Cause-and-Effect Analysis

A cause-and-effect analysis generates and sorts hypotheses about possible causes of problems within a process by asking participants to list all of the possible causes and effects for the identified problem. This type of analysis is often conducted by drawing cause-and-effect diagrams, which organize a large amount of information by showing links between events and their potential or actual causes and provide a means of generating ideas about why the problem is occurring and possible effects of that cause. Cause-and-effect analysis allows problem solvers to broaden their thinking and look at the overall picture of a problem. Cause-and-effect diagrams can reflect either causes that block the way to the desired state or helpful factors needed to reach the desired state.

When to Use Cause-and-Effect Analysis

As a graphic presentation with major branches reflecting categories of causes, a cause-and-effect analysis stimulates and broadens thinking about potential or real causes and facilitates further examination of individual causes. Because everyone’s ideas can find a place on the diagram, a cause-and-effect analysis helps to generate consensus about causes. It can help to focus attention on the process where a problem is occurring and to allow for constructive use of facts revealed by reported events.

However, it is important to remember that a cause-and-effect diagram is a structured way of expressing hypotheses about the causes of a problem or about why something is not happening as desired. It cannot replace empirical testing of these hypotheses: it does not tell which is the root cause, but rather possible causes.
There are two ways to graphically organize ideas for a cause-and-effect analysis. They vary in how potential causes are organized: (a) by category: called a *fishbone diagram* (for its shape) or *Ishikawa diagram* (for the man who invented it), and (b) as a chain of causes: called a *tree diagram*.

The choice of method depends on the team’s need. A *fishbone diagram*, organized around categories of cause, will help the team think about groups of causes, such as those that are staffing-related, resource-related, facility-related, etc. A *tree diagram*, however, will encourage team members to explore the chain of events or causes.

### Causes by Categories (Fishbone Diagram)

The fishbone diagram (called so for its shape) helps teams to brainstorm about possible causes of a problem, accumulate existing knowledge about the causal system surrounding that problem, and group causes into general categories. The branches (labeled by the boxes at the top and bottom) represent main categories of potential causes that contribute to the origin or maintenance of the problem (labeled “Effect” at the head of the fishbone), such as issues that are staffing-related, patient-related, resource-related, facility-related, etc. The smaller lines coming off the main branches represent subcategories or specific causes within the category.

[Diagram of a fishbone diagram]

When using a fishbone diagram, several categories of cause can be applied. Some often-used categories are:

- Human resources, methods, materials, measurements, and equipment
- Clients, workers, supplies, environment, and procedures

Categories for this type of cause-and-effect diagram vary widely, depending on the context. The group should choose those categories that are most relevant to them and feel free to add or drop categories as needed. A quality improvement team at a hospital in Bolivia developed a fishbone diagram to improve prenatal and delivery care (see image at left).

[Image of a fishbone diagram used at the hospital]

### A Chain of Causes (Tree Diagram) and the Five Why’s

A second type of cause-and-effect analysis is a *tree diagram*, which highlights the chain of causes. It starts with the effect and the major groups of causes and then asks for each branch, "Why is this happening? What is causing this?"

The tree diagram is a graphic display of a simpler method known as the *Five Why’s*. It displays the layers of causes, looking in-depth for the *root* cause. The Five Why’s can be used alone or with any cause-and-effect diagram.
Example of Applying the Five Why’s to Analyze the Root Cause of Incorrect Treatment

**Effect:** The patient received the wrong medication.

**Question 1:** Why did the patient get the incorrect medicine?
**Answer 1:** Because the prescription was wrong.

**Question 2:** Why was the prescription wrong?
**Answer 2:** Because the doctor made the wrong decision.

**Question 3:** Why did the doctor make the wrong decision?
**Answer 3:** Because he did not have complete information in the patient’s chart.

**Question 4:** Why wasn’t the patient’s chart complete?
**Answer 4:** Because the doctor’s assistant had not entered the latest laboratory report.

**Question 5:** Why hadn’t the doctor’s assistant charted the latest laboratory report?
**Answer 5:** Because the lab technician telephoned the results to the receptionist, who forgot to tell the assistant.

**Solution:** Develop a system for tracking lab reports.

**How to Use Cause-and-Effect Analysis**

Although several ways to construct a cause-and-effect diagram exist, the steps of construction are essentially the same.

**Step 1.** Agree on the problem or the desired state and write it in the **Effect** box. Try to be specific. Problems that are too large or too vague can make it hard for the team to move forward.

**Step 2.** If using a tree or fishbone diagram, define six to eight major categories of causes. Or the team can **brainstorm** first about likely causes and then sort them into major branches. The team should add or drop categories as needed when generating causes. Each category should be written into a box.

**Step 3.** Identify specific causes and fill them in on the correct branches or sub-branches. Use simple brainstorming to generate a list of ideas before classifying them on the diagram, or use the development of the branches of the diagram first to help stimulate ideas. Either way will achieve the same end: use the method that feels most comfortable for the group. If an idea fits on more than one branch, place it on both. Be sure that the causes as phrased have a direct, logical relationship to the problem or effect stated at the head of the fishbone.

Each major branch (category or step) should include three or four possible causes. If a branch has fewer, lead the group in finding some way to explain this lack, or ask others who have some knowledge in that area to help.
Step 4. Keep asking "Why?" and "Why else?" for each cause until a potential root cause has been identified. A root cause is one that: (a) can explain the "effect," either directly or through a series of events, and (b) if removed, would eliminate or reduce the problem. Try to ensure that the answers to the "Why" questions are plausible explanations and that, if possible, they are amenable to action.

Check the logic of the chain of causes: read the diagram from the root cause to the effect to see if the flow is logical. Make needed changes.

Step 5. Have the team choose several areas they feel are most likely causes. These choices can be made by voting to capture the team's best collective judgment.

Use the reduced list of likely causes to develop simple data collection tools to prove the group’s theory. If the data confirm none of the likely causes, go back to the cause-and-effect diagram and choose other causes for testing.

Points to Remember
Remember that cause-and-effect diagrams represent hypotheses about causes, not facts. Failure to test these hypotheses—treating them as if they were facts—often leads to implementing the wrong solutions and wasting time.

To determine the root cause(s), the team must collect data to test these hypotheses. The "effect" or problem should be clearly articulated to produce the most relevant hypotheses about cause. If the "effect" or problem is too general or ill defined, the team will have difficulty focusing on the effect, and the diagram will be large and complex.

It is best to develop as many hypotheses as possible so that no potentially important root cause is overlooked.

Be sure to develop each branch fully. If this is not possible, then the team may need more information or help from others for full development of all the branches.

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