Emergency Nurse

Training Nurses to Triage: A Scoping Review

--Manuscript Draft--

Manuscript Number:	EN2163R1
Article Type:	Article - if in doubt use this one
Full Title:	Training Nurses to Triage: A Scoping Review
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Abstract:	Background Accuracy in triage is important to ensure proper treatment of emergency department patients. To ensure accuracy, good quality training is needed for nurses. This scoping review explores current research surrounding training in triage, making recommendations for practice and suggests direction for future research. Methods The review followed the methodology from Arksey and O'Malley (2005). A systematic search of databases was conducted alongside grey literature searches, articles were screened for suitability, data was charted, and methodologies of the studies examined before the results were summarised. Results Sixty-eight papers were included, ranging from 1994-2022. Overall methodologies of papers were poor, with 36.8% rated high or very high quality. Most included studies were interventional, with interventions consisting of lectures, simulations, workshops, online courses, peer shadowing and specific tools. Outcomes were measured in different ways, some with questionable validity. Most included studies showed efficacy for interventions, although several high-quality studies showed no effect. Conclusions The heterogeneity of the studies makes comparisons difficult. This, combined with low methodological quality means caution is advised applying their findings to practice. Limited recommendations are made, including recommendations for future research, and identification of a gold standard for outcome measurements for assessing the efficacy of training in triage.
Keywords:	Triage; Training; Nurses; Scoping Review
Additional Information:	

Question	Response
Have all named authors contributed to the article and reviewed and approved its content before submission?	Yes
Please confirm that you have read and agree to our Publisher's Agreement that is available here	Yes
Have you been asked by RCNi to write this article?	No
Have you submitted this manuscript elsewhere?	No
Has this manuscript already been published?	No
Do you have copyright for all the images, graphics and figures included with your	Yes

submission?	
What is the word count of your article including the abstract, body text, boxes, tables and figures, and references?	4800
Author Comments:	As discussed with Sophie Blakemore via email exchange. Many thanks.

Training Nurses to Triage: A Scoping Review

Abstract

Background

Accuracy in triage is important to ensure proper treatment of emergency department patients. To ensure accuracy, good quality training is needed for nurses. This scoping review sets out to explore available research surrounding training interventions for triage, make recommendations for practice and provide direction for future research.

Methods

The review followed the methodology from Arksey and O'Malley (2005). A systematic search of databases was conducted alongside grey literature searches, articles were screened for suitability, data was charted, and methodologies of the studies examined before the results were summarised.

Results

Sixty-eight papers were included, ranging from 1994-2022. The overall methodologies of the papers were poor, with only 36.8% rated as high or very high quality. Most included studies were interventional, with interventions consisting of lectures, simulations, workshops, online courses, peer shadowing and specific tools. Outcomes were measured in several different ways, some with questionable validity. Most included studies showed efficacy for their interventions, although several high-quality studies showed no effect.

Conclusions

The heterogeneity of the studies means that comparison is difficult. This, combined with the low methodological quality means that caution is advised applying their findings to practice. Some limited recommendations are made, as well as recommendations for future research, including identification of a gold standard for outcome measurements for assessing the efficacy of training in triage.

1. Background

Triage is an important interaction for patients in emergency departments (ED), representing an assessment of their acuity and setting the course for their journey through the hospital (Gorick, 2022). Correct triage ensures that patients receive the treatment they need in the timeframe that they need it, preventing harm and ensuring flow through the ED (Farrohknia et al., 2011, Yurkova et al., 2011).

A recent systematic review by Hinson et al. (2019) found that error in triage occurs at unacceptably high levels and highlighted the need to improve triage performance and interrater reliability. Tam et al. (2018) described a need to improve triage accuracy and recommended monthly refresher training to increase accuracy and improve outcomes. Research exploring the impact of postgraduate qualifications found little evidence for their ability to improve triage accuracy (Ekins and Morphet, 2015, Jordi et al., 2015).

To be able to improve triage, we need to understand what research is available regarding training interventions. A search revealed one scoping review of triage training, focussing on triage training for rural settings (Hardy and Calleja, 2019) and no systematic reviews. A scoping review would allow assessment of the current knowledge regarding training interventions in triage, helping to direct future developments in both training and research (Pham et al., 2014). The authors undertook a scoping review with aims of establishing what research exists, and what future research is needed to improve training for triage.

2. Methodology

The scoping review followed the format outlined in Arksey and O'Malley (2005), consisting of five stages. The optional sixth phase of consultation exercise was not included.

2.1 Research Aims

The research question for this review is “What is the available research about training interventions for triage in the emergency department”.

2.2 Identifying Relevant Studies

Keywords for the searches are contained within Table 1. Search Strings for the database searches are contained within Supplementary File 1.

Searches were not restricted by date or geography to fully capture the available research. Although this may mean papers were included that are not considered current, it reduces the risks of excluding relevant papers. Language was not initially restricted, but studies in languages other than English where a good quality translation could not be obtained were excluded for practical reasons.

Medline Ovid, CINAHL, Cochrane, and BNI were all searched for relevant studies using targeted search strategies, with searches taking place until the 27th of September. Relevant organisations were searched for information, including OpenGrey, EThOS, The King's Fund, WHO, NIH, NICE, Manchester Triage Group, Australasian College for Emergency Medicine and Emergency Nurses Association and conference proceedings. Citations contained within included papers were checked for relevance.

2.3 Study Selection

2.3.1 Citation Management

Citations for all studies located during searches were first exported to Endnote 20 for deduplication and organisation, before being transferred to Rayyan for screening. Full texts were obtained where possible through the university library; where they were not available intra-library loans obtained, and lead authors contacted for manuscripts.

2.3.2 Eligibility Criteria

A set of inclusion/exclusion criteria were developed to screen included citations (Table 2.). Primary and secondary research about training was included, except for papers surveying the levels of training, which were excluded as they did not describe training. Where data was reported in multiple sources (i.e., in a thesis and publication) the most complete set of data was utilised.

2.3.3 Screening Process

Screening took place using Rayyan, with initial title/abstract screening followed by full-text screening using the criteria previously defined. Both reviewers screened each paper blinded to each other's decisions, results were compared, and any disagreements discussed until both agreed. Kappa for the title and abstract screening was 0.82 (95%CI 0.79-0.85), and for the full-text screening 0.84 (95% CI 0.75-0.94).

2.4 Charting the Data

Data was extracted from included studies for analysis utilising a standardised form in Excel. Both authors initially extracted from the same ten studies, then agreement was checked (Kappa 0.85 95%CI 0.58-1.12) and as almost perfect agreement was found, the rest of the studies were charted individually. The charted data is available in Supplementary File 2.

Methodological analysis used critical appraisal tools from Joanna Briggs Institute relevant to the study type. Appraisal was undertaken by both authors whilst blinded to each other's decisions, then compared with differences discussed and resolved (Kappa 0.8 95%CI 0.76-0.85). Overall methodological quality of papers was rated utilising a five-point scale ranging from very high to very low. A summary of the methodological appraisal is available in Supplementary File 3.

2.5 Collating, Summarising and Reporting the Results

Results were analysed following methods proposed by Arksey and O'Malley (2005), firstly by quantitative analysis of the extent, nature and distribution of the studies utilising descriptive statistics, and secondly via narrative analysis of the contents to gauge the extent of the research.

3. Results

3.1 Search and Selection of Papers

Search screening is available in Figure 1.

Searches of the databases yielded 6929 records, reduced to 3668 after deduplication. 132 records were located through other sources. Title and abstract screening resulted in 115 records moved to full text review. Five records from citation searches, three from websites and twenty from organisations were added, resulting in 125 reports for full text screening. Full texts could not be retrieved for nine reports. Good quality translations could not be obtained for six reports. 34 reports were not about triage training and so were excluded. 68 papers were included after full-text review. Full references for the included papers are available in Supplementary File 4.

3.2 General Characteristics

General characteristics of included papers are presented in Table 3. Included papers ranged from 1994 to 2022 (Figure 2.), with 95.6% undertaken since 2002, 67.6% since

2012 and 48.5% since 2017. Geographic distribution is presented in Figure 3., with only three papers (4.4%) from the UK, and the majority (45.6%) coming from North America. Most papers focus on the overall process of triage (75%), with the rest considering triage of a specific illness. Adult triage was the most explored (80.9%), although paediatrics (14.7%), mental health (2.9%) and maternity (1.5%) were all included. Sources included journal articles (92.6%), conference presentations (4.4%) and theses (2.9%).

3.3 Study Methodologies

A summary of study methodologies is available in Table 4. Graphical representation of the disposition of the studies stratified by intervention, outcome assessment methods and methodological quality are contained within Figures 4-7.

Overall, methodologies were poor, with only 36.8% rated as high or very high (Figure 8.). Study design was mostly interventional (79.4%), with 61.8% using quasi-experimental methodologies. Of these, 90.5% used pre/post testing, but only 19% used either comparison groups, controls, or both. Study follow-up was not completed or adequately analysed in 33.3% of the quasi-experimental studies, outcomes were not measured in reliable ways in 38.1%, and 31% lacked appropriate statistical analysis. Randomised control trials (RCTs) only made up 8.8% of included papers, with blinding not used in any. 33.3% of the RCTs did not measure outcomes in reliable ways, and 33.3% did not sufficiently describe the characteristics of the treatment groups to be able to assess similarity at baseline. Of the remaining study designs, 5.9% used cross-sectional designs, 1.5% used case series, and 1.5% used cost analysis. Of the non-interventional studies, 5.9% used qualitative designs, 2.9% were literature reviews, and 11.8% used non-standard designs.

The educational interventions used includes lectures (42.6%), simulations (27.9%), workshops (26.5%), online courses (8.8%), peer shadowing (5.9%) and specific tools (8.8%). 19.1% of papers utilised combinations of interventions, but only 16.2% (11/68) used comparisons (Figure 9., Figure 10.), of which 54% (6/11) were RCTs.

3.4 Outcomes

Methods of assessing outcomes are shown in Table 4. 42.6% of studies used multiple different outcome measurements, whilst 51.4% used one outcome measurement, and 5.9% had no measurable outcomes.

Of the papers that used quantifiable outcomes (85.3%, 58/68), 13.8% (8/58) showed no statistically significant outcomes. However, when only papers with high or very high quality were examined, this ratio changed to 16% (4/25). When this group was further limited to those that used a comparison between interventions, only one (11.1% 1/9) showed no significant differences.

However, outcome measurements were often abstracted versions of abilities to triage, using knowledge of triage both tested and self-reported, ED key performance indexes (KPIs), and self-reported confidence in triage ability to represent triage accuracy. Although tools used were often validated for use, solely using these to represent triage ability risks providing incorrect measurements (Coster, 2013). Furthermore, some studies did not consider triage ability, only measuring perceptions of interventions or mandatory training compliance, which, whilst useful, provide no indication of how effective the interventions are. The New World Kirkpatrick Model of assessing training (Kirkpatrick and Kirkpatrick, 2016) provides guidance for assessing effectiveness of training, with four levels, each analysing different methods of measuring training outcomes. These levels consist of reaction, participants feelings about the training; learning, measuring knowledge gained; behaviour, measuring how well people apply training; and results, measuring the impact training has on practice. The higher the level of the measurement, the more effective it is considered.

The model indicates that several measures used in the study (knowledge, confidence) fall at the second level, suggesting some benefit but not representing the most effective outcomes. Whilst ED KPIs could be considered to fall at the highest level of the model and are correlated to triage performance (Farrohknia et al., 2011), variables beyond triage training influence these outcomes, reducing their effectiveness. Of the outcomes used, only triage accuracy both meets the fourth level of the model and can be directly linked to triage training.

Only 55.2% (32/58) of studies using quantifiable outcomes directly measured triage accuracy, but not all the studies assessed accuracy in practice, with 53.1% (17/32) of those studies assessing in simulated circumstances. Of the studies rated high or very

high quality, 52% (13/25) directly measured triage accuracy, with 46.2% (6/13) using simulations and 53.8% (7/13) in practice. Of these thirteen papers, only 46.2% (6/13) used a comparison, and 23% (3/13, 1 of which used a comparison) had non-significant outcomes.

Only five studies were rated as high or very high methodology, used a comparison between interventions and/or control, assessed outcomes through measurements of triage accuracy in simulation or practice, and had statistically significant outcomes (Delnavaz et al., 2018, Ghazali et al., 2019, Hoseini et al., 2018, Kriengsoontornkij et al., 2010, Recznik, 2018).

4. Discussion

All interventions from included studies will be discussed to establish a comprehensive overview of their findings, however, due to the heterogeneity of the studies, the wide mix of outcome measurements, many of which were not direct measurements of triage accuracy, and the overall methodological quality of studies, significant caution is advised before applying these results to practice.

4.1 Lectures

Of the interventions, lectures were most used (42.6%). Lectures ranged from one-off sessions to regular sessions over weeks or months, each lasting from 20 minutes to several hours. Efficacy of the lectures were found to be good, with the majority of studies showing statistically significant increases in triage ability following intervention, although Arroabarren et al. (2018) was the only high quality study featuring solely lectures that was not aimed at a specific illness. Grossmann et al. (2014) did not find significant differences following the lectures, and neither did Olsson et al. (2022), even after combining lectures with simulations.

4.2 Simulation

Simulation had high representation, in 27.9% of papers. Simulations ranged from low fidelity, utilising role-playing and paper cases to very high fidelity with training mannequins, multiple disaster simulation or virtual reality. Efficacy of the simulations were shown to be very high, with the majority of the studies finding significant improvements following intervention. Studies with higher fidelity in their simulations demonstrated a greater improvement in ability compared to those using lower fidelity.

Jang et al. (2020) was the only high quality study that only used simulations that found significance, whilst Campbell et al. (2022) noted no significant changes in their study. Simulations and lectures were compared by Delnavaz et al. (2018) and Hu et al. (2021), with both finding that outcomes improved through both methods, although more from simulations. Recznik (2018) assessed two methods of simulation against each other in cross-over trials, with findings of significantly increased accuracy through both methodologies.

4.3 Workshops

Workshops were also highly represented (26.5%), although this may be due to the broad definition of workshops to label interventions. Workshops consisted of interventions where education was mixed, featuring group discussion, role-play, skills sessions and educational aids. Several paper's descriptions of interventions only mentioned workshops without further exploration of what was involved, leading to a lack of knowledge as to what was implemented and how it could be replicated elsewhere. Described efficacy of workshops was positive, with three studies that used controls finding significant levels of improvement (Hoseini et al., 2018, Kaiafas and Bennett, 2021, Ghazali et al., 2019). Smith et al. (2013) compared lectures against simulations and a combination of simulations and workshops with all groups showing increased tested triage knowledge. Only one study looking at workshops found a lack of significant positive outcomes (French et al., 2021), which further suggests potential efficacy.

4.4 Online Courses

Online courses made up 8.8% of included studies and generally consisted of courses run online instead of in-person, but one study (Greci et al., 2013) utilised an online interaction to simulate a patient surge, presenting a novel method of teaching triage, although the quality was low, and it measured self-reported knowledge. Outcomes for online interventions mostly used user acceptability, with good levels of acceptance, but lacking testing of efficiency. Only four studies examined effectiveness of interventions; Atack et al. (2005) and Rankin et al. (2013) both assessed accuracy in triage and whilst the former, with moderate quality, found their course improved accuracy, the latter, with high quality found no significant difference between experimental and control groups. Greci et al. (2013) measured self-reported

knowledge, finding increases, and Yazdannik et al. (2018) compared online courses with workshops through tested knowledge, showing improvements between both but greater from online.

4.5 Peer Shadowing

Peer shadowing was used in 5.9% of the studies, mostly in combination with lectures (75%). The interventions consisted of working with more experienced colleagues and learning from their decision-making processes. Kriengsoontornkij et al. (2010) considered peer shadowing combined with lectures, measuring triage accuracy in practice, finding significant increases. However, the other studies that considered peer shadowing either lacked measurable outcomes (Doherty, 2016, Jakobsen and Villumsen, 2011) or had a low-quality methodology with confidence as the outcome (Baston and Simms, 2002).

4.6 Specific Tools

Specific tools were discussed in 8.8% of studies. One study compared a serious game against tabletop exercises with the serious game group showing better simulated accuracy, although the quality of the study was low (Jarvis and de. Freitas, 2009). Jang et al. (2021) investigated the effects of peer-based learning and found that whilst ED waiting times were not significantly changed, accuracy in triage improved, although the quality was only moderate. Saban et al. (2021) assessed the effects of reflective practice, finding significant effects on both triage accuracy and ED KPIs. Schumaker and Bergeron (2016) presented a model for teaching triage, whilst Terenzi (2000) and Tsoy et al. (2019) both presented serious games, although methodologies of all three studies were rated as low, with only evaluations of tools presented as outcomes.

4.7 Qualitative methods

Several papers used qualitative methodologies (5.9%) and the literature reviews (2.9%). All the papers that used qualitative methodologies used them for assessment of their interventions, which, whilst useful, does not provide information as to the efficacy of their intervention. One literature review (Doherty, 2016) has been previously discussed, and the other (Recznik and Simko, 2018) described different methods of intervention for paediatric triage education.

5. Limitations

Nine papers were excluded due to inability to retrieve the full texts, and six were excluded due to inability to acquire a good quality translation. These fifteen papers may have contained relevant information about training in triage, but lack of ability to access that information means it was unavailable for this review.

Whilst methodological quality of included studies was assessed using validated tools, the presented information represents a subjective assessment made from the results of the validated tools by the authors. However, this assessment was made by both authors blinded to each other's decisions and agreement was at a very good level, increasing the rigour.

6. Conclusions

This review set out to explore current literature regarding training in triage and set directions for future research. The current literature is very heterogenous, covering a wide variety of interventions, and using multiple outcomes. Methodological quality of the included papers was largely poor, with only 36.8% rated high or very high quality, and most interventional studies lacking any comparison. Significant future research is needed to ensure the evidence base for training in triage is suitable for application to practice. The authors would recommend establishing a gold standard for measuring triage training outcomes: assessing accuracy in practice. Where this is not possible, assessing accuracy via simulation should be used as an alternative.

Lectures, simulations and workshops were all supported by results, although the specifics of interventions differed significantly between studies, and methods of assessing the interventions were not always rigorous. However, all three methods have good quality studies supporting their use, suggesting some effectiveness. Online courses, peer shadowing and specific tools were all tested, but both quantity and quality of the studies were not enough to currently be able to recommend these for practice. Several studies tested combinations of the outcomes, finding statistically significant improvements, which may help to direct future developments. Where comparisons between interventions were tested, improvements from both were found.

6.1 Implications for Policy and Practice

- Caution is advised when designing interventions for teaching in triage, with any future training courses requiring rigorous validation with comparisons against controls to demonstrate their effectiveness.
- Lectures, simulations and workshops all seem to have effectiveness in improving triage practice and may provide direction for development of future training.

6.2 Implications for Future Research

- Establishing a gold standard for measuring triage training outcomes would focus future research, with assessing accuracy in actual triage suggested by the authors as suitable.
- Further high-quality research into the effectiveness of interventions using these outcomes is needed.
- A meta-analysis of the interventions may provide good evidence for practice but given the heterogeneity of the research, this may prove difficult to undertake.

7. Author's Contributions

HG conceived of the study and designed the methodology. All authors conducted the review, drafted the manuscript, and read and approved the final manuscript.

8. Conflicts of Interest

The authors declare no conflicts of interest. The study received no funding.

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Table 1. Search Terms			
Nurs*	Emergenc* ADJ2 Department*	Triag*	Teac*

Nurse (MESH)	Accident* ADJ2 Emergenc*	Acuit*	Trai*
	A&E	Sever* adj3 ill*	Educat*
	“A & E”	Triage (MeSH)	Lesso*
	Emergency Department (MeSH)	Patient Acuity (MeSH)	Improv*
			Education (MeSH)

Table 2. Inclusion/Exclusion Criteria	
Inclusion Criteria	Exclusion Criteria
Focussed on the emergency department	Papers that survey the levels of training of the nurses
Concerns face to face triage practices	
Focus of study is improving triage through training	

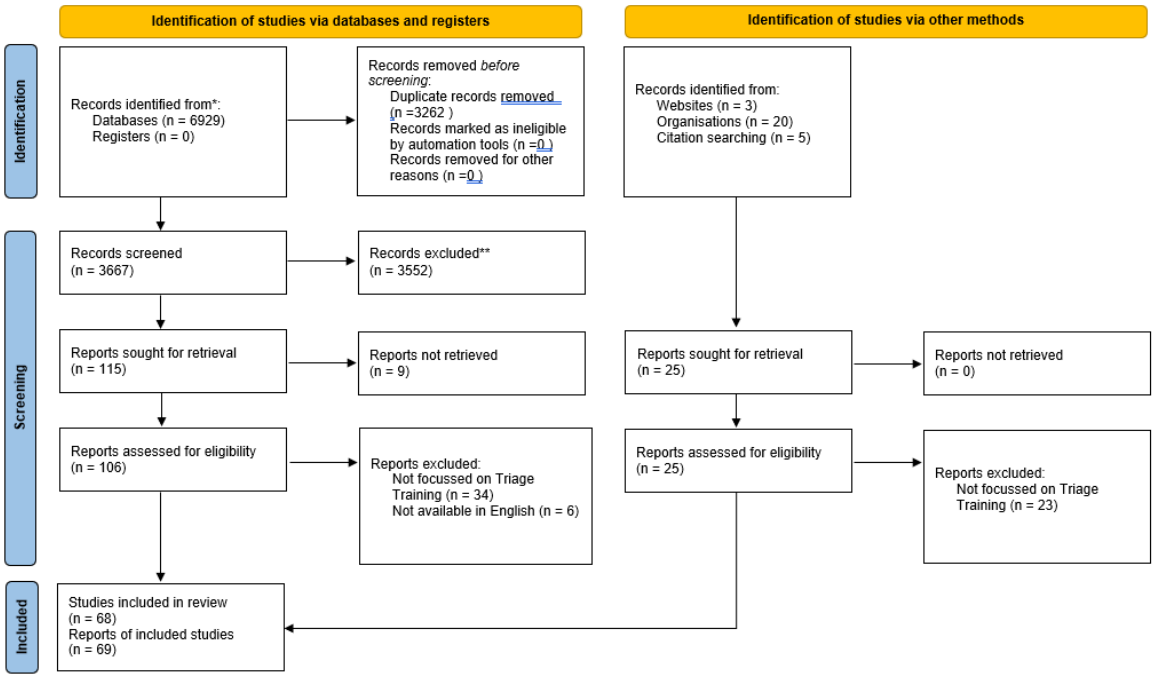
Table 3. Study Characteristics			
Characteristic		Number (n=68)	Percentage
Publication Year	<2002	3	4.4%
	2002-2006	7	10.3%
	2007-2011	11	16.2%
	2012-2016	14	20.6%
	2017-September 2022	33	48.5%
Type of Triage Studied	Overall Triage	51	75%
	Specific Illness	17	25%
	Adult Triage	55	80.9%
	Paediatrics	10	14.7%
	Mental Health	2	2.9%
	Maternity	1	1.5%

Place of Publication	UK	3	4.4%
	North America	31	45.6%
	South America	3	4.4%
	Europe	9	13.2%
	Asia	7	10.3%
	Middle East	8	11.8%
	Africa	2	2.9%
	Oceania	4	5.9%
	Caribbean	1	1.5%
Publication Source	Journal	63	92.6%
	Conference	3	4.4%
	Thesis	2	2.9%

Table 4. Study Methodologies			
Characteristic		Number (n=68)	Percentage
Methodological Quality	Very High	5	7.4%
	High	20	29.4%
	Moderate	19	27.9%
	Low	19	27.9%
	Very Low	5	7.4%
Study Design	Quasi-Experimental	42	61.8%
	Cross-Sectional	4	5.9%
	Case Series	1	1.5%
	Cost Analysis	1	1.5%
	Qualitative	4	5.9%
	Literature Review	2	2.9%
	No Specific Design	8	11.8%
	Lectures	29	42.6%

Intervention Type	Simulation	19	27.9%
	Online Course	6	8.8%
	Peer Shadowing	4	5.9%
	Workshop	18	26.5%
	Specific Tool	6	8.8%
	Combination of Interventions	13	19.1%
	Comparison of Interventions	11	16.2%
Outcome Measurement	Tested Levels of Knowledge	17	25%
	Self-Reported Levels of Knowledge	8	11.8%
	Accuracy in Simulated Triage	17	25%
	Accuracy in Actual Triage	15	22.1%
	ED KPI's	10	14.7%
	Evaluation of Training	18	26.5%
	Self-Reported Confidence	11	16.2%
	Cost Analysis	1	1.5%
	Training Compliance	1	1.5%
	Qualitative Analysis	6	8.8%
	No Outcome Measurement	4	5.9%

Figure 1. Prisma Diagram for Study Screening



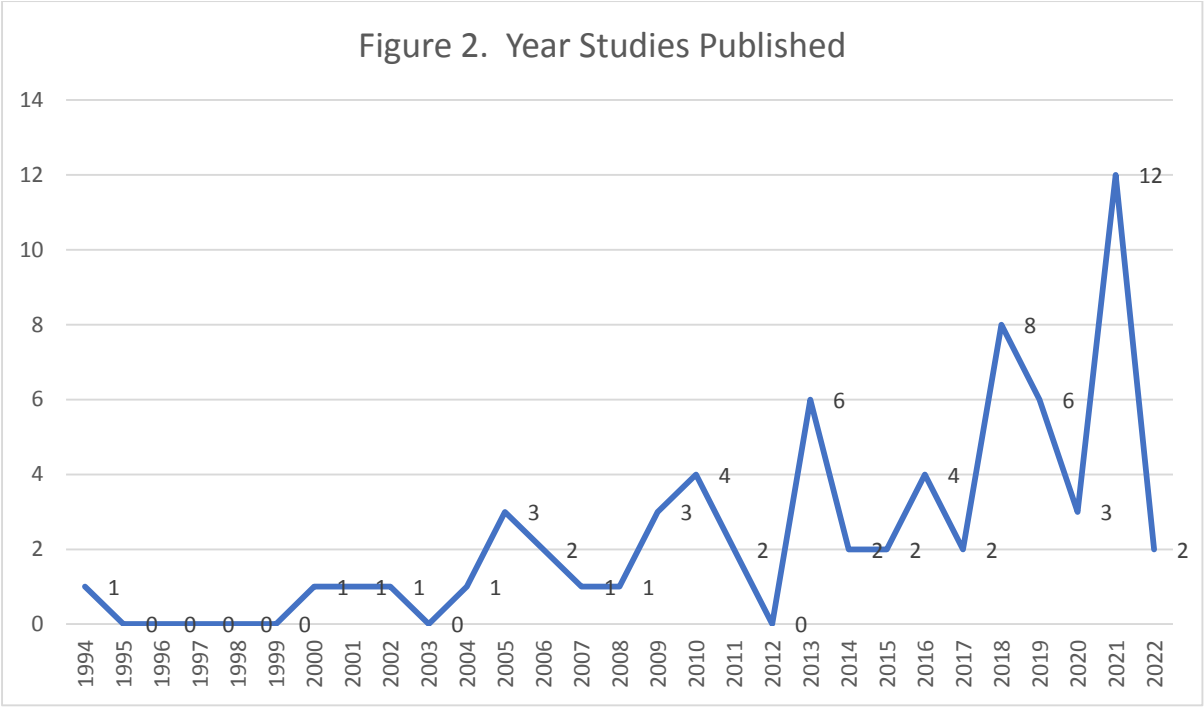


Figure 3. Geographic Distribution of Studies

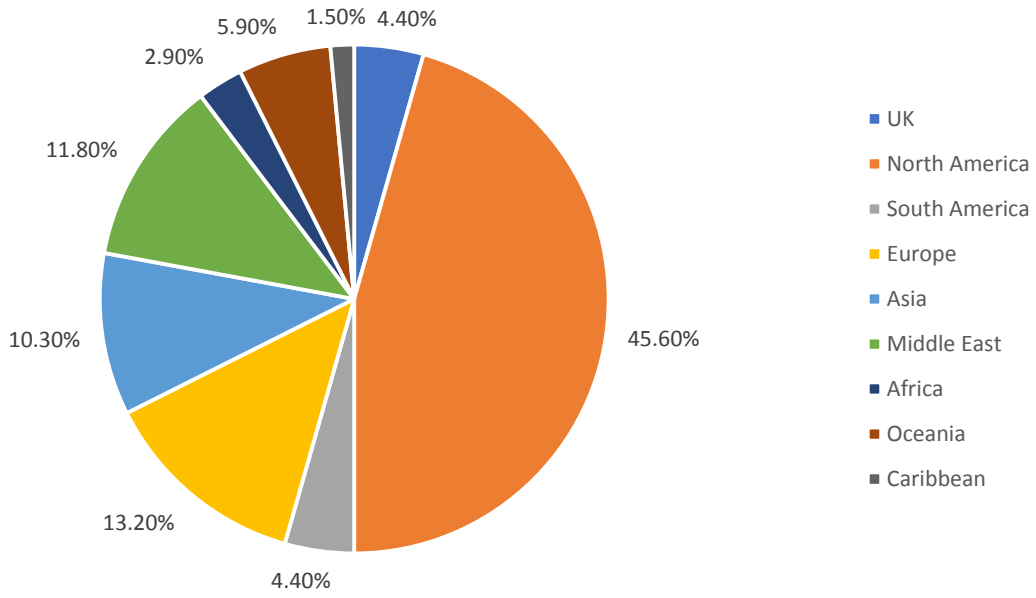


Figure 4. Included Studies by Outcome Assessment Method

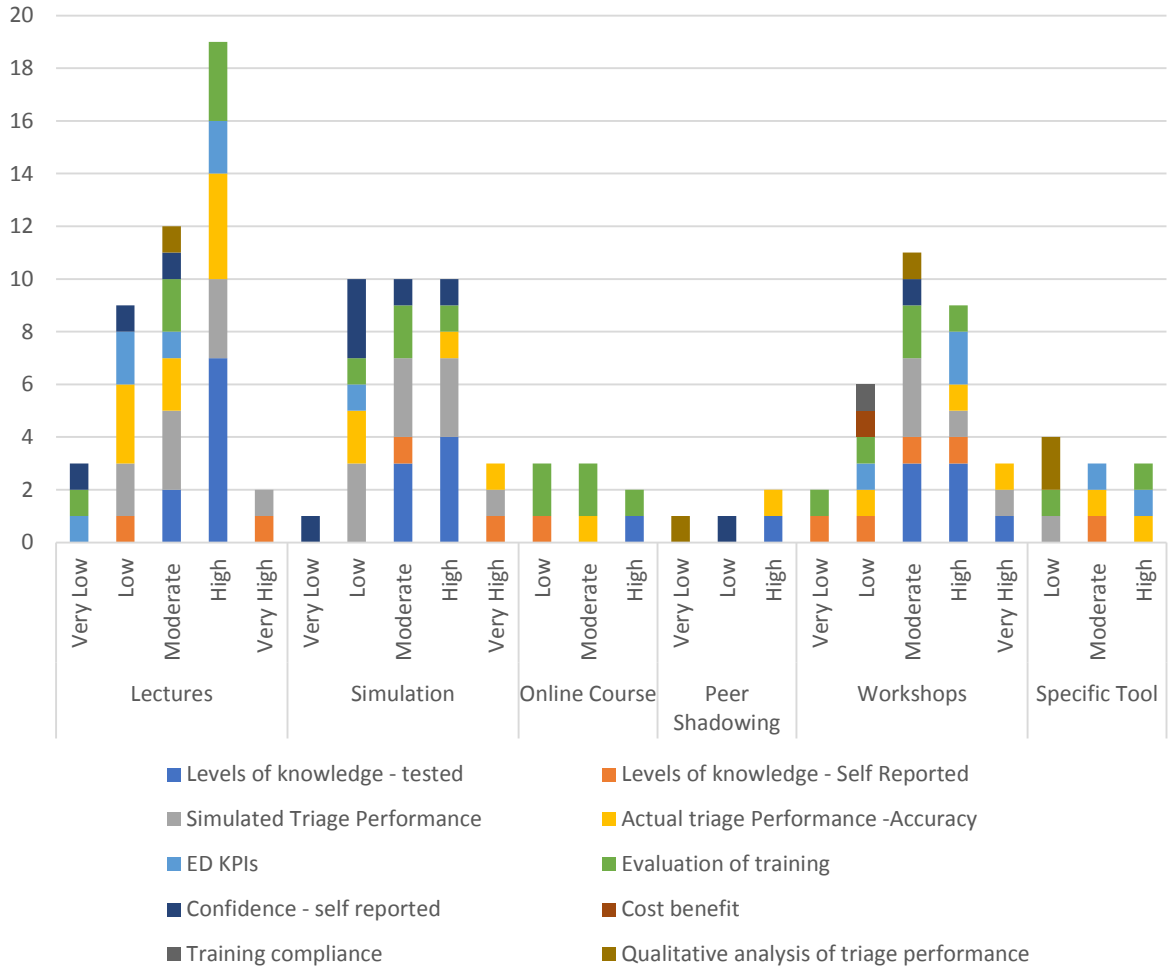


Figure 5. Included Studies by Methological Quality

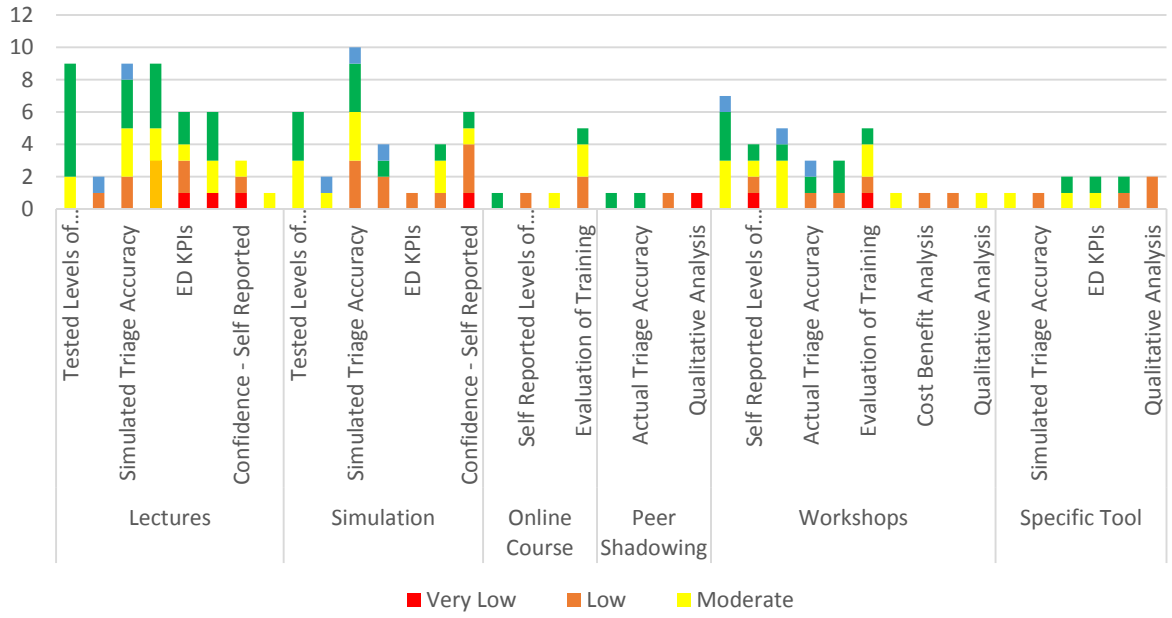


Figure 6. Contour Map of Included Studies

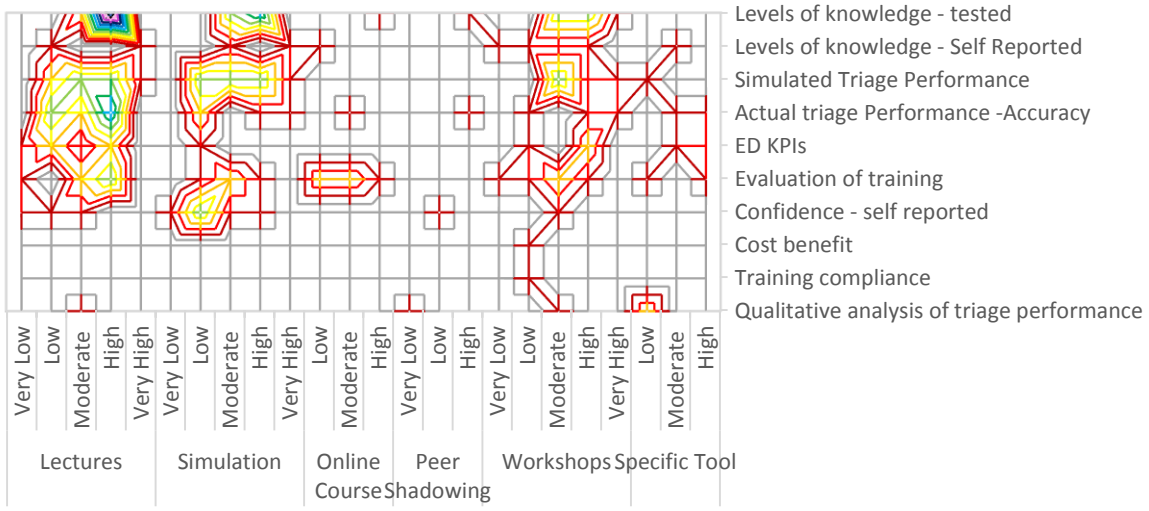


Figure 7. 3D Contour Map of Included Studies

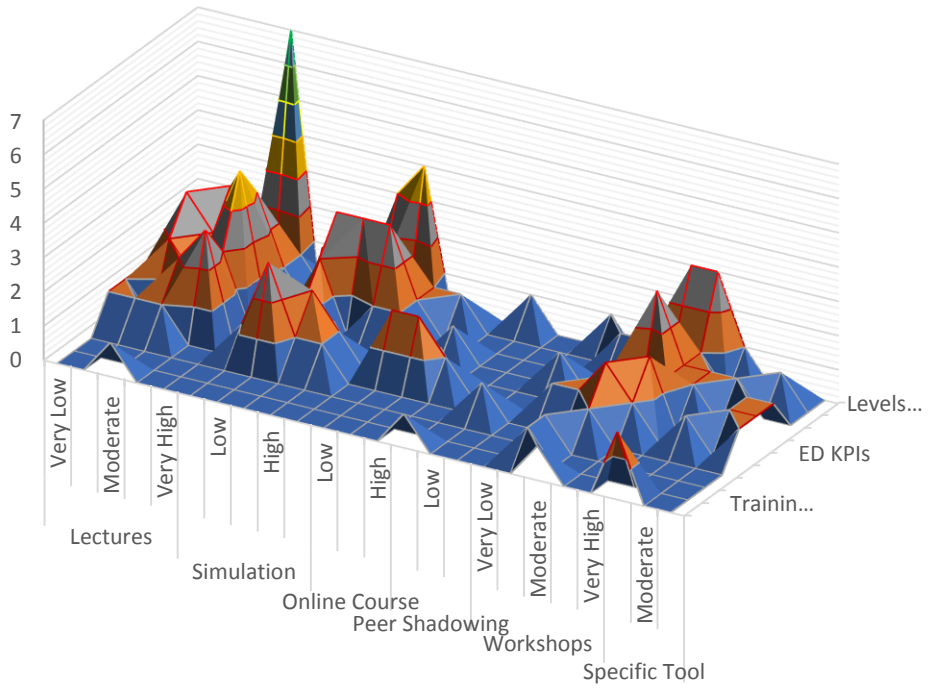
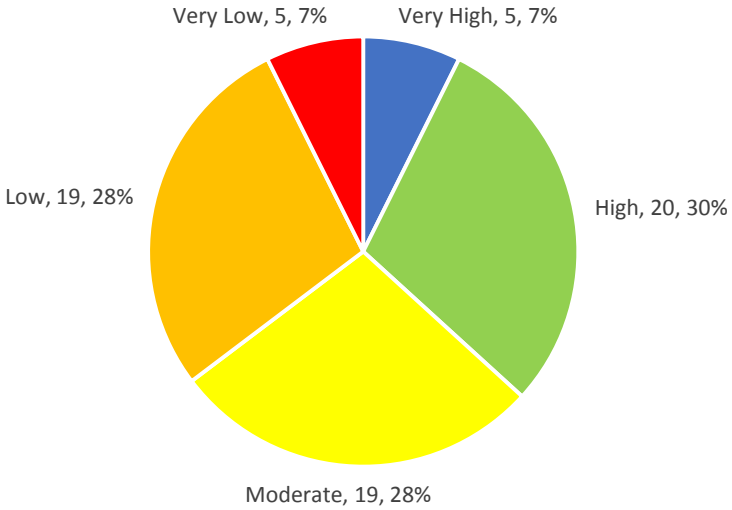


Figure 8. Methodological Quality of Studies



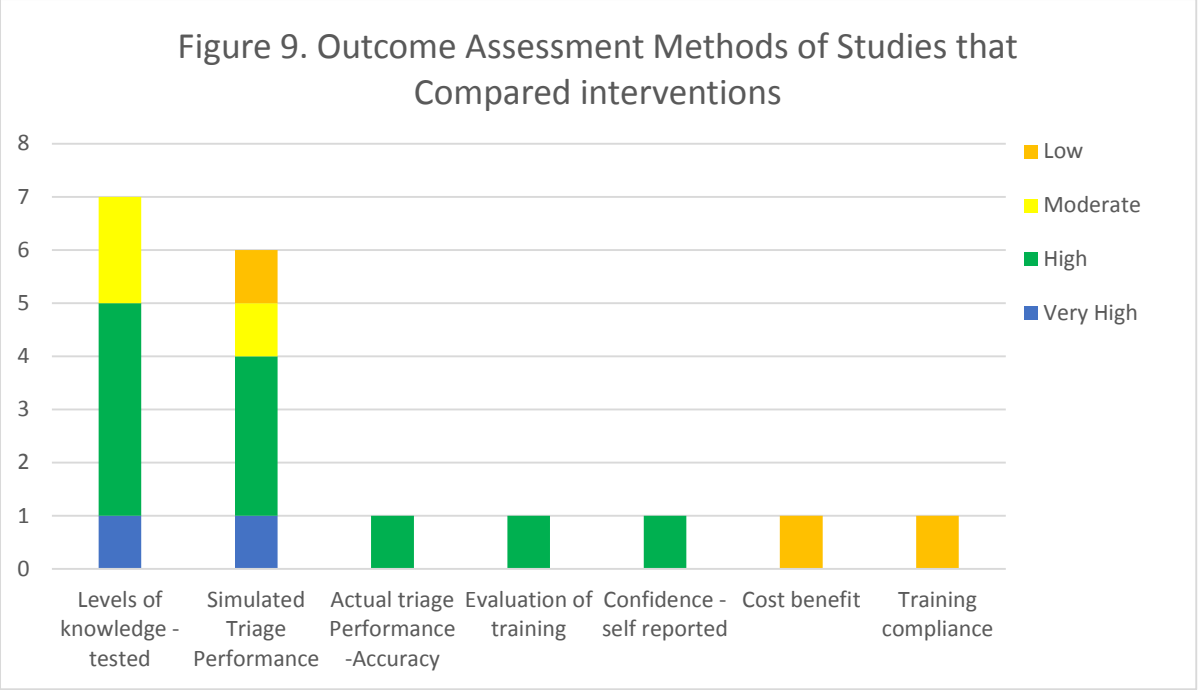


Figure 9. Outcome Assessment Methods of Studies that Compared interventions
8
7
6
5
4
3
2
1
0
Low
Moderate
High
Very High
Levels of knowledge - tested
Simulated Triage Performance
Actual triage Performance -Accuracy
Evaluation of training
Confidence - self reported
Cost benefit
Training compliance

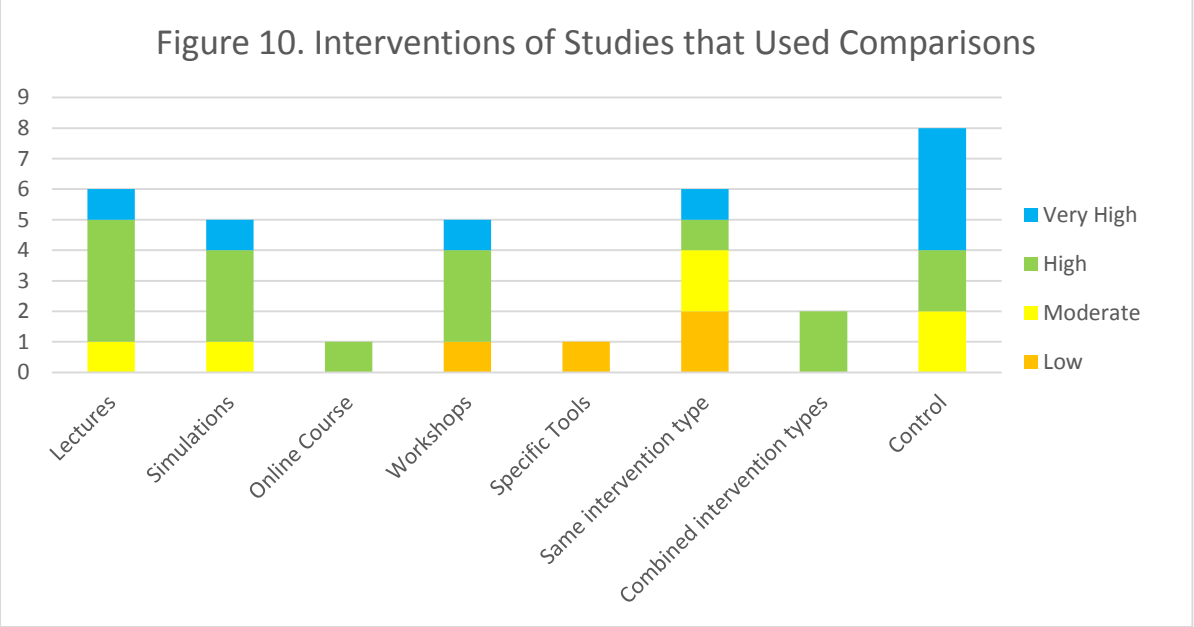


Figure 10. Interventions of Studies that Used Comparisons
9
8
7
6
5
4
3
2
1
0
Very High
High
Moderate
Low
Lectures
Simulations
Online Course
Workshops
Specific Tools
Same intervention type
Combined intervention types
Control

Page 1 – “This scoping review sets out to explore current research surrounding training in triage“ changed to “This scoping review sets out to explore available research surrounding training interventions for triage” for clarity

Page 2 – “regular” changed to “monthly” in sentence “Tam et al. (2018) described a need to improve triage accuracy and recommended monthly refresher training to increase accuracy and improve outcomes”.

Page 2 – added “Research exploring the impact of postgraduate qualifications found little evidence for their ability to improve triage accuracy (Ekins and Morphet, 2015, Jordi et al., 2015).” to explain this factor.

Page 2 – “something good quality training can aid” removed for word count

Page 2 - “Interventions” added to sentence “To be able to improve triage, we need to understand what research is available regarding training”

Page 2 - “Interventions” added to sentence “A scoping review would allow assessment of the current knowledge regarding training in triage”

Page 2 - “current” removed from sentence “The authors undertook a scoping review with aims of establishing what current research exists, and what future research is needed to improve training for triage.”

Page 2 – “current” changed to “available” in research question and “interventions” added

Page 2-3 added “Although this may mean papers were included that are not current, it reduces the risks of excluding relevant papers”.

Page 3 – “A thorough search of grey literature was also conducted to ensure full capture of relevant records (Mahood et al., 2014).” Removed for word count

Page 3 – Added “Manchester Triage Group, Australasian College for Emergency Medicine and Emergency Nurses Association”.

Page 3” Primary research about training was included, except for papers surveying the levels of training which were excluded as they did not describe training. Secondary research was considered for relevance to the research question and included where suitable.” Changed to “Primary and secondary research about training was included, except for papers surveying the levels of training, which were excluded as they did not describe training.” For word count

Page 4 – “a very good” changed to “almost perfect” to bring in line with Kappa reporting standards

Page 4 – Changed “moved forward” to “moved to full text review” for clarification

Page 4 – Four instances of “records” changed to “reports” for clarification

Page 4 – Changed “two” to “twenty” to reflect updated searches

Page 4 – “Seven reports were in languages other than English, a good quality translation was obtained for one of these, resulting in the exclusion of six reports” changed to “Good quality translations could not be obtained for six reports.” For wordcount

Page 4 – “Whilst not required for scoping reviews, included studies were analysed for methodological quality to assist with understanding the strength of the available research.” Deleted for word count

Page 4 – “Where no relevant tools existed, methodological quality was assessed via discussion between authors.” Deleted for word count

Page 5 – added “only three papers (4.4%) from the UK, and” to the sentence “Geographic distribution is presented in Figure 3., with the majority (45.6%) coming from North America.” to denote UK focussed research.

Page 5 – Changed “The New World Kirkpatrick Model of assessing training (Kirkpatrick and Kirkpatrick, 2016) indicates that several measures related to triage (knowledge, confidence)”

to

“The New World Kirkpatrick Model of assessing training (Kirkpatrick and Kirkpatrick, 2016) provides guidance for assessing effectiveness of training, with four levels, each analysing different methods of measuring training outcomes. These levels consist of reaction, participants feelings about the training; learning, measuring knowledge gained; behaviour, measuring how well people apply training; and results, measuring the impact training has on practice. The higher the level of the measurement, the more effective it is considered.

The model indicates that several measures used in the study (knowledge, confidence)” to ensure comprehension of what the model consists of and what the results mean.

Page 6 – “but even then” changed to but for wordcount

Page 7 – “in triage ability” added to sentence “with the majority of studies showing statistically significant increases following intervention” to clarify definition of good.

Page 8 – deleted “” from “again, described efficiency of workshops was good” for word count

Page 8 – Changed “following intervention, although Jang et al. (2020) was the” to “following intervention. Studies with higher fidelity in their simulations demonstrated a greater improvement in ability compared to those using lower fidelity. Jang et al. (2020) was the” to note impact of simulation fidelity on efficacy.

Page 8 – Changed “were generally made of” to “generally consisted of” for grammar

Page 9 – added “which further suggests potential efficacy.” to sentence “Only one study looking at workshops found a lack of significant positive outcomes (French et al., 2021).” to clarify meaning of statement.

Page 10 – “The selection of studies for inclusion was subject to the perspectives of the reviewers, and although the inclusion/exclusion criteria helped standardise this, some papers may not have been selected that contained relevant information, especially during the title/abstract screening.” Deleted for word count

Page 10 – “Risk of publication bias was not assessed by this study, meaning that the outcomes described may not be truly representative of the effects of the interventions. However, as this scoping review only sought to explore the published research this does not affect the results. Despite this, lack of assessment of publication bias means that further caution is recommended when applying the findings of this review.” Deleted for word count

Page 10 – added “increasing the rigour.” to the sentence “However, this assessment was made by both authors blinded to each other’s decisions and agreement was at a very good level” to clarify meaning

Page 10 – “Currently” added to “both quantity and quality of the studies were not enough to be able to recommend these for practice.” For clarity

Page 10 – changed “with assessing accuracy in simulation considered acceptable where this is not possible.” to “Where this is not possible, assessing accuracy via simulation should be used as an alternative” for clarity.

Page 11 – “A need has been identified for further high-quality research into the effectiveness of interventions using these outcomes” changed to “further high-quality research into the effectiveness of interventions using these outcomes is needed” for wordcount

Page 11 - Removed “Standardising triage training with a validated national curriculum utilising a mix of the interventions may be necessary to ensure efficacy.” as not enough support in review.

Pages 12/13 - references for Ekins and Morphet and Jordi et al. added

Page 13 – reference for Mahood removed

Page 15/6 – Table 3. Added UK as a section, reduced number counted in Europe.

Page 18 – updated PRISMA diagram to reflect updated searches

Page 19 – Changed Figure 3 to reflect inclusion of UK

General Comments

Thank you both for the helpful feedback and comments, as well as for the direction towards suitable resources.

We have now examined the supporting documents from the suggested organisations, as well as the Emergency Nurse's Association and updated the description of grey literature sources.

The Manchester Triage Group yielded no papers that met the inclusion criteria, and the papers found were all identified in the initial searches and reviewed then.

The Australasian College for Emergency Medicine contained a literature review that featured two papers not identified in the initial searches. However, upon review neither met the inclusion criteria. The other papers had been identified in the initial searches, with one included and the rest not meeting the inclusion criteria. The website also included the Emergency Triage Kit, for teaching triage. Whilst the kit itself was not included, the papers that supported the development and testing of the kit were all identified and reviewed during the initial searches. All other resources were examined but contained no suitable information.

The Emergency Nurses Association provided several policy documents of potential interest, however, upon examination the papers used to support these documents had all been captured in the initial searches and included/excluded as suitable.

Updated PRISMA Diagram to reflect extra searches.

Agreed, more analysis would be helpful for the reader, however, the analysis for our findings was deliberately limited for two reasons. Firstly, as a scoping review, this paper set out to establish what the research base is, for use in future research which will contain this more in-depth analysis, and as such is reflected in our conclusions and recommendations for future research. Secondly, the overall low quality of the methodologies in the included studies means that analysis of the results could potentially feature methodological biases that may impact that accuracy of any findings. We have taken caution to identify this several times throughout the paper to ensure the findings of this review are not misapplied.

With regards to pre-registration and triage tools these were not aspects compared by the literature, and as such this review has not discussed them. Again, you are right that they may have an effect, although we would argue that the ability to triage is not necessarily based on the tools used, but that these tools help provide guidance for assessing acuity. Following on from this, therefore, the skills for triage would be teachable and transferable no matter which triage tool is used. However, a study comparing teaching the same intervention with different triage tools would provide an interesting perspective on the matter.

Agreed, the wording of the research question does suggest a narrow perspective. Research question reworded to reflect the wider date range used.

This review did not specifically highlight practices in the UK for comparison with the global situation, as doing so may have skewed the perspectives for presenting the research, especially given the low number of papers from the UK (3). However, as the journal is UK based, UK added as a separate category to identify how many papers were from here. We agree that discussion of applications for the UK would increase the focus of this paper for UK based nurses, however, given the limited word count we are unable to include this, and as such will keep it to a globalised perspective.

Reflective practice discussed below.

Clarity of words addressed below.

Range of dates for inclusion in study addressed below.

Comments from manuscript:

Page 2. Regular changed to “monthly” to reflect findings of review.

Page 4. Have changed to “almost perfect” to reflect Kappa reporting standards. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3900052

Page 4. Use of the term records is taken from PRISMA reporting standards. However, for clarification purposes, some use of records changed to reports.

Page 5. As the paper is a scoping review, we set out to explore all available papers, with no limitations due to dates. This was to reduce the risk of excluding important information and seminal papers that may have been published outside the range generally used as current. Have added a sentence to the “Identifying Relevant Studies” section on page 2 explaining this.

Page 5. Agree with knowledge of Kirkpatrick Model, have added paragraph explaining model.

Page 7. Have expanded on following section of sentence to clarify meaning of good.

Page 8. An important distinction! Have added in sentence on improved efficacy of higher fidelity simulations.

Page 8. Have expanded sentence to explain meanings better.

Page 8. No, this is not a reliable measure. We would have liked to be able to note this here, however we feel the reliability of the different measures is thoroughly explored on pages 6 and 7, and due to the limitations of the wordcount we are unable to repeat here.

Page 9. We agree, exploring the effects of reflective practice would be beneficial for triage, and although there is only one paper specifically examining its effects on triage (Saban, 2021), there is a broad literature base supporting its uses in nursing. I (Lead author) feel this may make an excellent article in the future and would be happy to collaborate with you if you are interested in it. However, in terms of this review, further exploration of this topic is unfortunately not within its scope, which is to describe the available research about specific training to improve triage.

Page 10. Have expanded sentence to clarify effects on rigour.

Page 10. Thanks for highlighting, upon rereading this sentence does seem a bit confusing. Have reworded to clarify.

Page 11. Experience is highly important in triage training, and postgraduate study is likely to have a significant effect on triage ability. However, as this review set out to explore specific interventions for teaching triage, neither of these factors meets the inclusion criteria. I (lead author) currently have a systematic review in write up that highlights the importance of experience for triage. Most evidence for the effects of postgraduate study on triage comes from survey research, which was specifically excluded due to the lack of interventions. Several papers have explored its effects, Considine (2001), Ekins and Morphet (2015) and Jordi et al. (2015) all found no significant differences to triage ability as a result of postgraduate education. Sentence added to this effect to background (page 2.).

Page 11. Agreed, that this recommendation requires further support. We have removed as we feel that, whilst development of a national curriculum represents a necessary step for triage education in the UK, there is not enough evidence presented in the review alone to support this recommendation.

Search Strings

Click here to access/download

Spreadsheet

Supplementary File 2. Data Extraction.xlsx

Click here to access/download

Spreadsheet

Supplementary File 3. Methodology.xlsx