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Author

Wilson, Samuel, Rixon, Andrew, Brown, Cornelia

Published

2023

Journal Title

International Emergency Nursing

Version

Version of Record (VoR)

DOI

10.1016/j.ienj.2023.101371

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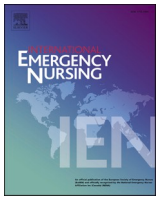
International Emergency Nursing 71 (2023) 101371

Contents lists available at ScienceDirect

International Emergency Nursing

journal homepage: www.elsevier.com/locate/aaen



Non-clinical intuitions and adaptive heuristics in emergency care: A scoping review

Samuel Wilson [a], Andrew Rixon [b,*], Cornelia Brown [a]

[a] Swinburne Business School, Swinburne University of Technology, Melbourne, Victoria, Australia
[b] Griffith Business School, Griffith University, Gold Coast, Queensland, Australia

A B S T R A C T

Background: Across a range of fields, including healthcare, heuristics are typically conceived as a source of bias and systematic error. However, research across the psychological and management sciences shows that intuition and heuristics are also vital sources of adaptive decision strategies, especially in complex, uncertain environments. The complexity of the emergency care environment marks this environment as one in which non-clinical intuitions and heuristics are likely to emerge and function as adaptive decision strategies. The aim of this study was to map and contextualize what is known about leadership and non-clinical intuitions and heuristics in emergency care.

Methods: Based on a systematic search of the Pubmed, Scopus, Web of Science, MEDLINE and CINAHL electronic databases, we conducted a scoping review to map what is known about leadership and non-clinical intuitions and adaptive heuristics in emergency care.

Results: Of the 1219 articles retrieved, 9 met the inclusion criteria. Our review revealed four key findings. First, intuitions are used to make judgments about patients, caring for patients, and coordinating with colleagues. Second, although non-clinical intuitions are documented, non-clinical heuristics are rarely studied. Third, the literature is focused on nurses and silent on the use of non-clinical intuition and heuristics among medical doctors. Finally, professional cultures influence clinicians' use of intuitive sense- and decision-making.

Conclusion: This review highlights the dearth of research into non-clinical intuitions and heuristics in emergency care. Understood in the context of insights from the psychological and management sciences about intuitions and 'smart' heuristics as adaptive decision strategies, our findings point to new frontiers of research into leadership in emergency care.

1. Introduction

To ensure optimum patient outcomes, emergency clinicians undertake extensive interpersonal and intergroup 'boundary work', defined as individual and collective work to influence the demarcations and distinctions between groups [1]. This work, which can be competitive or collaborative, occurs within emergency care teams and at the boundaries with other hospital departments [2]. Although this requires rational decision-making and clinical skills, reason and technical proficiency alone is not sufficient to ensure successful patient outcomes. Sophisticated non-clinical skills, which include communication, leadership and intuitive decision-making skills, are also essential components of the 'critical decision vortices' that underpin decisions about patient treatment [3].

As a growing body of research reveals, emergency care exemplifies a complex adaptive system [2,4], replete with complex clinical and medical leadership demands [5,6]. However, research into leadership in emergency care is in its infancy and there is a lack of clarity about the forms, antecedents, enablers of, and barriers to leadership in emergency care. This issue is compounded by the fragmentation of concepts and theories in studies of leadership in healthcare in general [7], as well as in studies of physician [8], emergency physician [9]and nurse leadership [10], which tend to make little distinction between leadership and non-clinical skills.

These challenges are further compounded by the general lack of sensitivity to context in these studies. Yet, as research from the psychological and management sciences demonstrates, context matters critically for sense-making, decision-making and behavior. To illustrate, research suggests that uncertain contexts often warrant a 'sensing' [11], intuitive approach to sense- and decision-making that is alive to the emergence of instructive patterns in the environment [12]. Furthermore, because complex contexts often require improvisational approaches to respond to changing task demands, problem solving in complex contexts calls for dynamic blends of hierarchical and distributed approaches [13,14] that engender coordination and flexibility [15].

As recently argued by Gigerenzer et al. [16], uncertain contexts are prime conditions for the development and use of 'smart' or 'adaptive'

* Corresponding author.
E-mail address: a.rixon@griffith.edu.au (A. Rixon).

https://doi.org/10.1016/j.ienj.2023.101371
Received 30 April 2023; Received in revised form 17 September 2023; Accepted 21 September 2023
Available online 20 October 2023
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heuristics, defined as "fast, frugal, and accurate strategies that enable rather than limit decision making under uncertainty" (p. 171). However, in fields from management [17] through to medicine [18,19] heuristics are often regarded as a source of bias and error. Given the complex, uncertain context of emergency care, and in light of what is known about the role of sensing [11], intuition [20,21] and heuristics [16] in these contexts, it stands to reason that leadership and non-clinical intuitions and heuristics are vital components of the judgment and decision-making toolkit of clinicians in emergency care. The aim of this review is to examine whether this is so.

To achieve this goal, in this scoping review we map and contextualize what is known about leadership and non-clinical intuitions and heuristics in emergency care. Given that terms like non-clinical and non-technical skills tend to be used as synonyms for leadership in the medical literature (see, e.g., [8,9]), we include these concepts in our mapping of the field while recognizing that leadership and non-technical and non-clinical skills are not regarded as synonyms in the leadership literature. Specifically, in this scoping review, we sought to map what is known about leadership, non-clinical intuitions and heuristics in emergency care and explore the implications of this knowledge for leadership and leadership development in emergency care.

2. Method

Arksey and O'Malley's [22] scoping methodology was used to explore the literature on non-clinical intuition and adaptive heuristics in emergency care. Given the focus on biases and errors in emergency care and the relative lack of attention to intuitions and heuristics, we sought to map and contextualize what is known, which lends itself to a scoping review rather than a systematic review of the relevant literature. The Arksey and O'Malley [22] scoping review framework comprises five stages: (1) identifying the research question; (2) identifying the relevant studies; (3) study selection; (4) charting the data; and (5) collating, summarizing, and reporting the results.

2.1. Stage one: The research question

The first stage requires the identification of an area of interest and to explore concepts, such as the target population. The research question aims to guide the employed search strategy. The research question for stage one of this review pertains to what is known about leadership and nonclinical intuitions and heuristics in emergency care. We draw on the insights from this process to explore implications for leadership and leadership development.

2.2. Stage two: Identifying the relevant studies

Next, according to Arksey and O'Malley [22], a comprehensive search of sources must be performed to identify relevant studies that will answer the research question. Consistent with this, a systematic search of several electronic databases for relevant English language peer-reviewed articles published between 2000 and 2023 was conducted, guided by the focal population, concept, and context, as presented in Table 1. Our search strategy was developed in consultation with a library scientist, who helped the research team develop the search terms and identify the appropriate databases (see Table 2).

2.3. Stage three: Study selection

Study selection results from a systematic process of reviewing candidate studies against inclusion and exclusion criteria [22], which are presented in Table 1. The associated PRISMA flow diagram is presented in Fig. 1. The search yielded 1700 articles identified from electronic database searching. After the duplicates were removed, 1219 articles remained. Three reviewers (SW, AR, CB) independently conducted the screening using Covidence systematic review software (https://www.covidence.org). CB and SW conducted the title and abstract screening, and AR resolved the conflicts in this phase. Next, CB and AR conducted the full-text screening and SW resolved the conflicts. The title and abstract screening resulted in 1182 articles being excluded. Of the 37 articles submitted for full-text screening, 28 articles were excluded, leaving 9 studies for review.

Table 1
PCC and inclusion and exclusion criteria.

Population: Clinicians (e.g., physicians, medical doctors, nurses, allied health, clinician-managers).
Concept: Non-clinical heuristics, intuitions, gut feelings, and habits.
Context: Emergency care, including the emergency department (ED) of a hospital.

Inclusion criteria
Peer-reviewed empirical studies published as quantitative, qualitative and mixed-methods studies of non-clinical/non-technical heuristics, intuitions, tacit and implicit cognition, gut feelings, and habits used by clinicians in the context of emergency care.
Review articles, including meta-analyses, systematic, scoping and rapid reviews.
Articles published in the previous 23 years (2000–2023) was considered.
Articles published in the English language.

Exclusion criteria
Literature focused on the clinical and non-clinical biases and errors of clinicians in non-emergency care contexts, including general practice.
Non-peer-reviewed and grey literature sources such as documents from government and non-government organizations, conference proceedings, academic dissertations, books, and book chapters.
Articles published before January 2000.
Articles not published in the English language.

Table 2
Search Strategy.

Database	Search terms	Results
Pubmed	(heuristics[Title/Abstract]) OR (intuit*[Title/Abstract])) OR (gut feeling[Title/Abstract])) OR (habit[Title/Abstract])) AND (non-clinical[Title/Abstract])) OR (non-technical[Title/Abstract])) OR (non-clinical skills[Title/Abstract])) OR (non-technical skills[Title/Abstract])) OR (non-clinical bias[Title/Abstract])) AND (emergen* [Title/Abstract])	234
Scopus	TITLE-ABS-KEY (heuristics) OR TITLE-ABS-KEY (intuit*) OR TITLE-ABS-KEY (gut AND feeling) OR TITLE-ABS-KEY (habit) AND TITLE-ABS-KEY (non-clinical) OR TITLE-ABS-KEY (non-technical) OR TITLE-ABS-KEY (non-clinical AND skills) OR TITLE-ABS-KEY (non-technical AND skills) OR TITLE-ABS-KEY (non-clinical AND bias) AND emergen* AND SUBJAREA (medi) OR SUBJAREA (nurs) OR SUBJAREA (heal) OR SUBJAREA (busi) AND (LIMIT-TO (LANGUAGE, "English")	16
Web of Science	(TS=(heuristics)) OR TS=(intuit*)) OR TS=(gut feeling)) OR TS=(habit)) AND TS=(non-clinical)) OR TS=(non-technical)) OR TS=(non-clinical skills)) OR TS=(non-technical skills)) OR TS=(non-clinical bias)) AND TS=(emergen*)	484
MEDLINE	(heuristics or intuit* or gut feeling or habit) and non-clinical) or non-technical or non-clinical skills or non-technical skills or non-clinical bias) and emergen*)	280
CINAHL	Heuristics OR intuit* OR gut feeling OR habit AND non-clinical OR non-technical OR non-clinical skills OR non-technical skills OR non-clinical bias AND emergen*	3955
	Refined to Major subject Heading: decision making; intuition; decision making, clinical communication; emotions; interpersonal relations; nursing practice; emergency care	686
Total		1700

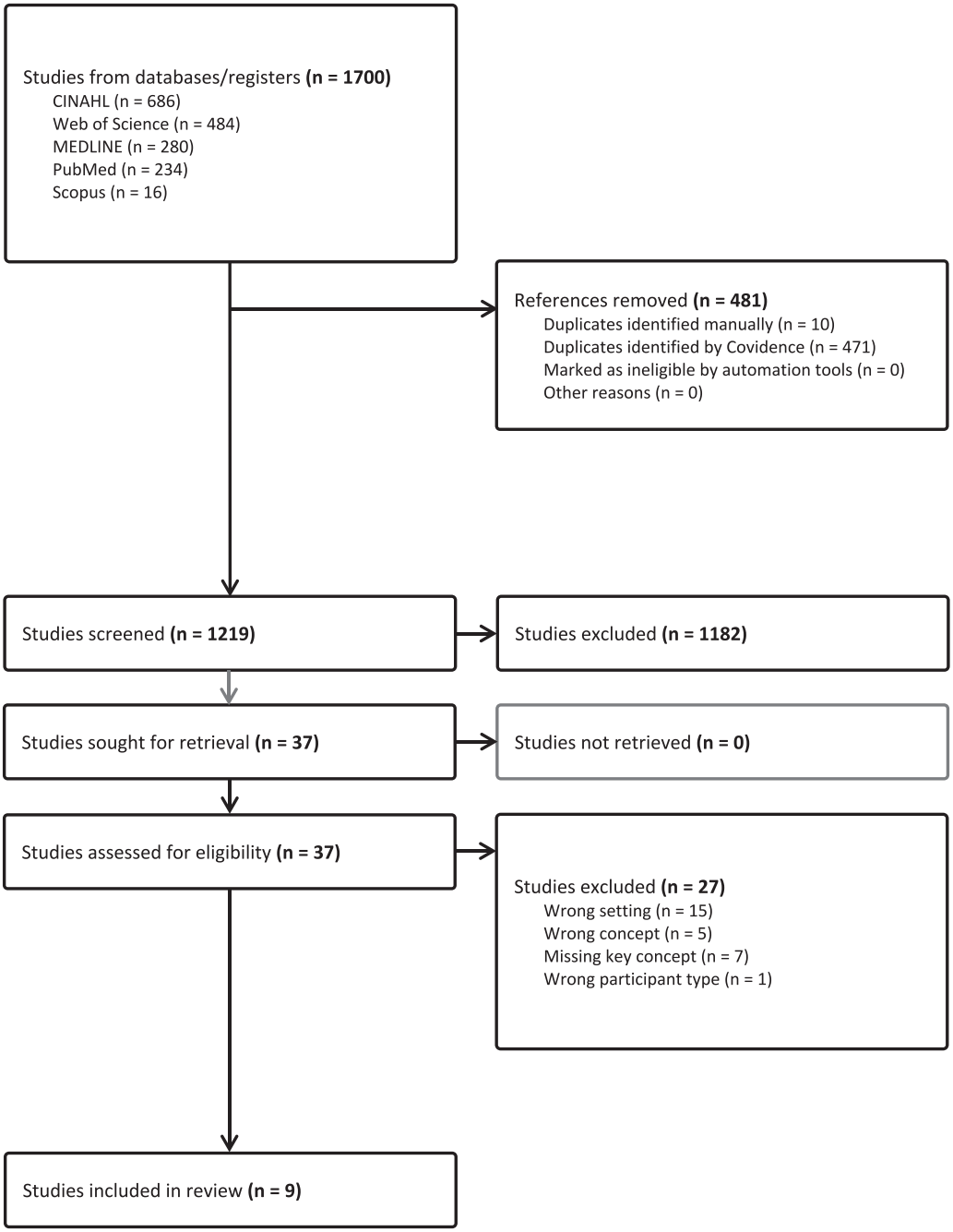

Fig. 1. Preferred Reporting Items for Systematic Reviews flowchart.

2.4. Stage four: charting the data

This stage of the framework requires the synthesis and interpretation of the data to answer the research question. The studies included in this review were charted and classified according to author, date, country, purpose, setting, method, focal nonclinical skills, type of heuristics and intuitions, characteristics of professional culture and key findings (see Table 3).

2.5. Stage five: collate, summarize and report results

This final stage requires a qualitative description to summarize and synthesize the data. Qualitative thematic analysis, as described by Levac et al. [31], was used to code and categorize the concepts identified in this review.

3. Results

3.1. Overall characteristics of reviewed studies

Of the nine articles included in this review, seven were empirical (1 quantitative, 6 qualitative) and two were review articles. Most of the empirical articles were from Anglophone countries (3 from the United States, 1 from Canada, 1 from the United Kingdom, and 1 from Australia). With the exception of Peters et al. [29], which included medical doctors, the participants of these studies were emergency care nurses. The two review articles [23,32] included clinical nurse samples from a range of clinical settings, including emergency care.

Table 3
Characteristics of studies.

Author, date	Study aim and research questions	Setting	Method	Focal non-clinical skills, abilities and practices	Types of Intuition and Heuristics	Characteristics of professional culture	Key findings
Alba [27]	*Study aim*: To investigate the relationship between nurses' use of intuition, years of work experience and ethical decision-making ability. *Research question*: What is the relationship between nursing experience, intuitive and rational thinking, and perceived ethical decision-making ability?	Emergency Nurses, USA	*Design*: Non-experimental, correlational research design. *Participants:* Emergency nurses (n = 182). *Procedure:* Participants were asked to provide demographic information (e.g., age, gender, years of experience), and to complete measures of intuitive and rational thinking and ethical decision-making.	Ethical decision-making	Nurses' intuitive emotional response and moral intuitions are associated with ethical decision-making ability.	Healthcare environment built on restrictive policies	There is a relationship between intuition and ethical decision-making ability No relationship was found between perceived ethical decision-making and years of experience and intuition, respectively
Clarke et al. [24]	*Study aim*: To explore how triage nurses in emergency departments make clinical decisions for patients who present with mental illness-related conditions (intuitive versus analytic). *Research questions*: (1) Where do triage nurses' decisions fall on the intuitive versus analytic dimensions of decision making for mental health presentations in the emergency department? (2) How does the CTAS as a "decision aid" help in the decision-making process? (3) To what extent do other factors such as attitudes and emotions influence the decision making of triage nurses?	Triage nurses in regional emergency departments, Canada	*Design*: Qualitative study, Think Aloud methodology. *Participants*: 11 nurses experienced in triage working at regional emergency departments *Procedure*: Nurses were asked to talk out loud about the reasoning process they would engage in while triaging patients in 5 scenarios based on mental health presentations to the emergency department. They were given a decision aid (structured triage scales) to assist their decision-making.	Communication with patients to manage patient uncertainty. Communication with healthcare professionals to manage distress.	Intuition informed by nurses' clinical experience and trust in colleagues. Nurses' relied on intuition to be adaptable in their approach to communication with patients.	Negative attitudes of colleagues towards patients with mental health problems can affect decision-making	Nurses used the decision aid but manipulated it to validate their intuitive judgement. Lack of knowledge of mental health conditions resulting in heuristic decision making informed by prior experience
Cone & Murray [25]	*Study aim*: To explore characteristics, insights, and decision-making skills in expert emergency triage nurses *Research questions*: No specific research questions listed.	Two Midwestern emergency departments, USA	*Design*: Qualitative, descriptive, involving two focus groups *Participants*: 10 expert emergency nurses from 2 EDs *Procedure*: Nurses participated in focus groups answering a set of pre-determined questions about characteristics of ED nurses and experiences in ED triage decision-making	Communication skills Empathy and compassion	Intuition as a gut feeling, "knowing something wasn't right". Expert intuition derived from experience working in the ED	Need for more positive supportive environment from managers	Characteristics that are key to emergency triage nurse decision-making include communication, experience, intuition and critical thinking

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Table 3 (*continued*)

Author, date	Study aim and research questions	Setting	Method	Focal non-clinical skills, abilities and practices	Types of Intuition and Heuristics	Characteristics of professional culture	Key findings
Edwards [30]	*Study aim*: To explore how nurses undertake the initial assessment at triage, in particular the process of initial visualisation of the patient. *Research questions*: No specific research questions listed.	A&E departments, United Kingdom	*Design*: Qualitative, grounded theory *Participants*: 14 emergency nurses from two demographically distinct A&E departments *Procedure*: Nurses were filmed during live triage encounters over a period of 9 months resulting in 38 recordings. At the end of the relevant shifts, the recordings were played back to the nurses who were asked to say what they were thinking at the tine	Affective engagement with patients.	Affective Intuition: an "engaged understanding" (of what the problem means to the patient). Nurses drew upon an intuitive understanding of the patient during the initial assessment.	Tendencies towards more medical notions of urgency as opposed to more wholistic approaches	The process of assessment at triage began prior to the first encounter with the patient, commencing as soon as the nurse saw the person The initial visualisation was almost exclusively based on intuitive appraisal Nurses were intuitively using one of two models during initial visualisation:1. "Fulcrum" model, where deviations from a central point are seen as concerning and, 2. The "Ranking Scale" model, where the greater move towards a contrast pole are seen as concerning
Lyneham et al. [28]	*Study aim*: To explore the experience of knowing in emergency nursing practice. *Research question*: What is the experience of knowing in emergency nursing practice?	Clinical nurse specialists in emergency care, Australia	*Design:* Qualitative, phenomenological. *Participants*: 14 clinical nurse specialists who had had an intuitive experience. *Procedure*: Nurses each participated in one semi-structured interview where they were asked to relate stories where intuition played a role in their work as an emergency nurse.	Emotional connection with patients	Intuition informed by knowledge and experience Intuition as an emotional connection (an energy and force that draws the nurse to the patient) Intuition as a "physical voice" (physical sensations demanding attention and action)	Intuitive decision-making remains contentious in Emergency nursing practice. (A particularly relevant divide between academic and practicing nurses)	Five themes emerged forming the basis of the phenomenon of intuition in emergency practice: Experience, knowledge, feeling (physical sensations), syncretism and connection with patients. Nurses have the desire to rationalise their intuitive thoughts and revert to the rational decision-making style. However, nurses eventually gain trust in their intuition and become motivated to act upon it
Melin-Johansson et al. [18]	*Study aim*: To review registered nurses' intuition in clinical settings, relationships, and the nursing process. *Research questions*: What does the qualitative and quantitative evidence tell us about nurses' intuition in: (1) the clinical setting; (2) in relationships; and (3) in the nursing process.	Articles included nurses who worked in hospital, critical or emergency care and were published in the USA (n = 8), Australia (n = 3), Norway (n = 1), Iran (n = 3) and the UK (n = 1).	*Design*: Integrative review, strengthened with a mixed studies review, qualitative convergent synthesis design. *Inclusion criteria*: Peer reviewed published papers written in English and relevant to the research questions and purpose. *Search strategy*: Database searches in PubMed, CINAHL and PsycINFO with relevant keywords *Study selection*: Studies were screened using the PRISMA	Emotional involvement with patients Assertiveness	Affective intuition (intuitively derived emotional availability, openness and vulnerability towards patients Intuition supports nurses' assertiveness (Integrating objective data with intuition can generate greater self-confidence and autonomy in nurses' clinical judgment and decision-making)	Ambivalence among Nurses to share and act on their intuitive experiences due to fear of being perceived as unprofessional	Length of experience in nursing associated with higher reliance on intuition The use of intuition is associated with increased autonomy, self-confidence, self-reflection Intuition plays a pivotal role in the nurse/patient relationship, facilitating a unique connection that is not physical or verbal ("an energy") as well as emotional involvement with patients Intuition provides support and guidance in the nursing process

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Table 3 (*continued*)

Author, date	Study aim and research questions	Setting	Method	Focal non-clinical skills, abilities and practices	Types of Intuition and Heuristics	Characteristics of professional culture	Key findings
			method, resulting in 16 studies selected for inclusion.		Expert Intuition Intuition as a form of personal knowledge gained through experience Intuition as reflective practice		(decision-making and validation)
Morrison & Symes [23]	*Study aim*: To summarise the research about the characteristics in expert nursing practice across a variety of expert nursing specialties *Research questions*: (1) How is expert nursing practice of experienced staff nurse clinicians characterized across a variety of clinical settings or specialties; (2) What work environmental factors that contribute to expert nursing practice?	Clinical staff nurses from a variety of specialties, including emergency care.	*Design*: Integrative literature review. *Inclusion Criteria*: 1. Studies on how experienced clinical nurses develop and express expert practice, 2. Studies across a variety of specialties and 3. Studies describing environments that support expert practice. *Search strategy*: Database searches of Medline, Cumulative Index and CINAHL were conducted Study selection:	Emotional involvement with patients (expert nurses are patient focused rather than task focused) Knowing the patient respecting the patient's unique perspective and promoting patient dignity and decision making. Risk taking (acccepting responsibility for actions as personal qualities of expert practice)	Intuition as an ordered, logical development of practice Intuition as reflective practice (self- reflection to recognize the presence of physical signs, such as a "gut" feeling)	Expert nursing practice requires a supportive work environment that promotes sharing knowledge and learning from experience. Risk taking and intuitive knowledge are two key components of expert nursing practice.	Five themes as characteristics of expert nursing practice: knowing the patient, reflective practice, risk taking, intuitive knowledge and pattern recognition, and skilled know-how Nurses use of intuition divided into three phases: 1. A cognitive phase, where action precedes assessment, 2. Transitional phase, where nurses use reflection to recognise their "gut feeling" and its associated meaning, and 3. Complete trust in their intuition
Peters et al. [29]	*Study aim*: To evaluate the impact of context and professional culture on physicians' intuitive clinical reasoning and decision-making through rhetorical-narrative analysis. *Research question*: How do medical professionals accomplish their work in situations where	Generalist specialities Canada	*Design:* qualitative, constructionist, grounded theory *Participants*: Physicians, General specialists: emergency medicine (n = 9), general internal medicine (n = 7), family medicine (n = 6) *Procedure*: 22 in-depths semi-structured interviews in which participants were asked to describe situations where they used clinical intuition for	Cooperation and communication with other clinicians Narrative habitus	Intuition informed by interactions among care team members Social process of clinical reasoning and decision-making: informed by dynamically produced and culturally constituted intuitive reasoning) Expert intuition	Clinical reasoning is distributed, contextual, and influenced by professional culture. The differential valuation of System 1 and System 2 reasoning is related to physicians' exchanges of tokens of membership with different groups.	Participants' stories about their clinical intuition were based on two competing narrative structures: 1. Stories about intuition turned into stories of evidence based on physicians' dominant clinical narrative structure (System 2 reasoning) 2. Intuitive reasoning made narratable using descriptive language (e.g., feeling, angst, instinct, fear) of events that

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Table 3 (*continued*)

Author, date	Study aim and research questions	Setting	Method	Focal non-clinical skills, abilities and practices	Types of Intuition and Heuristics	Characteristics of professional culture	Key findings
	they are unable to adhere to the cultural imperatives of EBM?		diagnostic decision-making (participants' "stories")				involved trusting the clinical intuition of others in clinical decision-making as well as through descriptions of the archetype of an experienced and intuitive "master clinician" Acknowledgement of and trust in own and other's intuition supports distributed clinical communication and decision-making
Roscoe et al. [26]	*Study aims*: (1) to explore the role of patients' stories in guiding emergency medicine triage decisions and (2) to investigate the decision rules and information resources most important to the triage process *Research questions*: (1) What decision rules and information sources are most pertinent to the triage process? (2) What is the role of the patient's story in guiding triage decisions?	Nurses in a Level I trauma centre located in a large, urban, not-for-profit teaching hospital in the southeastern United States.	*Design*: Qualitative, ethnographic study. *Participants*: 16 triage nurses in the ED. *Procedure*: 110 h of observing interactions between triage nurses and patients over a 4-month period. Semi-structured interviews were conducted by one of the researchers with the 16 triage nurses. Interview questions included general questions about the goal of triage, their approach to triage and the difficulties they encounter during triage	Narrative competence	Intuition as "narrative" sense-making that combines observable and measurable clinical facts with their own stories about the patients based on how patients talk and act.	The grand narrative of medicine as a scientific enterprise may discourage nurses from openly describing how their decisions depend on narrative sense-making.	Nurses relied more on visual (appearance of the patient) and vital clues (information from clinical tests) than patients' stories during the triage process Nurses "gut feelings" about the patients played an important role in the triage encounter Nurses intuitively created their own narratives about the patient to inform their triage decision-making

3.2. Quality appraisal

The Mixed Methods Appraisal Tool (MMAT) was used to assess the quality of the included articles [33,34]. Two researchers worked independently using the MMAT to perform a quality appraisal of the qualitative (n = 6) and quantitative studies (n = 1) included to allow simultaneous assessment. The number of "Yes" answers were divided by the number of applicable criteria to derive a percentage score. Overall, the quality of the articles included for review was moderate to high, with 28% (n = 2) scoring a 0.57 and 71% (n = 5) scoring a 1.0. The most common reason for a score deduction was lack of clarity about the research question, the use of a qualitative approach, and, among quantitative studies, the inability to assess risk of non-response bias.

3.3. Non-clinical skills and practices

Our review revealed four clusters of non-clinical skills and practices in emergency care. The first cluster pertains to the ability of clinicians—predominantly nurses—to form emotional, empathic, compassionate connections with patients [23,25,28,30,32]. These connections, in turn, were held to support nurses' emotional availability, openness and vulnerability towards patients.

The second cluster concerns nurses' perceptions of patients as 'moral patients', denoting the right of patients to be protected from harm (see, e.g., [35]). Nurses' moral consideration of patients was evident in their respect for their patient's perspective [23] and their centring of patient dignity in ethical decision making [23,27].

The third cluster pertains to clinicians'—again, predominantly nurses—capacities for self-awareness and self-assuredness, especially in the context of clinical judgment and decision-making. This was reflected in the use of intuition in the context of nurses' "narrative" sense-making [26] and the heightened sense of confidence and assertiveness nurses experienced in under conditions of time pressure and epistemic uncertainty [32].

Finally, the fourth cluster of non-clinical skills, abilities and practices that involve intuition and heuristics is communication [25], whether with patients (e.g., to manage patient distress and uncertainty; [24] or other healthcare professionals [24], especially when initiating interaction and sustaining cooperation [29].

3.4. Intuition and adaptive heuristics

The articles included in this scoping review broadly categorized intuition into individual sense-making and collective sense-making. Nurses' individual sense-making in clinical practices appeared to be strongly influenced by their experience, conceptualized variously as years of experience in the ED [25,27], personal knowledge [28,32] or clinical experience more generally [24]. This type of intuition was often, but not invariably (cf. [27]), tied to the concept of the "expert nurse', defined as someone who can legitimately rely on their acquired expert intuition to inform clinical practice and decision-making [25,29,30,32].

The review identified also 'affective' intuition as a key factor in nurses' individual sense making [27,30]. To illustrate, nurses described a strong emotional response based on an intuitive understanding of, and engagement with, patients [32]. Notably, affective intuition was often accompanied by physical sensations or "voices" demanding attention and action [25,28], sometimes verbalised as "gut feelings" about a patient [25]. Nurses identified self-awareness as key to recognizing the physical signs associated with those gut feelings [23]. Melin-Johansson et al. [32] emphasized the role of intuition in nurses' professional reflective practice, enabling nurses to integrate their intuitive experiences with rational deliberations about objective data. Consistent with this, Roscoe et al. [26] described how nurses combined intuition with observable, measurable clinical facts through 'narrative' sense-making, where nurses intuitively created their stories or narratives about patient to inform their triage decision-making.

Intuition also played an important role in collective sense making within the complex ED environment [29]. For example, medical doctors used descriptive language (e.g., angst, fear, instincts) to share their intuitive narrative about patients with other clinicians. Trusting the intuitive narratives of other clinicians emerged as another key characteristic of collective sense-making [29], pointing to socially constructed decision-making. Similarly, nurses' intuitive appreciation and trust in the advice of expert clinicians assisted their clinical decision-making [25].

Notably, although the concept of intuition was mentioned in all articles included in this scoping review, heuristics were rarely identified. Only Edwards [30] offered an example of an adaptive heuristic used to assist triage-related decision-making.

3.5. Professional culture and intuition

Many studies provided important insights into the role professional culture plays regarding non-clinical intuitions and heuristics in emergency care. Intuitive decision-making was seen as contentious within emergency nursing practice[28], with a sense of ambivalence reported among nurses about whether to share and act on their intuitions due to a fear of being perceived as unprofessional [32]. Roscoe et al. [26] suggested that the roots of this ambivalence are found in the 'grand narrative' of medicine as a scientific enterprise, which discourages the use, or admitting to the use of, intuitive judgments and decisions. Indeed, Edwards' [30] study of nurse triage revealed a context which prioritized medical notions of problem-centred urgency as opposed to more patient-centered approaches to wellbeing and care.

Notably, Peters et al [29] study found that clinical reasoning is distributed, contextual and influenced by professional culture, with medical doctors demonstrating differential valuation of intuitive and analytic judgment and decision-making based on the professional group with which they are communicating. Finally, risk-taking and intuitive knowledge were identified as two key, interlocking components of expert nursing practice [23], which are fostered by positive and supportive managerial environments [25]. However, these organizational environments or climates exist in tension with more rule-bound, restrictive, and risk averse policy healthcare environments [27]. In these contexts, nurses can be impacted by negative attitudes of colleagues towards intuitive modes of apprehending and acting in the world [24].

4. Discussion

In this scoping review, we sought to identify and map what is known about leadership, non-clinical and non-technical intuitions and adaptive heuristics in emergency care. Our review revealed four key findings. First, intuitions are used in the context of several interlocking non-clinical practices; namely, confidence in (clinical) judgments made in the context of time-pressure and uncertainty, relationships with patients, patient-related ethical judgment and decision-making, communication with patients and colleagues, and coordination and cooperation with colleagues. There were no overt references to studies exploring leadership-related intuitions and heuristics *per se*. Second, although the concept of intuition was germane to all studies in this review, heuristics were rarely studied. Third, nurses were always the participants in studies of non-clinical intuitions and heuristics in emergency care, with the literature silent on the use of intuition and heuristics among medical doctors. Finally, professional cultures seem to influence clinicians' use of intuition; there appears to be more acceptance of and tolerance for intuition among nurses than among medical doctors.

Our findings suggest that, in contrast to the now voluminous literature about biases and systematic errors in clinical decision-making, (see, e.g., [36–38]), surprisingly little is known about intuitions and heuristics in non-clinical decision-making. This is especially surprising when viewed in the context of insights from the psychological and

management sciences about the importance of intuitive and heuristics decision-making, particularly complex, uncertain contexts [12,16]. These insights, combined with the growing appreciation of human factors in health and emergency care (e.g., [39,40]) and emerging appreciation of the 'critical decision vortex' in emergency care [3], creates the possibility that studies of intuition and heuristics in emergency care may increase in the years ahead. The growing recognition of the importance of leadership and teamwork in medical emergency teams [41], and new insights into the use of intuition in management teams [42] underscore the importance of future studies of nonclinical individual and team-level intuitions and heuristics.

Notably, our findings about professional culture and intuition connect with emerging insights into how culture shapes the use of heuristics and how heuristics shape organizational culture (see [16]). Interestingly, the differential valuing of care and cure in the professional cultures of medicine (cure) and nursing (care) [43] appeared to be reflected in our finding that intuitive modes of sense-making and decision-making appear to be used more frequently among nurses than medical doctors in emergency care. Notably, Coget and Keller's [3] study points to how studies of intuitions and heuristics may be conducted with medical doctors. Investigations of the reciprocal relationship between action and learning logics (see [44]) in emergency nursing and medical cultures and the use of intuition and heuristics among nurses and doctors may be a fruitful avenue for future research.

5. Implications and recommendations

Our findings have a host of implications for future research into leadership and leadership development in emergency care. With respect to leadership research, our review revealed a dearth of research into leadership-related intuitions and heuristics in emergency care. Considering what is now known about the importance of intuitive and heuristic approaches to individual and collective sense-making and decision-making in complex, uncertain contexts [11,12,16,17,42], there are several lines of leadership inquiry that could be initiated in the context of emergency care. Expanding studies of critical decision vortices [3] in clinical decision-making to clinical and medical leadership may also represent promising lines of inquiry.

With respect to leadership development, there are opportunities for future research to build the adaptive toolbox of leadership and related non-technical skills in emergency care. Presently, leadership competency frameworks (e.g., [45], Health Leadership Competency [46] are silent on the role that intuitions and adaptive heuristics play in the acquisition and enactment of professional competence. Researchers could readily transfer methods from management and organizational studies to healthcare settings. For example, researchers could work with ED clinicians to develop "heuristic portfolios" [47] , toolkits of fast, frugal, and accurate strategies that enable decision making, especially in volatile, uncertain, complex and ambiguous contexts. Flyvbjerg [48] documents a process to elicit these adaptive heuristics, which can be readily applied in the context of emergency care. More generally, drawing on insights from the decision sciences, researchers could investigate how to educate emergency clinicians' intuitions in ways that increase the odds that clinicians learn the 'right' lessons from their interlocking clinical and non-clinical experiences (see, e.g., [20], mitigating the misperception that heuristics are synonymous with bias and systematic error.

6. Scoping review limitations

This review used Arksey and O'Malley's [22] review method to map what is known about non-clinical intuitions and adaptive heuristics in emergency care. Although every effort was made to ensure that a comprehensive search was conducted, it is nevertheless possible that some articles were missed. Further, given that only English literature was included, it is possible that articles on this topic have been published in languages other than English and are thus not represented in our findings. Moreover, most of the papers were qualitative papers each with their own limitations. Nevertheless, these papers provided a rich and deep insight that can be elaborated on in future qualitative, quantitative and mixed-methods studies of non-clinical intuitions and adaptive heuristics in emergency care.

7. Conclusion

This scoping review mapped and summarized what is known about leadership and non-clinical intuitions and heuristics in emergency care. The findings of this review reveal important insights into the current state of knowledge about intuitions and heuristics in emergency care and contributes to emerging insights from the psychological and management sciences that intuitions and heuristics are a source of adaptive, accurate decision-making and not simply a source of systematic error. The apparent lack of attention to leadership and non-clinical intuitions and heuristics in emergency care is a blind spot in emergency care research and represents a promising new frontier for future research into leadership in emergency care and leadership development in emergency care.

CRediT authorship contribution statement

Samuel Wilson: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Andrew Rixon:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Cornelia Brown:** Data curation, Writing – original draft.

Declaration of Competing Interest

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

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