CANADIAN INCIDENT
ANALYSIS FRAMEWORK

CANADIAN INCIDENT ANALYSIS FRAMEWORK

Creating a Constellation Diagram

Full Citation:
Incident Analysis Collaborating Parties. Canadian Incident Analysis Framework. Edmonton, AB: Canadian Patient Safety Institute; 2012. Incident Analysis Collaborating Parties are Canadian Patient Safety Institute (CPSI), Institute for Safe Medication Practices Canada, Saskatchewan Health, Patients for Patient Safety Canada (a patient-led program of CPSI), Paula Beard, Carolyn E. Hoffman and Micheline Ste-Marie.

This publication is available as a free download at: **www.patientsafetyinstitute.ca**

For additional information or to provide feedback please contact **analysis@cpsi-icsp.ca**

H. CREATING A CONSTELLATION DIAGRAM

The diagramming step of the analysis process is focused on recognizing all system issues that may have contributed to the incident rather than just the factors that are apparent and closer to the point of incident occurrence. Diagramming can assist teams to better understand systemic factors and the inter-relationships between them, better visualize these relationships, and help avoid the trap of hindsight bias. Diagramming is one of the elements that can increase the credibility, reliability and effectiveness of analysis in making care safer.

Many readers will be familiar with the use of Ishikawa (also called "fishbone")[52] and "tree"[53] diagrams to support analysis; however, both these types of diagrams have limitations. Ishikawa diagrams are helpful for brainstorming and clustering factors, but do not easily illustrate complex relationships between factors. Tree diagrams have been perceived as too "linear" and their top-down approach can be misleading in terms of relative importance of identified contributing factors.

Figure H.1: ISHIKAWA (FISHBONE) DIAGRAM

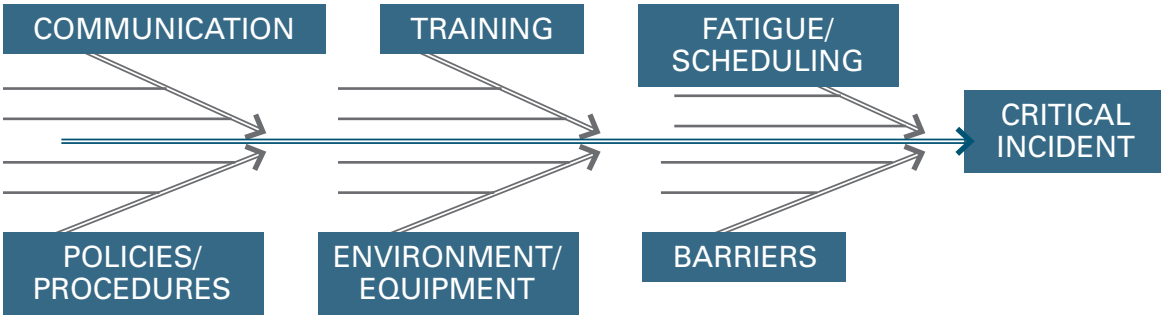
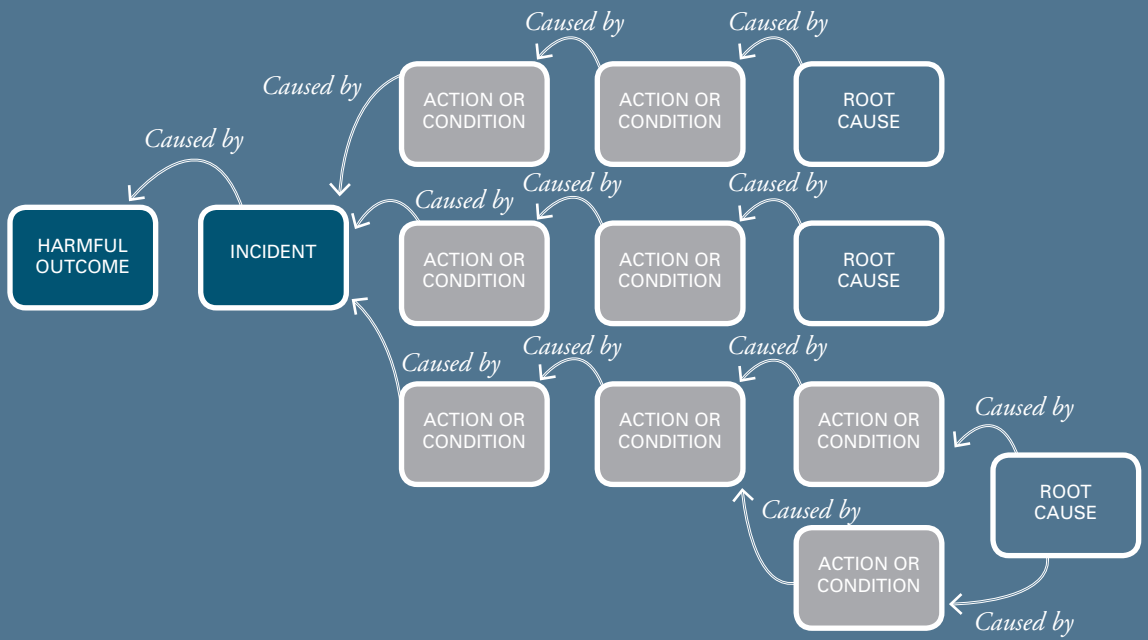


Figure H.2: "TREE" DIAGRAM



In an attempt to address the advantages and limitations of these two types of diagrams, the features of each were blended into a "constellation diagram", a new diagramming method developed by the authors. A literature search did not identify any references to constellation diagrams in the context used here (diagramming contributing factors in analyzing incidents); however there are references to diagramming and analysis methods (including statistical analysis) that emphasize the identification of groups of elements as well as their inter-relationships (e.g. the functional resonance accident model,[84] concept[85] and cognitive[86] mapping, social network analysis[87]).

Through its suggested categories of factors and use of guiding questions, the new diagram offers a systematic way to analyze contributing factors at the system level. In addition, the unique visual representation of the constellation diagram encourages and facilitates the identification of inter-connections and the sphere of influence among contributing factors, which will assist in identifying the contributing factors with the biggest impact on patient safety.

Improving safety and quality of care in complex adaptive healthcare systems is dependent on the ability to see how the parts of the system influence each other so the limited resources available can be focused with more precision to where the greatest risks are identified. The constellation diagram offers flexibility to accomplish this, more than the Ishikawa and tree diagrams.

There are five steps involved in developing a constellation diagram of a patient safety incident:

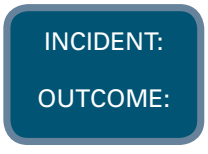
Step 1: Describe the incident.
Step 2: Identify potential contributing factors.
Step 3: Define inter-relationships between and among potential contributing factors.
Step 4: Identify the findings.
Step 5: Confirm the findings with the team.

The development and recording of the diagram can be done using the local resources available, such as a hand-drawn diagram that can be scanned in an electronic format, a photograph of sticky notes, as well as using software like Word®, Excel®, Visio®, Mindmap®, or others

Step 1: Describe the incident

a. Briefly summarize the incident and harm/potential harm in the centre of the diagram (typically fewer than 10 words). (*Figure H.3*)

Figure H.3: DESCRIBE THE INCIDENT



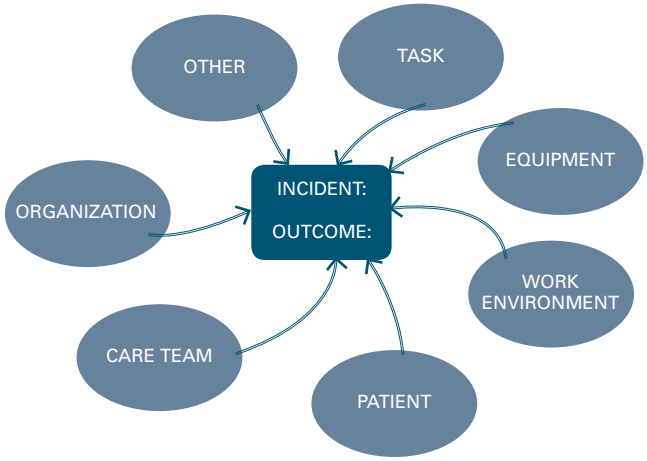
It is crucial for the team to clearly define the starting point for the analysis. This is usually a harmful outcome that the team wants to prevent. It is often, but not always, the actual outcome. For example, in the case of a near miss, the incident may have been recognized prior to the patient being involved. Alternatively, an incident may have occurred, but was

recognized and action taken prior to harm resulting. In both of these circumstances, the analysis team would identify the starting point for analysis as the potential harm, as no harm actually occurred.

Step 2: Identify potential contributing factors

a. Add the contributing factor categories (task, equipment, work environment, patient, care team, organization, etc.) to the diagram in a circle around the incident/outcome description. (*Figure H.4*)

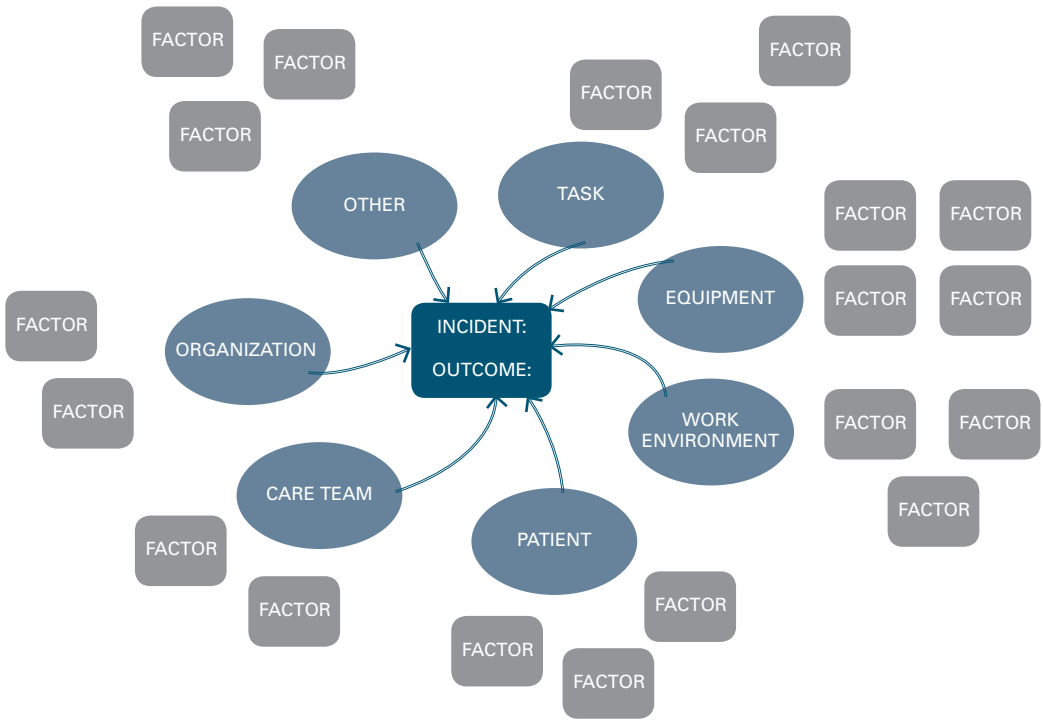
Figure H.4: ADD CONTRIBUTING FACTOR CATEGORIES



b. Use the example guiding questions provided (*Appendix G*), and other questions as appropriate, to identify potential contributing factors.

c. Place each potential contributing factor on a sticky note and group the factors near the category title (*Figure H.5*).

Figure H.5: IDENTIFY POTENTIAL CONTRIBUTING FACTORS



When identifying potential contributing factors, focus on systems-based factors, and not people-focused ones to ensure that likewise, the recommended actions are not people-focused. Keeping in mind human factors principles and systems theory, analysis should focus on "how" certain human actions occurred, not just that they occurred.

For instance, in the course of analyzing an incident in which an incorrect medication was administered, it was determined that the nurse was in a hurry. The fact that the nurse was in a hurry is a factual detail of what happened, and not a contributing factor. The contributing factor(s) are those that may have caused them to be in a hurry. Examples could include: too many tasks were assigned (the nurse was assigned too many complex patients); or the patient's medication needs conflicted with shift change (the patient was admitted right before the shift ended and the nurse wanted to give the patient their pain medications so that they did not have to wait until after the shift change). By focusing on the systems-based contributing factors, the analysis team will be able to identify higher-leverage solutions. Recommended actions should be consistent with one of the main tenets of human factors: fit the task or system to the human, not the other way around.

Step 3: Define inter-relationships between and among potential contributing factors

a. For each potential contributing factor ask, "How and why did this happen?"; "What was this influenced by?"; and "What else influenced the circumstances?".
b. Add the answers to these questions to develop "relational chains":
    i. Some contributing factors may be directly linked with each other,

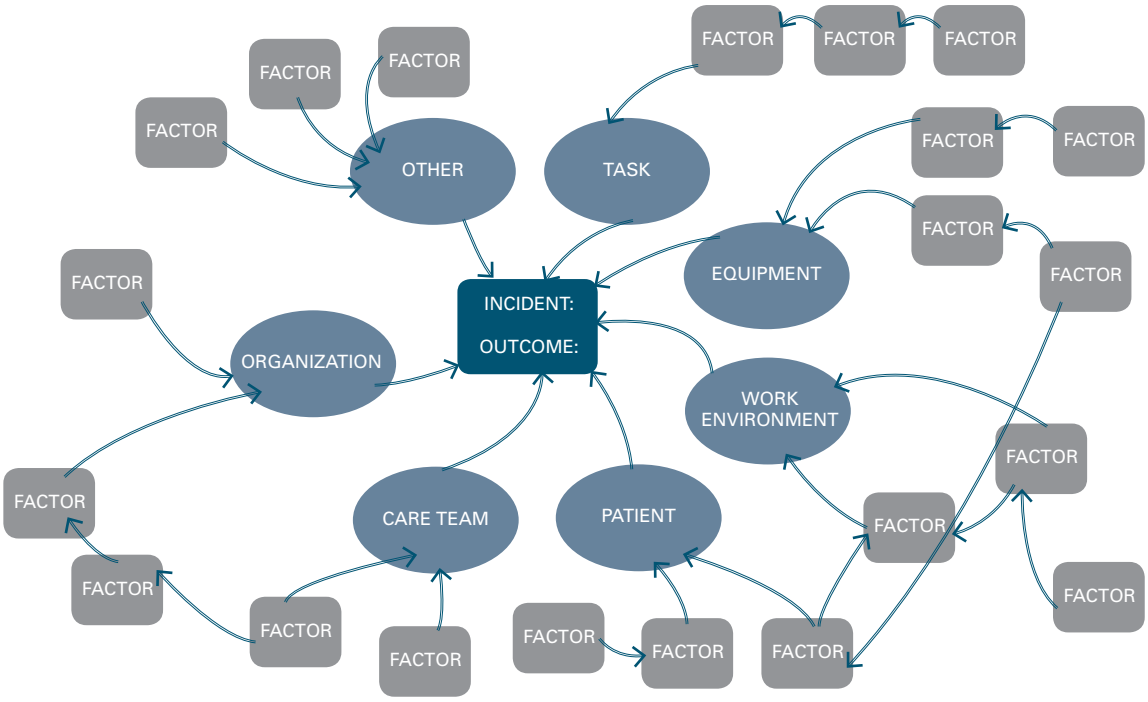
within the same category to create a chain.

ii. Some answers may come from different contributing factor categories; if so, show the linkage by drawing lines.

c. Continue to ask "why" and "what influenced it" questions until no further information can be generated.

Once the team has identified potential contributing factors using the categories of guiding questions, the second phase of analysis begins. Asking "What was this influenced by?", and "What else influenced the circumstances?", the team then expands the constellation diagram to include "relational chains" of contributing factors as shown in *Figure H.6*. This questioning process continues until there are no more questions, knowledge becomes limited, or until the issues identified fall outside the scope of the analysis. Expect that factors from different chains will be inter-related and may influence each other.

Figure H.6: DEFINE RELATIONSHIPS BETWEEN POTENTIAL CONTRIBUTING FACTORS



Step 4: Identify the findings

The next step in the analysis process is to identify the findings that are central to the incident. The team should expect to identify several findings – there is seldom, if ever, only a single reason why an incident occurred.

Findings will be identified in three categories:

a. Factors that, if corrected, would likely have prevented the incident or mitigated the harm – these will be the basis for developing recommended actions (note that these factors may require actions at different levels of the system).

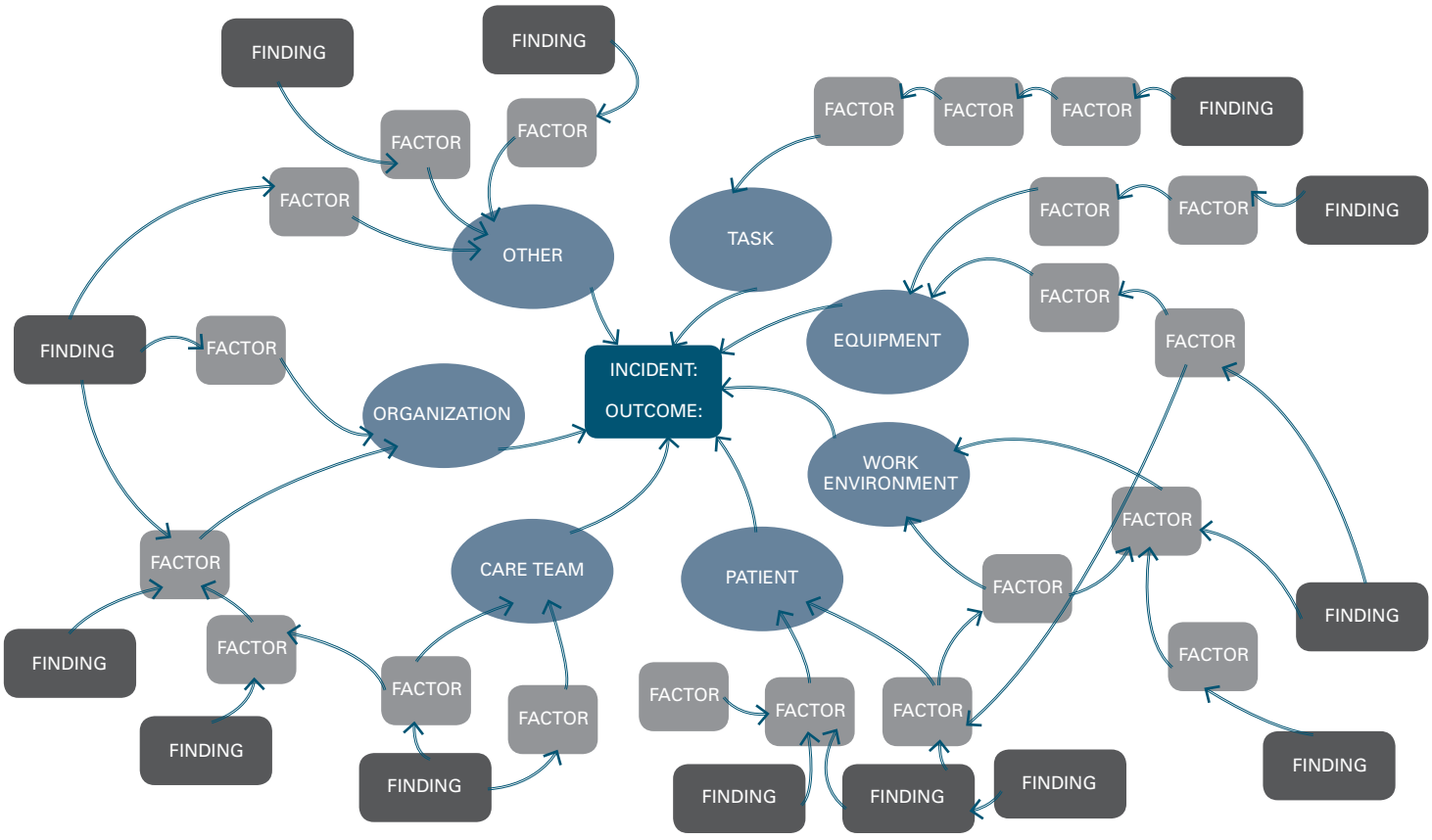
The question to be asked is: *"If this factor was eliminated or corrected, would it have likely reduced the risk of incident recurrence and/or harm?"* While it is possible that many contributing factors will be identified in the analysis, certain factors, if corrected, have the greatest probability to prevent the incident altogether, or mitigate harm from the incident. It is common for these factors to be "**highly relational**"; in other words, relationships or potential relationships between a number of the identified factors appear to have combined to enable an incident to occur, there is a sphere of influence amongst them. These findings will be the basis for developing recommended actions (note that actions may be required at different levels of the system).

b. Factors that if corrected, would not have prevented the incident or mitigated the harm, but are important for patient/staff safety or safe patient care in general. These issues should be included in the team's findings and brought to the attention of the appropriate individuals for follow-up and documented in the analysis report for future review and action as appropriate.

c. Mitigating factors – factors that didn't allow the incident to have more serious consequences and represent solid safeguards that should be kept in place.

An example of a completed constellation diagram is illustrated in *Figure H.7* below.

Figure H.7: COMPLETED CONSTELLATION DIAGRAM



Step 5: Confirm the findings with the team

a. Ensure consensus and support for the development of recommended actions.

The team should agree on the findings before moving forward to develop recommended actions. If there is a lack of immediate agreement, it is important to discuss and work through any disagreements to strive to arrive at consensus before proceeding. If key individuals involved in the incident are not participants on the analysis team, it is helpful to ask for their feedback on the findings of the analysis team as part of the process for verifying the findings. This stage of the process should also include a "back-checking" step; in other words, consider the impact of correcting the identified vulnerabilities (e.g. "If this factor had not been present or had been corrected, would the incident still have occurred?").