

# The Framework of a Robust, System-wide Magnetic Resonance Safety Program

\*Randy Parker, RT(MR), MRSO, MRSC<sup>1</sup>

Adam Gray<sup>1</sup>

Debra Buer<sup>1</sup>

Bradford Betz, M.D., FACR<sup>2</sup>

Yong Zhou, Ph.D.<sup>1</sup>

Evan Boote, Ph.D., FAAPM<sup>1</sup>

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2) Advanced Radiology Services, Grand Rapids, MI

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# Introduction, Purpose and Objective

## IDENTIFIED KEY COMPONENTS TO ALIGN BEST PRACTICES

Physical layout and patient screening are critical in reducing adverse events in MRI.

Demand for MRI services has increased as well as the number and complexity of active implanted medical devices (AIMD).

## LARGE, COST-CONSCIOUS HEALTHCARE SYSTEM

Diverse patient population implanted with complex passive and active devices

Operates 22 MRI units at 17 locations.

## MR SAFETY PROGRAM

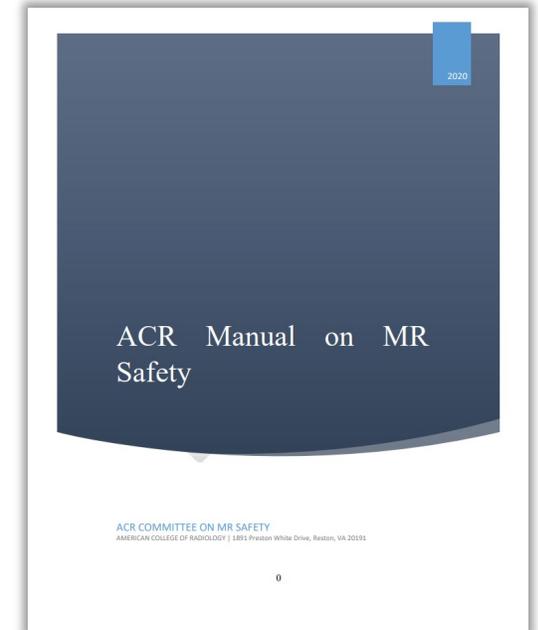
MR Medical Director (MRMD)

MR Safety Expert (MRSE / Internal MR Physicist)

Lead MR Safety Officer (MRSO)

MR Safety Expert Improvement Team (EIT) comprised of Radiology Leadership, Risk Management, and Process Improvement members

Certified MRSO or appropriate representative (MR Safety Associates) at each MRI facility. Under the direction of the Lead MRSO, MRMD, and MR Leadership



**ADOPTION OF AN INTEGRATED MR SAFETY PROGRAM IS ACHIEVABLE.  
LET US SHOW YOU!**

Investment in an expert, proactive MR Safety Program adds value to a cost-conscious Healthcare system.

- 
- Collected data provides key performance indices to justify the effort and cost of a robust MR Safety program.
    - Can be evaluated in real-time, providing leadership with insights into the load balancing of the thorough preemptive safety review tasks performed by the program.
    - Provide reasonable and timely access for patients
    - Quality imaging study done safely
    - Cost-efficient operation

# Material & Methods

Upon placement of an MRI order, the patient completes a comprehensive MRI screening questionnaire via a scheduling representative or secure electronic patient portal.

Based on questionnaire answers, MRI orders are flagged for safety review based on positive answers to certain questions

- Scheduling of the MRI is temporarily held unless emergent and approved by MR Safety/Radiologist

Screening answers are reviewed by MR Safety team member (MRSO)

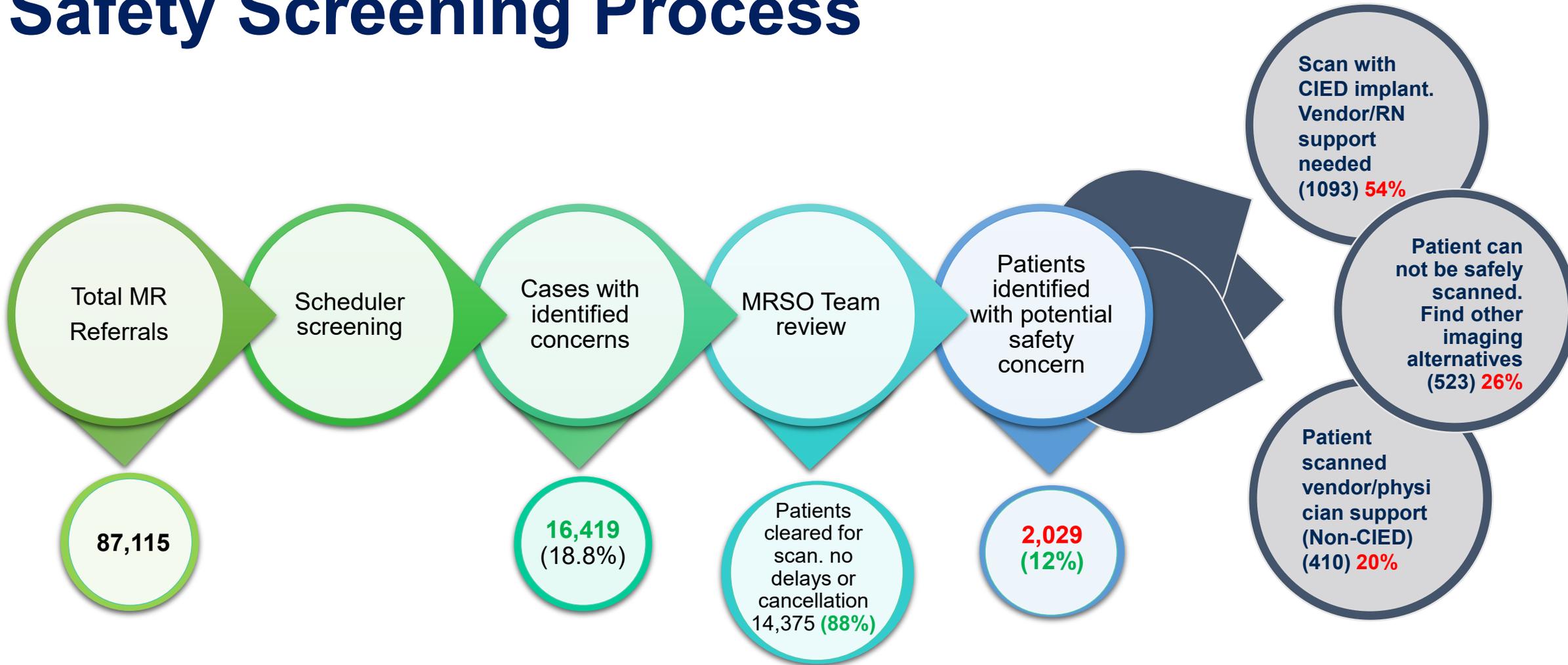
Data metrics identified and tracked electronically:

- Primarily based on outpatient MRI orders (Total MRI referrals)
- Total number of safety reviews performed
- Number of patients with contraindications for MR studies
- Number of patients allowed to proceed but have implants that need ancillary support from a vendor representative or specialty physician

Primary Metrics:

- Revenue loss avoided by last-moment MRI appointment cancellations due to safety contraindication
- Avoidable delays due to device research and coordination with staff and patient

# Safety Screening Process



12 Month period (10/9/21 – 10/10/22)

# Total Margin Loss Avoidance (TMLA)

## Internal Financial Analyst consultation

- If a patient shows up for an MRI that cannot be performed at that site due to an implant or other safety concern, the exam is denied or severely delayed. MRI unable to immediately backfill. Results in an unused MRI appointment.
- What is an MRI timeslot worth?

## Net Margin per Unit of Service (UOS)

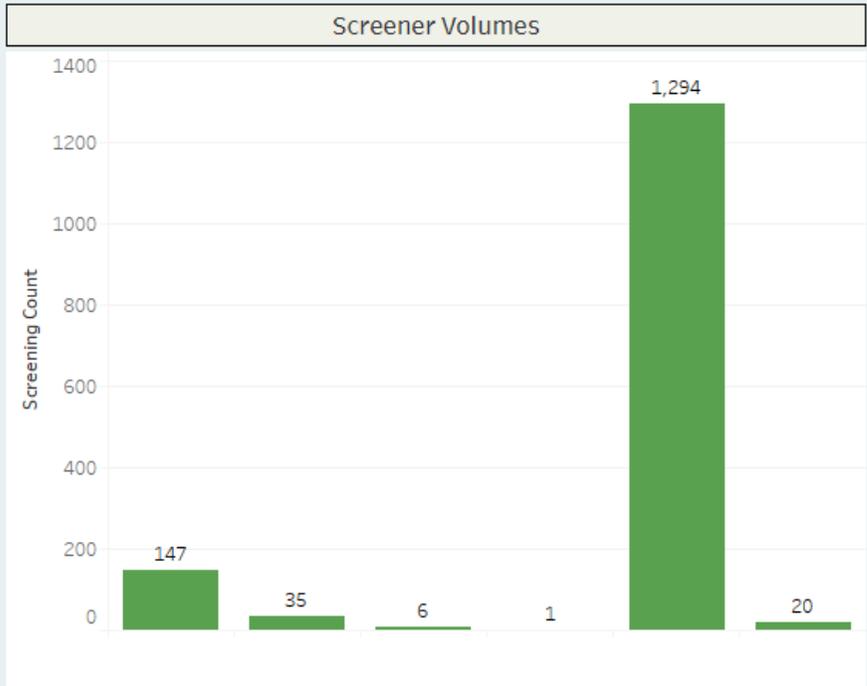
- Based on where MRI was performed
  - Hospital location = \$840/exam
  - Ambulatory/outpatient location = \$360/exam
  - Unable to proceed (Do Not Scan) = \$600\*
- Average per MRI exam
  - Includes CMS and all accepted commercial insurance payments
  - Based on completed exams ONLY

\*No MRI performed. Value calculated by averaging UOS for hospital and ambulatory locations

# Proceed with Vendor/Physician support

## MRI Safety Officer Volumes

\*Margin per UOS applied to studies needing physician/vendor support or flagged as a "Do not proceed"  
 \*\*Applied margin based on completed exams only; \$840 per GR/Hospital exam, \$360 per offsite exam, and \$600 per exam screened as "Do Not Proceed"



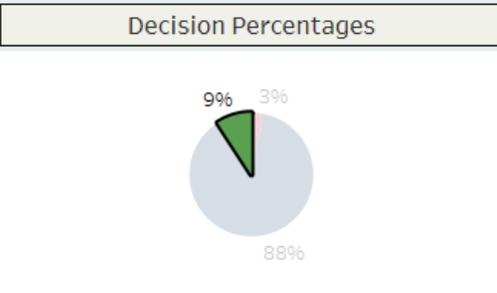
### Screening Decision and Cost Savings

Screening Decision	Vendor/Physician Support Required for Pacemaker/ICD?	Margin Loss Avoided	Non-Cardiac Vendor/Physician Support?			
			No	Yes	Yes-Shunt Adult	Yes-Shunt Peds
Proceed	No	\$48,120			82	
		\$95,760				147
	Yes	\$112,920		180		
		\$840		1		
Grand Total		\$665,280	1,093			
			1,093	181	82	147

Screening Date  
 10/10/2021 10/9/2022

Slider:

Screening Decision  
 (All)



### Total Margin Loss Avoided

**\$922,920**

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### Total Number of Patients Screened

**1,503**

Screening Decision  
 (All)  
 Do Not Proceed  
 Proceed  
 Proceed with Ve...

Screening Decision  
 Proceed with Ve...

### Details

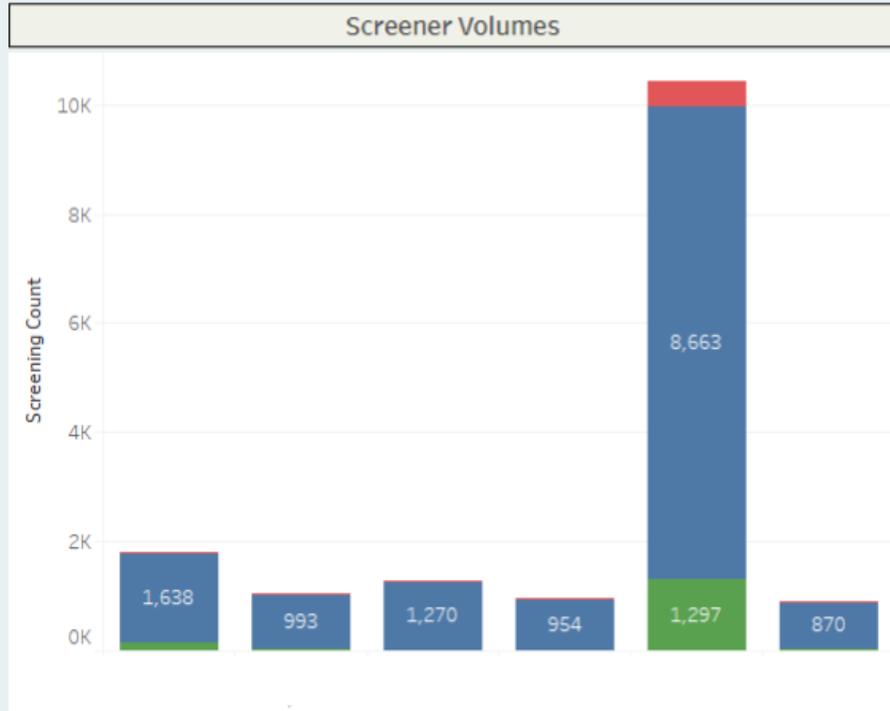
Screener Name	MRN	Accession Number	Screener Comment	Screening Date/Time	Referral Number	Order ID	Ordering Date
			Schedule on 1.5T or 3T at Blodgett in a pacemaker slot. OK to scan 1.5T and 3T Normal Mode. If ..	6/24/2022 ..			
			Schedule on 1.5T or 3T at Blodgett in a pacemaker slot. OK to scan 1.5T and 3T Normal Mode. If ..	6/24/2022 ..			
			Schedule on 1.5T at Blodgett in a pacemaker slot on Tuesdays. Ok to scan 1.5T normal level. Mu..	7/27/2022 ..			
			Schedule on 1.5T or 3T at Blodgett in a pacemaker slot on Tuesdays. Ok to scan 1.5T or 3T. SAR a..	5/17/2022 ..			
			Schedule on 1.5T or 3T in a pacemaker slot. OK to scan 1.5T and 3T Normal Mode. If scanning at ..	6/13/2022 ..			
			or 3T in a pacemaker slot. OK to scan 1.5T and 3T Normal Mode. If scanning at 3T from C-7 or ab..	6/20/2022 ..			
			Watchman safe to scan at 1.5T & 3T on normal level Schedule on 1.5T & 3T in a pacemaker slot. ...	6/3/2022 1..			

\*Courtesy of [www.tableau.com](http://www.tableau.com)

# Annual TMLA summary

## MRI Safety Officer Volumes

\*Margin per UOS applied to studies needing physician/vendor support or flagged as a "Do not proceed"  
 \*\*Applied margin based on completed exams only; \$840 per GR/Hospital exam, \$360 per offsite exam, and \$600 per exam screened as "Do Not Proceed"



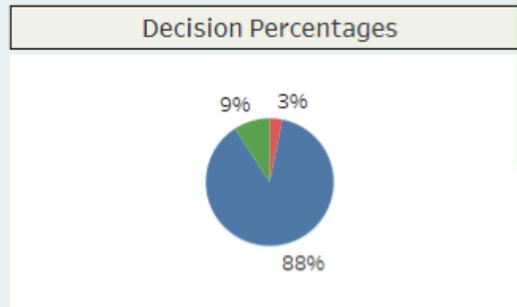
### Screening Decision and Cost Savings

Screening Decision	Vendor/Physician Support Required for Pacemaker/ICD?	Margin Loss Avoided	Non-Cardiac Vendor/Physician Support?			
			No	Yes	Yes-Shunt Adult	Yes-Shunt Peds
Do not proceed	No	\$313,800	523			
	Yes	\$1,200	2			
Proceed		\$0	14,388			
	No	\$45,600			82	
		\$95,760				147
		\$113,400		181		
	Yes	\$840		1		
Grand Total		\$655,200	16,008	182	82	147

Screening Date  
 10/10/2022: 10/9/2022

Screening Decision  
 (All)

Screening Decision  
 Do Not Proceed  
 Proceed  
 Proceed with Ve...



**Total Margin Loss Avoided**

**\$1,225,800**

**Total Number of Patients Screened**

**16,419**

### Details

Screener Name	MRN	Accession Number	Screener Comment	Screening Date/Time	Referral Number	Order ID	Ordering Date
			Null	8/8/2022 3:..			
			Null	4/15/2022 ..			
			Schedule on 1.5T or 3T at Blodgett in a pacemaker slot. OK to scan 1.5T and 3T Normal Mode. If ..	6/24/2022 ..			
			ortho hardware safe to scan at 1.5T & 3T - KSC	6/30/2022 ..			
			Aneurysm coiling ok to scan 1.5T and 3T, pt mentions pipeline stent as well which is also safe at ..	5/20/2022 ..			
			Penile implant ok to scan 1.5T and 3T - KSC	8/3/2022 4:..			
			ready to schedule - KSC	5/12/2022 ..			

# Benefits of comprehensive MRI Safety program

Maximized access to MRI for patients within and outside hospital system

Cost savings based on efficient MR slot utilization

Standardized and rigorous MR safety screening and awareness

MRI Safety program pays for itself by making entire MR enterprise more efficient

Data shows value of adopting an MRI Safety program and can also be used to highlight areas for process improvement.

Lessons learned from reported Zone 4 infractions, “good catches”

# References

ACR Committee on MR Safety, “American College of Radiology Manual on MR Safety”, V1.0 2020, <https://www.acr.org/-/media/ACR/Files/Radiology-Safety/MR-Safety>.

Delfino JG, Krainak DM, Flesher SA, Miller DL, “MRI-related FDA adverse event reports: A 10-yr review”, *Med Phys* 46(12), p 5562-5571, 2019.

Glik TB, “MR Imaging Safety”, *Magnetic Resonance Imaging Clinics of North America* 28(4), p. 481-488, 2020.

Food and Drug Administration, Center for Devices and Radiological Health, “Testing and Labeling Medical Devices for Safety in the Magnetic Resonance (MR) Environment”, issued May 20, 2021.

Questions?

SCAN ME

