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1 **Title: Use of the Delphi method to generate guidance in emergency nursing practice: a**
2 **systematic review**

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4
5 **Abstract**

6 **Aim:** To examine the application and methodological quality of the Delphi method used in developing emergency
7 nursing practices.

8 **Background:** Emergency nursing scope of practice has rapidly expanded in response to increasing patient
9 acuity, complexity and technological innovation. Determining best practice is crucial for delivering high quality,
10 safe and effective emergency nursing care. The Delphi method has been used to identify, prioritise complex
11 issues and develop evidence-driven guidance in emergency nursing practice. The use and quality of the Delphi
12 method in emergency nursing practice has not been examined.

13 **Design:** Systematic literature review

14 **Databases and Data treatment:** A systematic literature search was conducted using the following databases:
15 SCOPUS, EMBASE, Medline and ProQuest from date of inception to August 2019. The database search was
16 limited to scholarly articles or peer-reviewed journals. No language restrictions were applied. The Cochrane
17 Collaboration method and PRISMA checks were utilized to conduct the review.

18 **Results:** Of 246 records identified 22 (8.9%) studies met the inclusion criteria. A modified Delphi technique was
19 commonly used (n=15; 68.2%) and often conducted online (n=11; 50.0%). Eight practice guidance themes were
20 identified. Overall study quality was high (score 12/14; range 4 - 13), transparency of reporting varied.

21 **Conclusion:** Based on this review, the Delphi technique is an appropriate method for exploring emergency
22 nursing practice. The studies reviewed demonstrated that knowledge, skills and clinical expertise has
23 progressively expanded in the specialty of emergency nursing. Variation in the application, conduct and
24 transparency of reporting in Delphi studies developing guidance for emergency nursing practice is discussed.

25
26 **Keywords:** Delphi, Consensus, Systematic Review, Emergency Nursing, Clinical Practice
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1 Introduction

As nursing has developed as a profession, there has been a continual evolution of the discipline's scope of practice. Nursing practice has become more specialised in response to increasing patient demand, acuity, health system complexity and technological innovation [1, 2]. Emergency nursing practice is a specialty that has undergone rapid expansion in the nature and scope of practice [3]. Nursing continues to evolve to meet service and patient needs, therefore, determining best practice is crucial for delivering high quality, safe and effective care. The Delphi method has been widely used across a range of disciplines to develop and guide clinical practice. Practice guidance developed using the Delphi method informs clinician decision making and supports safe patient care. To date, the use of the Delphi method in developing practice guidance for emergency nursing has not been evaluated.

1.1 Background

Consensus group methods play a major role in nursing research [4]. They are particularly useful when empirical knowledge is lacking, limited or contradictory [5]. The two most common consensus methods use in health research are the nominal group technique and the Delphi technique. The nominal group technique (NGT) designed by Delbecq and Van de Ven [6] involves face-to-face discussion in small groups using a four-staged process: silent generation, round robin, clarification and voting (ranking or rating). The NGT is best suited to generating ideas to problems [7], whereas the Delphi technique is frequently used in the healthcare setting as a rigorous, iterative process with content experts to develop practice guidelines [8, 9].

The Delphi technique is a qualitative research method first developed by Dalkey and Helmer [10] at the Research and Development (RAND) Corporation in the 1950s. Since then, the Delphi technique has become an increasingly important method used to address issues in healthcare, and an attractive process for developing consensual guidance on best practice [9, 11-14]. The five main characteristics of the classic Delphi method are: use of experts, anonymity, controlled feedback, multistage iteration, and exploration of consensus via statistical aggregation of group response [15]. These characteristics enhance the validity and reliability of the study design to improve the quality of responses [16]. In contrast to other consensus building methods such as the nominal group method or consensus conferences, the Delphi method enables a large number of individuals across diverse locations and areas of expertise to be included anonymously. Anonymity for participants allows freedom of expression and open critique, and minimises any influence of social pressures or the voice of one or a few experts during the process [17]. Controlled feedback to participants between rounds provides a summary of group opinion. This allows participants to either retain or change their earlier opinion in light of other participants' views. Through planned iterations of the questionnaire, participants can anonymously change their opinions in view of the aggregated group response without reprisal.

64 In contrast to other consensus building methods such as the nominal group method or consensus conferences,
 65 the Delphi method enables a large number of individuals across diverse locations and areas of expertise to be
 66 included anonymously. Anonymity for participants allows freedom of expression and open critique, and
 67 minimises any influence of social pressures or the voice of one or a few experts during the process [17].
 68 Controlled feedback to participants between rounds provides a summary of group opinion. This allows
 69 participants to either retain or change their earlier opinion in light of other participants' views. Over 20 variations
 70 of the Delphi method have been described, where researchers have modified the approach to suit their needs
 71 [18]. The most popular formats include: the modified Delphi, the policy Delphi, the decision Delphi, the real-time
 72 Delphi, and the internet Delphi (Table 1).

74 Table 1: Types of Delphi and main characteristics

Type	Characteristics
Classic Delphi	Sequential questionnaires are used to systematically solicit and collect specific information on a particular topic. The first round typically begins with an open-ended questionnaire [5].
Modified Delphi	A similar method to the classic Delphi process. The 'modification' usually involves experts meeting (e.g. interviews, focus group) to discuss/rate the results, or the use of pre-generated items in round one, derived from the literature [19].
Decision Delphi	Same process as the classic Delphi, but the focus is on making decisions rather than coming to consensus [14].
Policy Delphi	Uses the opinions of experts to generate potential resolutions to policy issues or generate ideas on future policy directions [20].
Real-time Delphi	No 'rounds' are used, with calculation and provision of responses fed back to participants in real-time. Participants do not judge at discrete intervals (i.e. rounds), but can change their opinion as often as they like within the timeframe set [21].
Internet-based Delphi	Also known as 'e-Delphi', or 'web-based Delphi', follows the same process as the classic Delphi but is conducted using an online platform [22].

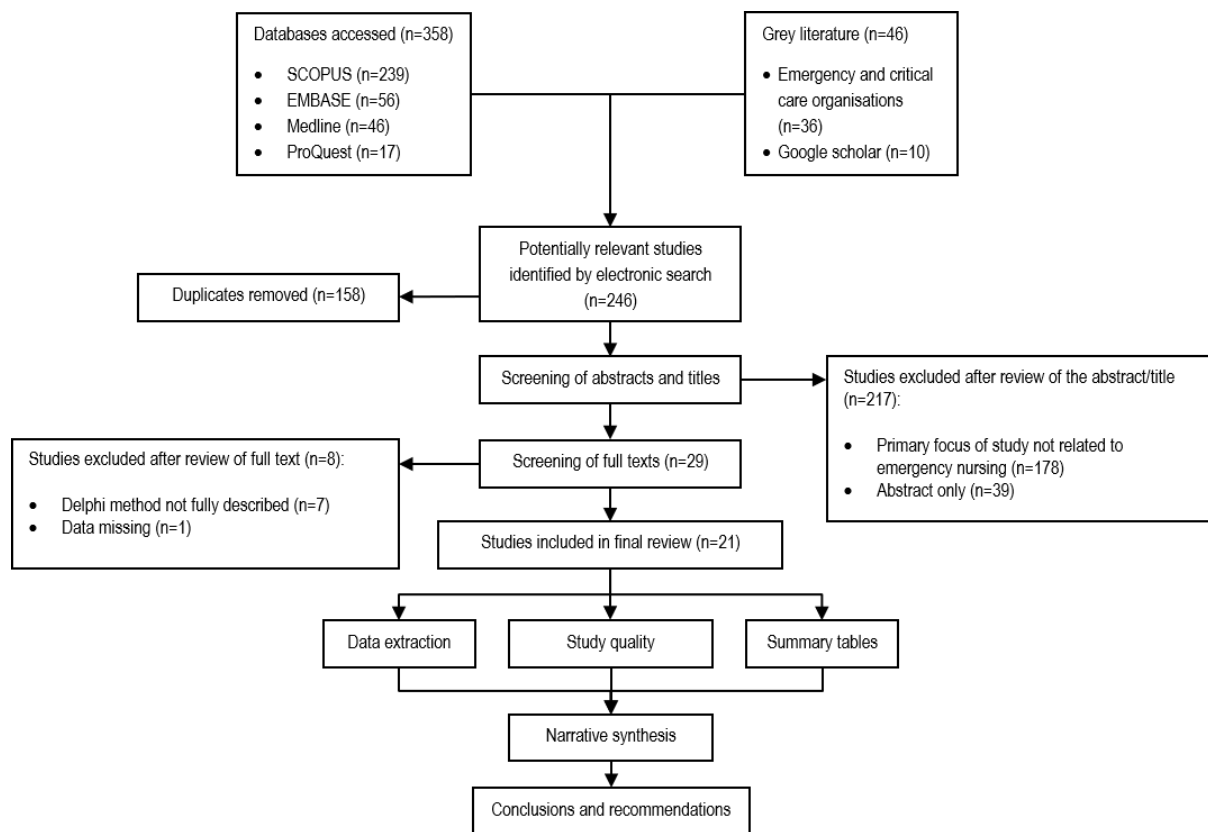
78 The Delphi method has been widely used in nursing to explore a wide range of topics such as role delineation
 79 [23-25], research priorities [26-28], quality performance indicators [29], standards of practice [30], tool
 80 development [31] and survey development [32]. Practice guidance developed using the Delphi process have
 81 implications for patient care and nursing practice. In order for the Delphi method to be a reliable and credible
 82 source of generating evidence in emergency nursing practice, an examination of the rigor and quality in its
 83 application is warranted. Thus, the overall objective of this review was to describe the use of the Delphi method

84 in developing guidance for emergency nursing practice, and to assess the application and reporting quality of the
85 Delphi method and results.

87 2 Methods

88 A methodological systematic review was undertaken to answer the review question 'How is the Delphi method
89 being used for the development of guidance for emergency nursing practice?' A key feature of a methodological
90 systemic review is its focus on the methodological features of studies as opposed to the relevance of the output
91 from the Delphi process [33-35]. The Cochrane Collaboration systemic review method guided the systematic
92 review of both qualitative and quantitative methods [36]. The Preferred Reporting Items for Systematic Reviews
93 and Meta-Analysis (PRISMA) checklist [37] was used to identify essential components of the review and guide
94 reporting of the study methods and results (Figure 1).

96 Figure 1: PRISMA flowchart of the search and systematic review process



99 2.1 Databases and data treatment

100 A systematic literature search was conducted using the following databases: SCOPUS, EMBASE, Medline, and
101 ProQuest from date of inception to August 2019. The search was limited to scholarly articles or peer-reviewed
102 journals, and no language restrictions were applied. Search strategies were customized for each database to

103 account for different search interfaces. A range of search terms were used to identify potential studies.

104 Reference lists of included articles were also searched for other relevant studies not already located (Table 2).

105 Table 2: Search strategy results

Database, search strategy	Results	Duplicates	Grand total
<i>SCOPUS</i>			
(ABS (Delphi) AND ABS (nurs*) AND ABS (emergency))	34	16	15
(ABS (consensus) AND ABS (nurs*) AND ABS (emergency))	205	41	164
<i>EMBASE</i>			
ab(Delphi) AND ab(nurs*) AND ab(emergency))	31	24	7
ab(consensus) AND ab(nurs*) AND ab(emergency))	15	6	9
<i>Medline</i>			
(Delphi and nurs* and emergency).ab	26	15	11
(consensus and nurs* and emergency).ab	30	0	30
<i>ProQuest</i>			
ab(Delphi) AND ab(nurs*) AND ab(emergency))	12	7	5
ab(consensus) AND ab(nurs*) AND ab(emergency))	5	0	5
Total	358	109	246

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2.1.1 Study selection

108 Studies were included that met the following criteria:

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- 110 1. The focus of the study addressed a research question, policy or practice guidance issue in the field of
111 emergency nursing practice or care;
- 112 2. The study aimed at improving emergency nursing practice or care through identifying consensus-based
113 components using the Delphi method;
- 114 3. The study produced guidance, a list of best practices, a protocol or a guideline; and,
- 115 4. The Delphi process was fully reported.

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2.2 Data collection, quality appraisal and synthesis

118 Two authors independently screened retrieved citations by title and abstract for eligibility. Studies that did not
119 meet the inclusion criteria were excluded, and any disagreement was resolved by discussion between all
120 authors. Full text versions of all potentially relevant studies were then obtained. An electronic data extraction
121 form was developed based on the literature [5, 38, 39], which consisted of two parts. The first part gathered
122 demographic information: name of author(s), year of publication, country of origin, Delphi method, panel size and
123 characteristics, number of rounds, response rate at each iteration, consensus method, setting and sample
124 characteristics and outcome. The second part of the data extraction form evaluated study quality and risk of bias

125 using criteria based in previous reviews of Delphi studies [5, 7, 40, 41]. For the purposes of this review, 'Yes'
 126 was given a value of 1, with 'No' and 'Cannot tell' a value of 0 (Table 3).

127

128 Table 3: Methodological quality of included studies

Term	Example
Purpose well defined	<ul style="list-style-type: none"> • Aims and objectives clearly stated • Study addressed a clearly focused issue • Relevant literature regarding topic area/field presented
Rationale for Delphi	<ul style="list-style-type: none"> • Appropriateness of utilising Delphi stated • Justification described for selected Delphi method
Selection of experts clearly justified	<ul style="list-style-type: none"> • Recruitment of experts described • Expert panel member selection criteria stated • Panel member relevance to topic/setting/work field described • Appropriate clinical / academic expertise / qualifications stated
Clear description of Delphi process	<ul style="list-style-type: none"> • Clear description of methods supported by literature
Flow chart	<ul style="list-style-type: none"> • Schematic of Delphi process provided • Diagram adequately reflects description of methods
Level of consensus and stability described	<ul style="list-style-type: none"> • Level agreement and stability described
Pilot test of instrument	<ul style="list-style-type: none"> • Developed instrument was tested using a representative sample
Data analysis clearly justified and reported	<ul style="list-style-type: none"> • Use of statistics clearly described and are appropriate
Transparent reporting of results	<ul style="list-style-type: none"> • Results are complete and clearly described
Information on rounds	<ul style="list-style-type: none"> • Response rates, panel feedback
Clear statement of findings	<ul style="list-style-type: none"> • Findings are explicit • Adequate discussion of the findings in relation to the aim(s)/objective(s) of the study
Trustworthiness of findings	<ul style="list-style-type: none"> • Credibility, transferability, dependability and confirmability of findings discussed • Results are believable
Discussion of limitations	<ul style="list-style-type: none"> • Strengths and weaknesses of study discussed

Term	Example
Risk of bias	<ul style="list-style-type: none"> • Potential risk bias discussed; conflict of interest examined • Strategies to minimise bias used e.g. order of Delphi questions randomised between round and/or panel members • Anonymity of panel members maintained, e.g. identifiable content in panel member comments redacted/filtered by moderator

Completed data extraction forms were then compiled by the lead author into SPSS [42]. Inter-rater agreement between appraising authors regarding assessment of methodological quality and risk of bias was high (ICC=.891; $p=.001$). Extracted data were then analysed in two ways. First, data were analysed using a quantitative or numerical approach, which included computation of the proportion (n) and percentage (%) of articles for categorical variables, with median, first interquartile (IQR) and range reported for continuous variables. Second, all authors then reviewed the numerical summary to apply meaning to the results.

3 Results

The search yielded 246 records between 2001 and 2019. Of these, 22 (8.9%) studies met the inclusion criteria. Included studies were published from a range of countries: Australia (n=7; 31.8%); Brazil (n=4; 18.2%); United Kingdom (n=3; 13.6%); United States of America (n=3; 13.6%); China (n=2; 9.1%); Sweden (n=1; 4.5%); Taiwan (n=1; 4.5%); and, Iran (n=1; 4.5%). All but two studies [43, 44] explicitly provided a rationale for using the Delphi method. Five themes were identified in the review: i) focus and purpose of the study, ii) study design and type of Delphi method, iii) selection of experts, iv) definition of consensus; and, v) methodological quality.

3.1 Focus and purpose of the studies

Defining, developing or assessment of emergency nurse competencies were the most common purpose cited (n=8; 36.7%) for using the Delphi method. For five (22.7%) articles, the focus was priority setting, while the remaining three studies sought consensus on research priorities in emergency nursing. Four (18.2%) articles reported developing tools to assess violence in ED, triage practices and extended nursing roles, three (13.6%) to develop performance indicators, two (9.1%) to develop role descriptions, and one (4.5%) to develop a protocol to evaluate the structure, process and outcome of ED nursing flowcharts guiding decision-making in poly-trauma patients.

The key outcomes generated from the Delphi studies commonly reported in table format (n=12; 54.5%) or list (n=5; 22.7%) detailing high level items. Two studies developed instruments to explore emergency nursing practice via a survey [32] or risk assessment tool [31]. Three other (13.6%) studies produced a framework for

157 emergency nursing competencies [45], nursing care practice guidance in poly-trauma patients [46] and a nurse
158 skill training curriculum [47] (Table 4).

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Table 4: Characteristics of included studies

Author (year), country	Focus	Aim/purpose	Output	
			Content	Format
Fry et al. [32], Australia	Tool development	Self-completing survey to examine current triage practice, the range of extended roles and the scope of triage decision making in New South Wales	50-item	Survey
Bayley et al. [27], USA	Priority setting	Establish research priorities for emergency nursing	Top 20 research priorities	Table
Beattie & Mackway- Jones [48], UK	Performance indicators	Identify performance indicators thought to reflect the quality of patient care in the ED	36 performance indicators	Table
Roger et al. [49], Australia	Priority setting	Establish research priorities for emergency nursing in the Western Australia	25 ranked research priorities	List
Kenwood et al. [50], UK	Priority setting	Identify key training and research areas to guide the development of emergency nurses in the UK Defence Nursing Services	51 topics regarding training/education, essential clinical skills, roles and research/audit	List
Valdez [51], USA	Priority setting	Identify societal and healthcare trends and major educational priorities for emergency nurses.	63 educational priorities and 42 societal and healthcare priorities identified	List
Hoyt et al. [52], USA	Practice competencies	Develop an initial list of competencies for NPs in emergency care settings	60 entry-level competencies for emergency nurse practitioners	Table
Wilkes et al. [31], Australia	Tool development	Develop a violence assessment tool	17-item violence assessment tool	Tool
O'Connell & Gardner [53], Australia	Practice competencies	Develop speciality competencies for NPs in emergency care settings	Four emergency NP speciality competencies	Table
Morphet et al. [54], Australia	Tool development	Identify the causes and common acts of violence in the ED as perceived by three distinct nursing groups: triage, non-triage nurses and nurse unit managers	30 ranked items across 4 themes: most significant people, causes and acts of violence and strategies for change	Table

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Author (year), country	Focus	Aim/purpose	Output	
			Content	Format
Lee et al. [55], Australia	Practice competencies	Develop a list of requisite clinical competencies for emergency nurses to provide adequate care for women experiencing intimate partner violence	38 requisite competencies for emergency nurses to provide adequate care for women experiencing intimate partner violence	Table
Ebrahimi et al. [43], Iran	Role description	Develop a role description of triage nurse	57 items, 50 of which reached consensus, describing the triage nurse role	Table
Fan et al. [45], China	Practice competencies	Develop and validate core competency standards for emergency nurse specialists	Validation of core competency standards for emergency nurse specialist	Standards
Santos et al. [56], Brazil	Performance indicators	Develop recommendations to guide delivery elder-friendly care in ED	38 aspects in 4 domains for delivery of elderly-friendly care in the ED	Table
Helms et al. [57], Australia	Role description	Develop an Australian nurse practitioner meta-speciality framework	Four validated meta-specialties: Emergency and Acute Care, Child and Family Health Care, Mental Health Care, and Primary Health Care	Table
Hersey & McAleer [58], UK	Practice competencies	Determine required competencies for a nurse in the ED assisting with rapid sequence intubation	6 competencies for requisite knowledge and skills to assist in rapid sequence intubation	List
Holanda et al. [44], Brazil	Tool development	Create an instrument to assess the professional competence of nurses in emergencies.	81-items to assess the competency of an observed nurse	Table
Considine et al. [28], Australia	Priority setting	Establish research priorities for emergency nursing in Australia	30 research priority themes across four priority groups	List
Gomes et al. [46], Brazil	Protocol	Evaluate the structure, process and outcome of nursing flowcharts used to guide care and decision-making in poly-trauma patients in ED	Three nursing care flowcharts for care of poly-trauma patients	Validation
Ju et al. [59], China	Performance indicators	Establish nursing-sensitive quality indicators for emergency nurses	16 nursing-sensitive quality care indicators	Table
Miranda et al. [47], Brazil	Practice competencies	Develop competency training frameworks for nurses being training in airway, breathing and circulation emergencies	Three training frameworks (airway, breathing and circulation)	Competency frameworks

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Author (year), country	Focus	Aim/purpose	Output	
			Content	Format
Murphy et al. [60], Sweden	Practice competencies	Identify essential disaster medicine competencies for emergency nurses	69 specific competencies for ED nurses' disaster preparedness divided over 12 domains	Table

3.2 Study design and type of Delphi method

Overall, the majority of studies utilised a modified Delphi method (n=15; 68.2%), compared to the classic Delphi technique (n=7; 31.8%); three studies also incorporated Delphi in a mixed methods design [51, 53, 57]. The average participant sample size was 39 (IQR 23.5, range 12-315) and typically included three rounds (n=13, 59.1%; range 2 – 4). Response rates for all rounds were reported in all studies. The median response rate was 90.9% (IQR 73.6, range 19.7% - 100.0%) in the first round, with an overall response rate across all rounds of 85.0% (IQR 70.9%, range 18.4% - 100.0%). Five studies had a response rate of less than 70% between rounds [27, 31, 43, 52, 56]. An online survey platform (n=12; 54.5%) was commonly used, compared to email (n=6; 27.3%) or by post (n=3; 13.6%) (Table 5).

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Table 5: Study design and response rates

Author(s)	Delphi method, iteration	N	Consensus level (%)	Number of rounds	Response rate (n) each round				Average response rate (%)
					1	2	3	4	
Fry et al. [32]	Modified, postal	12	83	2	12	12	-	-	100.0
Bayley et al. [27]	Classic, postal	147	n/s	3	147	101	79	-	74.1
Beattie & Mackway-Jones [48]	Classic, email	33	80	3	28	31	30	-	89.9
Roger et al. [49]	Classic, postal	58	n/s	2	58	46	-	-	89.7
Kenwood et al. [50]	Modified, n/s	33	75	2	19	28	-	-	71.2
Valdez [51]	Classic, n/s	68	n/s	3	50	50	50	-	73.5
Hoyt et al. [52]	Modified, internet	204	80	3	128	73	52	-	41.3
Wilkes et al. [31]	Modified, email	23	50	3	11	11	6	-	40.6
O'Connell & Gardner [53]	Modified, email	12	80	2	12	9	-	-	87.5
Morphet et al. [54]	Classic, internet	189	n/s	3	157	132	158	-	78.8
Lee et al. [55]	Modified, email	30	50	3	30	30	30	-	100.0
Ebrahimi et al. [43]	Modified, email	38	80	3	38	14	22	-	64.9
Fan et al. [45]	Modified, email	17	n/s	2	17	17	-	-	100.0
Santos et al. [56]	Modified, internet	216	70	3	72	49	44	-	25.5
Helms et al. [57]	Modified, internet	233	85	3	212	205	197	-	87.8
Hersey & McAleer [58]	Classic, internet	16	75	3	16	15	16	-	97.9
Holanda et al. [44]	Modified, internet	25	90	4	25	21	21	18	85.0
Considine et al. [28]	Classic, internet	315	80	2	232	214	-	-	70.8
Gomes et al. [46]	Classic, internet	15	70	2	15	13	-	-	93.3
Ju et al. [59]	Modified, internet	44	60	2	40	40	-	-	90.9

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Author(s)	Delphi method, iteration	N	Consensus level (%)	Number of rounds	Response rate (n) each round				Average response rate (%)
					1	2	3	4	
Miranda et al. [47]	Modified, internet	76	80	2	15	13			18.4
Murphy et al. [60]	Modified, internet	40	75	3	36	34	32		85.0

Key: n/s, not stated

3.3 Selection of experts

All studies described criteria used to select expert panel members. The most prominent inclusion criteria were: minimum length of clinical experience (n=8; 36.4%), with the median years' of experience 3 (IQR 5 years, range 1 - 10 years); representation of a particular professional role such as nurse educator or nurse practitioner (n=6; 36.4%%); membership of a specialist college or education program (n=4; 18.2%); recent publications relevant to the area of investigation (n=4; 18.2%%); and, postgraduate qualifications (n=3; 13.6%) (Table 6).

Table 6: Expert panel selection criteria

Author(s)	Expert panel selection criteria
Fry et al. [32]	Greater than five years emergency nursing experience, currently working in the field of leadership (clinical nurse consultant, educator, manager)
Bayley et al. [27]	Membership to an emergency nursing college, and/or member of a working group, research committee, scientific or editorial review panel related to emergency nursing
Beattie & Mackway-Jones [48]	Physician with specialist interest in emergency care or research, senior emergency nurse, or representative of the local health council
Roger et al. [49]	Membership to specialist emergency nursing college
Kenwood et al. [50]	Greater than five years emergency care experience, operational emergency care planning experience, or exposure to graduate emergency nursing education
Valdez [51]	Greater than five years emergency nursing experience and currently in a leadership role (educator, manager), with postgraduate qualification in nursing or education, or publication related to emergency nursing education
Hoyt et al. [52]	Endorsed nurse practitioner working in an emergency care setting
Wilkes et al. [31]	Registered nurse/nurse academic with experience in an emergency care setting with a research interest in violence against nurses
O'Connell & Gardner [53]	Endorsed nurse practitioners working in an emergency care setting
Morphet et al. [54]	Registered nurse working in an emergency care setting
Lee et al. [55]	Registered nurse with at least three years of emergency nursing experience or published studies related to intimate partner violence
Ebrahimi et al. [43]	Emergency nursing academic with interest in triage practice and research, previous involvement in triage committees or publications articles related to triage
Fan et al. [45]	Registered nurse, greater than five years of experience in emergency nursing and postgraduate education in emergency nursing

Author(s)	Expert panel selection criteria
Santos et al. [56]	Registered nurse with emergency care experience, and/or researchers with publications on the theme and/or conducting research in geriatric emergency care
Helms et al. [57]	Endorsed nurse practitioner with 12 or more months experience
Hersey & McAleer [58]	Emergency care clinician (emergency/critical care physician, nurse educator) with advanced airway skills
Holanda et al. [44]	Emergency nurses enrolled into an emergency care training program
Considine et al. [28]	Membership of an emergency nursing college, and attendance at an emergency nursing conference
Gomes et al. [46]	Professional experience and postgraduate qualifications in emergency care
Ju et al. [59]	Registered nurse with a minimum of five years of experience working in an emergency care setting
Miranda et al. [47]	Registered nurse with a least one year of experience working in an emergency care setting or teaching
Murphy et al. [60]	Registered nurse working in an emergency care setting or nurse academic within the field of emergency care

3.4 Definition of consensus

The majority of studies (n=17; 77.3%) reported a definition for reaching group consensus, commonly a percentage of ratings or the mean value on a rating scale. The percentage of agreement threshold varied between studies; median consensus level was 80.0% (IQR 70.0%, range 50% to 90%), while one study defined a negative consensus level of 80% [48]. One study used a more procedural definition that included mean rating score (≥ 3.5) and stability ($SD < 1$) of group response over successive rounds [55].

Attaining consensus based on statistical measures varied depending upon the rating scales used. The most common response formats were a 5-point scale (n=7; 31.8%) [31, 43-45, 53, 56, 60] or 4-point Likert scale (n=4; 18.2%) [28, 55, 57, 58]. Other scale levels were used, including 7-point (n=3; 13.6%) [27, 50, 51], 6-point [52], 9-point [48], and 13-point [46]. Five studies used ranking [27, 44, 57, 59, 60] rather than a scale.

Eight (36.4%) studies reported measures of central tendency; mean (n=6; 27.3%) [27, 31, 52, 53, 55, 60], median (n=2; 9.1%) [51, 53, 54] or mode (n=1; 4.5%) [55, 61]. Measures of distribution was less frequently reported (n=5; 22.7%): standard deviation (n=3) [31, 52, 53, 62], first interquartile (n=1) [54] and range (n=1) [52]. Several studies used convergence measures to evaluate concordance which included content validity index [28,

47, 57], Cronbach alpha [45, 46], continuity-corrected Chi-Square [57], and Kendall's coefficients of concordance [59].

3.5 Methodological quality

For the quality assessment of methodological rigor and transparency of reporting, overall quality was judged as high (median 12; IQR 9.5, range 4 - 13). Most studies (n=16; 72.7%) fulfilled at least 10 of the 14 predefined quality criteria. For some studies however, one or more criteria were not reported. Selection of experts was not clearly reported in three studies [43, 44, 49]. While methods were clearly described for 19 studies, only five [27, 44, 57, 59, 60] provided a flow chart illustrating the process. A clear definition of consensus or cut-off (e.g. mean >3.5) was not provided for three studies [27, 49, 54]. Five studies reported conducting a pilot test, to assess usability of the data collection methods and participant materials [52, 53], or the reliability and validity of the Delphi product (e.g. instrument) [32, 44, 45]. Of note, seven studies [31, 32, 43, 44, 48, 49, 56] did not describe or report strategies to reduce the potential risk of bias.

Overall, the studies with the highest methodological quality (satisfied >10/14 criteria) explored practice competencies [45, 52, 53, 55, 58, 60], priority setting [27, 28, 50, 51], performance indicators [48, 59], tool [32, 54] and protocol development [46], and role description [57] (Table 7).

Table 7: Methodological quality

Author(s)	Clear aim	Rationale for Delphi described	Selection of experts justified	Clear description of Delphi process	Flow chart	Level of consensus and stability described	Pilot testing of instrument	Data analysis clearly justified and reported	Transparent reporting of results	Information on rounds	Clear statement of findings	Trustworthiness of findings	Discussion of limitations	Risk of bias	Total (%)
Fry et al. [32]	1	1	1	1	0	1	1	1	1	1	1	1	1	0	12 (85.7)
Bayley et al. [27]	1	1	1	1	1	0	0	0	1	1	1	1	1	1	11 (78.6)
Beattie & Mackway-Jones [48]	1	1	1	1	0	1	0	1	1	1	1	1	1	0	11 (78.6)
Roger et al. [49]	1	1	0	1	0	0	0	1	1	1	0	0	0	0	6 (42.9)
Kenwood et al. [50]	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12 (85.7)
Valdez [51]	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12 (85.7)
Hoyt et al. [52]	1	1	1	1	0	1	1	1	1	1	1	1	1	1	13 (92.9)
Wilkes et al. [31]	1	1	1	1	0	1	0	1	1	1	1	0	0	0	9 (64.3)
O'Connell & Gardner [53]	1	1	1	1	0	1	1	1	1	1	1	1	1	1	13 (92.9)
Morphet et al. [54]	1	1	1	1	0	0	0	1	1	1	1	1	1	1	11 (78.6)
Lee et al. [55]	1	1	1	0	0	1	0	1	1	1	1	1	1	1	11 (78.6)
Ebrahimi et al. [43]	1	0	0	0	0	1	0	1	1	1	1	1	0	0	7 (50.0)
Fan et al. [45]	1	1	1	1	0	1	1	1	1	1	1	1	1	1	13 (92.9)
Santos et al. [56]	1	1	0	1	0	1	0	1	1	1	1	1	0	0	9 (64.3)
Helms et al. [57]	1	1	1	1	1	1	0	1	1	1	1	1	1	1	13 (92.9)
Hersey & McAleer [58]	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12 (85.7)
Holanda et al. [44]	0	0	0	0	1	1	1	0	0	0	0	0	1	0	4 (28.6)
Considine et al. [28]	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12 (85.7)
De Lima Gomes et al. [46]	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12 (85.7)

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Author(s)	<i>Clear aim</i>	<i>Rationale for Delphi described</i>	<i>Selection of experts justified</i>	<i>Clear description of Delphi process</i>	<i>Flow chart</i>	<i>Level of consensus and stability described</i>	<i>Pilot testing of instrument</i>	<i>Data analysis clearly justified and reported</i>	<i>Transparent reporting of results</i>	<i>Information on rounds</i>	<i>Clear statement of findings</i>	<i>Trustworthiness of findings</i>	<i>Discussion of limitations</i>	<i>Risk of bias</i>	Total (%)
Ju et al. [59]	1	1	1	1	1	1	0	1	1	1	1	1	1	1	13 (92.9)
Miranda et al. [47]	1	1	1	1	0	1	0	0	0	0	0	0	1	1	7 (50.0)
Murphy et al. [60]	1	1	1	1	1	1	0	1	1	1	1	1	1	1	13 (92.9)

Key: 'Yes' = 1, 'No' and 'not clear' = 0

4 Discussion

This is the first systematic review to examine use of the Delphi method in developing guidance for emergency nursing practice. Emergency nursing is a specialty with a broad knowledge base, and a scope of practice that is rapidly and progressively expanding. Application of evidence-informed practice in delivering safe, high-quality emergency nursing care is therefore critical. The last three decades have seen a strong movement towards evidence-based emergency nursing practice, with an emphasis on informing clinical decisions by the findings from rigorous research [63]. This review identified use of the Delphi method to establish research priorities, conduct needs assessments, select competencies and identify practice role responsibilities in emergency care. In general, the quality of the Delphi studies in this review was high. A meta-analysis could not however be performed due to significant study heterogeneity.

The Delphi method is useful in areas of limited research, and is best suited for “what”, “when” and “where” questions [8, 64]. The overall aim is to predict needs, explore areas where controversy, debate or lack of clarity exist, and to discover group attitudes and priorities. Guidance developed using the Delphi process have implications for patient care and nursing practice. In order for the Delphi method to be a reliable and credible source of evidence in guiding emergency nursing practice, consistency and quality both in the conduct and reporting of study findings is critical [40]. The review identified variability in the application and methodological quality of the Delphi method in generating guidance for emergency nursing practice. Effective implementation of the Delphi method requires careful consideration and deliberate execution of defining the research problem; selection of experts; survey development; data analysis and reporting. These issues are discussed further below.

4.1 Selection of experts

In Delphi studies, definition of an ‘expert’ is of critical importance, and varies according to the needs of the study. The criteria should include measurable characteristics that each participant group would acknowledge as those defining expertise; while still attempting to recruit a broad range of individual perspectives [65]. In this review, any conflict of interest amongst participants was poorly described. A rigorous and defensible research study must hold minimisation of bias as paramount. Conflict of interest has the potential to bias results and outcomes of expert opinions [62]. Conflicts of interest in emergency medicine has been well documented [66]. Whilst this has not been a specific issue identified in emergency nursing practice [67, 68], the use of experts through a Delphi method clearly has the potential to influence the practice of emergency care, and therefore any potential for bias needs to be considered, managed and reported.

There is no consensus regarding response rate for Delphi studies. Response rates vary widely, ranging as low as 8% to 100% [69]. A 70% response rate between rounds has been suggested to maintain rigor [70]. In this review, overall median response rate was 85.0%, although five studies had a response rate less than 70% [31,

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43, 47, 52, 56]. Strategies such as informed consent, limited time between rounds, limited number of rounds, continued communication with panel members, and short surveys may improve response rates [71].

Currently, there is no agreement on the panel size for Delphi studies, or what constitutes a 'small' or 'large' sample size. Within nursing, Delphi panel sample sizes have ranged from 6 [72] to 1,142 [73]. While Delphi results may be more reliable with larger panel sizes, this cannot be assumed. Larger panel sample sizes can make the technique unwieldy, and diminished returns reduce the validity of findings [74, 75]. DeVilliers, De Villiers and Kent [20] define sample size depending on whether the sample is homogenous or heterogeneous, and suggest the following sample size: 15-30 if panel members are from the same discipline, or 5-10 if from differing professional groups. There are no clear guidelines suggesting the numbers to be included in Delphi studies, as the sample is purposively selected and it depends on the topic being investigated.

4.2 Survey development

Despite the administrative and methodological complexity of conducting Delphi research, there has been limited debate about pilot testing. Pilot testing is often undertaken to evaluate feasibility, duration, cost, and identify limitations, and can provide valuable information to refine and improve the study design prior to full-scale implementation [76]. In this review, while pilot testing was rarely reported [32, 44, 45, 52, 53], findings led to changes to Delphi materials, and/or confirmed the appropriateness of the study design and methods. Pilot testing in Delphi research could provide useful guidance about the clarity and readability of survey questions [77], data collection and analysis methods [78], feedback processes and rigor [8, 79]. Delphi researchers should therefore report their approach to pilot studies [80].

4.3 Data analysis

In this review, a wide range of different rating scales (4 to 13-points) were identified, with the majority of studies selecting a 5-point Likert scale. Currently, there is no agreement about what scales should be used in Delphi studies. Inappropriate application of rating scales is a common reason cited for failure [81, 82]. Initial investigation into the impact of scale format found that item reliability increased when moving from 2-point scales towards 11-point scales, with minimal increases in item reliability observed beyond 7 points [83]. More recent studies comparing 5-point and 7-point Likert scales found that 5-point Likert scales with labels at the extremes, resulted in better data quality, internal consistency and discriminative validity [84, 85].

In Delphi studies, measures of central tendency are usually analysed with one or more measures of dispersion to evaluate the distribution of scores. In this review of 22 studies, eight reported at least one measure of central tendency measure, the most prominent being mean (n=6); few stated measures of distribution (n=5). In the health science literature, there has been a long-standing controversy regarding whether ordinal data, can be treated as interval data [86]. The use of mean, standard deviation and parametric statistics to describe ordinal

1 data, while strictly speaking is incorrect [87], in data that is not skewed, peaked or multimodal, there are no real
2 differences observed [88]. It was difficult to assess whether the measures of central tendency was appropriate
3 without measures of dispersion also being reported.
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6 **4.4 Ending the Delphi process**

7 Consensus measurement plays an important role in Delphi research. Traditionally, Delphi studies cease when
8 the survey procedure reaches a pre-determined level of agreement (i.e. consensus was achieved). While
9 consensus is generally felt to be of primary importance, definitions of consensus vary widely and are poorly
10 reported. In this review, percent agreement was the most common definition of consensus identified, but varied
11 between studies (50-90%). Currently, there is no universally agreed cut-off level regarding consensus. As
12 previous studies have demonstrated [61, 89], Delphi results can be greatly impacted by the level of consensus
13 set and rating scale used. However, while consensus is important, it is also meaningless if group stability has
14 not been reached a priori [90]. Group stability refers to the consistency of response between successive rounds
15 [91]. A variation of greater than 15% in any two consecutive rounds is considered to indicate instability (Scheibe,
16 Skutsch & Schofer 1975). In this review, stability across successive rounds was rarely reported.
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26 **4.5 Strengths and limitations**

27 A strength of this review was a systematic and comprehensive search approach for relevant articles.
28 Standardised assessment frameworks were also used to evaluate the credibility and quality of each study.
29 However, some limitations are also noted. First, the quality of studies included in this review was variable,
30 increasing the risk of selection and performance bias, and limiting the generalisability of study findings. The use
31 of narrative synthesis allowed for a comprehensive analysis of the identified literature; generating insights into
32 the use, quality and utility of the Delphi method in developing guidance in emergency nursing practice. Second,
33 as in any systematic review, relevant, but unpublished studies may not have been identified for inclusion. To
34 minimise this risk, the authors manually reviewed the grey literature to identify other possible studies.
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45 **5 Conclusion**

46 The Delphi technique, when guidelines for methodological rigor and transparency of reporting are followed, is an
47 appropriate method for exploring emergency nursing practice. The method is a versatile qualitative research
48 technique that is effective in gaining and measuring group consensus in healthcare. Use of the Delphi method in
49 generating guidance in emergency nursing practice to date has largely focused on defining, developing or
50 assessing emergency nurse competencies. Variations in the application of the Delphi method and
51 methodological quality were identified. This may indicate a gap between available methodological guidance and
52 publishing primary research relating to the use of the Delphi method in emergency nursing research.
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5.2 Declaration of Conflicting Interests

The authors declare that there is no conflict of interest.

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1 **Title: Use of the Delphi method to generate guidance in emergency nursing practice: a**
2 **systematic review**

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4
5 **Abstract**
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9 **Aim:** To examine the application and methodological quality of the Delphi method used in developing emergency
10 nursing practices.

11 **Background:** Emergency nursing scope of practice has rapidly expanded in response to increasing patient
12 acuity, complexity and technological innovation. Determining best practice is crucial for delivering high quality,
13 safe and effective emergency nursing care. The Delphi method has been used to identify, prioritise complex
14 issues and develop evidence-driven guidance in emergency nursing practice. The use and quality of the Delphi
15 method in emergency nursing practice has not been examined.

16 **Design:** Systematic literature review

17 **Databases and Data treatment:** A systematic literature search was conducted using the following databases:
18 SCOPUS, EMBASE, Medline and ProQuest from date of inception to August 2019. The database search was
19 limited to scholarly articles or peer-reviewed journals. No language restrictions were applied. The Cochrane
20 Collaboration method and PRISMA checks were utilized to conduct the review.

21 **Results:** Of 246 records identified 22 (8.9%) studies met the inclusion criteria. A modified Delphi technique was
22 commonly used (n=15; 68.2%) and often conducted online (n=11; 50.0%). Eight practice guidance themes were
23 identified. Overall study quality was high (score 12/14; range 4 - 13), transparency of reporting varied.

24 **Conclusion:** Based on this review, the Delphi technique is an appropriate method for exploring emergency
25 nursing practice. The studies reviewed demonstrated that knowledge, skills and clinical expertise has
26 progressively expanded in the specialty of emergency nursing. Variation in the application, conduct and
27 transparency of reporting in Delphi studies developing guidance for emergency nursing practice is discussed.

28 **Keywords:** Delphi, Consensus, Systematic Review, Emergency Nursing, Clinical Practice

1 Introduction

As nursing has developed as a profession, there has been a continual evolution of the discipline's scope of practice. Nursing practice has become more specialised in response to increasing patient demand, acuity, health system complexity and technological innovation [1, 2]. Emergency nursing practice is a specialty that has undergone rapid expansion in the nature and scope of practice [3]. Nursing continues to evolve to meet service and patient needs, therefore, determining best practice is crucial for delivering high quality, safe and effective care. The Delphi method has been widely used across a range of disciplines to develop and guide clinical practice. Practice guidance developed using the Delphi method informs clinician decision making and supports safe patient care. To date, the use of the Delphi method in developing practice guidance for emergency nursing has not been evaluated.

1.1 Background

Consensus group methods play a major role in nursing research [4]. They are particularly useful when empirical knowledge is lacking, limited or contradictory [5]. The two most common consensus methods use in health research are the nominal group technique and the Delphi technique. The nominal group technique (NGT) designed by Delbecq and Van de Ven [6] involves face-to-face discussion in small groups using a four-staged process: silent generation, round robin, clarification and voting (ranking or rating). The NGT is best suited to generating ideas to problems [7], whereas the Delphi technique is frequently used in the healthcare setting as a rigorous, iterative process with content experts to develop practice guidelines [8, 9].

The Delphi technique is a qualitative research method first developed by Dalkey and Helmer [10] at the Research and Development (RAND) Corporation in the 1950s. Since then, the Delphi technique has become an increasingly important method used to address issues in healthcare, and an attractive process for developing consensual guidance on best practice [9, 11-14]. The five main characteristics of the classic Delphi method are: use of experts, anonymity, controlled feedback, multistage iteration, and exploration of consensus via statistical aggregation of group response [15]. These characteristics enhance the validity and reliability of the study design to improve the quality of responses [16]. In contrast to other consensus building methods such as the nominal group method or consensus conferences, the Delphi method enables a large number of individuals across diverse locations and areas of expertise to be included anonymously. Anonymity for participants allows freedom of expression and open critique, and minimises any influence of social pressures or the voice of one or a few experts during the process [17]. Controlled feedback to participants between rounds provides a summary of group opinion. This allows participants to either retain or change their earlier opinion in light of other participants' views. Through planned iterations of the questionnaire, participants can anonymously change their opinions in view of the aggregated group response without reprisal.

64 In contrast to other consensus building methods such as the nominal group method or consensus conferences,
 65 the Delphi method enables a large number of individuals across diverse locations and areas of expertise to be
 66 included anonymously. Anonymity for participants allows freedom of expression and open critique, and
 67 minimises any influence of social pressures or the voice of one or a few experts during the process [17].
 68 Controlled feedback to participants between rounds provides a summary of group opinion. This allows
 69 participants to either retain or change their earlier opinion in light of other participants' views. Over 20 variations
 70 of the Delphi method have been described, where researchers have modified the approach to suit their needs
 71 [18]. The most popular formats include: the modified Delphi, the policy Delphi, the decision Delphi, the real-time
 72 Delphi, and the internet Delphi (Table 1).

74 Table 1: Types of Delphi and main characteristics

Type	Characteristics
Classic Delphi	Sequential questionnaires are used to systematically solicit and collect specific information on a particular topic. The first round typically begins with an open-ended questionnaire [5].
Modified Delphi	A similar method to the classic Delphi process. The 'modification' usually involves experts meeting (e.g. interviews, focus group) to discuss/rate the results, or the use of pre-generated items in round one, derived from the literature [19].
Decision Delphi	Same process as the classic Delphi, but the focus is on making decisions rather than coming to consensus [14].
Policy Delphi	Uses the opinions of experts to generate potential resolutions to policy issues or generate ideas on future policy directions [20].
Real-time Delphi	No 'rounds' are used, with calculation and provision of responses fed back to participants in real-time. Participants do not judge at discrete intervals (i.e. rounds), but can change their opinion as often as they like within the timeframe set [21].
Internet-based Delphi	Also known as 'e-Delphi', or 'web-based Delphi', follows the same process as the classic Delphi but is conducted using an online platform [22].

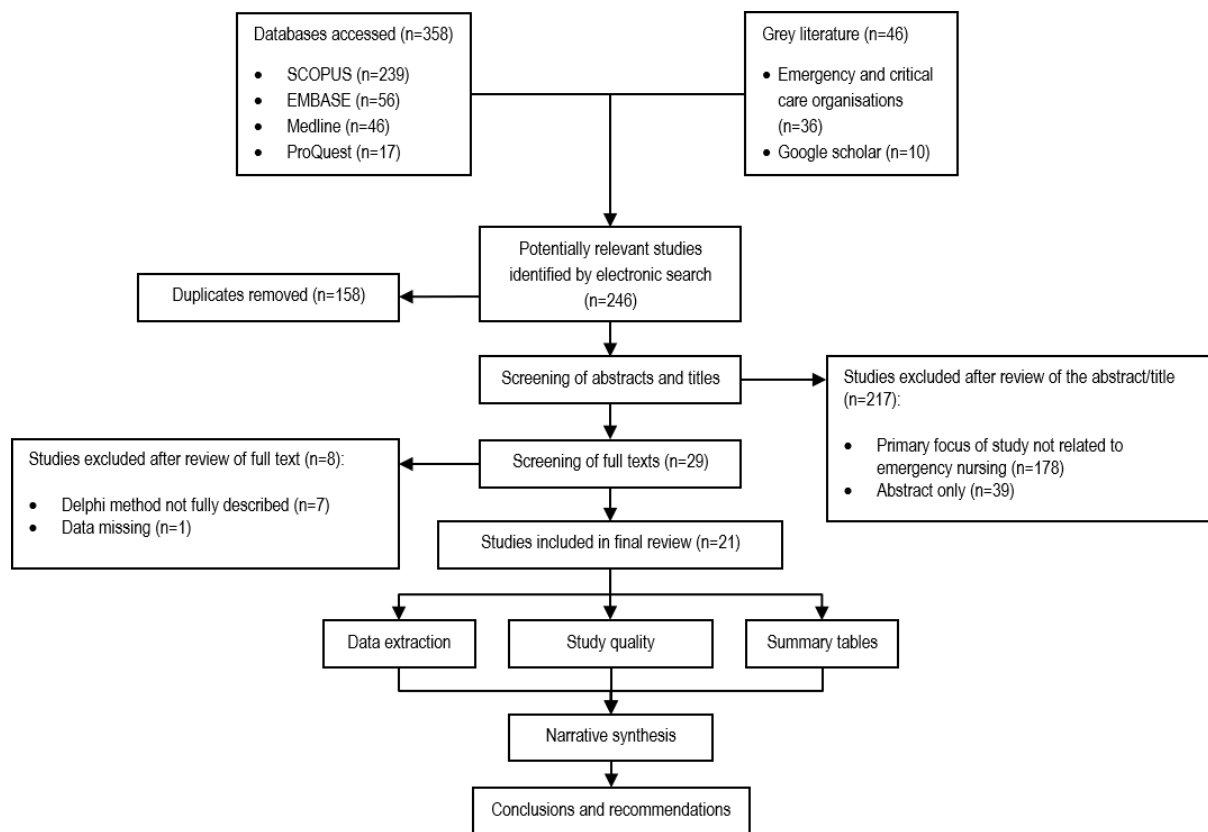
78 The Delphi method has been widely used in nursing to explore a wide range of topics such as role delineation
 79 [23-25], research priorities [26-28], quality performance indicators [29], standards of practice [30], tool
 80 development [31] and survey development [32]. Practice guidance developed using the Delphi process have
 81 implications for patient care and nursing practice. In order for the Delphi method to be a reliable and credible
 82 source of generating evidence in emergency nursing practice, an examination of the rigor and quality in its
 83 application is warranted. Thus, the overall objective of this review was to describe the use of the Delphi method

84 in developing guidance for emergency nursing practice, and to assess the application and reporting quality of the
 85 Delphi method and results.

87 2 Methods

88 A methodological systematic review was undertaken to answer the review question ‘How is the Delphi method
 89 being used for the development of guidance for emergency nursing practice?’ A key feature of a methodological
 90 systemic review is its focus on the methodological features of studies as opposed to the relevance of the output
 91 from the Delphi process [33-35]. The Cochrane Collaboration systemic review method guided the systematic
 92 review of both qualitative and quantitative methods [36]. The Preferred Reporting Items for Systematic Reviews
 93 and Meta-Analysis (PRISMA) checklist [37] was used to identify essential components of the review and guide
 94 reporting of the study methods and results (Figure 1).

96 Figure 1: PRISMA flowchart of the search and systematic review process



99 2.1 Databases and data treatment

100 A systematic literature search was conducted using the following databases: SCOPUS, EMBASE, Medline, and
 101 ProQuest from date of inception to August 2019. The search was limited to scholarly articles or peer-reviewed
 102 journals, and no language restrictions were applied. Search strategies were customized for each database to

103 account for different search interfaces. A range of search terms were used to identify potential studies.

104 Reference lists of included articles were also searched for other relevant studies not already located (Table 2).

105 Table 2: Search strategy results

Database, search strategy	Results	Duplicates	Grand total
<i>SCOPUS</i>			
(ABS (Delphi) AND ABS (nurs*) AND ABS (emergency))	34	16	15
(ABS (consensus) AND ABS (nurs*) AND ABS (emergency))	205	41	164
<i>EMBASE</i>			
ab(Delphi) AND ab(nurs*) AND ab(emergency))	31	24	7
ab(consensus) AND ab(nurs*) AND ab(emergency))	15	6	9
<i>Medline</i>			
(Delphi and nurs* and emergency).ab	26	15	11
(consensus and nurs* and emergency).ab	30	0	30
<i>ProQuest</i>			
ab(Delphi) AND ab(nurs*) AND ab(emergency))	12	7	5
ab(consensus) AND ab(nurs*) AND ab(emergency))	5	0	5
Total	358	109	246

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2.1.1 Study selection

108 Studies were included that met the following criteria:

109

- 110 1. The focus of the study addressed a research question, policy or practice guidance issue in the field of
- 111 emergency nursing practice or care;
- 112 2. The study aimed at improving emergency nursing practice or care through identifying consensus-based
- 113 components using the Delphi method;
- 114 3. The study produced guidance, a list of best practices, a protocol or a guideline; and,
- 115 4. The Delphi process was fully reported.

116

2.2 Data collection, quality appraisal and synthesis

118 Two authors independently screened retrieved citations by title and abstract for eligibility. Studies that did not
 119 meet the inclusion criteria were excluded, and any disagreement was resolved by discussion between all
 120 authors. Full text versions of all potentially relevant studies were then obtained. An electronic data extraction
 121 form was developed based on the literature [5, 38, 39], which consisted of two parts. The first part gathered
 122 demographic information: name of author(s), year of publication, country of origin, Delphi method, panel size and
 123 characteristics, number of rounds, response rate at each iteration, consensus method, setting and sample
 124 characteristics and outcome. The second part of the data extraction form evaluated study quality and risk of bias

125 using criteria based in previous reviews of Delphi studies [5, 7, 40, 41]. For the purposes of this review, 'Yes'
 126 was given a value of 1, with 'No' and 'Cannot tell' a value of 0 (Table 3).

127

128 Table 3: Methodological quality of included studies

Term	Example
Purpose well defined	<ul style="list-style-type: none"> • Aims and objectives clearly stated • Study addressed a clearly focused issue • Relevant literature regarding topic area/field presented
Rationale for Delphi	<ul style="list-style-type: none"> • Appropriateness of utilising Delphi stated • Justification described for selected Delphi method
Selection of experts clearly justified	<ul style="list-style-type: none"> • Recruitment of experts described • Expert panel member selection criteria stated • Panel member relevance to topic/setting/work field described • Appropriate clinical / academic expertise / qualifications stated
Clear description of Delphi process	<ul style="list-style-type: none"> • Clear description of methods supported by literature
Flow chart	<ul style="list-style-type: none"> • Schematic of Delphi process provided • Diagram adequately reflects description of methods
Level of consensus and stability described	<ul style="list-style-type: none"> • Level agreement and stability described
Pilot test of instrument	<ul style="list-style-type: none"> • Developed instrument was tested using a representative sample
Data analysis clearly justified and reported	<ul style="list-style-type: none"> • Use of statistics clearly described and are appropriate
Transparent reporting of results	<ul style="list-style-type: none"> • Results are complete and clearly described
Information on rounds	<ul style="list-style-type: none"> • Response rates, panel feedback
Clear statement of findings	<ul style="list-style-type: none"> • Findings are explicit • Adequate discussion of the findings in relation to the aim(s)/objective(s) of the study
Trustworthiness of findings	<ul style="list-style-type: none"> • Credibility, transferability, dependability and confirmability of findings discussed • Results are believable
Discussion of limitations	<ul style="list-style-type: none"> • Strengths and weaknesses of study discussed

Term	Example
Risk of bias	<ul style="list-style-type: none"> • Potential risk bias discussed; conflict of interest examined • Strategies to minimise bias used e.g. order of Delphi questions randomised between round and/or panel members • Anonymity of panel members maintained, e.g. identifiable content in panel member comments redacted/filtered by moderator

129

130 Completed data extraction forms were then compiled by the lead author into SPSS [42]. Inter-rater agreement
 131 between appraising authors regarding assessment of methodological quality and risk of bias was high
 132 (ICC=.891; $p=.001$). Extracted data were then analysed in two ways. First, data were analysed using a
 133 quantitative or numerical approach, which included computation of the proportion (n) and percentage (%) of
 134 articles for categorical variables, with median, first interquartile (IQR) and range reported for continuous
 135 variables. Second, all authors then reviewed the numerical summary to apply meaning to the results.

136

137 3 Results

138 The search yielded 246 records between 2001 and 2019. Of these, 22 (8.9%) studies met the inclusion criteria.
 139 Included studies were published from a range of countries: Australia (n=7; 31.8%); Brazil (n=4; 18.2%); United
 140 Kingdom (n=3; 13.6%); United States of America (n=3; 13.6%); China (n=2; 9.1%); Sweden (n=1; 4.5%); Taiwan
 141 (n=1; 4.5%); and, Iran (n=1; 4.5%). All but two studies [43, 44] explicitly provided a rationale for using the Delphi
 142 method. Five themes were identified in the review: i) focus and purpose of the study, ii) study design and type of
 143 Delphi method, iii) selection of experts, iv) definition of consensus; and, v) methodological quality.

144

145 3.1 Focus and purpose of the studies

146 Defining, developing or assessment of emergency nurse competencies were the most common purpose cited
 147 (n=8; 36.7%) for using the Delphi method. For five (22.7%) articles, the focus was priority setting, while the
 148 remaining three studies sought consensus on research priorities in emergency nursing. Four (18.2%) articles
 149 reported developing tools to assess violence in ED, triage practices and extended nursing roles, three (13.6%) to
 150 develop performance indicators, two (9.1%) to develop role descriptions, and one (4.5%) to develop a protocol to
 151 evaluate the structure, process and outcome of ED nursing flowcharts guiding decision-making in poly-trauma
 152 patients.

153

154 The key outcomes generated from the Delphi studies commonly reported in table format (n=12; 54.5%) or list
 155 (n=5; 22.7%) detailing high level items. Two studies developed instruments to explore emergency nursing
 156 practice via a survey [32] or risk assessment tool [31]. Three other (13.6%) studies produced a framework for

157 emergency nursing competencies [45], nursing care practice guidance in poly-trauma patients [46] and a nurse
158 skill training curriculum [47] (Table 4).

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Table 4: Characteristics of included studies

Author (year), country	Focus	Aim/purpose	Output	
			Content	Format
Fry et al. [32], Australia	Tool development	Self-completing survey to examine current triage practice, the range of extended roles and the scope of triage decision making in New South Wales	50-item	Survey
Bayley et al. [27], USA	Priority setting	Establish research priorities for emergency nursing	Top 20 research priorities	Table
Beattie & Mackway- Jones [48], UK	Performance indicators	Identify performance indicators thought to reflect the quality of patient care in the ED	36 performance indicators	Table
Roger et al. [49], Australia	Priority setting	Establish research priorities for emergency nursing in the Western Australia	25 ranked research priorities	List
Kenwood et al. [50], UK	Priority setting	Identify key training and research areas to guide the development of emergency nurses in the UK Defence Nursing Services	51 topics regarding training/education, essential clinical skills, roles and research/audit	List
Valdez [51], USA	Priority setting	Identify societal and healthcare trends and major educational priorities for emergency nurses.	63 educational priorities and 42 societal and healthcare priorities identified	List
Hoyt et al. [52], USA	Practice competencies	Develop an initial list of competencies for NPs in emergency care settings	60 entry-level competencies for emergency nurse practitioners	Table
Wilkes et al. [31], Australia	Tool development	Develop a violence assessment tool	17-item violence assessment tool	Tool
O'Connell & Gardner [53], Australia	Practice competencies	Develop speciality competencies for NPs in emergency care settings	Four emergency NP speciality competencies	Table
Morphet et al. [54], Australia	Tool development	Identify the causes and common acts of violence in the ED as perceived by three distinct nursing groups: triage, non-triage nurses and nurse unit managers	30 ranked items across 4 themes: most significant people, causes and acts of violence and strategies for change	Table

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Author (year), country	Focus	Aim/purpose	Output	
			Content	Format
Lee et al. [55], Australia	Practice competencies	Develop a list of requisite clinical competencies for emergency nurses to provide adequate care for women experiencing intimate partner violence	38 requisite competencies for emergency nurses to provide adequate care for women experiencing intimate partner violence	Table
Ebrahimi et al. [43], Iran	Role description	Develop a role description of triage nurse	57 items, 50 of which reached consensus, describing the triage nurse role	Table
Fan et al. [45], China	Practice competencies	Develop and validate core competency standards for emergency nurse specialists	Validation of core competency standards for emergency nurse specialist	Standards
Santos et al. [56], Brazil	Performance indicators	Develop recommendations to guide delivery elder-friendly care in ED	38 aspects in 4 domains for delivery of elderly-friendly care in the ED	Table
Helms et al. [57], Australia	Role description	Develop an Australian nurse practitioner meta-speciality framework	Four validated meta-specialties: Emergency and Acute Care, Child and Family Health Care, Mental Health Care, and Primary Health Care	Table
Hersey & McAleer [58], UK	Practice competencies	Determine required competencies for a nurse in the ED assisting with rapid sequence intubation	6 competencies for requisite knowledge and skills to assist in rapid sequence intubation	List
Holanda et al. [44], Brazil	Tool development	Create an instrument to assess the professional competence of nurses in emergencies.	81-items to assess the competency of an observed nurse	Table
Considine et al. [28], Australia	Priority setting	Establish research priorities for emergency nursing in Australia	30 research priority themes across four priority groups	List
Gomes et al. [46], Brazil	Protocol	Evaluate the structure, process and outcome of nursing flowcharts used to guide care and decision-making in poly-trauma patients in ED	Three nursing care flowcharts for care of poly-trauma patients	Validation
Ju et al. [59], China	Performance indicators	Establish nursing-sensitive quality indicators for emergency nurses	16 nursing-sensitive quality care indicators	Table
Miranda et al. [47], Brazil	Practice competencies	Develop competency training frameworks for nurses being training in airway, breathing and circulation emergencies	Three training frameworks (airway, breathing and circulation)	Competency frameworks

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Author (year), country	Focus	Aim/purpose	Output	
			Content	Format
Murphy et al. [60], Sweden	Practice competencies	Identify essential disaster medicine competencies for emergency nurses	69 specific competencies for ED nurses' disaster preparedness divided over 12 domains	Table

3.2 Study design and type of Delphi method

Overall, the majority of studies utilised a modified Delphi method (n=15; 68.2%), compared to the classic Delphi technique (n=7; 31.8%); three studies also incorporated Delphi in a mixed methods design [51, 53, 57]. The average participant sample size was 39 (IQR 23.5, range 12-315) and typically included three rounds (n=13, 59.1%; range 2 – 4). Response rates for all rounds were reported in all studies. The median response rate was 90.9% (IQR 73.6, range 19.7% - 100.0%) in the first round, with an overall response rate across all rounds of 85.0% (IQR 70.9%, range 18.4% - 100.0%). Five studies had a response rate of less than 70% between rounds [27, 31, 43, 52, 56]. An online survey platform (n=12; 54.5%) was commonly used, compared to email (n=6; 27.3%) or by post (n=3; 13.6%) (Table 5).

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Table 5: Study design and response rates

Author(s)	Delphi method, iteration	N	Consensus level (%)	Number of rounds	Response rate (n) each round				Average response rate (%)
					1	2	3	4	
Fry et al. [32]	Modified, postal	12	83	2	12	12	-	-	100.0
Bayley et al. [27]	Classic, postal	147	n/s	3	147	101	79	-	74.1
Beattie & Mackway-Jones [48]	Classic, email	33	80	3	28	31	30	-	89.9
Roger et al. [49]	Classic, postal	58	n/s	2	58	46	-	-	89.7
Kenwood et al. [50]	Modified, n/s	33	75	2	19	28	-	-	71.2
Valdez [51]	Classic, n/s	68	n/s	3	50	50	50	-	73.5
Hoyt et al. [52]	Modified, internet	204	80	3	128	73	52	-	41.3
Wilkes et al. [31]	Modified, email	23	50	3	11	11	6	-	40.6
O'Connell & Gardner [53]	Modified, email	12	80	2	12	9	-	-	87.5
Morphet et al. [54]	Classic, internet	189	n/s	3	157	132	158	-	78.8
Lee et al. [55]	Modified, email	30	50	3	30	30	30	-	100.0
Ebrahimi et al. [43]	Modified, email	38	80	3	38	14	22	-	64.9
Fan et al. [45]	Modified, email	17	n/s	2	17	17	-	-	100.0
Santos et al. [56]	Modified, internet	216	70	3	72	49	44	-	25.5
Helms et al. [57]	Modified, internet	233	85	3	212	205	197	-	87.8
Hersey & McAleer [58]	Classic, internet	16	75	3	16	15	16	-	97.9
Holanda et al. [44]	Modified, internet	25	90	4	25	21	21	18	85.0
Considine et al. [28]	Classic, internet	315	80	2	232	214	-	-	70.8
Gomes et al. [46]	Classic, internet	15	70	2	15	13	-	-	93.3
Ju et al. [59]	Modified, internet	44	60	2	40	40	-	-	90.9

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Author(s)	Delphi method, iteration	N	Consensus level (%)	Number of rounds	Response rate (n) each round				Average response rate (%)
					1	2	3	4	
Miranda et al. [47]	Modified, internet	76	80	2	15	13			18.4
Murphy et al. [60]	Modified, internet	40	75	3	36	34	32		85.0

Key: n/s, not stated

3.3 Selection of experts

All studies described criteria used to select expert panel members. The most prominent inclusion criteria were: minimum length of clinical experience (n=8; 36.4%), with the median years' of experience 3 (IQR 5 years, range 1 - 10 years); representation of a particular professional role such as nurse educator or nurse practitioner (n=6; 36.4%%); membership of a specialist college or education program (n=4; 18.2%); recent publications relevant to the area of investigation (n=4; 18.2%%); and, postgraduate qualifications (n=3; 13.6%) (Table 6).

Table 6: Expert panel selection criteria

Author(s)	Expert panel selection criteria
Fry et al. [32]	Greater than five years emergency nursing experience, currently working in the field of leadership (clinical nurse consultant, educator, manager)
Bayley et al. [27]	Membership to an emergency nursing college, and/or member of a working group, research committee, scientific or editorial review panel related to emergency nursing
Beattie & Mackway-Jones [48]	Physician with specialist interest in emergency care or research, senior emergency nurse, or representative of the local health council
Roger et al. [49]	Membership to specialist emergency nursing college
Kenwood et al. [50]	Greater than five years emergency care experience, operational emergency care planning experience, or exposure to graduate emergency nursing education
Valdez [51]	Greater than five years emergency nursing experience and currently in a leadership role (educator, manager), with postgraduate qualification in nursing or education, or publication related to emergency nursing education
Hoyt et al. [52]	Endorsed nurse practitioner working in an emergency care setting
Wilkes et al. [31]	Registered nurse/nurse academic with experience in an emergency care setting with a research interest in violence against nurses
O'Connell & Gardner [53]	Endorsed nurse practitioners working in an emergency care setting
Morphet et al. [54]	Registered nurse working in an emergency care setting
Lee et al. [55]	Registered nurse with at least three years of emergency nursing experience or published studies related to intimate partner violence
Ebrahimi et al. [43]	Emergency nursing academic with interest in triage practice and research, previous involvement in triage committees or publications articles related to triage
Fan et al. [45]	Registered nurse, greater than five years of experience in emergency nursing and postgraduate education in emergency nursing

Author(s)	Expert panel selection criteria
Santos et al. [56]	Registered nurse with emergency care experience, and/or researchers with publications on the theme and/or conducting research in geriatric emergency care
Helms et al. [57]	Endorsed nurse practitioner with 12 or more months experience
Hersey & McAleer [58]	Emergency care clinician (emergency/critical care physician, nurse educator) with advanced airway skills
Holanda et al. [44]	Emergency nurses enrolled into an emergency care training program
Considine et al. [28]	Membership of an emergency nursing college, and attendance at an emergency nursing conference
Gomes et al. [46]	Professional experience and postgraduate qualifications in emergency care
Ju et al. [59]	Registered nurse with a minimum of five years of experience working in an emergency care setting
Miranda et al. [47]	Registered nurse with a least one year of experience working in an emergency care setting or teaching
Murphy et al. [60]	Registered nurse working in an emergency care setting or nurse academic within the field of emergency care

3.4 Definition of consensus

The majority of studies (n=17; 77.3%) reported a definition for reaching group consensus, commonly a percentage of ratings or the mean value on a rating scale. The percentage of agreement threshold varied between studies; median consensus level was 80.0% (IQR 70.0%, range 50% to 90%), while one study defined a negative consensus level of 80% [48]. One study used a more procedural definition that included mean rating score (≥ 3.5) and stability ($SD < 1$) of group response over successive rounds [55].

Attaining consensus based on statistical measures varied depending upon the rating scales used. The most common response formats were a 5-point scale (n=7; 31.8%) [31, 43-45, 53, 56, 60] or 4-point Likert scale (n=4; 18.2%) [28, 55, 57, 58]. Other scale levels were used, including 7-point (n=3; 13.6%) [27, 50, 51], 6-point [52], 9-point [48], and 13-point [46]. Five studies used ranking [27, 44, 57, 59, 60] rather than a scale.

Eight (36.4%) studies reported measures of central tendency; mean (n=6; 27.3%) [27, 31, 52, 53, 55, 60], median (n=2; 9.1%) [51, 53, 54] or mode (n=1; 4.5%) [55, 61]. Measures of distribution was less frequently reported (n=5; 22.7%): standard deviation (n=3) [31, 52, 53, 62], first interquartile (n=1) [54] and range (n=1) [52]. Several studies used convergence measures to evaluate concordance which included content validity index [28,

47, 57], Cronbach alpha [45, 46], continuity-corrected Chi-Square [57], and Kendall's coefficients of concordance [59].

3.5 Methodological quality

For the quality assessment of methodological rigor and transparency of reporting, overall quality was judged as high (median 12; IQR 9.5, range 4 - 13). Most studies (n=16; 72.7%) fulfilled at least 10 of the 14 predefined quality criteria. For some studies however, one or more criteria were not reported. Selection of experts was not clearly reported in three studies [43, 44, 49]. While methods were clearly described for 19 studies, only five [27, 44, 57, 59, 60] provided a flow chart illustrating the process. A clear definition of consensus or cut-off (e.g. mean >3.5) was not provided for three studies [27, 49, 54]. Five studies reported conducting a pilot test, to assess usability of the data collection methods and participant materials [52, 53], or the reliability and validity of the Delphi product (e.g. instrument) [32, 44, 45]. Of note, seven studies [31, 32, 43, 44, 48, 49, 56] did not describe or report strategies to reduce the potential risk of bias.

Overall, the studies with the highest methodological quality (satisfied >10/14 criteria) explored practice competencies [45, 52, 53, 55, 58, 60], priority setting [27, 28, 50, 51], performance indicators [48, 59], tool [32, 54] and protocol development [46], and role description [57] (Table 7).

Table 7: Methodological quality

Author(s)	Clear aim	Rationale for Delphi described	Selection of experts justified	Clear description of Delphi process	Flow chart	Level of consensus and stability described	Pilot testing of instrument	Data analysis clearly justified and reported	Transparent reporting of results	Information on rounds	Clear statement of findings	Trustworthiness of findings	Discussion of limitations	Risk of bias	Total (%)
Fry et al. [32]	1	1	1	1	0	1	1	1	1	1	1	1	1	0	12 (85.7)
Bayley et al. [27]	1	1	1	1	1	0	0	0	1	1	1	1	1	1	11 (78.6)
Beattie & Mackway-Jones [48]	1	1	1	1	0	1	0	1	1	1	1	1	1	0	11 (78.6)
Roger et al. [49]	1	1	0	1	0	0	0	1	1	1	0	0	0	0	6 (42.9)
Kenwood et al. [50]	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12 (85.7)
Valdez [51]	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12 (85.7)
Hoyt et al. [52]	1	1	1	1	0	1	1	1	1	1	1	1	1	1	13 (92.9)
Wilkes et al. [31]	1	1	1	1	0	1	0	1	1	1	1	0	0	0	9 (64.3)
O'Connell & Gardner [53]	1	1	1	1	0	1	1	1	1	1	1	1	1	1	13 (92.9)
Morphet et al. [54]	1	1	1	1	0	0	0	1	1	1	1	1	1	1	11 (78.6)
Lee et al. [55]	1	1	1	0	0	1	0	1	1	1	1	1	1	1	11 (78.6)
Ebrahimi et al. [43]	1	0	0	0	0	1	0	1	1	1	1	1	0	0	7 (50.0)
Fan et al. [45]	1	1	1	1	0	1	1	1	1	1	1	1	1	1	13 (92.9)
Santos et al. [56]	1	1	0	1	0	1	0	1	1	1	1	1	0	0	9 (64.3)
Helms et al. [57]	1	1	1	1	1	1	0	1	1	1	1	1	1	1	13 (92.9)
Hersey & McAleer [58]	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12 (85.7)
Holanda et al. [44]	0	0	0	0	1	1	1	0	0	0	0	0	1	0	4 (28.6)
Considine et al. [28]	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12 (85.7)
De Lima Gomes et al. [46]	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12 (85.7)

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Author(s)	<i>Clear aim</i>	<i>Rationale for Delphi described</i>	<i>Selection of experts justified</i>	<i>Clear description of Delphi process</i>	<i>Flow chart</i>	<i>Level of consensus and stability described</i>	<i>Pilot testing of instrument</i>	<i>Data analysis clearly justified and reported</i>	<i>Transparent reporting of results</i>	<i>Information on rounds</i>	<i>Clear statement of findings</i>	<i>Trustworthiness of findings</i>	<i>Discussion of limitations</i>	<i>Risk of bias</i>	Total (%)
Ju et al. [59]	1	1	1	1	1	1	0	1	1	1	1	1	1	1	13 (92.9)
Miranda et al. [47]	1	1	1	1	0	1	0	0	0	0	0	0	1	1	7 (50.0)
Murphy et al. [60]	1	1	1	1	1	1	0	1	1	1	1	1	1	1	13 (92.9)

Key: 'Yes' = 1, 'No' and 'not clear' = 0

4 Discussion

This is the first systematic review to examine use of the Delphi method in developing guidance for emergency nursing practice. Emergency nursing is a specialty with a broad knowledge base, and a scope of practice that is rapidly and progressively expanding. Application of evidence-informed practice in delivering safe, high-quality emergency nursing care is therefore critical. The last three decades have seen a strong movement towards evidence-based emergency nursing practice, with an emphasis on informing clinical decisions by the findings from rigorous research [63]. This review identified use of the Delphi method to establish research priorities, conduct needs assessments, select competencies and identify practice role responsibilities in emergency care. In general, the quality of the Delphi studies in this review was high. A meta-analysis could not however be performed due to significant study heterogeneity.

The Delphi method is useful in areas of limited research, and is best suited for “what”, “when” and “where” questions [8, 64]. The overall aim is to predict needs, explore areas where controversy, debate or lack of clarity exist, and to discover group attitudes and priorities. Guidance developed using the Delphi process have implications for patient care and nursing practice. In order for the Delphi method to be a reliable and credible source of evidence in guiding emergency nursing practice, consistency and quality both in the conduct and reporting of study findings is critical [40]. The review identified variability in the application and methodological quality of the Delphi method in generating guidance for emergency nursing practice. Effective implementation of the Delphi method requires careful consideration and deliberate execution of defining the research problem; selection of experts; survey development; data analysis and reporting. These issues are discussed further below.

4.1 Selection of experts

In Delphi studies, definition of an ‘expert’ is of critical importance, and varies according to the needs of the study. The criteria should include measurable characteristics that each participant group would acknowledge as those defining expertise; while still attempting to recruit a broad range of individual perspectives [65]. In this review, any conflict of interest amongst participants was poorly described. A rigorous and defensible research study must hold minimisation of bias as paramount. Conflict of interest has the potential to bias results and outcomes of expert opinions [62]. Conflicts of interest in emergency medicine has been well documented [66]. Whilst this has not been a specific issue identified in emergency nursing practice [67, 68], the use of experts through a Delphi method clearly has the potential to influence the practice of emergency care, and therefore any potential for bias needs to be considered, managed and reported.

There is no consensus regarding response rate for Delphi studies. Response rates vary widely, ranging as low as 8% to 100% [69]. A 70% response rate between rounds has been suggested to maintain rigor [70]. In this review, overall median response rate was 85.0%, although five studies had a response rate less than 70% [31,

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43, 47, 52, 56]. Strategies such as informed consent, limited time between rounds, limited number of rounds, continued communication with panel members, and short surveys may improve response rates [71].

Currently, there is no agreement on the panel size for Delphi studies, or what constitutes a 'small' or 'large' sample size. Within nursing, Delphi panel sample sizes have ranged from 6 [72] to 1,142 [73]. While Delphi results may be more reliable with larger panel sizes, this cannot be assumed. Larger panel sample sizes can make the technique unwieldy, and diminished returns reduce the validity of findings [74, 75]. DeVilliers, De Villiers and Kent [20] define sample size depending on whether the sample is homogenous or heterogeneous, and suggest the following sample size: 15-30 if panel members are from the same discipline, or 5-10 if from differing professional groups. There are no clear guidelines suggesting the numbers to be included in Delphi studies, as the sample is purposively selected and it depends on the topic being investigated.

4.2 Survey development

Despite the administrative and methodological complexity of conducting Delphi research, there has been limited debate about pilot testing. Pilot testing is often undertaken to evaluate feasibility, duration, cost, and identify limitations, and can provide valuable information to refine and improve the study design prior to full-scale implementation [76]. In this review, while pilot testing was rarely reported [32, 44, 45, 52, 53], findings led to changes to Delphi materials, and/or confirmed the appropriateness of the study design and methods. Pilot testing in Delphi research could provide useful guidance about the clarity and readability of survey questions [77], data collection and analysis methods [78], feedback processes and rigor [8, 79]. Delphi researchers should therefore report their approach to pilot studies [80].

4.3 Data analysis

In this review, a wide range of different rating scales (4 to 13-points) were identified, with the majority of studies selecting a 5-point Likert scale. Currently, there is no agreement about what scales should be used in Delphi studies. Inappropriate application of rating scales is a common reason cited for failure [81, 82]. Initial investigation into the impact of scale format found that item reliability increased when moving from 2-point scales towards 11-point scales, with minimal increases in item reliability observed beyond 7 points [83]. More recent studies comparing 5-point and 7-point Likert scales found that 5-point Likert scales with labels at the extremes, resulted in better data quality, internal consistency and discriminative validity [84, 85].

In Delphi studies, measures of central tendency are usually analysed with one or more measures of dispersion to evaluate the distribution of scores. In this review of 22 studies, eight reported at least one measure of central tendency measure, the most prominent being mean (n=6); few stated measures of distribution (n=5). In the health science literature, there has been a long-standing controversy regarding whether ordinal data, can be treated as interval data [86]. The use of mean, standard deviation and parametric statistics to describe ordinal

1 data, while strictly speaking is incorrect [87], in data that is not skewed, peaked or multimodal, there are no real
2 differences observed [88]. It was difficult to assess whether the measures of central tendency was appropriate
3 without measures of dispersion also being reported.
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6 **4.4 Ending the Delphi process**

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8 Consensus measurement plays an important role in Delphi research. Traditionally, Delphi studies cease when
9 the survey procedure reaches a pre-determined level of agreement (i.e. consensus was achieved). While
10 consensus is generally felt to be of primary importance, definitions of consensus vary widely and are poorly
11 reported. In this review, percent agreement was the most common definition of consensus identified, but varied
12 between studies (50-90%). Currently, there is no universally agreed cut-off level regarding consensus. As
13 previous studies have demonstrated [61, 89], Delphi results can be greatly impacted by the level of consensus
14 set and rating scale used. However, while consensus is important, it is also meaningless if group stability has
15 not been reached a priori [90]. Group stability refers to the consistency of response between successive rounds
16 [91]. A variation of greater than 15% in any two consecutive rounds is considered to indicate instability (Scheibe,
17 Skutsch & Schofer 1975). In this review, stability across successive rounds was rarely reported.
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26 **4.5 Strengths and limitations**

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28 A strength of this review was a systematic and comprehensive search approach for relevant articles.
29 Standardised assessment frameworks were also used to evaluate the credibility and quality of each study.
30 However, some limitations are also noted. First, the quality of studies included in this review was variable,
31 increasing the risk of selection and performance bias, and limiting the generalisability of study findings. The use
32 of narrative synthesis allowed for a comprehensive analysis of the identified literature; generating insights into
33 the use, quality and utility of the Delphi method in developing guidance in emergency nursing practice. Second,
34 as in any systematic review, relevant, but unpublished studies may not have been identified for inclusion. To
35 minimise this risk, the authors manually reviewed the grey literature to identify other possible studies.
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45 **5 Conclusion**

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47 The Delphi technique, when guidelines for methodological rigor and transparency of reporting are followed, is an
48 appropriate method for exploring emergency nursing practice. The method is a versatile qualitative research
49 technique that is effective in gaining and measuring group consensus in healthcare. Use of the Delphi method in
50 generating guidance in emergency nursing practice to date has largely focused on defining, developing or
51 assessing emergency nurse competencies. Variations in the application of the Delphi method and
52 methodological quality were identified. This may indicate a gap between available methodological guidance and
53 publishing primary research relating to the use of the Delphi method in emergency nursing research.
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5.2 Declaration of Conflicting Interests

The authors declare that there is no conflict of interest.

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Highlights

- The Delphi method has been used to generate a wide range of guidance in emergency nursing
- Substantial variation was found in study design quality and reporting process
- Methodological and reporting standards needed to ensure credibility of resulting Delphi outcomes



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Pg. 1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Pg. 1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Pg. 3-4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Pg. 4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Pg. 6-7
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Pg. 6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Pg. 6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Pg. 6
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Pg. 6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Pg. 6-7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Pg. 6-7
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Pg. 6-7
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	Pg. 7
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	Pg. 6-7



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Pg. 6-7
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	n/a
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Pg. 8-13
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Pg. 8-13
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Pg. 15-17
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Pg. 8-17
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Pg. 8-13
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Pg. 15-17
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n/a
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Pg. 18-20
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Pg. 20
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Pg. 21
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Pg. 21

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

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