



Root Cause Analyses and Actions (RCA²) Workbook

A resource for IHI's online course with coaching: *Redesigning Event Review with RCA²*

- Risk-Based Prioritization Exercise
- **RCA² Case Example**
- Assessing Probability and Severity
- Developing an RCA² Team
- Drawing a Flow Diagram
- Applying Triggering Questions
- Exploring Contributing Factors
- Writing Causal Statements
- Identifying Effective Actions
- Implementing and Measuring Corrective Actions

Please note: To ensure your work is saved, we recommend downloading worksheets to your desktop before filling them out.

This workbook contains practice exercises from Redesigning Event Review with RCA², an online course in which participants receive tools, coaching, and community support to aid them in implementing RCA² at their organization. Learn more at ihi.org/RCA2course.

Risk-Based Prioritization Exercise

To effectively prioritize safety-enhancing improvement work, organizations should adopt a risk-based prioritization system for event review, which considers both potential severity and likely probability of events in question.

Compared to ham-based prioritization, an explicit risk-based prioritization process for event review lends objectivity and credibility; focuses on vulnerabilities that show the greatest potential for harm; and allows for “close calls” to become important learning opportunities.

Practice applying the Safety Assessment Code Matrix (SAC) for risk-based prioritization to the hypothetical scenarios below. (Hint: [Refer to the IHI tool.](#)) If you are working with a team, we recommend each member of your team complete the exercise independently before coming together to compare and discuss your responses as a group.

Ideally, your probability determination should be based on the data and experience of your organization. All events with a score of “3” require a full RCA². Even if RCA² is not warranted, there may still be an opportunity to take corrective action.

Severity and Probability	Catastrophic	Major	Moderate	Minor
Frequent	3	3	2	1
Occasional	3	2	1	1
Uncommon	3	2	1	1
Remote	3	2	1	1

1. A nurse was assisting a patient with morning care in the shower room. The patient was seated in a chair being washed when he slid off the chair and hit his face, hip, and shoulder. The patient did not lose consciousness, and a response team was notified. The patient was transferred to Radiology for x-rays and a CT scan to the head. Initial reports from these tests revealed no fractures or neurological injury. The patient was returned to the unit where neuro checks were initiated as per policy and reported as normal.

How would you score this event using risk-based prioritization and the SAC Matrix?

Score: _____

2. An employee working in Food and Nutrition Service was loading large cans of vegetables into a dry goods storage area. A can slipped and fell, hitting the employee on the toe. The employee sustained broken bones and was on medical leave for five days before returning to work in a limited-duty position.

How would you score this event using risk-based prioritization and the SAC matrix? (Hint: Refer to the full version of the tool in the [RCA² report](#).)

Score: _____

3. A patient's monitor detects a problem but does not trigger an alarm in the Surgical Intensive Care Unit (ICU). Although there is no alarm, nurses observe that the patient has developed cardiac arrhythmias. The patient codes and, because he has a "Do Not Resuscitate" (DNR) order, he is not resuscitated.

How would you score this event using risk-based prioritization and the SAC matrix?

Score: _____

4. An outpatient receiving an MRI scan brought his oxygen cylinder into the magnet room, where it was pulled into the bore of the magnet. The MRI technician activated an emergency shutdown, which turned off all electrical power to the magnet and expelled liquid helium, used for cooling the magnet, into the atmosphere outside of the building. Neither the patient nor the tech was injured. The magnet sustained superficial damage and was out of service for five days until a contractor could be brought in to replace the helium.

How would you score this event using risk-based prioritization and the SAC matrix?

Score: _____

5. An Environmental Management staff member was cleaning a waiting room in a pediatric hospital and noticed that potted philodendron plants had been added to all the tables in the room. Understanding that philodendrons can be poisonous if ingested, the staff member submitted a patient safety report.

How would you score this event using risk-based prioritization and the SAC matrix?

Score: _____

RCA² Case Example

On a December afternoon, as the city was busy preparing for the holiday season, the staff at Mercy Hospital were preparing for a busy evening. Sunday nights were historically the second busiest time of the week in the Emergency Department (ED), and patients had been arriving at a steady pace all afternoon.

Although original staffing plans for team members appeared appropriate, several staff members, including a nurse and a radiology technologist, were out sick.

Around 6:30 PM, 75-year-old **Mr. C. Green** arrived at the ED. He had slipped down several stairs while celebrating the local football victory and landed awkwardly on his arm. He noticed that the waiting area was quite full, but he had only a short wait to be seen.

Mr. Green was taken to an exam room and, after another short wait, was seen by the ED physician, **Dr. Joyce Kang**. The physician examined him and believed Mr. Green had fractured his wrist. After ruling out concern of head injury, she ordered an x-ray of Mr. Green's hand and some medication to relieve the pain.

At approximately 7:00 PM, 40-year-old **Mr. J. Greene**, who was visiting from out of town, arrived in the same ED complaining of severe abdominal pain. He was taken to an exam room, where the ED physician determined that Mr. Greene's pain was likely originating in his gallbladder. The doctor ordered a CT scan to confirm the diagnosis.

Tom, a radiology technologist with several years of experience, had recently joined the ED team at Mercy. Although his previous organization used an electronic health record (EHR), the EHR at Mercy was from a different vendor, and he was unfamiliar with the user interface. At about 7:30 PM, Tom came to pick up Mr. J. Greene for his abdominal CT scan. Mr. J. Greene was in room 4, directly across from Mr. C. Green who was in room 5, waiting to be taken for an x-ray of his hand.

Tom was in a hurry because the ED had learned it would be receiving several victims of a serious motor vehicle accident, and he knew there was a strong possibility that those patients would require some type of imaging test.

Tom walked into room 5 and introduced himself. Referring to the patient by his last name only, he wheeled Mr. Green to the testing area, where the short-staffed radiology team noted the physician's order for a CT scan with contrast.

Tom knew that at his old organization, the ED nurse always completed additional patient screening for iodinated contrast whenever a CT scan was ordered and entered it in the EHR. After checking the patient record for any known allergies and finding none, he helped Mr. Green onto the testing table. He checked his IV catheter by flushing with normal saline, administered the contrast, and then quickly began to perform the scan.

Typically, the radiology techs must verify two patient identifiers in the patient room (full name and date of birth) and five "rights" (right patient, right medication, right dose, right route, right time) prior to contrast injection. In his rush to ensure test availability for incoming critical patients, Tom did not complete the full patient verification in the patient room or prior to administering contrast.

Mr. C. Green was anxious about his condition and unaware that contrast was being administered through his IV. No one asked him about any prior history with contrast. The scan took about ten minutes, and Tom returned Mr. C. Green to his room.

A few moments later, Mr. Green's nurse, **Sally**, entered the room and found him short of breath and covered in a mild skin rash. The nurse called the ED physician, who ordered supplemental oxygen and 50mg of intravenous diphenhydramine. The team monitored Mr. Green's vital signs closely over the next few hours, as he made a full recovery.

With Mr. C. Green stable, the nurse went across the hall to check on one of her other patients, Mr. J. Greene. Although she hadn't seen the results from his CT scan come through, she figured the alert had been lost in the chaos and the ED physician had already reviewed the findings.

Finding Mr. Greene still in severe abdominal pain, she learned from Mr. Greene's family that he had not yet been taken for his ordered CT scan. The nurse checked in with Tom, who was the only radiology tech on duty that night. Tom was puzzled, given he had completed the test almost an hour ago. He quickly returned to his workstation and found he had inadvertently performed the CT on the wrong patient.

Assessing Probability and Severity

Use the case example to practice applying the Safety Assessment Code (SAC) Matrix for risk-based prioritization. Hint: [Refer to the IHI tool](#). Ideally your probability determination should be based on the data and experience of your organization.

SEVERITY and PROBABILITY	Catastrophic	Major	Moderate	Minor
Frequent	3	3	2	1
Occasional	3	2	1	1
Uncommon	3	2	1	1
Remote	3	2	1	1

How would you score this event using risk-based prioritization and the SAC Matrix?

Score: _____

Developing an RCA² Team

Use the case example to practice identifying RCA² contributors. Write the names of the individuals below in the grid, referring to the [RCA² Roles Worksheet](#) for help. Remember that people can fulfill multiple roles, and team members may also be interviewed.

Individuals:

- Joyce Kang, ED physician on duty
- Chief of Emergency Medicine
- Sally, ED nurse for C. Green and J. Greene
- Safety team member experienced in RCA²
- Tom, radiology tech on duty that night
- ED Clinical Nurse Specialist not on duty
- ED nurse on duty who did not care for either patient
- Mr. J. Greene
- Trained patient/family representative
- Radiology tech not on duty
- Human factors engineer
- Chief of Radiology
- Nurse manager for ED
- Mr. C. Green

RCA ² Roles	Team Member?	Interview?
Staff		
Staff directly involved in the event		
Front line staff working in the area/process being studied		
Staff who are not familiar with the process being studied		
Subject Matter Experts		
Subject matter expert(s) on the process being evaluated		
Subject matter expert on the RCA ² process		
Patients and Families		
Patient involved in the event		
Family of patient involved in the event		
Patient representative		

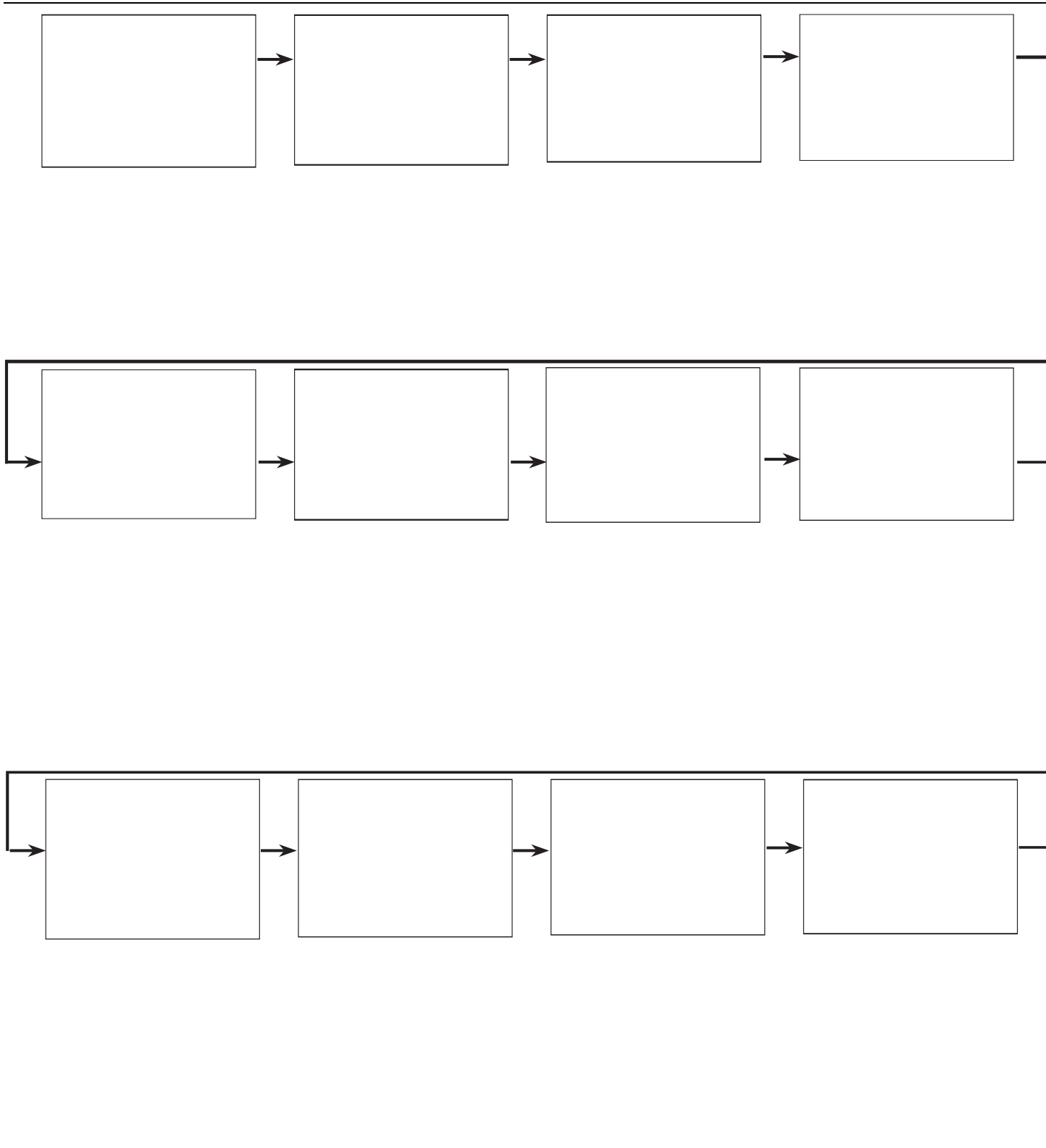
Drawing a Flow Diagram

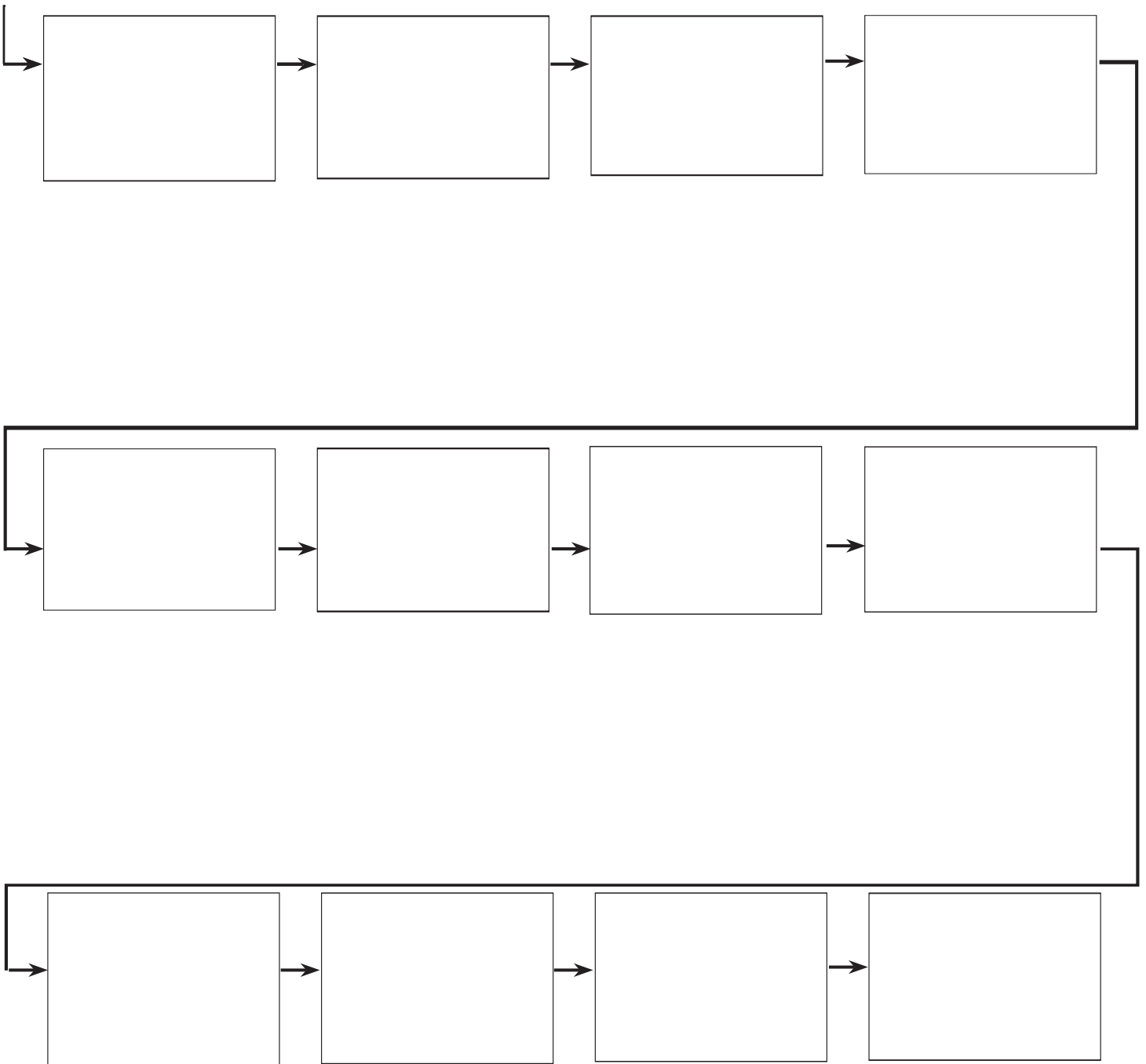
Referring to the timeline below and the [RCA² Flow Diagram Tool](#), create a basic flow diagram of the event described in the case example. Take note of where deviations occurred from what *should* have happened.

TIME	EVENT
5:45 PM	ED nurse scheduled to work evening shift calls in sick
6:00 PM	Radiology technologist scheduled to work evening shift calls in sick
6:15 PM	Tom, a radiology technologist, arrives for his shift 15 minutes late
6:30 PM	Mr. C. Green arrives at the Emergency Department
6:45 PM	Mr. C. Green is taken to an exam room
7:00 PM	Mr. J. Greene arrives at the Emergency Department
7:05 PM	ED physician, Dr. Joyce Kang, examines Mr. C. Green and orders an x-ray and pain medication
7:10 PM	Mr. J. Greene is taken to exam room
7:15 PM	ED physician examines Mr. J. Greene and orders a CT scan
7:20 PM	ED receives a call to prepare for several victims from a serious motor vehicle accident, scheduled to arrive via ambulance in 20 minutes
7:20 PM	Radiology team notes and reviews order for abdominal CT scan with contrast for Mr. J. Greene
7:25 PM	Tom leaves radiology to pick up Mr. J. Greene for his abdominal scan
7:30 PM	Tom enters Mr. C. Green's room and addresses him by last name only
7:35 PM	Tom wheels Mr. C. Green into testing area
7:38 PM	Tom refers to Mr. J. Greene's patient record, finding no indication of allergies reported in the EHR
7:40 PM	Tom administers iodinated contrast and begins scan
7:45 PM	Three victims from a serious motor vehicle accident arrive in the ED, 5 minutes later than anticipated, with two in critical condition
7:50 PM	Tom completes the CT scan and wheels Mr. C. Green back to his room
7:55 PM	A nurse, Sally, enters Mr. C. Green's room and finds him short of breath and covered in a mild skin rash
7:56 PM	ED physician is called to Mr. C. Green's room, where she orders supplemental oxygen and 50mg intravenous diphenhydramine
7:58 PM	Mr. C. Green receives medications and begins to show almost immediate improvement in symptoms
8:40 PM	Nurse Sally checks in on Mr. J. Greene and finds him still in severe abdominal pain. She learns from his family that he has not been taken for ordered CT scan.
8:45 PM	Nurse Sally finds Tom to request update on CT scan for Mr. Greene
8:50 PM	Tom, returning to his workstation, realizes he inadvertently performed the CT on the wrong patient

Flowchart Diagram for RCA²

Use this tool with your RCA² team to create a chronological depiction of the steps within the event you're reviewing. It should help you: 1. Establish a shared understanding of what happened 2. Identify any gaps in knowledge. 3. Compare what happened with what should have happened. 4. Investigate why any deviations occurred. Refer to the [RCA² report](#) for an example.





Interviewing for RCA²

Referring to the case example, the flow diagram you created, and the Triggering Questions you reviewed, write at least two interview questions for the individuals below.

Tom, the radiology technologist on duty that night:

1.

2.

Sally, the nurse on duty that night, who was assigned to both Mr. C. Green and Mr. J. Greene:

1.

2.

Mr. C. Green, the patient given the wrong test who suffered an adverse drug reaction:

1.

2.

The registration coordinator on duty that night:

1.

2.

A radiology tech who works in the Mercy ED but was not on duty that night:

1.

2.

Who else would you interview about this event? What are some of the questions you would ask them?

Role/Expertise:

1.

2.

Role/Expertise:

1.

2.

Pick any of the interview subjects above and practice writing a script for how you'll introduce yourself. Explain the purpose of the interview, establish ground rules, and express your sympathy if appropriate.

Exploring Contributing Factors

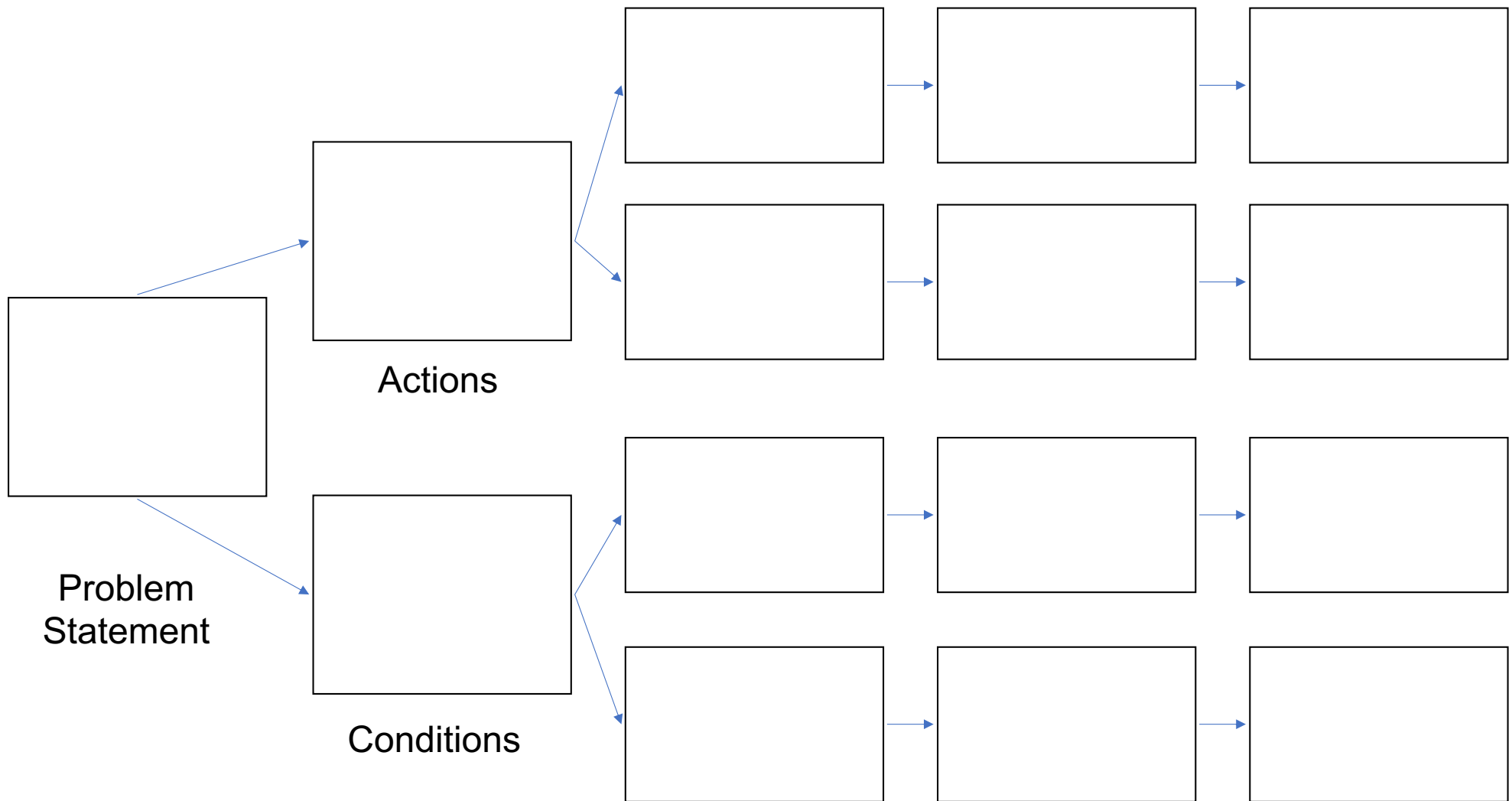
The next two pages contain tools that are critical to exploring the causes of adverse events and near misses as part of RCA².

Use the cause and effect diagram template (or a blank piece of paper or sticky notes) to create a cause and effect diagram for the case example. Along the way, refer to the Five Whys template to remind yourself and your team to keep asking *why* something happened or *why* a decision was made — until you get to the root cause.

Remember that health care is complex, and there are many contributing factors to adverse events and near misses. The goal is to identify as many contributing factors as possible.

Cause and Effect Diagram for RCA²

Use this tool with your RCA² team to explore causes that contributed to the adverse event or near miss you're reviewing. Input the problem you're seeking to address at the far left. Input the categories of primary causes (actions and conditions) as you see them. Then input causes within each category. As you identify causes, you may think of smaller causes that contribute to the larger causes; keep drilling down as much as it is helpful. (You may need more space than this template provides.) See the [RCA² report](#) for an example.



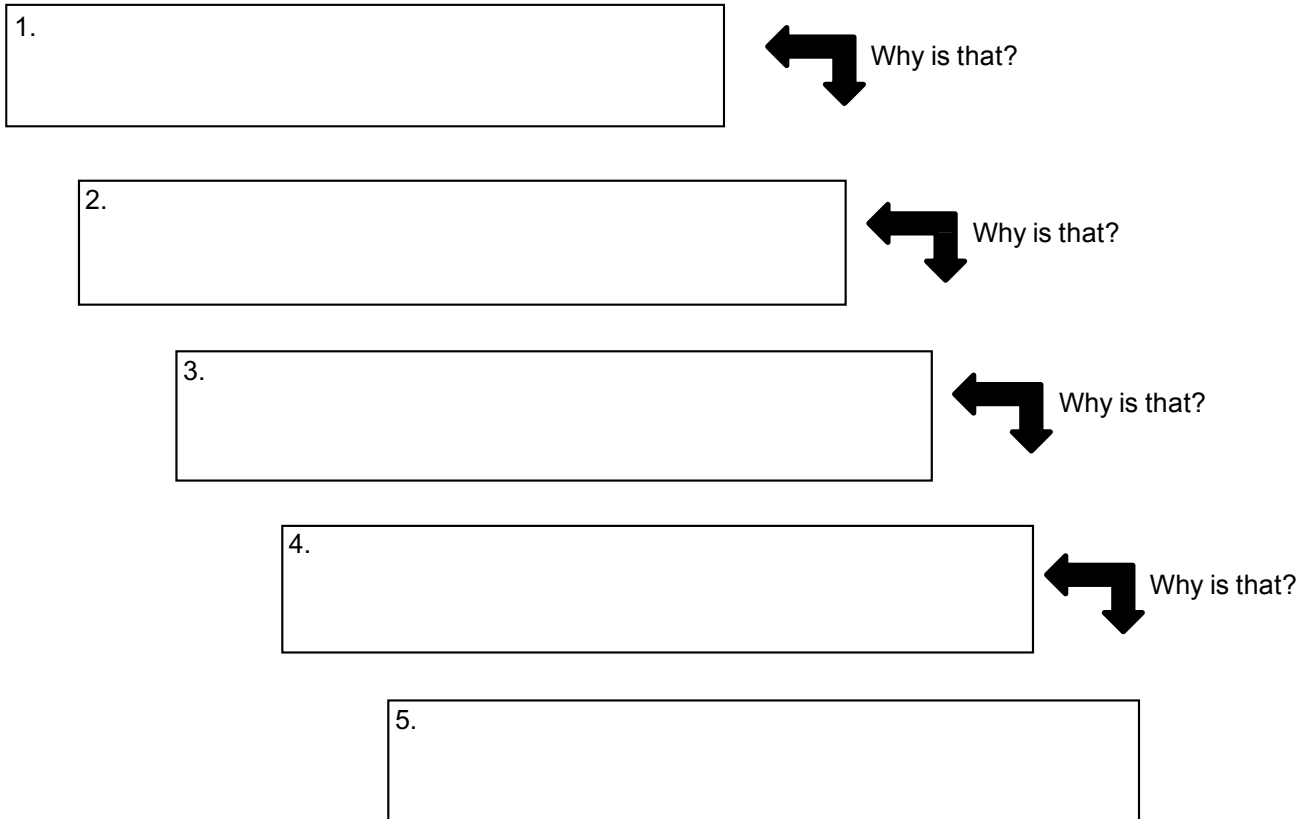
5 Whys for RCA²

Use this tool with your RCA² team to help you identify the root cause(s) of a problem — and generate potential change ideas — by asking “Why?” five times. See the [RCA² report](#) for an example.

EVENT. What happened? Define the problem as an event:

PATTERN. What's been happening? Define the problem as a *pattern* by selecting a poor performance factor:

STRUCTURE. Why is it happening? What are the tangible and intangible structures determining the results we see?



ACTION. What are the implications for action? What can you do to change the results?

Writing Causal Statements

After identifying system vulnerabilities through cause and effect diagramming and the five whys exercise, the RCA² team should document its findings through formal causal statements. Following the instructions from the [Causal Statement Worksheet](#), write two or three causal statements for the case example. Later, you will pair these statements with recommendations for corrective actions.

Causal Statement #1:

Clearly shows the “cause and effect” relationship.
Uses specific and accurate descriptors for what occurred.
Human errors have a preceding cause.
Violations of procedure are not root causes.
Failure to act is only causal if there is a pre-existing duty to act.

Causal Statement #2:

Clearly shows the “cause and effect” relationship.
Uses specific and accurate descriptors for what occurred.
Human errors have a preceding cause.
Violations of procedure are not root causes.
Failure to act is only causal if there is a pre-existing duty to act.

Causal Statement #3:

Clearly shows the “cause and effect” relationship.
Uses specific and accurate descriptors for what occurred.
Human errors have a preceding cause.
Violations of procedure are not root causes.
Failure to act is only causal if there is a pre-existing duty to act.

Identifying Effective Actions

The most important step in RCA² is the implementation of actions to eliminate or control system vulnerabilities, as identified in causal statements. The Action Hierarchy assists teams in identifying effective actions that provide sustained improvement. Teams should identify at least one stronger or intermediate-strength action for every RCA² review.

Review the list of potential actions for the case example and, referring to the causal statements you developed previously, use the Action Hierarchy Worksheet on the next page to rank each potential action as stronger, intermediate, or weaker.

Continue to complete the worksheet with your own ideas: What other actions could help?

Ideas for actions:

- Require barcode scanning prior to medication dispensing/administration.
- Identify staffing concerns as the main topic of discussion for the next hospital leadership WalkRounds.
- Increase staffing, ensuring at least two radiology technologists are on duty during the busiest days in the ED; incorporate use of float or on-call staff as needed.
- Create a checklist for radiology technologists and nurses and require its use prior to beginning all scans that require dye.
- Require and conduct additional staff training on use of electronic health record (EHR).
- Send an email memo to staff reminding them about required processes for patient verification.

Action Hierarchy Worksheet

Discuss how you can apply the concept(s) below to the process you want to improve. Generate a list of ideas, focusing on the feasible actions that are the strongest. See the [RCA2 Report](#) for an example of each action category.

Actions	Ideas
<p>Stronger Actions These tasks require less reliance on humans to remember to perform the task correctly.</p>	
<ul style="list-style-type: none"> • Architectural/physical plant changes • New devices with usability testing • Engineering control (forcing function) • Simplify process • Standardize on equipment or process • Tangible involvement by leadership 	
<p>Intermediate Actions These tasks are less effective than the strongest level actions but more effective than the weakest level.</p>	
<ul style="list-style-type: none"> • Redundancy • Increase in staffing/decrease in workload • Software enhancements, modifications • Eliminate/reduce distractions • Education using simulation-based training, with periodic refresher sessions and observations • Checklist/cognitive aids • Eliminate look- and sound-alikes • Standardized communication tools • Enhanced documentation, communication 	
<p>Weaker Actions These tasks require more reliance on humans to remember to perform the task correctly.</p>	
<ul style="list-style-type: none"> • Double checks • Warnings • New procedure/memorandum/policy • Trainings 	

Action Hierarchy levels and categories are based on Root Cause Analysis Tools, VA National Center for Patient Safety, http://www.patientsafety.va.gov/docs/joe/rca_tools_2_15.pdf

Implementing and Measuring Corrective Actions

In order to improve patient safety, corrective actions must be implemented, and their effectiveness must be measured. It's important to remember:

- Each action identified by the review team requires at least one measure, which may be a process or outcome measure.
- An individual, not a committee, should be assigned responsibility for each action and for the measurement of each action.
- An action due date should be set for each action.
- A measurement plan (including what will be measured, how it will be measured, and the expected level of compliance) should be in place for each action.

Referring to the causal statements you developed previously, choose two appropriate actions from the previous page, and create a feasible action plan. Refer to the [Action Planning Worksheet](#) for help.

Causal Statement #1	
Action(s)	
Person responsible	
Measure(s)	
Person responsible	

Causal Statement #2	
---------------------	--

Action(s)	
Person responsible	
Measure(s)	
Person responsible	