

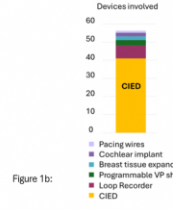
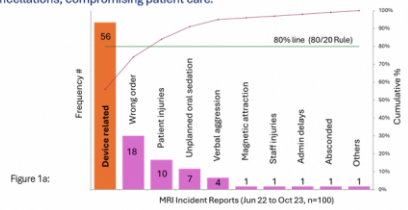
Incredible Care QIX Award (Process Excellence)

Project Title: Pre-MRI Safety Screening for Implantable Medical Devices: Implementation of a Data Analytics Dashboard to Enhance Workflow Efficiency		
Department: Department of Diagnostic Imaging	Period: October 2023 to September 2025	Facilitators/Author: Dr Andrew Makmur, Mr Liang Chong Ri
Sponsors (HODs): Prof Khong Pek Lan	Team Leader/s: Ms Regine Teo Ee Chin	
Team Members: Ms Hsin-Yu Jen, Mr Wei Xian Ong, Dr Eric Fang, Dr Yong Han Ting, A/Prof James Hallinan		

A. Define the Problem (PLAN)

Did you know **56%** of our MRI incidents are **device-related**, costing radiographers **400 mins** daily in manual pre-MRI safety screening?

The ageing global population has increased chronic diseases requiring Active Implantable Medical Devices (AIMD), such as Cardiac Implantable Electronic Devices (CIED)¹⁻³, and Passive Medical Devices (PMD), like programmable ventriculoperitoneal shunts⁴⁻⁵. These devices create significant MRI safety challenges. A Pareto analysis of MRI incident reports at our department revealed that 56% were **device related** (Figure 1a), followed by loop recorders, programmable ventriculoperitoneal shunts (VPS), breast tissue expanders and cochlear implants (Figure 1b). Of these implant-related incidents, 67.85% were due to **undisclosed implants**, while the rest (28.57%) were due to **non-compliance to CIED workflow**. **Undisclosed devices create MRI safety risks** (heating, displacement, torque, malfunction⁶⁻⁹) and cause delays or cancellations, compromising patient care.



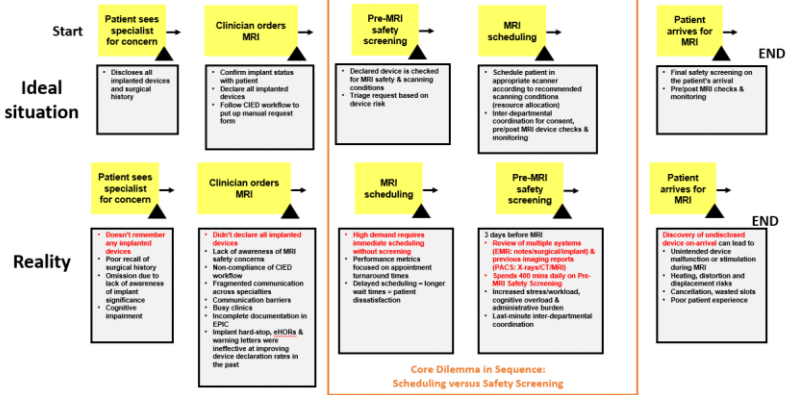
B. Goal (PLAN) Set SMART goals | Specific, Measurable, Achievable, Relevant, Time-based |

This quality improvement project aims to develop and implement a novel, data-driven approach to enhance workflow efficiency for pre-MRI safety screening of patients with implantable medical devices. By leveraging data analytics and a user-friendly dashboard, we aim to:

Reduce the average pre-MRI safety screening time to less than 200 mins/day by implementing a data analytics dashboard across all 5 MRI centres in NUH by March 2025.

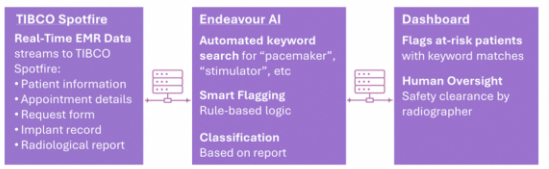


C. Problem Analysis (PLAN) Value Stream Map



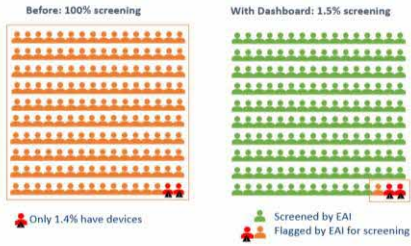
D. Interventions & Action Plan (DO)

A data-driven implant detection dashboard was developed using Endeavour AI + TIBCO Spotfire. The dashboard serves to centralise EPIC data, including appointment details, implant history, MRI request forms, and radiology reports into a single location. Leveraging on TIBCO Spotfire's streaming capabilities, the platform search these data using keyword matches, rule-based logic, and regular expressions to identify patients with devices based on radiology reports, device histories and request forms. Device is then classified based on keywords and identified on the dashboard for safety clearance by radiographers.



Development of the dashboard involved MRI radiographers with deep expertise in safety screening workflows, enabling comprehensive understanding and integration of user needs into the dashboard design.

E. Benefits / Results (CHECK)



	Manual Screening	With EAI Dashboard
Daily screening numbers	340 patients	2.3 patients (1.4% of workload)
Time taken for screening	2.5 mins/patient	1.5 mins/patient
Total time for screening	400 mins/day	4.5 mins/day

98% reduction in time!

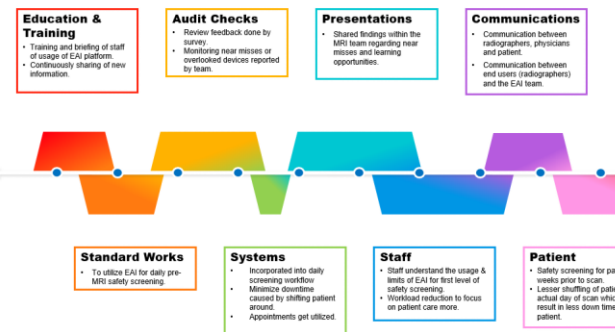
In the past, blanket screening of all scheduled patients took 400 mins a day. In comparison, the dashboard efficiently narrows the focus to just 1.5% of the daily workload (2-3 patients, ~5mins) for review, closely aligning with the 1.4% of unique patient visits to MRI that truly involved devices. Therefore, blanket screening a full schedule of patients to identify this small subset is highly inefficient and a disproportionate use of radiographers' time.

The preview of radiology reports on the dashboard also enables a more directed implant search in EMR, reducing the average screening time from 2.5 minutes per patient to 1.5 minutes.

The resulting time saving of 395 minutes is equivalent to a 0.8 full-time equivalents (FTE), freeing up radiographers to concentrate on clinical and patient tasks.

Early identification of undisclosed devices prevented an estimated 1280 minutes of scanner idle time and related revenue loss from on-arrival cancellations due to non-disclosure. In addition, early identification of these patients enabled their rescheduling from the satellite MRI centre, where safety and logistical constraints limit the ability to manage implanted devices.

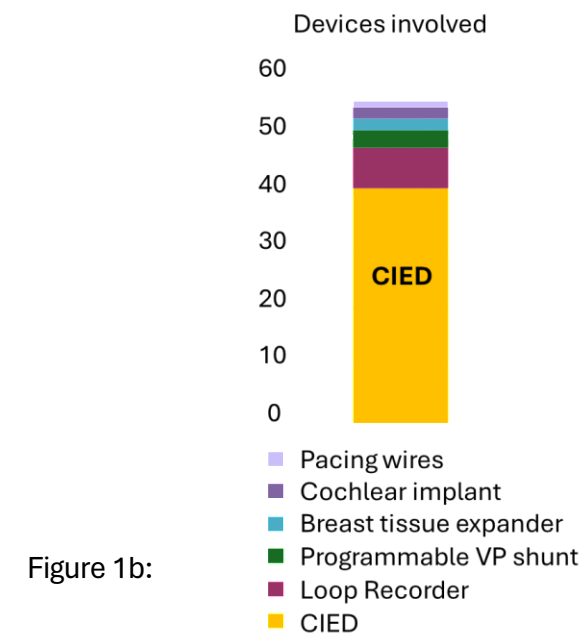
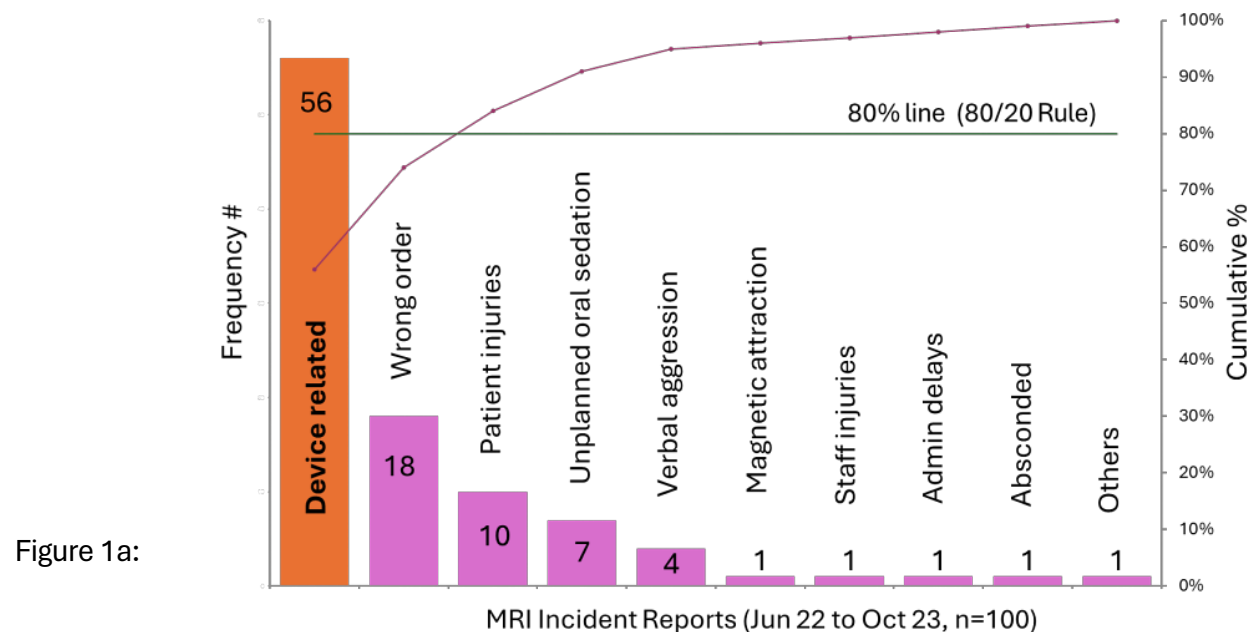
F. Strategy for Spreading/ Sustaining (ACT)



A. Define the Problem (PLAN)

Did you know **56%** of our MRI incidents are **device-related**, costing radiographers **400 mins** daily in manual pre-MRI safety screening?

The ageing global population has increased chronic diseases requiring Active Implantable Medical Devices (AIMD), such as Cardiac Implantable Electronic Devices (CIED) ¹⁻³, and Passive Medical Devices (PMD), like programmable ventriculoperitoneal shunts ⁴⁻⁵. These devices create significant MRI safety challenges. A Pareto analysis of MRI incident reports at our department revealed that 56% were **device related** (Figure 1a). Most incidents were related to CIED (73.21%), followed by loop recorders, programmable ventriculoperitoneal shunts (VPS), breast tissue expanders and cochlear implants (Figure 1b). Of these implant-related incidents, 67.85% were due to **undisclosed implants**, while the rest (28.57%) were due to **non-compliance to CIED workflow**. **Undisclosed devices pose MRI safety risks**, including heating, displacement, torque, and malfunction ⁶⁻⁹, which can cause delays or cancellations, thereby compromising patient care.



A. Define the Problem (PLAN)

Pre-MRI Safety Screening involves reviewing patient electronic medical records and radiology reports (X-ray, CT) to identify and assess device safety, and to mitigate risk whilst optimizing scheduling. However, this manual process is **time-intensive** (averaging 400 minutes for a workload of 160 patients daily or 2.5mins/patient) and is **unsustainable** with increasing workloads.



Devices of concern:

Active Implantable Medical Devices:

Cardiac Implantable Electronic Devices (CIED): Pacemaker, Implantable Cardioverter-Defibrillator (ICD), Cardiac Resynchronization Therapy Devices (CRTD)

- Requires informed consent before MRI, pre & post device checks involving Cardiology team, Manual request form (DDI CIED workflow for MRI)
- Scheduling in the appropriate scanner, keep scan time and conditions within recommended limits

Pump (pain, drug, insulin)

Neurostimulator (deep brain, vagal nerve, spinal, bone and bladder)

Cochlear implant

- Requires informed consent before MRI, pre & post device checks involving device vendor representative
- Schedule at 1.5T SolaFit only, keep scan time and conditions within recommended limits

Passive Medical Devices:

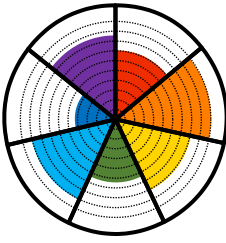
Epicardial pacing or Stimulator wires

- Requires informed consent before MRI
- Schedule at 1.5T scanner only

Programmable ventriculoperitoneal (VP) shunts

- Requires pre and/or post shunt checks involving Neurosurgery team
- Schedule at 1.5T scanner only

B. Goal (PLAN) Set SMART goals | Specific, Measurable, Achievable, Relevant, Time-based |

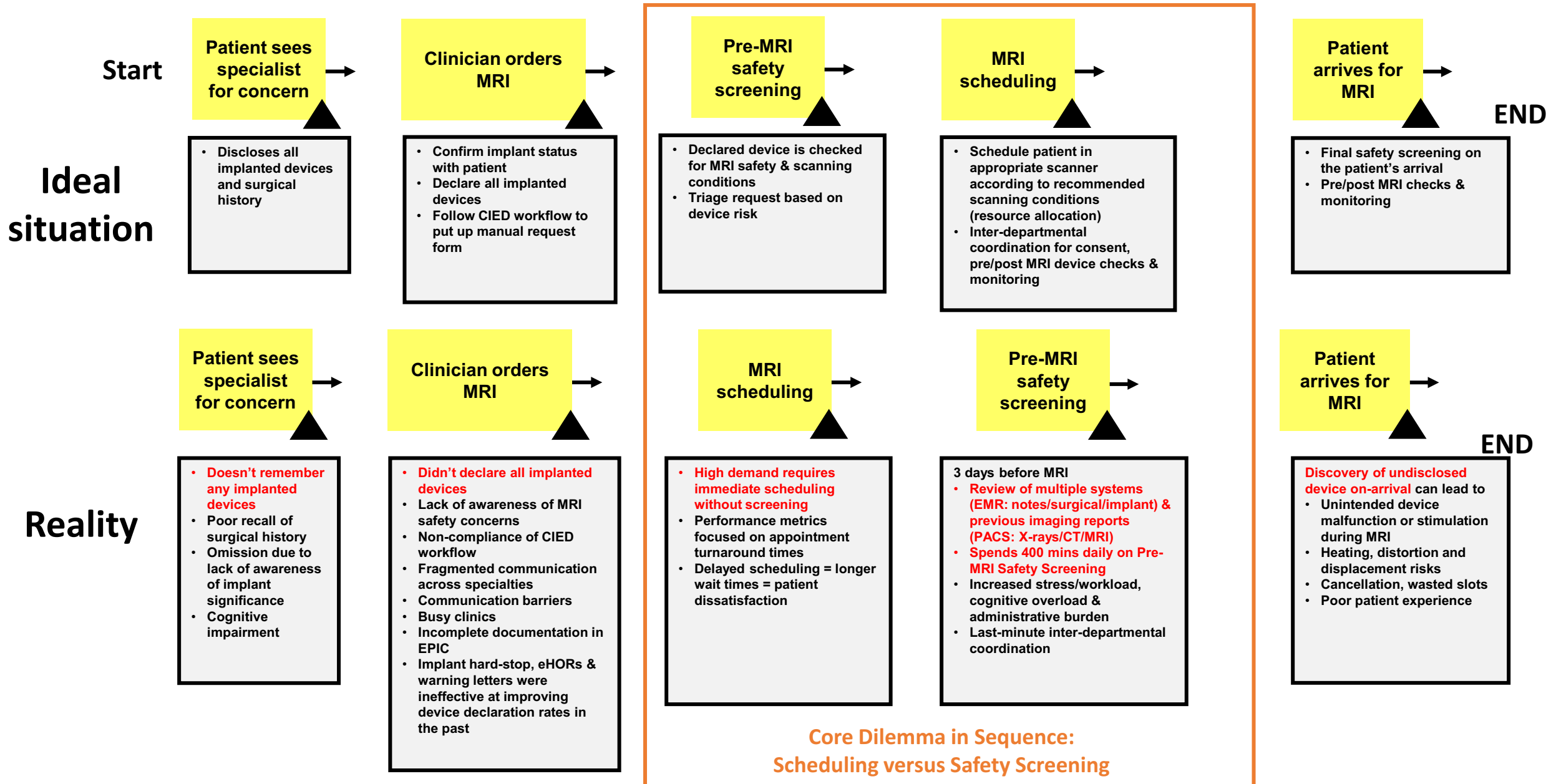


This quality improvement project aims to develop and implement a novel, data-driven approach to enhance workflow efficiency for pre-MRI safety screening of patients with implantable medical devices. By leveraging data analytics and a user-friendly dashboard, we aim to:

Reduce the average pre-MRI safety screening time to less than 200 mins/day (50%) by implementing a data analytics dashboard across all 5 MRI centres in NUH by March 2025.

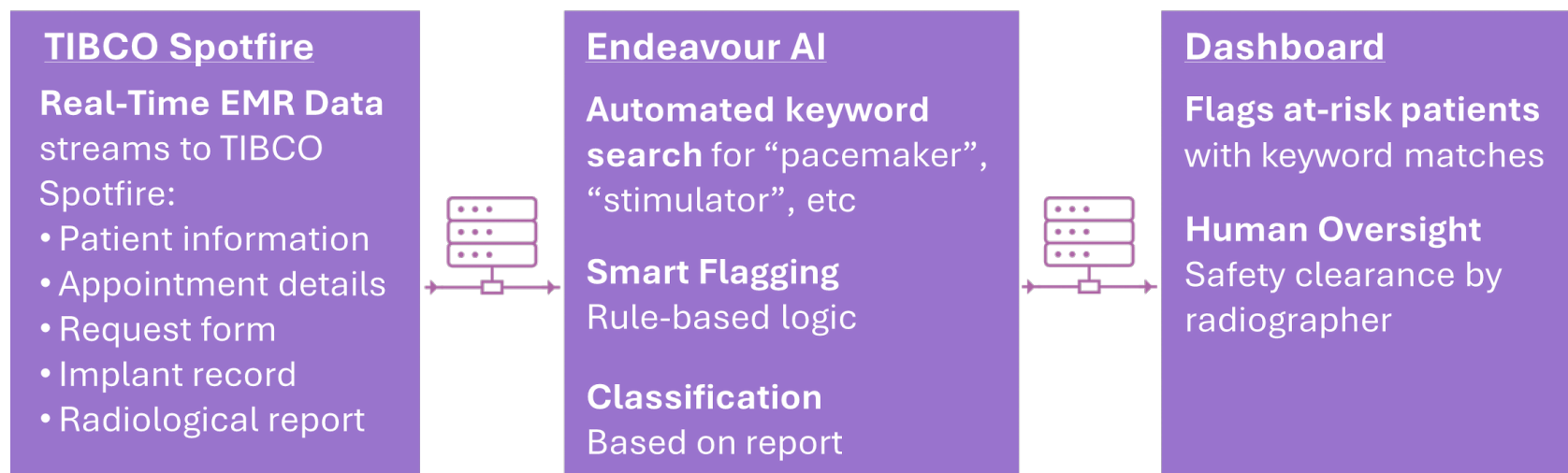


C. Problem Analysis (PLAN) Value Stream Map



D. Interventions & Action Plan (DO)

A data-driven implant detection dashboard was developed using Endeavour AI + TIBCO Spotfire. The dashboard serves to centralise EPIC data, including appointment details, implant history, MRI request forms, and radiology reports into a single location. Leveraging on TIBCO Spotfire's streaming capabilities, the platform search these data using keyword matches, rule-based logic, and regular expressions to identify patients with devices based on radiology reports, device histories and request forms. Device is then classified based on keywords and identified on the dashboard for safety clearance by radiographers.



Development of the dashboard involved MRI radiographers with deep expertise in safety screening workflows, enabling comprehensive understanding and integration of user needs into the dashboard design.

D. Interventions & Action Plan (DO)

The dashboard flags at-risk patients, displaying patient and appointment details, implant classification based on keyword-matched radiology reports, implant information from EMR and previews of relevant radiology reports to support radiographer review on a single page.

EAI Implant Dashboard - Pre-MRI Safety Screening

MRN	Name	Procedure	Location	Appointment	Implant Type	Implant	Report	Investigation	Date
xxx	xxx	MRI Heart	FIC	xxxxxx 8:30 AM	Pacemaker	Evera S VR MR..	dual-lead pacemaker is seen..	XR Chest PA	xxxxxx
xxx	xxx	MRI Brain	KRW	xxxxxx 9:00 AM	Shunt	Codman Bacti..	temporal VP shunt tip is in t..	CT Brain	xxxxxx
xxx	xxx	MRI Pancreas	L4	xxxxxx 1:00 PM	Pacing Wires	Avatus Aortic..	picardial pacing wires noted..	CT TAP	xxxxxx
xxx	xxx	MRI Orbits	L8	xxxxxx 9:30 AM	Cochlear	Kanso 2 CP11..	acts from cochlear implant o..	CT Brain	xxxxxx
xxx	xxx	MRI Liver	GLX	xxxxxx 11:00 AM	Loop Recorder	Reveal LINQ	and loop recorder within the..	CT Thorax	xxxxxx
xxx	xxx	MRI Lumbar	FIC	xxxxxx 4:30 PM	Stimulator		ds of the stimulator leads ar..	CT Brain	xxxxxx
xxx	xxx	MRI IAM	KRW	xxxxxx 2:00 PM	Shunt	Strata NSC Va..	of right ventriculoperitoneal..	MRI Brain	xxxxxx
xxx	xxx	MRC	L4	xxxxxx 8:00 AM	CRT-D	Medtronic CS..	sition of CRT-D is unchange..	CT TAP	xxxxxx

Patient details

Appointment details

Implant classified according to report

Implant info from EPIC

Preview of radiological report



A conditional rule-based code manages location-specific capabilities, ensuring flagged patients at the satellite clinic are rescheduled. The dashboard exhibits high versatility, and its customisable nature allows for on-the-fly adjustments to the layout, output, and keywords, enabling adaptation to evolving needs and the inclusion of new devices.

D. Interventions & Action Plan (DO)

Task	Start date	End Date	Progress	2023				2024							
				Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24
Project Conception and Planning															
*Project discussion	Oct 2023	Oct 2023	100%	[Gantt bar from Oct-23 to Oct-23]											
Development of EAI Dashboard															
*Dashboard development	Nov 2023	Nov 2023	100%	[Gantt bar from Nov-23 to Nov-23]											
*Manual upload of radiology orders	Nov 2023	Aug 2024	100%	[Gantt bar from Nov-23 to Aug-24]											
*Auto data stream verification	Aug 2024	Sep 2024	100%	[Gantt bar from Aug-24 to Sep-24]											
Testing and Iteration															
*Dashboard testing in parallel	Nov 2023	Aug 2024	100%	[Gantt bar from Nov-23 to Aug-24]											
*Keyword iteration	Nov 2023	Oct 2024	100%	[Gantt bar from Nov-23 to Oct-24]											
Implementation and Training															
*EAI Training Talks	Feb 2024	Oct 2024	100%	[Gantt bar from Feb-24 to Oct-24]											
*Pilot group training	Aug 2024	Aug 2024	100%	[Gantt bar from Aug-24 to Aug-24]											
*Pilot group testing	Sep 2024	Oct 2024	100%	[Gantt bar from Sep-24 to Oct-24]											
*Remaining radiographers training	Oct 2024	Nov 2024	100%	[Gantt bar from Oct-24 to Nov-24]											
Full Deployment and Monitoring															
*Data collection & Monitoring	Nov 2023	Oct 2024	100%	[Gantt bar from Nov-23 to Oct-24]											
*Full deployment	Nov 2024	Nov 2024	100%	[Gantt bar from Nov-24 to Nov-24]											

Figure 2: Evolution of the project, highlighting key milestones from initial conception and development through phases of manual data uploads, progressive data automation, and team trainings, culminating in full deployment in Nov 2024.

The project was developed by MRI radiographers familiar with pre-MRI safety screening processes, starting with dashboard development and layout, coding and identification of keywords.

In the beginning, radiology orders were not part of the initial HL7 data-stream from EPIC. These data were manually uploaded twice weekly into a database in EAI. In August 2024, an automated daily data dump of radiology orders from EPIC Clarity was deployed via Secure File Transfer Protocol (SFTP), enabling overnight updates. This minimised delays and ensured that newly scheduled patients could be flagged promptly.

In preparation for pilot testing and full deployment, a series of talks to introduce the EAI dashboard were conducted from Apr 2024. In Sep 2024,

a group of 10 MRI radiographers were trained for pilot testing in parallel with manual screening. Regular feedback were gathered from the pilot group ensuring that the dashboard met their functional needs. This pilot group of radiographers then help support the rest of the team for full deployment.

By November 2024 with full deployment, blanket manual screening of all MRI patients was fully replaced with selective screening of patients flagged by EAI dashboard, greatly reducing time taken.

The dashboard is currently used by all MRI radiographers, integrating it into our pre-MRI safety screening up to 2 weeks ahead of schedule.

E. Benefits / Results (CHECK)

Regular feedback was gathered from the pilot group, ensuring that the dashboard met their functional needs. The dashboard undergoes continuous iteration based on feedback and data quality checks. Near-miss incidents were followed up with targeted reviews to identify information or workflow gaps. Rates of flagged cases and false positives related to keyword iterations were also monitored over time.

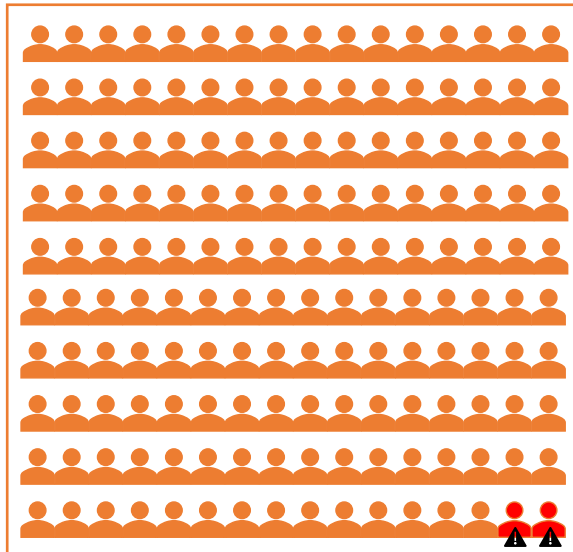
Data completeness and accuracy were ensured through EMR chart reviews, scheduling logs, radiology reports, and cancellation timestamps, with radiographers recording any discrepancies or near-miss events.

We prospectively evaluated 32,214 unique patient visits* to MRI over 1 year (Nov 2023-Oct 2024). Key performance metrics were measured, and a user survey was conducted 4 months after implementation. Missed or overlooked devices were tracked after implementation from Nov 2024 to Sep 2025.

* The unit of analysis was the “unique patient visit”, preventing multiple scans for a single patient from artificially inflating screening workloads.

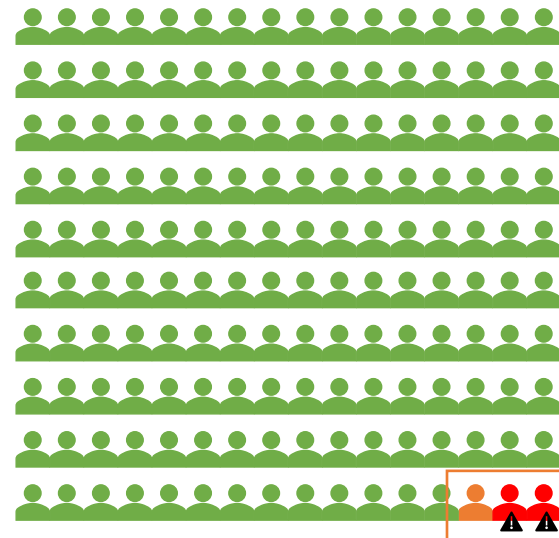
E. Benefits / Results (CHECK)



Before: 100% screening



 Only 1.4% have devices

With Dashboard: 1.5% screening



 Screened by EAI
 Flagged by EAI for screening

In the past, blanket screening of all scheduled patients took 400 mins a day. In comparison, **the dashboard efficiently narrows the focus to just 1.5% of the daily workload** (2–3 patients, < 5 minutes) for review, closely aligning with the 1.4% of unique patient visits to MRI that truly involve devices. Therefore, blanket screening a full schedule of patients to identify this small subset is highly inefficient and a disproportionate use of radiographers' time.

The preview of radiology reports on the dashboard also enables a more directed implant search in EMR, **reducing the average screening time from 2.5 minutes per patient to 1.5 minutes.**

The resulting **time saving of 395 minutes is equivalent to 0.8 full-time equivalents (FTE)**, freeing up radiographers to concentrate on clinical and patient tasks.

Early identification of undisclosed devices **prevented an estimated 1280 minutes of scanner idle time and related revenue loss** from on-arrival cancellations due to non-disclosure. In addition, early identification of these patients enabled their rescheduling from the satellite MRI centre, where safety and logistical constraints limit the ability to manage implanted devices.

	Manual Screening	With EAI Dashboard
Daily screening numbers	160 patients	2-3 patients (1.49% of workload)
Time taken for screening	2.5 mins/patient	1.5 mins/patient
Total time for screening	400 mins/day	4.5 mins/day

98% reduction in time!

E. Benefits / Results (CHECK)

The dashboard demonstrated exceptional reliability with **consistently high accuracy (Negative Predictive Value (99.91%) and Specificity (99.87%),** indicating **excellent ability in filtering out patients without implants.** False negatives were due to data limits or external records. Final safety interview on patient arrival remains essential.

Negative Predictive Value 99.91%*
CI: 99.86 - 99.96%

Specificity 99.87%*
CI: 99.78 - 99.93%

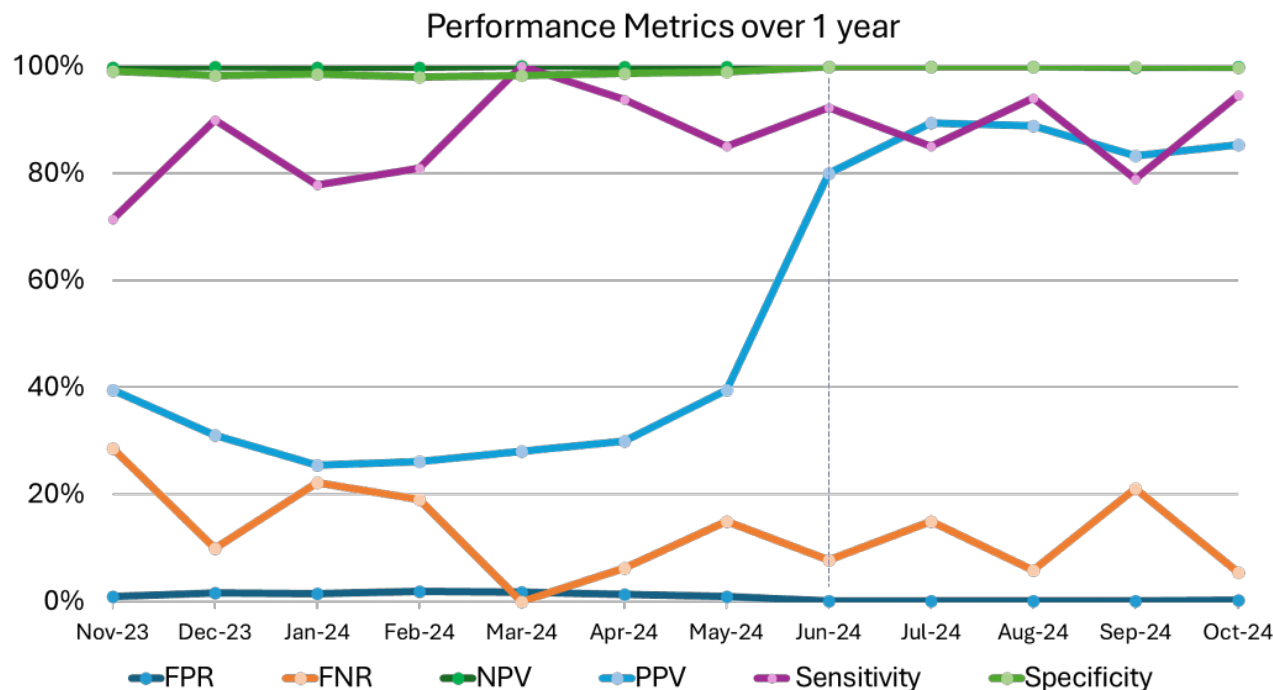
False Negative Rate 9.59%*
CI: 3.69 - 18.82%

Positive Predictive Value 85.71%*
CI: 76.13 - 92.68%

Sensitivity 90.41%*
CI: 81.18 - 96.31%

False Positive Rate 0.13%*
CI: 0.07 - 0.22%

*95% CI, based on last quarter of study



Continuous improvement was key. Keyword refinements in June 2024 led to significantly improved implant detection (Q2 vs Q4 , $p < 0.001$), reducing workload and enhancing accuracy (Appendix 2)

- PPV improved from 28.09% to 85.86% (205.6% improvement)
- FPR improved from 1.67% to 0.13% (-91.9% reduction)
- Specificity increased from 98.335% to 99.865% (1.556% improvement)

E. Benefits / Results (CHECK)

Limitations:

The dashboard had a **low false negative rate of 0.09%** (28 near-misses out of 32,214 unique patient visits).

Of these near-missed cases:

- 17 (60.71%) were due to data limitations—implants not disclosed on the request form or reported on previous imaging, and only records from May 2022 onward were searchable in our EMR
- 8 (28.57%) were due to same-day MRI appointments, which bypass the overnight dashboard refresh
- 2 (7.14%) resulted from incomplete keyword coverage
- 1 (3.57%) was due to radiographer oversight during dashboard review

Other Findings:

An **average of 41.09% of devices were undisclosed** (Appendix 1) in the MRI request form. During the study period, 189 patients with CIEDs were scheduled, yet 20.11% of these were undisclosed on the request form. Similarly, among 72 patients with programmable ventriculoperitoneal shunts, 26.39% were undisclosed. Notably, all 13 patients with retained epicardial pacing wires were undisclosed. This considerable under-reporting underscores the critical role of data analytics in bridging the gap between clinical documentation and the patient's actual implant status. The dashboard also flagged several AIMDs/PMDs that were implanted after the MRI was ordered (n=6), demonstrating its capability to **detect changes in implant status and reduce the risk of overlooked implants.**

E. Benefits / Results (CHECK)

A user survey (Appendix 3) was conducted 4 months after full implementation. The "Implant type" and "Report" columns, both highly rated at 86.43% and 85%, effectively helped radiographers narrow down the search for devices, concentrating their screening efforts in EPIC more effectively, saving time (84.29%) and reducing manual efforts (86.43%). The dashboard integrated seamlessly into daily workflows with **86% user satisfaction**.

Post Implementation (Nov 2024 to Sep 2025):

- Only 2 devices (both nerve stimulators) were missed by EAI due to data limits, but both were picked up by radiographers before MRI appointment
- However, another 2 devices (1 cochlear implant, 1 programmable VP shunt) were due to radiographer oversight during dashboard review, resulting in 1 cancellation on arrival to MRI

Impact:

- Data analytics help **triage at-risk patients** for safety clearance by radiographers
- Serves as a **first layer of safety screening**, effectively reducing pre-MRI screening workloads. Final safety screening on the patient's arrival remained essential
- **Revenue protection:** Early identification prevented 1,280 minutes of scanner idle time, avoiding revenue loss from same-day cancellations
- **Enhanced Safety:** Addresses discrepancies such as undisclosed devices due to patient/clinician omission, poor recall or change in device status
- **Scalable & adaptable** solution has been leveraged across multiple radiology applications:
 - Right siting of special MRI scans
 - Duplicate imaging checks for CT/MRI/US
 - BMD Implant Screening

E. Benefits / Results (CHECK)

Conclusion

The dashboard flagged at-risk patients early – up to 2 weeks in advance, as first layer of MRI safety screening, reducing screening workloads by 98%. This implementation demonstrates a successful paradigm shift from blanket screening to selective screening of at-risk patients using data analytics, achieving exceptional detection accuracy.

“Data analytics helped address risks from undisclosed devices, omissions, poor recall, and change in implant status—so no patient slips through the cracks.”



Strong reliability

99.91% NPV reduces risk of missed implants



Valuable Complement

Catches undisclosed implants due to recall or documentation issues



Improved Workflow

Screening workload cut from 400 mins to under 5 mins (98%)



Scalable & Adaptable

Applied to BMD Implant screening and duplicate imaging checks in CT/US/MRI



F. Strategy for Spreading/ Sustaining (ACT)

Education & Training

- Training and briefing of staff of usage of EAI platform.
- Continuously sharing of new information.

Audit Checks

- Review feedback done by survey.
- Monitoring near misses or overlooked devices reported by team.

Presentations

- Shared findings within the MRI team regarding near misses and learning opportunities.

Communications

- Communication between radiographers, physicians and patient.
- Communication between end users (radiographers) and the EAI team.



Standard Works

- To implement EAI for daily pre-MRI safety screening.

Systems

- Incorporated into daily screening workflow
- Minimize downtime caused by shifting patient around.
- Appointments get utilized.

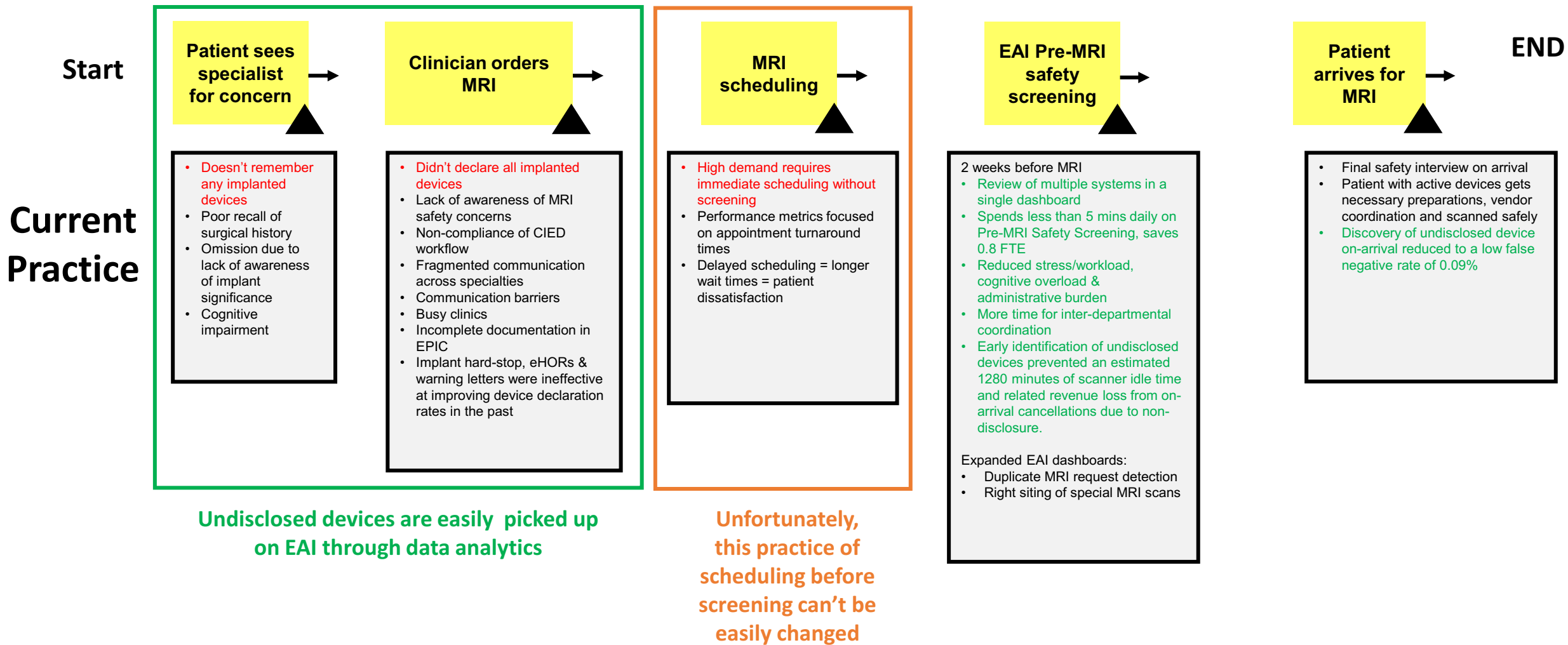
Staff

- Staff understand the usage & limits of EAI for first level of safety screening.
- Workload reduction to focus on patient care more.

Patient

- Safety screening for patient 2 weeks prior to scan.
- Lesser shuffling of patient's actual day of scan which will result in less down time for patient.

F. Strategy for Spreading/ Sustaining (ACT)



Appendix 1: Key Performance Metrics

	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24		
Monthly Scheduled	3707	3521	3994	3118	3346	3461	3506	3116	3787	3574	3458	3454	42042	Total year scheduled
Daily Scheduled*	169.333	167.95	175.55	155.53	158.6	157.381	160.14	148.8	157.609	160.762	157.71	151.09	160	Average Daily Scheduled
Unique vists #	2613	2436	2859	2515	2618	2703	2721	2502	2980	2836	2682	2749	32214	Total unique visits
EAI flagged ^	38	58	55	65	64	50	43	15	19	18	18	40	1.50%	Total EAI flagged
EAI cancelled	6	1	3	4	2	0	2	3	4	1	4	8	38	Total EAI cancelled
EAI missed (FN)	6	2	4	4	0	0	3	1	2	1	4	2	0.09%	Total EAI missed FN
Time saved (mins)	180	40	70	220	40	0	60	110	150	30	150	230	1280	Total time saved (mins)
True Positive (TP)	15	18	14	17	18	15	17	12	17	16	15	35	209	Total TP
False Positive (FP)	23	40	41	48	46	35	26	3	2	2	3	6	275	Total FP
True Negative (TN)	2569	2376	2800	2446	2554	2653	2675	2486	2959	2817	2660	2706	31699	Total TN
Cancelled on arrival	3	2	1	2	0	0	2	0	2	1	0	0	13	Total cancelled on arrival
FPR	0.89%	1.66%	1.44%	1.92%	1.77%	1.30%	0.96%	0.12%	0.07%	0.07%	0.11%	0.22%		
FNR	28.57%	10.00%	22.22%	19.05%	0.00%	0.00%	15.00%	7.69%	10.53%	5.88%	21.05%	5.41%		
NPV	99.77%	99.92%	99.86%	99.84%	100.00%	100.00%	99.89%	99.96%	99.93%	99.96%	99.85%	99.93%		
PPV	39.47%	31.03%	25.45%	26.15%	28.13%	30.00%	39.53%	80.00%	89.47%	88.89%	83.33%	85.37%		
Sensitivity	71.43%	90.00%	77.78%	80.95%	100.00%	100.00%	85.00%	92.31%	89.47%	94.12%	78.95%	94.59%		
Specificity	99.11%	98.34%	98.56%	98.08%	98.23%	98.70%	99.04%	99.88%	99.93%	99.93%	99.89%	99.78%		
Implants	40	46	40	31	39	35	35	25	39	35	38	48	451	Total Implants
Declared	21	32	26	18	21	26	19	11	26	21	18	29	268	Total Declared
Undeclared	19	14	14	13	18	9	16	14	13	14	20	19	183	Total Undeclared
Undeclared (%)	47.50	30.43	35.00	41.94	46.15	25.71	45.71	56.00	33.33	40.00	52.63	39.58	41.17	Monthly Average Undeclared (%)
Prevalence of Implants (%)	1.53	1.89	1.40	1.23	1.49	1.29	1.29	1.00	1.31	1.23	1.42	1.75	1.40	Prevalence of Implants (%)

Scheduled= All MRI procedures including no shows, failed and unsuccessful. *Daily average/mean. # Each unique patient visit which may consist of 1 or more MRI procedures, e.g., MRI cervical and lumbar spine for the same patient is one unique visit, and the implant screening is common for both procedures. ^EAI flagging for each unique patient visit. EAI= Endeavour AI dashboard for implant detection. TPR= True positive rate. FPR= False positive rate. PPV= Positive Predictive Value. NPV= Negative Predictive Value. Figures in () are percentages out of unique patient visits.

Appendix 2: Key Performance Metrics

	Q1 (Nov'23-Jan'24)				Q2 (Feb'24-Apr'24)				Q3 (May'24-Jul'24)				Q4 (Aug'24-Oct'24)			
	Value	Lower CI	Upper CI	Width	Value	Lower CI	Upper CI	Width	Value	Lower CI	Upper CI	Width	Value	Lower CI	Upper CI	Width
Sensitivity	79.66%	67.20%	89.25%	22.05%	90.91%	79.95%	97.14%	17.19%	85.42%	71.55%	94.50%	22.95%	90.41%	81.18%	96.31%	15.13%
Specificity	98.67%	98.46%	98.85%	0.39%	98.34%	98.11%	98.55%	0.44%	99.61%	99.47%	99.73%	0.26%	99.87%	99.78%	99.93%	0.15%
PPV	31.13%	23.58%	39.50%	15.92%	27.93%	21.40%	35.33%	13.93%	56.16%	42.37%	69.32%	26.95%	85.71%	76.13%	92.68%	16.55%
NPV	99.85%	99.77%	99.91%	0.14%	99.93%	99.87%	99.97%	0.10%	99.91%	99.85%	99.96%	0.11%	99.91%	99.86%	99.96%	0.10%
FPR	1.33%	1.15%	1.54%	0.39%	1.66%	1.45%	1.89%	0.44%	0.39%	0.27%	0.53%	0.26%	0.13%	0.07%	0.22%	0.15%
FNR	20.34%	10.75%	32.80%	22.05%	9.09%	2.86%	20.05%	17.19%	14.58%	5.50%	28.45%	22.95%	9.59%	3.69%	18.82%	15.13%

Quarterly key performance metrics, 95% confidence interval. PPV= Positive Predictive Value. NPV= Negative Predictive Value. FPR= False positive rate. FNR= False negative rate.

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