Conceptualizations of Clinical Decision-Making: A Scoping Review in Geriatric Emergency Medicine

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Abstract

Background: Clinical decision-making (CDM) is an important competency for young doctors, especially under complex and uncertain conditions, which is present in geriatric emergency medicine (GEM). Research in this field is however characterized by an unclear conceptualization of CDM. To evolve and evaluate evidence-based knowledge of CDM, it is thus important to identify different definitions and their operationalisations in studies on GEM.

Objective: A scoping review of empirical articles was designed to provide an overview of the documented evidence of findings and conceptualizations of CDM in GEM.

Methods: A detailed search for empirical studies focusing on CDM in a GEM setting was conducted in PubMed, ProQuest, Scopus, EMBASE and Web of Science. In total, 52 publications were included in the analysis, utilizing a data extraction sheet, following the PRISMA guidelines. Reported outcomes were summarized.

Results: Four themes of operationalization of CDM emerged; CDM as dispositional decisions, CDM as cognition, CDM as a model, and CDM as clinical judgement. Study results and conclusions differed according to how CDM was conceptualized. It was evident how especially frailty-heuristics lead to biases in treatment of geriatric patients, and that the complexity of this patient group was seen as a challenge for CDM.

Conclusions: This scoping review summarizes how different studies in GEM use the term CDM. It provides a snapshot of findings in GEM. Potentially, findings from CDM research can guide implementation of adequate CDM strategies in clinical practice but this requires application of more stringent definitions of CDM in future research.

Background

Clinical Decision-Making (CDM) is an important part of medical education. As young doctors are less experienced, their CDM is more likely to be influenced by uncertainty (1, 2) and associated with errors (3). Despite the importance of CDM, a variety of definitions and operationalizations are seen across medical domains (1, 4),

The literature on CDM takes its point of departures from a variety of perspectives and approaches (5, 6), but is commonly described as the formulation of hypotheses, diagnoses, and management plans in a systematic and structured process (4, 7–9). Elements such as heuristics and biases (10) contextual factors (11), and bias-reduction (12) are emphasized in the literature, evidently taking a cognitive approach in understanding the processes underlying the decisions (10, 13, 14). This approach focus on the impact of decision-aids (15, 16), and medical errors (12, 17), albeit struggling to link specific biases and errors. Reviews of this cognitively focused literature therefore explicitly call for more holistic empirical research into what moderates and mediates CDM (10). As such, the initiative for this scoping
review was to explore how CDM is conceptualized, in order to guide future research in building a comprehensive framework.

It is commonly understood, that it is a challenge to investigate how and when clinical decisions are made (9, 18). Clinical settings which challenge CDM may be most optimal for investigations (19–21), which can be said of emergency departments (EDs) (22). Furthermore, the decision-making literature underline how complex decisions are the most proficient for displaying the intricate structure of CDM (23). Care for geriatric patients is complex (24, 25), as they are more prone to adverse outcomes (26), compared to other adult patients (27–30). Geriatric-specific medical problems, e.g. multimorbidity (31) and biases, e.g. ageism (32), greatly impact CDM. We review the concepts of CDM within the empirical literature on geriatric patients in the ED.

To our knowledge, the conceptual dimensions of CDM has not previously been reviewed in this domain. Existing reviews have focused on the characteristics of geriatric patients in the ED (33), the distribution of a priori decisions when consultating geriatric patients in the ED (25), or the impact of an assessment of geriatric patient’s cognitive abilities on health outcomes (34). However, none of these reviews discusses how this body of research understand the concept of CDM. Moreover, the existing reviews does not find consistent results, which could be a consequence of the general confusion about how to describe and investigate CDM.

This scoping review analyze the conceptualizations (i.e. definitions and operationalization) of CDM in empirical articles in GEM. The aim was to create an overview of the conceptualizations of CDM employed in the current empirical research in this domain. Thereby, we wish to clarify the conceptualization of the psychological aspects of CDM.

**Methods**

Methods

Eligibility criteria

A systematic search of terms related to CDM and Emergency Medicine (EM) was performed on title or abstract in PubMed, ProQuest, Scopus, EMBASE and Web of Science on 13th of March 2020. Terms related to geriatrics was searched in entire manuscripts to allow inclusion of studies, which did not exclusively address geriatric patients. Inclusion criteria were: EM, CDM, elderly patients, peer reviewed, empirical articles published in English or Scandinavian languages (see Table 1). To exclude articles using the term “decision-making” in everyday language (e.g. sentences like: “this has consequences for decision-making”), CDM was defined as a delineated construct, which can be moderated or mediated by factors in the clinical setting or inherent psychological factors within the clinician.
Table 1
Literature search strategy

| Search string                                                                 | Where          |
|------------------------------------------------------------------------------|----------------|
| "Clinical Decision-Making" OR "CDM" OR "Clinical Decision Making" OR "Clinical Problem Solving" OR "Medical Decision Making" OR "Medical Decision-Making" OR "Medical Problem Solving" OR "Medical Problem-Solving" OR Diagnostic Reasoning* OR Clinical Reasoning* OR Medical Reasoning* OR Medical Judgement* OR Clinical Judgement* OR Diagnostic Judgement* OR Diagnostic error* | Title and/or Abstract |
| Geriatric* OR Gero* OR Older Patient* OR Older adult* OR Elder* OR Geronto* OR Aged OR Aging OR Ageing OR Senior*                          | Anywhere       |
| Emergency Medicine* OR Emergency Department* OR Emergency Ward* OR Emergency Team* OR Emergency Medical Team* OR Acute Medicine* OR "Acute Medical Teams" OR Acute Department* OR Acute Ward | Title and/or Abstract |

Exclusion criteria were: (1) patient groups with a mean age ≤ 64 years, (2) non-clinician decision-making, (3) survey of opinions, (4) single case reports, (5) treatment evaluations (e.g. comparing risks, etc.), and (6) diagnostic errors not investigated in relation to CDM (e.g. type of errors associated with re-admission).

Data collection process

Two blinded reviewers (MLG and GT) independently reviewed all studies in a standardized manner from agreed-upon exclusion guidelines. First, title and abstract were screened following the inclusion and exclusion criteria. After the initial screening, the two reviewers met to discuss and resolve discrepancies by consensus. Second, the reviewers (MLG and GT) independently screened full text studies for eligibility, adhering to those same criteria. A data extraction sheet inspired by the Cochrane Consumers and Communication Review Group's data extraction template was then introduced. The first author (MLG) independently used this for charting, analysing, and synthesizing data from all included studies.

Results

Search criteria yielded 1421 publications. In total, 758 remained after duplicates were removed, from which 52 were included in the final analysis. Using PRISMA guidelines (35, 36), data was extracted from all 52 records.

Study characteristics:

Overall study characteristics are presented in Appendix 1.

Designs

In all, 39 publications used a quantitative study design; prospective observational studies (n = 21), retrospective observational studies (n = 6), intervention studies (n = 3), randomized controlled trials (n = 2), survey studies (n = 5), or experimental studies (n = 2).
Eleven publications described qualitative study designs; interview studies (n = 5), think-aloud studies (n = 2), case studies (n = 2) or ethnographic studies (n = 2).

The remaining two studies described mixed method study designs; a case study and value-stream mapping from an ethnographic observation study, or focus group interviews and an experimental study.

**Settings**

Most studies were conducted in EDs at teaching hospitals (n = 36). The remaining were conducted in urban, tertiary-care EDs (n = 14), in-patient ED wards (n = 3), or community hospitals (n = 6), or were performed outside a clinical setting, utilizing written ED cases (n = 3).

**Health care professionals**

The majority of studies (n = 42) investigated clinicians, from ED specialists to Post Graduate Year (PGY) 1 residents, including other medical specialties (neurologists and cardiologists) working in ED settings. Other health care staff, (nurses, dieticians, therapists, support workers, pharmacists and emergency medical technicians), were included in 14 studies. Five studies did not specify which health care professionals they included (37–41).

**Geriatric patients**

Generally, studies defined geriatric patients in terms of a mean age over 65 years, or otherwise stratified patients in age intervals, making it possible to extract results referring specifically to the geriatric group. However, some only mentioned ‘elderly patients’ or presented case scenarios with geriatric patients, but did not specify age. These were included nonetheless.

Four themes in operationalization of CDM

A large variation was found in how studies assessed CDM, possibly reflecting different conceptualizations. Therefore, it seemed necessary to record how studies operationalized CDM, in order to describe these different conceptualizations. We sorted the different operationalizations into subthemes, which was grouped in four overarching themes, presented with examples in Table 2 (see appendix 2 for the full table).
| Overarching theme | Subthemes | ID | Examples of operationalization of theme |
|-------------------|-----------|----|----------------------------------------|
| **CDM as dispositional decisions** | Observations of demonstrated binary CDM | 19 | "The decision to order physical restraint..." (P1280) |
| | | 42 | "...followed by a question asking if the physician completing the questionnaire would cease or continue CPR under that set of circumstances." (P12) |
| | Observations of demonstrated categorical CDM | 6 | Decision-making refer to which specific decision was made based on the clinical data available: "...there also were instances when the clinician decision making was contrary to the absence of an AMI." (P1226) |
| **CDM as cognitive processes** | Cognitive: Illness scripts (networks of knowledge), Mental models, memory, judgement, human judgement/heuristic judgement/mental shortcuts, etc. | 32 | "Cognitive faculties deserve particular attention, as they are the bases of the clinical decision-making process... human abilities are limited and both gathering and retrieving information are inaccurate processes [2, 9]. Furthermore, in emergency medicine, "a priori" probabilities often are unknown, whereas missing data and ambiguities are frequent... This particular field favors intuitive and automatic tools as heuristics [1, 5]." (P2031) |
| | | 17 | "Heuristics are mental shortcuts that often produce valid judgments but can lead to errors in atypical or rare events. Because they reflect natural processes, heuristics are not easily, or even productively, replaced." (P9204) |
| | Knowledge and attitudes | 3 | "We designed a comprehensive written survey to assess ED provider knowledge, attitudes, and practice regarding placement of IUCs [including] team dynamics of decision making in UIC placement and management..." (P415) |
| | | 15 | Refers to confidence, attitudes and knowledge, but does not address decision-making, specifically. |
| **Uncertainty** | Diagnostic uncertainty: "...was quantified by a visual analogue scale (VAS) for ACS probability ranging from 0 to 100%." (P29) |
| **CDM as a model** | Statistical model/clinical decision rule | 14 | A decision-making analysis of certain risk stratification scores, as a statistical model. |
| | Decision rule and motivations/perception of utility | 39 | Validation of a decision rule and investigation of the motivations for certain decisions. They were surveyed about the latter. |
| Overarching theme | Subthemes | ID | Examples of operationalization of theme |
|-------------------|-----------|----|----------------------------------------|
|                  |           | 44 | Describes decision-making only in terms of the decision-making support tool, but no other description. |
| CDM as clinical judgement | Clinical judgement: use of a structure/tool | 43 | "Upon final ED disposition, study staff administered a survey to the attending ED physician or senior resident querying the physician's impression of the likelihood of an acute bacterial infection and the infections suspected on a 5-point Likert scale from very unlikely to very likely." (P1803) |
|                   | Clinical Judgement: Practice as usual | 37 | "Because, to the best of our knowledge, no validated scoring system exists to quantify clinical judgement, we a priori chose to use the disposition decision of the treating physician in the ED as a proxy measure for clinical judgement..." (P294) |
|                   |           | 24 | "Clinical judgement can be defines as "an interpretation or conclusion about a patient's needs, concerns, or health problems, and/or the decision to take action (or not), use or modify standard approaches, or improvise new ones as deemed appropriate by the patient's response" [11]. It is complex and requires a flexible ability to recognise prominent aspects of an undefined clinical situation interpret their meaning and respond appropriately. It relates to the experience of individual clinicians." (P5) |

**Theme 1: CDM as dispositional decisions (n = 11)**

Within this theme, CDM was operationalized as the decision itself, by recording which decisions were made (i.e. the decision to cease CPR or not), and how specific decisions were influenced by provider characteristics (i.e. confidence, uncertainty, etc.), social or contextual factors.

**Theme 2: CDM as cognition (n = 12)**

The cognitive processes underlying CDM included 'mental models', thought processes, or mental processing, described as heuristics, perception, knowledge or attitudes. A common premise amongst these studies, was that they "...recognize[d] the salience of individual cognition, as well as [acknowledged] that the knowledge and experience that guides that cognition is constructed through social interaction and organizational context." (42) (p161).

**Theme 3: CDM as a model (n = 7)**

These studies primarily investigated how CDM was aided by rules, guidelines, or technologies, or how statistical models of risks improved predictability and aided decisions about diagnosis or treatment.

**Theme 4: CDM as clinical judgement (n = 22)**
The common term clinical judgement referred to “...the normal practice by [clinicians] using individual's [clinical] knowledge, clinical expertise and gut feeling...” (p27) (43). Here, CDM was most often assessed through the clinician's estimated probability of a certain clinical outcome or a final diagnosis. However, despite being a demarcated expression, CDM as Clinical Judgement was generally not defined in terms of a theoretical framework, with only one publication providing a description of the psychological behaviour of clinicians:

“Clinical judgement... is complex and requires a flexible ability to recognise prominent aspects of an undefined clinical situation interpret their meaning and respond appropriately. It relates to the experience of individual clinicians.” (44)(p5).

However, this description was not rooted in a theoretical framework.

Relationship between operationalizations and study objectives

From this identification of operationalizations of CDM, it became relevant to link this to study objectives, in order to see if the different operationalizations organized meaningfully within specific aims of the research. By analyzing study aims in relation to CDM we found that CDM was investigated in three study objectives:

1) Effects of Aids (n = 33).
2) Effects of Cognitive processes or contextual factors (n = 14).
3) Effects of Training or experience (n = 5).

By this comparison we were able to provide a more comprehensive overview, demonstrating some tendencies amongst the empirical research in this field. This combined overview is presented in Table 3, representing each publication ID in both their theme of operationalization and type of study intervention.
Effects of Aids

When operationalizing CDM as clinical judgement (n = 21), the majority of studies (40, 44–55) investigating decision aids (i.e. a tool, rule or standardized testing) found them to improve diagnostic accuracy and reduce uncertainty. However, an almost similarly large percentage found no difference (37, 43, 56, 57) or a decline in performance (58–61).

When CDM was operationalized as cognition, disposition decisions, or a model, studies overall found that an aid improved performance, in terms of more accurate decisions and lower uncertainty (22, 39, 41, 62–69).

Effects of cognitive processes or contextual factors

Studies aiming to discern the impact of cognitive behaviour or contextual factors, predominantly operationalized CDM as dispositional decisions or cognitive processes. Regardless of the operationalization, the vast majority of studies (42, 70–79) found that clinician cognition (i.e. confidence or heuristics) or contextual factors (i.e. practices or patient behaviour) negatively affected CDM performance or the accuracy of diagnostics. Only two (80, 81) found that CDM performance was unaffected by cognitive factors such as knowledge, skill or uncertainty, however still arguing that this might not be true with more complex diseases (80). This might explain why Seuren, Stommel (82) found that organizational structures like formalized multidisciplinary team meetings improved CDM practices.

The effects of training or experience
All studies investigating the impact of training or experience found that, regardless of whether CDM was operationalized as either cognitive processes (83–85) or dispositional decisions (86, 87), experience and reflective learning had a positive impact on the clinicians’ confidence, effectively improving skills, and possibly leading to more accurate decisions.

CDM in GEM as a phenomenon

Finally, we synthesized how the included publications defined CDM, in order to describe some common conceptualizations. As a large portion of publications (n = 39) did not provide a definition or description, the synthesis includes the thirteen studies which did, as presented in Table 4.
Table 4
Definitions and descriptions of Clinical Decision-Making in geriatric emergency medicine

| Operationalization | Aid | Cognitive processes or contextual factors | Training or experience |
|--------------------|-----|------------------------------------------|------------------------|
| CDM as dispositional decisions | (6) (16) (41) | (8) (19) (21) (45) (51) (52) | (28) (42) |
| CDM as cognition | (32) (34) | (26) (33) (35) (30) (3) (29) (25) (46) | (13) (17) (15) |
| CDM as a model | (22) (39) (44) (7) (14) (48) (50) | | |
| CDM as clinical judgement | (1) (11) (5) (18) (36) (4) (9) (20) (27) (40) (24) (37) (23) (2) (10) (12) (31) (38) (43) (47) (49) | | |

| ID | Definition | CDM in GEM | Summary/themes |
|---|------------|------------|---------------|
| 13 | "In making [treatment decisions, physicians] consider the disease, patient circumstances, and patient perceptions, as well as other factors. [...] physicians engage in a large amount of mental processing [and] are often constrained by bounded rationality and satisficing..." (P154-155) | They found that the amount of treatment alternatives when encountering geriatric patients could alter decision-making. However, experience and the opportunity to supervise students reduced the risk of cognitive biases. | BIASES and DIAGNOSTICS | Complexity in geriatric patients increases risk of bias, as it requires a larger amount of mental processing. |
| 29 | "'Clinical experience" consists of several components: [e.g.] accumulated knowledge [and] skill in collecting historical data... Knowledge is accumulated more or less [as a] data bank. Biases of availability, representativeness, and anchoring have been shown to be relevant, but it is not clear how much they detract from the value of "experience"." (P163) | investigating coronary heart disease (CHD), which is a common geriatric medical condition, but does not address geriatric patients directly | BIASES | Address a common geriatric disease. |
| | | | EXPERIENCE | They found no effect of experience on decision making competencies in differential diagnosis of common conditions. |
| Operationalization | Aid | Cognitive processes or contextual factors | Training or experience |
|--------------------|-----|------------------------------------------|-----------------------|
| 30                 | "...the ways in which the cognitive processes were used to solve the clinical problem had an enormous impact on the diagnostic error. The overreliance on the use of patterns was crucial." (P1280) | Not addressed directly, other than the case description | DIAGNOSTIC ERROR: Overreliance on pattern-use in complex patients can increase diagnostic errors, and that errors are more likely to occur "...when clinical patterns run counter to expectations... [and that this] had a major role in causing the errors, rather than factors related to procedures or organization." |
| 32                 | Mental Shortcuts: "Cognitive errors are particularly frequent when the clinical decision-making process heavily relies on heuristics. These could be defined as 'mental shortcuts'..." (P2030). "Cognitive faculties deserve particular attention, as they are the bases of the clinical decision-making process... human abilities are limited and both gathering and retrieving information are inaccurate processes... “ | Cognitive errors with geriatric patients because of failed heuristics and complexity with patients. Aiming to show how technology use can be a reliant tool. | HEURISTICS Complexity in patients cause errors in cognition, as it is guided by heuristics. Especially geriatric patients are complex REFLECTION "...continuous reappraisal and critical interpretation of all information are the mainstay of both the diagnosing process and the conscious use of heuristics." |
| Operationalization | Aid | Cognitive processes or contextual factors | Training or experience |
|-------------------|-----|------------------------------------------|------------------------|
| 35                | Builds upon several theories but concludes by formulating a model, which "...recognizes the salience of individual cognition, as well as acknowledging that the knowledge and experience that guides that cognition is constructed through social interaction and organizational context." (P161) | “A number of studies internationally have identified that pain is often substantially undertreated or untreated in geriatric patients... There are particular issues with the management of pain for older patients in acute hospital settings.” (P153) | COMMUNICATION |
|                   |     | It moves beyond a model of pain recognition, assessment and management as being located within a sequential linear decision making framework, recognizing the importance of collaborative, co-constructed knowledge which develops time.” (P161) | It points to the importance of communication and patient involvement, especially with geriatric patients, in correct diagnostic assessment of pain. |
| 26                | Describes decision making as 'mental models' which is further described as thought processes. It refers to former studies describing "...how norms might affect hospital-based physician's decision-making heuristics, case perceptions, and the consequential diagnosis and treatment..." (P345) | patient shared decision making/preferences and other situational characteristics influencing acute care decisions: Describing the physician's mental models when encountering a terminally ill elderly patient and their decision to intubate or not and compare these with the appropriateness of the treatment plan (if the decision was a mistake or not). Treatment mistakes were related to patients reluctant to disclose mistakes to the physician and the physician reluctant to disclose uncertainty to patients. | DIAGNOSTIC ERROR |
|                   |     | Transparency between physician and patient affects risk of errors, but this was not compared between elderly and non-elderly patients. | BIASES |
|                   |     | However, it was described that this transparency might be influenced by heuristics and social factors. | |
| Operationalization | Aid | Cognitive processes or contextual factors | Training or experience |
|--------------------|-----|------------------------------------------|------------------------|
| 33                 | "...judgements are not based solely on a static phenomenen of pre-existing patient criteria, but come to be revised as the performance is played out throughout the interaction." (P2449) | based on a geriatric clinical encounter, the authors note that "...the nurse possesses prior expectations as to how someone of this age would appear." (P1446) | HEURISTICS |
|                    |     | Appraisal of the patient's symptoms is guided by clinician heuristics, which result in over- or under-triage with geriatric patients |                       |
| 17                 | "Heuristics are mental shortcuts that often produce valid judgements but can lead to errors in atypical or rare events. Because they reflect natural processes, heuristics are not easily, or even productively, replaced." (P9204) | No mention | HEURISTICS and EDUCATION |
|                    |     | They found that a narrative simulation game intervention reduced undertriage, by 'recalibrating' heuristics. This could be a result of the emotional part of a narrative approach, making them reflect upon their triage in another way. They did not, however, compare non-geriatric with geriatric patients, as all cases were geriatric, based on the assumption about common heuristics with elderly patients. |                       |
| Operationalization | Aid | Cognitive processes or contextual factors | Training or experience |
|--------------------|-----|------------------------------------------|------------------------|
| 19                 | "The decision to order physical restraint is complex, influenced not only by the uncertainty resulting from lack of clinical guidelines and evidence, but also by organizational and situational factors and patient-specific variables. [...] judgements are based on interactions between the environment and the individual." (P1280) | "...lack of education regarding acute care geriatric medicine and physical restraint..." + "Presence of dementia increased the likelihood of having a restraint order 1.7 times. Very old age (85 years) resulted in a trend for lower likelihood..." (P1285) | EDUCATION  
A lack of geriatric knowledge in acute settings increases risk of treatment errors |
|                    |     |                                          | COMMUNICATION  
The presence of dementia increased risk of treatment errors due to poorer communication opportunities and increased complexity |
|                    |     |                                          | HEURISTIC  
Older age decreased risk of treatment errors as a result of frailty heuristics, which was unique for geriatric patients. |
| 34                 | "Clinicians also use heuristic observation of objective factors and application of scientific data, but also 'tacit' knowledge based on acquired expertise and pattern recognition" (P116) | "The most important determinants of perception of inappropriate CPR were objective criteria such as... older age..." (P116) | HEURISTICS  
Older age increased risk of treatment errors in regards to CPR |
| Operationalization | Aid | Cognitive processes or contextual factors | Training or experience |
|-------------------|-----|------------------------------------------|------------------------|
| 24                | "Clinical judgement can be defined as "an interpretation or conclusion about a patient's needs, concerns, or health problems, and/or the decision to take action (or not), use or modify standard approaches, or improvise new ones as deemed appropriate by the patient's response" [11]. It is complex and requires a flexible ability to recognise prominent aspects of an undefined clinical situation interpret their meaning and respond appropriately. It relates to the experience of individual clinicians." (P5) | older patients are more often at high risk and current identification of these often relies on clinical judgement, which is flawed. Because of the complexity of these patients, a need for standardized, routine measurements are needed, in order to aid the identification of older patients at high risk of poor healthcare outcomes or admission to hospital. | TREATMENT ERRORS Elders are complex and therefore unaided clinical judgement alone is not enough. We need standardized measures to decrease risk of errors due to implicit flaws in cognition |
| 46                | "...at the individual level, we observed that ED physicians had the autonomy in decision-making [but] were also uncertainty avoidant when presented with equivocal results... At the ED-specific organisational level, this study highlighted the deep-rooted culture of the ED of practicing evidence-based Medicine [and how s]enior physicians were sources of information and role models... [P]hysician's decision to prescribe antibiotics was [also] influenced at the community level by patient expectations" (P5-6) | Majority of the participants reported a lower threshold in prescribing antibiotics for elderly patients, especially those with comorbidities or were immunocompromised. The main reasons were to prevent any potential deterioration of the patient's illness or occurrence of secondary bacterial infections. The availability of social support for elderly patients was also taken into consideration | HEURISTICS Heuristics about elderly patient’s frailty influenced prescription and the underuse of antibiotics amongst elderly patients |
|                   |     |                                         | UNCERTAINTY Physicians were uncertainty avoidant and tended to overprescribe antibiotics when faced with uncertainty |
Of these thirteen publications, all but two (44, 79) operationalized CDM as cognition, describing the process itself and influencing factors. CDM was defined as a ‘mental process’ (22, 70, 83) referring to thought processes, which were complex and flexible abilities reflecting the individual’s knowledge and experience (29). CDM as cognition was described as a pattern-recognising process (30), limited by the imperfect nature of cognitive retrieval (22, 44), and moderated by heuristics and biases (22, 65, 70, 71, 75, 78–80, 83, 84), social interaction and organizational context (42, 70, 71, 75, 78).

Overall, CDM with geriatric patients touched on four themes, commonly known in the CDM research, described below.

1: Diagnostic or treatment errors

The most prominent theme throughout all publications was clinicians’ risk of making errors in CDM. This was described as a result of overreliance on pattern-use (44), as more errors occurred when clinical findings conflicted with expectations, than as a result of inadequate clinical procedures or injudicious organizational factors (72). Furthermore, errors were mediated by contextual factors such as social desirability (70, 79) i.e. when physicians were reluctant to disclose uncertainty.

2: Biases and heuristics

The included publications also linked increased error-risk to age-specific biases or overreliance on heuristics (70, 79, 80, 84). Here, specifically the complexity of elderly patients were described to cause errors as normal clinical practice is guided by heuristics, which run the risk of simplifying complexity in urgent clinical settings (22). As such, it was argued that CDM with elderly patients in EDs required a larger amount of mental processing (83). In example, Edwards and Sines (71) described how the appraisal of symptoms was inherently guided by the clinician’s heuristics, resulting in over- or under-triage amongst elderly patients. However results varied, as some described how a frailty heuristic reduced risk of
improper restraint orders (75), while others showed how they more often induced uncertainty, increasing
risks in treatment decisions (i.e. ordering CPR (65) or prescribing antibiotics (78) and differential
diagnosis (79))

3: Communication

As a result of age-biased heuristics, one study underlined the importance of communication and patient
involvement, especially with geriatric patients, when correctly diagnosing pain levels (42). Here, the
presence of dementia increased risk of treatment errors due to poorer communication opportunities and
increased complexity (75).

4: Experience, education, and reflection

In order to counter these age effects on heuristics, and frailty biases, four studies addressed the impact of
experience, education, and reflection. The studies found that a lack of geriatric knowledge in acute
settings increases risk of treatment errors (75), but that reflection could help reduce the risk of cognitive
biases (83). Mohan, Fischhoff (84) investigated the impact of different approaches to reflection and
found that a narrative simulation game intervention reduced under-triage, by ‘recalibrating’ heuristics.
However, Fasoli, Lucchelli (80) argued that bias reduction interventions were ineffective with common
diseases, emphasizing how complexity is a key factor when describing how and when errors occur.

Summary of results

Overall, four overarching themes of operationalization of CDM emerged from the results. These
operationalizations revealed different approaches to how clinical decisions in GEM settings are made.
Some approached CDM as a cognitive phenomenon, or was concerned with different types of decision
aids. However, the term ‘decision-making’ held some challenges by being a common phrase. Moreover,
the theme ‘Clinical Judgement’ was commonly used as a delineated term, but most often referred to
‘practice as usual’, without relation to decision-making literature.

The different kinds of operationalizations led to varied conclusions. When approaching decision-making
as a cognitive process and looking at how decisions were made in practice, most found contextual or
cognitive factors that influenced this process. However, when looking at decision-making as ’clinical
judgement’ most studies were looking at how to aid routine judgement. Here, most found a positive
impact on outcome measures, but contradictory results, might reflect the lack of homogeneity in how
CDM were operationalized and measured.

It was evident how the complexity of geriatric patients held major challenges for CDM, and that e.g. frailty
biases were commonly described to influence CDM competencies. However, it was also described how
education and reflective practice could counter some of these effects.

Discussion
This review set out to describe the concept of CDM in empirical research performed with elderly patients attending the ED. The aim was to provide a deeper understanding of the concept of CDM in this specific patient group and setting.

As described in the beginning of this paper, CDM is a comprehensive field of research, drawing on several traditions from computational strategies and cognitive training, to sociology. However, recent discussions of this literature argue that the field has moved away from a psychological concept of the mind, focusing on error reduction, fragmented from the original theoretical assumptions (19, 88). The result of this shift in the empirical investigation of the phenomenon is that the exploration and intervention development become devoid of a theoretical framework. Moving research in such a direction, could result in the development of interventions, which does not have the desired effects. We see this consequence in prior reviews (10, 12, 15–17), which showed how difficult it was to synthesize this field of research. This review aimed to add insight into the challenges that we face and guide future research in the development and implementation of a concept of CDM.

How was the theory of CDM reflected in the reviewed studies?

We looked at how studies within the included publications, operationalized CDM and found that the majority of publications were non-theoretical. This led to notable differences in study objectives, which demonstrated this lack of consensus. Furthermore, a large number of the studies used decisions as a proxy measure, similarly not describing CDM within a theoretical framework. Here, the lack of a conceptualisation of the common term ‘clinical judgement’ lead to a methodological and ultimately, an empirical problem. With a non-defined and -described phenomenon, the operationalization risks being sporadic and unsystematic. Although the majority of studies found that decision aids had an impact on clinical judgement, the large amount of conflicting results points to problems with determining, which factors are causing different effects.

What constitutes CDM in the context of GEM?

This challenge leads to no clear answer as to what constitutes good CDM competencies with elderly patients in the ED. A synthesis of the eleven studies which provided a description or definition of CDM showed that the concept was generally understood as a cognitive process, affected by individual and contextual factors. Negative effects hereof were commonly countered by training or experience, pointing to emotional factors in reflection exercises, as more effective at prompting positive changes (84).

Geriatric patients were described as a particular complex patient-group, and a general frailty heuristic had an impact on CDM in different ways. It showed how this heuristic were both a protective factor in providing one treatment (75), and a risk factor providing another (22, 71), and that ‘recalibration’ of heuristics might be a trainable way of reducing errors (89). Moving beyond the specific types of procedures, treatments or diagnosis, it could be relevant to know how the setting implicates such a frailty heuristic. This argument has also recently been highlighted by Woo (90) in their discussion on the coming challenges of the ageing population and the impact of contextual factors. This calls for investigations
into how settings moderate and mediate proficient cognitive strategies, and how the interplay between cognition and context impose risks for the elderly patient, rather than polypharmacy or comorbidity in itself.

Strengths and limitations

Focusing on a subarea of this body of literature is in itself narrowing the scope of the review, and its application to other domains. A narrow scope and a more theoretical analysis were necessary methodological sacrifices in this scoping review, focusing on other aspects of the reviewed studies may have yielded other perspectives. However, a systematic approach aimed to provide empirically founded arguments, which can hopefully help qualify empirical research on CDM in the future.

Conclusion

With this scoping review, we aimed to understand what constitutes a clinical decision. However, no systematic review had to our knowledge, explored the conceptual dimensions of CDM in the domain of GEM. Therefore, this scoping review set out to systematically analyze the conceptualizations (definitions and operationalization) of CDM in empirical publications in GEM. The aim was to improve the conceptualization of the psychological aspects of CDM employed in the current empirical research in this domain, and formulate suggestions for a research agenda. We found that the majority of articles in this field of research did not provide a clear description or definition of the concept of CDM, and that the ones who did, primarily described it in cognitive terms. Only few pointed at contextual factors, arguing that CDM was, in fact, influenced by contextual or cognitive factors, when clinicians engage in complex decision-making. To this, age-specific biases were found to impact CDM in elderly patients in the ED, leading to errors in treatment and diagnosis. This was, however, not true in all circumstances, pointing to the importance of training of CDM competencies. As such, we found that this area of research reflected recent discussion concerning the lack of connections between the empirical research and available theoretical frameworks.

Future research

Amongst the theoretically rooted publications, some put emphasis on contextual factors impacting the cognitive CDM competency. This contextual component was, however, not a general theme in the reviewed publications and therefore needs to be elaborated on. As Hutchins (91) argue, we cannot truly see cognition in a vacuum, as it is ontologically bound by the context in which it operates. As such, there is a need for studies focusing on the link between cognitive components and contextual factors.

In order to formulate a concept of CDM, it seems important to delve into some unanswered question in regards to what CDM is, and under which circumstances a competent decision is mediated. Which parts of the process are inherent or learned, and importantly, which elements are in fact not idiosyncratic or context specific?
Abbreviations

CDM  
Clinical Decision-Making

GEM  
Geriatric Emergency Medicine

ED(s)  
Emergency Department(s)

EM  
Emergency Medicine

PGY  
Post Graduate Year (Residents)

Declarations

Ethics approval and consent to participate
Not applicable

Consent for publication
Not applicable

Availability of data and materials
Not applicable

Competing interests
The authors declare that they have no competing interests

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Authors’ contributions

MLG, PM, MM and CP contributed to the study conception and design. Material preparation and data collection was performed by MLG. Data analysis was performed by MLG, GT, PM and MM. The first draft of the manuscript was written by MLG, PM, CP and MM. All authors revised the drafts, read and approved the final manuscript.
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Figures
Figure 1

Study selection and PRISMA flowchart.
Supplementary Files

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- PRISMAchecklistConceptualizations.docx
- Appendix2Codingofoperationalizationsfulltable.doc
- Appendix1StudyCharacteristics.doc