

FISHBONE DIAGRAM

Category: Analysis Tool

ABSTRACT

The Fishbone Diagram^(G) is a tool for analyzing process dispersion. It is also referred to as the "Ishikawa diagram," because Kaoru Ishikawa developed it, and the "fishbone diagram," because the complete diagram resembles a fish skeleton. The diagram illustrates the main causes and subcauses leading to an effect (symptom).

It is a team brainstorming tool used to identify potential root causes^(G) to problems. Because of its function it may be referred to as a cause-and-effect diagram.

In a typical Fishbone diagram, the effect is usually a problem needs to be resolved, and is placed at the "fish head". The causes of the effect are then laid out along the "bones", and classified into different types along the branches. Further causes can be laid out alongside further side branches. So the general structure of a fishbone diagram is presented below.

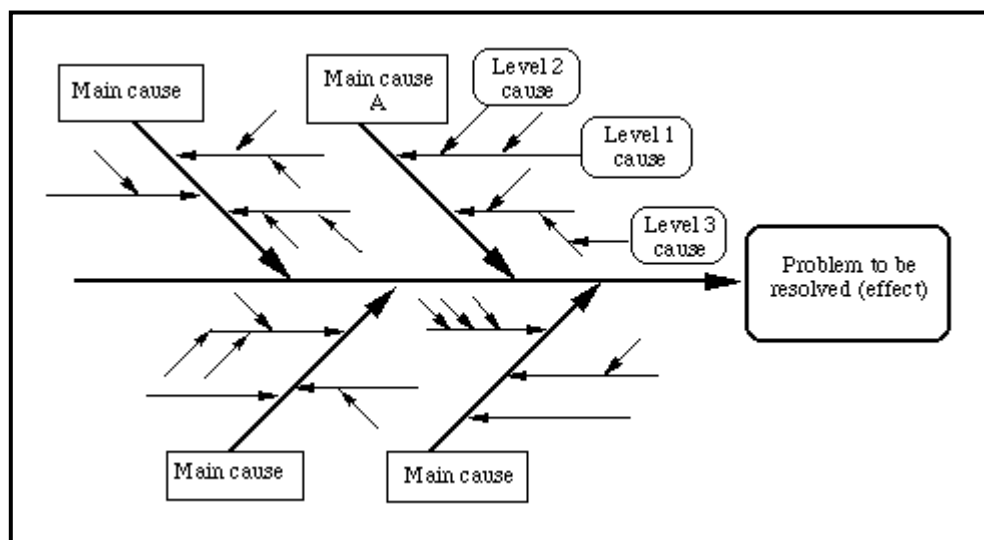


Figure 1: Fishbone Diagram - Structure

KEYWORDS

Cause-and-Effect Diagram, Ishikawa diagram, Fishbone diagram, Root Cause Analysis.

OBJECTIVES

The main goal of the Fishbone diagram is to illustrate in a graphical way the relationship between a given outcome and all the factors that influence this outcome. The main objectives of this tool are:

- Determining the root causes^(G) of a problem.
- Focusing on a specific issue without resorting to complaints and irrelevant discussion.
- Identifying areas where there is a lack of data.

FIELD OF APPLICATION

The Fishbone diagram could be applied when it is wanted to:

- Focus attention on one specific issue or problem.
- Focus the team on the causes^(G), not the symptoms.
- Organize and display graphically the various theories about what the root causes^(G) of a problem may be.
- Show the relationship of various factors influencing a problem.
- Reveal important relationships among various variables and possible causes^(G).
- Provide additional insight into process behaviors.

RELATED TOOLS

Pareto chart, Scatter diagram, Flowcharts Checksheets

DESCRIPTION

Dr. Kaoru Ishikawa, a Japanese quality control statistician, invented the fishbone diagram. It is often also referred to as the Ishikawa diagram. The fishbone diagram is an analysis tool that provides a systematic way of looking at effects and the causes that create or contribute to those effects. Because of the function of the fishbone diagram, it may be referred to as a cause-and-effect diagram. The design of the diagram looks much like the skeleton of a fish. Therefore, it is often referred to as the fishbone diagram. A cause-and-effect diagram can help identify the reasons why a process goes out of control. Often the fishbone diagram can be used to summarize the results of a brainstorming session, identifying the causes of a specified undesirable outcome. It helps to identify root causes^(G) and ensures a common understanding of the causes.

The steps for constructing and analyzing a Cause-and-Effect Diagram are outlined below:

Step 1 - Identify and clearly define the outcome or effect to be analyzed².

Formulate the problem and write it in a box on the right side of the diagram. Everyone must clearly understand the nature of the problem and the process/product being discussed. If everyone is not clear on

the purpose of the session, the session will not resolve the problem. In this step the following rules have to be applied:

- Decide on the effect to be examined. Effects are stated as particular quality characteristics, problems resulting from work, planning objectives, and the like.
- Use Operational Definitions. Develop an Operational Definition of the effect to ensure that it is clearly understood.
- Remember, an effect may be positive (an objective) or negative (a problem), depending upon the issue that's being discussed.
 - ✓ *Using a positive effect which focuses on a desired outcome tends to foster pride and ownership over productive areas.* This may lead to an upbeat atmosphere that encourages the participation of the group. When possible, it is preferable to phrase the effect in positive terms.
 - ✓ *Focusing on a negative effect can sidetrack the team into justifying why the problem occurred and placing blame.* However, it is sometimes easier for a team to focus on what causes a problem than what causes an excellent outcome. While you should be cautious about the fallout that can result from focusing on a negative effect, getting a team to concentrate on things that can go wrong may foster a more relaxed atmosphere and sometimes enhances group participation.

You must decide which approach will work best with your group.

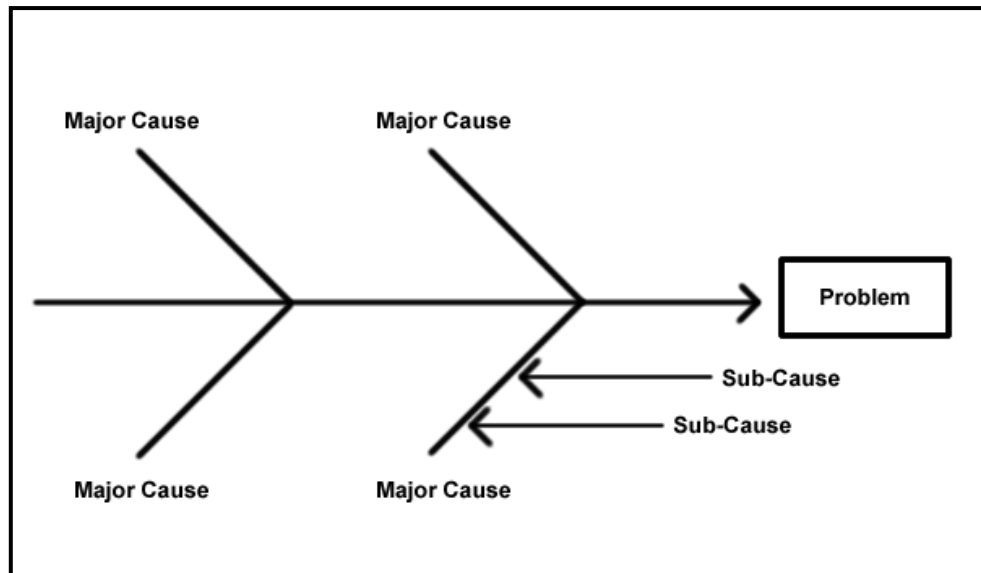
Step 2 - Use a chart pack positioned so that everyone can see it, draw the spine and create the effect box.

- Draw a horizontal arrow pointing to the right. This is the spine.
- To the right of the arrow, write a brief description of the effect or outcome which results from the process.
- Draw a box around the description of the effect.

Step 3 - Identify the main causes^(G) contributing to the effect being studied.

These are the labels for the major branches of your diagram and become categories under which to list the many causes related to those categories.

- Establish the major causes, or categories, under which other possible causes will be listed. You should use category labels that make sense for the diagram you are creating.
- Write the main categories your team has selected to the left of the effect box, some above the spine and some below it.
- Draw a box around each category label and use a diagonal line to form a branch connecting the box to the spine.



Step 4 - For each major branch, identify other specific factors which may be the causes of the effect

- Identify as many causes or factors as possible and attach them as subbranches of the major branches.
- Fill in detail for each cause. If a minor cause applies to more than one major cause, list it under both.

Step 5 - Identify increasingly more detailed levels of causes and continue organizing them under related causes or categories. You can do this by asking a series of why questions.

You may need to break your diagram into smaller diagrams if one branch has too many subbranches. Any main *cause* (3Ms and P, 4Ps, or a category you have named) can be reworded into an *effect*.

Step 6 - Analyze the diagram. Analysis helps you identify causes that warrant further investigation. Since Cause-and-Effect Diagrams identify only Possible Causes, you may want to use a Pareto Chart to help your team determine the cause to focus on first.

- Look at the “balance” of your diagram, checking for comparable levels of detail for most of the categories.
 - ✓ A thick cluster of items in one area may indicate a need for further study.
 - ✓ A main category having only a few specific causes may indicate a need for further identification of causes.
 - ✓ If several major branches have only a few subbranches, you may need to combine them under a single category.
- Look for causes that appear repeatedly. These *may* represent root causes.
- Look for what you can measure in each cause so you can quantify the effects of any changes you make.

BENEFITS

- Helps determine root causes
- Encourages group participation
- Uses an orderly, easy-to-read format to diagram cause and effect relationships
- Indicates possible causes of variation
- Increases knowledge of the process by helping everyone to learn more about the factors at work and how they relate
- Identifies areas for collecting data

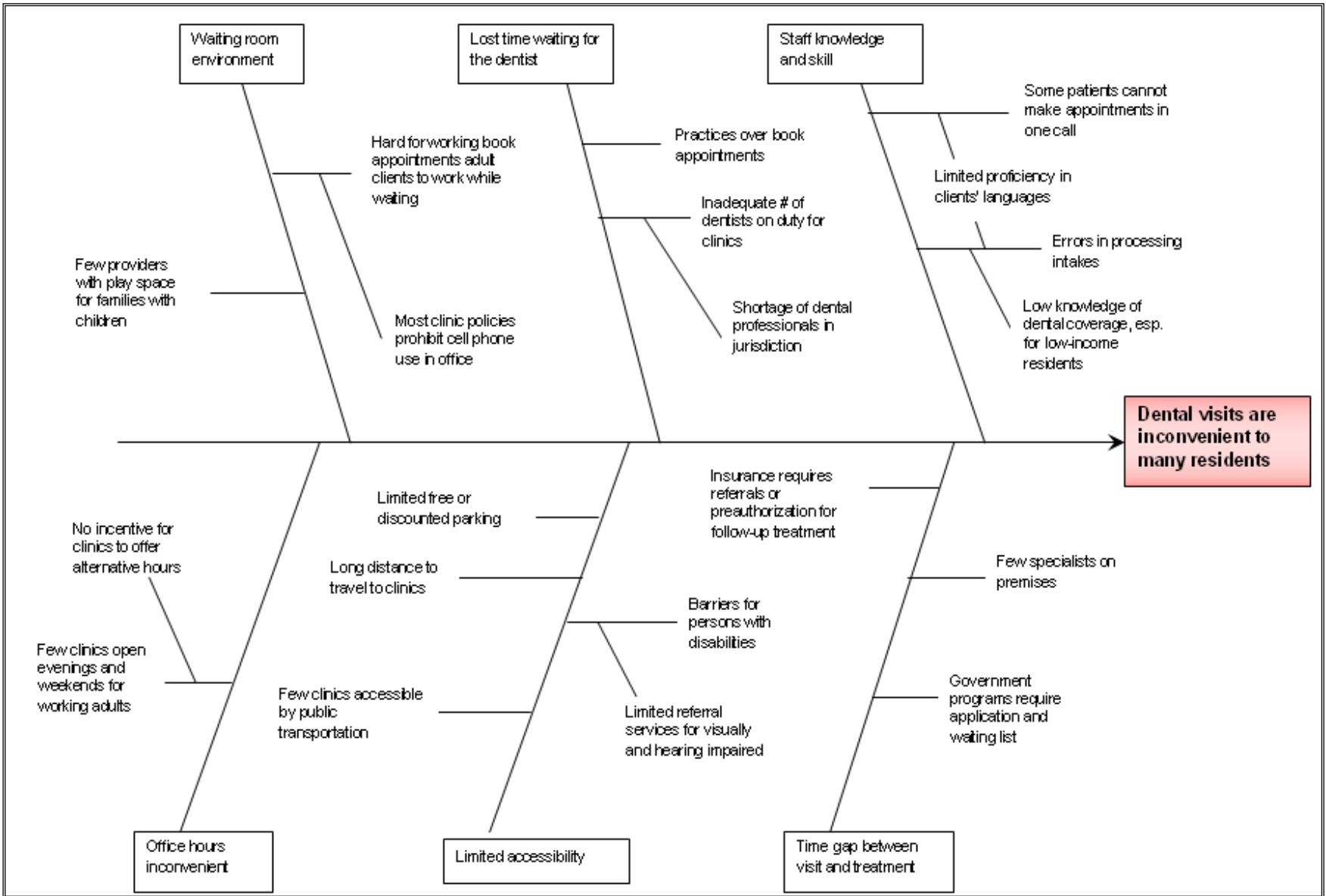
PREREQUISITES

- A problem is composed of a limited number of causes, which are in turn composed of sub causes.
- Distinguish these causes and sub causes is a useful step to deal with the problem.

EXAMPLES – CASE STUDY

Example problem: Low utilization of dental services by adults⁵

The following Fishbone Diagram shows how a public health team could delve into one potential root cause of low utilization of dental services by adults throughout the jurisdiction: "Dental visits are inconvenient to many residents."



BIBLIOGRAPHY

1. American Society for Quality, Fishbone diagram
<http://www.asq.org/learn-about-quality/cause-analysis-tools/overview/fishbone.html>
2. Balanced Scorecard Institute, Basic tools for process improvement, Module 5 – Cause and Effect diagram
<http://www.balancedscorecard.org/files/c-ediag.pdf>
3. Ishikawa, Kaoru (1986). Guide to Quality Control. Tokyo, Japan: Asian Productivity Organization.
4. Walton, Mary (1992) The Deming Management Method, Mercury Business
5. Public Health Infrastructure, *Fishbone (Ishikawa) Diagram (Example)*
<http://www.phf.org/infrastructure/PublicHealthFishbone.pdf>
(accessed on 8/8/2007)