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ENHANCEMENT OF SAFETY BARRIERS IN A MAGNETIC RESONANCE UNIT: A Brazilian Experience

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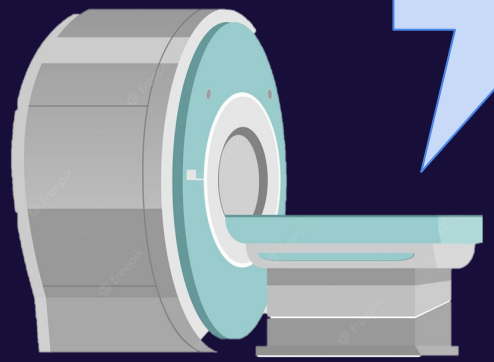
Introduction

Magnetic resonance imaging (MRI) is the result of the interaction of a **strong magnetic field** with hydrogen protons within the patient´s body...

...which create a situation where a **radiofrequency pulse (RF)** is applied through RF coils.

The **signal emission** is provided by the hydrogen protons, and then collected, processed and converted into **images**.



Source: Mazzola et al

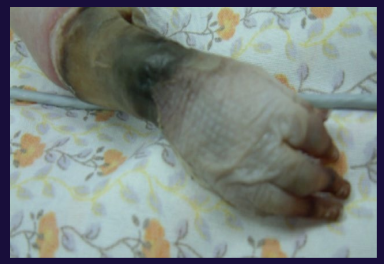
Under normal conditions of use of the MRI device, the magnetic field never turns off!

MRI components that can be related to **adverse effects** on patients:

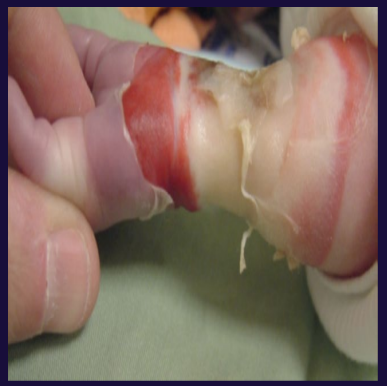
RADIOFREQUENCY | **GRADIENTS** | **CRYOGENIC**

MAGNETIC FIELD | **CONTRAST AGENTS**

Main adverse effects related to the magnetic field: attraction/twisting ferromagnetic objects; changes in the functioning of non-compatible electronic devices; tissue burnings, etc.



Source: Haik et al



Source: Mailonline

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Introduction

Adverse events related to the magnetic field have been described worldwide:

In 2008, 148 reports were submitted

Pennsylvania Patient Safety Advisory

Safety in the MR Environment: MR Safety Screening Practices

1568 adverse events reported between Jan/2008 and Dec/ 2017.

MRI-related FDA adverse event reports: A 10-yr review

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Some adverse events have also taken place at our institution in the recent years.

Aiming to prevent these events, the American College of Radiology has defined four **safety zones** within MRI facilities:

Zone I
UNRESTRICTED AREA
Access and circulation allowed.
Free of magnetic field interaction.

Zone II
CONTROLLED AREA
MRI Safety Screening Questionnaire
Near the exam room.

Zone III
RESTRICTED AREA
ATENTION!!!
Patient preparation for exam
Near magnetic field

Zone IV
RESTRICTED AREA
DANGER!!! Access with authorized personnel only
Inside exam room

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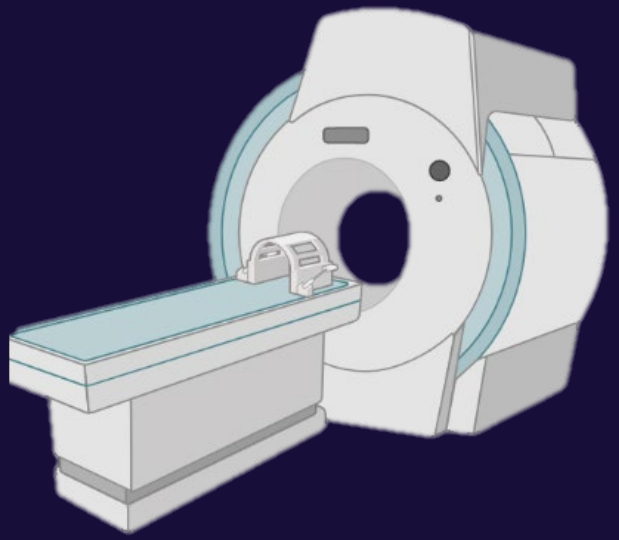
Objectives

To describe our institucional experience in optimizing safety barriers in a MRI unit of a Brazilian private hospital (8 MRI machines).



To discuss the importance and the feasibility of the educational and security initiatives in order to prevent accidents and to provide a better experience for patients and healthcare professionals.

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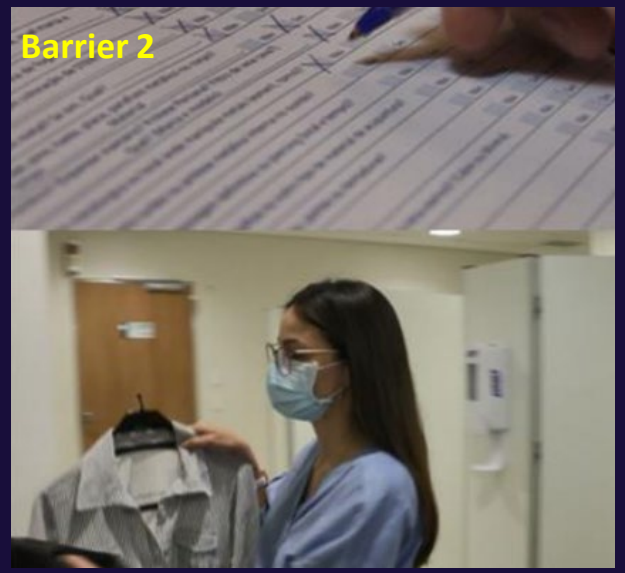
Methods

This project was developed from September 2019 to September 2021. The following security barriers were implemented:

- **Barrier 1 -** The scheduling team asks a series of standardized questions to ensure that the patient have no contraindications to the MR scan.

- **Barrier 2 -** The patients is oriented to fill a security questionnaire, to change clothes and to remove disposable metallic belongings (zone I).



Source: Sirio Libanes Hospital

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Methods

- **Barrier 3 -** A first professional check all the patient´s answers in the safety questionnaire (zone II). Some answers can require personalized investigation.
- **Barrier 4 -** A second professional recheck the identification data and the safety questionnaire before entering the examination room with the patient (zone III).

Source: Sírio Libanês Hospital

Hospital SírioLibanês
SOCIEDADE BENEFICENTE DE SENHORAS

Magnetic Resonance Imaging

Pre-Exam Questionnaire

Accounting: Same:
Patient: M.P.S Age: 35
Date of hospitalization: 10/07/222 Bed:
Physician:

Attention, please: your answers are extremely important for the performance of the test.

Weight 65 Kg

1. Do you use a pacemaker?	X No	Yes
2. Have you ever been submitted to clip or cerebral valve placement?	X No	Yes
3. Have you ever undergone aneurism surgery?	X No	Yes
4. Have you ever had a wound caused by metal chip or firearm?	X No	Yes
5. Have you ever undergone heart surgery or stent placement?	X No	Yes
6. Do you have a Port-A-Cath catheter (totally implantable)?	X No	Yes
7. Do you have prostheses, clips, pins, stems, plates, or metallic screws in the body?	No	X Yes
8. Do you work in metallurgy or a place where metal is handled (grinder, lathe)?	X No	Yes
9. Do you wear a hearing aid or inner metallic aid in the ear?	X No	Yes
10. Do you have tattoo, definite makeup or piercing (site and time)?	X No	Yes
11. Do you have points, needles or any other type of acupuncture material?	X No	
12. Do you have dental braces, bridges or dental prosthesis?	X No	
13. To women: are you pregnant?	X No	
14. Have you undergone any recent surgery that implanted metals?	X No	
15. Are you wearing contact lenses or common makeup?	X No	
16. Do you have any renal disease or any grade of renal failure?	X No	

Previous exams maintained in the hospital

Exam	Origin
No exam	

I am aware of the importance of this questionnaire and authorize the performance of the exa

Signature of the Patient / Responsible person
M.P.S

E_0116_Pre-Exam-Questionnaire_Magnetic-Resonance-Imaging - 11/2007

Security Questionnaire

The safety questionnaire is an important barrier to identify risk factors to adverse events and MR contraindications. In this case, the pointed answer must be further investigated.

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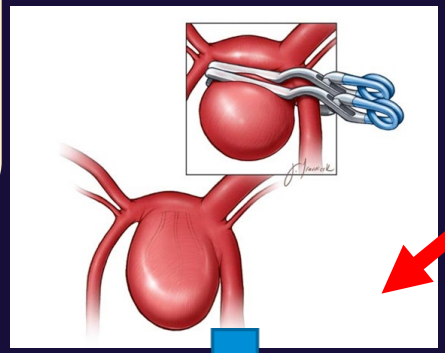
Methods

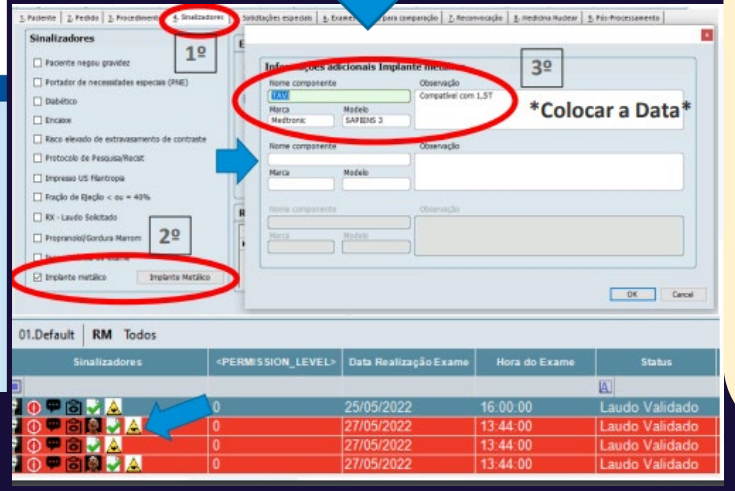
Internal Improvement Standards

The investigation of the compatibility of materials and devices was carried out by consulting the **MRI safety website.**

https://www.mrisafety.com



The **patient registration system** was fed with data related to MRI safety, such as the size of implants and devices.



Whenever necessary, **additional security measures** were taken in our service, such as the instalation of a security camera at MR waiting room after an wheelchair accident.

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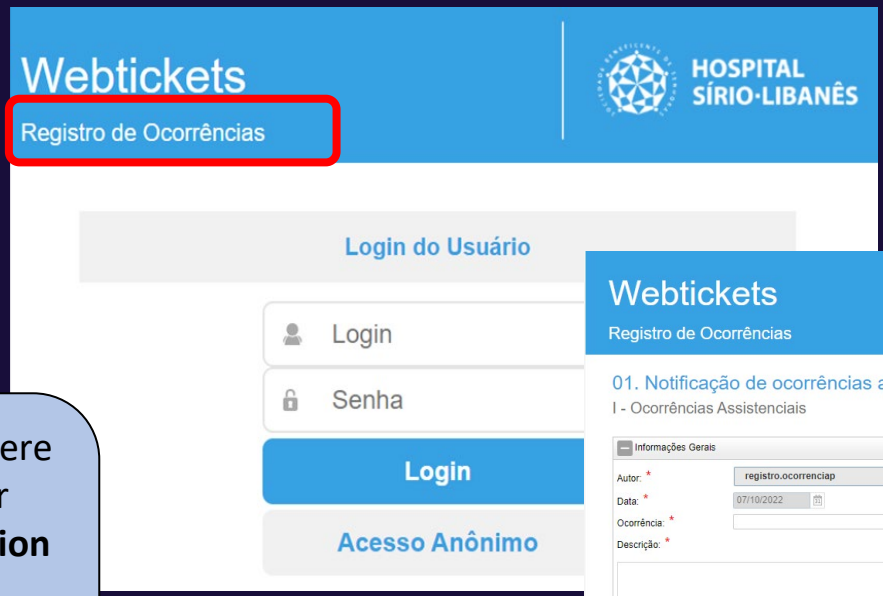
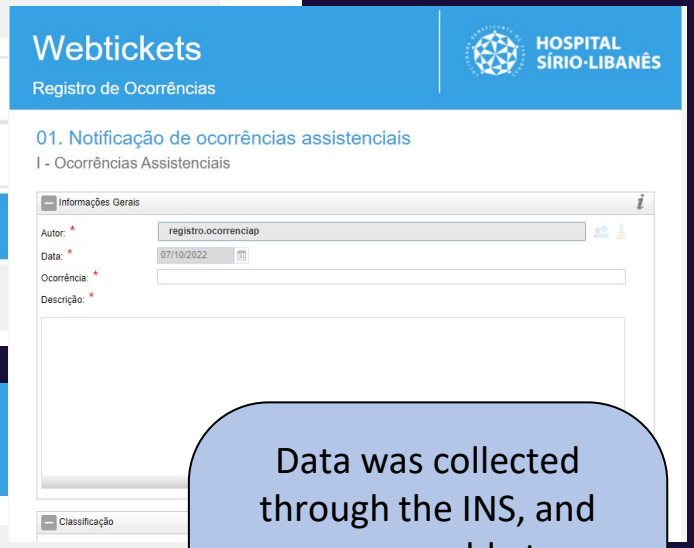
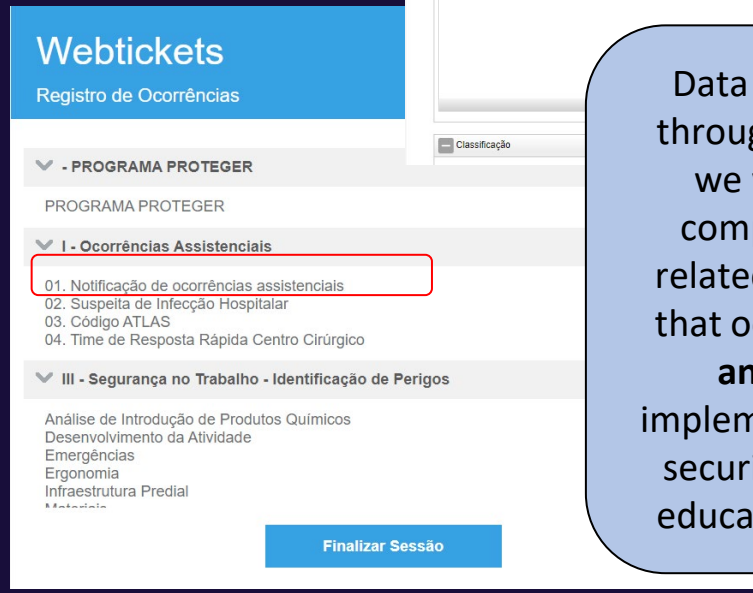
Methods

Adverse events were recorded in our **incident notification system (INS),** available in our institution's internal platform.







A **educational training** was carried out anually, first for all employees in the radiology department and then for other care professionals who could have indirect (such as the cleaning team) or intermittent (such as transport tema) contact with the MRI unit.

Data was collected through the INS, and we were able to compare the data related to the events that occurred **before and after** the implementation of our security project and educational training.

Source: Sirio Libanes Hospital

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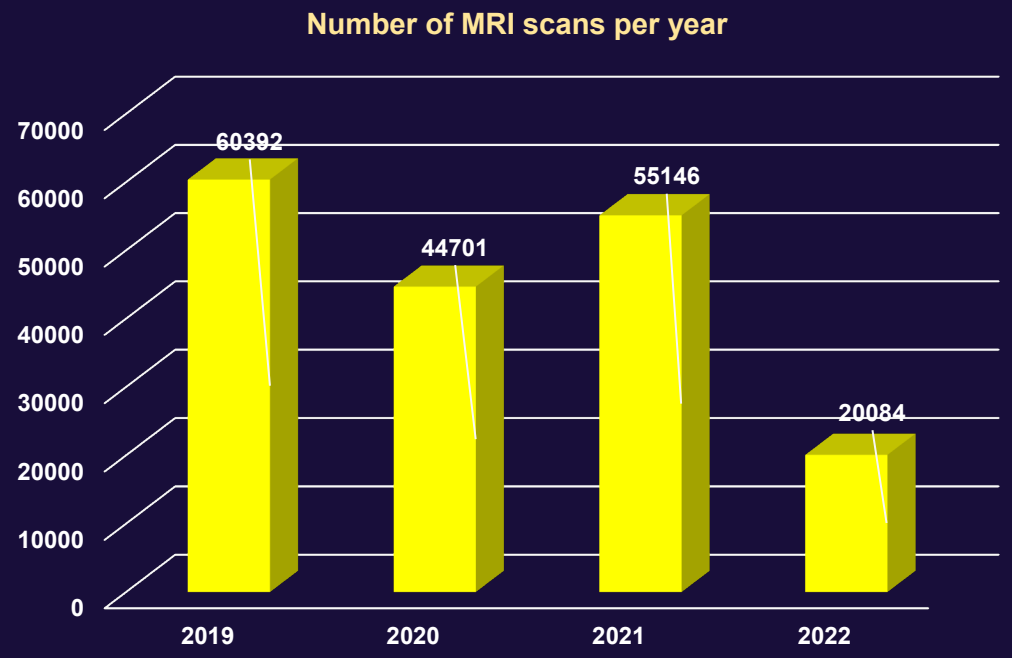
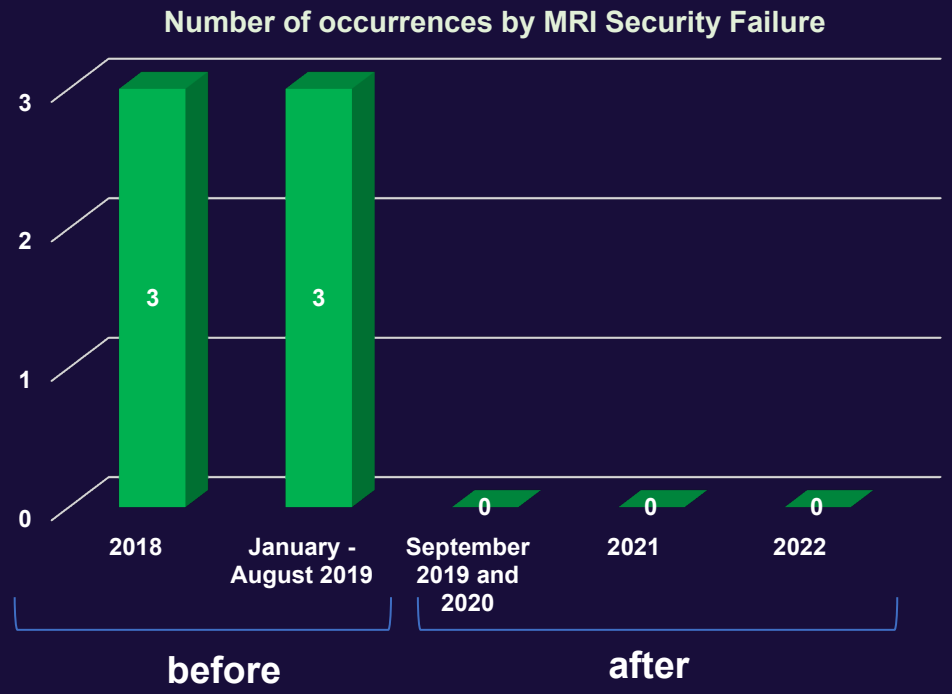
Results

The impact of our interventions was evaluated by the number of adverse events recorded in our incident notification system, **before** and **after** the described safety barriers and educational training program.





Source: Sirio Libanes Hospital

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Take home message

Safety in the MR environment is a institutional duty!

Each institution should elaborate its own security and education plan (following international guidelines) in order to prevent adverse events and to provide a better experience for patients and healthcare professionals.

References

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