

# Review Article

## Root Cause and Error Analysis

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### ABSTRACT

**Error is an inevitable part of life and cannot be completely eliminated, but it can be minimized. A root cause analysis is a technique for understanding the systematic error causes that is involved beyond a person or people to implement an errors and including field and environmental causes of errors when occur in this situation too. An important factor of an error occurrence is a root cause (causes) in causal factors that its revision or removing caused to prevent the recursion of a situation such as an error when is occurring in a process. The process of root cause analysis is consist of six steps: the beginning of the process, Data collection and mapping information, Identifying the problems, Analyzing Information, Solution Providing, Implementing the solutions (action plans), Writing the report.**

**Keywords:** Root Cause Analysis, Diagnostic Error

### Introduction

**E**rror is an inevitable part of life and can not be completely eliminated, but it can be minimized (1-3). The Error is always accompanied by all aspects of health care (4-5). Error management was considered in the reactive clinical environment in the past. This means that the error was dealt to analyze the causes to prevent its recurrence but now it emphasize preventive or proactive approach that the error possibility has been adopted in this manner and it can be managed before the error occurred (6-9). Error will not necessarily lead to damage.

Error is considered to find fault and blame and punishment, but also shown to learn, diagnose and treat a major problem in the design and functioning of the health system (9-11).

### Root Cause Analysis

A root cause analysis is a technique for understanding the systematic error causes that is involved beyond a person or people to implement an errors and including field and environmental causes of errors when occur in this situation too (12-15). Root cause analysis, retrospectively and multi -functionally, design the hierarchical error and return to errors whenever it is going to occur

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and let to recognize the real causes of errors (16,18). Thus organizations can get learned these errors and acted operationally. The root analysis is an investigated and organized analysis process to identify the actual cause (causes) of a problem and finding ways to eliminate this cause (causes) (19).

### **Contributed causes to the occurrence of an error**

Factors that impact on performance, lead to providing non- secure events or making errors are classified as follows (20-23):

1. Influencing Factors: Factors involved in the occurrence of an error, but by removing them, may not prevent the occurrence of an error, although their deletions are generally excluded to increase safety in providing services.
2. Causal Factors: Factors that directly caused to an error and its deletion lead not to remove or decrease of an error or occurrence.

### **What is a root cause?**

An important factor of an error occurrence is a root cause (causes) in causal factors that its revision or removing caused to prevent the recursion of a situation such as an error when is occurring in a process (24-25). The root causes get providing a field for the occurrence of the surface cause (obvious or immediate cause) (26-28). The root cause is the causes that is identified or completely deleted by removing it or that it has significantly reduced the incidence (Both within departments and across the organization) (29-32).

### **Why analyze the root causes?**

1. Deficiencies and weaknesses in the system can lead to human errors
2. Evidence shows that in organizations with high trust the systematic errors can reveal the deficient system flaws
3. Need to learn from incidents and errors that have occurred in the past ( emphasis on the

learning process )

4. Events and adverse occurrences are the symptoms of a pathological disasters in organization
5. Disease in the organization can affect the various working system
6. Accurate analysis of much critical incident or an error is a very useful analysis than many precipitous accident or error (33-39).

### **The purpose of root analysis performances**

- To learn the risks (adverse and catastrophic failures) with the aim of reducing the possibility of their occurrence or the severity of their consequences in the future
- For understanding:
  1. What it happened?
  2. How it happened?
  3. Why it happened?
  4. The causes identification: - Surface – root
  5. What can we do to prevent the occurrence of trauma or an error again in the future ?( Decreasing the further occurrence rate of an error )
  6. Focus on improving systems / processes, not people (40-45).

### **The process of root cause analysis**

The first step: the beginning of the process

1. Forming the team

The first step in the process of root cause analysis and initiate the process, the team is formed that including 3-4 person individually with the skills in the field of recognizing the clinical and inter-field subjects and considering them and with a least well-learned person in the field of the error consideration process (46-49).

2. The definition of incidents

The first step is the definition and identifying an error. We should precisely explicit and define what it happen in this stage (or it closely to happen) and the problem must be specific and clearly defined as possible. The brain storming is a good tool in this stage (50-53).

What is a brain storming? It is a technique for generating an ideas and comments by a group as possible and during a collaborative creative process (54-56).

The brain storming process

1. Define the subject
2. Familiarization of group members with the matter during a determined time like a few minutes.
3. Think briefly in group members (i.e. within 10 minutes )
4. Generate ideas on the subject by a Members
5. Gather and Clarify ideas (57-58).

The second step: Data collection and mapping information

1. Data Collection:

At this stage, the team is ready to examine the issue more precisely. This step involves gathering information from various sources about desirable incidents and error (or pseudo- event). Information is a critical factor in the process of

investigation and analysis. 60% of time in this processing should be spent in this step (59-60).

2. Mapping Information

Aftercollectinginformation,itshouldbedescribed the incidents and error. This description should provide information about the time, place and circumstances of the incident or an error (60-64).

The third step: Identifying the problems (Issues)

When it considers an event or error, we found weaknesses and deficiencies that have existed in the process of providing the services. These problems are generally categorized in two problems “Care Delivery Problems” and “Service Delivery Problems ”.

To identify these problems, team could be analyze and find the root causes of these problems (65-68).

The forth step: Analyzing Information

The tools that are used to identify contributing factors and root causes:

1. Fish Bone diagram or cause and effect graph (Fig. 1).

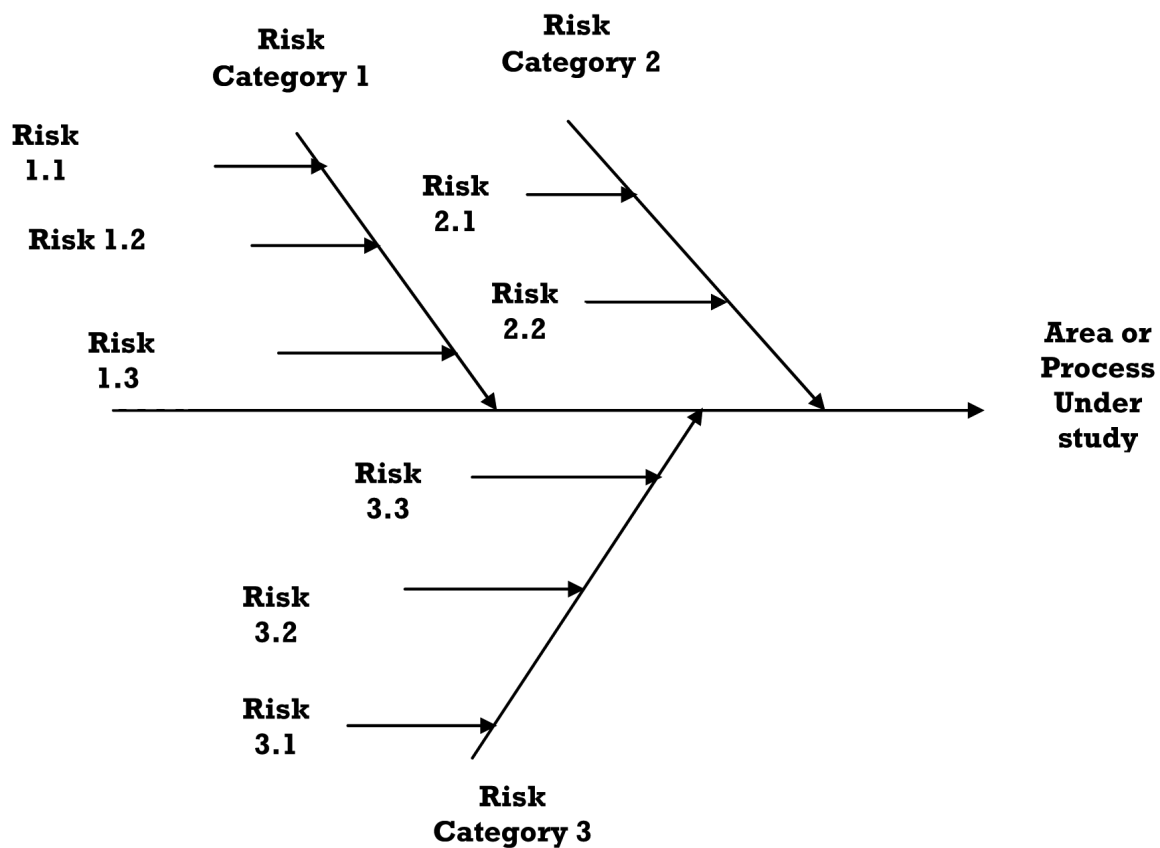


Fig. 1: Fish Bone diagram or cause and effect graph

When we want to identify the risks of a process or causes an accident or error (either surface or root = involved factors) to a more structured approach, tried to use this tool (69, 71). It is efficient to categorize and rank the causes.

- In the head: desired problems (CPD or SDP)
- The main blades: various groups involved in the accident / incident (Contributory Factors)
- Any small blade: special causes identified for each category
- Each fish has a problem related to the identification of evolving factors.

### **5 Whys tools**

Tool that let users to ask about continuous whys to determine the cause (causes) of each issue (CPD or SDP) to solve a simple and non complex problems very easily and also answer that why 3-5-7 must be used respectively (69-70).

#### **The manner of performing 5 Whys technique**

1. Writing the problems definitely,
2. By using the good methods (brain storming – think writing) ask team members to answer “why it happens” or “why it causes to make a problem”? (If you find more than one answers, each one must be analyzed separately).
3. If the answer of this “why” is not determined the source and origin of this problem, can be repeated it again and write this answer.
4. Draw the question process as flip chart.
5. Return to the third step, if the team members confirmed not to find the root cause of this problem and repeat it again to reveal your root cause.
6. The number of these “whys” may be more or less than five (56, 72-73).

#### **Data Charts**

- The aim of drawing the data chart is to identifying

methods and models of a process during a time.

- The step to draw data chart:
- To draw two line vertically.
- To write considered time on the horizontal axes and divide as the same distance.
- To write observed frequency on the vertical line.
- To put dot on the junction of both vertical and horizontal lines coordinate with specification and frequency.
- To join dots with direct line (57, 51, 73).

### **Constraint Analysis**

Constraint: it is controlled performance that has been designed and executed for preventing any damages (people, things and building, the validity of organization, society) (74).

#### **The fifth step: Solution Providing**

In this section of RCA process, team get a list of root causes of problems or errors and ready to provide the virtual solutions to remove and delete these systematic problems. These solutions which are also called the correction or improvement performances prevent the occurrence of error or its repetition for designing and implementing these new well known root causes (56, 74- 75).

#### **The sixth step: Implementing the solutions (action plans)**

The action plan in implementing the changes (Table 1).

- What we want to do (identified target - a detailed description of an activity - its impact on various aspects of performance)
- Who will be responsible for implementation?
- Which time this work is done? (Using a Gantt chart)
- What resources are required to perform this action? (64, 75, 76)

**Table 1-** Diagram of an action plan

Root Causes	Desired Action	Implemented Responsible	Completion Date	Needed Sources	Persistence Method

The seventh step: Writing the report

Research report must include the following:

- 1 - What event / incident / error happened?
- 2 - Whom the accident / incident / error are going to happen?
- 3 - When the accident / incident / error happened?
- 4 - Where the accident / incident / error happened?
- 5 – How the accident / incident / error happened?
- 6 – Which root cause (causes) are the radical accident / incident / error?
- 7 - What are the suggestions to improve? (How, who, what, when, etc.) (64,66,74-76).

### Conclusion

Error is an inevitable part of life and cannot be completely eliminated, but it can be minimized. A root cause analysis is a technique for understanding the systematic error causes that is involved beyond a person or people to implement an errors and including field and environmental causes of errors when occur in this situation too. By applying RCA, traditional, individual and rapid reaction behaviors will be avoided at times of error and it will be possible to analyze what, when, how and why has happened. Then, we can find a solution to avoid any recurrence of errors in the future.

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