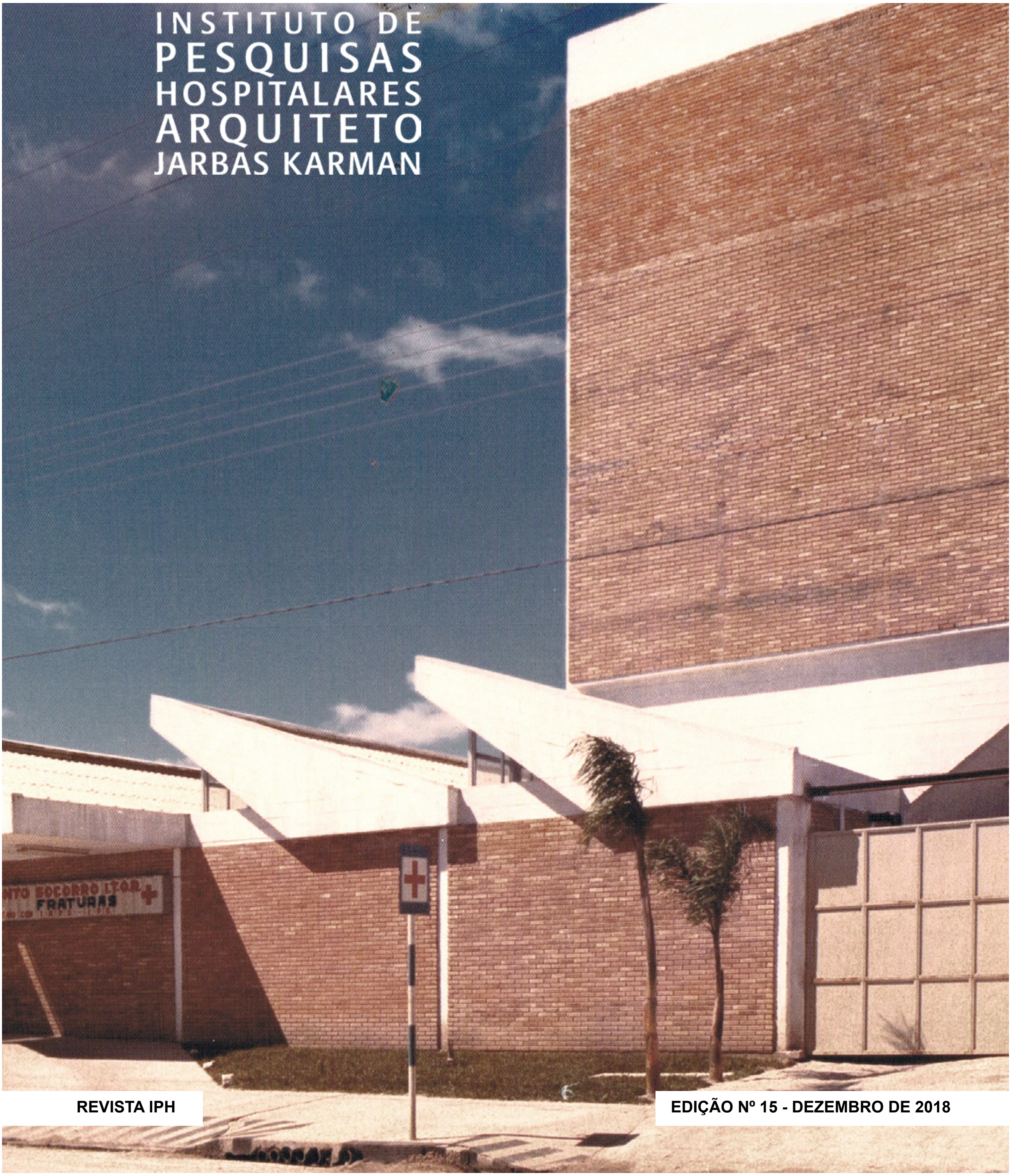
REVISTA | MAGAZINE

IPH 15

INSTITUTO DE PESQUISAS HOSPITALARES ARQUITETO JARBAS KARMAN



REVISTA IPH

EDIÇÃO Nº 15 - DEZEMBRO DE 2018

Revista IPH

Edição Nº15

Dezembro de 2018

Conselho Editorial

Fabio Bitencourt

Jorgeny Catarina Gonçalves

Marilena Pacios

Ricardo Karman *diretoria@iph.org.br*

Editor

Ana Beatriz Bueno Ferraz Costa *revista@iph.org.br*

Expediente IPH

Erick Vicente *erick@iph.org.br*

Giliard do Nascimento

Rita Moraes *secretaria@iph.org.br*

Paulo Mauro Mayer de Aquino *paulomauro@iph.org.br*

Projeto Gráfico

Erick Vicente

Imagem da capa

Hospital Miguel Piltcher

Fonte: Acervo IPH / Coleção Irineu Breitman

ISSN 2358-3630

Endereço para correspondência

IPH - Instituto de Pesquisas Hospitalares Arquiteto Jarbas Karman

Rua Vargem do Cedro, nº74 , Sumaré

São Paulo - SP

CEP.: 01252-050

Tel. (11) 3868-4830

E-mail: *revista@iph.org.br*

Endereço eletrônico: *www.iph.org.br/revista*

ENGLISH

VERSION

Summary

Editorial

We are delighted to bring to you the IPH Magazine #15 as 2018 comes to its end. This issue discusses two notable contemporary topics: the implementation of alternative energy sources within hospitals and of integrated engineering management systems.

The latter is portrayed in the study "Implementation of Clinical Engineering Integrated Management System", which describes the experience of carrying through the management system at University of São Paulo's Clínicas Hospital, written by their team, it displays results and the impact on indexes. It is a case study that helps us understand the process of executing a new system and its outcomes.

The essay "Grid-tie photovoltaic systems: brief history and its implementation in the hospital environment" reveals one of the most up-to-date concerns of our history by discussing the ever-growing, however still in development, introduction of photovoltaic energy in hospitals. The text presents the costs and benefits of the technology and a case study. We hope this analysis might contribute not only for the expansion of its use but also, and chiefly, for the deliberation on how new energetic alternatives can be used in healthcare facilities.

Our magazine also debates another recurring question in currently researches, i.e. "humanization", in two pieces: "Humanizing the Hospital" and "Hospitality x Hospitable Hospitals x Humanization".

Finally, we had to save some space to reflect upon our own work, which leads us to the review of Irineu Breitman, whose health-related work was shown in an exclusively exhibition organized by the Institute in 2018. Also, part of his oeuvre is now housed at IPH's Collection. The article systematizes the first reflections that emerged while the curation of his exhibition, hoping to spark off curiosity so other researchers might explore the work of Irineu Breitman and other Brazilian architects from the 20th and 21th centuries.

We want the 2018 edition to give rise to new ideas, and therefore new dialogues, for the year to come.

IPH's photovoltaic systems
Source: Sostício Energia

Case study

Implementing an Integrated System for Clinical Engineering Management

Hospital das Clínicas – HC-FMUSP

Authors:
Alessandro de Souza Mota
Cleiton Vieira Caldeira
Dennis Vicente do Nascimento
Diego Hernani Lopes da Silva Ribas
Fabio Martins Correa
Ferdinando Silvestre de Melo
Francisco Claudio Cardoso Gomes Benetti
Gustavo Borjes Sanjinez
Ilan Akisaburo Kimura
Katia Keiko Hara

1. ABSTRACT

The lack of an integrated system for the management of medical and hospital equipment at the Medical School of University of São Paulo's Clínicas Hospital (HC-FMUSP) following Institutes: Central (ICHC); Orthopedics and Traumatology (IOT); Psychiatry (IPQ); Radiology (INRAD) and Children (ICR); as well as at the Suzano Auxiliary Hospital (HAS) hindered the management of clinical engineering techniques. After implementing the system, it was possible to inventory equipment and implement management actions, which brought as benefits: maintenance planning, historical data of the equipment, better communication between healthcare and clinical engineering teams when monitoring service requests, development of indexes and unified management of contracts.

2. INTRODUCTION AND THE PROBLEM AHEAD OF US

The lack of an integrated management system made it difficult to inventory medical and hospital equipment; get the accurate history of equipment; carry out preventive maintenance programs, calibration and electrical safety test; which are means to ask the clinical engineering staff for opening service requests that enable monitoring, the development of performance and cost guidelines, the control of contract maintenance and tracking maintenance and actions performed.

Knowing the quantity and quality of existing medical and hospital equipment is key to structure a clinical engineering service. Although obtaining the data for inventory is rather a simple task, in this case, the great difficulty was the complexity and size of HC-FMUSP complex, which is comprised of ten institutions: eight institutes and two auxiliary hospitals that adds up to approximately 2,400 (two thousand and four hundred) beds, 80 (eighty) operating rooms and 600,000 (six hundred thousand) square meters of built area, from which the project contemplates five institutes and one auxiliary hospital.

3. BACKGROUND AND THE PROPOSED SOLUTION

Illustration 1, bellow, portraits in brief the implementation of the system background:

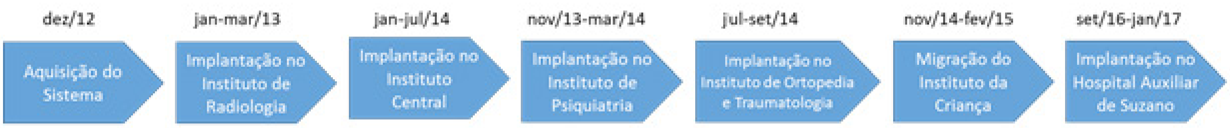


Illustration 1: Implementation of the System Background

<u>Acquisition:</u> In this phase, we carried out a study regarding existing systems in the market that dealt with analysis of functionalities, the acquisition, and the parameterization of the basic criteria of the system, which initially consisted of the development of the descriptions of the equipment families, followed by the parameterization of important points, such as occurrences, causes and registration of work orders, that is, the main defects presented by the equipment, the reasons that cause an equipment to present a defect and the activities performed by the technical team. We also defined he types of maintenance were also defined, among them, installation, corrective, preventive, calibration, electrical safety test, user support, etc.

<u>Implementation/Merger:</u> In this phase, we inventory the equipment based on physical data, (serial number, patrimony, brand, model, etc.) by performing on-site gathering within healthcare facilities, subsequent insertion in the management system. For this task, it was also necessary to register manufacturers and suppliers; models and criticalities of the equipment; and the auxiliary departments to finally proceed with the registration of the equipment. At the end of each registration, a TAG, automatically generated by the system, is printed and affixed to the equipment. Illustrations 2 and 3 bellow show the equipment registration screen and s sample registered cardioverter.

Since the Children's Institute (ICR) used the system in an individual and isolated manner, the implementation phase was characterized by the migration of the database to the new integrated base in accordance with parameters defined in the new management model.

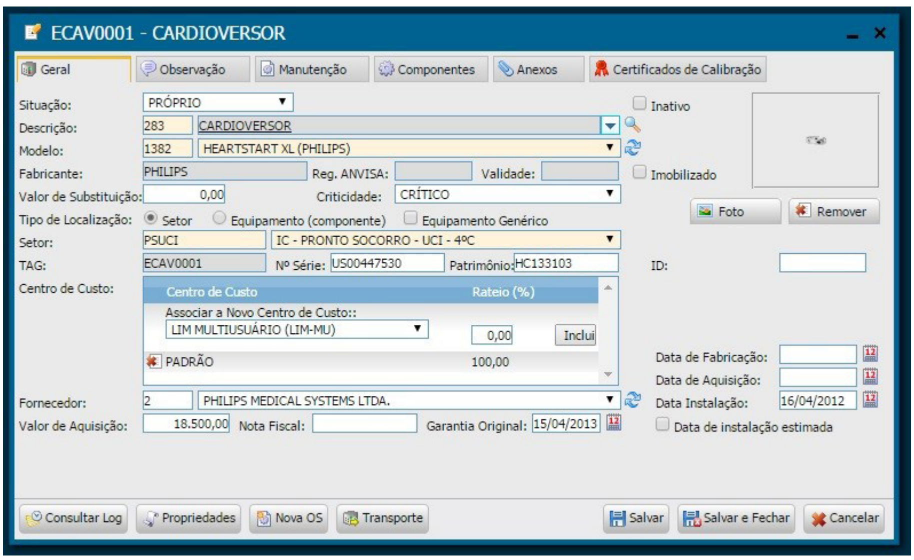


Illustration 2: Equipment Registration Screen

Illustration 3: Cardioverter - ECAV0001

During the implementation phase, we carried out training sections with the clinical engineering team to try other system tools, such as the work orders module, maintenance plans, contracts, etc. Illustrations 4, 5 and 6 present the screens regarding the aforementioned tools.

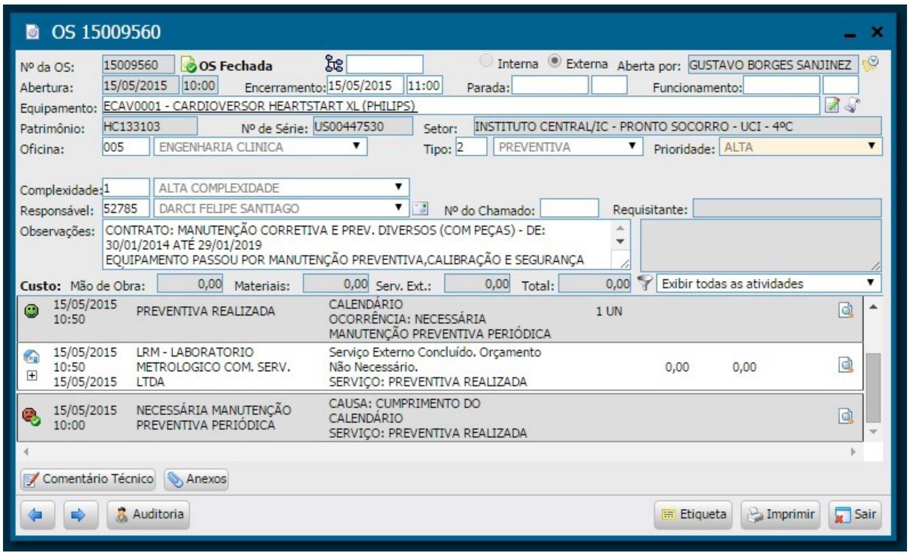


Illustration 4:
Work order screen

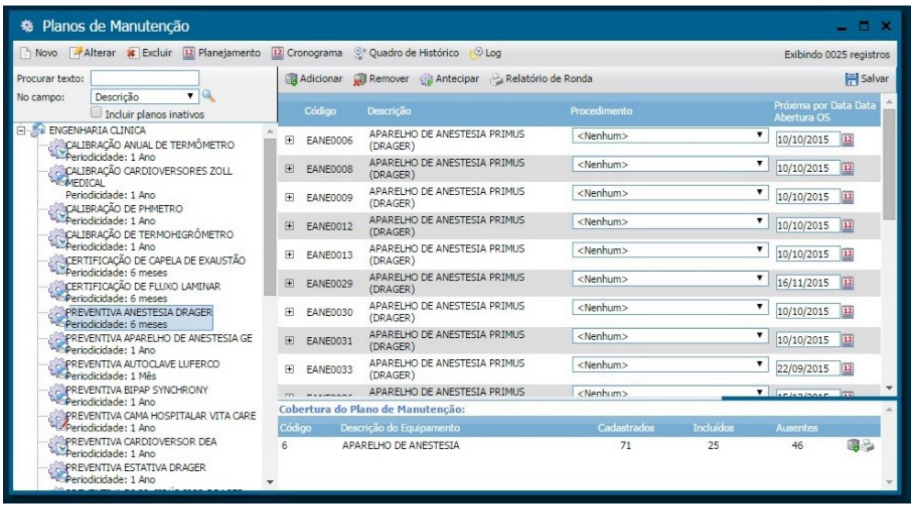


Illustration 5:
Maintenance Plan
Screen

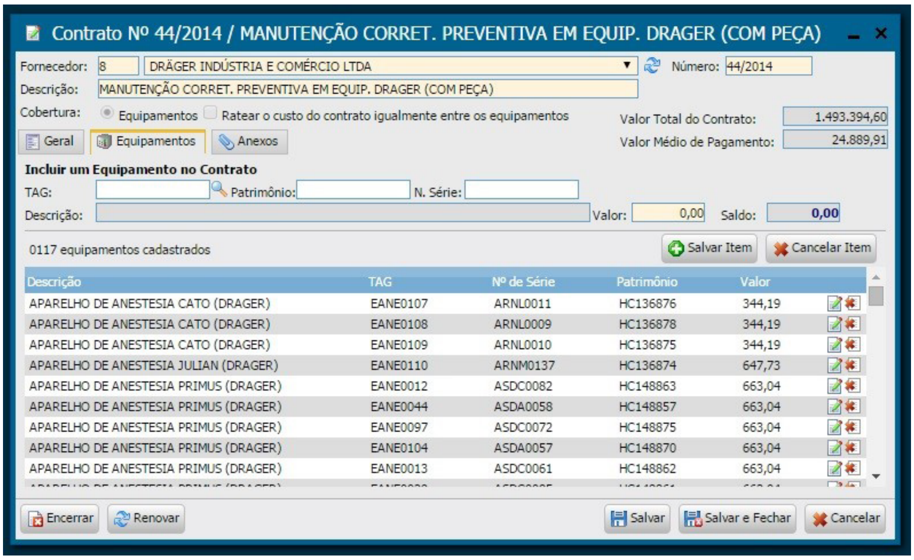


Illustration 6:
Contract Screen

Besides training with the clinical engineering team, the healthcare team also learned how to use the system, since it allows all HC staff to request a service, proceed with follow-up and even evaluate the service provided.

4. RESULTS

After implementing the maintenance management system, we reached the following outcome:

4.1. Inventory

As a result of implementing the project within the aforementioned institutions, we registered about 17,000 equipment.

Illustrations 7 and 8, show the distribution of equipment sorted by criticality and some specialty.

Once we had the criticalities defined, it was possible to implement the work order priorities.

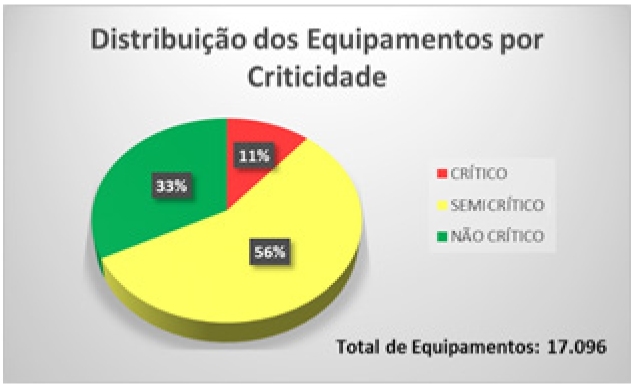


Illustration 7:
Equipment sorted by Criticality

MODALIDADE	QUANTIDADE
DIAGNÓSTICO POR IMAGEM	425
ELETROMÉDICO	13.565
LABORATÓRIO	2133
ESTERILIZAÇÃO	91
DEMAIS MODALIDADES	882
	17.096

Eletromédico	Quantidade
APARELHO DE ANESTESIA	118
BOMBA DE INFUSÃO	1.546
BISTURI ELÉTRICO	164
CAMA ELÉTRICA	1.100
CARDIOVERSOR	205
ELETROCARDIÓGRAFO	127
HEMODIALISADORA	88
MONITOR MULTIPARAMÉTRICO	1.016
VENTILADOR PULMONAR	318
SONDAS ENDOSCÓPICAS	144

Diagnóstico por Imagem	Quantidade
ANGIÓGRAFO	2
ARCO CIRÚRGICO	21
ECOCARDIÓGRAFO	9
RESSONÂNCIA MAGNÉTICA	7
TOMÓGRAFO	9
GAMA CÂMARA	2
PET-CT	1
PET-MR	1

Esterilização	Quantidade
AUTOCLAVE	22
LAVADORA DE MATERIAIS	8
LAVADORA TERMODESINFETADORA	13
LAVADORA ULTRASSÔNICA	9

Illustration 8: Equipment sorted by Specialties

4.2. Maintenance Planning

Once we had carried out the inventory, it was possible to perform a thorough analysis of existing equipment and implement a maintenance program based on priorities using the records of maintenance plans, automating the process of opening work orders, improving control and enabling the automatic schedule of maintenance procedures. Illustrations 9 and 10 show a sample timetable generated by the anesthesia device plan for the year 2016 and the list of maintenance procedures scheduled by each institution.

Cronograma de Execução de Manutenções Planejadas

PERÍODO DE 01/01/2016 ATÉ 01/01/2017
PLANO DE MANUTENÇÃO: PREVENTIVA ANESTESIA DRAGER
OFICINA: ENGENHARIA CLINICA

IC - BERA - 6ºF

TAG / Nº de Série / Patrimônio	Equipamento	Plano de Manutenção	Jan 16	Fev 16	Mar 16	Abr 16	Mai 16	Jun 16	Jul 16	Ago 16	Set 16	Out 16	Nov 16	Dez 16
EANE0097 NS: ASDC0072 PAT: HC148875	APARELHO DE ANESTESIA PRIMUS (DRAGER)	PREVENTIVA ANESTESIA DRAGER			X						X			

IC - CENTRO CIRURGICO UROLOGIA - 7ºGS

TAG / Nº de Série / Patrimônio	Equipamento	Plano de Manutenção	Jan 16	Fev 16	Mar 16	Abr 16	Mai 16	Jun 16	Jul 16	Ago 16	Set 16	Out 16	Nov 16	Dez 16
EANE0067 NS: ASCC0098 PAT: FFM50563	APARELHO DE ANESTESIA PRIMUS (DRAGER)	PREVENTIVA ANESTESIA DRAGER			X						X			
EANE0096 NS: ASCC0099 PAT: FFM50565	APARELHO DE ANESTESIA PRIMUS (DRAGER)	PREVENTIVA ANESTESIA DRAGER			X						X			

PAMB - CENTRO CIRURGICO - 9º

TAG / Nº de Série / Patrimônio	Equipamento	Plano de Manutenção	Jan 16	Fev 16	Mar 16	Abr 16	Mai 16	Jun 16	Jul 16	Ago 16	Set 16	Out 16	Nov 16	Dez 16
EANE0107 NS: ARNL0011 PAT: HC136876	APARELHO DE ANESTESIA CATO (DRAGER)	PREVENTIVA ANESTESIA DRAGER						X						X
EANE0108 NS: ARNL0009 PAT: HC136878	APARELHO DE ANESTESIA CATO (DRAGER)	PREVENTIVA ANESTESIA DRAGER					X						X	
EANE0109 NS: ARNL0010 PAT: HC136875	APARELHO DE ANESTESIA CATO (DRAGER)	PREVENTIVA ANESTESIA DRAGER						X						X
EANE0006 NS: ASDC0078 PAT: HC148871	APARELHO DE ANESTESIA PRIMUS (DRAGER)	PREVENTIVA ANESTESIA DRAGER				X						X		

Gerado por: FERDINANDO SILVESTRE DE MELO Pág. 1 de 3

Illustration 9: Preventive Maintenance Schedule Automatically Generated by the System

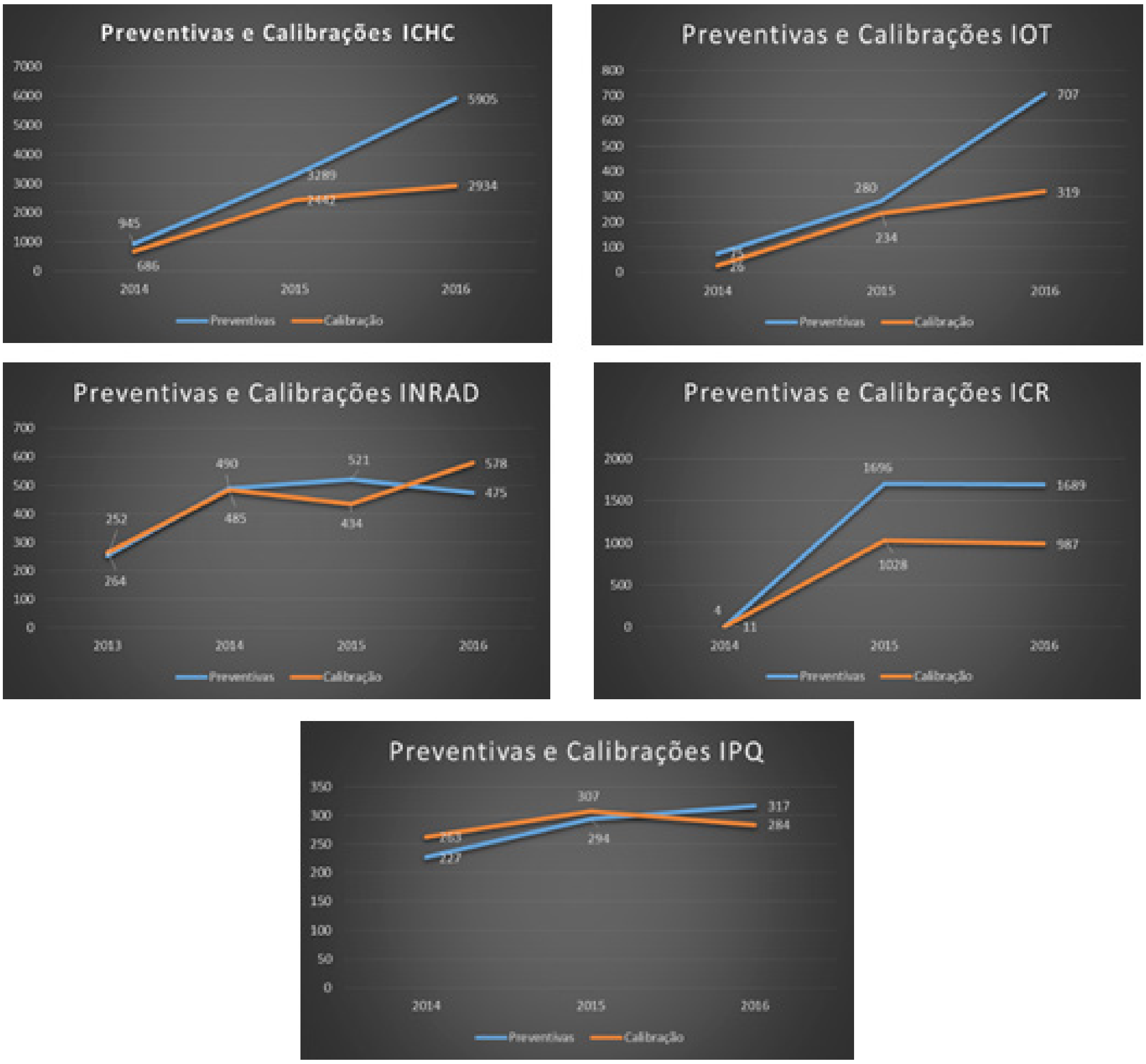


Illustration 10: List of Scheduled Maintenance Procedures by Institution

4.3. Background of the Equipment

By referring to the equipment background performance data, it is possible to analyze its life cycle and make decisions regarding the need for maintenance or technology replacement.

Illustration 11 portraits the maintenance background of an autoclave installed at the Institute of Psychiatry, including the work orders and costs.

Histórico do Equipamento

TAG:	SAUT0003	Patrimônio: HC128095	Nº de Série : 050694
Descrição:	AUTOCLAVE		
Modelo:	HSD31G MDP		
Fabricante:	SERCON INDUSTRIA E COMERCIO		
Proprietário:	IPQ - CENTRAL DE MATERIAIS E ESTERILIZAÇÃO - 2ª CENTRAL		
Localização Atual:	IPQ - CENTRAL DE MATERIAIS E ESTERILIZAÇÃO - 2ª CENTRAL		
Data de Aquisição:		Valor de Aquisição: R$ 0,00	Valor de Substituição: R$ 0,00
Resumo Financeiro:	Mão de Obra: R$ 0,00	Peças: R$ 0,00	Serviços Ext.: R$ 11.244,40 Total: R$ 11.244,40

Nº da OS	Abertura	Fechamento	Tipo	Situação
15017406	07/10/2011 08:00	07/10/2015 16:30	PREVENTIVA - Externa	Fechada

DESCRIÇÃO			QTD	VALOR	TOTAL
AN	08/10/2015 12:08	ANEXOS			
SO	07/10/2015 16:30	PREVENTIVA REALIZADA	1 UN		
SE	07/10/2015 16:30 07/10/2015	SERCON IND E COM APARELHOS MÉDICOS		0,00	0,00
OC	07/10/2011 08:00	NECESSÁRIO MANUTENÇÃO PREVENTIVA PERIÓDICA			
				Custo Total da OS:	0,00

Nº da OS	Abertura	Fechamento	Tipo	Situação
14001589	31/03/2014 08:30	05/04/2014 13:00	VALIDAÇÃO TÉRMICA - Externa	Fechada

DESCRIÇÃO			QTD	VALOR	TOTAL
AN	10/06/2015 20:30	ANEXOS			
SO	02/04/2014 12:30	ACOMPANHAMENTO TÉCNICO	1 UN		
SE	02/04/2014 12:30 02/04/2014	EMPRESA DE VALIDAÇÃO TÉRMICA		1.500,00	1.500,00
MO	02/04/2014 08:00	FABIO MARTINS CORREA	04:30	0,00	0,00
MO	01/04/2014 08:00	FABIO MARTINS CORREA	06:40	0,00	0,00
MO	31/03/2014 08:30	FABIO MARTINS CORREA	06:30	0,00	0,00

Nº da OS	Abertura	Fechamento	Tipo	Situação
14002136	08/05/2014 08:30	02/06/2014 16:54	CORRETIVA - Externa	Fechada

DESCRIÇÃO			QTD	VALOR	TOTAL
AN	10/06/2015 20:30	ANEXOS			
SE	28/05/2014 16:30 28/05/2014	SERCON IND E COM APARELHOS MÉDICOS		3.113,57	3.113,57
PE	09/05/2014 17:00	AGUARDANDO ORÇAMENTO			
SO	08/05/2014 09:20	DISJUNTOR REARMADO	1 UN		
MO	08/05/2014 08:45	FABIO MARTINS CORREA	00:35	0,00	0,00
OC	08/05/2014 08:30	NÃO FUNCIONA CORRETAMENTE			
				Custo Total da OS:	3.113,57

Legenda: CO - Cancelamento da OS, CT - Certificado, FT - Foto, MO - Mão de Obra, OC - Ocorrência, SO - Solução, PE - Pendência, MT - Material, PO - Parecer de Obsolescência, PR - Procedimento, SE - Serviço Externo, TR - Transporte; LR - Laudo de Recebimento, LI - Laudo de Instalação, AN - Anexos, OB - Obras

Gerado por: FERDINANDO SILVESTRE DE MELO — Pág. 1 de 13

Illustration 11: Equipment Maintenance Background

4.4. Opening and Following up a Client Work Order

With the new system, all employees from the aforementioned institutes may request a service, proceed with the follow-up and even assess the service provided, the latter being mandatory, since it is not permitted to open a new requisition before evaluating a previously completed one. We keep track of maintenance during its procedure and after its completion to improve the workflow and ensure bidirectional communication and traceability of actions and information. Moreover, the system saves paper by avoiding printing.

Illustrations 12, 13 and 14 bellow present the screens regarding the opening, follow-up and assessment of work orders.

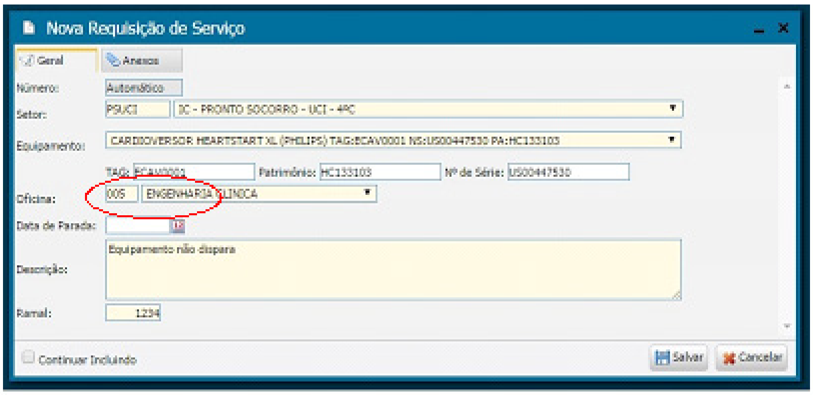


Illustration 12:
Opening a Work Order Screen

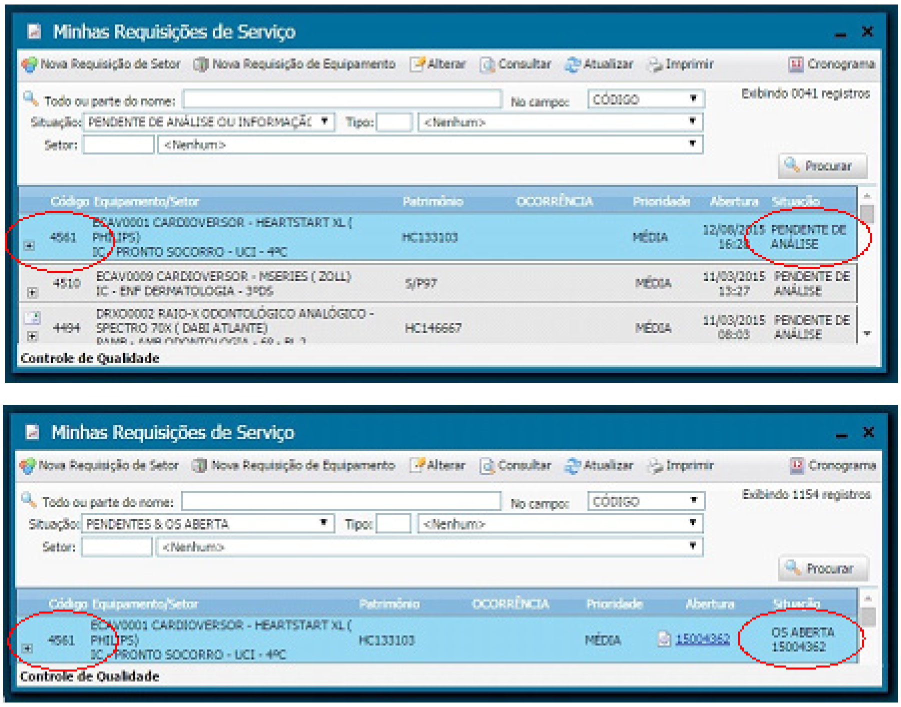


Illustration 13:
Work Order Follow-up Screen

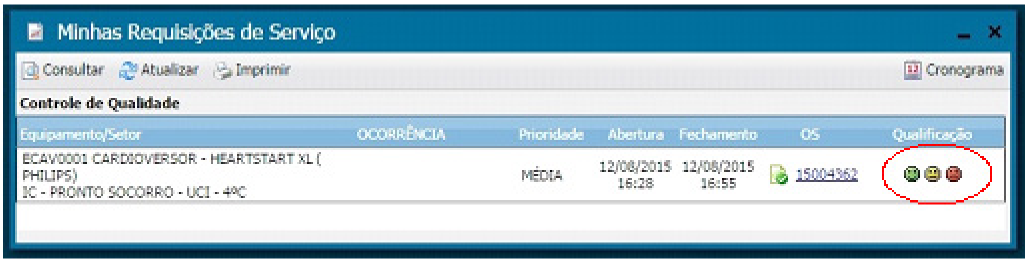


Illustration 14: Work Order Assessment Screen

4.5. Indexes

By implementing the system, we were able to standardize indexes for the management of the technology park. Besides analyzing the performance of the service provided, we are able to accomplish a more detailed study of the performance of the equipment, as well as to compare results among the institutes. Currently, we are using the following indexes: Respect for the Preventive Maintenance Schedule; Equipment Availability; General Maintenance Cost; Technical Team Productivity; Causes for the Work Orders; Clinical Engineering Response Time; Pending Work Orders, among others.

The illustrations bellow show some of those indexes.

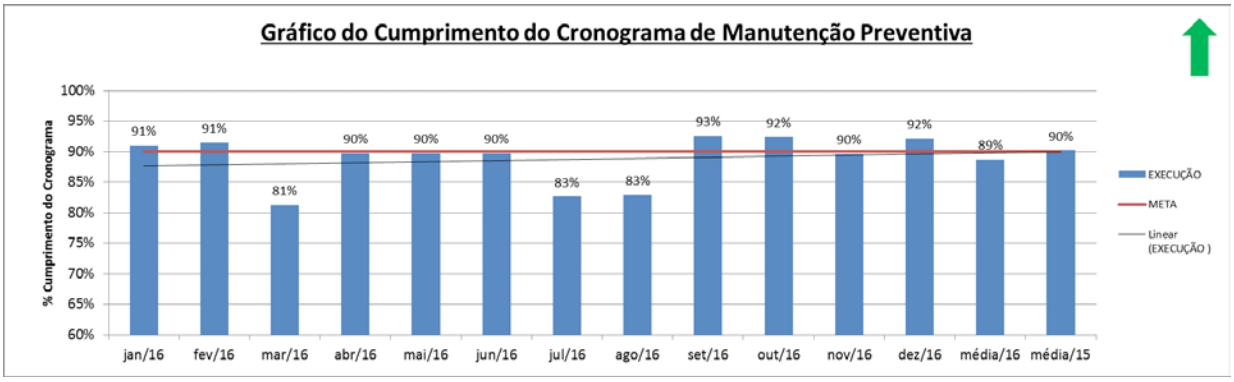


Illustration 15: Respect for the Preventive Maintenance Schedule Index

Description: Percentage of execution of the preventive maintenance scheduled in a month

Calculation: (∑Preventive Maintenance Carried Out / ∑ Preventive Maintenance Scheduled) x100%

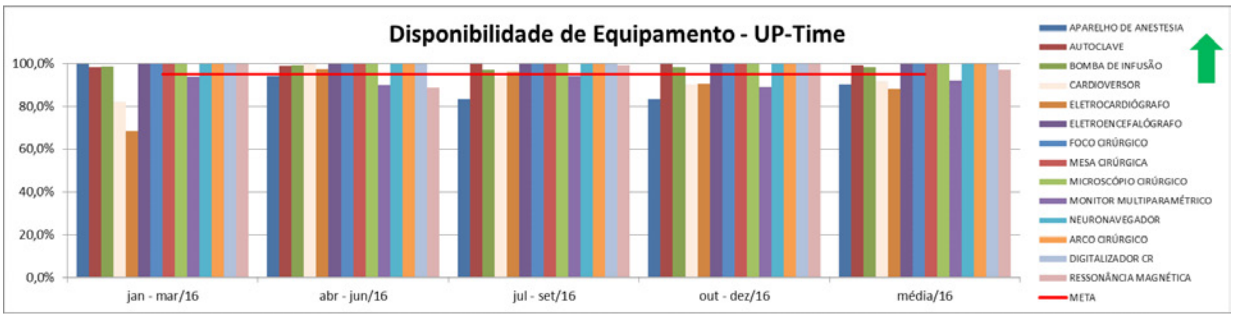


Illustration 16: Equipment Availability Index

Description: Percentage of time the equipment was available for use

Calculation: $\frac{\sum\text{Lifespan in the Period Required} - \sum\text{Non-functioning in the Period Required}}{\sum\text{Lifespan in the Period Required}} \times 100\%$

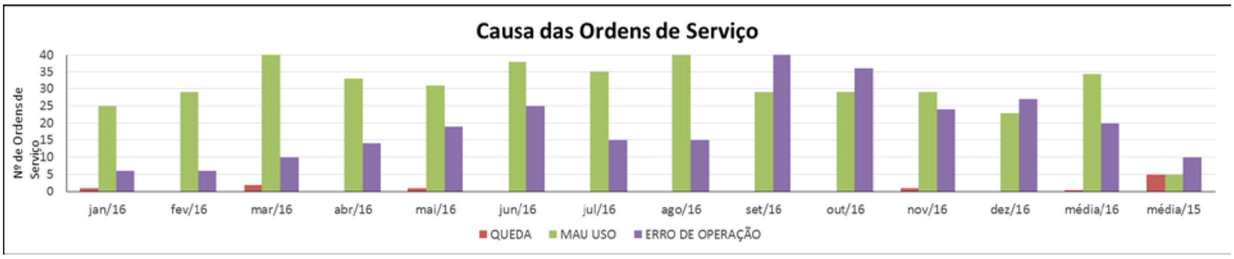


Illustration 17: Causes for the Work Order Index

Description: What triggered the work order

Calculation: ∑Total Amount of Causes by Sort

4.6. Contracts

The implementation of the system provided greater visibility of existing contracts, which, in turn, enabled improvements, inclusion of new equipment and, above all, the unification of several contracts from the same manufacturer into a single one.

Bellow, we list some benefits from unifying contracts:

• Greater control and better management of the contract and less administrative processes;

• Reduction and unification of costs for the same equipment by comparing prices and taking as reference the lowest price among the contracts to be unified;

• For contracts where it was not possible to reach a better value, we improved the technology gain by, for instance, incluing preventive kits in contracts for pulmonary ventilators, transducers in ultrasound contracts, etc.;

• In addition to the inclusion of corrective and preventive maintenance parts, for some contracts, we also included consumables / accessories to reduce equipment's downtime - whether due to maintenance problems or lack of an accessory - to the fullest, hence increasing its availability to the user;

• Decrease of single and distinctive processes to purchase parts and / or services;

• Increase of equipment availability.

The benefits mentioned above, lead to several additional qualitative benefits, such as: increasing high-quality exams, enhanced safety for patients and users of equipment, etc.

Illustration 18 presents the advantage in HC-FMUSP's annual economic result accomplished after unifying the contract of a supplier of diagnostic imaging equipment with an increase in technology. Illustration 19 shows improved performance regarding Institute of Radiology's equipment belonging to the aforementioned contract.

Illustration 18: Economic Impact for HC-FMUSP after the Unification of Contracts

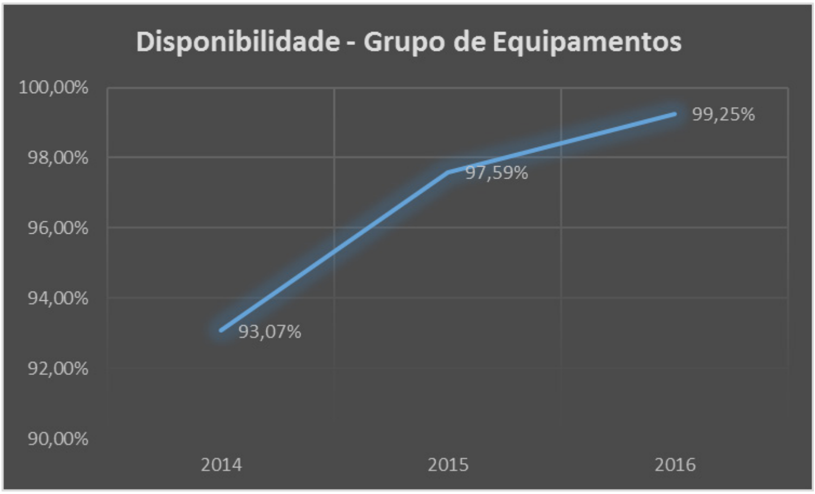


Illustration 19: Performance Outcome of INRAD Equipment after the Unification of Contracts

4.7. Hospital Accreditation

Considering the topics mentioned above, it is safe to say the implementation of the system, i.e. the clinical engineering department, was elemental for the success of the hospital accreditation process: the institutions we alluded to have been accredited by ONA (National Accreditation Organization) either on level 1 or 2, depending on their implementation process.

Article

Grid-tie photovoltaic systems: brief history and its implementation in the hospital environment

Authors:
Rafael Kotchetkoff Carneiro
Ana Carolina de Oliveira Sousa
Lucas Teixeira
Pedro Carneiro

ABSTRACT

The study concerns the implementation of grid-connected photovoltaic systems, intended to reduce energy consumption and clean energy generation, in hospital environments. It takes into account the physical and electrical interventions required in hospitals for the correct implementation of the photovoltaic system, as well as conducting a brief financial study regarding the reduction in energy billing. Some case studies of design and implementation in hospitals in Brazil and in the world are presented.

KEYWORDS

Photovoltaic system, hospital environment.

CATEGORIES OF THE ISSUES WE COVERED

This paper has been divided into three great categories:

• Contextualization of the energy industry

• Technical review and integration with hospitals

• Case study and decision-making process

Therefore, we hope to help those designing hospital plants; healthcare directors; and every professional involved in organizing and running a hospital to have a broader understanding of the reasons for implementing a photovoltaic system; the low technical risks associated to it; and the decision-making process that enables such execution.

CONTEXTUALIZATION

The increasing global consumption of energy

Men has changed its perception regarding electrical energy throughout time, from an unknown event, in early contemporary era, to a key element in less than half a century.

Currently, increased energy consumption means economic growth and better quality of life. Nonetheless, the downsides are also a reality, especially with respect to environmental issues.

Global energy consumption has skyrocketed about 5,000% since the year 1800 and over 100% over the last 30 years, chiefly after Chinese economic restructuring and the expansion of emerging countries (IEA, 2016, p.8).

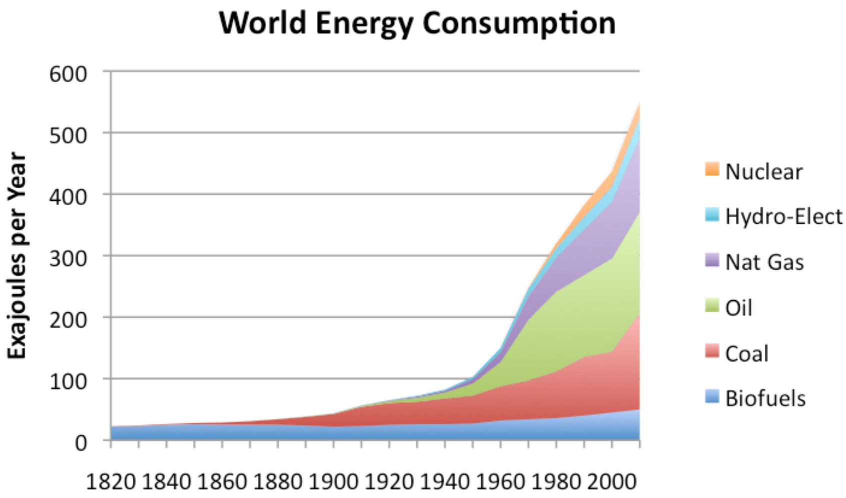


Illustration 1:
Increase of power generation by sort over the years.

Source:
Based on Vaclav Smil estimates from Energy Transitions: History, Requirements and Prospects together with BP Statistical Data for 1965 and subsequent

ENVIRONMENTAL IMPACTS RESULTING FROM ELECTRICAL ENERGY

The environment has been suffering from massive impacts caused by the boost of electrical power worldwide, which is responsible for one quarter of the direct sources of greenhouse gas emission (IPCC, 2014, p. 44), mainly due to the construction of power plants and transmission lines, besides the use of the so-called dirty sources of energy, such as coal.

Since energy consumption will certainly keep growing, as well as environmental concerns, the research and development of renewable energy sources is developing progressively. If, in the early 70's, roughly 0,1% of energy came from renewable sources, nowadays this number has increased in 14 times (IEA, 2016, p.6).

In the light of this context and once renewable energy has become cheaper and less centralized when compared to big power stations, new possibilities have aroused for the generation of energy with the Shared Distribution (W El-Khattam, 2004, p. 119).

ALTERNATIVE ENERGY IN BRAZIL

In 2012 Brazil implemented the Energy Compensation System, which laid the foundations for a set of market rules for the shared generation of alternative sources, largely when referred to photovoltaic solar energy and wind power (ANEEL, 2012).

Since then, it has been possible to install a photovoltaic system connected to the regular power network in general buildings and houses, which ensure more time of and cheaper energy supply.

As a consequence, Brazil has improved its capacity to provide photovoltaic power, going from zero to 21MW between 2014 and 2015, as well as wind power and other sources of renewable energy (TOLMASQUIM, p.279).

Fonte	Potência Instalada (MW)		Variação
	Janeiro/2014	Dezembro/2015	
Eólica	2.653	8.277	+212%
Hidráulica	97.956	100.601	+3%
Térmicas	20.129	22.079	+10%
Térmica Biomassa	9.484	10.999	+16%
Fotovoltaica	0	21	-
Nuclear	2.007	2.007	0%
Total	132.229	143.985	+8%

Illustration 2: Installed power 2015/2016 by category

Fonte: CCEE, 2015b, 2016

Solar energy acts at the same time as direct and indirect source of power for almost all the other types of energy found in nature and that we use to generate electrical energy. Solar photovoltaic power runs by directly changing solar radiation into electrical power, however thermal, hydro, wind, biomass, and tidal power are indirectly generated by solar energy.

THE USE IN HOSPITAL ENVIRONMENTS

Hospitals handle a number of electromedical equipment (also known as medical and hospital equipment), several light bulbs, and there is usually a heavy use of air-conditioning, which leads to an increasingly high use of electrical energy that financially impact a hospital's budget, money that could be better used to invest in hospital's target activity. By using photovoltaic systems, primarily the ones connected to the network, producing its own energy and reducing electricity consumption provided by the supplier the hospital will greatly reduce its costs and carbon emission.

PRINCIPLES FOR OPERATION

The photoelectric effect and the *annus mirabilis* of physics

The photoelectric effect was first observed by the French physicist Edmundo Bequerel in 1839 (NASA, 2002), who discovered that certain materials produced electric current when exposed to the sun.

Some decades later, in the year 1905, physics had its annus mirabilis, mainly after Albert Einstein published his most important articles. In the most famous one, Einstein describes the famous equation $E = m.c^2$, which relates energy to mass. Despite the popularity of his equation and his fame due to his study on the Theory of Relativity, it was Einstein's work describing the nature of light in the photoelectric effect (EINSTEIN, 1905) that won him the Nobel Prize in Physics and triggered the modern age of the study of photovoltaic energy.

In short, the generation of electric energy happens when the photons, coming largely from the sun, supply enough energy for the electrons of the materials to move, allowing the generation of electric current. It is noteworthy that it is not the heat of the sun that causes electrical energy to be produced in this case, but the light and the solar radiation that reach the material responsible for such transformation.

Physical construction of photovoltaic modules

Most of photovoltaic cells are produced via semiconductor material, which are widely used within the electronic industry to manufacture chips.

The cells are generally made of silicon coated with a thin layer of antireflective material, usually a special type of glass, which provides good transparency, weather and impact resistance.

For the construction of solar cells, a silicon wafer is covered in a way as to generate an electric field in the material. When light is incident upon the cell, the electrons are released from their atoms in the semiconductor, generating current.

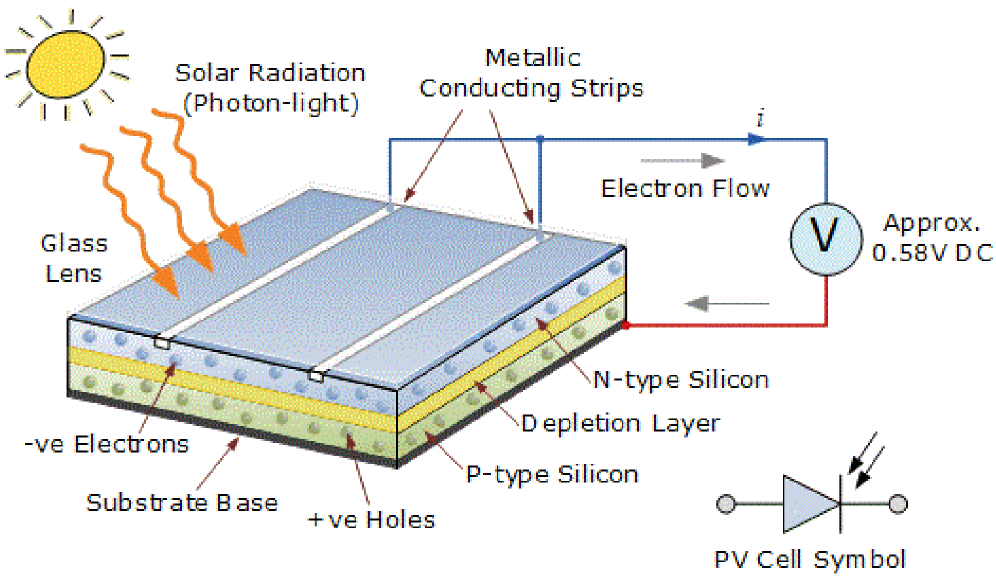


Illustration 3: How a photocell works
Source: Adapted from Alternative Energies Photovoltaic "Solar Cell for Photovoltaic Solar Panels.pdf"

The intensity of current produced varies according to the incidence of solar radiation. In the event of a source of shadow, the generated electric current lessens, therefore cutting back on the power provided by the module.

History of the modern photovoltaic cella

A collection of photovoltaic cells electrically connected over a base is called photovoltaic module, the serial connection of such modules is called a string; finally, a set of strings give rise to a photovoltaic array.

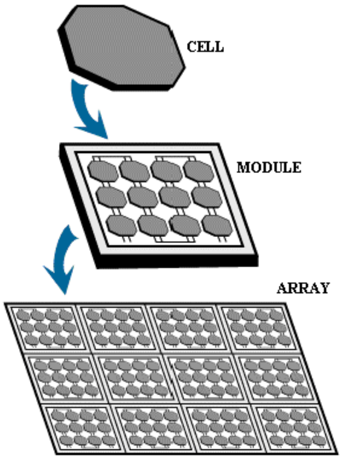


Illustration 4:
Interconnections between photovoltaic cells and modules

Source:
Science Beta NASA - How do Photovoltaics Work? August, 6th, 2008

The first photovoltaic module was built in 1954 by Bell Laboratories and it was considerably expensive to be produced on a large scale. Five years later, this technology was used to provide electrical energy to NASA's spacecraft and satellites and, thanks to this investment, the cost of producing photovoltaic modules has been reduced.

Soon after, in the seventies, there was the global oil crisis, making room for the recognition of alternative sources of energy.

Currently, the research of more efficient technologies and materials to produce the photoelectric effect is continuously expanding according to a study carried out by the American National Renewable Energy Laboratory (NREL, 2014).

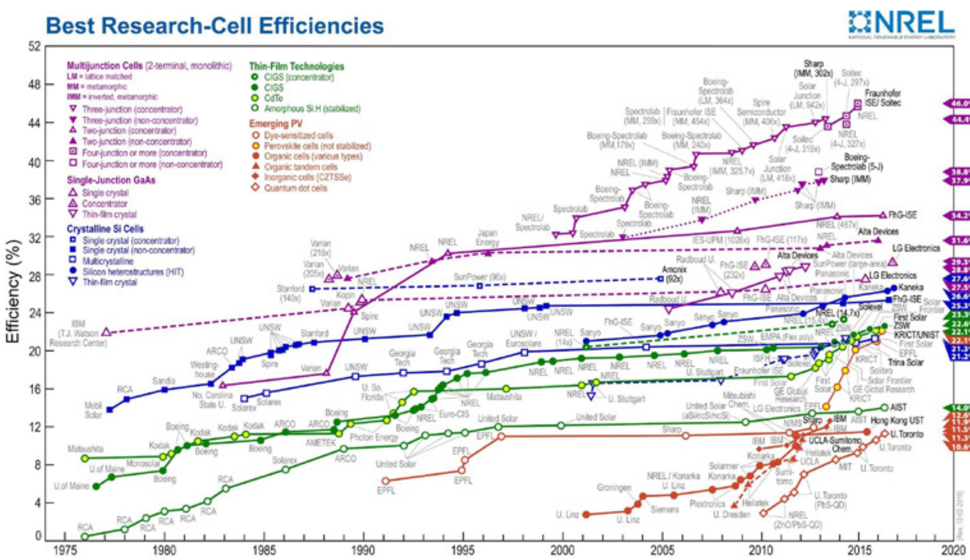


Illustration 5
Source: National Renewable Energy Laboratory 2014

TENDENCIES IN THE PHOTOVOLTAIC INDUSTRY

National overview

In 2012, the Brazilian Electricity Regulatory Agency (ANEEL) introduced the Normative Resolution # 482, later replaced by the updated Normative Resolution #687/2016, which set the general conditions for the micro and mini-generation distribution in the country, as well as for the electrical energy compensation system.

This resolution allows the clients from energy suppliers to have their own generation systems and to trade their surplus for energy credit, which can be used to subside further electricity bills up to 60 months.

It is noticeable that the photovoltaic energy generation industry is one of the fastest growing Brazilian ones, even during the country's recent economic crisis, showing a projection of growth of 300% in 2016 (MEYER, 2016).

Between 2013 to 2015, the number of photovoltaic solar systems in Brazil grew more than 70 times. Even if the number of facilities is numerically low when compared to the countries with a more consolidated industry, such as Germany, China and the United States, the Energy Research Company (EPE) forecasts an exponential growth until to 2024 (EPE, 2014, PDEE pp. 383).

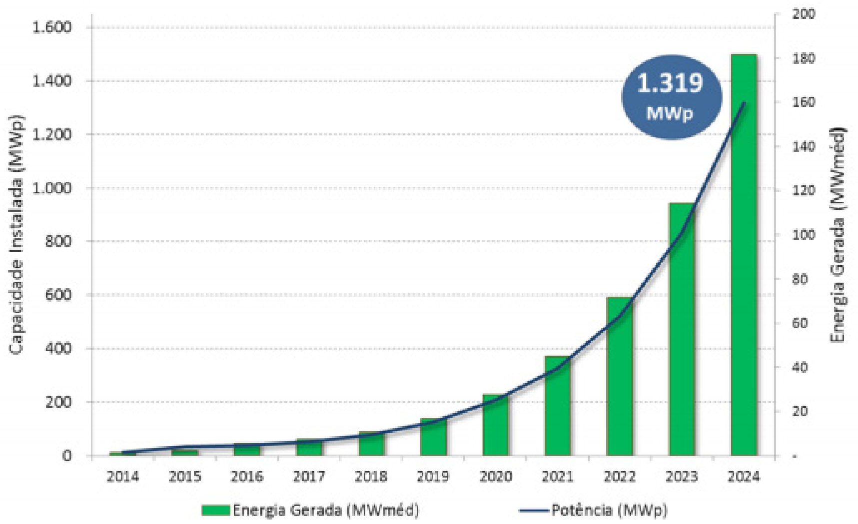


Illustration 6

Source:
Energy Research Company 2014

Brazilian potential

Brazil is a country with high levels of insolation and, therefore, is believed to become a well-stablished generator of photovoltaic solar energy.

German insolation levels, one of the largest photovoltaic producers in the world, are lower than Brazilian's; the best German insolation area presents only two thirds of the levels found in Brazilian worst area (VILLALVA, 2015).

In Brazil, the Northeast and Central-West areas receive the highest solar insolation, above all in the countryside of Bahia. The Brazilian National Institute of Space Research (INPE) has designed the Brazilian Solar Atlas (INPE, 2006, p.40), which is shown below considering the global solar radiation, inclined plan, annual average.

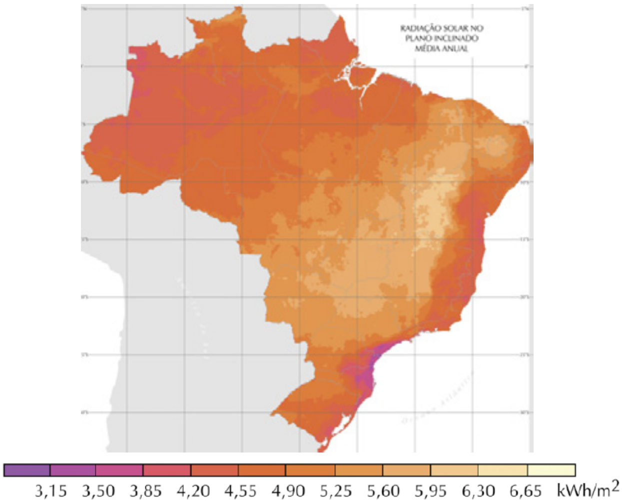


Illustration 7
Source: Brazilian National Institute of Space Research, 2006

Illustration 8: Research Photovoltaic Dam Irecê, Bahia, one of the areas with the highest levels of insolation in Brazil
Source: Solstício Energia, 2015

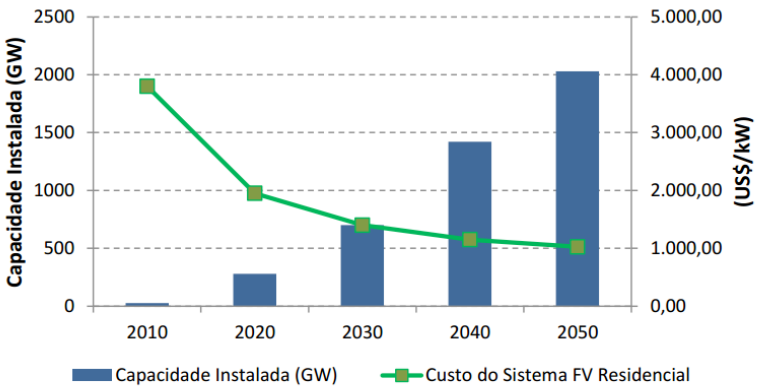
Global perspective

International Energy Agency (IEA) is estimating an exponential growth of the installed capacity of photovoltaic energy. It is estimated that by 2050 there will be about 2,000 GW installed, more than 100 times the total installed capacity in Germany in 2010.

According to IEA data, by 2020, residential and commercial systems will account for approximately 60% of photovoltaic generation; photovoltaic plants will account for 30%; and isolated systems, 10%. This growth is a result of increased demand for small systems due to a fall in cost of close to 50% between 2010 and 2020 (IEA, 2012).

Illustration 9:
An estimate growth of installed capacity and costs until 2050

Source:
EPE study based on IEA (2012)



AN ANALYSIS OF THE TYPES OF PHOTOVOLTAIC SYSTEMS

The grid-tie photovoltaic systems differ from the off-grid ones in three primary aspects: type of equipment; purpose of use; and associated cost.

Type of system	Used equipment	Purpose	Cost
Grid-tie	Photovoltaic panels Frequency inverter	Cheaper electricity bill Minimized impact on the environment To prevent increasing fees	Low
Off-grid	Photovoltaic panel Batteries Charge regulator Frequency inverter	To generate power in areas without electrical supply Independence from electrical suppliers	High

Illustration 10
Source: Solstício Energia, 2017

There are a number of advantages the grid-tie systems offer: higher guarantee of energy supply during periods of no insolation; cheaper installation; regulated market; cheaper electricity bill; less environmental impact; low-budget maintenance cost compared to off-grid systems since it does not require the use of batteries.

The purpose of the photovoltaic frequency inverter

Just like batteries and power unities, the photovoltaic modules generate tension and ongoing current, therefore, to supply power to common equipment, they must carry transform direct current into alternating current. The equipment responsible for this transformation is the photovoltaic inverter.

Inverters are then responsible for the connection to the grid and it is through them that the energy supplied by the panels feeds the light bulbs and other equipment connected to the conventional electricity grid.

Considering its different uses, there are some topologies of photovoltaic inverters, as presented below.

Type of Inverter	Advantages	Disadvantages	Regular use
Micro-inverter	To optimize small arrangements of panels and individual panels Placed underneath the photovoltaic panel	Higher cost of scalability Higher maintenance cost	Few panels Panels with multiple orientations More presence of shadow
String e Multi-string inverter	To optimize small arrangement of panels It offers a range of potency levels Well established market A good variety of models made available	Low-level optimization in the occurrence of shadow	Roof installation Commercial, residencial and industrial installations
Central inverter	An exclusive inverter for a great arrangement of panels	It requires an extensive area It requires arrangements of panels alike	Photovoltaic power stations

Illustration 11
Source: Solstício Energia, 2017

Over the years and needing to reduce the cost of inverters, several manufacturers have emerged and consolidated themselves in the market with various technologies. Thus, the cost per Watt (unit power) of the inverter has plummeted in the last decades (GERALDI, 2013), making it easier to purchase the equipment and reducing the overall cost of implementing photovoltaic systems.

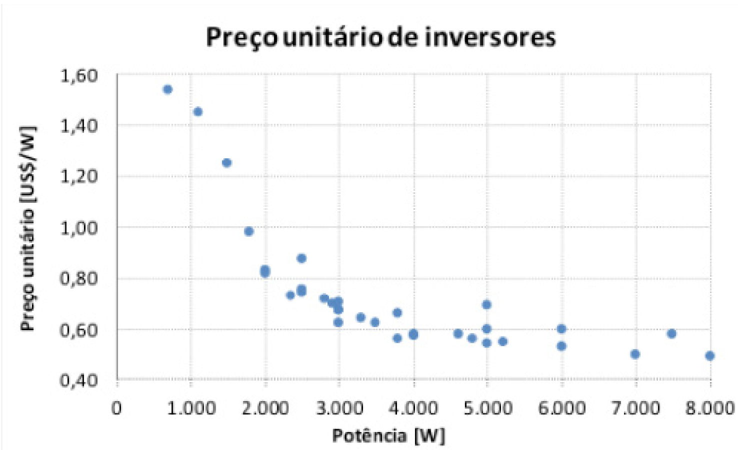


Illustration 12
Source: EPE - Energy Research Company, "An Analysis concerning the Implementation of Solar Generation in the Brazilian Electric Matrix," Rio de Janeiro, 2012

Illustration 13: Installation of a string photovoltaic inverter
Source: Solstício Energia 2016

Inverters in the hospital environment

The most suitable types of inverters for hospital environment use are the micro-inverters and the string inverters, the latter being generally the most cost-effective one.

Both types require little physical area of usage, produce very low noise, below 50dB (A), and need simple shelter infrastructure, sometimes it is even possible to expose them outdoors.

Therefore, the necessary adjustments to shelter the equipment are minimal whether for already existing hospitals or for the ones being planned.

INTERFERENCE WITH MEDICAL AND HOSPITAL EQUIPMENT

A constant concern within healthcare facilities is the safety of equipment, its operators and the patients in contact with them; hence the reason for also analyzing the operation of medical and hospital equipment whenever there are photovoltaic generators.

Sources of electrical interference with medical and hospital equipment and its associated risks

There are three leading sources of electrical interference that might impact medical and hospital equipment, which may cause inconsistent measurements and material loss to the equipment, besides harming the treatment or putting the like of a patient at risk (AMARAL, 2012).

Causes for electrical interference	Source of the interference	Associated risks
Low-quality supply of electrical energy	Power supplier	Flaws or malfunctioning of medical and hospital equipment, which might affect diagnosis and put patients at risk
Electric transient	Direct and indirect action of lightning	Flaws, malfunctioning and structure damages of medical and hospital equipment, which might affect diagnosis and cause material loss to the hospital, besides putting the patient's life at risk
Electromagnetic interference	Equipment lacking cell regulation	Flaws, misreading, and malfunctioning of medical and hospital equipment, which might harm diagnosis and put the patient's life at risk

Illustration 14
Source: Solstício Energia 2017 and AMARAL 2012 p.43

The photovoltaic inverter and the interference with medical and hospital equipment

In view of the causes of interference shown in the table above, it is possible to conclude a high-quality photovoltaic inverter will hardly harm either patients or medical and hospital equipment.

In addition, the sale of inverters in Brazil is only made after INMETRO (Brazilian Regulatory Agency) certifies it, which ensures inverters follow all Brazilian rules regarding a safe operation. If the inverter uses Wi-Fi communication, ANATEL (Brazil's Telecommunications Agency) must also authorizes its use.

Causes for electrical interference	**Strategies to mitigate problems with photovoltaic inverters**
Low-quality supply of electrical energy	To use only inverters certified by INMETRO Automatic power cut in case of low-quality energy
Electric transient	Anti-panic devices linked to the equipment but with independent installation
Electromagnetic interference	Wi-Fi modem certified by ANATEL Coat equipment with electromagnetic protection

Illustration 15

It is also noteworthy that the source of power that feeds the electrical equipment little alters its operation.

Therefore, for instance, a computerized tomography machine's operation is the same regardless of the source of its electrical energy, which could be photovoltaic; hydroelectric; or gas-fired.

HOW TO INTRODUCE A PHOTOVOLTAIC ENERGY SYSTEM AND ESTIMATE THE ELECTRICAL INFRASTRUCTURE FOR HOSPITALS

There are many ways to participate in ANEEL's Electric Energy Compensation System. The simplest one is by implementing a photovoltaic system in areas with few sources of shadow within the hospital, such as roofs and parking lot coverage. Nonetheless, it is also possible to implement the system through quotas of a solar condominium and remote consumption, in which the photovoltaic plant is not placed in the unit of consumption.

Designing and estimating the electrical infrastructure for the establishment of photovoltaic systems within hospital environments

Generally speaking, photovoltaic systems require little intrusive infrastructure, which often leverages an area previously underused, such as roofs and parking covers.

Moreover, the interface connecting photovoltaic inverters to the hospital power grid is relatively simple, requiring only appropriate cabling and a convenient place to shelter the inverter, which may even be exposed to weather changes.

Example of a hospital suitable for receiving grid-tie systems

A model hospital would have some relatively simple technical aspects to receive a photovoltaic system with quality. It is important to emphasize that the items listed make it easier to implement photovoltaic systems but are not *sine-qua-non* conditions to make it possible.

Technical aspects	**Advantages**
No shadow over the roof	More energy produced by the panels
Northbound roof and/or inclined closely towards the place latitude	
High-quality roofing tiles	Safer fixing structure
High-quality roof structure	
Electrical conduits from the roof to inverter sites	Besides ensuring safety, preserves electric cabling by not exposing it
Provision of power grid towards the inverter site	Besides making the process easier, it increases the quality of installation
Restrict access to the inverter site	It helps mitigate risks during operation
Trained maintenance team	

Illustration 16

Even if an already existing hospital fails to provide such technical aspects, chances are the grid-tie will still be viable.

IMPLEMENTATION IN HOSPITAL ENVIRONMENTS AROUND THE WORLD

There are already several hospitals around the world with successful experiences in the implementation of photovoltaic systems of various types and sizes.

There are hospitals exclusively powered by isolated systems from the grid, which fully supply the hospital and store the energy in batteries, especially in places where the electrical grid is non-existent or of poor quality.

There are also cases where the system is connected to the grid by a structure of energy credit and sale, like the Belgian case described below, in which 95% of the energy consumed comes from the grid-tie system and then the valued is discounted from the power bill.

Illustration 17: Hospital that received a donation of a 19kW off-grid system in northern Benin, which supplies the warehouse and the local cafeteria
Source: MORAGUES, 2015

Illustration 18: Photovoltaic system connected to the 425kW grid in Soignies, Belgium, in an existing hospital, which reduces electricity costs by 95%
Source: TECSOL 2014

Illustration 19: A system connected to a 266kW grid with 38 string inverters in Pialba, Australia, which has been designed considering the photovoltaic system from its inception and has been optimized to receive the grid-tie
Source: ABB, 2013

Illustration 20: Photovoltaic system connected to the grid with 2.34 kWp of panels and 3 kW inverter, located in São Paulo, Brazil, at the headquarters of the Hospital Research Institute Jarbas Karman
Source: Solstício Energia, 2016

Impact on the Electric Bill – Brief Economic Analysis

To understand the impact photovoltaic systems will have on the energy bills of a hospital, it is necessary to first explain how most Brazilian hospitals are charged. ANEEL generally estimates the classification of customers in the captive energy market - consumer units that buy energy directly from the suppliers or licensees - in two large groups: customers that are connected in low voltage, i.e. customers B, and clients connected in average / high voltage, i.e. customers A. How each of these units is charged varies according to their respective class.

B1 - Residencial	A1 (230 kV ou mais)
B2 - Rural	A2 (88 a 138 kV)
B2 - Cooperativa de Eletrificação Rural	A3 (69 kV)
B2 - Serviço Público de Irrigação	A3a (30 a 44 kV)
B4 - Iluminação Pública	A4 (2,3 a 25 kV)
B4a - Rede distribuidora	AS (Subterrâneo)
B4b - Bulbo da lâmpada	

Illustration 21: Fees according to the consumer unity and connection voltage
Source: MME, 2011

Consumer units that have contracted demand above 75 kW must be connected in at least medium voltage and classified from subgroup A4, as above. Thus, for the purpose of this study, a standard case is adopted where the hospital is classified before the concessionaire in the subgroup A4, and, in addition, has chosen green charging. The charging possibilities within the A4 subgroup are: conventional - it benefits small and medium-sized establishments; green - benefits medium and large sized establishments that have a consumption at controlled peak hours, where the fee is higher; and blue - benefits medium and large establishments that need to consume energy during peak hours. The more specific differences between these tariff subgroups will not be addressed in that article.

In general, excluding other possible charges and fines, the value of the energy bill of an A4 Verde consumer unit shall be calculated according to equation 1.

$$VALUE = \frac{(C_{FP} * (TE_{FP} + TUSD_{FP}) + C_P * (TE_{FP} + TUSD_P)) + D * TD)}{(1 - \%ICMS - \%PIS - \%COFINS)} \qquad \textbf{Equation 1}$$

Where C represents the energy consumption in kWh; D, the contracted demand in kW; TE, the energy tariff; TUSD, the distribution system use tariff; FP, off-peak; P, peak hours; % ICMS, % PIS and % COFINS represent the tax rates that affect the energy bill.

As one of the goals of acquiring a grid-tie system is to reduce the electric bill, within the scope of the Electric Energy Compensation System provided by ANEEL, it is clear from equation X1 that, by reducing the CFP and CP variables, the value of the account reduces energy consumption in the same proportions. This is possible because, for the whole national territory, the PIS and COFINS taxes are levied on the amount consumed, and the credits generated are written off.

Besides, 22 states of the nation have already adhered to the exemption of ICMS for micro and distributed mini-generation.

In general, the financial return for the purchase of an grid-tie for a hospital classified as Green A4 is close to 7 years, depending on variables such as energy tariffs, hospital consumption profile, and the power of the system to be installed. The price of larger systems, normalized per unit of power, is usually lower by the scale gain of the project.

However, considering that photovoltaic solar generation happens generally at a time considered off-peak, in order for the system to be completely viable, with paybacks in the order of 5 years, it is necessary to have a generation higher than the consumption of the unit. This is because ANEEL estimates that to use the credits generated during off-peak hours, the relation between the energy tariffs (TE) of each should be respected. Thus, it is interesting for the hospital, which pays a ratio of about 3 to 4 times to the full P rate compared to FP, to acquire a larger system, since this relation does not hold when considering the energy. It is common to find a factor of 1.4 times, comparing PET with TFP.

The market estimate for grid-tie photovoltaic systems for 2017 is positive, not only because of increasing acquisitions by Brazilians - today there are more than 7,000 consumer units with distributed generation - but also because, with the global expansion of technology, prices are plunging. Each kWp - power unit commonly used for photovoltaic systems - is capable of generating around 1400 kWh per year, and is costing today, for larger systems, around 1,000 US dollars.

Considering medium-sized hospital with an average monthly energy consumption of 100,000 kWh, a system larger than 850 kWp would be needed for full credit generation, again remembering that the ratio of generation to consumption rebate tip is not 1: 1. Thus, the implementation cost for this system would be close to US 15 million dollars, with a 5-year discounted payback. It should always be taken into account that the energy tariff in Brazil is not stable and has variations that can be avoided with the acquisition of a photovoltaic system, such as tariff flags. The acquisition of a grid-tie system is therefore not only a safe investment - the system has a 25-year life expectancy - but also a security in relation to subsequent increases in energy charging.

Case studies in existing or planned hospitals in Brazil

In terms of the architectural model, hospitals are usually defined by the horizontality of construction. The need for expansion over time of operation and the physical division between specialties lead to a set of independent blocks, both in the design of the roof and in the electrical connections, which interferes with the compatibility of the roofs for installation and demand a different form of sizing that follows these concepts.

Illustration 22:
System connected to the 650kW network with 11 string inverters in Araguaína, Tocantins, in an illustrative image that composes the photovoltaic project

Source:
Solstício energia, 2015

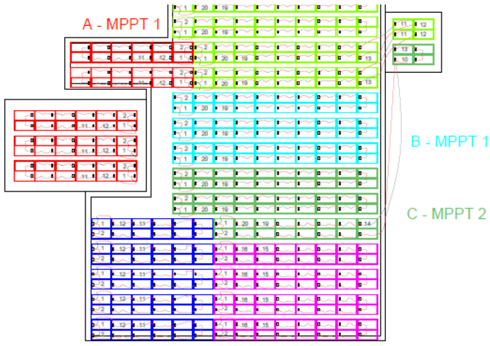
In discontinuous buildings such as hospitals, it would be ideal to develop the project considering a physical division of the system, established by the layout and distance of the roofs. In this way, it is possible to optimize the amount of cables and other inputs used to reduce the time and impact of the installation of the hospital routine and to increase the reliability of the system operation.

In the case of the 124.8kWp photovoltaic system installed in Hospital Israelita Albert Einstein, in São Paulo - SP, the installation site of the panels was chosen due to the available green roof area. There is a symbiotic integration between photovoltaic and green roof systems, where there is a reduction of temperature and increase in air circulation under the photovoltaic modules, and a reduction of direct sunlight on the lawn.

Other criteria that were taken into account for the planning of the installation of this photovoltaic system, besides the location of the modules, were those previously mentioned, as the location of the electrical connection point, electric room availability for the inverters, with restricted access, among others.

It also became necessary to study the selectivity and adjustment of the electrical protection equipment in the connection frame of the Hospital substation, due to the criticality of the connection point, which also fed the blood bank. In the study of selectivity, it is taken into account if, in case of any electrical fault of the photovoltaic system, there will be consequences of the electric protection in other circuits, with consequent interruption in the power supply.

Consequently, the study carried out contemplated the readjustment of the protection devices to act selectively to ensure an error or electrical problem in the photovoltaic system causes interruption of energy only in the photovoltaic system thus not affecting the operation of any other power circuit.



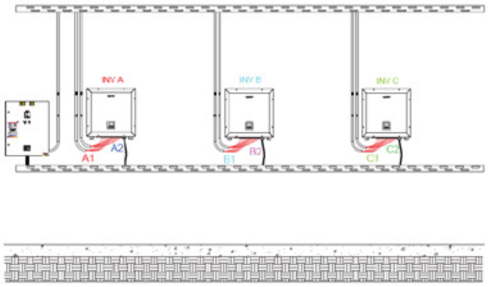


Illustration 23:
System connected to the 124.8 kWp grid with 3 string inverters in São Paulo, SP, in comparative and illustrative images of the execution and design of the photovoltaic system at Hospital Israelita Albert Einstein - HIAE

Source:
Solstício energia, 2018 and Google Earth (Digital Globe), 2018

Reiterating the Feasibility of Implementing Photovoltaic Systems in Hospitals

Throughout this article, we have shown the possibility of generating clean energy in loco for the hospital environment, contextualizing with the global growth of photovoltaic energy and its consequence reduction of cost to the point where investment in solar energy becomes financially interesting.

We also presented the principle under which photovoltaic systems run and their main components, exploring key issues in the integration of energy generation in hospitals and reiterating the technical and financial feasibility of this type of project.

REFERENCES AND ADDITIONAL BIBLIOGRAPHY

Agência Nacional de Energia Elétrica (Brasil). **Atlas de energia elétrica do Brasil** / Agência Nacional de Energia Elétrica. 3. ed. Brasília: Aneel, 2008. Disponivel em: <http://www2.aneel.gov.br/arquivos/pdf/atlas_par1_cap2.pdf> Acesso em: 15/01/2017

AMARAL, H L M. Interferências Eletromagnéticas. **Transitórios e Qualidade da Energia**: impacto nos equipamentos eletromédicos e desenvolvimento de um gerenciador de energia. 2012.

CAPETTA, D. **PEA 5730 - Planejamento Integrado de Recursos**. Tema 21. 2006. Disponível em: <www.seeds.usp.br/pir/pea5730/arquivos/tema21_2006.ppt> Acesso em: 15/01/2017

Empresa de Pesquisa Energética. **Série Estudos da Eficiência da Energética - Nota Técnica DEA 10/14 - Consumo de Energia no Brasil - Análises Setoriais, 2014**. Disponível em: <http://www.epe.gov.br/mercado/Documents/S%C3%A9rie%20Estudos%20de%20Energia/DEA%2010-14%20Consumo%20de%20Energia%20no%20Brasil.pdf > Acesso em: 15/01/2017

Empresa de Pesquisa Energética. **Série Recursos Energéticos - Nota Técnica DEA 19/14 - Inserção da Geração Fotovoltaica Distribuída no Brasil - Condicionantes e Impactos, 2014**. Disponível em: <http://www.epe.gov.br/mercado/Documents/S%C3%A9rie%20Estudos%20de%20Energia/DEA%2019%20-%20%20Inser%C3%A7%C3%A3o%20da%20Gera%C3%A7%C3%A3o%20Fotovoltaica%20Distribu%C3%ADda%20no%20Brasil%20-%20Condicionantes%20e%20Impactos%20VF%20%20(Revisada).pdf> Acesso em: 15/01/2017

Operador Nacional do Sistema Elétrico - ONS. **Histórico da Operação - Geração de Energia**. Disponível em: <http://www.ons.org.br/historico/geracao_energia.aspx> Acesso em: 15/01/2017

PAVLOVIC, T M, MILOSAVLJEVIC, D D, RADIVOJEVIC, A R e A. PAVLOVIC, M A. Comparison and Assessment of Electricity Generation Capacity for Different Types of Photovoltaic Solar Plants of 1 MW in Sokobanja, Serbia. **Thermal Science**, Year 2011, Vol. 15, No. 3, pp. 605-618

PINHO, J T e GALDINO, M A - CEPEL - CRESESB. **Manual de Engenharia para Sistemas Fotovoltaicos**, 2014. Disponível em: <www.cresesb.cepel.br/publicacoes/download/Manual_de_Engenharia_FV_2014.pdf> Acesso em: 15/01/2017

SILVEIRA, A H. **Avaliação do Potencial de Conservação de Energia no Setor Hospitalar da Região Sul do Brasil**, 2008. Disponível em: <http://meriva.pucrs.br/dspace/bitstream/10923/3220/1/000401161-Texto%2bCompleto-0.pdf> Acesso em: 15/01/2017

TVERBERG, G. World Energy Consumption Since 1820 in Charts. In: **Our Finite World**, 2012. Disponível em: <https://ourfiniteworld.com/2012/03/12/world-energy-consumption-since-1820-in-charts/> Acesso em: 15/01/2017

U.S. Energy Information Administration Office of Energy Analysis U.S. Department of Energy Washington, DC 20585. **International Energy Outlook 2016 With Projections to 2040.** 2016. Disponível em: <http://www.eia.gov/outlooks/ieo/pdf/0484(2016).pdf> Acesso em: 15/01/2017

Article

Irineu Breitman's hospital design

Author:
Erick Rodrigo da Silva Vicente

ABSTRACT

This article presents part of the career and work of the architect Irineu Breitman, focusing on his projects for healthcare facilities. In 2018, IPH - Instituto de Pesquisa Hospitalar Arquiteto Jarbas Karman made the decision of housing part of his architectural collection to recover, organize and make his production known, which includes notable hospitals in the southern region of Brazil. Between October 30 and November 1, the Institute organized an exhibition of his work during the 8th Brazilian Congress for the Development of the Hospital Building, where we could structure a brief professional trajectory and identify some of the main works, highlighting interesting aspects of his architecture. The Fêmina Hospital(1954), Joana de Gusmão Children Hospital (1977) and Regional Hospital of Santa Catarina (1979) are among some of the projects shown to the public.

KEYWORDS

Irineu Breitman; Healthcare Facilities; Hospitals; Brazilian Modern Architecture;

INTRODUCTION

There are few publications dedicated to documenting the architecture of Brazilian healthcare facilities including studies that could lead to a better understanding of their physical-functional aspects. The issue becomes more urgent when we consider the architectural production developed from the second half of the twentieth century.

We might say there was a significant change in the ideas regarding hospital design in the 1950s, triggered by the organization of the I Hospital Planning Course by the Institute of Architects of Brazil, in São Paulo (IAB-SP)[1]. According to Renato Gama-Rosa Costa, the event was a milestone for the consolidation of the architects as "protagonists of the hospital construction process, from its conception to the accomplishment of the work", to which he adds:

> [...] The course taught by and for physicians and architects at IAB-SP during 6 days in, April 1953, represented a turning point in this process in Brazil. The team of teachers included great hospital designers, such as Rino Levi, Jarbas Karman, Jorge Machado Moreira, Roberto Cerqueira César and Oscar Valdetaro, having physicians participating in the conception of the project more as consultants than as co-authors (as in the case of the Hospital das Clínicas de São Paulo). Among the attendees, there were some hospital designers, professionals or even students, such as Paulo

Antunes Ribeiro, responsible for the Arnaldo de Moraes Maternity project in Rio de Janeiro; Aldary Toledo, architect for the Bankers Institute of Retirement and Pensions; Arnaldo Mesquita, of the Works Division of the Ministry of Education and Health; João Filgueiras Lima, architecture student and future designer for the Sarah Network hospitals, among others. (Costa, 2011, p. 46)

As a result, researching the architects who have had intense production in the hospital field since then, proposing new solutions and outlining the design strategies that have arisen in architectural innovations, whether in the organization of the program or in the design of the space, is fundamental to understand the transformations of buildings during the second half of the twentieth century.

Among those architects, there is Irineu Breitman, a professional who has had a solid production in the southern region of the country between 1954 and 1998. Former professor at Federal University of Rio Grande do Sul's School of Architecture (FAU-UFRGS) and at Pontifical Catholic University of Rio Grande do Sul (PUC-RS), Breitman has had some of his hospital projects published in important Brazilian magazines, was awarded several prizes and honors and has become well-known among architects who have dedicated their work to the design of healthcare institutions.

Luiz Carlos Toledo, referring to the "evolution of the hospital building in Brazil", states that Breitman, followed by some other architects, owned "not only a broad domain of architectural design" but also "technical-operational aspects of the projected units, especially in relation to infrastructure and hospital management "(Toledo, 2006, p.27).

Considering it all, in August 2018, the Hospital Research Institute, Architect Jarbas Karman (IPH) acquired part of Breitman's collection aiming at recovering, organizing and bringing his production to light. In the same year, between October 30 and November 1, the institute organized an exhibition of his work focusing on his hospital designs during the VIII Brazilian Congress for the Development of the Hospital Building[2]. During the curatorial process, which I carried out teamed up with Eduardo Kariya Nishitani, it was possible to draft his professional trajectory and to identify some of his main works, highlighting interesting aspects of his architecture. Work that will be presented next.

Illustration 1: Exhibition of Irineu Breitman's work in Curitiba
Source: IPH Collection

Illustration 2:
Exhibition of Irineu Breitman's work in Curitiba

Source:
IPH Collection

BRIEF PROFESSIONAL TRAJECTORY

Irineu was born on June 3, 1930, in Cachoeira do Sul (Rio Grande do Sul state). He is the son of the award-winning photographer Sioma Breitman, a Ukrainian who immigrated to Brazil in 1924 and who built his career by portraying places and people from the cities he lived in.

Illustration 3:
Irineu Breitman

Source:
IPH Collection/Irineu Breitman

According to his testimony recorded in video[3], he was supposed to become a civil engineer and mathematics teacher, however after being introduced to an Argentine magazine of architecture, presented by a colleague, he changed his destiny. He enrolled in the Institute of Fine Arts, currently the Federal University of Rio Grande do Sul's School of Architecture (FAU-UFRGS), graduating on June 25, 1953. A year before his graduation, he signed the design for the Brazilian Israeli School of Porto Alegre, revealing great potential.

Illustration 4:
Irineu Breitman (to the left) next to the model of the Brazilian Israeli College

Source:
IPH Collection/Irineu Breitman

Still during the 1950s, he designed the Fêmina Hospital, which won him a bronze medal at the VI Salon of the Riograndense Association of Fine Arts "Francisco Lisboa" (more about this project to follow), won a competition to design an elderly home, "Lar dos Velhos", and was elected chairman for the Institute of Architects of Brazil, Rio Grande do Sul division (IAB-RS, between 1958 and 1961).

Illustration 5: Irineu Breitman (upper left corner), along with the IAB delegation, traveling in China
Source: IPH Collection/Irineu Breitman

In the following decade, he was awarded the silver medal in the I Architecture Hall of Rio Grande do Sul; designed a series of houses in Pelotas and Porto Alegre; was reelected IAB-RS chairman (between 1963 and 1965); began teaching plant design at the Federal University of Rio Grande do Sul's School of Architecture; and designed the Pinel Clinic for the treatment of psychiatric diseases.

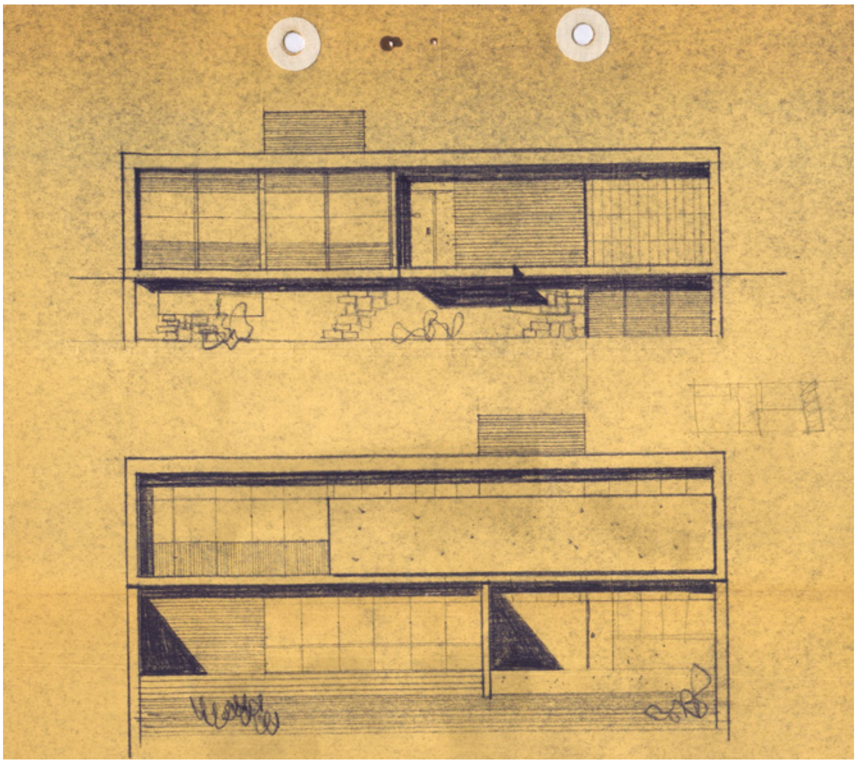


Illustration 6:
Isaac Aguinsky Residence, 1963

Source:
IPH Collection/Irineu Breitman

His production increased in the 1970s after founding HOSPLAN, a company that brought together several professionals with experiences in healthcare facility plan designs. At that point, he partnered with physician and administrator Paulo Lindolfo Lamb, who provided consulting in the area of hospital planning and became an important collaborator in the hospital area. In 1974, he designed Miguel Piltcher Hospital; in 1977, Joana de Gusmão Children Hospital; both designs show a growing preference for physical and functional horizontalization. In 1977, he also began teaching hospital architecture at the hospital administration post-graduation course at the Hospital Association of the State of Rio Grande do Sul and the Pontifical Catholic University of Rio Grande do Sul, which gave rise to his work as passing on and sharing his knowledge regarding the area of hospital buildings architecture.

In 1978, HOSPLAN becomes HOSPITASA. At that moment MD Paulo Lamb (hospital advisor), engineer Paulo Azambuja (structure), Werner Laub (hydraulic and electrical), engineer Aldo dos Santos (medical gases), engineer Fulvio Petracco (air conditioning), engineer João Osório (boilers and steam), engineer Sergio Faerman (radiation protection), agricultor Robald Jamieson (landscaping) and architect Ligia Botta (landscaping). Irineu, who coordinated the team and designed the architect plans, believed the multidisciplinary work was very important for a thorough hospital architecture plan.

Illustration 7:
Work plate from HOSPITASA

Source:
IPH Collection/Irineu Breitman

In 1979, he designed three large public hospitals in the state of Santa Catarina: Physician Hans Dieter Schmidt Regional Hospital in Joinville; São José Regional Hospital, in Florianópolis; Regional Hospital of the West, in Chapecó. The first is a two-story horizontal hospital, and the other two have a horizontal base and a laminar tower.

Illustration 8: Irineu Breitman and Paulo Lamb (both left) next to the models of the regional hospitals of Santa Catarina
Source: IPH Collection/Irineu Breitman

Illustration 9: Irineu Breitman (left) and Jarbas Karman in presentation at the "Assembly of the Latin American Federation of Hospitals", 1980
Source: IPH Collection/Irineu Breitman

In the decades to come, he took part in a series of national and international congresses and events focused on healthcare services, using his hospital designs to impart his experiences, defending horizontal development and the attention to the physical and psychological comfort of users. In 1998, he designed University of Passo Fundo's Teaching Hospital with his son and architect Lucio Breitman, the building was never built though. He was honored on several occasions, including the ADH Congress in 2004 at PUC-RS' School of Architecture in 2010, and the VIII Brazilian Congress for the Development of the Hospital Building in 2018.

FROM MODERN TO CONTEMPORARY HOSPITAL

According to Irineu Breitman's professional résumé, he has designed about 58 healthcare buildings, among new works, extensions and renovations. Unfortunately, just like it normally happens with so many collections of architecture, much of his drawings and memorials have been lost over time. With the purpose of recovering, preserving and disseminating his production, IPH received part of his architectural collection, which accounts for 14 projects developed between 1954 and 1998.

Glancing through it, IPH found 8 projects that stood out, among which 7 were built. Those were chosen to compose the exhibition and offer a panorama to allow a better understanding of Breitman's.

Fêmina Hospital

His first experience regarding the architecture of hospital buildings was in 1954 with Fêmina Hospital, built in the city of Porto Alegre. Only one year after graduating as an architect, Breitman took on the responsibility of designing what would become one of the main hospitals in Porto Alegre devoted to women's health.

Illustration 10: Fêmina Hospital

Source: IPH Collection/Irineu Breitman

Inspired by the principles of Rio de Janeiro School, more precisely by Jorge Machado Moreira architecture, the project proposed a vertical foil supported by pilotis, with nine floors (ground floor, mezzanine plus eight floors), a lower floor surrounded by two large gardens and a three-story building located in the back of the site. The hospital, which was not built according to the original plan, was advised by architect Jarbas Karman, who had probably influenced the design of a technical space for equipment and installations between the first and second floors[4] as well as an 1,80-meter ceiling height, which used to be rather unusual for the time but widely defended by Karman throughout his career.

The floors dedicated to the nurses' stations were single unit[5], the stations were in the central area of the floor and offered a large living room / solarium for patients and families to spend time together.

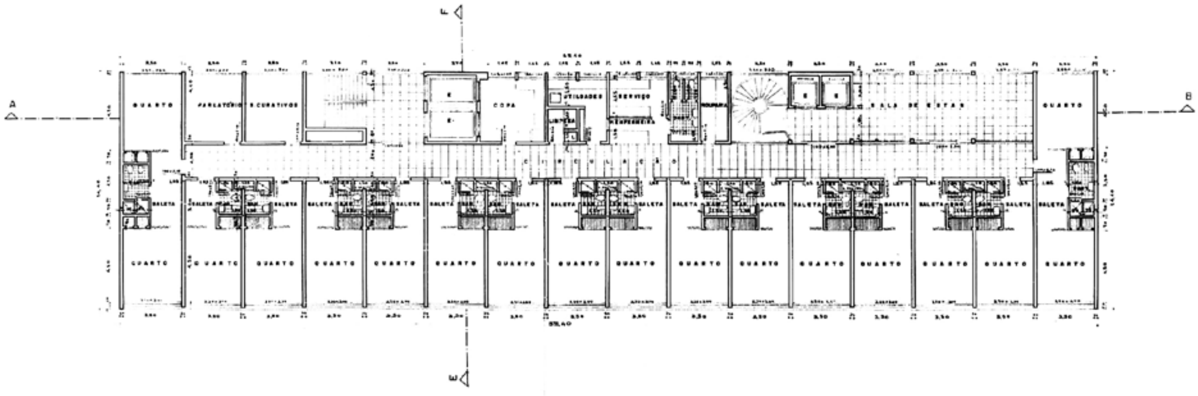


Illustration 11: Plant of the 7th, 8th, 9th and 10th floors - Fêmina Hospital
Source: IPH Collection/Irineu Breitman

The hospital has suffered many modifications and some expansions were carried out in the empty areas of the terrain, but much of the original aspects of the design was preserved, chiefly on its facades, such as the blue tessellations on the piloti and the pink ones on the tower.

Illustration 12: Current Status of the Fêmina Hospital
Source: IPH Collection/Irineu Breitman

Illustration 13: Current Status of the Hospital Fêmina
Source: IPH Collection/Irineu Breitman

Pinel Clinic

Ireneu had experiences with different physical-functional hospital programs. One of them was the project for the new Pinel Clinic building, in 1968, for the treatment of psychiatric patients.

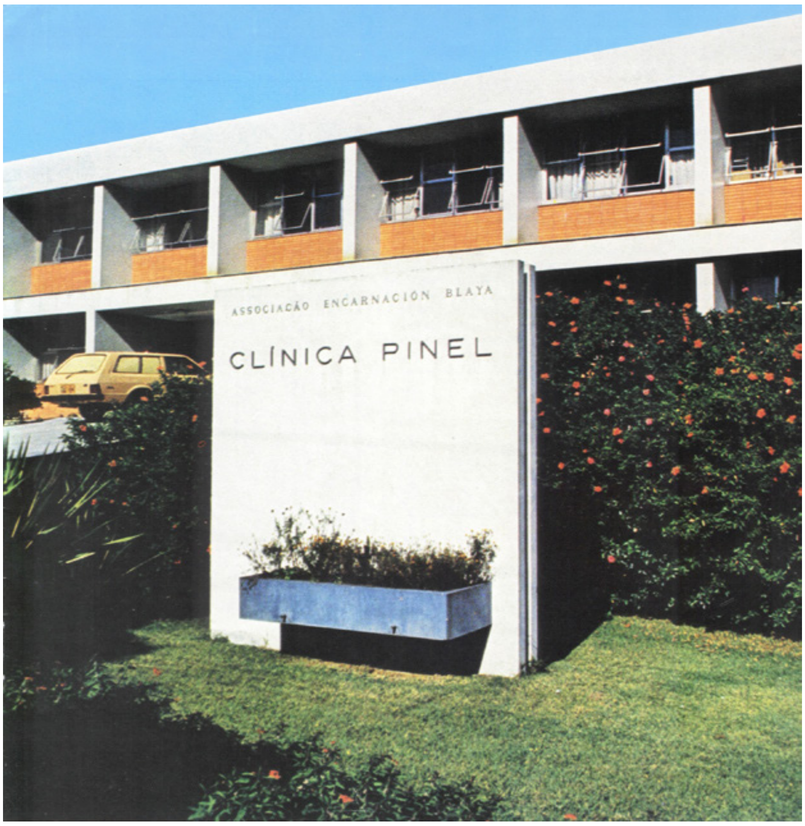


Illustration 14:
Pinel Clinic

Source:
IPH Collection/Irineu Breitman

Pinel Clinic was founded in 1959 by psychiatrist Marcello Blaya Perez. In the 1950s, Perez made a trip to the United States and Canada, during the experience he spent some time at the Menninger School of Psychiatry, in Topeka, Kansas, where he had contact with a style of psychiatry practice strongly based on psychoanalysis. Upon returning to Brazil, he shared his new knowledge in Porto Alegre. His clinic had to function in adapted mansions until he was able to acquire a terrain to build a proper building for it. It was when he hired Irineu Breitman to develop the project and the engineer Pedro Gus to manage the work.

The architectural program proposed two phases of care: the first one dedicated to welcoming patients, ambulatory services and Day Hospital; the second one dedicated to psychiatric admissions focused on the control patient episodes.

The design had two perpendicular foils with different facades. The first one facing, Rua Santana, had three floors and was composed of a grid and sills coated with ceramic tiles; the second one, perpendicular to the first, had four floors and it was also composed of a grid, but with sills of different heights and coated with turquoise-blue tessellations.

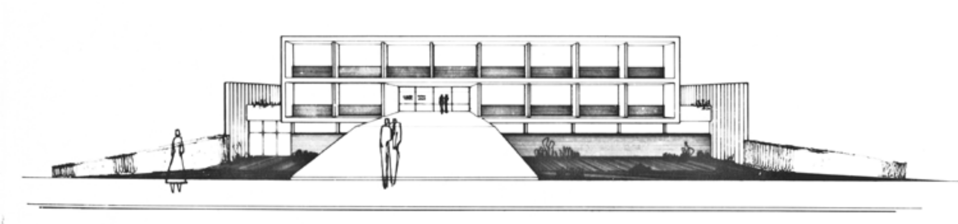


Illustration 15: Pinel Clinic's perspective
Source: IPH Collection/Irineu Breitman

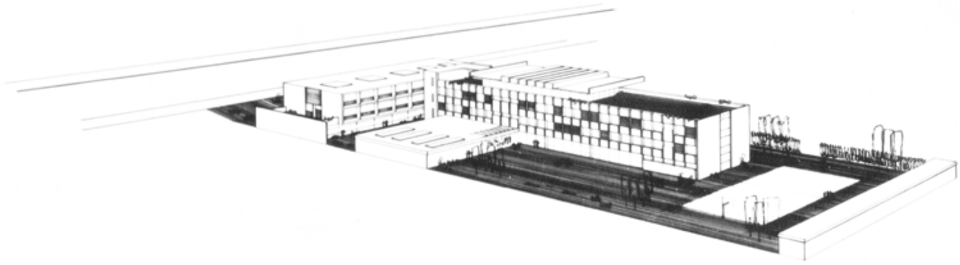


Illustration 16: Pinel Clinic's aerial perspective
Source: IPH Collection/Irineu Breitman

Another interesting detail was the design of the windows. They had retractable blinds whose foils were placed in such a distance that prevented patients to pass through them, forgoing the need for security grills, which were common at psychiatric hospitals at the time. There was also a special attention so ensure walls and the gardens did not evoke a feeling of imprisonment. The project also stands out for its generous group areas, such as living rooms with large openings to the outside and outdoor recreational areas, with swimming pool and sports court.

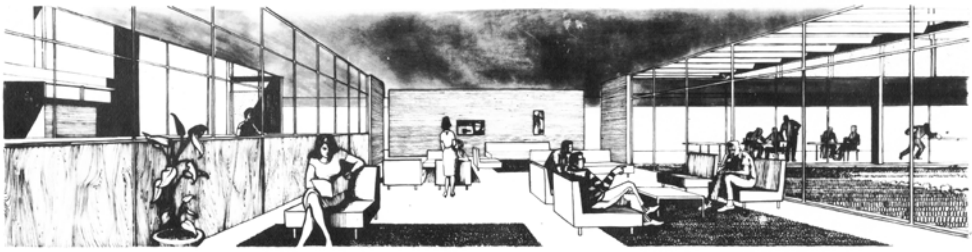


Illustration 17: Perspective of the living room of the Pinel Clinic
Source: IPH Collection/Irineu Breitman

Illustration 18:
Living room of the Pinel Clinic

Source:
IPH Collection/Irineu Breitman

Miguel Piltcher Hospital

Over time, the experiences with "Lar dos Velhos", in 1958, and Pinel Clinic influenced Breitman to opt for the horizontalization of hospital edifications. Miguel Piltcher Hospital, designed in 1974 in the city of Pelotas, marked the transition from the "Rio de Janeiro School" to the search of more formal and aesthetic solutions, which would be more appropriate to the functional issues of hospital buildings.

Illustration 19: Miguel Piltcher Hospital
Source: IPH Collection/Irineu Breitman

The building uses a mixed typology, defined by Lauro Miquelin as "tower block" (Miquelin, 1992, p.59 and 60), also known as "tower base". This typology remains very regarded nowadays since it is a solution that makes it possible to place several similar hospital services on the same level. The ground floor houses the outpatient care clinic and diagnostic, therapy, logistical and administrative support sectors. The nurses' stations are located on the floors at the laminar tower, which is located on the opposite side of the main access.

It is also noteworthy the use of Sheds on the ground floor coverage. Irineu has always been worried about users hygrothermal and psychological comfort. Opting for a single floor to shelter more than half of the functional program, coupled with the reduced dimensions of the terrain (which was practically all occupied with the horizontal projection of the building) made it difficult to develop gardens, which greatly contributes to the quality of the environment. Thus, to provide natural lighting and ventilation to indoor spaces, Irineu designed a sequence of Sheds, executed in reinforced concrete, arranged longitudinally (parallel to the tower), allowing the installation of tall windows in almost all rooms of the ground floor. This design strategy has been used in almost all hospital projects since then.

Illustration 20: Indoor environments illuminated by Sheds
Source: IPH Collection/Irineu Breitman

Illustration 21: Indoor environments illuminated by Sheds
Source: IPH Collection/Irineu Breitman

Joana de Gusmão Children Hospital

His preference for horizontal hospitals was consolidated in 1977 when he designed Joana de Gusmão Children Hospital, a public institution located in the city of Florianópolis, Santa Catarina. It has 14,835 m² of constructed area and capacity for up to 280 beds.

Imagem 22: Children's Hospital Joana de Gusmão
Source: IPH Collection/Irineu Breitman

This hospital was designed to replace Edith Gama Ramos Children Hospital, open in 1964 and the first one in the state of Santa Catarina dedicated to children. Nowadays, Joana de Gusmão is considered one of the most important children and pediatric teaching hospitals in Latin America[6].

The building is composed of three blocks placed parallelly. The west block and the central block have two floors, while the east block has three (the first level being for parking spaces). While the peripheral blocks have corresponding levels, the central block was positioned at "mid-level", allowing the adoption of "half-ramps" in the development of vertical circulations. This strategy of creating intermediate levels to enable the use of "half-ramps" became important in Breitman's work, since it made it possible to make the hospital complex horizontal without increasing the distance users must walk.

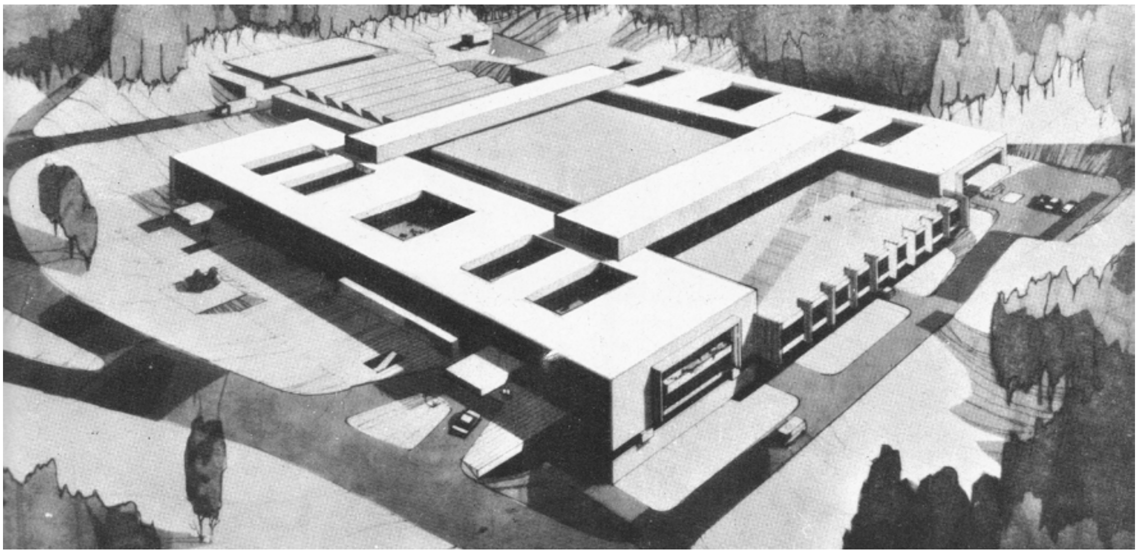


Illustration 23: Aerial perspective - Children's Hospital Joana de Gusmão
Source: IPH Collection/Irineu Breitman

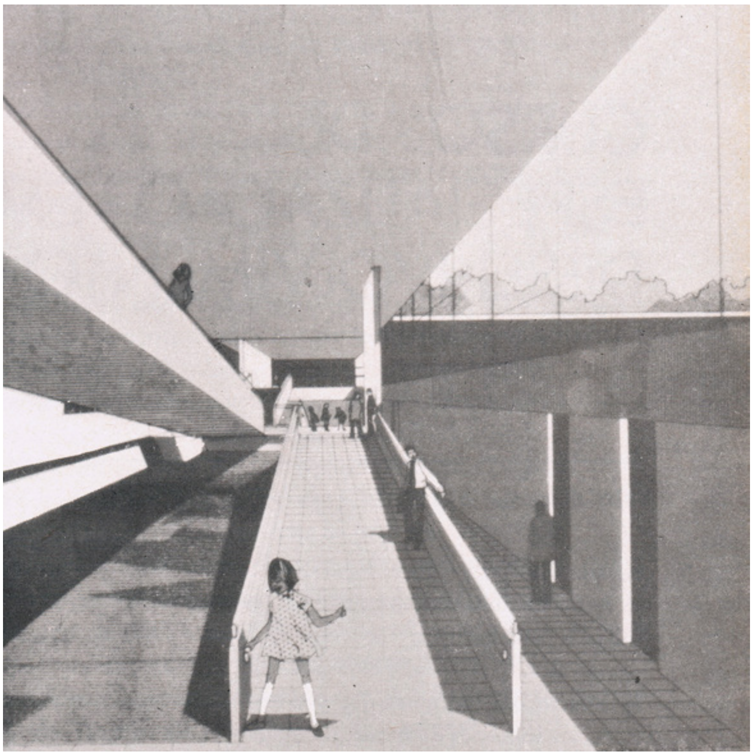


Illustration 24:
Perspective of "semi-ramps" - Children's Hospital Joana de Gusmão

Source:
IPH Collection/Irineu Breitman

The distribution of the program also contributed to the reduction of routes, since the positioning of functional units considers their interrelationships. The ground floor (level 2 of the peripheral blocks) is intended for outpatients, emergency, radiology, laboratory, neonatology, administration and medical comfort; the first floor, located on the ground floor (level 3 of the peripheral blocks) concentrates the units of hospitalization; the second floor of the central block (level 2.5) is positioned between the two levels of peripheral blocks and house the units that serve the entire hospital, such as operating rooms, ICU, CME and the areas of technical and logistical support, such as kitchen and laundry. Therefore, to reach the sectors located on the second floor of the central block it is necessary to travel only half a ramp.

We can see a significant change in the spatial distribution of admissions in relation to previous designs. The rooms are positioned practically on both facades, the areas dedicated to therapy and technical support are at the heart of the floor and there are two nursing posts, each serving about 36 beds. This was Irineu's first experience with "dual-sided"[7] hospitalization units and with the decentralization of nursing posts, strategies that will emerge in different ways in all of his subsequent hospital projects.

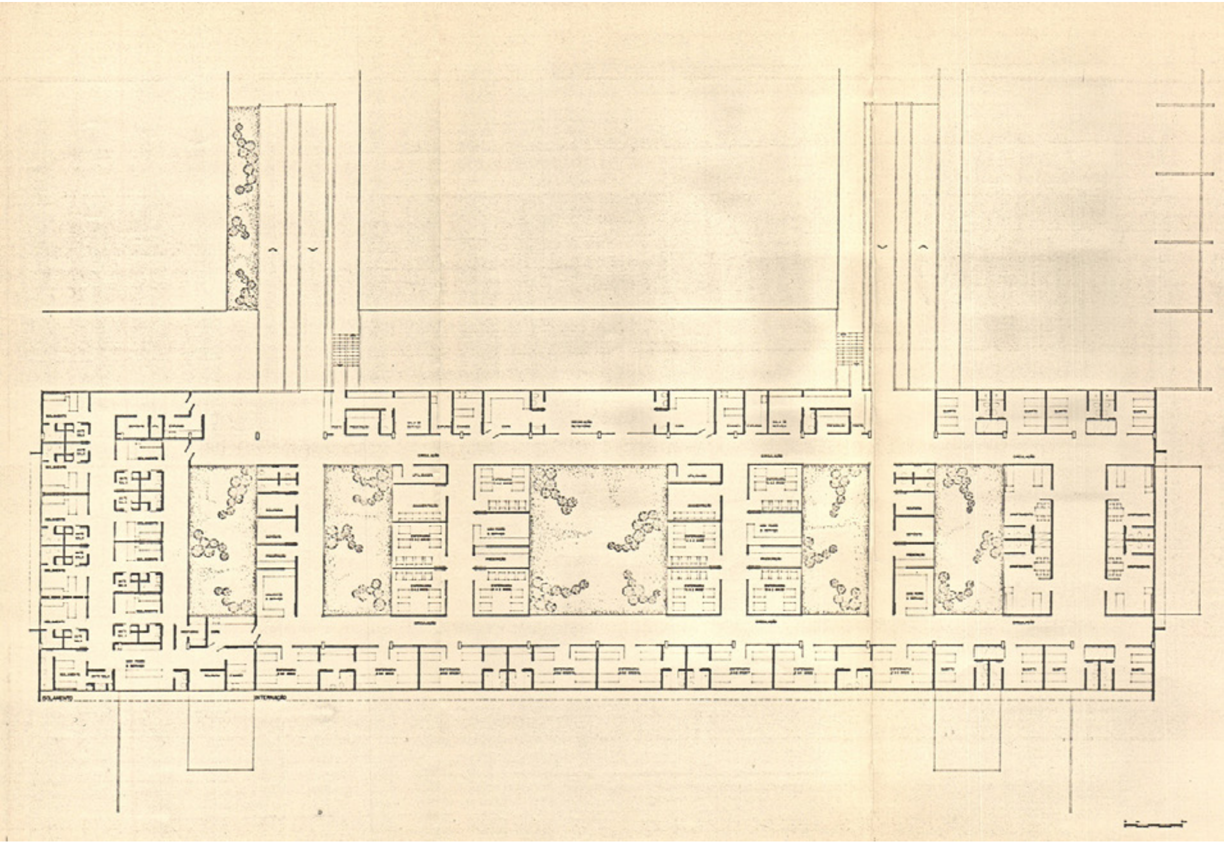


Illustration 25: Hospitalization plan - Children's Hospital Joana de Gusmão
Source: IPH Collection/Irineu Breitman

Another important aspect was the implementation of several gardens. The hospital, in addition to being surrounded by a large green area, has gardens surrounding the blocks, generating an intense relationship between building and nature, a condition that greatly contributes to the recovery of patients.

Santa Catarina regional hospitals

Later, in 1979, Irineu and his HOSPITASA team designed three large public hospitals in the state of Santa Catarina: Physician Hans Dieter Schmidt Regional Hospital in Joinville; São José Regional Hospital, in Florianópolis; and Regional Hospital of the West, in Chapecó.

Illustration 26:
Regional Hospital Dr. Hans Dieter Schmidt

Source:
IPH Collection/Irineu Breitman

Illustration 27:
Regional Hospital São José

Source:
IPH Collection/Irineu Breitman

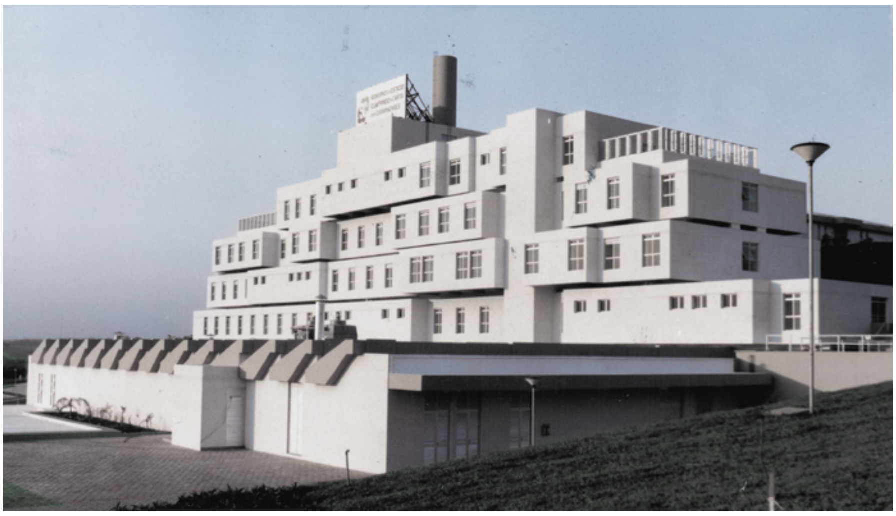


Illustration 28:
Western Regional Hospital

Source:
IPH Collection/Irineu Breitman

Even though the architectural plan is very similar for these three hospitals, the projects present different features, each with a formal concept to best suit the design to the geography of the terrain.

The first is a horizontal hospital developed in two and a half uneven floors connected by "half-ramps", very similar to Joana de Gusmão. Composed basically of three main parallel blocks, hospitalization and outpatient care units are in the peripheral ones, while surgical center, ICU and technical-logistic support units are in the central block, mid-level.

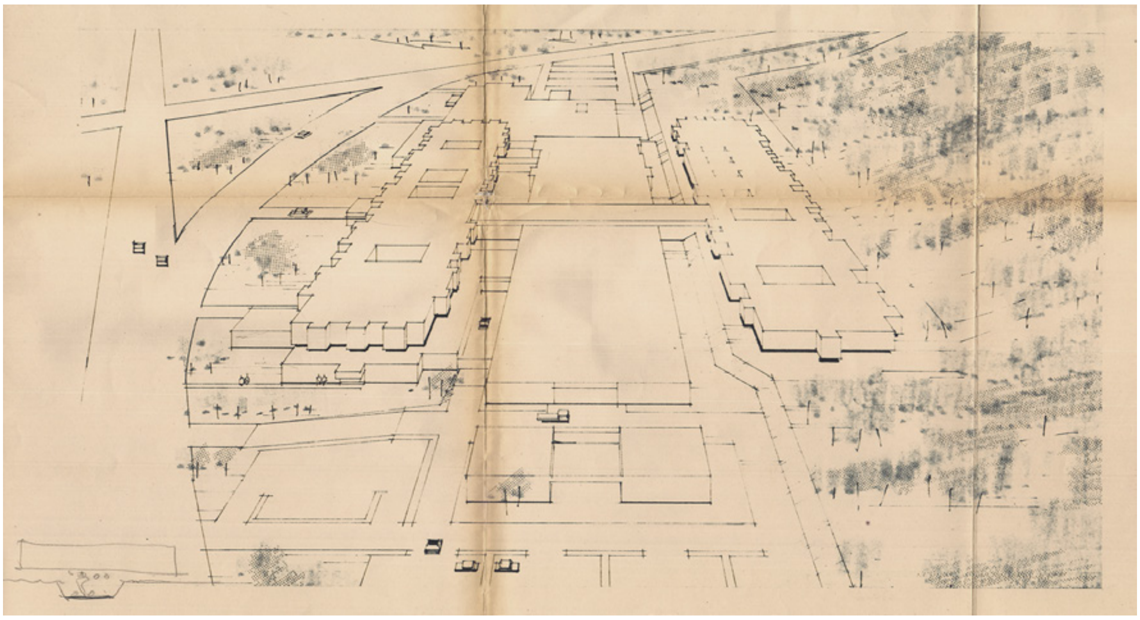


Illustration 29: Perspective - Regional Hospital Dr. Hans Dieter Schmidt
Source: IPH Collection/Irineu Breitman

The other two follow the "base-tower" typology, like Miguel Piltcher Hospital design. Both have a base (blocks ranging from two to four floors) and a laminar tower (both with four floors). The floors comprising the base include outpatient care, diagnosis areas, administrative areas and technical-logistical support sectors. The raised floors, composing the tower, house mainly the units for hospitalization.

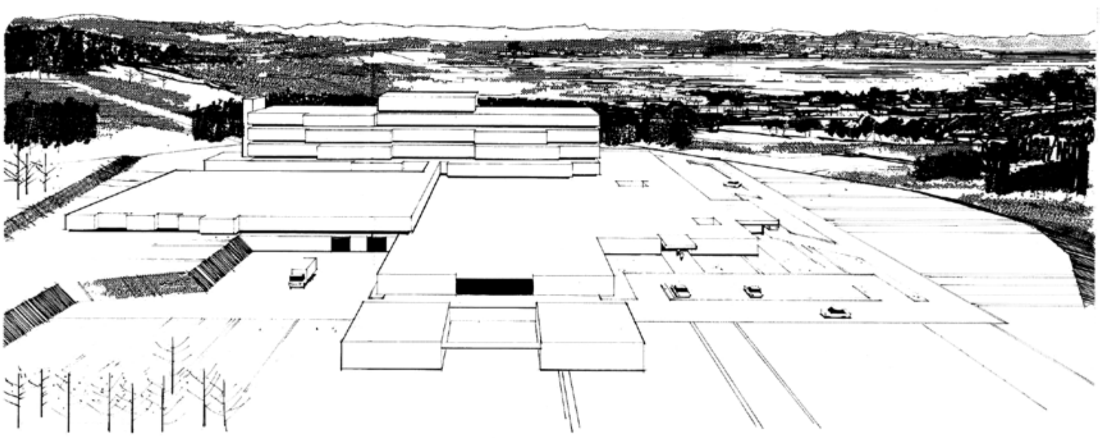


Illustration 30: Perspective - Regional Hospital São José
Source: IPH Collection/Irineu Breitman

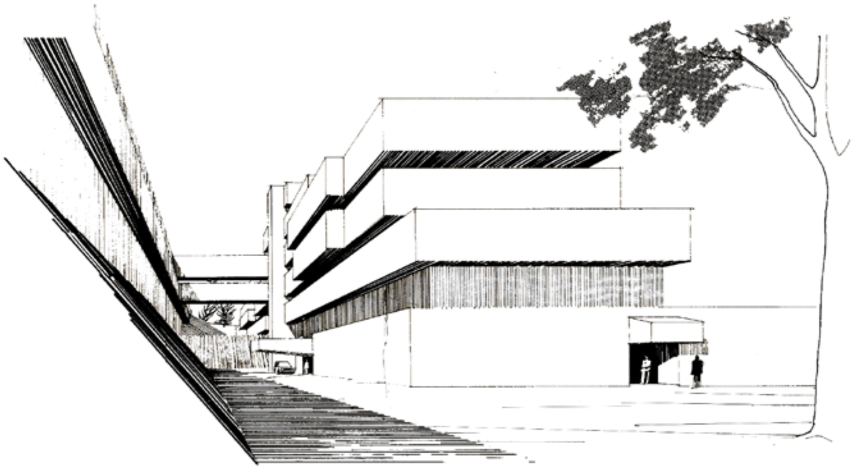


Illustration 31:
Perspective - Western Regional Hospital

Source:
IPH Collection/Irineu Breitman

These three hospitals have some noteworthy features. Firstly, the hospitalization units have rooms that occupy the two longitudinal facades; a central corridor; a nursing station for about 32 beds; and a variation in the distribution of patients in apartments (1 bed), bedrooms (2 beds) and infirmaries (3 beds). This variation between apartments and wards generated rooms with different lengths, the largest of which were structured in balance, giving a beautiful set of volumetric alternations in the facades.

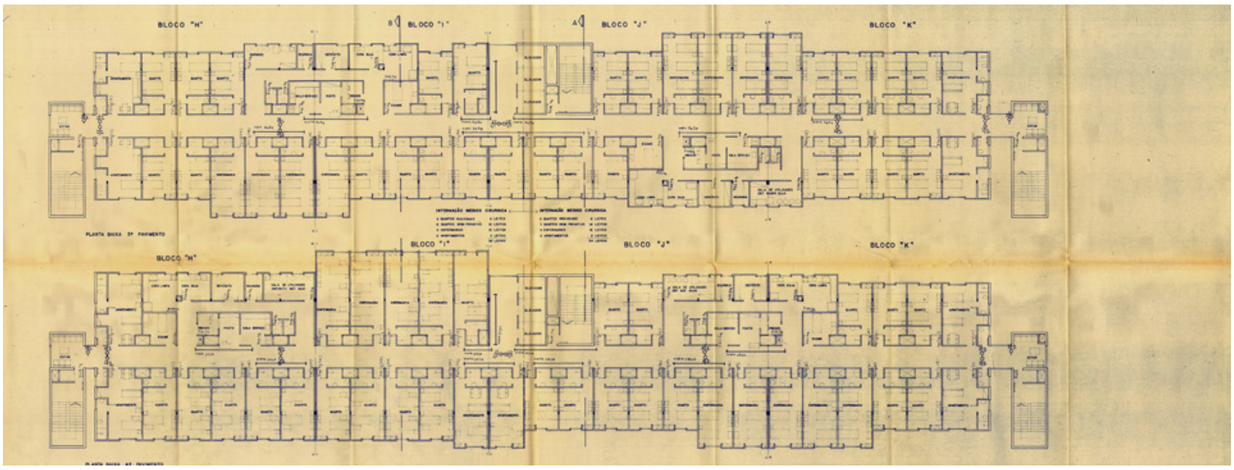


Illustration 32: Hospitalization plan - Hospital Regional São Jose
Source: IPH Collection/Irineu Breitman

Secondly, the use of technical basements throughout the hospital, suspending the building from the ground, allowing the execution of totally visible installations (not embedded in slabs or crawl spaces), facilitating the work of repair teams and reducing maintenance costs.

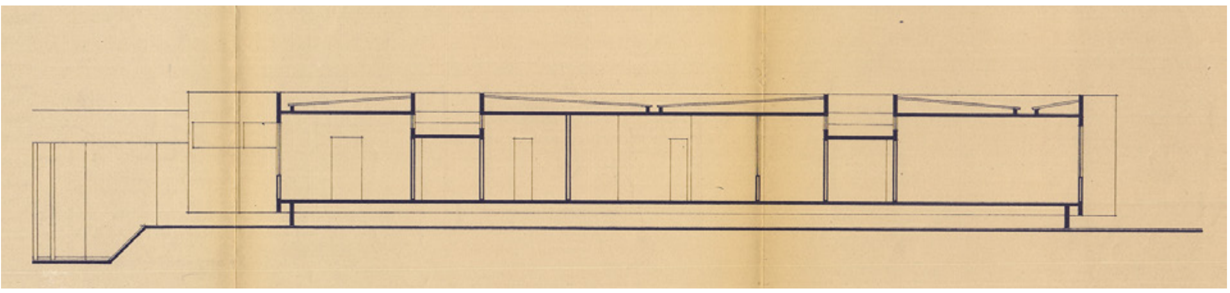


Illustration 33: Section of the hospitalization block - Regional Hospital Dr. Hans Dieter Schmidt
Source: IPH Collection/Irineu Breitman

Finally, as in Miguel Piltcher plan, the top-floor roofs were executed in Sheds of reinforced concrete to provide natural lighting and ventilation inside.

Illustration 34: Coverage in Sheds - Regional Hospital São José
Source: IPH Collection/Irineu Breitman

University of Passo Fundo Teaching Hospital

The University of Passo Fundo Foundation (FUPF) is the sponsor of the University of Passo Fundo (UPF), which offers several undergraduate and postgraduate courses in the area of health sciences, such as medicine and pharmacy. In 1998, the foundation hired Breitman to design its future teaching hospital, which would aim at both training future professionals and providing the population with healthcare services, improving the local hospital network. The building would be established in the university campus, in a 62,573.00 m² terrain, and have 29,034m² of constructed area, 300 beds for hospitalization and 47 beds in the ICU. Unfortunately, the project was never carried out.

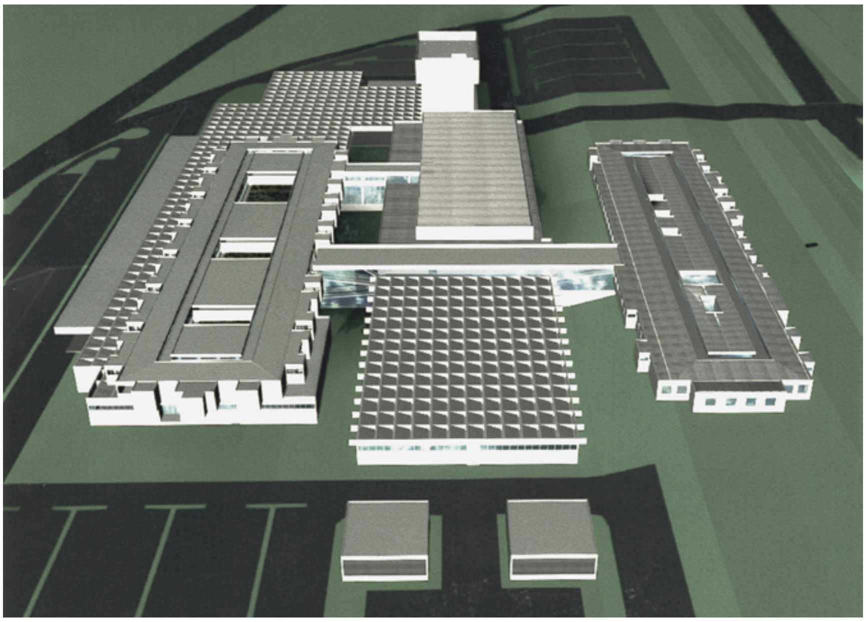


Illustration 35: Electronic Perspective - School Hospital of UPF

Source: IPH Collection/Irineu Breitman

Using the same premises as Joana de Gusmão’s, and very similar to Physician Hans Dieter Schmidt’s, the project for this teaching hospital consisted of two and a half floors, distributed in basically three blocks. The vertical circulation would be developed using two “half-ramps”; natural lighting and ventilation inside pavements would be ensured by Sheds; and the set is suspended, mostly, one meter from the ground, generating a large technical basement. The distribution of the architectural program also follows the same premise of the hospital in Joinville, with the difference that this is a university hospital, and the teaching and research area is concentrated in a five-story building located northwest of the set.

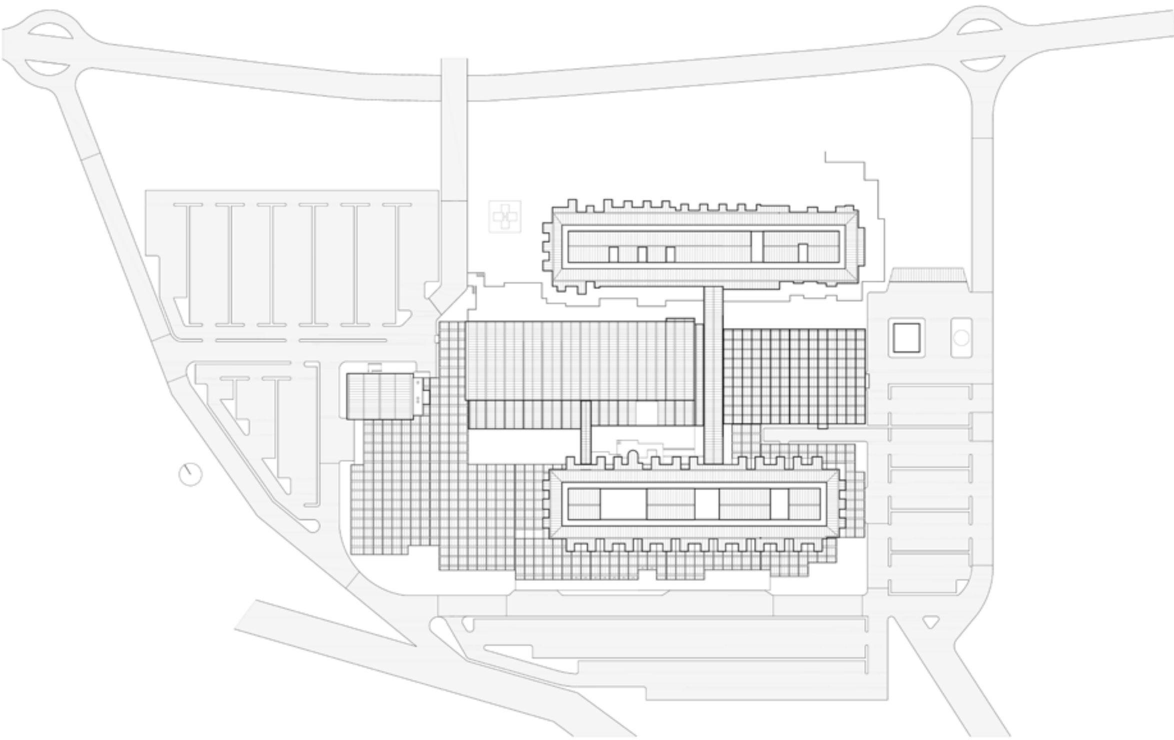


Illustration 34: Site plan - School Hospital of UPF
Source: IPH Collection/Irineu Breitman

CONCLUSION

Hospital architecture has undergone major transformations in the second half of the 20th century. The most effective participation of the architects during the designing and building processes; the creation of the first regulatory guidelines; the technological advances; and the creation of events dedicated to teaching and researching within the hospital area broaden the debate and provided great infrastructural advances. Acknowledging this process is elemental to better understand the contemporary hospital building and plan future healthcare institutions. The work of Irineu Breitman belongs to this period and has been transformed during these events. Looking at it, in an attempt to grasp its multiple aspects, it will certainly offer us valuable information to carry out the arduous task of exploring the concepts that permeate the healthcare facilities from the past and the present.

Irineu began his career very early, designing his first hospital only one year after getting his architecture degree. The result was a building that reflects the "Rio de Janeiro school" paradigms, which were taken to Porto Alegre in the 1940s by a group of teachers who studied in Rio de Janeiro and abroad. However, for his further healthcare facility plans, he sought to align himself with new concepts, researching physical-functional planning and the most advanced technologies, becoming a careful researcher and, consequently, an important teacher.

There are many aspects that stand out in his work, from the wise organization of the functional program to his concern regarding the comfort of users. Over time, the shapes of his buildings corresponded to a certain set of concepts that sought operational efficiency; reduction of operational costs; safety; and patient comfort. But at the same time, he practiced architecture to the fullest by conferring aesthetic and urban significance to his buildings.

There is no doubt Toledo is right to highlight Irineu Breitman as an important name for the twentieth century architecture of Brazilian healthcare facilities. We still need to further study his work, since the observations presented here are not enough to provide a deep critical assessment of his architecture. Nonetheless, whenever we come across his projects and writings, it becomes clear we have a lot to learn from his work.

FOOTNOTES

01. The *I Hospital Planning Course* was organized by the Institute of Architects of Brazil and took place in the city of São Paulo between April 13 and 17, 1953. It was coordinated by the Hospital Planning Committee led by architects Amador Cintra do Prado, Jarbas Karman and Rino Levi. In the following year, a book with a collection of its classes and debates was released, it also included the attending list of professors and students.

02. The Brazilian Congress for the Development of the Hospital Building is organized every two years by the Brazilian Association for the Development of the Hospital Building (ABDEH). It is currently the foremost event regarding physical and functional planning of healthcare facilities and brings together architects, engineers, and several health professionals from Brazil and abroad.

03. Declaration given by Irineu Breitman during an interview for architect Maturino Luz, which was recorded in video by Flávia Seligman. The video is available at IPH's Collection / Irineu Breitman.

04. IPH Magazine used a different term to designate the floors regarding the Fêmina Hospital plan than the one chosen by the article: the floor below the technical area is referred to as "third floor" and the one above, "fourth floor".

05. The expression "single unit" refers to a nurses' station with bedrooms on only one side of the floor, whereas the other one is for the station itself and supporting areas.

06. According to information found on the hospital's web page, accessed on December 11, 2018 at http://www.hijg.saude.sc.gov.br/index.php/institucional.

07. A "dual-sided unit" refers to a nurses' station with bedrooms on both sides of the floor or that occupies the building's both façades. The station itself and the supporting areas might be placed in between bedrooms or in the middle of the floor.

REFERENCES AND ADDITIONAL BIBLIOGRAPHY

ALMEIDA, Guilherme de; BUENO, Marcos; DONADUSSI, Marcelo. **Irineu Breitman: Exposição sobre a obra de um dos pioneiros da arquitetura moderna gaúcha**. 2011. Disponível em: <http://www.vitruvius.com.br/revistas/read/drops/11.043/3825>. Acesso em: 7 dez. 2018.

BLAYA, Marcello; BREITMAN, Irineu. Hospital Psiquiátrico Encarnación Blaya. **Arquitetura**, Rio de Janeiro, n. 35, p.18-19, 1965.

BLAYA, Marcello; BREITMAN, Irineu. Ante-projeto do Psiquiatrico Encarnación Blaya. **Hospital de Hoje**, São Paulo, n. 27, p.17-20, 1966.

BREITMAN, Irineu. Hospital Escola da Fundação Universidade de Passo Fundo. **Revista IPH**, São Paulo, n. 04, p.39-42, 2004.

BREITMAN, Irineu. Apologia ao Hospital Horizontal. **Revista IPH**, São Paulo, n. 05, p.34-37, 2004.

BREITMAN, Irineu. Projeto do Hospital Infantil de Florianópolis. **Revista Gaúcha dos Hospitais,** Porto Alegre, v. 5, n. 3, p.67-71, 1977.

BREITMAN, Irineu; KARMAN, Jarbas. Hospital Fêmina. **Hospital de Hoje**, São Paulo, n. 13, p.415-418, 1959.

BREITMAN, Irineu; LAMB, Paulo Lindolfo. Hospital Hans Dieter Schmidt: Ambientes acolhedores em contraponto aos partidos verticais. **Projeto**, São Paulo, n. 162, p.66-70, 1993.

COLEÇÃO PIRELLI / MASP DE FOTOGRAFIA (São Paulo) (Comp.). **Sioma Breitman**. 2006. Disponível em: <https://colecaopirellimasp.art.br/autores/231>. Acesso em: 7 dez. 2018.

COSTA, Renato Gama-Rosa. Arquitetura hospitalar em São Paulo. In: MOTT, Maria Lúcia; SANGLARD, Gisele (Org.). **História da saúde: São Paulo: instituições e patrimônio histórico e arquitetônico (1808-1958)**. Barueri, SP: Minha Editora, 2011.

FLORIANÓPOLIS. Hospital Infantil Joana de Gusmão. Secretaria do Estado da Saúde. **Institucional: Sobre o HIJG**. 2018. Disponível em: <http://www.hijg.saude.sc.gov.br/index.php/institucional>. Acesso em: 7 dez. 2018.

KARMAN, Jarbas B.; LEVI, Rino; PRADO, Amador Cintra do. **Planejamento de Hospitais**. São Paulo: IAB-SP, 1954.

LUCCAS, Luís Henrique Haas. **Arquitetura Moderna em Porto Alegre (Parte I)**: Antecedentes e a linhagem Corbusiana dos anos 50. 2016. ISSN 0719-8906. Disponível em: <https://www.archdaily.com.br/br/790990/arquitetura-moderna-em-porto-alegre-antecedentes-e-a-linhagem-corbusiana-dos-anos-50-luis-henrique-haas-luccas>. Acesso em: 7 dez. 2018.

LUCCAS, Luís Henrique Haas. **Arquitetura Moderna em Porto Alegre (Parte II)**: Entre o "Estilo Internacional" e o padrão brutalista nos anos 60/70. 2016. ISSN 0719-8906. Disponível em: <https://www.archdaily.com.br/br/791414/arquitetura-moderna-em-porto-alegre-parte-ii-entre-o-estilo-internacional-e-o-padrao-brutalista-nos-anos-60-70>. Acesso em: 7 dez. 2018.

MIQUELIN, Lauro Carlos. **Anatomia dos edifícios hospitalares**. São Paulo: CEDAS, 1992.

MUSEU DA HISTÓRIA DA MEDICINA DO RIO GRANDE DO SUL (Porto Alegre) (Ed.). **Dr. Marcello Blaya Perez**. 2012. Projeto de História Oral Médicos do Rio Grande do Sul: faço parte desta história. Disponível em: <https://www.youtube.com/watch?v=4z36K7wqGms>. Acesso em: 7 dez. 2018.

NARDINO, Júlio César dos Santos. **Hospital Fêmina: obra emblemática da arquitetura moderna hospitalar de Irineu Breitman.** 2017. 1 v. Dissertação (Mestrado) - Curso de Arquitetura, Programa de Pós-graduação em Arquitetura e Urbanismo, Centro Universitário Ritter dos Reis - Universidade Presbiteriana Mackenzie, Porto Alegre, 2017.

SERRANO, Eneida; EMERICH, Karina. **Sioma: O papel da fotografia**. 2014. Vídeo. Disponível em: <https://www.youtube.com/watch?v=x23bz9QfYuI>. Acesso em: 7 dez. 2018.

TOLEDO, Luiz Carlos. **Feitos para curar: arquitetura hospitalar e processo projetual no Brasil**. Rio de Janeiro: ABDEH, 2006.

Article

Humanizing the hospital

Author:
Gúliti Ricardo Fagundes Nascimento

ABSTRACT

This article aims to reflect on the concepts of humanization, focusing on the effective practices fostered by the National Humanitarian Assistance Policy (PNHAH). The conception of this project is increasingly conditioned in its great complexity, in the large amounts of standards to be followed and the search for the improvement of the physical quality of the space. In view of this, environmental comfort issues are disregarded in hospital settings, making them difficult to endure.

KEYWORDS

Environmental comfort; Humanization; Humanization of hospital care; Physical space.

INTRODUCTION

The humanization of healthcare facilities concerns the building structure resulting from architecture projects whose purpose is to achieve a standard that leads to users' satisfaction and well-being by making use of a set of tools and organizing the environment in a way that soothes the individual.

Brazil lacks studies regarding hospital humanization since this concept may at times be used to describe the building of a facility or the service it provides for the population.

Nonetheless, some people in the hospital industry believe the humanized environment is already a reality since it would be a prerequisite to draw clients. On the other hand, others are of the opinion that a humanized environment must have volunteer workers. Therefore, scientific knowledge provides a better understanding of how the environment interfere on people's health. We also know there are some factors that can both harm or benefit a treatment, so it is important to consider the nature of a hospital and medical assistance's work changes over time, adding new values to reach more quality of life for clients where improving the healthcare facility becomes part of patient care.

Fontes (2004) believes the humanization of healthcare facilities is being considered when designing a new building plan. The author arguments:

> The most recent health plans in architecture have been applying the concept of humanizing care, representing a new and holistic focus on the patient who is seen as part of a context instead of a bunch of symptoms and pathologies to be studies by isolated medical specialties. (FONTES, 2004. p.59).

We must concern patients as a whole, freeing the space from noises; vibrating colors; textures; and air pollution, attempting to get them in contact with nature with openings that allow them to see the outside. Moreover, indoor gardens have been used as an alternative to improve que quality of buildings.

Color is a powerful stimulant that may affect humor and sensitiveness, producing foremost impressions, emotions and sensorial responses that might disturb our state of awareness, trigger a desire, set off our imagination and evoke feelings of attraction or repulse, therefore acting upon us as either a stimulating or soothing energy Costi (2002, p.115).

One must consider the use of colors since it contributes for therapeutic process and body and mind balance. When used accurately it boosts well-being. However, it is advisable to level the use of colors with proper illumination to achieve functional and cozy spaces that provide stimulus and feelings to their occupants.

Lida (2002) affirms color visibility, contrast, and purity is what catch our attention, and to achieve that it must be toned down (using white) or darken (with black). However, contrasting colors – yellow over blue background; green over magenta; or red over cyan – can be tiring if the space requires permanent attention.

It is also noteworthy that in Brazil most of healthcare facilities fail to provide any sort of illumination, treating every room the same whereas each space should be considered according to its need and purpose.

Therefore, the light must be regarded not only as a sole visual resource but also as its benefits to our health. To ensure all hospital activities – procedures; exams; entertainment; and monitoring – are carried out satisfactorily and safely it is important to set up illumination systems for that purpose (ANVISA, 2007).

Natural illumination should be available in the building to enhance its structural quality and patient’s recovery, besides reducing energy use and the need of artificial light and air-conditioning. Finally, colors and illumination when combined might help with patient’s recovery, promoting significant progress in the course of treatment as well as leading to a more humanized, pleasant and comfortable spaces.

As a result, a patient-driven institution requires a number of factors, being the physical building one of them. For the architectonic plant to cover patient needs as much as possible, it is key to evaluate the building after operation begins, which should be one of the stages of the project (CARPMAN et al., 1986; MALKIN, 1992).

Nevertheless, the effort is made to consider the aspects of humanization to design comfortable spaces for the patients and seek solutions with the purpose of fulfilling technical and human needs by developing spaces for entertainment and socialization, which will be used as therapeutic actions to ensure patient’s mental and physical well-being. The building then must present a physical structure that is open to the use of new technologies to develop more humanizing conditions.

METHODOLOGY

We undertook a quantitative work of literature review focusing on discussing solutions concerning environmental comfort that enhances physical quality of the space and the humanization process within hospitals in general. Our references included scientific articles; books; academic papers; and online libraries such as ANVISA's Environmental Comfort in Healthcare Facilities Manual, and the National Guidelines for Hospital Humanization.

ACOUSTIC COMFORT

A hospital requires special acoustic comfort conditions. There is the need to comply with the level of noise recommended by technical standards, however there are places and situations where unnecessary and loud noise is produced, and unnecessary noisy is the cruelest lack of consideration (apud HOSKING, 1999, p. 163).

Architect and engineer Jarbas Karman states that among all deficiencies found in the construction of healthcare facilities the noises and vibrations are the ones who leave us with hardly any alternative for afterward maintenance. Also, according to him, hospital special equipment is noisy and therefore call for specific implementation with appropriate and limited localization (KARMAN, 2011, p. 78).

J. C. Yoder, doctor and professor at University of Chicago's Pritzker School of Medicine, believes the noises produced within hospitals put patients at risk. He arguments that "hospitals should take action to reduce night noises to promote patient's comfort and recovery, since lessen noises might be a simple way to adopt careful attitudes" (YODER, 2012, p. 1).

Consequently, it is advisable to be prudent and knowledgeable when choosing coating material to correct acoustic performances, combining hygienic and acoustic elements. Deciding on the proper flooring may make it easier to keep a healthy environment hence contributing for the control of hospital infections and the comfort of patients and other users. Such material must be resistant to abrasion, or other impacts it might suffer; washing; chemical products for disinfection; and deterioration caused by circulation of people and equipment (MIGUEZ, 2013, p. 2).

Some floor coating material, like floor blanket or vinyl planks, rubber or linoleum, might reduce noise reverberation in the hospital environment. Besides rubber and vinyl coatings, there are some special conductive flooring for operating rooms and other environments with specific grounding conditions (ANVISA, 2014).

The ceiling coating could enhance the acoustic comfort inside healthcare facilities, there are fixed and removable ones, and for each type there are factors to consider regarding its contribution for noise cutback. The prevention and control of infections must also be taken into account respecting asepsis and cleaning recommendations, seeing as RDC #50 says the appropriate materials for wall, flooring and ceiling coating in critical and semi-critical areas must be resistant to washing and use of disinfectant (BRASIL, 2002, p. 107).

Some specific noises within healthcare facilities cause outstanding discomfort for both patients and professionals who directly deal with support activities. There is usually little control over those noises causing great amount of human discomfort in the hospital environment (ANVISA, 2014).

Even so, we must observe the sound reverberation impact that each material can have over the environment and the acoustic discomfort they might cause.

VISUAL COMFORT: ILLUMINATION AND COLORS

To measure the quality of the environment for health assistance we ought to consider the visual comfort arranged by light and color elements aiming at alleviating the work to be done.

According to the Brazilian National Standards Organization (ABNT), on its NBR ISO/CIE 8.995 – 1 – Illumination at working places (2013, p. 1).:

> Good lighting enables the visualization of the environment, allowing people to see each other, move safely, and perform visual tasks in an efficient, accurate and safe manner avoiding eye fatigue and discomfort. Illumination might be natural, artificial, or a combination of both.

Therefore, the use and intensity of light must be a concern when planning hospital environments, visual comfort might encourage an active participation in the therapy. The space design must consider the user lighting demands and the natural conditions of the environment.

Thereby, the solutions must include apertures overlooking outdoor landscapes with the use of architectonic materials and elements that respect users' privacy, such as brise-soleil and balconies, as well as other architectonic elements that leverage natural conditions. (ANVISA, 2014).

In the areas intended for admissions, where patients might spend many hours or days, certain artificial illumination conditions and the possibility to see the outside may bring comfort and the important perception of time due to the circadian rhythm. The project should also contemplate the specificity of the activity carried out in every environment and the ergonomic impact lighting has over users. For emergency rooms; operating rooms; intense care unities; and other critical areas, the effects of visual impact caused by excessive illumination might lead to relevant emotional discomforts, bringing about displeasure and stress, feelings that harm the quality of the assistance. (ANVISA, 2014).

Nonetheless, an important approach to be considered in healthcare facility plans willing to offer the best high-quality comfort is the FGI recommendations regarding natural illumination and a view to natural landscapes whenever possible (FGI, 2010, p. 15).

COLORS

Using chromatic references to set an ambience for health buildings has become a current practice. Humanized solutions, such as surgery centers with windows between rooms and outdoor windows and different colors for each room, an intensive care unity with similar features with visualization of outdoor chromatic conditions might contribute to a less unfeeling hospital, but at the same time keep the formality its procedures and functions require. (ANVISA, 2014).

The architectonic plan is an elemental link between clients' expectations and the effectiveness of the actions carried out in the building, which assume two roles: offer the services it was built for and provide therapeutic aid in addition to medical care. If the building architecture fails to achieve its therapeutic role, it is expected that at least it will not interfere negatively with patients' treatment. (ANVISA, 2014).

The space architecture and ambience play a key role in humanization. If drugs have the power to relieve physical pain, colors might mitigate the monotony of long-lasting confinement. The colors on healthcare facility walls represent abstract values that are perceived differently by each patient. One way or the other, the colors will not change the quality of the service, although they might provide a much-needed sensation to patients.

Colors have various functions and effects over the individual: biological and psychological effects; and it give a sense of security while organizing and orientating the space (COSTI, 2002; GRANDJEAN,1998; IIDA, 1997).

Colors are the most noticeable aspects, they establish a social, geographic and cultural link with the person's age and sensitiveness. There are no standard colors defined, no chromatic treatment can be regarded as a rule, there is no sole solution, though it is often useful to design a space the patient can relate to culturally, which resembles his/her home, imparting affection (ROMANELLO, 2006, p. 84).

Nonetheless, healthcare environments require attention since they receive a great diversity of people. Color is a powerful language that can affect much more than just our mental capacity, humor and time perception. They can also influence our perception of volume, shape, space and perspective (HOSKING, 1999, p. 119).

THEORETICAL REFERENCES

Nas últimas décadas, o hospital tem se tornado um espaço para cura de várias enfermidades. A preocupação em se ter ambientes mais arejados, bem iluminados, que possam garantir as atividades dos usuários e amenizar a permanência desgastante de seus pacientes proporciona cada vez mais discussões e melhorias para esses espaços.

> Humanize means to give humane conditions to anything or any place. It is a value while respects human life. It embraces social, ethic, educational and psychic circumstances inherent to every human relationship. (VASCONCELLOS, 2004, p.23).

Hospital buildings evolved throughout time following new technologies, the concerns regarding the hygiene and the architectonic solutions that prioritize natural illumination and ventilation (COSTI, 2002).

Consequently, the influence of the light on hospital environments – whether in spaces used by patients or workers – has been dealt by some professionals using new illumination approaches (FONSECA, 2000 apud HOREVICZ e DE CUNTO, 2007).

Toledo (2006) believes the client's perception of hospital buildings in Brazil has been little explored when considering the concept of humanization, diminishing the chances of fulfilling their expectations and needs, which will reflect on the quality of the plant and on the humanization of hospital environments.

He adds that workers and clients have visual requirements for quantitative elements regarding illumination. But the plants usually adopt time-honored standards that are not always the most appropriate ones, which lead to either flawed solutions or solutions that fail to meet the needs intended (TOLEDO, 2006, p. 96).

Zumtobel (2008) assumes the natural light is a key factor for this sort of environment during the day; during the night, there must be a planning of the main activies with the use of artificial illumination. In places lacking natural illumination, there is the possibility to create, with artificial illumination, the effects of day light including its changes throughout the day, which might reduce anxiety, arousing well-being and helping to appease family members or visitors. On that account, the illumination project of a hospital is as important as planning the whole building, especially if regarded as the main factor to promote the humanization of the physical space (ZUMTOBEL, 2008).

Mezono (1995) highlights hospital humanization is also the humanization of the society as a whole, noting that a violent, iniquitous and exclusionary society interferes with the context of healthcare facilities, especially hospitals. Humanizing hospitals means doing whatever it takes to make it more suitable for the people, respecting their rights.

By that means, properly ventilated and illuminated hospital buildings with enjoyable premises speed up patients' healing process, since they feel more comfortable to face their exhausting admission routine.

In Brazil, humanization standards are established by the Ministry of Health through governmental programs, such as the National Program to Humanize Hospital Care (PNHAH); the Humanization Program during Prenatal and Birth (PHPN); and the National Humanization Policy (PNH) (VAITSMAN; ANDRADE, 2005). HumanizaSUS was developed with the purpose of offering humanized assistance for those depending on the National Health Service (SUS) because it is believed investments must be made on improving the management of institutions and the services provided to the population as well on equipment, technologies and the renovation of facilities (BRASIL, 2002).

Actions taken within national health bodies and hospitals have driven us towards important progress in the relationship between clients and professionals, besides better organizing the service, taking better care of facilities, improving access and the communication with the hospital, as well as providing training for the implementation of humanization projects (BRASIL, 2002).

Humanization can be understood as the democratization of the relationship between workers, clients, and managers. The National Humanization Policy (Humaniza/SUS) is seen as a role model to a more effective care assistance that focuses on communication, exchange of information and knowledge, conversation, listening one another, and sharing decisions among workers, managers and clients (KLOCK et al., 2006).

In spite of that, integrating these hospital environments requires a humanization process that has become more natural to healthcare facilities because the way clients and workers recognize the space will set the bar for the interaction between user and space, which can be either positive or negative for recovery.

> The quality of a hospital might speed up the healing process, therefore reducing hospital time and consequently the costs with keeping hospitalized patients. Humanizing these spaces puts the focus on the patient, making the relationship between body, mind and soul indivisible. Therefore, we consider the quality of the environment and the physical or psychological influence it has on the patient, a key contribution for the recovery process. (LINTON, 1992, p. 126).

CONCLUSION

This article discussed humanization as the main area in hospital architecture in healthcare facilities.

In Brazil, the concept of humanized environment is still new, given that hospitals are major constructions that require various technical specificities, unique flows and a consistent theoretical foundation to be planned, which involves a reassessment of the real purpose of the hospital building developing areas that might indeed contribute to patient's recovery.

Humanizing healthcare facilities is of the foremost importance. Besides playing a part in the therapeutic process of the patient it also contributes for the quality of the healthcare services provided by the professionals established there.

Finally, integrating indoor and outdoor spaces is important within the hospital environment for patients – who feel better and recover faster – and workers – who are able to perform better once they have a more pleasant and less stressful working environment; ensuring relevant reduction in costs due to abridged time in the hospital and less consumption of drugs. Such practice involves everyone and could be put into practice effective immediately, all we need is to change the way we look at one another.

REFERENCES AND ADDITIONAL BIBLIOGRAPHY

ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS (ABNT). **Iluminação de Ambientes de Trabalho**. Parte 1: interior. ABNT NBR ISSO/CIE 8.995-1. Rio de Janeiro, abr. 2013, 46 p.

BRASIL. ANVISA. Agência Nacional de Vigilância Sanitária. **Conforto Ambiental em Estabelecimentos Assistenciais de Saúde** / Tecnologia em Serviços de Saúde. Brasília: 1ª edição, Agência Nacional de Vigilância Sanitária, 2014.

BRASIL. ANVISA. Agência Nacional de Vigilância Sanitária. **Resolução RDC nº 50**, de 21 de fevereiro de 2002. Regulamento Técnico para planejamento, programação, elaboração e avaliação de projetos físicos de estabelecimentos assistenciais de saúde. ANVISA Publicações Eletrônicas 2002.

______ **Segurança no Ambiente Hospitalar**. 2007. Disponível em: < http://www.anvisa.gov.br/>. Acesso em: 01/12/2017.

CARPMAM, J. R., Grant, M., & Simmons, D. A (1986). **Design that cares: planning health facilities for patients and visitors**. Chicago: American Hospital Association.

COSTI, M. (2002). **A influência da luz e da cor em salas de espera e corredores hospitalares**. Editora EDIPUCRS, 1ª edição, Porto Alegre.

THE FACILITY GUIDELINES INSTITUTE (FGI). **Guidelines for design and construction of health care facilities** – 2010 edition. American Society for Healthcare Engineering of the American Hospital Association (ASHE). Chicago, 2010.

FONTES, M. P. Z. (2004) **Humanização na Arquitetura da saúde: a contribuição do conforto ambiental dos pátios e jardins em clima quente e úmido**. In ENTAC 2004 – trabalho completo em cd room. São Paulo: Encontro Nacional de Tecnologia do Meio Ambiente Construido.

HOREVICZ, E.; DE CUNTO, I. **A Humanização em Interiores de Ambientes Hospitalares**. Revista Terra e Cultura, Nº 45, Ano 23, dezembro 2007, Centro Universitário Filadélfia, Cornélio Procópio, 2007.

HOSKING, Sarah; HAGGARD, Liz. **Healing the hospital environment**. Design, management and maintenance of healthcare premises. E & FN SPON. Taylor and Francis Group. London, 193 p., 1999.

KARMAN, Jarbas. **Manutenção e Segurança Hospitalar Preditivas**. São Paulo: Estação Liberdade: IPH, 2011.

KLOCK, Luciana Lúcio; GALVÃO, Claudia Raff; CHANES, Marcelo. **Administração hospitalar**: instrumentos para a gestão profissional. In: FEDERIGHI, Waldomiro José Pedroso. O enfoque do planejamento estratégico na gestão hospitalar. São Paulo: Edições Loyola, 2006, p. 73- 117.

LIDA, Itiro. **Ergonomia: Projeto e Produção**. São Paulo: Edgard Blucher, 2002.

LINTON, Patrick E. Creating a total healing environment. In: Symposium on Healthcare Design, S, 1992, San Diego. **Innovations in Healthcare Design: selected presentations fron the first five Symposia on Healthcare Design**. New York: Sara O. Marberry, 1995.

MALKIN, J. (1992). **Hospital Interior Design**. Nueva York: Van Nostrand Reinhold.

MEZONO, J. C. **Gestão da qualidade na saúde: princípios básicos**. São Paulo: J. C. Mezono, 1995.

MIGUEZ, Claudia. A aplicação sustentável de pisos vinílicos nos estabelecimentos assistenciais de saúde. Artigo. **Informativo ABDEH: Ambiente Saudável**, São Paulo, p. 2, 2013.

ROMANELLO, Isabella. **Il colore: espressione e funzione. Guida ai significati e agli usi del colore in arredamento, architettura e design**. Milano: Ulrico Hoepli Editore S. P. A., 2006.

TOLEDO, L. C. **Feitos para Curar: Arquitetura Hospitalar e Processo Projetual no Brasil.** Rio de Janeiro: ABDEH, 2006, 127 p.

VAITSMAN, J; ANDRADE, G, R, B. **Satisfação e responsividade: formas de medir qualidade e humanização da assistência à saúde**. Ciência e a saúde coletiva. Rio de Janeiro, v.10, nº 3, p. 599 – 613, [s.d]. 2005.

VASCONCELOS, R.T.B. **Humanização de ambientes hospitalares: características arquitetônicas responsáveis pela integração interior/ exterior**. 2004. Dissertação (Mestrado). Faculdade de Arquitetura e Urbanismo, Universidade Federal de Santa Catarina, Florianópolis, 2004.

YODER, J. C. et al. Hospital Noise Puts Patients at Risk. AJN, **Arch Intern Med**, v. 112, n. 4, apr. 2012.

ZUMTOBEL. **Lighting Hand Book**. Debindorn/Austria, dez. 2008. Disponível em: <www.zumtobel.com/healthcare>. Acesso em 01 de dezembro de 2017.

Article

Hospitality x Hospitable Hospitals x Humanization

Author:
Teresinha Covas Lisboa

> Science is cold. Death is gelid. Care must be warm and come from body and soul. Health and comfort are expressions of human solidarity; there are different ways to express human kindness. Kindness lies within gestures, listening, comforting, nursing. From the staff of our hospital is expected – respecting the wishes of our customers – to be close to delight them with what they need. However, the greatest thing we can offer them is human kindness. And we must learn and teach how to provide such an act of love. If the employee is not ensconced, he or she will not ensconce the patient either, it must be mutual. (GONZALO VECINA NETO, 2015).

Hospitality or hospitable hospitals is a set of services offered to internal and external customers to provide assistance; comfort; well-being; safety and high-quality service, grouping the professional practices within health institutions.

According to Dias, "hospitable hospitals aims at designing and organizing a humane space in order to help improve the hospital system" (2006, p. 343), holding out a safe environment for the customer, i.e., patients; family members; TAs; caretakers; friends; and visitors in general.

Taraboulsi defines Hospitality as "the interaction of people in which prevails sociability and solidarity values, amicable interpersonal relationships, courtesy related to the efficiency in what we intend to do or offer" (2009, p. 157). Moreover, he defines Hospitable Hospitals as:

> [...] the art of offering efficient, expeditious, heart-warming, committed and respectful services, which give rise to customers' amusement and, above all, a humane hospital service and environment (2009, p. 158).

Hospitality is felt within hospitable hospitals in the coziness of the building, in the humane hospital and doctor services and, especially, in people's behaviors (their gestures and attitudes). Taraboulsi adds: this is what characterizes hospitality healthscapes, which is the essence of hospitable hospitals (2009, p.159).

Any healthcare facility building must be supported by legislation rules to ensure high-quality work environment and patient, TAs, and the staff well-being: they should all come first. Institutions that deal with such customers are: hospitals, nursing homes, spas, laboratories, dental care facilities, plastic surgery facilities, physiotherapy clinics, among others.

The lack of structural comfort in healthcare institutions, specifically in hospitals, leads to either overabundance or shortage of heat; humidity; ventilation or fresh air; besides constant and intense noises; deficient light; and unattractive smells that harm work motivation and undermine patient recovery.

When the institution invests on the building and its interior design, results are translated into a more humane healthcare assistance and, according to ANVISA (2014, p. 20), result in:

- Less stressed and tired healthcare professionals and more efficient assistance;
- Improved patient safety;
- Less stressed patient and higher chances of clinical success;
- Improved healthcare assistance in a wide range.

We should also consider cross infection, which is the transfer of harmful microorganisms from one patient to the other, usually via staff or contaminated instrument.

In order to keep the risk of cross infection at a minimum, the environment must be the first management concern to ensure proper conditions for employees and patients.

Building, expanding or refurbishing a hospital building entails the assistance from hospital administrators; architects; engineers; members of Hospitable Hospitals, and the Hospital Infection Control Committee.

Florence Nightingale's "Notes on Nursing" presented the results from having appropriate air; light; heating; cleanness; silence; and proper diet, i.e. making and serving it right (DIAS, 2006). Florence's care towards Crimean War's soldiers produced better health conditions. The following recommendations were proposed by her:

> [...] air ventilation should not be just appropriate, but pleasant; light should not bother customers; sounds must be softened (noises and other sounds); and the place where customers are admitted must be properly cleaned. Besides, bed linen and clothes must be clean and smell good; and furniture ought to be good looking and get disinfected after discharges, so they are in condition to welcome the next customer (DIAS, 2006, p. 341).

Changing the rationale within a healthcare institution depends on several factors:

- Social Factor (determining);
- Social and Cultural Factor (level of education and cultural background);
- Personal Factor (cycle of life, financial situation, lifestyle);
- Psychological Factor (encouragement).

Therefore, prior to establishing a hospitable hospital with focus on humanization, it is necessary to rethink the organizational structure; moreover, all parts involved must be integrated into and aware of the new model. It is important to emphasize that nursing services benefitted from hospitality since it boosted patient-driven assistance.

In such changes, we note:

• Different concept of assistance;
• Change of behavior (internal and external);
• Integration of unities;
• Realignment of job positions;
• Development of control indexes (assessments);
• New job opportunities;
• Efficient execution of activities held within institutions;
• Promotion of the quality of the service and branding (Marketing);
• Carrying through a Social and Environmental Responsibility Program;
• Department integration (Communications);
• Uncovering new talents;
• Improving quality of working life;
• Assessment of the services provided (internal and external);
• Getting better performance assessments.

As we could see, there are great advantages in managing healthcare services and there are several tendencies being carried out to diminish moments of pain and separation:

• Continuous Social Service assistance;
• Support to families, visitors, and TAs;
• Socialization for everyone through ludic programs, especially for the elderly;
• Cultural activities (choral, theater, painting, drawing);
• Courses, seminars, and counselling;
• Collections of comic books and toys;
• Doutores da Alegria (Clown Care Unit);
• Jumble sales;
• Travelling library;
• Storytellers;
• School tutoring.

The aforementioned strategies are coordinated and overseen by a committee that assesses the results and implements new activities considering patient and family member suggestions in undertaken researches. Even in the event of death, the triad, hospitality – hospitable hospital – humanization, works along to offer family members support and comfort.

Finally, to achieve it all, it is key to have an engaged and committed workforce, one that meets the competences, values and goals agreed upon when hired. The role of the administrator, therefore, as an appraiser is of high importance since once you appreciate and endorse professional development of people, they deliver the hospitality the population is entitled of.

REFERENCES AND ADDITIONAL BIBLIOGRAPHY

BRASIL. Agência Nacional de Vigilância Sanitária. **Conforto ambiental em estabelecimentos assistenciais de saúde**. Brasília: Anvisa, 2014.

DIAS, Maria Antonia de Andrade. **Humanização no espaço hospitalar: uma responsabilidade compartilhada**. São Paulo: O mundo da saúde, 2006, abr./jun. 30(2):340-342.

LISBOA, Teresinha Covas. **Competências de gestores no processo de humanização em saúde**. São Paulo: Laços, 2015.

TARABOULSI, Fadi Antoine. **Serviços hospitalares: teoria e prática**. São Paulo: Reichmann & Autores Editores, 2005.

IPH

INSTITUTO DE PESQUISAS HOSPITALARES ARQUITETO JARBAS KARMAN