



Evaluation of emergency evacuation in school buildings: protocol for a systematic review

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Abstract

Children are amongst the most vulnerable affected groups by natural and human-made disasters. Disaster preparedness education programs have been developed to help reduce risk and increase resilience for hazardous events. A better understanding is needed about children evacuation behaviour in schools and the time needed for evacuation. Therefore, a systematic review is proposed to search for relevant information about emergency evacuation response in schools. This systematic review protocol was developed to present adequate guidelines that can provide relevant research results to fulfil the sought objective. Sixteen databases will be accessed (Scopus, Web of Science, and ScienceDirect, between others) and a total of three keyword expressions will be used. The selection process will be thoroughly described, including detailed data treatment and used eligibility criteria, to contribute to the extensive research on this field.

1. INTRODUCTION

1.1. Background

Disasters profoundly affect society in a social, economic and psychological term (Mermer, Donmez, & Daghan, 2018). The outcomes of natural disasters include death casualties, destruction of health facilities, and health crises (Bustami & Baharuddin, 2018). Human reaction to threats and emergencies in crowded spaces is a crucial issue for disaster preparedness, emergency management and evacuation planning (Haghani & Sarvi, 2018). Understanding the social and dynamical behaviours of a crowd is essential for any decision process related to safety (Bellomo, Clarke, Gibelli, Townsend, & Vreugdenhil, 2016).

Children are amongst the most vulnerable affected groups by natural and human-made disasters (Codreanu, Celenza, & Jacobs, 2014; Fu & Underwood, 2015; Gibbs *et al.*, 2014). In the 2008 earthquake in Sichuan, China, many children died, in one of the biggest disasters for children (Watts, 2008). The increasing number of affected children draws a concerning picture for their future. During an emergency, children are dependent on adults to communicate the risk and to instruct or assist them with the appropriate response (Codreanu *et al.*, 2014; Fothergill, 2017).

Schools are critically essential sites for children, families, and communities and have a very strategic role in disseminating information to develop the knowledge of the population (Lai, Esnard, Lowe, & Peek, 2016; Sujarwo, Noorhamdani, & Fathoni, 2018; Yasuda, Muramoto, &

Nouchi, 2018). Schools need to have disaster plans that are uniquely designed for the school culture and interface with a broader community (Blum *et al.*, 2008).

Either quantitative or qualitative methods are used to prepare a school community for responding safely to a disaster. The evacuation process is dynamic and incorporates human behaviour, which has a critical effect on evacuation efficiency (Chen, Tang, Song, Huang, & Guo, 2019). For an in-depth exploration and insight into the students' perceptions of the school evacuation plan, focus groups, interviews, and individual mapping exercises can also be performed (Vásquez *et al.* 2018). Evacuation drills allow to test safety practices and procedures of the school emergency plan and evaluate school personnel performance during a crisis (Allen, Lorek, & Mensia-Joseph, 2008). Evacuation time is essential in the evacuation process for recognising the required time by the occupants to move from the hazard area to a safe region when they acknowledge the danger and start to evacuate (Ng & Chow, 2006).

Understanding behavioural patterns and the corresponding complex phenomena during an evacuation is critical to enhancing evacuation safety and efficiency.

The purpose of the systematic review is to find evidence of emergency evacuation response in schools. In order to do so, data will be gathered concerning the evacuation dynamics and response towards disasters in school building: observed behaviour during evacuation drills, travel speeds and total evacuation time.

2. METHODOLOGY

This systematic review protocol follows the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) Statement (Moher *et al.*, 2015; Shamseer *et al.*, 2015).

2.1. Eligibility criteria

Studies will be selected according to the criteria outlined below. To be considered eligible, a study must examine the disaster response behaviour of children and adults during evacuation drills in school buildings. Participants of the studies will, therefore, include children and adults that participate in drill exercises in a school building. Interventions addressing the performance of evacuation drill exercises or real drills are also studies of interest.

The comparators relevant to this study will be the time of evacuation and the type of evacuation procedures.

Articles only considering pre-disaster analysis or post-disaster analysis, without performing evacuation drills, will not be included. Similarly, the articles that only include computer simulation drills will not be considered eligible.

Literature reviews and conference papers will not be included. Articles from 2013 upward will be retrieved. The references list of the obtained articles will be checked in order to find and include more relevant studies. This way, older articles would be included.

Only publications written in English will be considered.

2.2. Information sources

The research will be conducted in the following electronic databases: Scopus, Web of Science, ScienceDirect, Inspec, PubMed, PsycArticles, ERIC, Business Source Complete, SpringerLink, Wiley Online Library, Oxford Journals, SciELO - Scientific Electronic Library Online, Informaworld (Taylor and Francis), MetaPress, Directory of Open Access Journals (DOAJ), IEEE Xplore.

The research will be conducted on journal articles from 2013 to 2019 in order to obtain the most relevant information about emergency evacuation behaviour in schools. Additional studies will be screened in the reference chapter of the included articles identified through the first stage of research. For this step, the date will not be an exclusion criterion. The literature search will be limited to the English language.

2.3. Search strategy

The following keyword expressions will be used during the database search:

[(emergency OR disaster) AND ((management AND school) OR (response AND school) OR (planning AND school) OR (preparedness AND school))], [{"Reaction time" OR "Response time" OR "Evacuation time" OR "Human response" OR "Human behaviour" OR "Response preparedness"}] AND ((emergency AND school) OR (disaster AND school)), [{"Risk assessment" OR "Hazard awareness" OR "Risk perception" OR Safety} AND ((emergency AND school) OR (disaster AND school))].

The search in the several databases will be set for the "Article title, Abstract, Keywords", whenever possible.

The selected articles will be analysed, with the identification of potential new keywords. A new search will then be managed if new keywords are found.

For the search of any additional study within the scope of the review, the references of the collected articles will also be analysed. This process will be performed until no more related outcomes can be found.

2.4. Study records

2.4.1 Data management

An Excel table will be used to help register the number of articles obtained from the search. This process will allow registering all identified studies through the selection phases. After completing the search and recording the number of collected articles in [Table 1 \(Appendix 1\)](#), the selected articles from each database will be exported for screening and removing duplicates.

Mendeley software will be used for references management.

2.4.2 Selection process

As each keyword expression is entered in the databases, the following criteria will be considered with search filters:

Date: Articles published between January 2013 and May 2019.

Article type: Articles and Articles in Press.

Source type: Journals.

Language: English.

Removal of duplicated articles.

Articles will not be included if any of the following conditions are found:

- Studies that do not perform drill experiments;
- Studies that only make computer simulation drills;
- Studies that only consider pre-disaster emergency analysis (educational phase);
- Studies that only consider post-disaster emergency analysis (recovery and rehabilitation phases);
- Studies that only consider subjective methods of assessment, without execution of evacuation drills.

Potential eligible records will be identified through the screening phase. Two reviewers will independently analyse title and abstract; a third reviewer will solve any disagreement. All the information will be registered and justified.

For selecting the studies to be included in the systematic review, the full-text from the resultant studies will be retrieved and assessed to determine if the following conditions are satisfied:

- Studies include the performance of evacuation drill experiments or real drills;
- Studies include the preparedness response phase.

Any article removal, after examining the full-text, will be justified and recorded.

2.4.3 Data collection process

From the final selected studies, some information will be extracted, including general study information, sample characteristics, context, study characteristics and significant limitations. One reviewer will conduct the data extraction with the verification by another reviewer. This will allow to reduce bias and reduce data extraction errors.

2.5. Data items

Summary and descriptive tables will be built with information on the following topics:

1. Study general information: authors, publication year, country.
2. Sample characteristics (children): size, BMI, mean age.
3. Context: type of emergency, type of school, number of schools, speed, density, flow, order and time of arrivals, pre-evacuation time, evacuation time; type of intervention (qualitative study).
4. Study characteristics: aims, procedures/methods, conclusions, equipment, and software.
5. Major study limitations.

2.6. Outcomes and prioritisation

Data will be gathered concerning the evacuation dynamics and response to disasters in the school building.

From the proposed research, the following primary outcomes are expected:

1. To identify the characteristics related to evacuation time;
2. To identify the adopted behaviour responses during the evacuation drills.

The most frequently evaluated parameters will be assessed, and an outcomes comparison from different studies will be presented.

Therefore, the expected outcomes of this systematic review are the resulting time of evacuation and the comparison results between evacuation procedures.

2.7. Risk of bias in individual studies

The bias assessment in included articles will be considered, using the taxonomy suggested by Higgins *et al.* (2011).

2.8. Data synthesis

This parameter does not apply to the proposed systematic review.

2.9. Meta-biases(es)

This parameter does not apply to the proposed systematic review.

2.10. Confidence in cumulative evidence

This parameter does not apply to the proposed systematic review.

2.11. Protocol registration

The protocol is under registration.

AUTHORS' CONTRIBUTIONS

Study design and development: RM, JD, MV

Title and abstract screening: RM

Full-text screening: RM

Data extraction: RM

Critical appraisal: RM, JD, MV

Data analysis and interpretation: RM, JD, MV

Draft of the protocol: RM

Support in draft's development: JD, MV

All authors read and approved the final version of the manuscript.

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Appendix 1

Table 1 – Form sheet summarising the proposed rejection criteria

Summary of collected articles	Summary of selected articles	Summary of rejected articles	Summary of Total Rejected Items					Database	Keyword Group A + Keyword Group B								
			Date	Type of document	Source type	Language	Other		Out of topic	n° of selected articles	n° of collected articles	n° of articles included after criteria					
												Date	Type of document	Source type	Language	Other	Out of topic
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
							Total	0	0								
							SCOPUS	0									
							web of science										
							ScienceDirect										
							Inspec										
							PubMed										
							PsycArticles										
							ERIC										
							Business Source Complete										
							SpringerLink										
							Wiley Online Library										
							Oxford Journals										
							SciELO - Scientific Electronic Library Online										
							Informaworld (Taylor and Francis)										
							MetaPress										
							Directory of Open Access Journals (DOAJ)										
							IEEE Xplore										