



Tinkering and overruling the computer decision support system: Working strategies of telephone triage nurses who assess the urgency of callers suspected of having an acute cardiac event

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Abstract

Aims and objectives: To understand clinical reasoning and decision-making of triage nurses during telephone conversations with callers suspected of having acute cardiac events, and support from a computer decision support system (CDSS) herewith.

Background: In telephone triage, nurses assess the urgency of callers' conditions with clinical reasoning, often supported by CDSS. The use of CDSS may trigger interactional workability dilemmas.

Design: Qualitative study using principles of a grounded theory approach following COREQ criteria for qualitative research.

Methods: Audio-stimulated recall interviews were conducted amongst twenty-four telephone triage nurses at nine out-of-hours primary care centres (OHS-PC).

Results: Telephone triage nurses use clinical reasoning elements for urgency assessment. Typically in telephone triage, they interpret the vocal—but not worded—elements in communication (paralanguage) such as tone of voice and shortness of breath and create a mental image to compensate for lack of visual information. We confirmed that interactional workability dilemmas occur. Congruence, established when the CDSS supports the triage nurses' decision-making, is essential for the CDSS' value. If congruence is absent, triage nurses may apply four working strategies: (a) tinker to make CDSS final recommendation align with their own assessment, (b) overrule the CDSS recommendation, (c) comply with the CDSS recommendation or (d) transfer responsibility to the GP.

Conclusion: Triage nurses who assess urgency may experience absence of congruence between the CDSS and their decision-making. Awareness of how triage nurses reason and make decisions about urgency and what aspects influence their working strategies can help in achieving optimal triage of callers suspected of acute cardiac events at OHS-PC.

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Relevance to clinical practice: Triage nurses' reasoning and their working strategies are vital for outcome of triage decisions. Understanding these processes is essential for CDSS developers and OHS-PC managers, who should value how triage nurses interact with the CDSS, while they have the benefit of callers in mind.

KEYWORDS

acute cardiac events, after-hours care, clinical reasoning, interactional workability, paralanguage, primary care, telephone triage

1 | INTRODUCTION

Telephone triage is the gateway to medical help for patients in primary care in the Netherlands (Smits et al., 2017). Accurate triage is of vital importance, specifically for the identification of highly urgent cases, such as patients who are suspected of having an acute cardiac event (Bosner et al., 2010; Rawshani et al., 2014). Triage nurses assess the urgency of the patient's health problem; should an ambulance be sent right away or is consultation at the out-of-hours service sufficient? Urgency assessment may be seen as a clinical reasoning process of triage nurses (Noon, 2014). Clinical reasoning has been studied in physical triage (Goransson, Ehnfors, Fonteyn, & Ehrenberg, 2008; Patel, Gutnik, Karlin, & Pusic, 2008). However, clinical reasoning during telephone triage, a situation where triage nurses have limited clinical information, is not well-investigated (Pettinari & Jessopp, 2001; Wahlberg, Cedersund, & Wredling, 2003).

In most Western countries, computer decision support systems (CDSSs) are used to support telephone triage decision-making (Lake et al., 2017). Commonly used CDSSs are constructed as a list of questions, starting with questions that ask for an immediate medical response, and gradually questions come up about symptoms which allow for a longer response time (Kuriyama, Urushidani, & Nakayama, 2017). The use of CDSS in telephone triage has a complex dynamic which can induce many, so-called, "interactional workability dilemmas" (May et al., 2007; Murdoch et al., 2015). Interactional workability dilemmas may be described as difficulties between the rigid CDSS structure and the wider context of the patients' narrative (Murdoch et al., 2015). The use of CDSS in telephone triage has been investigated during day practice of general practitioners and in a study about telenurses handling calls patients with chronic obstructive pulmonary disease (COPD) (Barken, Thygesen, & Soderhamn, 2017; Murdoch et al., 2015). These situations differ from the triage of patients suspected of acute cardiac events (Rawshani et al., 2014) because urgency and time pressures may specifically trigger interactional dilemmas with CDSS in the triage assessment.

Out-of-hours primary care (OHS-PC) are general practice co-operatives which were set up for urgent help requests that could not wait until the daytime consulting hours of the patient's general practitioner (GP) (Keizer, Maassen, Smits, Wensing, & Giesen, 2016). In the Netherlands, triage nurses handle calls independently with a GP stand-by to consult in difficult situations. In the OHS-PC, the GP stand-by and the triage nurses are not familiar with the callers and

What does this paper contribute to the wider global clinical community?

- This study confirms that triage nurses have to deal with interactional dilemmas while working with a CDSS for urgency assessment. Interactional dilemmas occur when congruence with CDSS with the triage nurses' decision-making is absent.
- This study reveals four working strategies: how triage nurses act when they experience absence of congruence with the CDSS and their decision-making. Working experience, the patient's context, feelings of uncertainty and management demands influence what strategy they choose.
- Interpreting paralanguage and creating a mental image are known reasoning strategies; we highlighted their importance for telephone triage. Training for telephone triage needs to be adjusted based on these findings.

their medical history. In the Netherlands, the triage system is overall safe, with only 0.006% serious adverse events a year (Rutten, Kant, & Giesen, 2018). A serious adverse event is defined as an unintended or unexpected event related to the quality of care and resulting in death or a severe harmful event for the patient ("Healthcare Quality, Complaints, and Disputes Act (WKKGZ)," 2016). The majority of serious adverse events is of cardiovascular origin, such as missed myocardial infarction (Rutten et al., 2018).

It is unknown how triage nurses reason during their out-of-office hour's telephone conversations. These conversations are under time-pressure when callers are suspected of having acute cardiac events.

1.1 | Rationale and research questions

Our aim is to understand clinical reasoning and decision-making of triage nurses during telephone conversations, under time-pressure with callers suspected of having acute cardiac events, and support of these processes from a CDSS. Such understanding is necessary

to improve the workability of the CDSS and to optimise support for triage nurses.

Our research questions are as follows:

1. How do triage nurses reflect on their reasoning elements and decisions which took place during their telephone conversations for triage of callers suspected of having acute cardiac events?
2. How do triage nurses use a CDSS to support their clinical reasoning and decision-making during these telephone conversations?

2 | BACKGROUND

Given our interest in clinical reasoning, relevant theories were the hypothetico-deductive approach, the intuitive humanistic approach and the dual-process theory (Croskerry, 2009b; Noon, 2014). For the use of the CDSS and interactional aspects, we employ the interactional workability theory (May et al., 2007; Murdoch et al., 2015).

2.1 | Clinical reasoning

The hypothetico-deductive approach aims to understand how clinicians make decisions and hypotheses as if they are logical, rational decision makers (Dowding & Thompson, 2004). It assumes that reasoning starts with gathering information, from which cues are used to generate preliminary hypotheses about a specific diagnosis or list of differential diagnoses. The professional interprets and classifies cues as confirmatory, negative or noncontributory to the hypotheses. The professional weighs each alternative hypothesis and then chooses the one supported by evidence (Elstein & Schwartz, 2002; Monteiro & Norman, 2013). Knowledge and experience are required to process information into reliable hypotheses successfully.

The hypothetico-deductive approach was found to be abstract and difficult to apply in real-life decisions, and hence, the importance of intuition was recognised (Carper, 1978). The intuition-humanistic approach was defined in six key aspects: pattern recognition, similarity recognition, common sense understanding, skilled know-how, sense of salience, and deliberate rationality (Noon, 2014). Intuitive judgements are said to be unaware and intrinsic, often referred to as a “gut feeling,” “hunch” or “sixth sense” (Cioffi, 1997). However, intuition was never seen as in opposition to traditional analytical reasoning. Although one is considered to be unaware of intuitive judgements, the process involves rational elements of knowledge (Brush, Sherbino, & Norman, 2017; Croskerry & Nimmo, 2011). For example, the assessment of the vital sign pain, an indicator of a patient's acuity, entails both intuitive and rational elements (Wood, 2008).

The concurrent use of rational and intuitive decision elements comes together in the dual-process theory (Croskerry, 2009b). The dual-process theory consists of system one reasoning, which is automatic, fast and intuitive, and system two reasoning, which is deliberate, reliable and analytical (Croskerry, 2009a). Croskerry suggested that these reasoning systems work separate from one another, in

stages (Croskerry, 2009a). In contrast, Norman said the systems work together in a continuum, and the reasoning processes are parallel and complementary (Monteiro & Norman, 2013; Norman et al., 2017). Furthermore, Croskerry argued that system one reasoning is more susceptible to cognitive biases, because it heavily relies on heuristics, and he suggested that cognitive biases may be reduced by slowing down the reasoning (Croskerry, Singhal, & Mamede, 2013). The evidence for the effect of slowing down strategies is scarce: in contrast, several studies show that faster response times are more often associated with a correct diagnosis (Brush et al., 2017). Norman proposed that prior experience and knowledge is more important to reduce cognitive biases (Brush et al., 2017; Norman et al., 2017).

2.2 | Reasoning during triage

In assessing the urgency, the triage nurse uses the caller's response to the CDSS questions and the CDSS recommendation, which consists of one out of six possible urgency levels (Appendix 1) (Kuriyama et al., 2017). Previous studies assessing physical triage by nurses identified that decisions were based on both analytical and nonanalytical reasoning strategies (Benner, 2004; Patel et al., 2008). With an increase in experience, triage nurses' decisions became more based on intuition (Noon, 2014). Experienced nurses relied more on behavioural cues, time factors and medical, social and contextual factors to judge the patients' complaints (Edwards & Sines, 2008; Johannessen, 2016). During telephone triage, nurses have to deal with the absence of physical parameters and compensate for this lack of information, by creating a mental image of the patient and the situation from which the call is made (Edwards, 1998; Pettinari & Jessopp, 2001).

2.3 | Interactional workability

The aim of using a CDSS is to standardise and thereby presumably increase the accuracy and reliability of nurses' urgency decisions (Johannessen, 2016; Noon, 2014). However, there are limits to standardisation because general rules may underdetermine what should be done in a specific case (Dong et al., 2007). Interactional workability is the way that a complex intervention, such as a CDSS, affects interactions between people and their work processes (May et al., 2007). During telephone triage, the interaction is between the patient, the triage nurse and the CDSS (Murdoch et al., 2015). Interactional workability is characterised by the dimensions *congruence* and *disposal of work* (May et al., 2007). *Congruence* in the interactions between the intervention, the users' role and the context is key to promote the ease of use and efficiency of the intervention. *Disposal of work* considers how the interactions with (technical) interventions, such as the CDSS, contribute to the fulfilment of the purpose of the intervention (e.g. following a guideline) (May et al., 2007). Congruence in the interactions gives rise to disposal of work. The introduction of a CDSS for triage systems seems to

reduce the nurses' opportunities for making their own judgements (Johannessen, 2016). In practice, triage nurses rarely use the recommendations from the CDSS in isolation. Instead, they combine and compare digital, clinical and subjective patient information to identify any conflicts (Barken et al., 2017; Dowding et al., 2009). The level of experience influences how nurses use decision support. Novice nurses said they carefully followed the guidelines, whereas more senior triage nurses said they have internalised the guidelines and use these alongside their own judgement (Patel et al., 2008).

3 | METHODOLOGY

We designed a qualitative study using the principles of a grounded theory approach (Kennedy & Lingard, 2006; Kolb, 2012). Twenty-four triage nurses from nine OHS-PC locations were invited for semi-structured audio-stimulated recall interviews (Dempsey, 2010). The Consolidated Criteria for Reporting Qualitative Research were used to report the findings of this study (see File S1).

3.1 | Context

The study was conducted at nine OHS-PC locations in the Netherlands, who collaborate in the foundation "Primair Huisartsenposten" (Erkelens et al., 2019). This foundation provides care for approximately 1.5 million residents in the Netherlands, covering both rural and urban areas. The triage nurses working at the OHS-PC are required to have a 3-year education for certified primary care nursing assistant and a specific training for telephone triage about how to use the CDSS the Netherlands Triage Standard (NTS, a modified version of the Manchester Triage Standard) (Huibers et al., 2012; Kroneman et al., 2016). Since the introduction of the NTS in 2011 in the Netherlands, this system has been used by most OHS-PC, by approximately half of the ambulance dispatch centres and by an increasing number of emergency departments (Smits et al., 2017). The triage nurse fills out the caller's responses in the semi-automatic NTS system, which then automatically generates urgency allocations. The urgency level generated by the NTS can be adjusted by the triage nurse if the nurse disagrees with the NTS advice. Most often, adjustments are preceded by consultation of the supervising GP, who has the final responsibility for the urgency level decision (Keizer et al., 2016). All telephone calls to the OHS-PC locations are routinely recorded and archived for training and quality control purposes.

3.2 | Recruitment procedures

Recruitment of participants was done by the research team members, who initially contacted the triage nurse managers. The manager asked the triage nurses in their team who was interested in reflecting on their clinical reasoning during telephone triage. We encouraged

the managers to maximise variation of sampling, to gather triage nurses with varying levels of experience in telephone triage and experience in health care elsewhere. We have no insight into how many triage nurses refused to participate, but as the triage nurses were enabled to participate within working hours, we assume there were no other than practical reasons to refuse. Triage nurses who expressed themselves as senior in general had at least six years of working experience in telephone triage in the OHS-PC. When a triage nurse was recruited by the manager, the research team members made an appointment for an interview of one hour at their OHS-PC. Before the interview, the triage nurses were asked to focus on triage conversations in which they suspected that the caller had an acute cardiac event, during telephone shifts in the two weeks before the interview. We encouraged them specifically to bring forward not only conversations of "clear" cases, but also cases in which the triage nurse was uncertain about his or her urgency assessment. The research team members retrieved the recordings of these conversations from the recording archive. All interviews were conducted between July 2016–July 2018 by three researchers (LW, MH and DE). The researchers introduced themselves to the triage nurses as GP trainees and researchers in the field of telephone triage of acute cardiac events.

3.3 | Design

We performed face-to-face semi-structured interviews, using audio-stimulated recall technique. Every interview, we started with listening to an audiotape of a telephone triage conversation. This technique helps the participant to give meaning to and reflect on their behaviour in a real-life situation (van Braak, de Groot, Veen, Welink, & Giroldi, 2018). A topic list comprised of open questions about clinical reasoning and working with the CDSS was used as a framework (Appendix 2). All interviews were audiotaped and subsequently transcribed verbatim for analysis. In addition, triage nurses completed a 6-question questionnaire about their education, working experience at the OHS-PC and whether they had working experience in patient care elsewhere.

3.4 | Research team

Our research included three female GPs in training (LW, MH and DE), of which two clinician scientists who combine the GP specialty training with a PhD project (LW and DE) about telephone triage. Since these researchers were in training and had limited clinical experience, they had no assumptions beforehand about clinical reasoning and workability with the NTS. Four members of the team were experienced researchers in primary care clinical research (female DZ and males FR, AH and RD) of which one a practicing GP who has a special interest in mixed methods studies on quality and patient safety (DZ) and two with a special interest in cardiovascular diseases (FR and AH). RD is a practicing GP and the

director of the GP specialty training. Finally, in the team was one female researcher qualified in the learning sciences and qualitative research (EdG).

3.5 | Ethical approval

This interview study is part of a mixed-method study about telephone triage in patients suspected of having acute cardiac events (Erkelens et al., 2019); the study was approved by the Ethical Review Board of the UMC Utrecht. Anonymity was guaranteed, and participation was voluntary. Informed consent of the participants was obtained at the beginning of each interview.

3.6 | Data analysis

Data were analysed with constant comparison within and between cases, using both deductive and inductive approaches (Kennedy & Lingard, 2006; Kolb, 2012). We took an approach according to the principles of a grounded theory (iterative and focused on theory development) for the inductive analysis of the data about the CDSS use, and we took a deductive approach for the analysis of reasoning strategies. Coding was done using NVivo version 11, qualitative data analysis software. Two researchers (LW and MH) studied independently in iterative cycles of four transcripts and started with open coding. They discussed their findings with a third researcher (EdG) until consensus was achieved. The codes were identified through active interaction with the data by carefully reading each line and memo writing. The initial codebook was developed through reading and coding the first nine transcripts and discussed with a third and fourth researcher (EdG and DZ). The codes were categorised, and each theme was compared across all participants, to investigate, clinical reasoning strategies and working with the CDSS. Sixteen interviews were independently coded

by two researchers (LW and MH), and five interviews were coded by one researcher (LW). From then on, a framework was developed and improved through axial and thematic coding. The final coding was then applied to the last three transcripts by three researchers to confirm the emergent theory (EdG, DZ and DE). The remaining research team members discussed and approved the analysis during the development of the final manuscript (FR, AH and RD). Researcher triangulation was achieved through discussions about our findings with a research team with diverse research and working backgrounds. In addition, we discussed our results with members of the national association of primary care organisations, and with GPs with additional training and skills in acute care; the attending triage nurses and GPs in these meetings recognised our findings as relevant and representative for daily practice at OHS-PC.

4 | RESULTS

Baseline characteristics of the participants are presented in Table 1. Variety was achieved in all the relevant characteristics such as education level, telephone triage working experience and other working experience in health care with direct patient observations. Most of the respondents were women (91.6%).

4.1 | Clinical reasoning

The analyses showed that triage nurses combined elements of the hypothetico-deductive approach with elements of the humanistic-intuitive approach in their clinical reasoning. Triage nurses gathered information, used their knowledge about diseases and tested hypotheses about the disease(s) of concern. Within the humanistic-intuitive approach, triage nurses used pattern recognition and intuition, and they created a mental image of the patient to compensate for

TABLE 1 Baseline characteristics of triage nurse participants ($n = 24$)

Median age (IQR) in years	46 (36.5–53.5)
Gender	22 women, 2 men
Education level	20 nursing assistants, 2 nurses, 1 medical student and 1 nurse practitioner
Education for telephone triage assessment	17 triage nurses have completed the formal education for telephone triage assessment, 7 are in training
Working experience as telephone triage nurse in the OHS-PC	1 <1 year, 9 one–three years, 5 four–six years, 9 >6 years
Previous working experience elsewhere with direct patient observations	14 triage nurses have worked or currently work with direct patient observations, and 10 have never worked with direct patient observations
Present working experience elsewhere with direct patient observations	12 triage nurses currently work with direct patient observations, at the following settings: <ul style="list-style-type: none"> • 8 in GP day-care practice • 3 in hospital • 1 in home care

Note: Urgency levels

the lack of visuals during telephone triage. The more senior triage nurses tended to ask more questions beyond the required CDSS' questions during the telephone conversations. They aimed to gather in-depth information about the symptoms and the patient's context and wishes. In our analyses, there were no remarkable differences in clinical reasoning between nurses who work or have worked elsewhere in health care with direct patient contact. Furthermore, we found triage nurses were aware of potential cognitive biases in their reasoning, described in the literature about the dual-process theory (Croskerry, 2009b).

She said straight off that she was sweating because of the heat and the menopause, but I don't agree with her explanation, though it could be, of course. It can be a real pitfall, getting distracted. You stop having a clear view of the situation.

(T8)

Yesterday the ECG was okay. The E.R. doctor thought the symptoms were stomach-related but I don't want to be influenced by that. I want to know why this patient is phoning now. What has changed?

(T18)

Triage nurses strongly included the patient's sound of voice in their clinical reasoning. They used the nonverbal, paralinguistic aspects of the conversations, such as talking and breathing speed, gasping and tone of the voice. The vocal elements in communication, such as the intensity of voice or volume, were in previous studies defined as paralanguage (Ephratt, 2011). Interpreting paralanguage was particularly adapted to judge the credibility of the degree of pain and dyspnoea that the patients communicate. Both senior and novice triage nurses interpreted paralanguage, but senior nurses were more confident, and they said it is a skill that improved with experience.

I can tell by the sound of her voice that she's anxious. She's breathing fast and she can't hear or answer my questions. There's a certain haste in her voice.

(T13)

Experience teaches you when someone sounds sick. You can really hear if someone's in pain, or feeling worried, or that it's serious... It's also a gut feeling. (T18)

Interpreting paralanguage is combined with other reasoning processes to create a mental image of the patient, with the aim to judge the clinical status of the patient.

I make a mental image of the patient's physical state: how is she doing at the moment, what's the color of her skin, how is her breathing...?

(T6)

4.2 | Interactional workability with the CDSS

The support that the CDSS provides for the urgency decision-making was dependent on whether the CDSS' recommendation is congruent to the triage nurses based on their assessment of the caller's narrative. Triage nurses considered the CDSS supportive for the registration of patient's name, date of birth, location and the gathering of clinical information.

It was quite clear what to do for this patient. He'd had pain in the middle of his chest for under twelve hours and vegetative symptoms. The NTS advice was a U1, so I sent for the ambulance.

(T14)

Interactional workability dilemmas occurred when the CDSS does not support the triage nurse's clinical reasoning or decision-making: then, the CDSS constrains the decision-making process. This occurred, for example, when in the CDSS there is a mandatory choice for a main presenting symptom which misaligns with the clinical situation. As a result of the CDSS' construction, the triage nurse is forced to continue with the list of questions to be able to complete the triage assessment in the CDSS.

If you have a patient who is breastfeeding and has chest pain, the main presenting symptom 'chest pain' doesn't fit the clinical condition. It's an inflammation of the breast, nothing cardiac is happening. But you have to tick all the boxes in the list of questions to complete the triage assessment.

(T4)

Another example of an interactional dilemma is when the answer options within the CDSS are too restrictive in conjunction with the caller's narrative.

You have to choose between oppressive, stabbing or unclear pain, but some people have both pressing and stabbing pain. In that case I go for unclear, but actually I don't think that's appropriate.

(T13)

4.3 | Strategies of triage nurses

To deal with the absence of congruence of the CDSS with the triage nurses' decision-making, triage nurse applied four working strategies. These strategies were labelled by us as tinkering, overruling, complying and transferring responsibility to the GP. Tinkering was often practiced when the CDSS does not support the decision-making of the triage nurse. With tinkering, the triage nurse strived for a certain CDSS urgency recommendation which fitted her own decision through, amongst others, switching between main

presenting symptoms and up- or downgrading pain or dyspnoea scores.

She'd had oppressive pain for under twelve hours... but I needed more to get U1 urgency, so I looked for symptoms that could increase the urgency. Finally I set the pain score to 'severe'. Then the NTS advice is U1 so I don't have to explain why to the GP.

(T10)

In overruling, the triage nurse entered the symptoms according to how the patient responds, but the triage nurse did not comply with the CDSS recommended urgency, because she thought a higher or lower urgency was appropriate for the patient. In overruling, the triage nurse involved the supervising GP as is required according to the triage protocol of the OHS-PC.

Some patients say they're having severe dyspnea. Then the NTS advises immediate U1. But if the patient doesn't sound dyspneic on the phone ... then I'll go to the GP and ask if I can give it less urgency.

(T13)

Complying was the third strategy of triage nurses. In complying, the triage nurse complied with the urgency recommendation given by the CDSS despite the fact that the CDSS recommendation was not in line with his or her own decision-making. Some triage nurses indicated that management demands make them decide as such. Managers audit the triage nurses' telephone conversation recordings on a regular basis to establish whether the triage nurses comply with a certain conversation format, based on the CDSS structure. Triage nurses expressed that they feel the tension between performing

triage assessment which is accurate according to their professional convictions and what is expected from them to meet the audit demands.

But then they say you don't perform well... that your conversations should be different, that you should comply more to the NTS and you should change your way of questioning...

(T3)

The fourth working strategy was to transfer the responsibility to the supervising GP of duty. The triage nurse asked the supervising GP to take over and let him or her take the decision.

This elderly patient had so much going on. It began with dizziness and falling over, which led to a head wound of uncertain size. He had a long medical history, including diabetes, and besides that lived alone. Every question I asked seemed to turn up more problems. It got so confusing for me that I decided the GP should take over.

(T1)

In Figure 1, a full model is presented with the clinical reasoning elements, centrally the congruence with the CDSS and the four working strategies.

Results indicate that the triage nurses' experience, the patient's context, feelings of uncertainty and management demands influenced their choice for the strategies. In general, novice nurses may experience more feelings of uncertainty and be more likely to comply or ask the GP to take over responsibility. Senior triage nurses expressed to feel more confident about their decision-making, and therefore, they tended more to overrule and tinker.

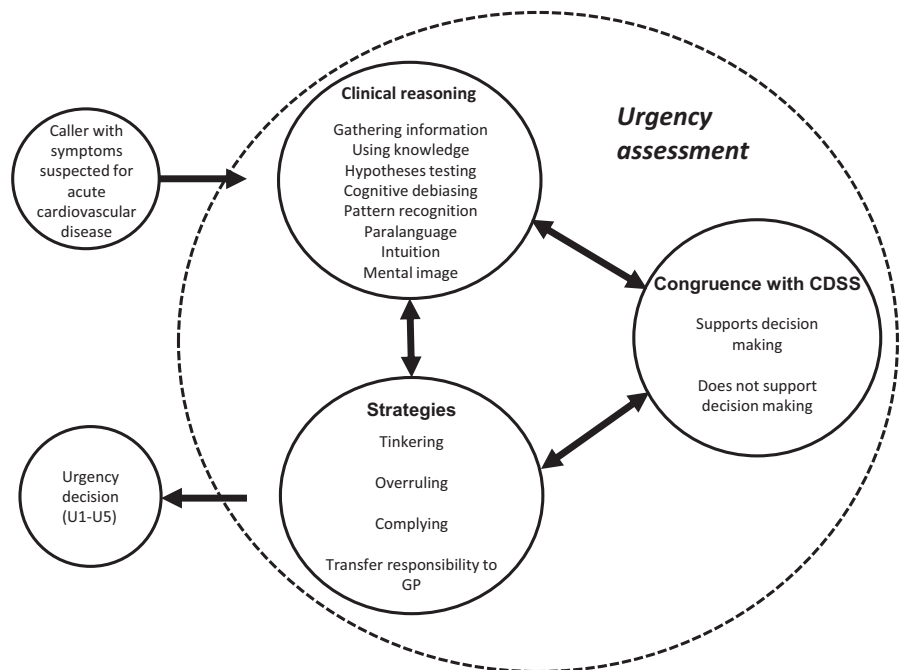


FIGURE 1 Model of telephone triage nurses' urgency assessment while working with the CDSS

I didn't know what effect a pacemaker has on chest pain... so that's why I asked the GP. In general I tend to consult the GP fairly quickly, just to be sure, since I'm still in training.

(T17)

Senior triage nurses told that they used the context to support their decision-making. Context may be about patient characteristics, cultural background, caller history or behaviour on the telephone.

People in this area code rarely call for help. They don't have medical insurance, so if they do call, you know it's serious.

(T12)

Uncertainty was mentioned by all triage nurses, meaning they perceived the patient to be giving too limited or too much information or conflicting information. Conversations with callers who had limited language skills or showed strong emotions were also mentioned to trigger uncertainty. Triage nurses mentioned that their uncertainty was sometimes enhanced by the CDSS, which constrains them because the CDSS necessitates them to reduce the patient's problem to one or more individual measurable symptoms that can be administrated within the CDSS structure. For patients with potentially urgent conditions, triage nurses tended to go for the safest strategy.

I asked five or six times if he was unconscious, but the son didn't seem to understand what I meant. I thought it was serious because the patient had a history of stroke and cardiac bypasses. Meanwhile the call had already gone on for five minutes, so I decided not to wait for more clarity and just sent an ambulance.

(T16)

5 | DISCUSSION

With the principles of a grounded theory approach, we analysed the reflections of telephone triage nurses and we identified that triage nurses use diverse known reasoning elements for their urgency assessment. In combining elements of the hypothetico-deductive approach with elements of the humanistic-intuitive approach, they adjust to the patient's narrative. Triage nurses assess the urgency by creating a mental image and interpreting the callers' paralinguistic. Whether the CDSS supports the decision-making of the triage nurse is important in choosing the triage nurses' working strategies. We distinguished four working strategies triage nurses apply while using CDSS: tinkering to make the final advice align with their own assessment, overruling the CDSS advice, complying with the CDSS advice and transferring responsibility to the GP. We found that the triage nurses' work experience, the patient's context (such as patient characteristics and caller history), feelings of uncertainty and management demands influence their choice for a strategy.

Interactional dilemmas, earlier reported in the literature, are present in our study and described as the feeling of negotiating between the CDSS questions and the patient's narrative which may include diverse symptoms (Murdoch et al., 2015). In the few studies about interactional workability, which are not specifically about telephone triage nurses, the telemedicine setting both enabled and constrained the nurses' reasoning and decision-making (Barken et al., 2017; Murdoch et al., 2015). When the CDSS does not support the triage nurses' decision-making, this may lead to time delay, which worsens the patient's prognosis when having acute cardiac event (Rawshani et al., 2014). The technical design of the CDSS in our study supports in a certain manner the purpose of the intervention; triage nurses consider the CDSS supportive for the registrations of patient's name, date of birth and gathering clinical information with the help of the question lists that pop-up after choosing a main presenting symptom in the CDSS. However, triage nurses consider the CDSS only supportive for gathering clinical information when the main presenting symptom and corresponding questions align with the clinical condition. In the case of absence of congruence, triage nurses will apply strategies which will not fulfil the purpose of the CDSS (such as following the guideline), and therefore, the CDSS does not accomplish disposal of work. Studies about interactional dilemmas are scarce, and knowledge is lacking on what strategies triage nurses apply when they experience absence of congruence. In one Swedish interview study about working environment, it was briefly mentioned that some triage nurses complied to the CDSS because they were afraid of making a wrong assessment (Wahlberg & Bjorkman, 2018). We also found that management demands were one of the aspects that influenced the choice for the working strategies. Given telephone triage in the Netherlands is very safe (Rutten et al., 2018), it is a shortcoming when managers should limit their audits' focus on complying to the CDSS. We argue that it would be more relevant for managers to use feedback on clinical outcomes, which will be helpful for the triage nurse to improve their urgency assessment performance, given the fact that providing feedback improves accuracy of new tasks (Nederhand, Tabbers, Splinter, & Rikers, 2018).

In our study, interpreting paralinguistic showed to be important for urgency assessment. Triage nurses combine interpreting paralinguistic with other reasoning elements and create therewith a mental image to compensate for the lack of visual information. Paralinguistic is studied within linguistics, but there is limited research about interpreting paralinguistic in telephone triage conversations (Ephratt, 2011). In one study, senior triage nurses used caller self-tests and listened carefully to detect physical signs (Pettinari & Jessopp, 2001). In this study, the concept of interpreting paralinguistic was not mentioned, but "listening for physical signs" suggests that triage nurses use the paralinguistic aspects of the conversation. In a study performed at the emergency department, telephone triage nurses said they judged the credibility of patient's symptoms on how they narrate their story, and how they behave or speak and imagine what the patient's physical appearance looks like (Edwards & Sines, 2008). Detailed information was, however, lacking in these studies on how triage nurses listened for physical signs and how they interpreted these for their urgency

assessment. "Knowing the patient" was the cornerstone of reasoning in the prior mentioned Swedish study about telenurses who managed patients with COPD; such familiarity with the patients enabled telenurses to value the clinical symptoms as either normal for the patient or as a warning sign (Barken et al., 2017). In this way, the triage nurses acquired in-depth knowledge that empowered them to see past the CDSS and adapt their decision to the clinical situation. In our study, triage nurses were not familiar with the callers, which implicate that they have to rely stronger on other reasoning elements for urgency assessment. Our study indicates that interpreting paralanguage and creating a mental image may be keystones for urgency assessment when triage nurses are not familiar with and cannot see the caller. Further research in exploring how triage nurses interpret paralanguage in their urgency assessment may help to acquire additional knowledge for improving telephone triage training.

5.1 | Strengths

We interviewed twenty-four triage nurses with a variety of work experience and training. By using the audio-stimulated recall interview technique, we obtained an accurate view of triage nurses' reasoning elements. This method is considered reliable to understand participants' implicit theories and reflections on key events in a real situation of interest (van Braak et al., 2018). Findings were discussed with the members of the research team, who have diverse research backgrounds, to optimise transparency and researcher triangulation. Understanding how clinical reasoning takes place in telephone triage of patients suspected of potential urgent conditions while working with a CDSS is important to improve workability with the CDSS and improve the training of triage nurses. As these interviews were performed in an open, nonjudging and confidential atmosphere, we had rich data to analyse and achieved a good understanding of triage nurses' clinical reasoning.

5.2 | Limitations

At the time of the interviews, the telephone conversations that were used for listening during the interview were performed at a maximum of two weeks before the interview. However, because the nurses perform a large number of calls every shift, some nurses may have found it hard to remember their reasoning during these specific conversations used during the interview. The literature about audio-stimulated recall recommends that an interview should be conducted as soon as possible after the recording, but does not indicate a specific period (Dempsey, 2010). For future research, a (video) observation study might give additional information on how triage nurses use the CDSS by observing exactly how they use the options provided by the interface of the CDSS. Also, a think-a-loud study with triage nurses during telephone conversations, although very difficult to realise in an urgency setting, could contribute to our understanding (Lyle, 2003).

6 | CONCLUSION

Telephone triage nurses use clinical reasoning elements for urgency assessment of callers suspected of potentially acute cardiac events. They interpret paralanguage and create a mental image to compensate for the lack of visual information. Congruence with the CDSS is a key aspect, which in this study is established when the CDSS supports the triage nurses' decision-making. If congruence is absent, triage nurses apply four working strategies, which are (a) tinkering to make the final recommendation align with their own assessment, (b) overruling the CDSS recommendation, (c) complying with the CDSS recommendation or (d) transferring responsibility to the GP.

7 | RELEVANCE TO CLINICAL PRACTICE

This study confirms triage nurses have to deal with interactional dilemmas while working with CDSS, with lists of questions that may misalign to the clinical condition or have too restrictive answer options. Understanding triage nurses' working strategies with CDSS and what influences their choices herewith may help to develop improved education and also may add to a constructive safety culture in the workplace. Telephone triage training may benefit by sharing how interpreting paralanguage and creating a mental image is done. Awareness that triage nurses' reasoning and their working strategies are vital for the outcome of triage decisions is important for CDSS developers and managers. CDSS developers may benefit by involving the triage nurses' input to improve interactional workability. About implications for managers, we argue that it would be counter-effective when managers solely focus their audits of triage nurses on complying with the CDSS. Given that in the Netherlands, current telephone triage is very safe, and managers better shift the focus of audits more to clinical outcomes of triage decisions.

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CONFLICT OF INTEREST

None of the authors reports a conflict of interest.

AUTHOR CONTRIBUTIONS

Study concept and design: LW, DZ, DE, EG; acquisition of data: LW, DE, MH, EG; analysis and interpretation of data: LW, DZ, MH, EG; drafting of the manuscript: LW, DZ, EG; critical revision of the manuscript for important intellectual content: DZ, DE, AH, RD, FR, EG.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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APPENDIX 1

URGENCY LEVELS

Urgency level	Implication
U0	Reanimation
U1	Life-threatening, GP/ambulance should arrive within 15 min
U2	Emergency, GP should arrive within 60 min
U3	Urgent, consultation by GP within 3 hr
U4	Routine, consultation by GP the same day
U5	Advice given by triage nurse

APPENDIX 2

QUESTIONNAIRES

Original version questionnaire, August 2016

Topic: clinical reasoning

- Which moment or moments in the call was/were important for your reasoning? We will listen to the fragment/fragments again.
- Why was this fragment important for your reasoning?
- What did you take into consideration here?
- What made it striking for you?
- What did it mean to your reasoning process that the patient said this (.....)?
- Here you asked the following question (...?) What made you think of that question?

Topic: interactional workability

- Does the NTS support the decision (s) you made in this fragment?
- Where in this fragment did the NTS decision supporter help you? Can you say more about that?
- Are the questions you asked here based on the NTS, or did you also have questions that come from outside the NTS?
- Why did you ask those questions? And why did you ask those questions right here?
- Do you often ask questions that go beyond the NTS?
- Do you remember the main presenting symptoms that the NTS suggests?
- Which main presenting symptom did you choose? Why?
- What is/are the most important reason/s that led to this choice?
- Did you answer all the questions related to this presenting complaint? Why or why not?
- Did you switch to another main presenting symptom while asking questions? Why did you? What did you take into consideration?
- Do you remember what the NTS recommended level of urgency was?
- What do you think of the urgency the NTS recommends? Why do you agree or disagree?

Topic: acute cardiac events

- Are there any special features in the triage of these patients? What makes the triage special or difficult or easy?

- Is the triage of patients with suspected acute cardiac event (compared to other types of triage phone calls) generally very clear or do you also get conversations where it is not so clear?

Topic: uncertainty

- How sure of your reasoning were you in this call?
- What were you unsure about and why?
- How did you deal with this uncertainty?
- How did this doubt/uncertainty influence your determination of urgency?
- Consultation with general practitioner: why did you or why did you not consult the GP? What did you expect from this consultation?

Topic: context

- Did anything else influence your reasoning process (other than the patient's characteristics) in this call? Things in yourself, in the environment?
- Can you imagine the circumstances to this call?
- How did that influence your reasoning during the triage call?

Supplementary topics, February 2017

Topic: interactional workability (adapted questions)

- When does the NTS work for you and when does it get in your way?

- In your opinion, when is the NTS suitable for a particular case, and when is it not?
- If the NTS is not "working" for you, how do you do the triage? What do you base your decisions on?
- Have you noticed if using the NTS has any influence on the conversation with the patient? Do the questions match, or not? Have you noticed any clashes? What do you do if the questions do not fit the patient's story very well?
- What do you do if the patient gives unclear answers? The NTS requires a yes/no choice. Do you fill it in, or leave it open?

Topic: paralinguage

- You say the patient sounds sick... what do you mean by that? What precisely do you base this on?
- Can you state explicitly what you hear then, in this fragment?
- How decisive for the triage is it for you, that the patient sounds like that?

Topic: patient's personality

- You indicate that this patient is a... type of person. What do you mean? What kind of influence does this have on your reasoning process?
- How decisive for the triage is it for you that this patient is a... type?