Beyond FMEA: The Structured What-If Technique (SWIFT)

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Abstract

Although it is probably the best-known Prospective Hazard Analysis (PHA) tool, Failure Mode and Effects Analysis (FMEA) is far from the only option available. This paper introduces one of the alternatives: The Structured What-If Technique (SWIFT). SWIFT is a flexible, high-level risk identification technique that can be used on a standalone basis, or as part of a staged approach to make more efficient use of bottom-up methods like FMEA.

In this paper we describe the method, assess the evidence related to its use in healthcare using a systematic literature review, and suggest ways in which it could be better adapted for use in the healthcare industry. Based on the limited evidence available, it appears that healthcare workers find it easy to learn, easy to use, and credible. Especially when used as part of a staged approach, SWIFT appears capable of playing a useful role as component of the PHA armamentarium.

Background

Patient safety risk management has traditionally been retrospective in nature, aimed at solving problems that have already occurred. Root cause analysis is perhaps the best-known example of this approach. There is broad consensus in the wider risk management community that waiting for something to go wrong before developing preventive measures is not enough, and since the mid 1960's, a number of prospective hazard analysis (PHA) techniques have been developed in other high-risk industries. It wasn't until the 1990's, however, that they began to make their way into the healthcare sector, and it was not until 2001 that the Joint Commission began requiring their use by organizations they accredit. [1]

One of the most widely-used formal PHA techniques in healthcare is *Failure Mode and Effects Analysis* (FMEA), [2] and its siblings, Healthcare *Failure Mode and Effects*

Analysis (HFMEA); [3] and *Failure Mode, Effects, and Criticality Analysis* (FMECA). [4] But, while FMEA may be the first method to come to mind when many healthcare risk managers consider PHA, it is far from the only method available.

Through its Patient Safety Research Portfolio, the UK Department of Health funded a research project that led to the development of a Prospective Hazard Analysis (PHA) Toolkit to support the integration of PHA techniques into healthcare risk management. [5] The PHA Toolkit includes a new method: The Preliminary Risk Review (PRR), which provides an initial risk assessment, and also serves as a scoping and screening tool, helping users to determine which parts of the system or process of interest require a more in-depth analysis. [5,6]

This research also identified a number of existing PHA techniques and supporting techniques that might be usefully applied to the healthcare sector, and prioritized ten of these for initial inclusion in the toolkit. (See Text Box 1 for the full list.) This paper introduces one of these methods: *The Structured What-If Technique* (SWIFT). [7,8]

Text Box 1. Pre-existing PHA and Supporting Methods Included in the PHA Toolkit [5]

- Hazard and Operability Studies (HAZOP)
- The Structured What-if Technique (SWIFT)
- Human Error Assessment and Reduction Technique (HEART)
- Failure Mode and Effects Analysis (FMEA)
- Barrier Analysis
- Influence Diagrams
- Fault Tree Analysis (FTA)
- Event Tree Analysis (ETA)
- Absolute Probability Judgment (APJ)
- Risk Matrices

The Structured What-If Technique (SWIFT)

Introduction

The *Structured What-If Technique* (SWIFT) is a systems-based risk identification technique that employs structured brainstorming, using pre-developed guidewords / headings (*e.g., timing, amount, etc.*) in combination with prompts elicited from participants (which often begin with the phrases "What if…" or "How could…"), to examine risks and hazards at a systems or subsystems level. This differentiates it from its precursor, the hazard operability studies (HAZOP) method, which is similar, but which identifies hazards through a detailed review of low-level processes, subcomponents of equipment, etc. [8]

SWIFT is essentially a magnifying glass to HAZOP's (or FMEA's) microscope. By focusing on high-level processes, it can often be conducted more quickly than more detail-oriented methods. Indeed, one industry source reports that a SWIFT risk assessment can be conducted in as little as one-third the time required for a HAZOP-based approach, [9] a result that was replicated in a study comparing SWIFT to HFMEA in a healthcare setting. [10] This time savings is a significant advantage. The corresponding disadvantage is that some hazards may be overlooked when using the SWIFT approach that would be identified using the more detail-oriented HAZOP or FMEA. [10]

SWIFT need not be used on a standalone basis, however. As with the PRR described above, it can be used as the first part of a staged approach to quickly identify processes and subsystems for which it would be worth the investment of conducting an FMEA, HAZOP, FTA or other detail-oriented risk assessment. This approach has the potential to significantly reduce the overall amount of time and tedium [11] involved, without sacrificing rigor. Similarly, while the outputs of a SWIFT are qualitative, the technique can be used to identify sub-systems/processes that could benefit from a quantitative PHA approach. [12]

Because SWIFT is a workshop-based technique in which potential risks are elicited from participants, it is important to assemble the right team when using this approach; ideally this should include the representation of all stakeholder groups and those with the most intimate knowledge of the system or process being assessed (often frontline workers). SWIFT is very dependent on participants' knowledge of the systems and processes being assessed. In addition to producing a more valid risk assessment, including these participants can have another important benefit: Participating in the SWIFT can enhance commitment to new and existing risk controls. [12]

Procedure

The methodological contribution of SWIFT is as a technique for hazard identification (when asking *"How could…"*), and risk identification (when asking *"What if…"*). But in practice it is typically supplemented by risk analysis (*i.e.,* characterizing and estimating the risk [13]), risk evaluation (*i.e.,* determining whether the risk is acceptable, or requires action [13]), and risk treatment planning (*i.e.,* developing and assessing action plans to control risk [13]). [12]

The risk analysis and risk control generation are often generic (using no particular method), while the risk evaluation and risk control evaluation typically use a real or implied risk matrix. Alternately, a more rigorous assessment may be undertaken in which a supporting technique such as Barrier Analysis [5,12,14] or Influence Diagrams, [5,15,16] is substituted for the generic risk analysis. A suggested procedure for conducting a risk assessment using SWIFT is illustrated in Text Box 2.

Text Box 2. A Procedure for a Risk Assessment Using SWIFT (Based on the PHA Waterfall Model)[5]

1. ***Prepare the Guidewords***
   The facilitator should select a set of guidewords to be used in the SWIFT

2. ***Assemble the Team***
   Select participants for the SWIFT workshop based on their knowledge of the system / process being assessed and the degree to which they represent the full range of stakeholder groups

3. ***Background***
   Describe the "trigger" for the SWIFT (*e.g.,* a regulatory change, an adverse event, etc.)

4. ***Articulate the Purpose***
   Clearly explain the purpose to be served by the SWIFT (*e.g.,* to improve patient satisfaction scores)

5. ***Define the Requirements***
   Articulate the criteria for success (*e.g.,* No lost revenue over the next 5 years from reduced compensation as a result of low patient satisfaction scores)

6. ***Describe the System***
   Provide high-level textual and graphical descriptions of the system or process to be risk assessed. Do not get bogged down in detail.

7. ***Identify the Risks / Hazards***
   This is where the Structured What-If Technique is applied. Use the guidewords / headings to each system, high-level subsystem or process step in turn. Participants should use prompts starting with the phrases like "What if…" or "How could…" to elicit potential risks / hazards associated with the guideword.

   For instance, if the process is "*Keep the patient informed about his or her condition*," and the guideword is "*time, timing or speed*," prompts might include: *"What if the patient is told about his or her condition while still sedated?"* (wrong time) or *"How could the patient be left waiting too long without an update on his or her condition?"* (wrong timing).

8. ***Assess the Risks***
   Using either a generic approach or a supporting risk analysis technique, estimate the risk associated with the identified hazards. In light of existing controls, assess the likelihood that they could lead to harm and the severity of harm they might cause. Evaluate the acceptability of these risk levels, and identify any aspects of the system that may require more detailed risk identification and analysis.

9. ***Propose Actions***
   Propose risk control action plans to reduce the identified risks to an acceptable level.

10. ***Review the Process***
    Determine whether the SWIFT met its objectives, or whether a more detailed risk assessment is required for some parts of the system.

11. ***Overview***
    Produce a brief overview document to communicate the results of the SWIFT.

12. ***Additional Risk Assessment***
    Conduct additional risk assessments using more detailed or quantitative techniques, if required.

Use of SWIFT in Healthcare

We conducted a systematic literature review on 09 January 2012 to identify papers describing the use of SWIFT in healthcare risk management. Table 1 describes the search strategy.

Databases Queried	Search Terms
EMBASE Medline PsycINFO CINAHL Health Business Elite	"Structured What-If Technique" (In any field) "Structured What If Technique" (In any field)

Table 1. Literature Review Search Strategy

Papers were assessed to determine: The guidewords used; the amount of time invested; the participants perceptions of the technique; and whether SWIFT was paired with the use of a method to support risk control generation and analysis.

This search resulted in two hits, only one of which described the use of SWIFT in healthcare. [7] (The other was an advertisement.) We were also aware of two reports from the gray literature (i.e., research reports not available from bibliographic databases like those above) that described the use of SWIFT in healthcare. [5,10] Interestingly, all three studies took place within the UK.

Peer Reviewed Journal Article

The article by Smith, et al. [7] describes the use of SWIFT to identify risks in a system with a very broad scope:

"Nonoperative risks associated with adult elective surgery under general anaesthesia."

It is difficult to imagine addressing a problem of the same breadth with FMEA, given the technique's time-intensive and detail-oriented nature. Even using SWIFT, this assessment required the UK National Patient Safety Agency (NPSA) to convene panels of experts in a series of sessions over five days totaling somewhere between 240 and 300 person-hours (30 hours of total session time, with 8-10 participants per session). If a SWIFT can be assumed to take approximately one-third the time of an FMEA, this would imply that it would require on the order of 800 person-hours to assess this system using an FMEA.

The authors described the guidewords used as:

"environmental factors, human causes, operating errors, maintenance/calibration, health and safety, communications, etc."

Their study identified 102 risks, and resulted in 95 risk control recommendations.

As with other risk assessment techniques (*e.g.,* RCA [17] or FMEA [18]), SWIFT does not provide direct support for the generation or analysis of robust risk controls. Nor was a separate risk control method used to support this step. This is reflected in one of the limitations noted by the authors, namely:

> *The high priority given in many of the recommendations to awareness of risks and training to reduce them. These are superficially cheap and easy solutions but can serve to divert attention away from underlying system factors to the people who are closest to the patient, those whose actions are most likely to lead to a visible adverse event.*

The authors describe SWIFT as "…straightforward to learn and easy to use," and noted as a positive side effect the fact that the participants learned a lot from each other during the sessions; in fact, many of the proposed actions focused on the dissemination of risk controls that were already being used by some participants. They also suggested that risk assessments with a broad scope could lead to more systemic risk control than taking a single-issue focus. Based on the findings of this paper, SWIFT, with its relative speed and its ability to serve as a scoping and screening tool, would appear to be a good tool for this job.

Gray Literature

A Comparison with HFMEA

As part of a broader study of e-health, researchers in the UK compared the use of SWIFT and HFMEA to examine the risks involved in the technologies used in an anticoagulant service. [10] SWIFT was used in this case as a standalone method, not *with* HFMEA as in the staged approach, but in parallel, as a way of testing the methods against one another.

In order to make the comparison as rigorous as possible, the researchers allocated each method to one of two groups of volunteers; the volunteers in each group were matched in terms of profession and seniority. The same facilitators led both sessions, and these were conducted one right after the other, so the two groups were not able to communicate with one another until both had finished.

The SWIFT took 2 hours, while the HFMEA required 5.5 hours (plus a 30 minute lunch break, for a total of 6 hours). Participants provided positive feedback for both methods. They were satisfied with the process, and confident in the results; however, those results differed significantly between the two methods. Although there were many areas of agreement between the two methods, more than 50% of the risks identified by each method were not picked up using the other approach. And both produced results that were significantly different from what the researchers found through RCA and ethnographic research.

These findings contribute to a growing consensus in the research literature that accurate risk identification in healthcare requires the triangulation of data from multiple sources. [19–23] Using SWIFT as part of a staged approach *with* FMEA might therefore be, not only more efficient, but also more *effective* than using either alone.

The guidewords used were not described, and SWIFT was not used in combination with any method to support the risk control process.

PHA Toolkit Evaluation

As part of the evaluation research for the PHA Toolkit, two pilot case studies were conducted in which SWIFT was one of the components used. Among the guidewords used were:

> *too soon / too late / doesn't happen / wrong order, etc.*

Both of these case studies included the use of more than one PHA method, and did not aim to assess SWIFT, as such. And in both cases, artificial time constraints imposed by the nature of the study meant that the risk assessments could not be fully completed. However, the participants generally found the technique credible and easy to use.

SWIFT was not used in combination with any method to support the risk control process.

Adapting SWIFT for the Healthcare Sector

Guidewords for a More Complex Environment

SWIFT originated in the chemical process industry, as a faster and easier alternative to HAZOP. [12] Healthcare is generally considered to be a far more complex system, and some of the original guidewords for SWIFT (see Textbox 3) may be confusing or difficult to apply to the healthcare environment. The method is flexible, however, and the facilitator can choose any guidewords that seem appropriate. A proposed set of guidewords is shown in Textbox 4.

Textbox 3. Original SWIFT Guidewords [8]

The Original SWIFT Guidewords

- Material problems
- External events or influences
- Operating errors and other human factors
- Analytical or sampling errors
- Equipment or instrumentation malfunction
- Process upsets of unspecified origin
- Utility failures
- Integrity failure or loss of containment
- Emergency operations
- Environmental release

Text Box 4. Proposed Guidewords for SWIFT in Healthcare

Proposed Guidewords for SWIFT in Healthcare

Wrong: **Person or people**

Examples: *Wrong patient surgery, Referral to the wrong specialist, Treatment delivered by staff suffering from fatigue*

Wrong: **Place, location, site or environment**

Examples: *Wrong site surgery, Retained surgical sponges, Failure to isolate a patient with SARS, Unwarranted patient discharge, Poor lighting*

Wrong: **Thing or things**

Examples: *Poorly-designed equipment, Wrong medication, Wrong syringe,*

Wrong: **Idea, information, or understanding**

Examples: *Poor communication at handoff, Patient misinformed, Incorrect understanding of who is responsible for a given function*

Wrong: **Time, timing, or speed**

Examples: *Treatment is not delivered in a timely manner, Patient is not given time to process a cancer diagnoses before the appointment ends, Medication not delivered on schedule*

Wrong: **Process**

Examples: *Wrong surgical procedure performed, Failure to perform a suicide risk assessment for a mental health patient, Work-arounds used to avoid complying with safety procedures*

Wrong: **Amount**

Examples: Understaffing, Drug overdose, Drug shortages, Capacity shortfalls during a disaster

Another option might be to use the category headings from the NPSA Fishbone Diagram Tool: *Patient factors, Individual (staff) factors, Task factors, Communication factors, Team factors, Education and training factors, Equipment and resources, Working condition factors, Organizational and strategic factors.* [24]

Risk Control Generation and Analysis

Like other commonly-used risk assessment methods, [17] SWIFT originated in an industrial setting, where its use would typically be led by fully trained safety / reliability engineers. In that context, it is perhaps safe to assume that a good understanding of the risk will necessarily lead users to devise robust and appropriate risk controls. In healthcare, however, this tends not to be the case. As the paper by Smith et al., above, illustrates, healthcare workers find it very difficult to generate high quality risk controls, or to differentiate between those that will prove robust and those that are weak –or possibly even harmful. [14,25–30]

None of the papers we found described the use of a method to support the risk control process after a SWIFT. In this, it is no different from RCA [17] or FMEA. [18] There appears to be no widely-used method to support robust risk control in healthcare risk management, regardless of the risk assessment technique employed. There is a pressing need for the development of tools to support risk control after both prospective and retrospective risk assessment.

Cost-Effectiveness

When examining the same system, SWIFT appears to be considerably less time-consuming than FMEA, [9,10] and produces overlapping but different results. [10] In common with FMEA, it also produces different results from RCA and ethnographic research, even when examining the same system. [10] There is an increasing weight of evidence that comprehensive healthcare risk assessment requires the triangulation of data from multiple sources and techniques. [10,19–23] Additional research is required to define the most cost-effective role for each, including the correct balance between retrospective and prospective risk assessment methods in healthcare risk management.

Conclusion

The Structured What-If Technique (SWIFT) is a flexible, high-level risk identification technique that can be used on a standalone basis, or as part of a staged approach to make more efficient use of detail-oriented methods like FMEA. Based on the limited evidence available, it appears that healthcare workers find it easy to learn, easy to use, and credible. [5,7,10] Different risk identification methods produce different results, and triangulation between multiple methods is probably the best way to achieve an accurate understanding of the risks in a given system. [19–21] Especially when used as part of a staged approach, SWIFT appears capable of playing a useful role as a component of the PHA armamentarium.

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