colors (red) to the coldest (blue), in which a radius was used for the calculation of $n=7$. Highways with warmer colors represent greater integration; thus, the study tried to establish the relationship of the most integrated pathways as vectors of dissemination of the virus.



Map 2. Map Brazilian highways x Covid-19. Source: Author (2020).

By relating Maps 1 and 2, it can be observed that some cities act as integration centers, such as the cities of Juazeiro do Norte (CE), Feira de Santana (BA), Rio de Janeiro (RJ), São Paulo (SP), Uberlândia (MG), Brasília (DF), Montes Claros (MG), Porto Alegre (RS) and Cascavel (PR). In addition to these cities, it is possible to note that the stretch or intersection of some highways also has a better degree of integration, as can be seen in the stretches of BR-116 (Rio de Janeiro to Fortaleza); BR-376 (Maringá to Ponta Grossa); at the intersection between BR-232 and BR-116; and in Campos Novos (SC) region, with BR-282 to the west and BR-470 to the east. Unlike the virus, this analysis can be done in a static way, in which only the construction of a new highway would alter the indexes found. Thus, the analysis found here was maintained over time. The following is a view of the virus scatter maps allied to the integration map:

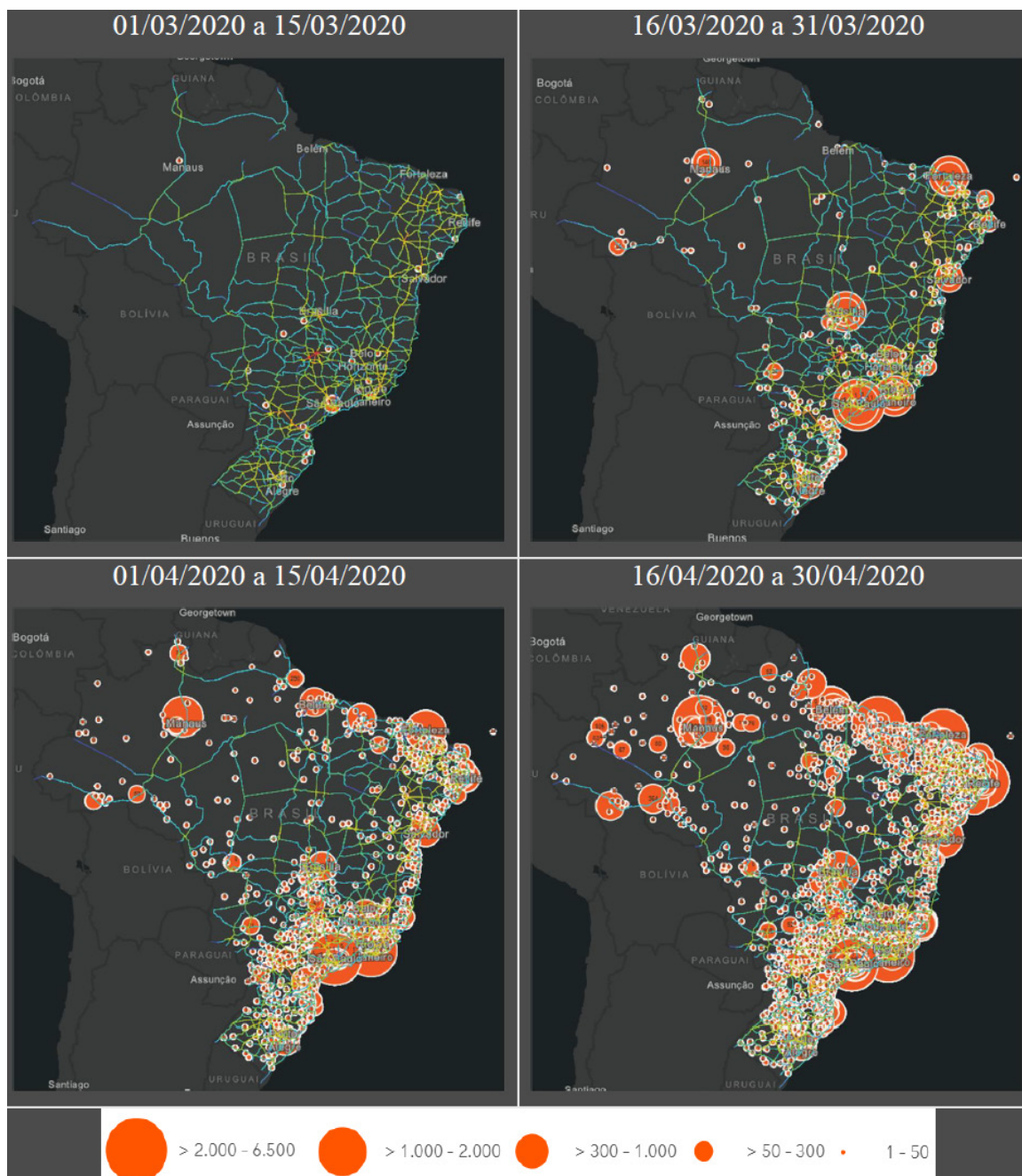
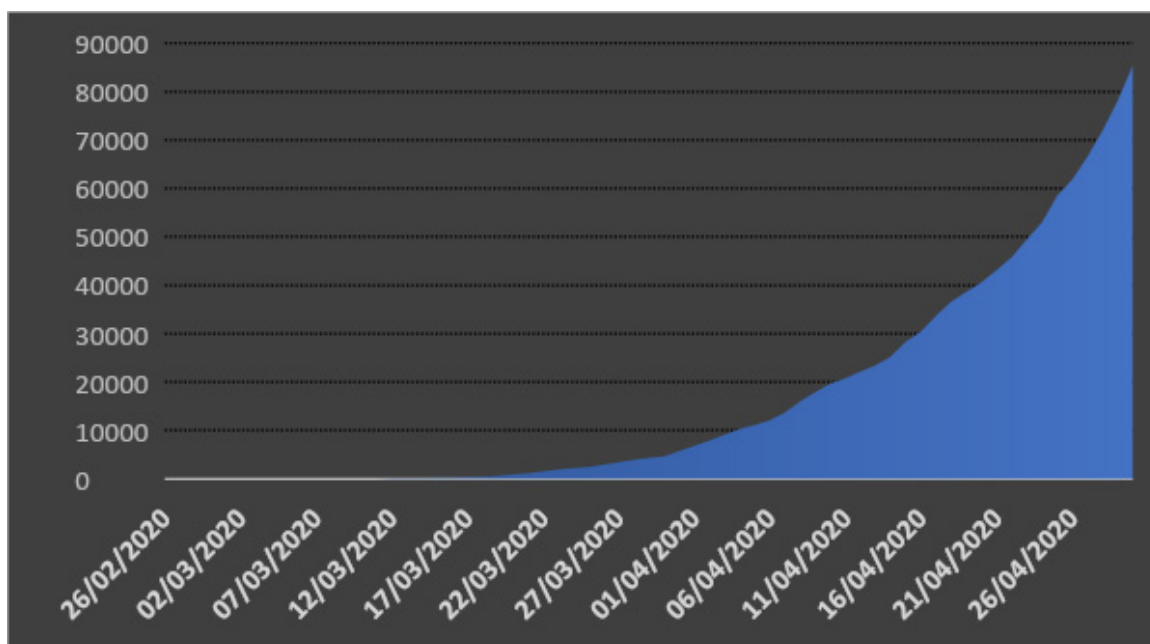


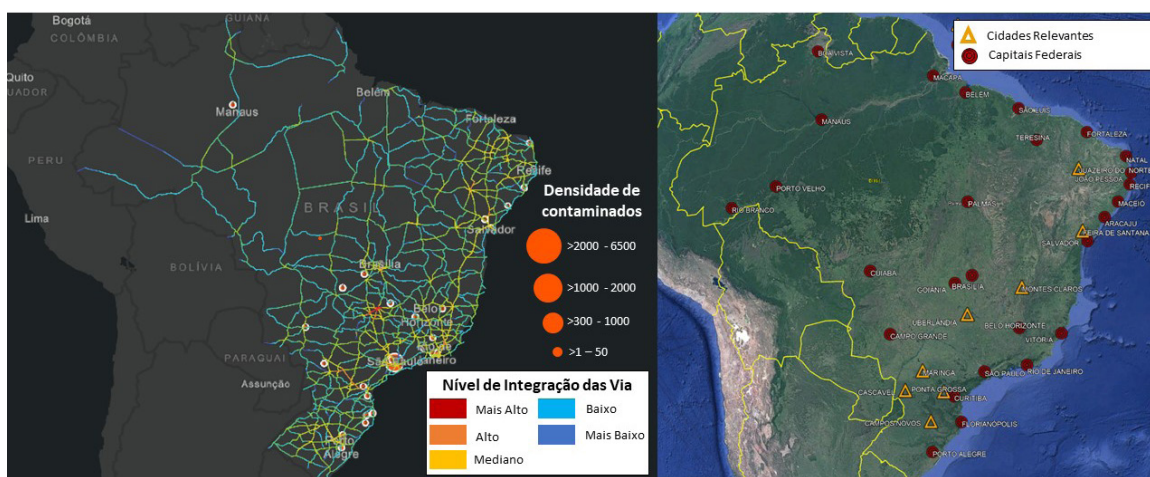
Table 1. Dispersion of confirmed cases of Covid-19 over time – 1st/3/2020 to 30/4/2020. Source: Author, based on a map of UFRGS (2020).

The maps in Table 1 show the rapid growth in the number of confirmed cases of Covid-19 in Brazil, a fact that is even clearer when analyzing Graph 1, which demonstrates it more accurately.



Graph 1. People infected with Covid-19. Source: Author (2020), based on data from BRASIL.MS (2020).

For a better understanding of this phenomenon, the map in Table 1 is shown individually and enlarged. Thus, the first half of March 2020 was studied, as shown in Map 3.

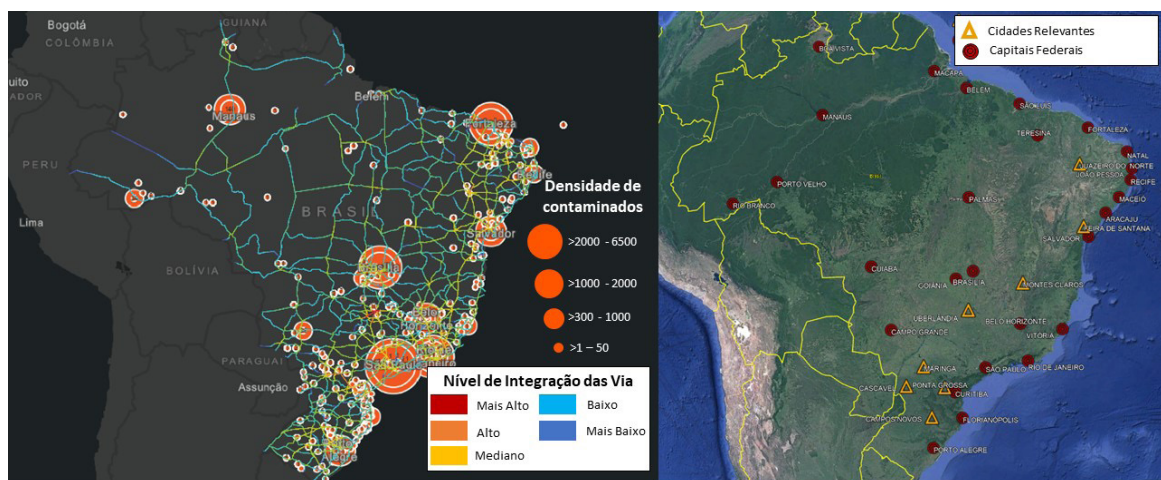


Map 3. Map Brazilian highways x Covid-19 - 1º/3/2020 to 16/3/2020. Source: Author (2020).

Map 2 shows only a few cases recorded in February, in which infected cities have in common the large flow of passengers at their airports, which is the gateway to the virus in our country. It is noteworthy that the month of February was marked by a popular national event that lasts day and night, Carnival, greatly increasing the flow of passengers.

Map 3 depicts the first half of March 2020, in which the change is notorious, both in Map and Table 1. In this period, only the cities of São Paulo and Rio de Janeiro had a significant record, presenting 64 and 23 cases, respectively. It was from this moment, in which the virus began to become notorious in Brazil, that its diffusion between cities did not occur exclusively by air, but also by land.

The second half of March, shown by Map 4, shows the evolution more clearly, even enabling the creation of vectors that pointed to the direction of dissemination of Covid-19.



Map 4. Map of Brazilian highways x Covid-19 contamination - 16/3/2020 to 31/3/2020.
Source: Author (2020)

Map 4 shows a higher occurrence in Brazilian capitals, which reinforces the thesis that part of the spread occurred by land, since the capitals are interconnected by the federal highways, and the highways BR-116 and BR-101, which connect several coastal cities, from the north coast to the southern coast of the country, can be highlighted. Another highway evidenced by the map is BR-381, which connects Belo Horizonte to São Paulo, and BR-040, which connects Belo Horizonte to Rio de Janeiro. The roads mentioned have a high level of integration, thus reinforcing the idea that the most integrated highways facilitated the spread of the virus.

Still there is the fact that, among the capitals, the tourist cities had more expressive numbers of contamination. It is necessary to remember that the virus has an incubation period of up to 14 days (BRASIL.MS. FIOCRUZ,2020). Thus, Carnival and the school holiday period this year were of great contribution to the spread of Covid-19. This fact may have demonstrated a trend: the initial spread was mainly caused by tourism.

In addition to tourism, regions of large industries and agricultural production also encourage the transit of people, in this case, people from small towns and rural areas tend to be contaminated by people who have been in large centers.

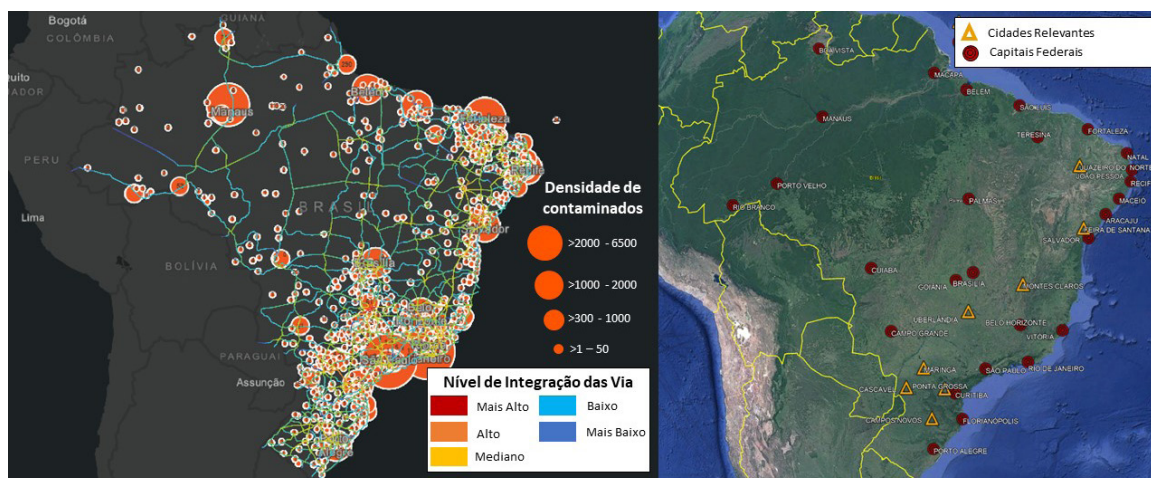
The month of March also marked the beginning of social isolation in almost all states of the federation, as shown in Table 2 (data taken from Decrees published by each Brazilian state in 2020):

Social isolation marked a time when the transit of people in cities and between cities was reduced to the minimum necessary. Thus, the next cases in this study showed little or no influence from people outside their cities or states, with the predominant participation of the local population of each city.

Acre	16/03/2020	Maranhão	30/03/2020	Rio de Janeiro	11/03/2020
Alagoas	18/03/2020	Mato Grosso	31/03/2020	Rio Grande do Norte	13/03/2020
Amapá	17/03/2020	Mato Grosso do Sul	16/03/2020	Rio Grande do Sul	01/04/2020
Amazonas	23/03/2020	Minas Gerais	19/03/2020	Rondônia	17/03/2020
Bahia	16/03/2020	Pará	18/03/2020	Roraima	27/03/2020
Ceará	19/03/2020	Paraná	16/03/2020	Santa Catarina	23/03/2020
Distrito Federal	19/03/2020	Paraíba	17/03/2020	São Paulo	13/03/2020
Espírito Santo	13/03/2020	Pernambuco	14/03/2020	Sergipe	16/03/2020
Goiás	13/03/2020	Piauí	23/03/2020	Tocantins	21/04/2020

Table 2. Beginning of social isolation by Brazilian state. Source: Author (2020), based on Decrees of the states and territories.

Although, by the end of March 2020, virtually all units of the federation had decreed social isolation as a measure of containment to the advance of Covid-19, due to the incubation period of the virus, the effects were felt only after the second half of April.



Map 5. Map of Brazilian highways x Covid-19 contamination - 1st/4/2020 - 15/4/2020. Source: Author (2020).

Map 5 already shows a very large number of infected cities, but the vast majority below 300 cases, as can be seen by the orange circles representing the density of contamination in the place. Virus contagion occurs exponentially (BRASIL.MS. FIOCRUZ, 2020), that is, each contaminated person transmits the virus to at least 16 people, as shown in Illustration 1.

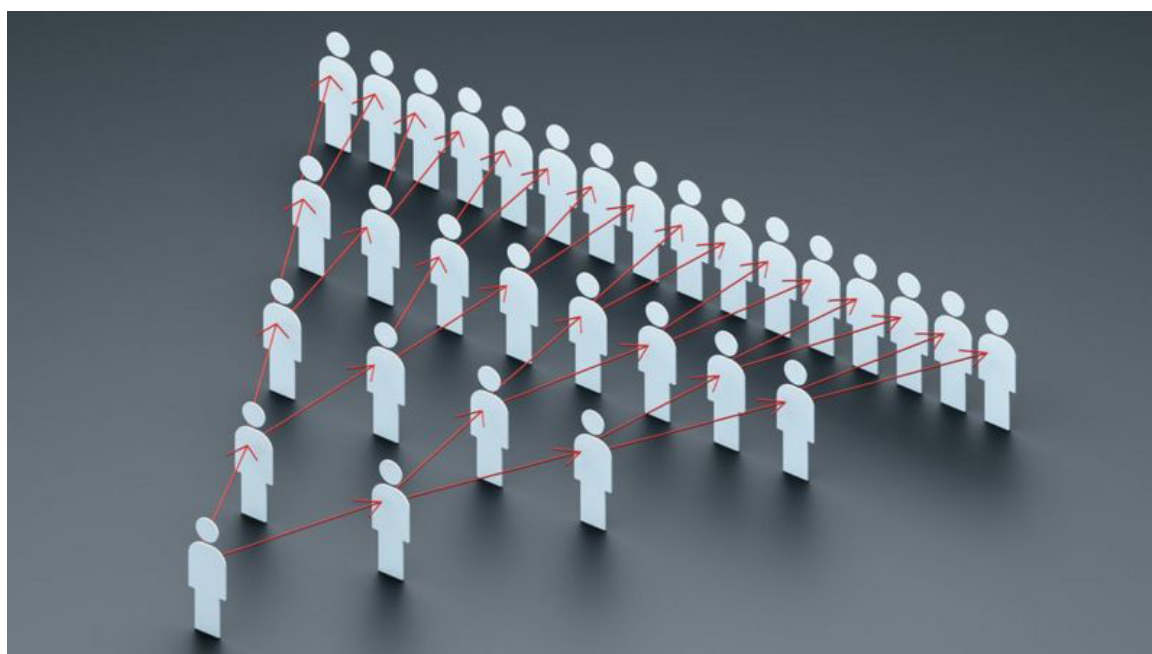
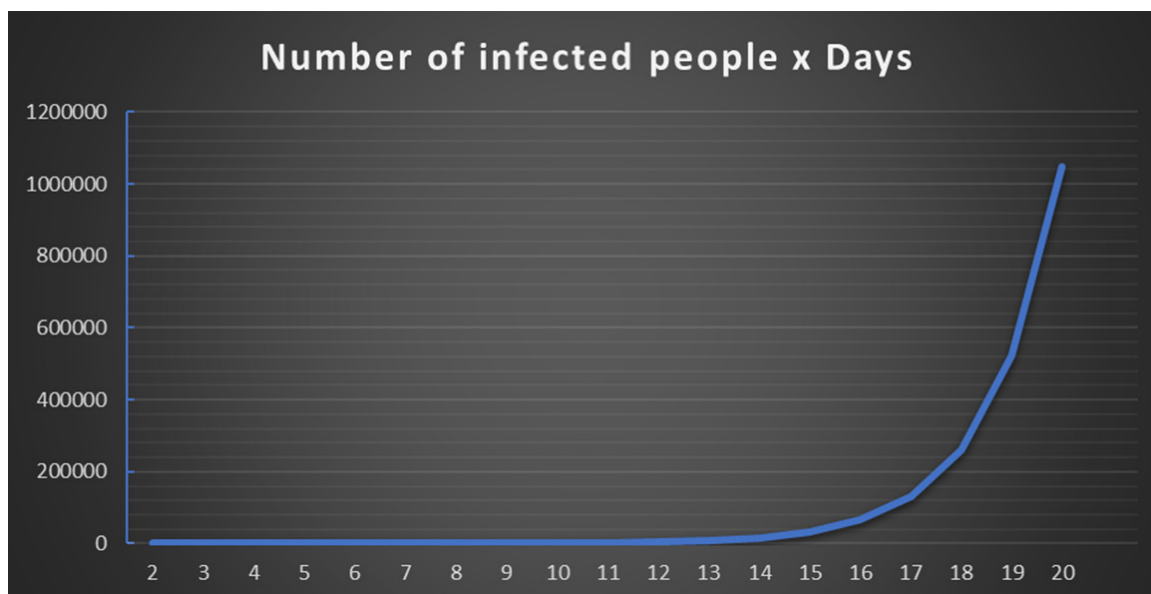


Figure 1. Progression of Covid-19 contamination. Autor (2020). Source: BBC (2020).

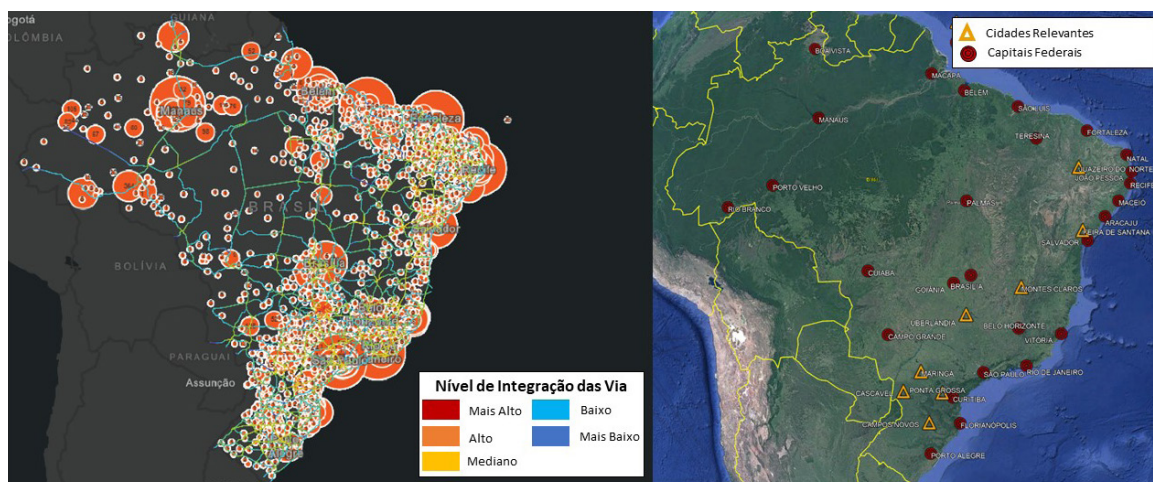
Thus, two people contaminate four, and so on, generating an exponential series, as shown in Graph 2. After 20 days, it is possible to reach 1,048,576 infected people.



Graph 2. Number of infected people x days. Source: Author (2020).

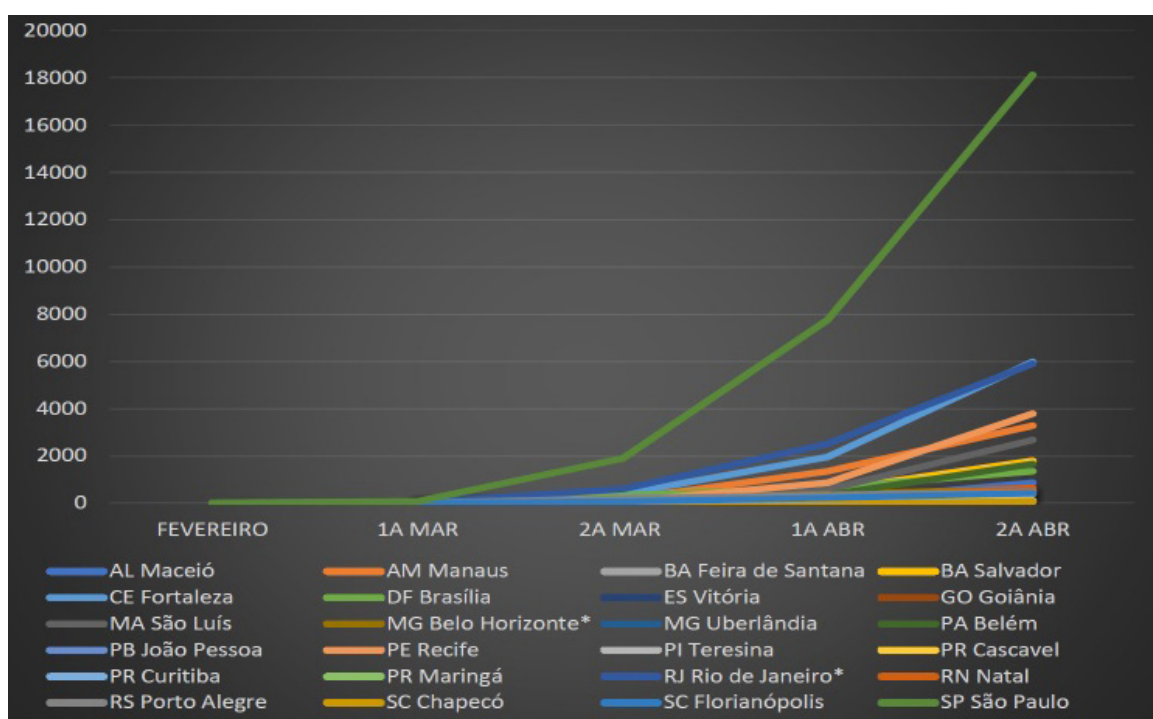
Therefore, only one individual can be responsible for the contamination of 300 people in just under 18 days, making it very difficult to point a pattern to the high number of infected people. Despite the difficulties, it was noticed that the facts observed in Map 4 continue to be related to the dispersion of the disease. In addition to the facts listed in Map 4, it is possible to notice that the Covid-19 spreads radially in the capitals, with a higher occurrence in the nearest cities, which are on the highways with better level of integration. Although both BR-116 and BR-101 act as vectors of virus dissemination, it is perceived that BR-101 exerts more influence. The cities of São Paulo and Rio de Janeiro formed a major spreader of the disease, because large and important highways that depart from these major cities helped transmit the virus.

Map 5 also shows that Manaus, because it is isolated from other infected cities, in a future study, would be the best city to understand the behavior of the virus. This is due to the fact that its population has little contact with other regions, with little external influence and can be considered to have an isolated system. This fact nullifies what is known as the edge effect.



Map 6. Map Brazilian highways x Covid-19 - 16/4/2020 to 30/4/2020. Source: Author (2020).

Map 6 already shows much of the national territory taken by the virus. Due to the confinement, the spread of the virus should occur almost without the influence of transportation through highways, or even by air. The dispersion became almost exclusively done by local agents. Moreover, it was possible to notice that the places that presented high numbers continued in an upward curve, especially the city of São Paulo. Graph 3 shows some of the major cities affected and their behavior during the period of this study.



Graph 3. Major cities affected. Source: Author (2020), based on data from the Ministry of Health (BRASIL.MS, 2020).

Final considerations

The speed with which Covid-19 spread around the world showed the fragility of the world health system, leveling both the most affluent and most needy countries. The pandemic has not only caused a health crisis, but has had serious side effects, especially in the economy. The truth is that, in a pandemic, little can be done to change the world situation, but there are guidelines that can be implemented at borders to preserve the nation.

Until May 18, 2020, Brazil had a budget, from the Ministry of Health, destined to combat Covid-19 of R\$ 24,167,950,734.00 (PRESIDENCY OF THE REPUBLIC, CONTROLADORIA-GERAL DA UNIÃO, 2020), and about 35% of this amount has been spent to date. The annual budget for Health, planned in 2019, for the year 2020, was of R\$ 19.3 billion (EXAME MAGAZINE, 2019), that is, we had not even reached half of 2020 and the annual budget planned was already exceeded. The Covid-19 pandemic has had several effects, which can already be felt, with the economic and undersupply being the most noticeable, but much is still to come.

The work assumes that one must do everything possible to contain the advances of the virus, protecting life to the fullest. But the fact is that the situation experienced resembles a war. The planning is carried out reactively, always after the movement of the opponent. Once the battle is over, there will be several learnings for sure. Certainly, this will not be the last pandemic experienced in Brazil, and this was the central point of this study: to outline containment strategies for a possible new epidemic, not only to preserve life, but also to cause less impact in our country, especially in the economy. Although our focus was on finding solutions for future pandemics, this model is not limited only to this application. The solutions proposed here can be applied in vaccination campaigns, epidemics, as well as in further fields of expertise, besides health. The points of greater integration point to the places where flow control can be more effective.

The study showed that highways and airports were the main diffusers of the virus. With this in mind, there are some observations about the strategies taken. Social isolation was necessary, but it has an inside-out view. In this study, it was observed that this view, in which the population was confined to their homes, tends to be partial, and does not consider the whole. At an early stage, the opposite tends to be more effective from the point of view of spatial syntax, as shown in Illustration 2, adopting a macro view of the situation.



Figure 2. Social isolation x Flow control. Source: Author (2020).

The proposed model is flow control, in which airports and strategic points of some highways were monitored, and only cities with a high degree of contagion suffered strategies, such as social isolation. In addition to the containment aspect of contagion, this would lead to a huge savings for the Union and the Federative Units. Today, resources are allocated as needed and, however much effort, they are always one step behind the problem. The change of strategy would cause resources to be allocated at fixed points, and those infected would be directed to the control points. This policy would also be beneficial in isolating those asymptomatic patients who are generally responsible for much of the spread of the disease. If another pandemic happens, this model will be much more productive and economical, establishing a strategy that will not only be momentary, but that can be used in several other emergencies.

The suggestion is the creation of screening sectors in airports, especially those that receive and offer international flights, especially in tourist cities, with rapid tests. In the case of contamination, within the airport itself, there should be a small hospital with capacity for hospitalization of patients, thus, the passenger would receive medical care until the restoration of his health. The study showed that using spatial syntax, especially the study of the integration of pathways, is beneficial to outline strategies on where to place control points. Let it be clear that the intent of this strategy is not the closing of borders, but the examination of those who comes through, in order to ensure health. The analysis of the axial map and the integration of the highways show that BR-101, BR-116, BR-376 and the departures of the cities of Brasília, São Paulo, Rio de

Janeiro and Porto Alegre are paramount for the control of a pandemic. In the case of highways and cities, small health units could be built for the contaminated, near the inspection posts of the Federal Highway Police, or even have trailers prepared for this service, which could move as needed. These strategies would be much more effective and less impactful from a social point of view, enabling a much smaller economic impact.

This study took into account only federal highways, but their deepening, including state highways and combining the level of integration of roads with statistical data of the flow of people, would further deepen the guidelines proposed here. The aim of this work was to suggest possible guidelines to be taken in a future pandemic, optimizing human and financial resources. Due to the great spread of the virus in Brazil, the points shown here would be of little efficacy at the present time and should be implemented preventively.

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A reflection on the impact of the Covid-19 pandemic on architecture and urbanism

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Abstract

This article aims to show how the moment of social isolation, lived more intensely in the year 2020, can change the parameters of residences in the future. The methodology used was that of explanatory research, in which we analyzed studies that show that the low plants of the houses, and their changes over time, provide an x-ray of the economic-social context lived at the time of their project. The impacts experienced in 2020 should generate a new demand, of a new product (residence), which is not yet available in the market. The study discusses some characteristics the authors believe should change the current concept of residential design. In addition to product changes, the work exposes some social implications, which should occur due to the changes that the current Covid-19 pandemic will require, changing the current urban context. Although we consider the current crisis is temporary, it is observed that the disorders experienced should leave marks and, therefore, it is concluded that the changes identified may impact the future, implying changes that will be due to the moment experienced during this pandemic.

Keywords

architecture after Covid-19; future housing; social developments after Covid-19; urban dynamics.

Introduction

The pandemic generated by Covid-19, which began in early 2020, raised several questions about its implication in Architecture and Urbanism. In the various debates held throughout this year, whether to seek or find a solution to the new challenges posed by the mentioned pandemic to humanity as a whole. After what has been experienced, it is believed that future residential projects will not provide offices for adults and larger places where children can carry out their school activities. It is considered that the houses will no longer have only one computer for the whole family, but one per resident, regardless of their age. All these changes will not only be structural, but will affect behaviors.

In one of these changes, we observed that the families returned to cooking at home, giving even more prominence to the space of the kitchen, something that could already be noticed in recent years, mainly due to the concept of an integrated kitchen and the profusion of television cooking shows. According to the website Consumidor Moderno (2020), when comparing this same period of 2020 with the year 2019, there was an increase of 45% in the number of followers of cook profiles on social networks, such as "Panelinha", presented by Rita Lobo. It was observed that people were literally prevented from leaving home and forced to cook, increasing the time of coexistence, which also implicated a change in the behavior of families, where previously it was observed that each member was an island (Illustration 1).



Illustration 1. Each family member is an island. Source: Today (2018).

Parents are now obliged to assist in the development of their children and their school activities, at a time when the relationship between teacher, student and parents has never been more important in our most recent history. Teachers, from their homes, in addition to their family obligations, need to set up real recording studios, in rooms that once had only normal lighting, and were filled with special lamps, allowing the classes to be recorded and broadcasted with higher quality, getting the same accesses during the day.

It is irrefutable that the social dynamics of people were affected during the pandemic, with profound impacts on our society. Bjarke Ingels (2014 p.1), famous Danish architect, explains how architecture is a reflection of the way we live: "Architecture is the art and science of ensuring that our cities and buildings fit into the way we want to live our lives: the process of manifesting." Thus, it is considered that the moment that society goes through is of great social change, from which, due to the needs, a new model of residence will emerge, taking into account the new social dynamics.

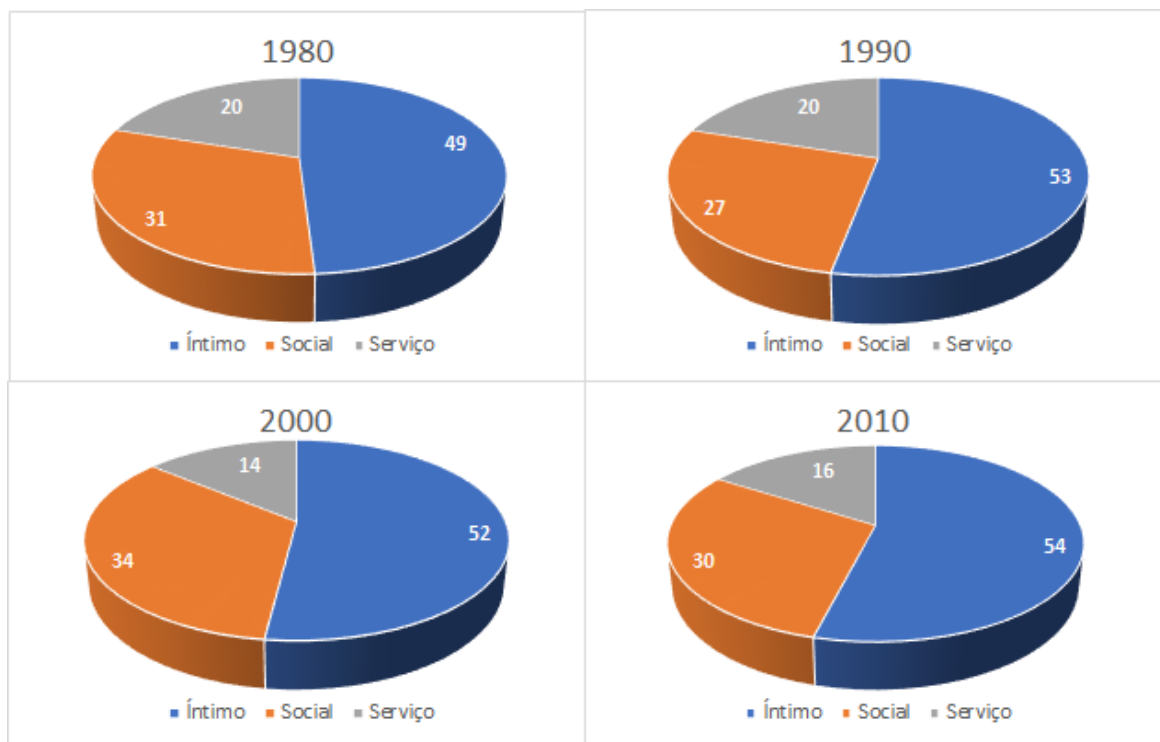
The aim of this article is to put on the agenda some expected changes for future architectural projects, especially residential projects. These changes are based on the social dynamics observed today. To sustain the points presented here, it was briefly shown how, at other times in history, the configuration of a residence was a reflection of the moment experienced by society, more precisely the period between 1980 and 2010. In addition to presenting arguments for design changes, something concrete and tangible, this paper brings to the debate social issues that should happen if society really absorbs some changes in social dynamics as something more lasting.

Development

When the evolution of houses over time is studied, it is possible to see that there have been changes in their configuration and area over time. These changes have always been a reflection of changes in society. This can be verified by the work of architect Aline Carolino (2020), who analyzes the projective change of real estate developments in the city of João Pessoa, Paraíba. Her work studies apartments with similar typologies over the period from 1980 to 2016, evaluating all the plants of 48 buildings, summing up to 104 plants.

In her work, Carolino (2020) uses three guidelines to evaluate residences, and emphasis is given to the dimensional analysis. This concept derives from what was presented by France (2008), in which he relates the total area, the areas by sectors (social, intimate and service) with the size of

the most important space of each sector. Over time, it is possible to see there is a change in the participation of each space in the entire residence, as shown in Graph 1.



Graph 1. Change in the sectors of a residence over the years. Source: Carolino (2020).

About Graph I, Carolino (2020, p.42) still states:

When compared to the average of the sector area of each decade in relation to the average of the total area of the apartments, it was observed that there are variations for projects with different needs programs, depending on the number of rooms. What can be noted is that the apartments with a suite and two bedrooms have higher proportions in the occupation of the apartment to the intimate sector, going from the average of 48% in 1980 to up to 60% in some copies of 2010 (even with the loss of the balcony in the suite). This occurs primarily to the detriment of the service sector, but sometimes the social sector.

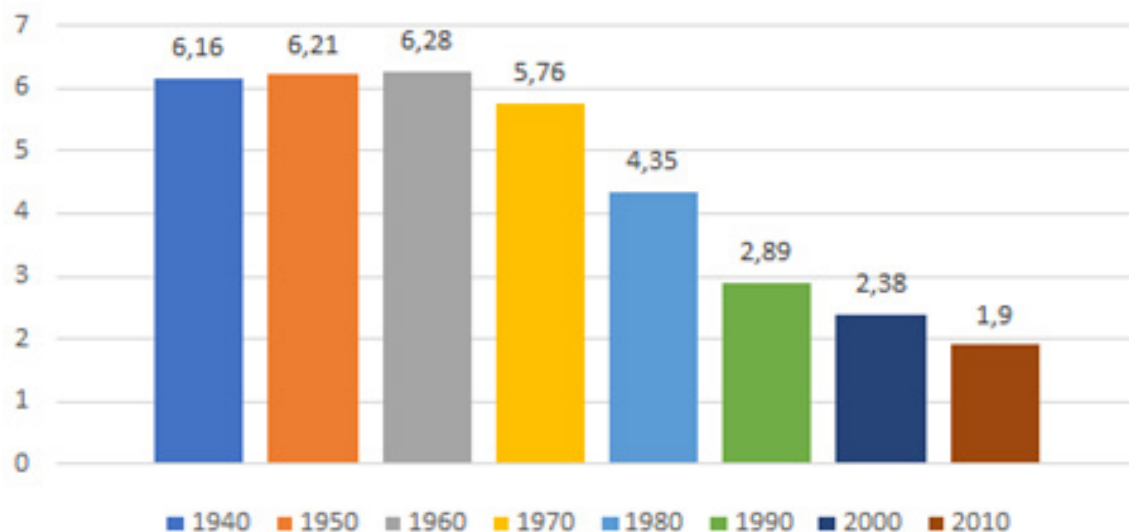
It is evident that, over the years, there has been an increase in the intimate area and a reduction, mainly, of the service area. The typology analyzed was that of three bedrooms with one bedroom combined with a bathroom, standard for the middle class. The research also showed that, in addition to the change of the area in percentage, there was a decrease of up to 30 square meters in the total built. This change went beyond the change in the built area, also reaching the configuration. The first enterprises had facilities for maid, over the years, this room became a reversible room and, finally, it was extinguished.

The 2000s marked the end of the room intended for the maid, and although Carolino's study (2020) had the city of João Pessoa (PB) as her focus, it is known to all that this reality reached all over Brazil. The changes in the three-bedroom apartments were to present consumers with a new product, more in line with their expectations. The extinction of the maid's room is something that almost everyone can identify with. The middle class, in the 80s, had at least one help, who would sleep in her employers' house, often working from Sunday to Sunday. Brazil's Federal Constitution of 1988 (BRASIL, 1988) changed labor arrangements, which changed in part the profile of society. Gradually, this employee began to go home on weekends, and would no longer be available 24/7. This situation is supported by the fact that, before the 1988's Constitution, domestic workers did not have a law to support them, especially with regard to working hours, paid weekly rest, vacations and other rights previously far from the category, as Balduino (2018) states:

The Federal Constitution of 1988 granted domestic workers the right to the minimum wage, the 13th salary, wage irreducibility, paid weekly rest, 120-day maternity leave, vacation + 1/3, paternity leave, retirement, advance notice and social security. [...] The sole paragraph of Article 7 of the FC/88 was amended by EC 72/13, which guaranteed these employees the working hours of 8 hours per day and 44 hours per week. The employer who does not comply with the standard will pay overtime with a minimum of 50% higher than the normal hour.

The age at which children began to attend schools and day care centers also changed the dynamics of homes, without the nanny, something common until then. Social changes were shaping the residences.

Before the 2000s, real estate launches were focused on residences for families of four to five members, but society was breaking some paradigms. The number of buildings that had smaller families as their target audience began to increase, even due to the decrease in the fertility rate (BRASIL. IBGE) (Graph 2).



Graph 2. Birth rate – Brazil. Source: BRAZIL. IBGE (2010).

This fall occurred mainly due to the advancement of women's rights, which, for the most part, were able to leave home and seek professional fulfillment, becoming increasingly independent. In addition to this factor, it became increasingly common couples without children, single people and the elderly who had different needs of the standard family, that is, a couple and two children. This change is evidenced by a study conducted by IBGE between 1995 and 2005 and published in 2006, as seen in the following excerpt:

The Synthesis of Social Indicators reveals that between 1995 and 2005, in the Southeast region, the percentage of families formed by couples with children fell from 56.6% to 48.5%. Factors, such as the growth in women's participation in the labor market, may have caused changes in the structure of Brazilian families: the number of those headed by women grew 35% in the period. This increase has occurred even in families where the spouse is present. The Synthesis also revealed that in Brazil, in 2005, there were almost six million people living alone (BRAZIL, 2006).

This real estate change was not imposed by construction companies but reflected a new social dynamic. What dictated this change were cultural and economic changes. Today, the needs are also changing, and so should rise a new product, molded according to the longings of society.

Another, more recent change in the configuration of real estate occurred due to the fact that many families no longer have a cook, motivated, above all, by economic factors. This situation was driven by the insertion of women in the labor market, since, more busy and far from their homes, people began to eat in restaurants, which is confirmed by Carvalho (2017, p. 484, author's highlights):

In recent decades, the expansion of the industry and the food market outside the home are substantial changes, fostered not only by technological advances in the way of producing, storing, preparing and serving food, but also for socioeconomic and cultural issues, such as the massive integration of women into the labor market and the effective separation between labor and residence spaces in large cities. As Garcia (2003) notes, “due to new demands generated by the urban way of life, the dinner is imposed the need to reconsider their life according to the conditions that provide, such as time, financial resources, places available to feed, place and periodicity of purchases, and others”.

Thus, the family members assumed this role. Despite being a paradigm break for the elderly, and may be difficult to accept, the kitchen integrated with the living room is something that many younger couples have been looking for. The act of cooking, for many, ceased to be a must and became a moment of family conviviality, or even something that is part of the party, being with friends and cooking, rescuing old values from the social dynamics of families. The integration of the kitchen and its social implications should be understood as Carvalho explains (2017, p.1):

The commensality, in this way, would condense the traits of hospitality with those of rituals at the table, besides representing a source of pleasure from the enjoyment of pleasant companies, considering that the act of group eating can assume transcendent psychological dimensions for the individual and create, as Iashley, Morrinson and Randall (2005) defend, unique and unforgettable dining experiences.

Covid-19 is bringing new needs and, as a consequence, new challenges. It would be very immaturity to think that changes do not bring side effects, so in the next section, we present some expected changes in the home product and its possible consequences.

The new challenges

The current situation of social isolation due to Covid-19 caused some dynamics in homes to be altered, situations that were not foreseen.

Today, when you enter a house, you usually go through a social or intimate area, easily connected to the rest of the residence. Due to health issues, the ideal is that one can have a hygiene area before entering the intimacy of the home (Figure 2). This fact can cause future projects to have washbasins and a clothing change area before you can enter the house.



Illustration 2. Hygiene area. Source: Metropolis (2019).

Most people are working from home, which is perhaps the most impactful effect, affecting both homes and businesses. The residences had, for the most part, the dining table transformed into a work table, where each member of the family, in possession of his/her computer, uses part of the table.

This change may bring transformation in the design of the furniture, such as, for example, lower dining table, less imponent, but bringing greater comfort for prolonged use. Until then, it was thoughtless that a house with five members could have everyone needing an office space simultaneously. Added to the situation of those who are working from home, students should also be inserted in this context, because they are prevented from going to school and need a table to be able to perform their activities. Since everyone is in the same environment, the problem arises: each in their virtual meeting, father and mother with their work teams, and children with their teachers, the noise of so much talk is unbearable.

Future real estate launches will probably offer rooms with larger area, so that everyone can be accommodated; or there will be a kind of environment where there will be a large bench with partitions, allowing each one to exercise his/her activity (Illustration 3).



Illustration 3. Collective work station. Source: Author (2017).

The second problem with home office is that many companies have realized the performance of their employees has not been affected by the fact that they are working from home. A survey conducted by DataSenado Institute (2020) interviewed 5,000 people who are working from home. According to the institute, there was an increase in productivity of 41% by employees, and of 38% of the company as a whole. These data are consistent with Nascimento (2020, p. 4), who, in his research, determined an increase between 15% and 30% of productivity. This fact is causing many companies to be rethinking their work model. According to InfoMoney Magazine (2020), Banco do Brasil will close 19 of its 35 office buildings throughout the country. Once other companies take this example, it is easy to imagine empty urban centers. This fact will bring both advantages and disadvantages. The first impact that can be imagined is the reduction in traffic to large urban centers, which can contribute greatly to the improvement of air quality, as well as to the reduction of noise pollution. Thus, Maia (2020, p. 1) brings some benefits that the isolation caused by the pandemic brought to the environment, as seen in excerpt below:

Decreased air pollution in large cities, cleaner waters, unusual passage of wild animals in urban centers, empty beaches with turtles massive spawning. These and other consequences of the reduction of human circulation and their impact on the environment have been reported during the pandemic and are important for reflections on environmental issues on the planet. [...] For the first time in about 80 years, Dhauladhar mountain, which is part of the Himalayan mountain range, could be spotted again in India. This phenomenon occurred due to the drop in air pollution due to decreased production in factories and reduced traffic in quarantine. In China, this reduction has reached 25% since the beginning of the pandemic, and social isolation in the country may have saved between 50,000 and 75,000 people from death from pollution, according to Stanford University.

The first disadvantage would be the abandonment of commercial buildings (Illustration 4), which, if something is not done, will leave such places prone to invasions and crimes. Changes will be necessary in the city's masterplans to allow changes in activities in that sector, such as moving from a commercial building to a mixed-use building, allowing housing. This would be interesting especially from the point of view of public safety, making a sector of the city occupied not only during business hours.



Illustration 4. Abandoned and invaded building in downtown São Paulo. Source: Exarte (2019).

The second disadvantage would be that, with the decrease in commercial establishments, there would be a decrease in the supply of jobs that require less qualification, such as vigilant, maintenance, cleaning, maid, secretaries, and many others. This decrease in supply could bring great social problems, of which it is not yet possible to measure its impact.

The fast pace of the cities and the long working hours caused lunch, a moment in the past of paramount importance for the family, to be abandoned, as already shown in the above excerpt from Carvalho (2017, p.1). The great truth is that the vast majority of people rarely had the opportunity to have lunch at home and, gradually, this event was losing importance in family dynamics. Many have come to rely almost exclusively on delivery services and ready-to-eat food. Social isolation caused families, previously distant at this time, to resume this event as a family habit. Driven by necessity, often even financial one, many who rarely ventured into the kitchen began to prepare their own food daily. The increase in people who started cooking was not the only change, but the pandemic brought several social transformations in eating habits, something that has been studied on several fronts, as we see in Ferreira's (2020) excerpt:

In the pandemic, everything changed places to make room for a new way of life. The way of eating has not been exempted from the impact of social isolation. A study conducted at USP evaluated how Brazilian women, from

different social classes and nutritional states, experienced this moment, affected by psychological aspects in relation to their eating habits and choices. The data show that they cooked more, decreased the going to supermarkets and used more delivery services.

Due to the fact that everyone was at home all the time, this task came to be shared, unlike the generation of our grandparents, when, mainly, women were the only responsible for the kitchen. Now, the family as a whole occupies this task, bringing the need for greater spaces in the future. The open concept or American kitchen (Illustration 5) should be consolidated in the real estate market.



Illustration 5. Integrated kitchen. Source: VivaDecora (2020).

Just like with home office, we believe this new imposed eating concept should also bring an increase in unemployment for people who worked as maids and cooks. Families have sought to restrict other people's access to their homes, without many employees. Since such professions are no longer indispensable, it is our understanding many homes may dismiss them.

Among the spaces of a residence, perhaps this sector is considered of main importance, as Carolino points out (2020, p.11, author's highlights) in the following excerpt:

In the service sector, the apartments until the 1990s, mostly, have programs that have kitchen, service area, maid rooms and service

bathroom, as well as found in apartments in Maceió, AL, Lima and Toledo (2018). Since the 2000s, in the sample studied, this sector has been reduced in terms of its program in a more expressive way. This decade presents, for the most part, only the environments indispensable to it, which are "kitchen" and "service" – the latter often decreased to the minimum possible area, sometimes just the space of a wash basin.

It was precisely the kitchen that, in the midst of this crisis, began to play a major role. This space can be divided into two parts: cleaning and storeroom.

Despite the social isolation experienced, hardly anyone has the condition to spend more than a month without leaving home. It turns out that, after going out, the ideal is that everything is decontaminated, making the service area an important place. The truth is that, even in middle-class developments, this space is limited by the minimum necessary for a washing basin and a washing machine. In our assessment, this has proven insufficient, especially for those who have been forced to keep their work routine away from home. Today, there is much more strictness towards the hygiene of clothes, increasing the flow in the laundry, for which should not be counted only the space for the machine and the basin, but the space to dry and store, with effective separation, clean and dirty clothes. This place, even because there is no longer the presence of the maid as it occurred in the past, was the one that suffered the greatest reduction. The absence of the maid in homes, although much more common today, has been evolving in the mind of architects since the 1940s, as shown by Homem (2003, p.19):

We will verify that, for the first time in São Paulo, the kitchen was thought as an organic whole, which, together with the evolution of domestic equipment, would cause notable changes in relation to the large areas of kitchen activities. Be that as it may, the distribution of the kitchen linked to the North American slope was not unknown, as we saw above. On the other hand, more related to European architecture, modern architects, who began working in the 1930s and 1940s, were aware of the need to organize the kitchen in order to enable users to save steps and energy, even because the difficulty of relying on the maid was increasing. But now it was about the vulgarization of modern cuisine, depending on the production of appliances and related utensils.

The truth, in our view, is that society is in the process of learning, and one of the concerns is how to avoid leaving home. The main reason that leads us to leave the house is still the need for food, so the storeroom should resume its importance. Until recently, many had become accustomed to doing weekly purchases, as needed, but it was not always the case. In the past, during hyperinflation, the practice was to stock, in order to minimize financial damage. About this period, Rossi (2013) explains:

In Brazil, hyperinflation occurred in the 1980s and early 1990s, when rampant inflation exceeded 80% per month – yes, per month. That is, the same product came to almost double the price from one month to the next. Data from Instituto de Pesquisas Econômicas (Fipe) show that between 1980 and 1989, the average inflation in the country was 233.5% per year. In the following decade, between 1990 and 1999, the annual change increased to 499.2%.

With the end of this period, the storeroom was decreasing its participation in the footage of a house. Nowadays, many apartments have only one closet to store food, and many people wish to have more space. The projects of the future should increase this space so neglected until recently.

The emptying of urban centers may be the main concern for urban planners. Brazil was strongly influenced by Modernism, so many of our capitals have commercial sectors with specific zoning. Once the occupation of these sites decreases, it will be possible to have totally empty buildings, abandonment will be the next step.

The abandonment of a building, or even a whole set, implies several social problems. As a place is abandoned, it becomes careless, and soon there will be the deterioration of that heritage. According to the Theory of Broken Windows, developed by James Wilson and George Kelling (1969), as Ortega (2016) explains:

The authors of the theory argued that if a factory window was broken and repaired immediately, people passing through the site would assume that no one cared about it and that, in that region, there was no authority responsible for punishing those responsible for the harmful attitude. Before long, other people would start throwing stones to break the other windows.

The theory shows us that abandoned buildings would soon be places enabling illicit activities. In addition to crime, the place may be an attraction for invasions of movements, such as the MTST (Movement of Homeless Workers), and abandoned buildings in urban centers are the main focus of this movement, as Ramos (2009) demonstrates in her dissertation entitled: “The war of places in the occupations of abandoned buildings of São Paulo”. Today, there is an example of a region in this situation: Cracolândia, in the city center of São Paulo. Ideally, state governments monitor the situation and develop urban plans for these centers and can even refit commercial buildings to serve as residences, often for the low-income population.

By bringing the low-income resident, who usually lives far from the city, to the center, the abandonment of the place will be avoided. Well beyond just new residential buildings, there will be the revitalization

of the centers. Not an aesthetic revitalization, as there are many in our country, but a human revitalization.

Final considerations

The first thing we must understand is that the real estate market, although it cares little about social issues, for the sake of survival, will act according to the market's demands. The new challenges for future housing proposed here will become a reality as there is a demand in the market, or that it becomes a "facilitator" of sales, which brings commercial advantages for construction companies.

When comparing the projects of the 80s with the current ones, we saw that there was a decrease in the total built area. We believe that, hardly, the properties will increase its area, but probably other parts will be sacrificed so that these new environments can be offered. In fact, we are victims of a system that evaluates a property by footage, not by quality. This can be proven when we analyze the code of works of any Brazilian city and note that there are minimum footage, openings and finishes established for a work to be approved. Seeking to avoid the citation of all the codes of all federative units in Brazil, we leave the Code of Works of the Federal District for those who want to verify (Secretariat of State and Urban Development and Housing, Codes of Works of the Federal District, 2015). In addition to the Code of Works, the condition for the construction of a property to be financed by Caixa Econômica Federal – a public-private bank used to promote the real estate market as a state policy – through its Technical Guidance Notebook (2019), deals much more with the minimum issues than the quality. Once the area was increased, even if it had little financial impact on the construction company, the effect for the buyer would be substantial.

The implications in cities are perhaps the most observed today. The fact that streets, parks, schools, restaurants, and so many other places are empty is hardly imperceptible. Perhaps one of the strangest factors is not hearing the noise of children on playgrounds, schools or even playing in the street. On the one hand, social isolation brought families together more, but practically extinguished social life. The urban planner will have new challenges; seek to understand the new social dynamics will be complex and will bring many obstacles.

Schools, commerce and offices are accumulating dust, and probably many will remain closed, even after the release of activities. Some will remain closed due to financial factors, others for fear that a second wave may still emerge. The truth is that no one can say what will happen to the cities. The city described by the Charter of Athenas (1933), available

on the IPHAN website (BRAZIL. IPHAN, 2019), which would be sectorized, each party performing its function as a machine, perhaps it is something that will stay for the history books.

Although technological advances have been essential for life not to stop in the midst of this pandemic, they will also be the reason for irreversible changes in our society. As mentioned earlier about Banco do Brasil vacating 19 buildings (InfoMoney, 2020), other companies will follow this path. There are changes that have happened due to Covid-19, but that should not return to the previous state. The implications this will bring to cities was only seen in science fiction works.

The future of cities and the implications of this period of isolation will be the object of study by several professionals, such as sociologists, psychiatrists, and urban planners. At the present time, it is only possible to try to predict hypothetical situations and be prepared if the situation presents itself. It is not the intention of the authors to be alarmist or pessimistic, but to predict as many possible situations as possible and, thus, try to be prepared for the future, reducing the impact of changes.

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Floor covering of hospital floors: Case study of the vinyl blanket applied in a hospital in Salvador, BA

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Abstract

The vinyl blanket is a type of floor covering composed of polyvinyl chloride (PVC) that has been widely used in hospital environments for offering low cost, different sizes and colors, easy applicability, and maintenance. The aim of this article was to analyze the application of vinyl blanket in the largest public hospital in the North and Northeast, located in the city of Salvador, Bahia, in order to improve its application in these environments. This analysis was developed through a case study in a specific sector of the hospital, Hemodynamics. The study was developed through research in articles already published about the hospital sector and its standards, in addition to the process of installing the vinyl blanket to better understand the object and the material to be studied. Based on the knowledge acquired, the study was developed with on-site verification method of application of the vinyl blanket and the evaluation of the result regarding the physical and hygienic requirements for a hospital.

Keywords

Vinyl blanket, hospital floor covering, hemodynamic.

1 Introduction

Floor coverings are of great importance for any development, as they can provide comfort to the user, as well as finishing and functionality for the environments. However, it is necessary to make a careful study about its use, since it is necessary to worry about the technical performance of the coating: durability, safety, cleaning, appearance, acoustics, and maintenance.

In hospital environments, the vinyl blanket has been widely used due to its ease of application, maintenance and cleaning, in addition to the cost-benefit. In addition, this coating meets the normative requirements described in the Resolution of the National Health Surveillance Agency, Collegiate Board Resolution No. 50/2002 (RDC).

This article aims to value the quality of the application of the vinyl blanket and analyze whether or not it meets the physical and sanitary requirements of a hospital environment.

The hospital under study, inaugurated in the late 1980s, is the largest in the North and Northeast regions of Brazil. With more than 600 beds, it serves 120,000 people in outpatient clinics per month and 1,300 hospitalizations, in addition to performing 3,500 deliveries per year, becoming a reference in areas such as obstetrics, pediatrics, physiotherapy and orthopedics, as well as procedures of great complexity, such as neurosurgery (INTS, 2019).

The present study was first developed from a bibliographic research, with the objective of knowing the standards and specifications of a hospital environment and the vinyl blanket in order to analyze the applicability of the coating. Thus, some visits were made on site, in order to monitor and analyze the installation of the material and, therefore, to investigate the conditions of hygienic and physical efficiency of a vinyl blanket in the hospital. This study, in addition to addressing technical aspects, stands out in its social character, since it aims to improve the application of this coating in compliance with all functional and sanitary needs of a hospital, aiming at reducing the risks of hospital infection.

2 Floor coverings

2.1 General concepts

In a hospital environment, the choice of floor covering is established by the functionality of the institution, which, according to RDC no. 50/2002 of the National Health Surveillance Agency (2002, p. 36), is understood as

"[...] the physically determined and specialized space for the development of a given activity, characterized by differentiated dimensions and facilities".

The environments of a hospital, according to RDC No. 50/2002 of the National Health Surveillance Agency, are classified according to the transmissibility of diseases by the following criteria:

Critical areas - are environments where there is an increased risk of transmission of infection, where risk procedures are performed, with or without patients, or where immunosuppressed patients are found;

Semi-critical areas - are all compartments occupied by patients with infectious diseases of low transmissibility and non-infectious diseases;

Non-critical areas - are all other compartments of healthcare facilities not occupied by patients, where no risky procedures are performed (BRASIL, 2002, p. 99).

The environments, according to RDC No. 50/2002 of the National Health Surveillance Agency (2002, p. 92), should follow the "[...] hygrothermal and luminous comfort requirements, which in the location of the building on the ground must be followed the requirements of the local work code". With this, it is necessary to observe the functionality of the place from the characteristics of the population system that uses it and the devices and equipment present.

In this sense, the materials for coatings in these hospital environments, according to RDC No. 50/2002 of the National Health Surveillance Agency (2002, p. 107), should be "[...] resistant to washing and the use of disinfectants [...]". In addition, this choice has to prioritize "[...] finishing materials that make surfaces monolithic, with as few grooves or gaps as possible, even after frequent use and cleaning [...]" (BRASIL, 2002, p. 107).

For the footers, according to RDC No. 50/2002 of the National Health Surveillance Agency (2002, p. 107), it is important to look at their union "[...] with the wall so that the two are aligned, avoiding the traditional footer bounce that allows the accumulation of dust and it is difficult to clean." Thus, for this junction, according to RDC No. 50/2002, it is noticed that:

The execution of the junction between the footer and the floor must be in such a way that it allows the complete cleaning of the formed corner. Baseboards with sharp rounding, besides being difficult to perform or even unsuitable for various types of materials used for finishing floors, because they do not allow rounding, do not facilitate the cleaning process of the site, whether done by waxers, or by squeegees or brooms wrapped by cloths (BRASIL, 2002, p. 107).

Finally, another important feature in the choice of coating is low sound emission, since noise, both for professionals and for the sick, can “[...] cause disorders to these people and even influence patient recovery” (GOES, 2010, p. 17).

2.2 Types

According to Sayegh (2007), with the wide variety of types of floor coverings on the market, it is necessary to have doubled attention in choosing the best product to apply in the desired environment. Therefore, the responsible professional should evaluate the material regarding hospital requirements, especially sanitary, with attention to its cleaning and maintenance.

In this sense, according to Bicalho and Barcellos (2002, p. 63-64), the commonly used and available materials have the following characteristics:

- a** Industrial high strength - monolithic floor (floor junction and continuous baseboard), molded on site, based on stone dust, which allows integrity of the joints to the floor;
- b** Synthetic resin coating based on epoxy - monolithic floor, executed on top of a concrete base on which it becomes resistant and easy to clean;
- c** Vinyl on plates - easy installation and cleaning (with damp cloth, without using a lot of water);
- d** Vinyl or linoleum in blankets - easy installation and cleaning, intact (welded joints), which makes it monolithic (continuous footer execution);
- e** Granite – due to its porosity, it becomes a very resistant floor, especially for heavy traffic, with characteristic of “hiding” dirt;
- f** Ceramics – low water absorption index, has several types that go up to high resistance to traffic and impacts. A good example is the porcelain type (hard, practically waterproof, but of high cost). It is important to choose the type that has a narrow joint and the use of epoxy-based grout;
- g** Marble – characteristics similar to granite, with less resistance and more absorption. It is indicated to use it in the most polished form to facilitate its cleaning;
- h** Conductive – used to eliminate electrostatic charges in certain environments with high risk of explosion and thermal shock, due to the presence of certain substances. Therefore, it is important to

have the grounding of the equipment and runoff of the floor to the land potential.

2.3 Vinyl blanket

Vinyl floors, according to Sayegh (2007), “are formed by apolyvinyl chloride (PVC) compound mixed with specific additives that confer malleability and resistance. They are available in plates and blankets.” With this, according to the author, for hospital environments:

“the blankets, with widths between 0.6 m and 2 m, are ideal for places where cleaning is essential, because they form a monolithic set, which includes the skirting board. By not presenting seams, it avoids dust accumulation, cleaning condition required for hospital facilities and laboratories” (SAYEGH, 2007, online).

Despite the great applicability of the vinyl blanket in hospital environments, Sayegh (2007, online) recalls that [...] “most of the floors available on the market are recommended only for internal use, as they lose color with exposure to the sun and do not resist rain and constant water, which cause their detachment”. In this same sense, the manufacturer Tarkett warns that “[...] excessive use of water in cleaning floors with dry joints can cause the floor to depart from the floor, making room for infiltrations” (TARKETT, 2016, p.6).

The maintenance of the vinyl blanket is another positive feature in this type of coating, because, according to Sayegh (2007), one can easily “[...] replace damaged parts without affecting the rest of the coating”, which implies simple maintenance. In addition, according to the author, the vinyl blanket is very useful for hospital environments, because it has acoustic absorption capacity for the emission of sound from carts with polyurethane wheels (SAYEGH, 2007).

2.4 Application

2.4.1 Preparation of the floor

For Sayegh (2007, online) “[...] the success of the floor system still depends on a good preparation of the floor and correct application of the material, with mortars and grouts specific to each product”.

In this sense, the types of counter floors allowed for the application of the blanket, according to the General Installation Manual of the manufacturer TARKETT (2016, p. 8), are:

- a** Cement - concrete slab or plucked;
- b** Ceramic - has joints less than 5 mm;
- c** Stone - polished granites and marbles. The parts must be adhered and leveled with joints less than 5 mm;
- d** High strength floor;
- e** Paviflex - allowed if it is with only another layer of the Paviflex type. These plates must not have malfunctions, they must be intact, firm, with acrylic adhesive and without wax. If there is any trace of this wax, it should be removed, and the surface regularized to start the installation;
- f** Locations with heating systems;
- g** On mezzanine.

On the other hand, some counter floors are not allowed, according to the General Installation Manual of the manufacturer TARKETT (2016, p. 8-9), among them:

- a** Burnt cement - the floor should be cut and a new base should be prepared;
- b** Wood (laminates, clubs, parquets, boards, etc.) – removal and preparation of a new base;
- c** Stones and ceramics with joints larger than 5 mm - removal and preparation of a new base;
- d** Paviflex with bituminous adhesive, called “black glue” – complete removal of the floor and glue. The glue remnant should be sanded with wet sand and with the aid of an electric sander and diamond disc. Without this procedure, the coating installed on top may take off;
- e** Other vinyl floors (LVT, blankets) – removal and preparation of a new base;
- f** Acrylic or epoxy paint - the floor should be sanded with sandpaper no. 60 or electric sander to create porosity;
- g** Industrial kitchen;
- h** Outdoor.

2.4.2 Cleaning of the counter floor

According to the General Installation Manual of the manufacturer TARKETT (2016), for the application of the blanket, it is necessary to remove all dust from the floor to apply the bonding adhesive of the vinyl coating.

2.4.3 Vinyl blanket glue

The application of the adhesive, according to the manufacturer TARKETT (2016), should be done in circular movements with the use of a clipper and, to minimize the effects of the teeth of the plucking, a roll of wool should be used.

After applying the adhesive, the manufacturer TARKETT (2016, p. 15) suggests that the blanket be glued smoothing "[...] the coating with a wooden ruler coated with carpet [...]" and then use "[...] the 50 kg steamroller in order to avoid airbubbles."

For splicing one blanket into another, the manufacturer TARKETT (2016, p.15) recommends that: "[...] the joints must be tightly closed, touching each other's ends, without being compressed or tooopen"; and be used "[...] hot welding on vinyl blankets in all commercial areas to prevent water used during cleaning from penetrating the backfloor, wall or under the blanket." As for the hospital environment, the manufacturer recalls that the "[...] facilities in health areas should always have hot welding", in addition to the "[...] hot welding [be] mandatory in patches of blankets and conductive plates" (TARKETT, 2016, p. 16).

2.4.4 Baseboard

For curved baseboards, according to the General Installation Manual of the manufacturer TARKETT (2016, p. 14), it is recommended to "[...] leave a leftover of the blanket on the edges near the walls and according to the size of the baseboard provided in the project." With this, this manual advises the use of a curved support, because "[...] facilitates floor maintenance and ensures excellent hygiene" (TARKETT, 2016, p. 18). Also according to this manufacturer, for the execution of the baseboard glue, it is suggested that "[...] acrylic adhesive should be applied with low-coat wool roller and double contact: on the wall and on the coating" (TARKETT, 2016, p. 12).

To give finishing, the manufacturer also suggests sealing the "[...] silicone trims, using a professional applicator to avoid excess" (TARKETT, 2016, p. 20).

2.4.5 Post-application care

In post-application care, the manufacturer TARKETT (2016) recommends the removal of all powder from the vinyl blanket after its installation and the protection of the floor with the help of the person responsible for the work to avoid damage to the product already installed.

3 THE HOSPITAL

The hospital under study stands out for being the largest public hospital in the North and Northeast of the country, inaugurated in the 80's, with emphasis on procedures of great complexity. In this way, it can serve more than 30,000 people in the outpatient clinic, has more than 600 beds, 1,300 inpatients per month, and perform more than 3,500 deliveries per year. In this sense, it has become a reference in several areas, such as emergency services, general surgery, oral maxillofacial, pediatric and neonatal, medical clinic, pediatrics, digestive hemorrhage, high-risk maternity and, mainly, neurosurgery (INTS, 2019).

Among the various areas, the Hemodynamics sector of the hospital underwent a renovation of requalification and expansion of services, with the objective of serving a greater number of patients and adapting to the means of work. Thus, Hemodynamics is a sector that, according to Linch, Guido and Fantin (2010, p. 489):

[...] medical specialties such as cardiology, radiology, neurology, among others, use Hemodynamics Units (UHDS) as support for the performance of diagnostic or interventional therapeutic procedures. These make use of methods sometimes faster and more accurate, with techniques aimed at lower risks to patients (LINCH; GUIDO; FANTIN, 2010, p. 489).

Located on the Ground Floor, from Block B of the main building, Hemodynamics was remodeled in order to humanize the unit, adapt it according to the appropriate methodology to the work processes and the standards that cover it, in addition to expanding its services in the hospital. The location of this sector can be seen in Illustration 1.



Illustration 1. Hemodynamics Location Plant. Source: Own Authorship (2017).

The recovered area was 343 m², whose space was already used for UHD. The expansion includes the implementation of a new examination room and support environments, examination recovery room, nursing station, coordinations, meeting room, team living room and warehouse, as can be seen in Illustration 2.

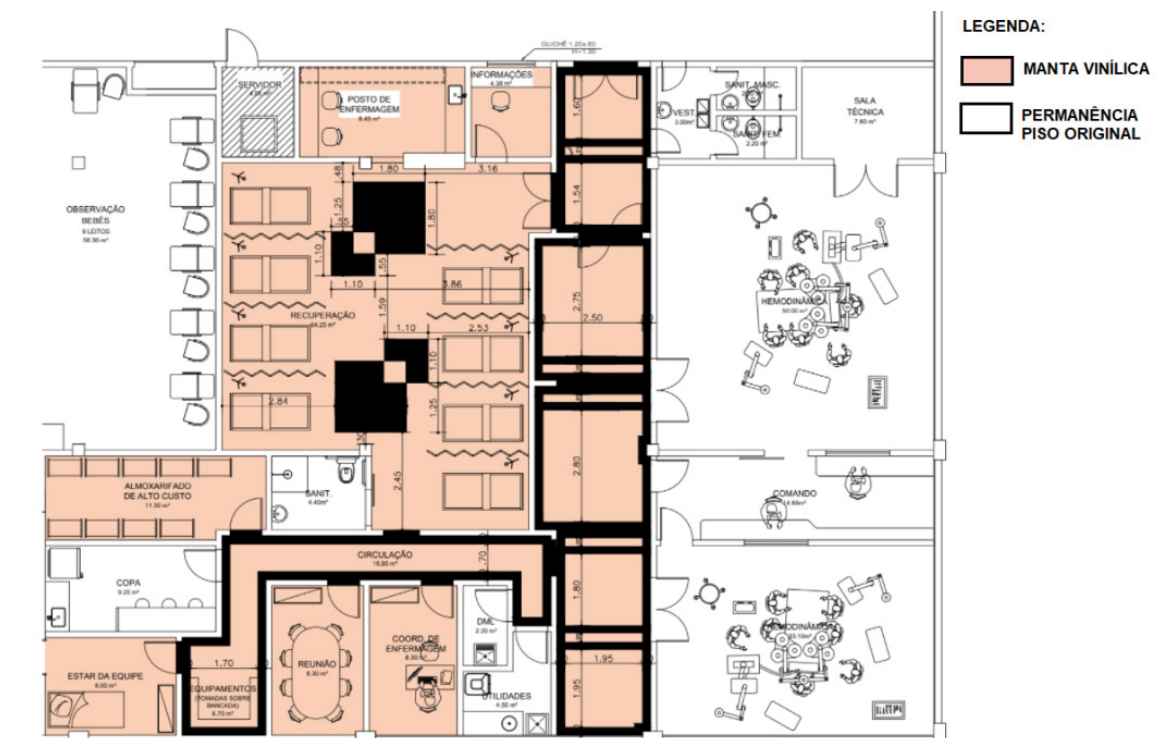


Illustration 2. Ampliation and vinyl blanket layout . Source: Own Authorship (2017).

Among all the modifications made, we highlight the installation of the high traffic vinyl blanket in much of Hemodynamics (in pink). The blanket, which has characteristics of being distributed in rolls of 20 m x 2 m with 2 mm thickness, antifungal and antibacterial, was installed following the paging plant with patterns and colors defined by design, broken down in Illustration 2. It is noteworthy that there was no installation of this coating in humid areas (canopy, toilets, utilities, and Department of Cleaning Material), since it does not resist well to constant water.

4 Case study to evaluate the application of the vinyl blanket in a hospital in Salvador

4.1 Research methodology

The case study was conducted, first, with literature research on the theme treated; then daily visits were made for observation and analysis of the application of the vinyl blanket in loco. This follow-up of the service was carried out with the completion of a work diary and photographic reports, with the objective of recording the main events of the remodeling for approximately four months.

Despite being a practical service with fast application, its installation required time, due to concern with the integrity of the coating. This concern begins with the proper and thorough execution of the floor (essential step for the application of the vinyl blanket). Then, brickwork, coatings, installations, finishes were performed and, only after four months of intervention, the installation of the vinyl blanket was carried out.

This whole process is related to the concern of avoiding any damage to the vinyl blanket with subsequent activity (movement of people, material and objects). In this way, only after the execution of the services of closing and opening walls, painting, electrical installations, and ceramic laying, the vinyl blanket can be installed.

4.2 Analysis of the application of the vinyl blanket

4.2.1 Counter floor

As a fundamental part for the good performance of the vinyl blanket, the execution of the floor was done with caution and with the objective of regularizing the areas that were damaged with the total removal of the old vinyl coating, the Paviflex (product produced from the base of soybean oil) with bituminous adhesive. The removal of the Paviflex was indispensable, because the vinyl blanket installed over this surface could come out in the future, as warned by manufacturer.

4.2.2 Cleaning of the counter floor

The complete cleaning of the remaining dust of the floor was done so that the glue adhesive had greater support to the blanket and the floor, as recommended by the manufacturer. This service can be seen in Illustration 3.



Illustration 3. Removal of dirt from the floor for the application of the vinyl blanket.
Source: Own authorship (2017).

After cleaning the floor, it was possible to observe traces of the black glue from the old coating, the Paviflex, still very present on the floor, as can be seen in Illustration 3. Therefore, it was necessary to remove it with a helicopter-type concrete straightener to sand the glue with damp sand, completely removing it.

4.2.3 Vinyl blanket glue

The glue adhesive was applied and spread on the blanket and the floor. In circular movements and with the aid of the toothed plucking, the glue was spread and, later, the wool roller was used to minimize the markings of the plucking, as suggested by the manufacturer. After applying the

adhesive, the blanket was positioned, distributed and pressed against the floor to secure it throughout the area. Its distribution followed the specifications contained in the detailing plant, in the colors and defined patterns. In regions of junction between blankets, milling on the seams and welding with hot welding were performed to amend them and make them uniform, as shown in Illustration 4.



Illustration 4. Installation of the vinyl blanket. Source: Own authorship 2017.

4.2.4 Baseboard

The baseboard was executed in a curved manner. For this, a leftover of the blanket was left near the walls, as suggested by the manufacturer. With this, the double contact adhesive was spread on the baseboard and in the region of the wall to be installed. To help, a curved support was used to facilitate the execution of the curvature of the footer. Then a silicone glue was applied above the skirting board to completely seal the vinyl blanket and make it fully uniform, giving the finish to the coating. Details in Illustration 5.



Illustration 5. Details of the baseboard and the silicone glue. Source: Own authorship 2017.

4.2.5 Post-application care

After installation, the vinyl blanket was cleaned, removing all the dust generated by the application. However, it was not protected from the activities that were performed on site after installation.

4.3 Result

Evaluating the results of the application of the vinyl blanket, it is observed that this floor covering was able to meet the physical and hygienic requirements of the hospital for the Hemodynamics sector, due to a good installation of the coating.

As for the physical requirements, the vinyl blanket brought safety, hygrothermal, luminous and visual comfort due to the layout of the coating, the color design and comfortable patterns. In addition, the blanket provides a large acoustic capacity, with reduced noise of stretchers, chairs and people moving in and out of the unit.

As for hygienic requirements, the floor became uniform and monolithic (reducing the possibility of water infiltration) from good executions of seams between the blankets and curved baseboards, in addition to the counter floor itself. In addition, the type of baseboard adopted provides a complete cleaning of the accumulation of dirt in the corners and wall encounters, facilitating the cleaning of the place; necessary for hospital facilities and laboratories, reducing the risk of infections.

Post-installation care was not fully taken, in contrast to the good application of vinyl blanket in Hemodynamics. Although the floor was cleaned of impurities caused by its application, no protection was made. Finishing activities to Hemodynamics, such as the application of plots on the windows and walls, installation of counter tops and furniture, in addition to the movement of people, were performed without the adequate protection of the vinyl blanket, such as plastic canvases.

5 Final considerations

Vinyl flooring has become a coating widely used in hospital environments due to its practicality of installation; variety of sizes, colors and models; facility of cleaning; and simple maintenance.

In view of the advantages of using the vinyl blanket in the remodeling of the Hemodynamics department in Salvador Public Hospital, the designer's sensitivity to use such a coating stands out, corresponding to the physical and immunological requirements for the site, mainly because it meets the requirements of RDC No. 50/2002. Physically, the coating brought acoustic and luminous comfort to patients and staff. As for hygiene, the coating has become uniform and monolithic, protecting the space from infections, and facilitating its cleaning, respectively.

In this sense, changes, and remodeling in hospital environments, particularly in floor coverings, should start, first, from the technical capacity of the professional and his/her knowledge regarding the needs

of a hospital in compliance with physical, logistical and, mainly, hygienic requirements, through ANVISA RDC No. 50/2002, so as not to harm the entire system to combat hospital infection.

The good result of the application was possible due to the good execution of the floor. Since this is the basis of the whole process, in addition to having been well regularized and leveled, the manufacturer's recommendations regarding the removal of glue remnants from old coatings, in this case Paviflex, were met. Thus, it was possible to guarantee the integrity and durability of the blanket, avoiding future detachments.

With regard to post-installation care, the protection of the vinyl blanket immediately after its application is indispensable, since any damage can harm all its integrity and investment, causing rework on site.

Finally, cleaning hospital environments is essential to avoid contamination and infections. However, it is important to note that the vinyl blanket is not water resistant. In this way, it is important to take care when cleaning the coating.

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