Causal Analysis - Tools

Flow Diagram
- It is applicable to all incidents, especially complex incidents.
- Pros: Easy use, Easy data Organization
- Cons: Time-consuming

Brain Storming
- For incidents of which the cause is not clear and there is no available breakthroughs.
- Pros: It effectively puts heads together and embodies collective wisdom
- Cons: It is somewhat divergent, and the effect is difficult to control.

Ishikawa Diagram
- It is applicable to all incidents.
- Pros: Questions focus on five to seven aspects, Graphic representation of causes, Cause and effect relationships
- Cons: No representation of logical relationships, No chronology

Causal Tree Analysis
- For causes where no expert is available to raise proper questions or the incident occurs repeatedly, it can be quite useful to resolve procedure problems.
- Pros: Schematic description, Reconstruction of the chronology of the facts, Consideration of multiple causes: linking of causes to their effects, Accessible method (a few hours of training)
- Cons: Factors not ranked, Schematic description is not easy to understand for those who did not create it
Flow Diagram

- Describe what happened with the initial flow diagram

- Identified information gap, question, and/or missing information via conduct interviews, visits to area, process the simulations, review documents

UC San Diego Health

Cause-and-Effect Diagram

UC San Diego Health
## Common causal factors

<table>
<thead>
<tr>
<th>Human behavior</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Slip causing physical error</td>
</tr>
<tr>
<td></td>
<td>Poor judgment</td>
</tr>
<tr>
<td></td>
<td>Negligence</td>
</tr>
<tr>
<td>Failure to detect a developing problem</td>
<td>Loss of attention</td>
</tr>
<tr>
<td></td>
<td>Lack of information</td>
</tr>
<tr>
<td>Policies, procedures, and regulations</td>
<td>Policy inadequate</td>
</tr>
<tr>
<td></td>
<td>Relevant policy nonexistent</td>
</tr>
<tr>
<td></td>
<td>Policy not followed</td>
</tr>
<tr>
<td>Communication</td>
<td>Poor or incomplete</td>
</tr>
<tr>
<td></td>
<td>Inadequate communication patterns</td>
</tr>
<tr>
<td></td>
<td>Medical records incomplete/absent</td>
</tr>
<tr>
<td>Equipment design and construction</td>
<td>Poor human factors engineering</td>
</tr>
<tr>
<td></td>
<td>Software operation failure</td>
</tr>
<tr>
<td>Failure to interpret the nature of a developing problem</td>
<td>Expectation bias</td>
</tr>
<tr>
<td></td>
<td>Incorrect information</td>
</tr>
<tr>
<td></td>
<td>Inadequate search</td>
</tr>
<tr>
<td></td>
<td>Missing information</td>
</tr>
</tbody>
</table>

Spraker et al., Evaluation of near-miss and adverse events in radiation oncology using a comprehensive causal factor taxonomy, Practical Radiation Oncology (2017) 7, 346-353

## Causality

The goal of the causal table is to facilitate the identification of all root causes and contributory factors that underlie an incident and to improve consistency of interpretation amongst different users.

1. Organizational management
2. Technical
3. Human behavior involving staff
4. Patient-related circumstances
5. External factors
6. Procedural issues
7. Other

Cause-and-Effect Diagram

Five rules of Causation

**Rule 1:** Clearly show the “cause and effect” relationship

**Rule 2:** Use specific and accurate descriptors for what occurred, rather than negative and vague words.

**Rule 3:** Human Errors must have a preceding cause*.

**Rule 4:** Violations of procedure are not root causes and must have a preceding cause.

**Rule 5:** Failure to act is only causal when there is a pre-existing duty to act.

Causal Analysis

Exercise 3 Event

Grace Gwe-Ya Kim, Ph.D. FAAPM
Radiation Medicine & Applied Sciences

The radiation oncologist prescribed 300 cGy to the 90% isodose for 15 fractions using 6 MeV electron beam energy to the left nose with the clinical setup. SSD = 105 cm, 3.5 cm Standard Circle Insert, 0.5 cm Bolus.

The dosimetrist performed the MU calc incorrectly, and correction to 90% was not applied.

The error MU was noticed during the weekly check. The patient has received 10 fractions.
Causal Taxonomy:

**Organizational Management**
- Inadequate human resources – Staffing not consistent with professional recommendations

**Technical**
- Environment (within the facility) – Environment

**Human behavior involving staff**
- Slip causing physical error (failure in performance of highly developed skills as intended or maintained)

**Human behavior involving staff**
- Poor judgment (e.g., failure to carry out quality control on a patient due to time limitation)

**Procedural issues**
- Failure to develop an effective plan - Inappropriate assumptions

**Procedural issues**
- Failure to execute the planned action - Plan misinterpreted