

Criteria for Successful Occupational Health and Safety Risk Assessment: A Systematic Review

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ABSTRACT

It has become common practice in the workplace to assess occupational health and safety (OHS) risks with a variety of methods and standardized procedures. Although OHS risk assessment is widely applied in workplaces, its success is seldom assessed, and no criteria for this have been defined. This systematic literature review, carried out as per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement, sought to answer two research questions: RQ1 “What criteria exist, if any, to assess the success of OHS risk assessment?” and RQ2 “What factors support the success of the risk assessment?”. The review included articles published between 1971 and 2021 from the Scopus and Web of Science databases. A total of 13 studies were chosen for detailed qualitative review. Four studies presented some criteria for success, but these were non-transparent, lacking a clear indication of the origins of the results and the supporting evidence. Factors supporting the success of OHS risk assessment include hazard identification, employee involvement, access to stored data, training, hazard review, communication of results, general hazard awareness, workplace-specific hazard awareness, and situational awareness. In contrast, lack of time, criteria for risk assessment methods, and a company’s insufficient support in obtaining the necessary information in carrying out an objective risk assessment were mentioned as barriers. This review, therefore, showed that no plausible criteria for successful OHS risk assessment are currently available. Further research is thus recommended to determine the criteria for the success and success factors for OHS risk assessment.

Keywords: Risk assessment, Occupational health and safety, OHS, OSH, Success, Criteria

INTRODUCTION

Several methods for assessing occupational health and safety (OHS) risks have become common practice in the workplace, some of which are even standardized (Brocal and Reniers 2018; Khan and Abbasi 1998; SFS-EN IEC 31010 2019). Most of these risk assessment methods are related to, for example, process safety (Boonthum et al. 2014; Summers 2003), decision-making (Hopkins 2011), and assessment of risk acceptability and tolerability (Melchers 2001; Tchiehe and Gauthier 2017). Furthermore, various risk indicators and evaluation criteria for selecting risk metrics have been suggested (Johansen and Rausand 2014), and there are studies concerning the quality of risk analysis (Rouhiainen 1992). Some recent studies also highlight the factors

undermining the success of OHS risk assessment (Carter and Smith 2006; Nenonen et al. 2021).

Despite the vast literature on industrial risk assessment in general, little is known about the success criteria and factors of OHS risk assessments. In this study, a systematic literature review was conducted to elucidate the factors influencing the success of the OHS risk assessment process. The study's research questions were: RQ1 "What criteria exist, if any, to assess the success of OHS risk assessment?" and RQ2 "What factors support the success of the risk assessment?"

MATERIALS AND METHODS

A systematic literature review was conducted in January 2022 based on the updated Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Page et al. 2021). Such a review consists of a versatile search of all prospective relevant articles using clear and reproducible selection criteria (Cook et al. 1997). Two researchers formulated the research questions and decided to cover the years 1971–2021 and to include peer-reviewed and full-text articles from the Scopus and Web of Science databases. Search words were selected and combined using the logical operators AND and OR. The applied search-query strings were:

Scopus: TITLE-ABS-KEY(("risk assessment" OR (hazard AND (recognition OR identification)) AND ("occupational health and safety" OR ohs OR osh OR "occupational safety and health")) AND (criteri* OR success*)))

Web of Science: (((TS=("risk assessment" OR (hazard AND (recognition OR identification)))) AND TS=(("occupational health and safety " OR ohs OR osh OR "occupational safety and health"))) AND TS=((criteri* OR success*)))

The selection process followed the PRISMA 2020 flow diagram (Figure 1) (Page et al. 2021). One researcher searched the databases and transferred the data in csv format to MS Excel. No automation tools were used. The table consisted of publication information, abstracts, and keywords.

After duplicates were removed, 478 articles remained. A total of 316 articles were included based on their titles. The abstracts were then analyzed, and 30 articles were included. Six were unavailable. Hence, a total of 24 articles were read, looking for answers to the study's research questions. Notes for each article were added to the search table, as well as information regarding whether the article answered the research questions. A more detailed, qualitative analysis was conducted on 13 articles. Eight did not match either of the research questions and were thus omitted.

The selected articles answered RQ1 only partially. Therefore, the researchers discussed the possibility of loosening the inclusion criteria. As a result, all the titles were carefully read and were rejected only if they were entirely unrelated to OHS risk assessment. The abstracts were also read closely and considered if it seemed that the research questions could be addressed at least to some extent.

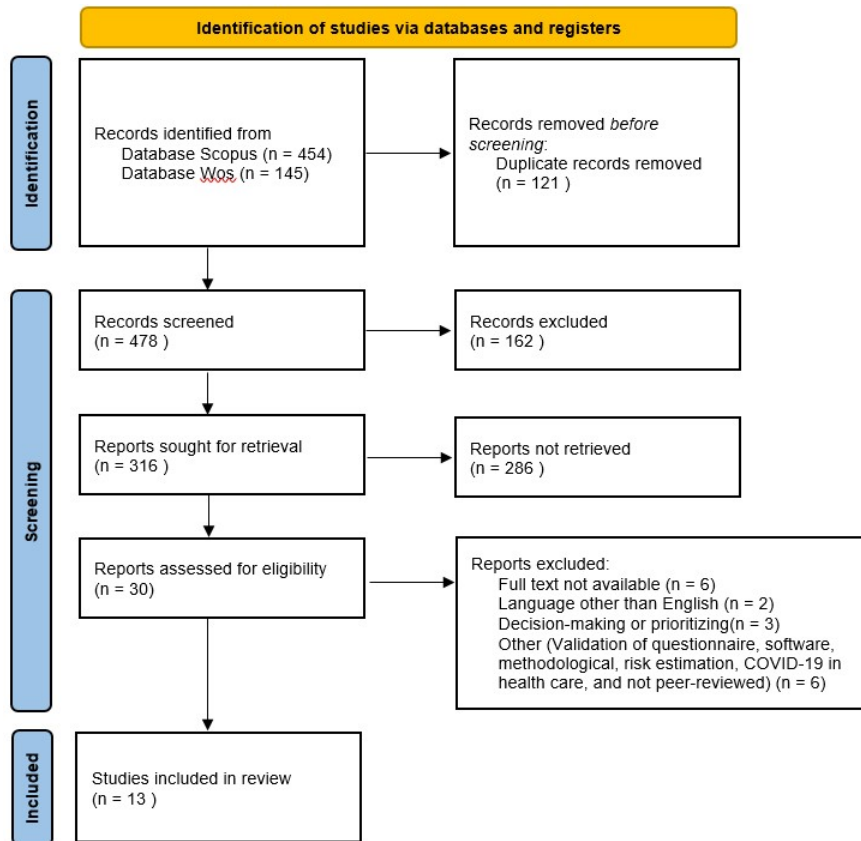


Figure 1: The systematic review in the PRISMA flowchart (Page et al. 2021).

RESULTS AND DISCUSSION

The content of 13 chosen articles was carefully examined. The researchers thus concluded that only five studies discussed criteria for assessing the success of OHS risk assessments, success factors, or barriers to success (Table 1).

The criteria for determining a successful OHS risk assessment were mentioned in four studies (Ebrahimi et al. 2011; Hrica and Eiter 2020; Marhavidas and Koulouriotis 2021; Rodrigues, Romero, et al. 2015). Ebrahimi et al. (2011) and Hrica and Eiter (2020) discussed success factors. In addition, two studies (Rodrigues, Romero, et al. 2015; Rydell et al. 2019) revealed limitations and barriers to successful OHS risk assessment, concluding that a minimum of these aspects should be taken into account.

Criteria of OHS Risk Assessment Success

Based on a complete literature review, Ebrahimi et al. (2011) identified 68 criteria for a successful OHS system by benchmarking Alberta's OHS standards, and used interviews to weight the categories obtained. Hrica and Eiter (2020) highlighted the importance of hazard identification in their framework, where several competencies and characteristics are found necessary

Table 1. Included articles, distribution of the inclusion criteria, and themes.

Author, Year	RQ1	RQ2	Themes
Ebrahimi et al. 2011			Success of OHS management
Rodrigues, Romero, et al. 2015			Barriers to successful risk assessment
Rydell et al. 2019			Investments in successful OHS assessment
Marhavilas and Koulouriotis 2021			Risk acceptance criterion
Hrica and Eiter 2020			Hazard recognition criterion
da Silva and Amaral 2019			Success factors and barriers of OHS assessment
Sousa et al. 2014			OHS research and management
Darabont et al. 2017			OHS management system
Delvika and Mustafa 2019			Evaluation of OHS management system
Rodrigues, Arezes, et al. 2015			Evaluation of risk acceptance
Tchiehe and Gauthier 2017			Evaluation of risk acceptance
Kudryavtsev et al. 2018			Identifying OHS risks and evaluation of companies
Diebig and Angerer 2021			Criticality of risk factors

to recognize hazards in high-risk work. However, further scientific evidence would be required to confirm the results of these studies. Ebrahimi et al. (2011) do not explain the reasons to use the Alberta's OHS standards to audit OHS practices in connection to the construction of the Iranian subway. In Hrica and Eiter (2020), more transparency about the hazard recognition competence framework would be valuable, as their study references an unpublished source.

The study of Marhavilas and Koulouriotis (2021) mentioned various technical documents concerning OHS risk acceptance criteria, which addressed techniques, mathematical and software tools and methods, but did not set out the criteria for a successful risk assessment. Rodrigues, Romero, et al. (2015) approached the issue of OHS risk assessment success by developing a questionnaire for OHS practitioners to classify barriers and limitations focusing on factors for the quality of the risk assessment process. As Marhavilas and Koulouriotis (2021) found in relation to the acceptability of risks, there is plenty of literature in different fields, but very few studies that look at OHS activity.

Success Factors in OHS Risk Assessment

Ebrahimi et al. (2011) turned their 68 criteria into eight categories, one of which was named "Hazard identification and assessment—components of an effective system". Other categories were related to the success of the OHS system more commonly. According to the results by Ebrahimi et al. (2011), the most important ones were "Hazard identification and assessment" and "Hazard control". The former consisted of criteria such as "job inventory", "hazards identification", "hazards evaluation", "workers involvement",

“access to records”, “training”, “hazard review”, and “results communication”. Moreover, the health and safety experts described in a study of Hrica and Eiter (2020) work-site practices and competencies that support the suggested hazard recognition competencies framework. The success factors identified included categories such as “general hazard knowledge”, “site-specific hazard knowledge”, and “situational awareness”. Motivation and experience were also seen as key factors (Hrica and Eiter 2020). Although, the two studies approached hazard identification on a slightly different scale, they included similar factors for successful risk assessment.

In their analysis of the factors limiting OHS risk assessment, Rodrigues, Romero, et al. (2015) found that the time availability, the criteria included in the risk assessment methodologies, and the information available to carry out an objective assessment proved to be barriers. The identified limitations in a successful risk assessment should be taken into account, but this alone is not enough to guarantee a successful risk assessment. Moreover, in a work environment investment study, Rydell et al. (2019) identified risk assessment as one of the seven critical elements for the success of OHS activities. Their study revealed that a large proportion of companies made investments in the work environment before the risk assessment required by law and that a large proportion of the assessments were informal and did not meet the requirements of Swedish legislation. The reasons for not conducting statutory risk assessments varied and included, for example, managers’ insufficient knowledge and understanding of the importance of risk assessment, as well as financial constraints (Rydell et al. 2019). These findings are in line with those of Rodrigues, Romero, et al. (2015) concerning the barriers to successful risk assessment.

CONCLUSION

The criteria revealed in this literature review were related to successful OHS risk assessment were that OHS risk assessment is a part of the OHS system, hazards identification framework, several technical documents concerning OHS risk acceptance criteria without criteria for a successful risk assessment, and a questionnaire for OHS practitioners to classify barriers and limitations. Regarding the factors for assessing the success of the risk assessment two studies by literature review approached hazard identification from a slightly different point of view, hence, they included similar factors for successful risk assessment. In addition, another two studies were in line with concerning barriers to successful risk assessment. Detected success factors included, for example, identifying and evaluating hazards, involving employees, training, accessing stored data, reviewing hazards, communicating results, general and work-specific awareness, and situational awareness. On the contrary, founded barriers were limited time, criteria concerning risk assessment methodologies, availability of information, inadequate knowledge and understanding of the importance of risk assessment, and financial constraints.

Accordingly, this study confirmed the original suspicion that there is a gap in the literature concerning the success factors of the OHS risk assessment.

In the literature, the success of OHS management and risk assessment in different industrial installations and related quality criteria have been studied, as have decision-making methods and risk acceptability. In many cases, OHS risk assessments differed from major accident-related industrial risk assessments. The main limitation of the study is the paucity of available scientific evidence. Therefore, further research is recommended to determine the criteria and success factors for OSH risk assessment.

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