

A Practice Guideline on Hazard Analysis Method Selection for Radiotherapy Departments

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ABSTRACT

Background Worldwide there are a lot of risk analysis methods present. However, these methods are not all applicable within the healthcare environment. Through the complex interplay of technology, professionals and patients quality management is specifically challenging within this radiotherapy environment. To make sure the efforts for hazard analysis are met by enhanced patient care it is important to choose the right approach and method.

Methodology Twelve hazard analysis methods that are already used by radiotherapy departments or assumed to be applicable were identified. This paper provides an overview of the twelve identified methods' characteristics resulting in recommendations to radiotherapy departments about when to use which method. Aiming to further increase the safety of the radiotherapy processes.

1 Introduction

As the importance of patient safety gained a greater focus within the healthcare community, risk management tools originally developed within non-healthcare areas were increasingly adapted for use [4]. Within the non-healthcare setting a wide range of methodologies are used with a limited number applicable to the healthcare setting and more specifically to radiotherapy. Defining the right approach and method within quality management will enhance the care patients receive [27]. However, radiotherapy presents an additional degree of complexity in quality management through the complex interplay of technology, professionals and patients [27]. An initial review of the techniques defined in relevant databases for healthcare

identified 12 accident investigation and analysis techniques for further review from which only 6 techniques achieved acceptable reliability [32].

In The Netherlands the PRISMA-RT system has been used extensively to improve the safety and quality of radiotherapy process. Within PRISMA-RT the gap between the healthcare safety practice and the increasing amount of published literature on the ever-growing number of risk analysis tools was identified, resulting in this article. The aim of this guideline is to help to increase the safety of radiotherapy preparation and delivery by providing a guide to professionals in choosing the optimal risk analysis tools for the investigations they carry out.

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2 Methods

Both retrospective and prospective analysis methods were used in this study. A list of methods already in use by the Dutch radiotherapy departments was compiled: [28]

Prevention, Recovery and Information System for Monitoring and Analysis for healthcare (PRISMA-medical);

TRIPOD-beta (TRIPOD-β);

Systematic Incident Reconstruction and Evaluation (SIRE);

Ishikawa (fishbone) diagrams;

Healthcare Failure Modes and Effects Analysis (HFMEA);

Bowtie analysis;

Hazard And Operability study (HAZOP);

Hazard Analysis and Critical Control Points (HACCP);

Enterprise Risk Management (ERM);

Functional Resonance Analysis Method (FRAM);

Systems-Theoretic Process Analysis (STPA);
& Video-reflexive ethnography.

For each of the identified methods a literature study was conducted to identify its purpose and traits and where it would be most appropriate in the proposed guideline flowchart. Each method was categorized for the applicability or possession of the following traits:

being a prospective or retrospective analysis method (used to analyze hazards within a process or to analyze unwanted events);

the mechanisms of the analysis method, either root-cause analysis, barrier analysis or systems theory (systemic analysis);

the ability of the analysis method to analyze novice processes;

& the amount of expertise needed to apply the method (either high or low).

3 Results

The results of the literature study into the properties of the different analysis methods is summarized in table 1. The detailed findings of the literature review can be accessed via the corresponding author. In

table 1 a minus sign (-) depicts a trait to be less applicable or not present for the specified analysis method. A plus sign (+) in table 1 depicts a trait to be more applicable or present for the specified analysis method.

Table 1: Summary of each method’s properties.

	Prospective method	Retrospective method	Root-cause analysis	Barrier analysis	Systems theory	Analysis of novice processes	Needed expertise
PRISMA-medical	-	+ [30]	+ [5]	-	-	-	+ [6]
TRIPOD-β	-	+ [17]	-	+ [11]	-	-	-
SIRE	-	+ [20]	+ [21]	+ [21]	-	-	+/-† [21]
Ishikawa	+ [1]	+ [1]	+ [19]	-	-	-	UK‡
VRE	-	+ [7]	-	-	+ [14] [15]	-	UK‡
HFMEA	+ [10]	-	+ [10]	-	-	-	+ [12]
Bowtie	+ [22]	+ [22]	-	+ [24]	-	-	+ [25]
HAZOP	+ [9, p11] [18, p9]	-	+ [9, p1-2]	-	-	-	+ [23]
HACCP	+ [13]	-	-	+ [13]	-	-	UK‡
ERM	+ [26]	-	-	-	-	+ [26]	+† [29]
FRAM	+ [31]	+ [31]	-	-	+ [8]	-	-
STPA	+ [2] [16]	-	-	-	+ [2]	+ [16]	+ [3]

† Dependent on the chosen analysis method.

‡ Unknown. Could not be determined.

Based on the properties of the investigated methods a flowchart was developed containing guiding questions to help determine the recommended analysis

method, see figure 1. To support departments in finding an analysis methods that fits the departments’ available expertise sub recommendations are also in-

incorporated in the flowchart.

4 Discussion

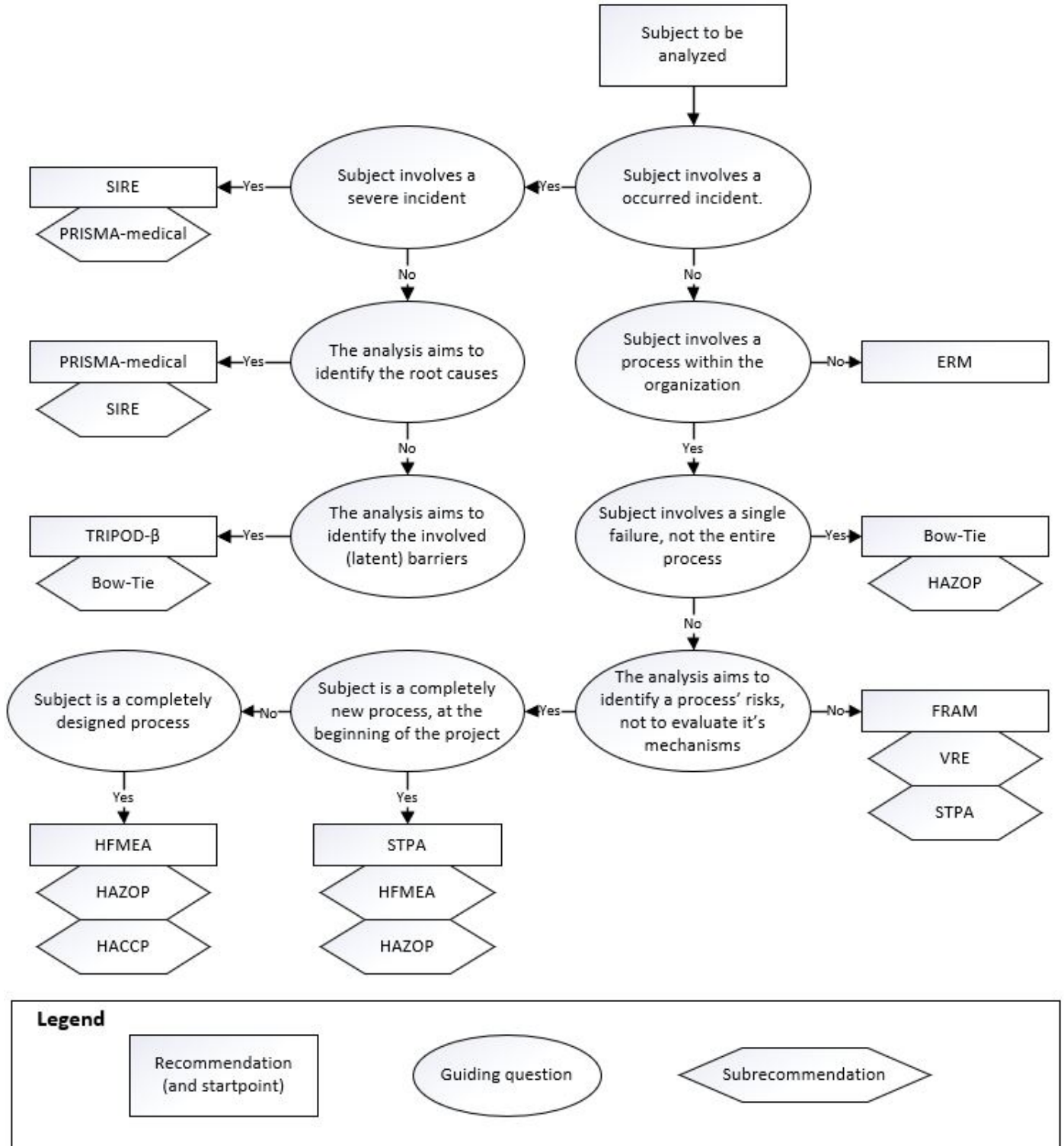
Choosing the right approach and method for performing analyses is important because it will make sure the efforts made will translate in better patient care. Nevertheless, it is important that not only the right choice but also the right execution is key in translating these efforts in better care. Having staff within one department who are well trained and knowledgeable for all the described methods would be nearly impos-

sible. Where the necessary expertise is not available then it is important to be able to identify alternative methods where the expertise is already available. The method should always be appropriate to achieve the determined goal. The flowchart guideline developed as part of the project will support departments in selecting both the primary and alternative method.

5 Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Figure 1: Guideline flowchart indicating which analysis method is recommended



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