Root Cause Analysis versus Shallow Cause Analysis: What’s the Difference?
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Abstract: Does regulatory compliance with RCA guidelines ensure patient safety? Many Risk Managers (RM) today face overwhelming tasks and must prioritize them to ensure patient safety. What is the difference between troubleshooting, problem solving and root cause analysis? Are the outcomes different when we use The 5-Whys, The Fishbone or a Logic Tree? Can deficiencies in our approach to RCA increase the risk of harm to the patient? These questions will be discussed in depth and contrasted using a common example to determine if we are using Root Cause Analysis or Shallow Cause Analysis.

“Cause and effect, means and ends, seed and fruit, cannot be severed; for the effect already blooms in the cause, the end preexists in the means, the fruit in the seed.”

- Ralph Waldo Emerson, 19th century Transcendental philosopher from Selected Writings of Ralph Waldo Emerson

Regulatory Compliance Versus Patient Safety

We will start this discussion with a recent quote from an article in Quality Digest:

“Is the healthcare industry in denial when it comes to practicing Six Sigma? The answer, unfortunately, is yes. Although the industry is slowly adopting the methodology, the majority of these initiatives aren’t designed to improve the quality of the medical treatment offered to patients. Instead, most health organizations focus on improving care from the administrative side. As a result, patients aren’t getting the quality improvements to which they are entitled. The real issues facing healthcare are ignored due to medical practitioners who are afraid to admit that the lack of quality care is a result of their own errors and inefficiencies.”

While this article focused on the specific application of Six Sigma, it may as well have been written about Root Cause Analysis (RCA) as well. The driving force behind statements like the above is that regulatory compliance is being confused with patient safety. We are being led to believe that if our RCA efforts are compliant, then the patient is safer. In the quote above we are able to be compliant yet not affect the quality of patient care. That should defeat the purpose of the intent of the regulation. If it does not, then the regulation itself has loopholes. The question boils down to, if we pass a

regulatory audit of our investigation practices, does that ensure the patient will be any safer? No.

For the many that will read this paper they will be able to reflect on their own experiences under such conditions. They will see, think back and realize that success was tied to passing the audit as opposed to linking their analysis effort to how the patient was made safer. This author has been unable to find credible studies that indicate that a compliant organization’s patients are substantially any safer than a non-compliant organization’s patients. What happened to the direct link to patient safety? It has been lost to the desire for compliance and securing funds to maintain the status quo. The concept of true Root Cause Analysis has been replaced with the concept of Shallow Cause Analysis.

**Analytical Process Review: Shallow Cause Analysis?**

Shallow Cause Analysis (SCA) represents a less disciplined approach to patient safety than true Root Cause Analysis (RCA). Many of the tools on the market today that are being referred to as Root Cause Analysis, fall short of the essential elements of an RCA. Typical tools in this category are the 5-Why’s, the fishbone diagram and many form based RCA checklists. Many of these tools came from the Quality initiatives, which flourished in the 70’s and 80’s and remain ingrained in American corporations today.

We refer to these as tools and just like tools in a toolbox; we must use the right tool for the right project. Therefore we must have a clear understanding of the scope of the project before deciding which tool is most appropriate. When determining the breadth and depth of analysis required, we must explore the magnitude and severity of the undesirable event at hand. Typically, we would not conduct formal RCA on events, but rather their consequences. If we have an event occur, an undesirable outcome of some sort, then its priority is usually proportional to the severity of its consequences.

When is it appropriate to use brainstorming versus troubleshooting versus problem solving versus root cause analysis? While a hundred definitions likely exist for each of these terms, we choose to use the following ones:

**Brainstorming**: A technique teams use to generate ideas on a particular subject. Each person in the team is asked to think creatively and write down as many ideas as possible. The ideas are not discussed or reviewed until after the brainstorming session.

**Troubleshooting**: To identify the source of a problem and apply a solution to "fix it".

**Problem Solving**: The act of defining a problem; determining the cause of the problem; identifying, prioritizing and selecting alternatives for a solution; and implementing a solution.

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2 [http://www.asq.com](http://www.asq.com), American Society of Quality
3 [http://www.fairfield.k12.ct.us/develop/cdevelop02/glossary.htm](http://www.fairfield.k12.ct.us/develop/cdevelop02/glossary.htm)
4 [http://www.asq.com](http://www.asq.com), American Society of Quality
**Root Cause Analysis**[^5]: A method used to identify and confirm the causes of performance problems or adverse trends and identifies the associated corrective actions needed to prevent recurrence of the causes. Root Cause Analysis (RCA) techniques apply investigative methods to unravel complex situations to determine root causes of performance problems, identify associated causal factors, check for generic implications of an event, determine if an event is recurrent, and to recommend corrective actions.

In order to recognize what is Root Cause Analysis and what is NOT Root Cause Analysis (Shallow Cause Analysis), we would have to define what criteria must be met in order for a process and its tools to be called Root Cause Analysis. The following are the essential elements[^6] of a true Root Cause Analysis process:

1. Identification of the Real Problem to be Analyzed in the First Place
2. Identification of the Cause-And-Effect Relationships that Combined to Cause the Undesirable Outcome
3. Disciplined Data Collection and Preservation of Evidence to Support Cause-And-Effect Relationships
4. Identification of All Physical, Human and Latent Root Causes Associated with Undesirable Outcome
5. Development of Corrective Actions/Countermeasures to Prevent Same and Similar Problems in the Future
6. Effective Communication to Others in the Organization of Lessons Learned from Analysis Conclusions

Brainstorming is traditionally where a collection of experts throw out ideas as to the causes of a particular event. Usually such sessions are not structured in a manner that explores cause and effect relationships. Rather people just express their opinions and come to a consensus on solutions. When comparing this approach to the essential elements listed above, brainstorming falls short of the criteria to be called RCA and therefore falls into the Shallow Cause Analysis category.

Troubleshooting is usually a “band-aid” type of approach to fixing a situation quickly and restoring the status quo. Typically troubleshooting is done by individuals as opposed to teams and requires no proof or evidence to back up assumptions. This off-the-cuff process is often referred to as RCA, but clearly falls short of the criteria to qualify as RCA.

Problem Solving comes the closest to meeting the RCA criteria. Problem Solving usually is team based and uses structured tools. Some of these tools may be cause and effect based some may not be. Problem solving oftentimes falls short of the RCA criteria because it does not require evidence to back up what the team members hypothesize. When assumption is permitted to fly as fact in a process, it is not RCA.

[^5]: [http://www.alwaysimproving.com](http://www.alwaysimproving.com)
    [www.proactforhealthcare.com](http://www.proactforhealthcare.com)
Figure 1: Comparison of Analytical Processes to RCA Essential Elements

<table>
<thead>
<tr>
<th>Analytical Process</th>
<th>Disciplined Data Collection Required?</th>
<th>Typically Team (T) Versus Individual (I) Based</th>
<th>Formal Cause And Effect Structure</th>
<th>Requires Validation of Hypotheses Using Evidence</th>
<th>Identification of Physical (P), Human (H) and Latent (Latent) Root Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstorming</td>
<td>N</td>
<td>T</td>
<td>N</td>
<td>N</td>
<td>P or H</td>
</tr>
<tr>
<td>Troubleshooting</td>
<td>N</td>
<td>I</td>
<td>N</td>
<td>N</td>
<td>P</td>
</tr>
<tr>
<td>Problem Solving</td>
<td>N</td>
<td>T</td>
<td>N</td>
<td>N</td>
<td>P or H</td>
</tr>
<tr>
<td>Root Cause Analysis</td>
<td>Y</td>
<td>T</td>
<td>Y</td>
<td>Y</td>
<td>P, H &amp; L</td>
</tr>
</tbody>
</table>

**Analytical Tools Review**

The goal of this description is not to teach how to use these tools properly, but to demonstrate how they can lack breadth and depth of approach. Analytical tools are only as good as their users. Used properly, any of these tools can be used comprehensively to produce good results. However, experience shows the attractiveness of these tools is actually their drawback as well. These tools are typically attractive because they are quick to produce a result, require few resources and are inexpensive. These are the very same reasons they often lack breadth and depth.

Let’s start with the 5-Whys. While there are varying forms of this simplistic approach, the most common understanding is the analyst is to ask the question “WHY?” five times and they will uncover the root cause.
The form this approach may look like is as follows:

![Diagram](image)

**Figure 2: The 5-Why’s Analytical Tool**

There is a reason we do not hear about the NTSB investigator’s using the 5-Why approach in the course of their investigation. The main flaws with this concept are that failure does not always occur in a linear pattern. Multiple factors combine laterally to allow the undesirable outcomes to occur. Also there is never a single root cause and this is a misleading aspect of this approach. People tend to use this tool by themselves and not in a team and rarely back up their assertions with evidence.

The fishbone diagram is the second popular analytical Quality tool on the market. This approach gets its name from its form, which is the shape of a fish. The spine of the fish represents the sequence of events leading to the undesirable outcome. The fish bones themselves represent categories that should be evaluated as to having been a contributor to the sequence of events. These categories change from user to user. The most popular categories tend to be:

- The 4 M’s:
  - Methods, Machines, Materials, Manpower
- The 4 P’s:
  - Place, Procedure, People, Policies
- The 4 S’s:
  - Surroundings, Suppliers, Systems, Skills
The fishbone is often a tool used for brainstorming. Team members decide on the categories and continue to ask what factors within the category caused the event to occur. Once these factors are identified then they ask why the factors occurred and so on.

As a brainstorming technique this tool is less likely to depend on evidence to support hypotheses and more likely to let hearsay fly as fact. This process is also not cause-and-effect based, but categorically based. The users must pick the category set they wish to use and throw out ideas within that category. If the correct categories for the event at hand were not selected, key root causes could be missed.

The PROACT\(^7\) Logic Tree is representative of a tool specifically designed for use within RCA. The logic tree is an expression of cause and effect relationships that queued up in a particular sequence to cause an undesirable outcome to occur. These cause and effect relationships are validated with hard evidence as opposed to hearsay. The data leads the analysis, not the loudest expert in the room. The strength of the tool is such that it can, and is, used in court to represent solid cases.

A logic tree starts off with a description of the facts associated with an event. These facts will comprise what is called the Top Box (the Event and the Modes). Modes are the manifestations of the failure and the Event is final consequences that triggered the need for an RCA. While we may know what the Modes are, we do not know how they were permitted to occur. So we proceed with the questioning of how could the Mode have occurred?

Many have been conditioned to ask the question why during such analyses. However, using this methodology the question used is how could? When looking at the differences between these two questions we find that when simply asking why we are connoting a singular answer and to a point, an opinion. When asking how could we are seeking all the possibilities (not only the most likely) and evidence to back up what did and did not occur.

\(^7\) PROACT is a registered trademark of Reliability Center, Inc. (www.reliability.com)
This questioning process is reiterative as we follow the cause-and-effect chain backwards. Simply ask the questions, answer them with hypotheses and use evidence to back it up. This holds true until we uncover the Human Roots or the points in which a human made a decision error. Human Roots represent errors of omission or commission by the human being. Either we did something we should not have or we did not do something we should have done. At this point we are exploring the reasoning of why someone made the decision they did.

This is an important point in the analysis because we are seeking to understand why someone thought the decision they made was the correct one. At this point in the analysis we do switch the questioning to why because we are exploring a set of answers particular to an individual or group. Our answers are what we call Latent Root Causes or the organizational systems in place to help us make better decisions. The Latent Roots represent the rationale for the decision that triggered the consequences to occur. These are called latent because they are always there laying dormant. They require a human action to be triggered and when triggered, they start a sequence of Physical Root Causes to occur. This error-chain continues if unbroken to the point that it results in an adverse outcome that requires an immediate response.

As can be told from this description, the logic tree approach is certainly cause-and-effect related, requires evidence to back up what people say and requires the depth of understanding the flaws in the systems that contributed to poor decisions.

The failure of a process to achieve its designed objective has to do with the design of the linkages between steps in the process: how the steps relate to one another – the hand-offs. It is the interrelationships that are themselves prone to failure and that propagate the effects of a failure to other parts of the process, often in ways that are unexpected (side effects) or not immediately evident (long-term effects). The logic tree’s strict adherence to graphically representing these tightly coupled relationships makes it more accurate than the other tools described for that reason.

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In addition to these most commonly used approaches described above, many simply use form-based Root Cause Analysis. This is basically a one size fits all mentality. It is root cause by the numbers similar to painting-by-the-numbers. The same questions are asked no matter the incident and opinions are input as acceptable evidence. Checklists are often provided which give people the false sense that the correct answer must be within the listed items. No “pick-list” RCA process can ever be comprehensive enough to consider all the possibilities that could exist in each working environment. However the innate human tendency to follow the path of least resistance makes using pick lists very attractive. As noted author Eli Goldratt says, “An expert is not someone that gives you the answer, it is someone that asks you the right question”. That is exactly what RCA is all about.

Many people choose to use form-based RCA systems because the regulatory authority seeking compliance provides them free of charge and suggests they be used. The paradigm is that “we are using their forms so we will have a better chance of complying if we use them”. This may indeed be true, but does not mean the analysis was comprehensive enough to ensure the undesirable outcome will not recur. Hence, once again, compliance does not necessarily ensure patient safety!

**Technology Review**

All of the aforementioned tools can either be applied manually using a paper-based system, or automated using a form or fashion of software. One point we need to make clear is that software IS NOT a panacea for any analysis. We liken this to Microsoft Word\textsuperscript{®}\textsuperscript{10}, if you do not know English, it is of little value. The same hold true for RCA

\textsuperscript{10} MS Word is a registered trademark ® of the Microsoft Corporation
software, if the analyst does not understand proper investigative methodology and technique, software will be of little value.

**Paper-Based Approach:** Experience shows most of the time such analyses are conducted using paper-based approaches (easel pad and post-its). This leads to a double handling of data and a time lag. After the team meeting, some poor sole must then re-input the data from the easel pads into an appropriate program (i.e. – word processor, graphics program or spreadsheet program). Then usually about a week later the information is disseminated to the team members for them to review and conduct their assigned tasks.

When we first entered the healthcare markets this is one point that stood out. Analysts were reporting their RCA’s were taking an average of three (3) to six (6) months. Having been in this business for over 20 years and involved in hundreds of analyses, this seemed excessive and it was likely due to inefficiencies of the analysis process. As this was investigated it was found that most the of reasons these analyses took so long was because of 1) inability of the whole team to meet on a regular and timely basis, 2) when meetings were scheduled, not everyone attended, 3) when meetings were scheduled those that did show up were not prepared and 4) when meetings were held a disciplined process was not being used and the team saw no end to the analysis (therefore became disinterested).

Once paper-based analyses were completed, they were then presented, distributed and put into a hard file somewhere. One of the greatest advantages any organization can get from RCA is to raise the knowledge and skills of their workforce regarding how failures have occurred in the past. This is often referred to as lessons learned in the nuclear industry.

**Software-Based Approach:** The primary value of software is to efficiently document and disseminate information. Technology is more effective than humans in enhancing process consistency and in receiving, storing and processing information. Technology does not take shortcuts. It is not influenced by emotion. And it has the advantage of being a long-term improvement in contrast to risk-reduction strategies that, say, focus on staff retraining.  

Software can eliminate the double handling of data related to any analysis. Experience shows that this cuts the analysis time in half on average, simply due to conducting the analysis in a more efficient manner and, getting people information quicker and reducing the amount of team member time required per analysis.

Software also provides great flexibility in storage of analyses. All analyses can be stored in a single database that can be mined for lessons learned. For instance if we would like to search the data base (often called data mining) for all analyses conducted on ADE’s in the ER at BAC Hospital, we can easily do so to see how others have approached a similar problem we may be experiencing. Effective use of this sharing is often referred to as knowledge management or corporate memory.

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However, as with all advantages there come some disadvantages. Technology itself can intimidate people and create a resistance to their using it. We tend to trust humans as opposed to machines. For instance, “pilots tend to listen to the air traffic controller (as opposed to messages they receive from a machine) because they trust a human being and know that a person wants to keep them safe.”

No matter the analytical process used, the tools employed in the execution or technology used; if the craftsman [analyst] using the tool is not educated properly the tool will not function to its fullest capability. Analysts must have a complete understanding as to the difference between a shallow cause analysis and a root cause analysis. Without knowing the differences, how can they be sure they can be credible and thorough? If they are not sure they have captured all of the contributing causes they cannot ensure the undesirable will not happen again. Analysts must also have the desire and the will to find the whole truth and settle for nothing less. The problem with this purist approach is that many in the organization do not want to know the truth – that is another paper!

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Case Study

Case Study Background: A 65 year old man was admitted with hemoptysis in October 20XX. He underwent a right upper lobectomy in December 19XX. His final diagnosis was adenocarcinoma (T1NoMo). He received radiotherapy and chemotherapy for recurrent malignancy in August of 20XX.

During this admission he was found to have bleeding from an obstructing tumor of the right main stem bronchus. Laser bronchoscopy was performed in October 20XX. During the procedure, endobronchial fire occurred. This was treated with prompt removal of bronchoscope and endotracheal tube. The patient was reintubated and irrigated with Normal Saline. The patient survived this event, but died in July of 20XX from metastatic lung cancer.

Analyzing Method #1: The 5-Whys Approach - Sample

```
Endotrachial Fire During Bronchoscopy

Fire Initiated in Right Bronchus

Fuel Source Present in Right Bronchus

Nitrogen Used to Ventilate Chamber

Too Much Nitrogen Introduced
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Analyzing Method #2: The Fishbone Diagram Sample

Methods
- Bronchoscopy Procedure Issue
  - Anesthetic Procedure Issue
  - Scheduling/Timing Issue
  - Overload
- Nitrogen Issue
- Foreign Debris/Contamination

Machines
- Faulty Bronchoscope Source
  - Endotrachial Tube Issue
    - Fiber Optic Assembly Issue
    - Manufacturer
- Anesthesiologist Error
  - Inexperienced
- Surgeon Error
  - Fatigued

Materials

Manpower

Fire in Endotrachial Tube During Bronchoscopy
Analyzing Method #3:
PROACT Logic Tree

OR/ Patient Fire - Sentinel Event

Endotrachial Fire During Yag Laser

Fire Occurred Prior to Procedure

Fire Occurred During Procedure

Fire Occurred After Procedure

Fire Initiated inside the Right Bronchus

How Could?

Fire Initiated Outside the Right Bronchus

How Could?

Presence of Sufficient Oxygen

How Could?

Presence of Sufficient Fuel

How Could?

Presence of Sufficient Ignition

How Could?

Sufficient Fuel Source Within Patient

Smoldering Tumor Causing Smoke Plume

Laser Mis-Fired In Bronchoscopy Tube Oper. Channel

Contaminated Operating Channel

Contaminated During Cleaning Process

Chemical Contamination

QC Issue - Failure to Detect Contamination

Why?

Decision to Clean Equipment Using Flammable Agent

Decision in Accordance with Procedure

Decision Not in Accordance With Procedure

Why?

Current Procedure Inappropriate

Why?

Sufficient Fuel Source Introduced Into Patient

Bronchoscope Source

Laser and Fiber Optic Assembly Damaged

Suff. Additional Gases Intro’d And Exposed To Laser

ET Tube Ignited

Foreign Debris

Why?

Sufficient Fuel Source On OR Staff

Sufficient Fuel Source within Atmosphere

How Could?

Sufficient Fuel Source Within Patient

Smoldering Tumor Causing Smoke Plume

Laser Mis-Fired In Bronchoscopy Tube Oper. Channel

Contaminated Operating Channel

Contaminated During Cleaning Process

Chemical Contamination

QC Issue - Failure to Detect Contamination

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QC Issue - Failure to Detect Contamination

Why?

Decision to Clean Equipment Using Flammable Agent

Decision in Accordance with Procedure

Decision Not in Accordance With Procedure

Why?

Current Procedure Inappropriate

Why?
Based on the above examples of the various tools applied to the same situation, we could construct a “filter” of what tools would have likely identified which root causes and which tools likely would not pick up other root causes.

<table>
<thead>
<tr>
<th>Root Causes Identified</th>
<th>5-Whys</th>
<th>Fishbone</th>
<th>PROACT RCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too Much Nitrogen Introduced</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Anesthetic Procedure Issue</td>
<td></td>
<td>X</td>
<td>Evidence proves this not to be true</td>
</tr>
<tr>
<td>Fiber Optic Assembly Issue</td>
<td></td>
<td>X</td>
<td>Evidence proves this not to be true</td>
</tr>
<tr>
<td>Anesthesiologist Error</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Contaminated Operating Channel of Brochoscope Source</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contamination During Cleaning Process Using Flammable Agent</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Purchasing Pressures to Reduce Cost</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>No QC Review Process in Place When Evaluating New Vendor’s Offerings</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Failure to Detect Contamination Prior to OR Use</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>No QC Inspection of Cleaned Instruments Prior to Use in OR</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Sufficient Additional Gases Introduced and Exposed to Laser</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Mismanagement of Anesthetic Gases</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**Conclusion:**

The use of the 5-Whys leads users to believe only one root cause exists. Since evidence is not normally required to validate this string of logic, that one (1) cause could likely be wrong.

The fishbone, while more exploratory than the 5-Whys, is a brainstorming technique that relies solely on the input of the team to serve as fact. Because it is not strictly cause-and-effect based, but category based, a path to failure is murky at best. Because hearsay is the primary evidence, the limited causes identified could also very well be wrong (similar to trial-and-error).

The PROACT Logic Tree is more comprehensive because it attempts to “rewind the video” of the event happening. It is starting with facts and reeling backwards from that point on (just like a detective’s investigation). Evidence collected will determine what did and did not occur, not hearsay. The logic tree will drill past the physical and human levels to uncover the systems issues or the latent root causes that influenced decision-making. Without correcting the systems issues, we will likely run the risk of recurrence of the event somewhere, sometime. By correcting the systems issues we will correct the
undesirable behaviors (decision-making processes) that triggered the physical consequences to occur and eventually harm the patient.

A recent article from Governing.Com published and entitled *Plague of Errors - Hospital infection rates are rising and killing 90,000 patients a year. Can the states put a stop to it?* In this article the following statement is made regarding the results of a doctor’s use of true Root Cause Analysis, “…By drilling down to the root cause(s) of the problem, Shannon’s [Dr. Shannon] team managed to identify causes that might otherwise have gone undetected. In the year before Shannon instituted his reforms, 37 patients developed central-line infections, and 51 percent of those died. In the year that followed the implementation of his team’s reforms, only 6 patients developed an infection, and only one of those patients died.” Would we have been able to make such claims if we had used only Shallow Cause Analysis approaches? RCA saves lives, money and time!

When evaluating which RCA processes are best for your organization be sure not to let factors such as cost, minimum compliance, time and ease trump the important characteristics of value, comprehensiveness, patient safety and efficiency. Otherwise as the old adage goes, we will face the “pay me now or pay me later” scenario and this is dangerous when lives are at stake.

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13 Buntin, John. “*Plague of Errors - Hospital infection rates are rising and killing 90,000 patients a year. Can the states put a stop to it?*” [http://governing.com/articles/8med.htm], 2005.