It Totally Possibly Could Be: How a Group of Military Physicians Reflect on Their Clinical Reasoning in the Presence of Contextual Factors

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ABSTRACT Introduction: Contextual factors (eg, diagnostic suggestion and burnout) can affect physician clinical reasoning performance, leading to diagnostic error. Yet, contextual factors have only recently been studied and none of that work focused on how physicians appraise (ie, evaluate) the clinical situation as they reason. The purpose of this qualitative study was to use appraisal to describe the effect of contextual factors on clinical reasoning. Materials and Methods: Physicians (n = 25) either viewed two video cases or participated in two live scenarios, one with contextual factors and one without. Afterwards, they completed a "think-aloud" reflection while reviewing the cases. Transcribed think-alouds were coded for appraisal markers, comparing cases with and without contextual factors. Results: When contextual factors were present, participants expressed more emotional evaluation and uncertainty about those emotions. Across all types of cases, participants expressed uncertainty about the case and assessed what "could" or "would" have gone differently. Conclusions: This study suggests that one major effect of contextual factors may be that they induce emotions, which may affect the process of clinical reasoning and diagnostic error. It also suggests that uncertainty may be common in clinical practice, and we should thus further explore its impact.

INTRODUCTION

A general surgery physician, watching a video of herself in a simulated case: "He [the patient] brought up acid reflux. And it seemed like he was very excited that he had solved his problem and that this wasn't something scary, and I was trying to like ... validate this? Because, you know, it totally possibly could be, but at this point I was very concerned that it was cardiac. So I think maybe I ... spent more time than I would've liked to, trying to, like, validate his concern."

As this physician watches herself on a video and reasons aloud, she reflects on the standardized patient's concern about his chest pain and his desire for it not to be a "scary" diagnosis. Thus, in the midst of determining diagnosis and treatment, she also must process this additional element in the situation, something to which she reacts with emotion ("concerned"), uncertainty ("possibly"), and a proposition about what she would have done under different circumstances. In all these ways, she is appraising the clinical scenario: evaluating her-

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self, others, and the situation. This article examines how physicians negotiate these contextual factors—features other than the content needed to arrive at the diagnosis (eg, diagnostic suggestion in the quote above)—which can influence clinical reasoning through the lens of their appraisals.

Clinical reasoning has been described as the process "that enables practitioners to take wise action, meaning to take the best justified action in a specific context."² This description acknowledges the vast complexity of clinical reasoning tasks, which include both the action taken (eg, assigning a diagnosis, ordering a test, and making a treatment plan) and the context of the action (eg, a rushed appointment with a new patient who might also struggle with English). We approach the clinical context (including the participants, their interactions, and salient features of the environment) through the lens of situated cognition. This theory argues that individual cognition (reasoning in this case) is inseparable from the context in which it happens. From this theoretical perspective, situational (ie, contextual) factors associated with the physician, patient, and encounter all interact (Fig. 1).^{3,4} Recent research indicates that some contextual factors can negatively impact the diagnostic process, resulting in context specificity: a physician arriving at two different diagnoses for two patients with the same diagnosis who also have the same symptoms and findings but different situations.^{5,6} Context specificity undoubtedly results in diagnostic error, a problem that has come to the forefront of healthcare in the United States recently, affecting most of us at least once over the course of our lifetimes.^{7,8}

Context specificity is recognized as an important problem in medical education, but has only recently been studied,

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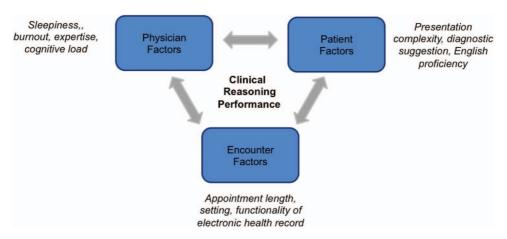


FIGURE 1. Situated cognition model for clinical reasoning.

with emerging work suggesting that contextual factors (eg, diagnostic suggestion by the patient, patient language difficulties, physician burnout, and short appointment times) do affect performance across levels of experience, from residents to attending physicians.^{3,10} In the military medical environment, where physicians often practice in austere settings with limited resources, it is arguably even more important to understand, and therefore mitigate, the effect of context specificity to reduce diagnostic error. A potentially useful tool for understanding this effect is appraisal: explicit evaluations of the situation, either through emotional evaluations of self, patient, or environment (eg, feeling "anxious"), modal verbs assessing what the physician might have done or did not do (eg, what the participant "would" have done differently), and hedging a claim to express uncertainty (eg, "most likely" [ie, not definitely] gastroesophageal reflux disease [GERD]; see the Results section for more examples and explication).¹ Analysis of appraisal in medical education is limited but has proven to be a useful lens for understanding the process by which clinicians evaluate their own and others' roles in the clinical enterprise. 11,12 We discuss below how appraisal may interact with the clinical reasoning process, particularly in the presence of contextual factors.

HOW EMOTIONAL EVALUATION, ASSESSMENT, AND UNCERTAINTY MAY IMPACT CLINICAL REASONING

Emotional evaluations of the clinical encounter (eg, emotional states like feeling "frustrated"), although not a primary focus in clinical reasoning literature, can offer telling appraisals of the clinical encounter, guiding as well as impeding the reasoning process. ^{13–16} Both positive and negative emotions can impact the reasoning process. ¹⁷ Moreover, negative emotional reactions like anger, sadness, and shame can narrow one's attention, negatively affect risk estimation, lead to withdrawal and lowered empathy, and influence diagnostic accuracy through increased cognitive load. ^{13,15,18,19} Moreover,

these effects can be made worse with the addition of other contextual factors like sleep deprivation and time constraints, 5,15 both of which are common in the deployed environment. Finally, a previous study examining mentions of contextual factors in case reflections found that emotional reactions were common and were usually associated with some form of tension, which the authors hypothesize may negatively affect reasoning. 6

Another type of appraisal that can be associated with clinical reasoning is assessment, particularly self-assessment.²⁰ Although different fields and lines of work operationalize assessment and self-assessment differently, we focus here on the broader pragmatic definition of assessment as an evaluation of self, other, or situation using modal verbs like "would" and negative markers like "not." Informal assessments of clinical practice, like the ones studied here, may take the form of modal "would" or "could" statements about how physicians would optimize the relationship with the patient (eg, engaging in conversation to put a patient at ease) or what additional information (eg, labs and patient history) physicians could obtain in order to come to a diagnosis. This focus on what could be done differently offers an opportunity for reflection. Yet, as argued by McBee et al., a desire for more information is closely related to difficulty with diagnostic closure. 6 In their study, those who wanted more information had more difficulty with closure and, vice versa, those who were having difficulty with closure asked for more information.

The final type of appraisal in clinical reasoning we focus on is uncertainty, which we broadly define as using hedges²¹ like "kind of" or "possibly" to be less definitive about one's claims. Although uncertainty can be beneficial (ie, working against overconfidence, which can be associated with diagnostic error),²² a body of research suggests that it can negatively affect clinical reasoning outcomes and the stress level of the patient, and can lead to unnecessary testing and misspent time and money.^{23,24} There is a growing recognition of the need to identify and manage uncertainty effectively,^{23,25} but there is still limited research conceptualizing uncertainty in clinical

Condition Case Without Contextual Case With Contextual Contextual Factors Number of Factors Factors Participants 9 Video A Angina Diabetes Non-native speaker challenging physician's credentials 5 Video B Diabetes Angina Diagnostic suggestion and circuitous historian 11 Live scenario Diabetes Diagnostic suggestion Angina

TABLE I. Description of Conditions and Contextual Factors

reasoning, particularly regarding the phenomenon of context specificity.

The purpose of this qualitative study was to use markers of appraisal to describe the effect of contextual factors (eg, diagnostic suggestion, non-native speaking patient) on the moment-to-moment clinical reasoning process. We examine transcripts of physicians' oral reflections on clinical cases, asking:

- 1. How do participants use appraisals to refer to contextual factors, if at all?
- 2. Do participants appraise themselves and others differently in the presence of contextual factors, if at all? If so, how?

MATERIALS AND METHODS

As part of a larger study conducted at the Uniformed Services University of the Health Sciences (USU) and Walter Reed National Military Medical Center (WRNMMC) examining the effects of contextual factors on clinical reasoning processes, active duty resident and attending physicians in internal medicine, family medicine, and surgery were invited via email to participate. Our strategy in selecting this sample was consistent with the larger study's goals focusing on these specialties and with our simulation design in which the scenarios (video and live) and cast simulated patients were aligned. After informed consent was obtained, participants were quasirandomly assigned (based on participant schedules) to one of three groups (video one, video two, or live scenario), each with a control (noncontextual) and contextual factor case (Table I).

Participants in the video conditions watched two cases, while participants in the live scenario condition engaged in two live scenario-based simulations (Table I). There was a set time limit for each encounter: videos ran 5 to 6 minutes and live scenarios up to 15 minutes. Participants were advised that our goal was to examine their clinical reasoning processes and that there was no penalty if they did not complete the encounter within 15 minutes. All cases were straightforward depictions of common presentations in primary care and surgical practice, namely, new onset diabetes mellitus and unstable angina, allowing us to explore the impact of contextual factors on performance.

Immediately after either watching each video case or participating in each live scenario case, participants were instructed to "think out loud" about their thoughts as they came to a diagnosis with no cuing or interruptions from the interviewer while either rewatching each video (video condition) or watching the video of their own live simulation (live condition; see Battista et al. for a more detailed description of the procedure and cases). ^{26,27} This "thinkaloud" methodology has been shown in other studies to be an effective way to examine clinical reasoning. ^{3,28,29} Think-alouds lasted between 4 and 19 minutes and were then transcribed verbatim for analysis. The USU Institutional Review Board granted approval for this research protocol (MED-83-3824).

Data analysis followed a four-step process. First, following our prior work on coding for context specificity, ⁶ we identified places in the think-alouds where participants explicitly mentioned the designated contextual factor (eg, noting that the non-native speaker might not understand an English medical term). Second, we reviewed and discussed these examples as a coding team (A.K., D.R., and M.O.), identifying markers of appraisal (drawn from systemic functional linguistics), ^{1,30} which would help us to track the effect of contextual factors in the transcripts.

Third, we selected three commonly occurring appraisal markers (450 instances across the 50 transcripts) among video and live treatment groups and aligned them with prior work on clinical reasoning: emotional evaluations (eg, mental states like frustrated and evaluations like rude), assessments (eg, modal markers like would and negative markers like not), and hedges denoting uncertainty (eg, kind of, possibly; see Bhise et al. for a similar coding structure). ^{21,31} We utilized the strategy of searching for instances where these markers were present because their presence had significant implications in a prior study ¹⁰ and because think-aloud time differed between the video and live contexts. Finally, we compared the use of these markers in cases with and without contextual factors as an interpretive team.

RESULTS

Participants were 25 internal medicine (n=18), family medicine (n=2), and general surgery (n=5) active duty military physicians at USU and WRNMMC. Ten participants were female and 15 were male, and 15 were residents and 10 were staff physicians. Their ages ranged from 27 to 61 years old (m=36 years old) with 0 to 34 years in practice (m=7 years).

Contextual Factor Appraisal Type Quote Gender Specialty Condition Age Diagnostic suggestion Emotional evaluation Wonder if he's anxious about his sister having Male 47 Internal Video B esophageal cancer and he might die medicine So at this point, I'd say most likely it is GERD, but I Diagnostic suggestion Hedger of Male 29 Internal Video B uncertainty, medicine want to do more to rule out acute coronary syndrome. assessment, Not confident in saying it's that yet emotional evaluation Circuitous patient Hedgers of So he's kind of a poor historian. Makes it kind of Male 29 Surgery Video B difficult to really isolate it history uncertainty Non-native speaking So this (yeast infection) is really bothering her, and he 27 Internal Emotional evaluation Video A Female patient seems pretty callous about it medicine Non-native speaking Assessment As this goes on, it becomes clear that your history that Male 52 Family Video A patient you are getting is not necessarily an accurate history or medicine a complete history. So, uh, it would have been in his (the video doctor's) best interest to get an interpreter and I would have gotten an interpreter Challenging Hedgers of When she asks about, like, if he's competent enough to, Female Internal Video A physician uncertainty, kind of, take care of that. He does the exam, but she, medicine credentials emotional like, asks him to wash his hands before he starts...makes

you wonder if she's kind of anxious or on edge, a little

distrustful of him and this medical setting

TABLE II. Examples of Participant Mentions of Contextual Factors

Of the 25 participants, 23 (92%) referred explicitly at some point to one of the designated contextual factors (ie, diagnostic suggestion, circuitous history, non-native speaking patient, or questioning of physician's credentials). Most of the participants referred to the contextual factors at some point using appraisals: emotional evaluations, assessments, or hedges of uncertainty (Table II). In these examples, participants evaluated their own and the patient's emotions, primarily negative; they assessed their own and the video doctors' decisions, positing different or additional actions they could have taken, and they expressed uncertainty, both about the diagnostic process and their interpretation of the situation.

evaluations

Our appraisal analysis revealed one notable difference between the types of cases: when reflecting on cases with contextual factors, participants offered more emotional evaluation, about three times per think-aloud without contextual factors and eight times per think-aloud with contextual factors (a t-test showed this to be a significant difference at the P < 0.001 level). In these emotional evaluations, they expressed their worry for the patient (particularly with the angina case, where several participants mention their "concern" about the patient's symptoms) or anger at the physician in the video (particularly with the diabetes case in which the patient struggles with English and the doctor does not bring in an interpreter; eg, the fourth example, "callous," in Table II). These emotional evaluations were usually negative (which is consistent with our design of the contextual factors, which were typical distractors in practice), often offering evaluations of the patient's emotional state (eg, the last example in Table II). The cases without contextual factors, however, stimulated very few emotional evaluations.

Assessments, in contrast, appeared relatively equal both in cases with contextual factors (52 times across the sample) and without contextual factors (49 times across the sample). Participants used modal verbs like would or should and negation (eg, not and did not) to make assessments about what did not happen and probably should have. In other words, they made statements about some optimal condition in which they had more information or behaved differently. These assessments were primarily about what should have been asked in the patient history, what should have been done on physical examination, and what tests should have been performed for diagnosis and management. For example, in referring to a video of an angina case without contextual factors, a participant says, "I would have asked him if he has any nausea when he's having this pain. I would have **asked** him whether or not he had any diaphoresis, or sweating, when he had the pain. She (physician in the video) didn't really ask about any of those kinds of things, so I think those all would have been helpful." Here the participant assessed what the physician in the video did not do and what he would have done in the same situation. Participants made these same sorts of assessments about themselves, most often in the live scenario cases, as in this comment on the diabetes case without contextual factors: "I didn't actually order a thyroid, now that I think about that (...) But that would be something I would want to get, too."

Additionally, we found that the assessments and emotional evaluations discussed above were combined with hedges of uncertainty. For example, in discussing the angina case with contextual factors, a participant used both modal verbs of assessment (underlined) and hedges of uncertainty (bold), "I would probably trial him on a PPI [proton pump inhibitor],

Quote	Contextual factor	Gender	Age	Specialty	Condition
That supports a peripheral neuropathy, um, which kind of goes along with maybe some untreated diabetes	None	Male	30	Internal medicine	Video B
I think reflux is probably the most likely thing, but other things I'm thinking about are angina, he's a smoker, he has that history. He did not really say he had pain with exercise, so that's kind of leading me away from that	Diagnostic suggestion and circuitous history	Male	29	Surgery	Video B
But at this point, (I was) kind of done with what I felt I could get out of the history and physical	None	Male	30	Surgery	Live scenario
So you wonder maybe there could've been some damage to things like the pituitary or the hypothalamus, unlikely. But, possibly	Non-native speaking patient, questioning physician credentials	Male	47	Internal medicine	Video A

TABLE III. Hedging About History-Diagnosis Connection Across Conditions

um **kind of** counsel him to avoid foods that trigger GERD. [...] I think that's **probably** what I **would probably do** for him." Thus, even in discussing optimal cases of what one would or should do, participants tended to express hedging towards uncertainty. This type of appraisal, like assessments, occurred across both conditions (eg, it's probably, not necessarily "related here"), with 151 hedges coded for cases with contextual factors and 146 hedges coded for cases without contextual factors. As we might perhaps expect in a think-aloud task asking for thoughts toward a diagnosis, most of the hedging related in some way to the process of coming to a diagnosis, particularly connecting findings from the history with the diagnosis (either leading or differential), as in Table III. In these examples, participants were denoting uncertainty in the posited connections among evidence (eg, smoking history) and possible diagnoses (eg, angina). Note that in this third example, the participant was explicitly moderating the force of his own reasoning, noting that he was "kind of done."

Although examples like those in Table III occurred similar across conditions, we also found some types of uncertainty hedging occurring more frequently in the presence of contextual factors, related to: (1) participant affect, (2) patient affect, (3) patient characteristics, and (4) assessment of patient credibility, shown in Table IV. In the first two examples, participants softened references to feelings—their own or their patient's, minimizing the sense of concern. In the last two examples, participants softened references to patients that might not be interpreted as kind or complimentary. In all these examples, the contextual factor brought along with it some kind of emotion or judgment, so the participant took the conversational time and energy to soften the statement. One consequence of this is that participants hedged statements around diagnosis and clinical reasoning (Table III) less, focusing their conversational time and energy on issues related to the contextual factors.

DISCUSSION

This study offers important insights into the process of clinical reasoning as reflected in the think-alouds of these active duty

physicians and how this process differs in the presence of contextual factors. First, explicit mentions of contextual factors are usually accompanied by some kind of appraisal, whether it is evaluating the emotions at play (one's own or the patient's), assessing the clinical actions and diagnostic steps taken, or hedging to express uncertainty about the diagnostic process. Second, in cases with contextual factors, participants do more emotional evaluation and hedging of emotions or judgments. Thus, the presence of these contextual factors seems to stimulate participants to reflect more on emotional states and to spend their reflection time carefully qualifying (ie, hedging) their claims about emotions and patients. Third, whether or not contextual factors are present, physicians regularly assess in their reflections how a clinical encounter "could" or "would" have gone and express uncertainty about what is "probably" or "possibly" going on clinically. In the context of these think-aloud reflections, assessment of what has been done and uncertainty about what is going on seem to be more the norm than the exception.

This work has teaching implications, particularly around emotions and their role in clinical education and practice. Recent research with internal medicine residents suggests that, when unexamined, negative emotions like shame can fester, leading to emotional distress, impaired self-regulation, and disengagement from learning, among many other negative outcomes.³² If negative emotional evaluations are indeed more prominent in the presence of contextual factors, medical educators should be aware of this and the additional support learners might need in these situations, both regarding the clinical reasoning process and their own and the patient's emotional health. This is particularly important, since physician and patient emotions heavily affect each other and the diagnostic process.¹⁴ Currently, medical school curricula are focused far more on content than on context; perhaps more attention to context—and how to notice and manage the emotions and mitigate uncertainty—would lead to better emotional regulation in the face of these contextual factors.

These findings suggest several implications for research in clinical reasoning. To begin, if contextual factors somehow

TABLE IV.	Hedging in the Presence of Contextual Factors	

Hedged element	Quote	Gender	Age	Specialty	Condition
Participant affect	And this is with like any more exertion than walking, so I am kind of like , "Oh! That's scary."	Female	30	Internal medicine	Live scenario
Patient affect	It seemed like he was very excited that he had solved his problem (ie, it is GERD, not a cardiac issue) and that this wasn't something scary. And I was trying to like validate this? Because, you know , it totally possibly could be , but at this point I was very concerned	Female	34	Surgery	Live scenario
Patient characteristics	So he's kind of a poor historian. Makes it kind of difficult to really isolate it, but he said it was kind of a burning pain	Male	29	Surgery	Video B
Patient credibility	(After patient maintains he has no medical problems) He's been in the military a while, it's probably not totally true	Female	39	Family medicine	Live scenario

steer physicians to spend more reflective time on emotional evaluations, particularly negative ones, it is critical to better understand the effects of these evaluations on clinical reasoning. For instance, research in the appraisal-tendency framework suggests that not all negative emotions have the same effect on reasoning. For instance, although anger and sadness are both negative emotions, anger leads people to attribute control to individuals (eg, anger at the individual doctor in one of the study videos for not calling in an interpreter) and to be more certain about their judgments. 17,33 Meanwhile, sadness leads people to attribute control more generally to the situation (eg, sadness for the situation in which our patient with angina tries desperately to convince the physician that he has GERD, a less "scary" situation) and to be less certain about their judgments. In addition, although some negative emotions, like shame or disappointment, tend to be psychologically "deactivating" for physicians, thereby resulting in disengagement from a given situation, other negative emotions, like confusion or frustration, can actually lead to greater arousal and situational engagement and, potentially, enhanced performance.³⁴ Future research could explore how eliciting specific types of negative and positive emotions (both activating and deactivating) affect diagnostic certainty, particularly anchoring and diagnostic closure.6,34

Next, participants across cases with and without contextual factors regularly express alternate paths and uncertainty, assessing how they "could" or "would" proceed combined with the hedging of what they "might" or "probably" think is happening. This suggests that uncertainty is quite common in clinical practice. Indeed, it may be more common than the literature suggests as our cases were straightforward and common to practice and included practicing attendings and residents. Nonetheless, uncertainty was still a common theme, indicating a need to further explore the impact of uncertainty on clinical reasoning and diagnostic error. McBee et al. propose, for instance, that uncertainty can hinder diagnostic closure, 6 which could generate unnecessary costs and delay care. This could be a particular problem in acute and austere military environments where there may be few additional

diagnostic tests or procedures one could perform in an effort to alleviate uncertainty before moving forward with treatment. Studies further exploring how an "it totally possibly could be" attitude affects the diagnostic process and diagnostic outcomes are needed.

A final research implication is methodological: appraisal, drawn from the functional linguistics tradition, ^{1,30} appears to offer effective tools for studying clinical reasoning. This is particularly true when taking a situated cognition perspective, in which researchers seek to explain how a variety of factors (related to physician, patient, and situation) interact moment-by-moment in the clinical reasoning process.³ As previous work suggests, appraisals offer a rich window into the practice of medicine and medical teaching, revealing the varying stances clinicians take towards themselves, their patients, and the broader clinical and institutional environment.^{11,12}

There are several limitations to this study. First, all participants were drawn from two (closely related) sites so these patterns may not hold for other military physicians. The designed video and simulation cases represented the primary care and surgical settings, and thus, we did not select participants from other common medical specialties (eg, psychiatry and gynecology or psychiatrists and gynecologists). However, given the goal of studying the clinical reasoning process in the presence and absence of contextual factors, our purposive sample selection strengthened our findings. Future work should explore other sites, as well as other types of physicians (eg, critical care and oncology) to offer a broader picture. Second, thinkaloud reflections were retrospective (ie, after participating in or viewing the case and giving the diagnosis), but this allowed participants to concentrate fully on the case as they were coming to their diagnosis without having to verbalize. Meanwhile, prior work has shown the value of retrospective think-alouds for examining clinical reasoning.^{3,35} Finally, we drew these data set from both live and video simulation modalities, which are different experiences for the participants. Because we were finding similar results across the two modalities and because our focus was on the contextual factors, we chose to combine live and video in this analysis. Future planned analyses in this project will further explore the differences between those modalities.

CONCLUSIONS

Given the relationship between contextual factors and diagnostic error, ³⁶ continued qualitative work like this exploring how physicians reason through contextual factors moment-bymoment is critical. This study suggests that one major effect of context specificity may be that it induces emotions, negative ones in these cases, that might affect processing speed or attention.³ Physicians' awareness of their emotions and ability to recognize their effects on clinical reasoning may thereby strengthen the diagnostic process and have a positive impact on diagnostic error.^{37,38} Moreover, this study highlights the prevalence of uncertainty even in straightforward cases without contextual factors. Given this, future work should examine how contextual factors related to the physician like sleep deprivation and burnout might affect diagnostic reasoning, both process and outcome in the presence of uncertainty, even when context specificity is not at play. 10,39,40 The language physicians use to reflect upon their practice—ie, not only what they say but how they say it—can offer valuable insight into how they make assessments and evaluations about themselves, their patients, and the broader clinical situation.

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