

STAMP for Hospital Safety

STAMP Workshop 2019

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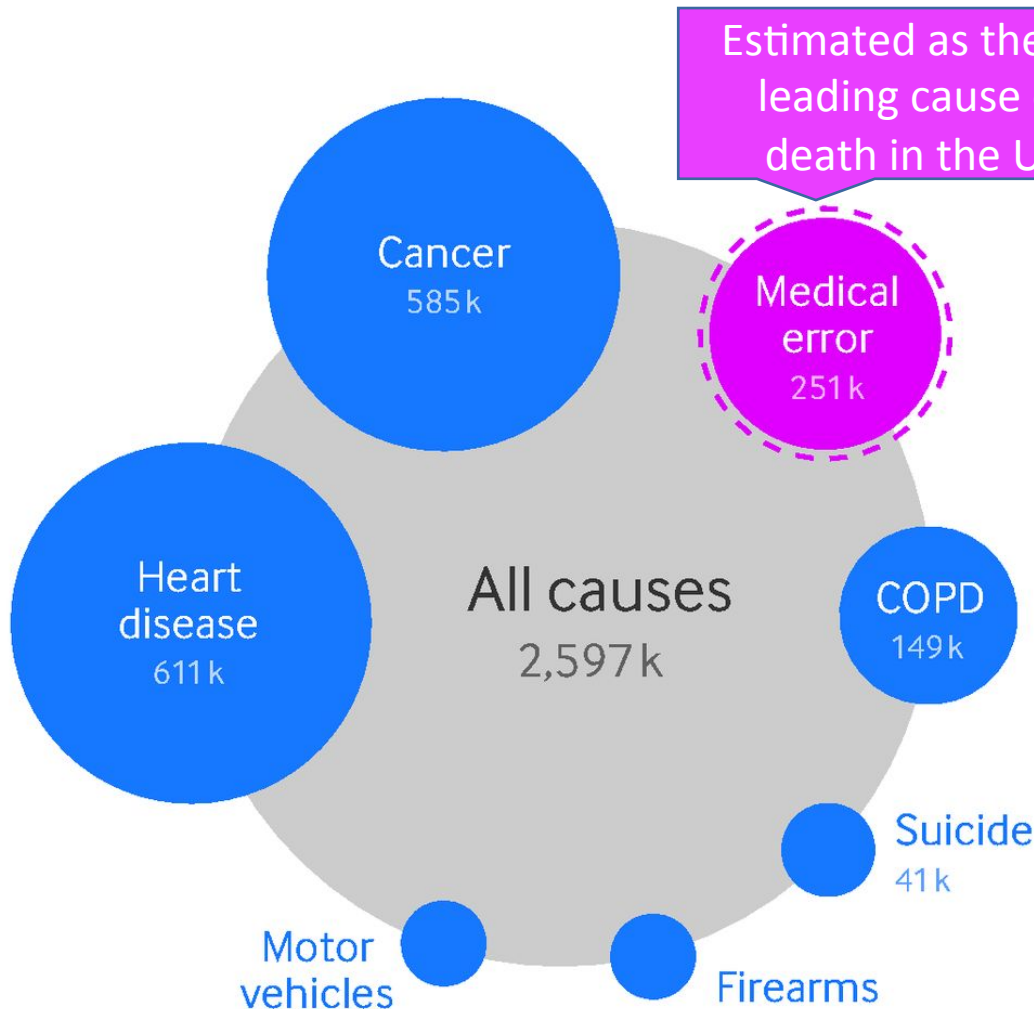
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Agenda

- Hospital safety, radiation oncology, MRI simulator
- Highlight of STPA on MRI simulator
- Challenges and suggestions for adopting STPA in health care
- Safety management activities with STPA results

MRI = magnetic resonance imaging

Hospital Safety

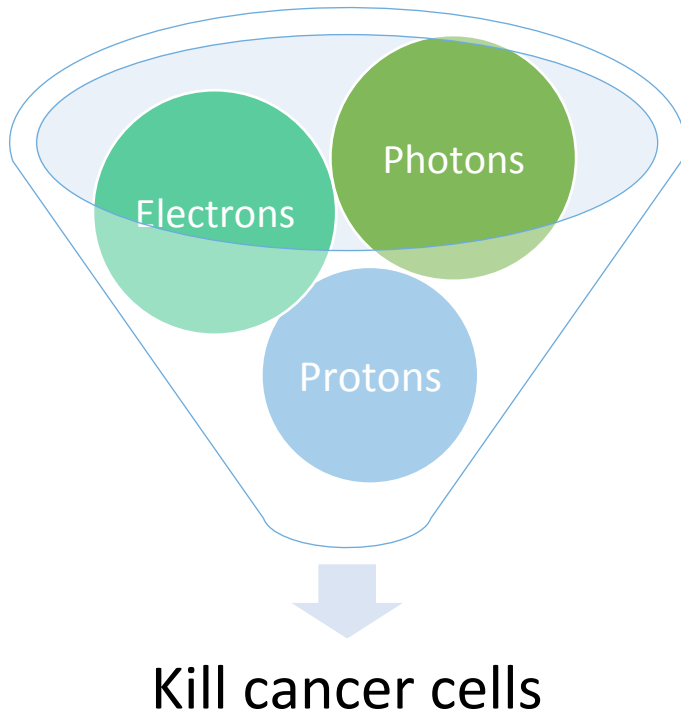


Some patient safety problems

- error or delay in diagnosis
- adverse drug events
- restraint-related injuries or death
- infections
- burns
- mistaken identity

In the US, ~300 MRI-related adverse event reports a year, with the most common event being thermal burns

Overview of Radiation Oncology



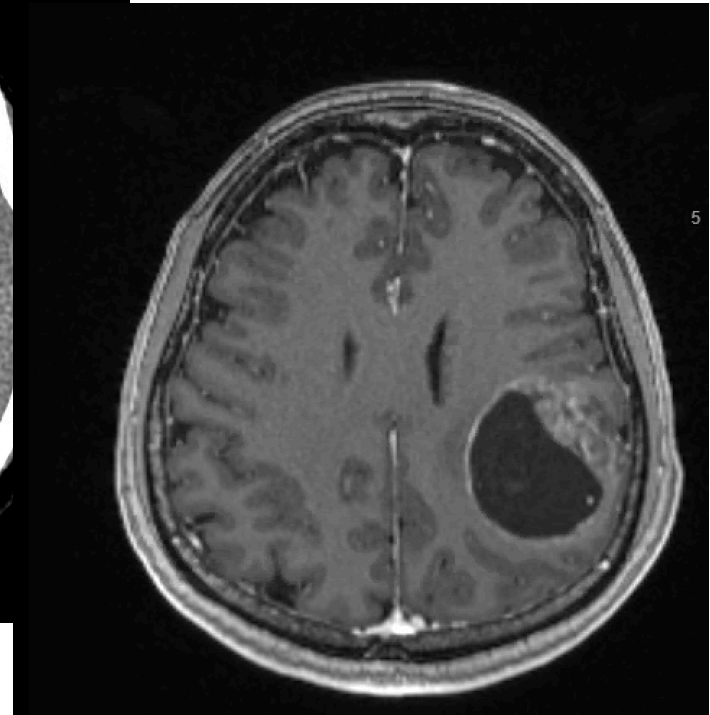
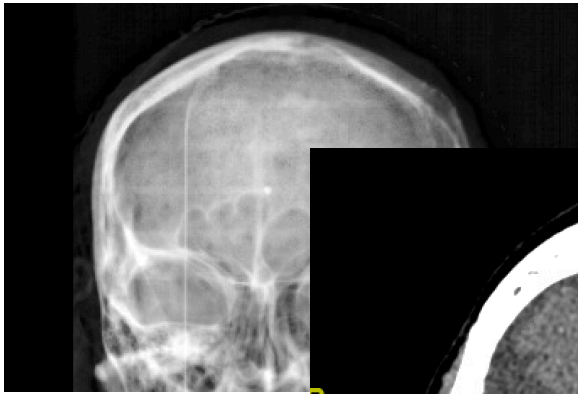
MRI Simulator

- MR-guided Advanced Procedure and Simulation Suite (MAPS)
- New generation of 3T MRI adapted for RT
- Enables MR-guided simulation, brachytherapy, treatment response assessment

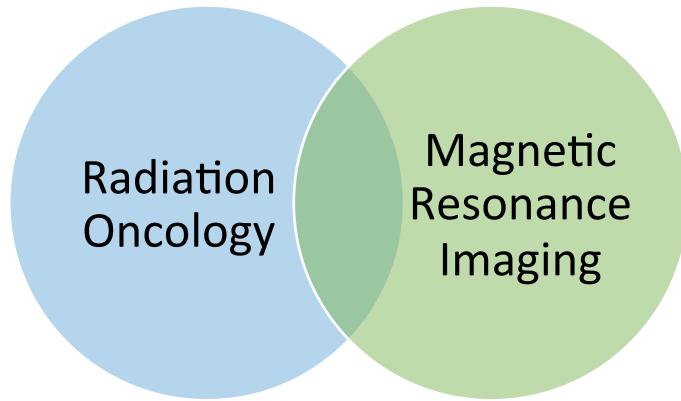


RT = Radiation therapy

Advantage of MRI



Safety Needs for MRI Adoption



- No consensus guidelines specific to **radiation oncology**
 - Guidelines are taken from diagnostic radiology
- Devices more **complex**, with **differing risks**, than current standard devices

Opportunity for a STAMP Project!

STPA for Implementation of MRI Simulator Losses

- L1. The **patient** is **injured** or **killed** in the **process of MRI simulation**.
- L2. A **nonpatient** is injured or killed in the process of MRI simulation.
- L3. The patient is injured or killed from **subsequent treatment** due to **inaccurate** MRI simulation.
- L4. **Damage** or **loss of equipment**.

STPA for Implementation of MRI Simulator Hazards

H1. Ferromagnetic object exposed to a large magnetic field [L1, L2, L4]



H2. Electronic, electrical, and mechanical device exposed to large magnetic or RF fields [L1, L2, L4]



H3. Human or equipment exposure to cryogen or quench gas [L1, L2, L4]



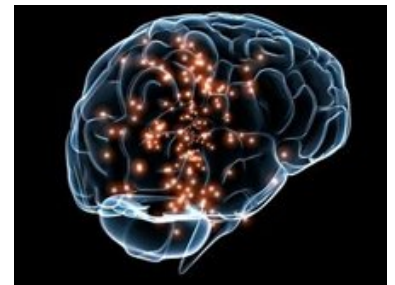
STPA for Implementation of MRI Simulator

Hazards (cont.)

H4. Human exposure to loud noise [L1, L2]



H5. Human overexposure to large
magnetic field or RF field [L1, L2]



STPA for Implementation of MRI Simulator

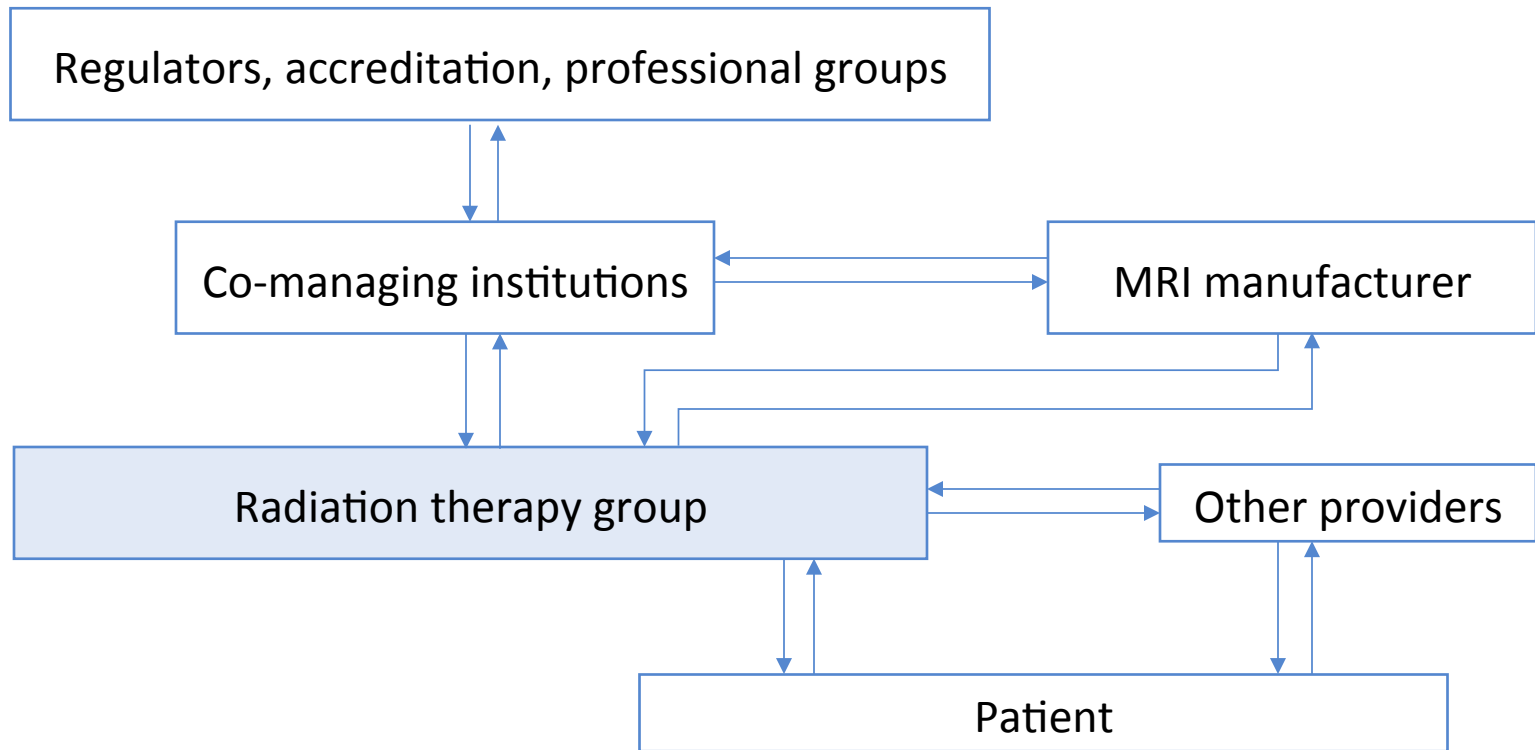
Hazards (cont.)

H6. Simulation acquired is wrong patient, wrong location, wrong iso, or with poor immobilization [L3]

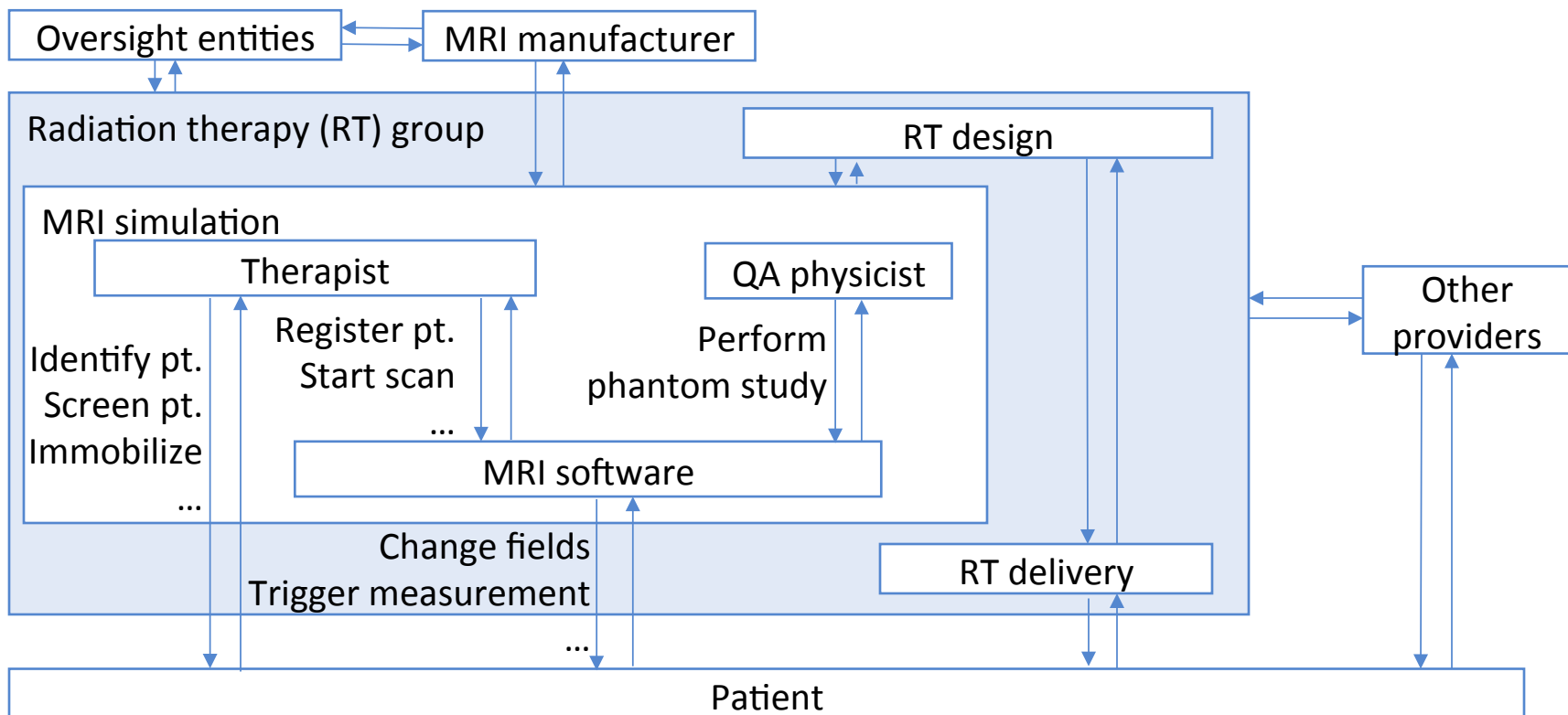
H7. Simulation acquired contains artifacts or otherwise poor image quality, or not transmitted for RT planning [L3]

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STPA for Implementation of MRI Simulator

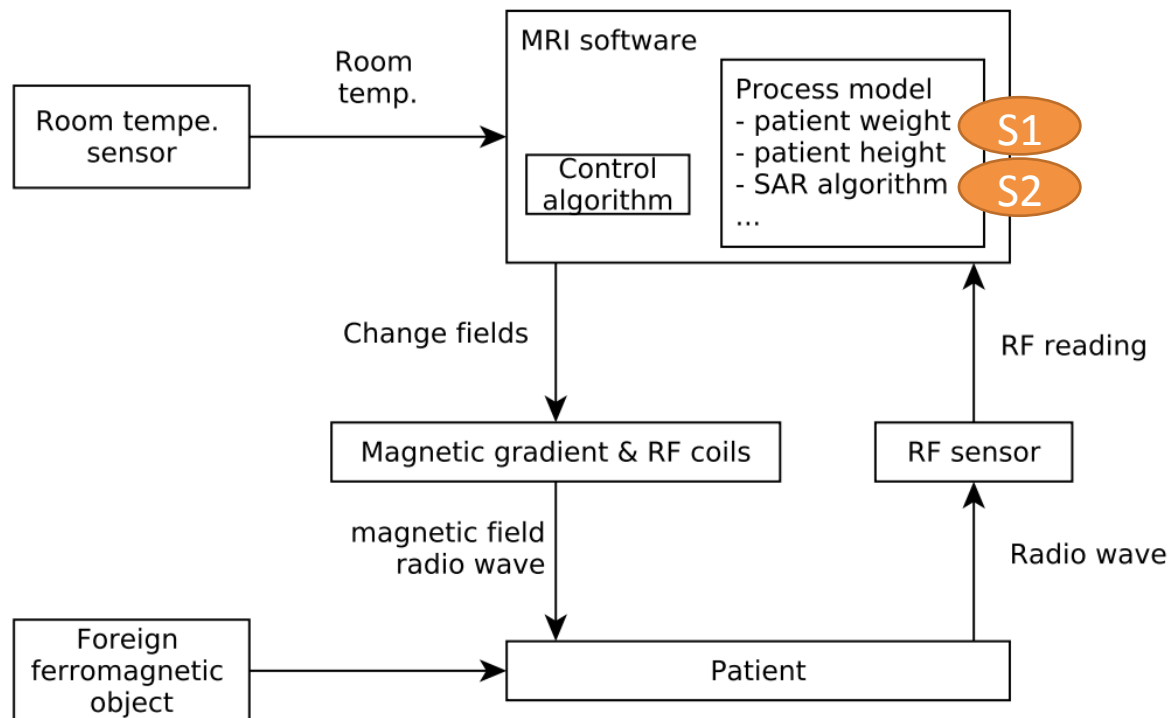


STPA for Implementation of MRI Simulator



STPA for Implementation of MRI Simulator

UCA: MRI software change fields even when true SAR* limits are exceeded. [H5]

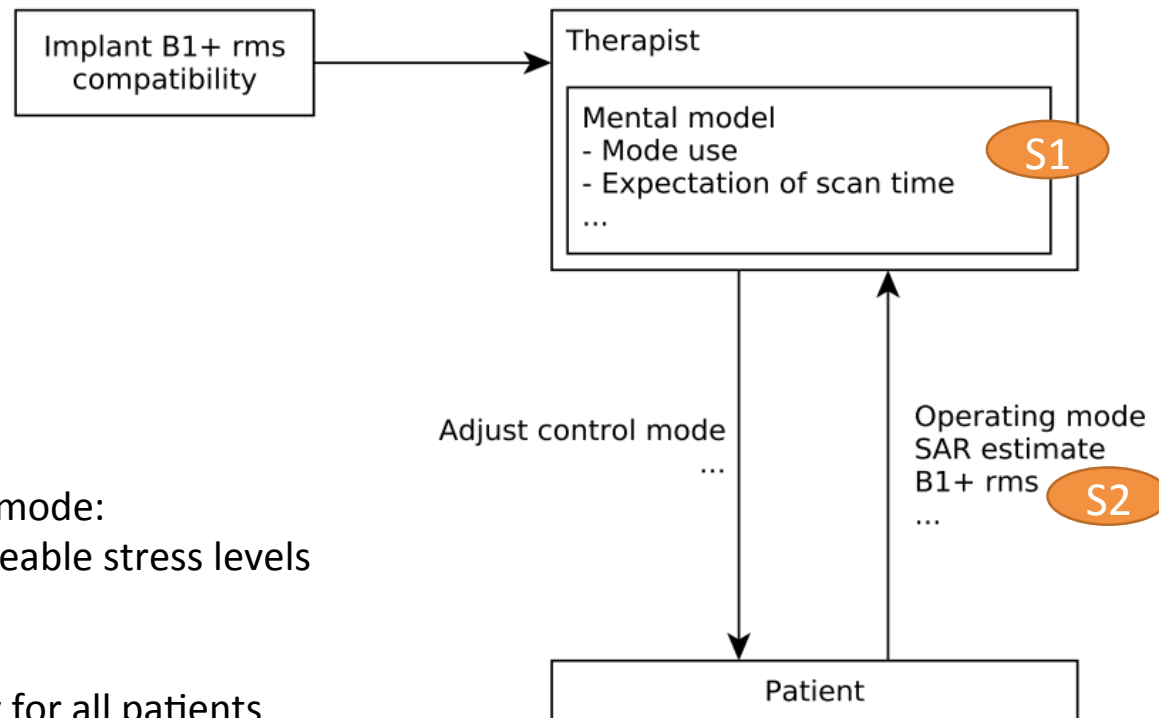


*Specific absorption rate (SAR) [W/kg]

a stress indicator of RF energy being deposited to the patient's body

STPA for Implementation of MRI Simulator

UCA: Using 1st level control mode* or above when MR sequence can be obtained in normal mode [H5]



*1st level control mode:
potential for noticeable stress levels
vs.
normal mode:
can be used safely for all patients

Value of Adopting STPA

- Ability to analyze the system prior to go live
- Better results than analysis via other means
 - Improved comprehensiveness from expanded scope
 - Broader set of loss scenarios considered
- Opportunity for thorough system familiarization



Ability to inform safety management,
especially safety policy making

Challenges in Adopting STPA in Health Care

Difficulty mapping system

Natural thought process: workflow

Natural bias to focus on subsystem of interest

Suggestions

- Attend a workshop and/or practicum before starting the analysis
- Have a cheat sheet (one-page STAMP definitions and tips on system mapping)
- Include a systems engineer on the team

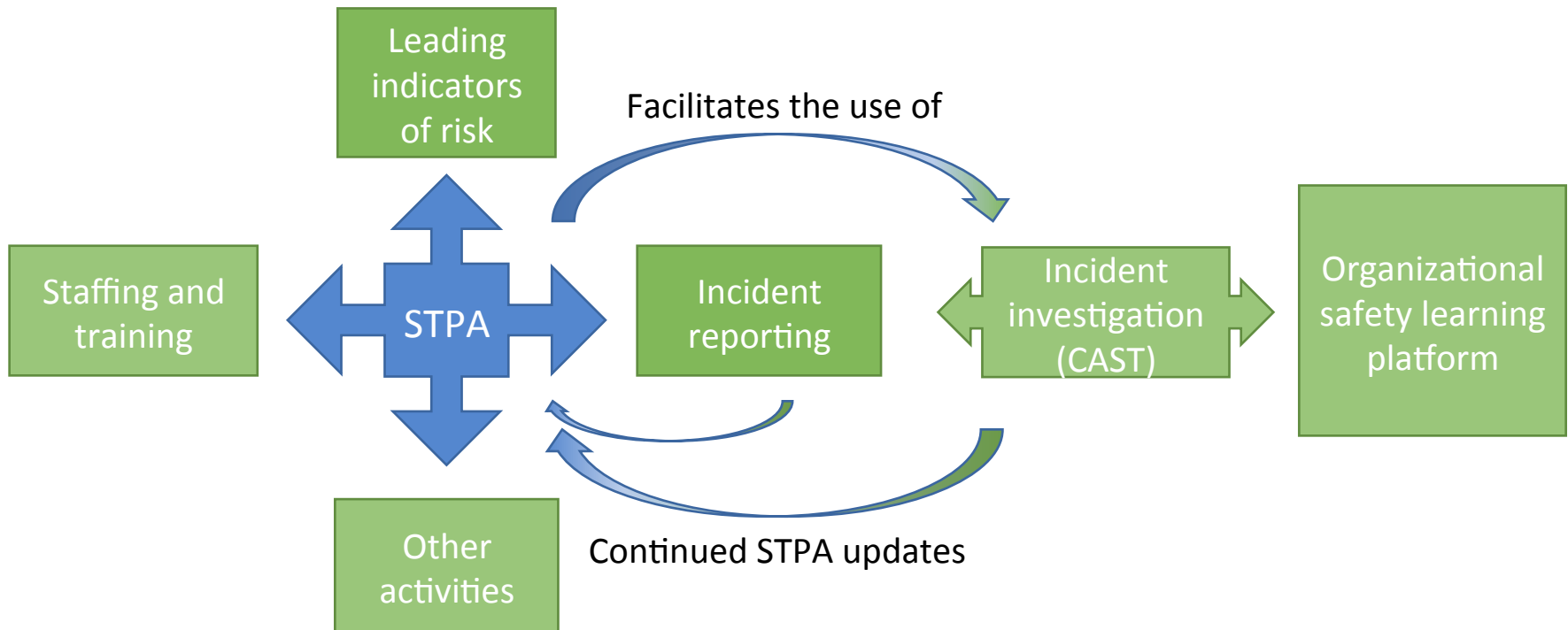
Challenges in Completing STPA in Health Care

Challenge

Identifying resources for answers to technical questions when information is proprietary

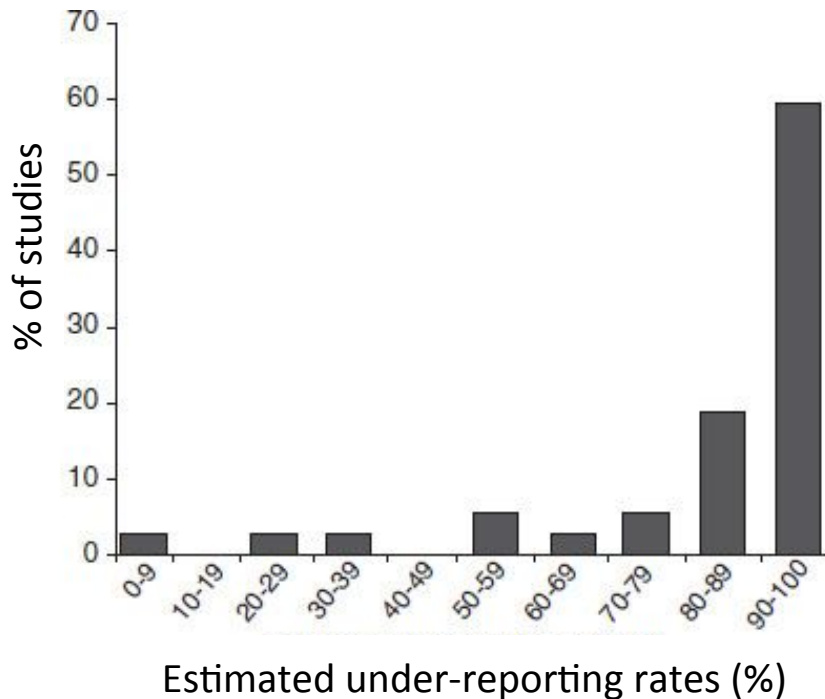
Supporting Safety Management

- Safety management goes beyond defining frontline procedures
- STPA results are useful for long-term safety management activities



Common False Sense of Security

Substantial under-reporting in health care



Top 5 barriers for reporting for doctors

No incident follow-up (57.7%)

Form was too long; lack of time (54.2%)

Incident seemed “trivial” (51.2%)

Ward was busy; forgot (47.3%)

Not sure who is responsible to report (37.9%)

Safety Monitoring in Health Care

What makes a metric useful for safety monitoring?

- Important to the organization
- Represent what they intend to measure
- Usable for the people expected to employ the data to improve safety

- Produce similar results when used repeatedly
- Affordable to collect

Assumption-based leading indicator of risk

Directly traceable to hazards and accidents

Identifies flaws in engineering practices or operational behavior

Accompanied by hedging actions to prepare for the possibility that an assumption will fail

Requires thoughtful implementation

Leading Indicator of Risk for MRI Simulator

Assumption:

- All patients are registered ahead of time with no "emergency patients" (UCA46)

Leading indicator:

- Time between patient scheduling and the MRI scan

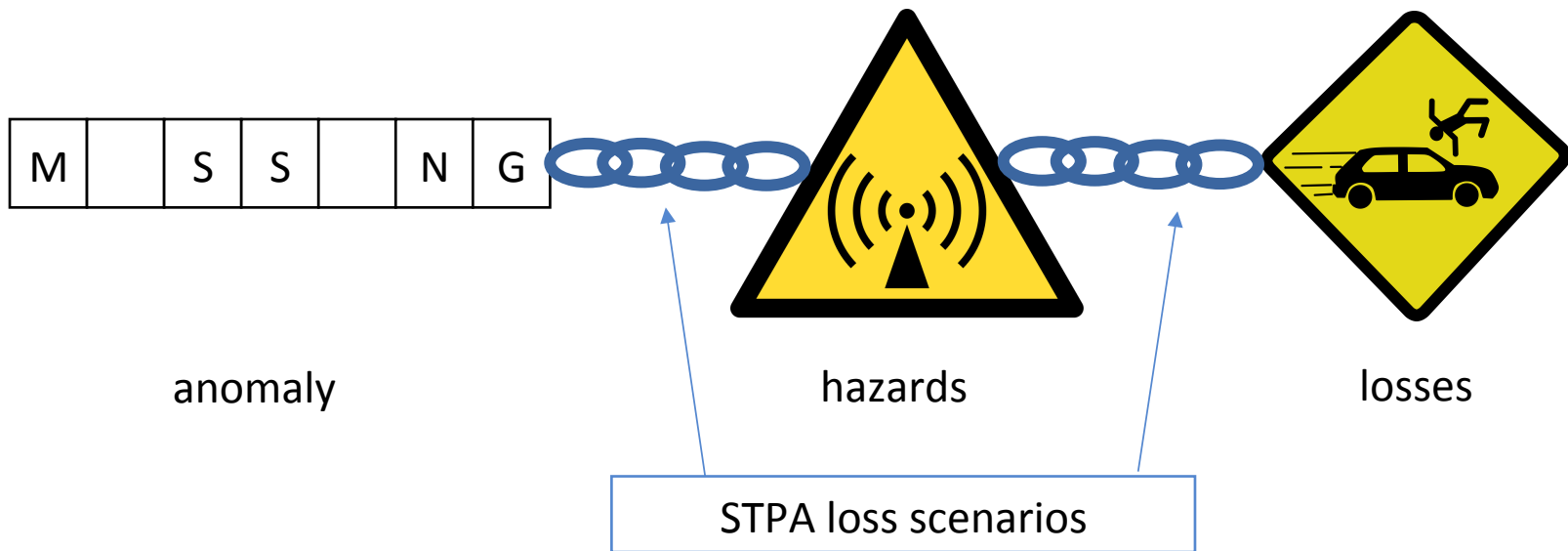
Hedging action:

- Requires pre-MRI X-ray imaging for risk-benefit assessment

Priming Incident Reporters

“What to report?”

“This seems trivial”



Top 5 barriers for reporting for doctors

Not sure who is responsible to report

Education can be further tailored for each role!

Summary

- STPA enhances safety and system familiarization for MRI simulator implementation
- Solutions exist to overcome challenges of adopting STPA in health care
- STPA results can support continual safety management

Acknowledgements

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Questions?

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