Title of Project: Emotional Influences on Diagnostic Error in Emergency Medicine: An Experimental Approach to Understand Diagnostic Failure and Facilitate Improvement for Patients with and without Mental Illness

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1. STRUCTURED ABSTRACT

Purpose: To (1) identify how emotions impact emergency physicians' and nurses' clinical reasoning, judgment, and behavior and (2) examine strategies to mitigate these influences.

Scope: Despite awareness that emotions may compromise clinical reasoning and patient safety, research is scant. Understanding emotional influences, especially in high-risk practices like emergency medicine, is essential for developing interventions.

Methods: (1) Qualitative interviews were conducted with emergency physicians, nurses, and patients. (2) Mixed methods. Physician and nurses described recent emotional patient encounters, reported emotions, and described emotional influences on their clinical behavior. (3) We developed computer-simulated patient encounters that experimentally varied patient behaviors (irritable versus calm) and presence/absence of mental illness. Physicians and nurses assessed simulated patients in six randomized experiments (two tested cognitive interventions).

Results: (1) Grounded theory models revealed that emotions resulting from patient, provider, hospital, and system factors can influence clinical judgments and behavior and that emotion management strategies may mitigate these. (2) Participants reported that emotions influenced their clinical judgments and behavior in their patient encounters, especially anger-inducing encounters. (3) Emotions were similar across participants and simulated encounters. Angry (versus calm) encounters evoked more negative and fewer positive emotions and less engagement. In simulated encounters, irritable patients led to more unfavorable judgments (poor historian, pain assessment) and greater expectations of negative outcomes (treatment nonadherence, poor prognosis). Diagnostic accuracy did not vary across encounters; however, nurses were less likely to recommend tests necessary to diagnose patients with (versus without) mental illness.

Key Words: Emotions, Clinical Reasoning and Judgment, Patient Safety, Emergency Department

2. PURPOSE

The overarching goals of this research project were to integrate research from social cognitive and affective science to (1) identify and understand how affective factors (e.g., emotions, stigma) impact emergency physicians' and nurses' clinical reasoning, judgments, and behavior when treating patients with and without mental illness and (2) investigate strategies to mitigate these influences. These goals were pursued though three specific aims.

> **Aim #1.** Identify factors that serve as barriers to and facilitators of diagnostic reasoning in emergency medicine from key stakeholders (ED physicians, nurses, and patients) in the diagnostic process.
>
> **Aim #2.** Determine the influence of affect on cognitive processing among healthcare providers assessing "patients" with and without mental illnesses in emergency contexts.
>
> **Aim #3.** Assess the influence of cognitive interventions that may mitigate the influence of affect-induced biases and improve the reliability of the diagnostic process.

3. SCOPE

Background/Context. Despite growing awareness among patient safety experts that healthcare providers' emotions may compromise patient safety, surprisingly little research has explored this possibility (1–5). Yet, social cognitive and affective science researchers have accumulated a substantial body of evidence demonstrating that emotions can profoundly influence *what we think* and *how we think*. That is, emotions reliably influence our cognitive processing, which impacts our judgments, decisions, and behavior (6–9). According to Kahneman's dual-process model of reasoning, information processing is guided by two broad systems:

(1) *System 1*, which is driven by reliance on intuitive, heuristic, and abstract information, including pattern recognition, and (2) *System 2,* which is driven by detailed, analytic, concrete, and rational processes (10,11). Applications of this model to clinical reasoning emphasize that errors tend to result from an over reliance on system 1 processing and an under reliance on system 2 processing (12). According to this model, emotions trigger system 1 processing. Difficult patients, challenging working conditions, and other factors that can elicit anger, frustration, or irritation in healthcare providers may be especially likely to trigger system 1 processing.

Traditional views in medicine that characterize decision making as driven by cold and rational cognitive processes are currently outdated (4,5,13). It is now well established that emotions are a fundamental and ubiquitous part of human experience, and there is no evidence to suggest that emotions do not also emerge during clinical practice, with the potential to influence clinical judgment and behavior. The scant research in this domain demonstrates that negative affective factors (e.g., "difficult" patients (14), rudeness, and incivility in the clinical environment (15) adversely impact clinical reasoning and other outcomes; however, these studies often do not assess emotions directly and tend to make assumptions about the role of emotions. Thus, a comprehensive understanding of healthcare providers' emotions and the impact of these emotions on clinical reasoning, judgments, and behavior are lacking. Consequently, little is known about how to mitigate adverse effects of emotions on patient safety. An interdisciplinary research approach to investigating these issues is essential to fill these knowledge gaps and to lay the foundation for developing strategies to improve patient safety.

The need to understand the role of emotions in clinical judgments and behaviors is particularly important in medical specialties that carry a high risk of diagnostic error and adverse events, such as emergency medicine (EM) (16–18). EM is characterized by "flesh and blood" (i.e., fast and frugal) decision making in response to a fast-paced environment, lack of a prior relationship between providers and patients, high uncertainty, limited availability of medical histories, and frequent interruptions – all factors known to enhance reliance on system 1 processing (19) – with the potential for faulty clinical and diagnostic reasoning (10,12,20). The ED is also where many vulnerable and highly stigmatized patient populations seek care, including individuals with mental illnesses and/or substance use disorders (21–23). Such patients can elicit negative emotions (e.g., anger, frustration) and be subjected to chronic negative attitudes held by healthcare providers. Thus, the care that these vulnerable populations receive may be particularly impacted by affective factors.

Setting. US Emergency Departments (ED); Computer Simulated ED.

Participants. ED physicians, nurses, and patients

Incidence and Prevalence. An estimated one in 18 patients receives an incorrect diagnosis in the ED, with one in 50 experiencing an adverse event (18). Emotions may influence clinical reasoning, judgments, and behavior and contribute to these negative outcomes; however, the frequency of these effects is unknown. Certain populations (i.e., those with mental illness and/or substance use) may be particularly vulnerable to these effects. Approximately one in five people in the US experience mental illness each year, and one in 20 have a serious mental illness (24). Psychiatric and substance use concerns account for one in eight ED visits in the US, and these visits have continued to rise (23).

4. METHODS

<u>Aim 1</u>. Identify factors that serve as barriers to and facilitators of diagnostic reasoning in emergency medicine from key stakeholders (ED physicians, nurses, and patients) in the diagnostic process.

Study Design. Qualitative research studies employing grounded theory.

Data Sources/Collection. Following the completion of a pilot study with 15 emergency physicians and 10 emergency nurses recruited from a well-established academic hospital in New England, we conducted our main study. We conducted face-to-face, in-person interviews with emergency physicians (n=45) and nurses (n=41) from four academic medical centers and four community hospitals in New England. We also interviewed patients who presented to the ED with a physical health complaint and had a history of mental illness and/or substance use documented in their medical record. These patients completed interviews in-person during their ED visit and later via telephone (n=50). Finally, we conducted a study between September 2020 and February 2021 to investigate emergency physicians' emotional experiences in response to COVID-19 and the coping strategies that they used to navigate the pandemic. This study involved video-based interviews (via Zoom) with 15 emergency physicians working in Boston hospitals and 11 working in New York City hospitals (early epicenters of the pandemic). In all studies, we continued participant recruitment and interviewing until we reached theoretical saturation. Participants were compensated in cash or with a gift card.

Interventions. Not applicable.

Measures. Interview topics and questions (i.e., the interview guide) were based on pilot interviews, a literature review, and consultation and feedback from experts. All interviews were audio recorded, transcribed verbatim, and coded using NVivo qualitative software. Coding followed constant comparative analysis guidelines used in grounded theory research (25). Multiple research assistants (RAs) served as coders. Throughout the coding process, rigorous procedures were used to ensure reliability and accuracy (e.g., use of carefully constructed and shared codebooks, constant communication and documentation, multiple coders for a subset of transcripts, ongoing discussion and resolution of coding discrepancies). This coding led to the emergence of themes, which we developed into the grounded theory models presented in the results section.

Limitations. Nearly all the physicians and nurses who participated worked in hospitals in New England, none were trainees (i.e., residents) or advanced practice providers, and all worked in emergency medicine. Thus, findings may not be transferable to other geographic areas, providers, and medical specialties. Likewise, patient participants were recruited from one large hospital in New England, and numerous patients declined to participate, which may limit transferability of findings. As in all qualitative research, there is the possibility that selection, self-report, and/or recall biases may have influenced the results. Although we used procedures to minimize these concerns, we cannot definitively rule them out.

Aim 2. Determine the influence of affect on cognitive processing among healthcare providers assessing "patients" with and without mental illnesses in emergency contexts.

Study Design. Mixed methods research (Study 1) and randomized experiments (Studies 2-5)

Data Sources/Collection. Data for all Aim 2 studies were obtained from physicians and nurses via the internet. All participants were recruited from invitations sent by electronic or postal mail. Regardless of the recruitment method, participants were required to contact us to indicate their interest in participating in a study and to request a study link. We followed careful procedures to confirm that everyone who requested a link to participate was an emergency physician or nurse. We sent each participant a unique, one-time use link to complete the study online via the Qualtrics platform. Once completed, participants were compensated with either a check or gift card. The recruitment strategies differed across studies, as described below.

Study 1 (physicians and nurses). This mixed methods study assessed an emotion elicitation task that required nurses and physicians to recall their own recent patient encounters. We sent study invitations via email to emergency physicians and nurses listed on hospital and ED mailing lists available through our contacts at numerous US hospitals. Our sample consists of 50 emergency physicians and 44 emergency nurses.

Studies 2 and 3 (physicians). Our initial experiment (Study 2) was designed to assess the computer simulated clinical cases that we developed for this project. It was conducted with a randomly selected sample of emergency physicians recruited by Direct Medical Data (DMD), a company licensed by the American Medical Association to contact physicians directly for marketing and research purposes. We recruited 82 emergency physicians from across the US. After refining our computer simulated clinical cases (described in measures below), we conducted a separate experiment (Study 3) to further evaluate the cases and examine the effects of patient emotion (integral affect; e.g., affect elicited by the patient being evaluated) and patient mental illness on physicians' clinical reasoning and decision making. We purchased a mailing list of randomly selected EM physicians from the American College of Emergency Physicians (ACEP). Only postal addresses were available, so we sent invitation letters via postal mail to randomly selected physicians. Letters contained a QR code that physicians scanned to provide their email addresses and express interest in enrolling in the study. We recruited 134 emergency physicians from across the US.

Studies 4 and 5 (nurses). Using the computer simulated clinical cases (modified for use with nurses), we conducted an experiment (Study 4) to investigate the effects of patient emotion (integral affect) and patient mental illness on nurses' clinical reasoning and decision making. Contacts (e.g., nurse managers) at eight hospitals shared our study invitation with emergency nurses, resulting in the recruitment of 130 nurses. A second study (Study 5) with emergency nurses investigated the effects of incidental affect (i.e., affect due to something other than the patient being evaluated [e.g., affect from a prior patient encounter]) on nurses' clinical reasoning and decision making. We purchased a list of randomly selected EM nurses' names and postal addresses from the Emergency Nurses Association (ENA) and followed the same procedure we used to recruit physicians using the ACEP list (Study 3). We recruited 160 nurses from across the US.

Interventions. Not applicable.

Measures

Study 1 (physicians and nurses; mixed methods). Using methods to elicit and assess emotions (adapted from research in social cognitive and affective science (7,26,27)), this study investigated participant (n=50 emergency physicians, 44 emergency nurses) emotional experiences and engagement in their own recent patient encounters and their perceptions of the effects of these emotions on their clinical decision making, behavior, and patient care. Participants vividly recalled and wrote about three recent patient encounters (qualitative data): one that elicited frustration/anger (angry encounter), one that elicited happiness/ satisfaction (positive encounter), and one involving a patient with a mental health condition (mental health encounter). Using sliding scales, participants rated their engagement and emotions (i.e., angry, sad, anxious, fatigued, happy, self-assured) in each encounter (quantitative data) and reported their perception of whether and how their emotions may have influenced their clinical decisions and behavior (qualitative data). The order in which patient encounters were recalled was systematically varied (angry, positive, then mental health encounter versus positive, angry, then mental health encounter) to explore possible emotion transfer (i.e., carry-over effects; the possibility that describing an angry [versus positive] patient encounter immediately before describing a patient with mental illness will yield more negative patient descriptions and emotions [i.e., incidental affect]). A codebook for qualitative data was developed via an iterative process involving four independent coders, consistent with the rigorous procedures used in our qualitative studies described in Aim 1. Linguistic Inquiry Word Count software (LIWC, 2015) was used to assess emotional tone in participants' patient encounter descriptions.

Studies 2 and 3 (physicians; randomized experiments). Our research team created, refined, and rigorously tested clinical cases for use in all experimental studies. Clinical cases were developed by experts in emergency medicine, internal medicine, and patient safety through a highly iterative and collaborative process. Once developed, we filmed standardized patient actors displaying one of four clinical case presentations (i.e., migraine, abdominal pain) featuring an out-of-cemara male ED physician. We created four versions of each case, by manipulating two key independent variables in each case, using a 2x2 experimental design: (1) patient behavior (irritable versus calm) and (2) patient mental illness (present versus absent). Other than the two variables that we experimentally manipulated, all other patient information was identical across all clinical case versions. For irritable patient conditions, we incorporated patient behaviors that we identified in our qualitative (Aim 1) and mixed method studies (Aim 2; Study 1) as triggers of frustration and anger in emergency physicians and nurses. These were incorporated into the experimental materials and videos, along with information about the patient's mental health condition (in relevant conditions). We created an electronic health record (EHR) for each patient case, and participants reviewed the EHR before viewing the randomly assigned patient encounter video (3-4 minutes long). As participants navigated through each interactive patient encounter, they received physical exam results, were given the opportunity to order tests and imagining studies (and received the results for each), reported clinical judgments throughout the case (e.g., estimates of patient pain, extent to which the patient is a good historian, patient prognosis, desire for a consultant on case) using sliding scales, and generated differential and final diagnoses for the patients' condition along with a treatment plan. Participants also completed questionnaires assessing their emotional reactions to each patient (similar to Study 1, Aim 2) and an assessment of their attitudes toward people with mental illness (i.e., a subscale of the *Opening Minds Stigma Scale for Health Care Providers*). In Study 3, we also assessed physicians' anxiety to uncertainty in patient care using the Stress from Uncertainty (SUS) subscale of the *Revised Physicians' Reactions to Uncertainty Scales*. In all studies, two board-certified emergency physicians coded participants' differential diagnoses, final diagnoses, and treatment plans for accuracy.

Following initial case development, each of the four clinical cases were iteratively pilot tested with ED physicians. Three emergency physicians completed the study one at a time while on a video call with members of our research team. These physicians shared their screen, shared their thought process aloud while assessing each clinical case, and answered questions from our team. Based on physician feedback, the cases were modified, and a sample of 82 physicians completed the full study online (Study 2), which involved assessing four patients (reflecting one of each of the four versions described above). Based on participant feedback and findings from this initial test of our clinical cases, we further revised the cases and procedures and again reviewed them separately with three different ED physicians on video calls, as described above. Following final case modification recommendations from these physicians, as well as two EM experts (our clinical case writers) and two patient safety experts on our team, we conducted a second experiment (Study 3) to (1) test these cases and (2) investigate the impact of patients' affect-eliciting behaviors (integral affect) and the presence versus absence of patient mental illness on 134 EM physicians' clinical judgments, diagnosis, and behavior. Although some procedural changes were implemented based on feedback received in Study 2 (e.g., the process for ordering tests and imagining studies was revised to improve the accuracy of the results participants requested), the measures for this study were the same.

Studies 4 and 5 (nurses; randomized experiments). Experiments 4 and 5 were conducted with nurses using the clinical cases that we developed for Studies 2 and 3; however, given that these cases and measures were initially designed for use with physicians, we made several modifications to use these cases with nurses.

We altered the patient encounter videos by replacing (via voice over) the male physician's voice with the voice of a female playing the role of nurse. An expert nurse and researcher on our team (Gleason) adapted the cases for nurses. Key changes in the cases and materials for Studies 4 and 5 included (1) asking participants to indicate their agreement with a (hypothetical) attending physician's decision to order unspecified tests for the patient, asking participants to make recommendations for what tests should be ordered, and assessing participants' willingness to advocate for the these tests, (2) the addition of a patient handoff in which participants wrote up the information they would provide in a verbal report for the next nurse who would be assuming care of the patient, and (3) the elimination of questions requesting differential and final diagnoses. Physical exam results, EHRs, and other measures (e.g., emotion, engagement) and clinical judgments (e.g., estimates of patient pain, extent to which the patient is a good historian, patient prognosis) were the same as those used in Studies 2 and 3. These modified cases were pilot tested in an iterative manner with four emergency nurses using a procedure similar to the one used with physicians in Studies 2 and 3. After changes based on pilot testing, we collected data for Study 4, which required participants to assess four patient cases (reflecting one patient from each cell of the 2 [irritable versus calm patient behavior] x 2 [mental illness present versus absent] experimental design), as in Studies 2 and 3. Participants responded to most measures using sliding scales; patient handoffs required written text, which was coded for the inclusion of specific patient information (e.g., vital signs, additional tests or care recommendations, negative patient descriptions). Four research assistants (blind to experimental condition) independently coded the handoffs using a shared codebook. The development of the codebook and coding followed rigorous procedures used in our earlier studies. Our nurse expert coded test recommendations to capture whether participants recommended at least one test necessary to correctly diagnosis the patient.

Study 4 (just described) investigated the influence of integral affect on nurses' clinical judgments and behavior. Study 5 investigated the influence of incidental affect to examine possible affect transfer effects (i.e., carryover effects from one unrelated patient task to another). Using the task developed and tested in Study 1 (Aim 2), participants were randomly assigned to recall and vividly write about one of their own patient encounters in which they felt (1) angry/frustrated, or (2) satisfied/pleased, or (3) they were not asked to complete this task (control condition). Participants were then randomly assigned to evaluate a patient who exhibited irritable/angry behaviors, complained of significant fatigue, and either did or did not have a mental illness (schizophrenia). All participants then evaluated the same last patient (a calm patient complaining of a severe headache who did not have a mental illness). Finally, participants in the control condition were randomly assigned to recall and write about a patient encounter in which they felt angry/frustrated or satisfied/pleased. This task was added at the end of the study for those in the control condition so that we would have encounter descriptions available for separate analysis from all study participants. The clinical cases used in this study were selected from those modified and used in Study 4, and the same measures and coding procedures were used in Study 5.

Limitations. All participants completed the studies online and were instructed to do so at a time and in a location in which they would be alone and uninterrupted for an hour. Based on feedback we received from participants, we believe that most followed these instructions; however, we are unable to determine the frequency with which participants may have deviated from them. Despite this limitation of remote participation, we were able to recruit physicians and nurses from across the US and from nearly every state, which is a notable strength.

Our use of computer-simulated patient encounters allowed us to carefully control and experimentally manipulate variables of interest to identify causal effects of emotion on clinical reasoning and decision making. Although such control is the hallmark of experimental research, it comes with limitations. Most notably, simulated patient encounters lack the rich and complex information that healthcare providers experience when they interact with patients in the ED.

We moved beyond simple vignette studies and created interactive patient encounters that were more active and engaging than what is typically used; however, it is difficult to determine the extent to which our findings would generalize to real ED clinical practice. Similarly, we developed four unique clinical cases (with four versions of each to reflect systematic variation in patients' emotional behaviors and presence/absence of mental illness) and were unable to assess the extent to which our findings are generalizable to other clinical cases, conditions, or patient behaviors. In addition, studies in which we asked participants to recall and write about one or more of their own recent patient encounters are subject to possible recall biases. Given that participants decided whether to enroll in our studies, self-selection biases may present another limitation.

Our team faced some challenges in creating clinical cases that were appropriately difficult for attending ED physicians and nurses and that were capable of producing differences in clinical reasoning, judgment, and diagnosis as a function of patients' emotion-eliciting behaviors and the presence/absence of a mental illness. We spent considerably more time than expected creating, iteratively testing, and modifying cases. For this reason, we were unable to test the effects of incidental affect on physicians as part of Aim 2, but this was explored in Aim 3.

Aim 3. Assess the influence of cognitive interventions that may mitigate the influence of affect-induced biases and improve the reliability of the diagnostic process.

Study Design. Randomized experiments

Data Sources/Collection. Data collection was conducted online using the Qualtrics platform and the procedures described in Aim 2. We again recruited emergency physicians from across the US by purchasing a list of randomly selected EM physicians' names and postal mailing addresses from ACEP. We followed the recruitment and study enrollment procedures described in Aim 2 (Study 3) and conducted two experiments to assess cognitive interventions to reduce emotional influences. We recruited 154 physicians for Study 1 and 157 for Study 2. Participants were compensated with a gift card.

Interventions. We tested two cognitive interventions that we hypothesized would mitigate the effects of emotion on physicians' clinical judgments and behavior. In Study 1, we assessed the effects of an emotion attribution/awareness intervention (27, 28). In this experiment, all physicians first wrote about a recent patient experience in which they felt irritated, frustrated, or angry (incidental affect manipulation). Participants randomly assigned to the no-intervention control condition then went on to assess two patients in simulated patient encounters (developed in Aim 2; patient 1 was the target patient – she presented with a migraine and no mental illness, and she behaved in a calm or irritable manner; patient 2 was the same for all participants and presented with fever and sore throat, had a mental illness, and behaved in a calm manner). Participants randomly assigned to the intervention condition were first presented with the information below before assessing the two patients. The information included in the intervention was based on psychological research and informed by the findings in our qualitative studies (Aim 1).

> *Research studies conducted with emergency physicians demonstrate that the irritation, frustration, and/or anger that you experienced in the patient encounter that you described are common. In fact, these emotions are natural, normal, and understandable human reactions to difficult situations – reactions that we all routinely experience. Indeed, emotions are often highly adaptive and help us successfully navigate the world. However, the ways in which humans process information are imperfect, and sometimes our emotions can seep into our thinking processes and lead us astray.* ***When you assess the following patients, please keep this in mind and try not to let the negative emotions from the patient experience you described influence your thinking.***

In Study 2, we assessed the effects of an information stop rule intervention incorporated throughout two simulated patient encounters (developed in Aim 2) (29). Two stop rules were assessed: (1) "Do I feel I have enough information to diagnose this patient?" and (2) "Do I feel like I need more information to diagnosis this patient?" A "yes" response to the first question and a "no" response to the second would terminate information search and acquisition and likely lead to system 1 heuristic processing, premature closure, and diagnostic error. In contrast, a "no" response to the first question and a "yes" response to the second would lead to more a thorough information search, acquisition, analytical processing, and likely better clinical decision making, reasoning, and diagnostic accuracy (via system 2 processing). Research demonstrates that certain emotions (e.g., anger) are associated with "yes" responses. Each participant completed two patient assessments (one with an irritable patient and one with a calm patient; neither had a mental illness) and were randomly assigned one information stop rule to use in the first encounter and the other stop rule to use in the second encounter. Participants were given the information stop rule at the start of each encounter and were asked at various points throughout the encounter to record a yes or no response to the stop rule question.

Measures. We used the clinical cases and computer-simulated patient encounters developed in Aim 2 for both studies in Aim 3. Other than incorporating the interventions described above, our procedures and measures in these studies were the same as those we used in Study 3 (Aim 2).

Limitations. These studies share the same limitations as those described in Aim 2.

5. RESULTS

<u>Aim #1</u>. Identify factors that serve as barriers to and facilitators of diagnostic reasoning in emergency medicine from key stakeholders (ED physicians, nurses, and patients) in the diagnostic process.

<u>Principle Findings</u>. Our large-scale qualitative study conducted with emergency physicians and nurses resulted in comprehensive model (see *Figure 1*) that identifies the range of emotions that providers experience, emotional triggers, emotion regulation strategies that providers use, and providers' perceptions of how their emotions impact patient care, outcomes, and safety (30). Our results reveal that healthcare providers experience a broad range of emotions in response to patient, hospital, and system factors – all of which can adversely influence patient safety. Negative emotions (especially anger and frustration) are very common, particularly in response to specific patient populations (e.g., those with mental illness, substance use, unreasonable expectations), hospital factors (e.g., communication among staff), and system factors (e.g., patient boarding). Healthcare providers reported that they employ a variety of strategies to regulate their emotions (especially emotional suppression) to decrease the likelihood of patient harm, and they largely believed that they employ these strategies effectively. Nonetheless, they acknowledged that negative emotions could adversely influence patient safety.

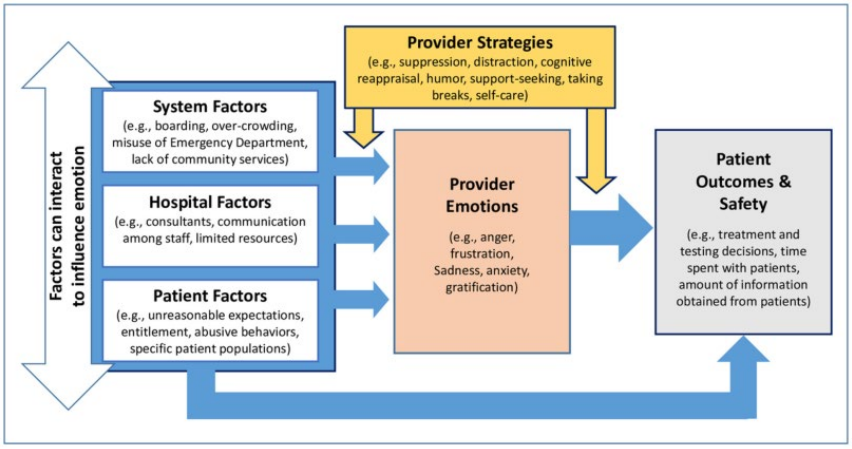

Figure 1 Grounded model of provider emotions and patient safety in the emergency department.

Figure 1. (from Isbell, Boudreaux, Chimowitz, Liu, Cyr, & Kimball, 2020; *British Medical Journal: Quality & Safety)*

In a preplanned topical analysis of our qualitative data, we conducted a deep exploration of how patients who are known to elicit negative emotions (e.g., anger, frustration) are treated in the ED. This analysis focused on patients with mental health conditions and/or SUDs. Our work resulted in a model that captures the cyclical dynamics of emotional, diagnostic, and logistical challenges that providers experience when caring for these patients as well as the impact of these challenges on clinical reasoning and patient care (see *Figure 2*) (31). Importantly, our model captures the ubiquitous influence of negative emotions, attitudes, and biases (i.e., stigma) in shaping these processes and outcomes.

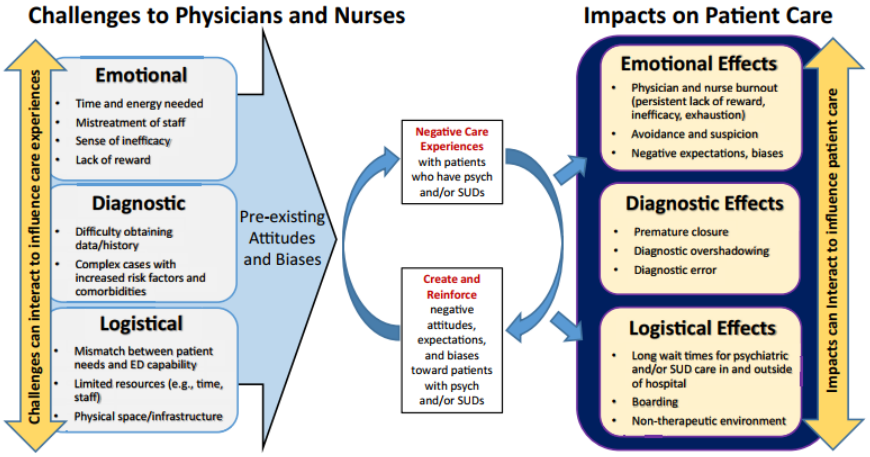

Figure 2. Expanded grounded model of cyclical dynamics of challenges and impacts on patient care for patients with psychiatric (psych) conditions and/or SUDs in the emergency department.

Figure 2. (from Isbell, Chimowitz, Huff, Liu, Kimball, & Boudreaux, 2023; *Annals of Emergency Medicine*)

Our in-depth interviews with patients with mental health conditions and/or SUDs who sought care in the ED for a physical health concern revealed a broad range of negative and positive care experiences, which were distributed across three interlocking but distinct domains involving providers, treatments, and the healthcare system (see *Figure 3*) (32). Findings demonstrate that stigma and perceived biases due to mental health and/or SUDs extend to medical care experiences not directly related to these conditions (e.g., dismissive, rushed, unprofessional care, diagnostic and clinical errors). Participants also identified positive care experiences

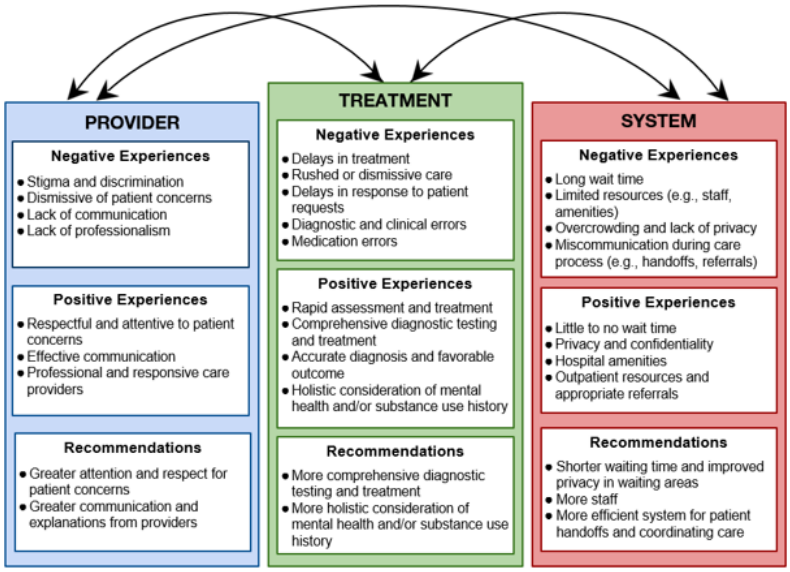

Figure 3. (from Isbell, Le, Huff, Whillock, Kimball, & Boudreaux, under review)

(e.g., attentive, efficient, communicative, and quality care) that informed recommendations for improving care. These recommendations involve localized interventions and systemwide healthcare reform.

The qualitative study that we conducted during COVID-19 provided an opportunity to investigate intense real-time emotions experienced by ED physicians in response to the pandemic as well as the emotion regulation and coping strategies they employed (33). Our results demonstrate that physicians experienced heightened levels of anxiety, empathy, sadness, frustration, and anger during the pandemic.

Although these emotions were elicited by factors that were unique to the pandemic (e.g., medical uncertainty surrounding COVID-19, fear and risk of contracting the illness), many of the ***sources*** of physicians' emotions mapped to the broad categories we identified in our earlier qualitative study (shown in *Figure 1*). That is, patient, hospital, and system factors played a fundamental role in shaping physicians' emotional experiences (e.g., policies about patient visitors, scarce resources, patient volume and acuity, challenges involving use of PPE, managing patient expectations). Frustration and anger were common responses to frequent changes to hospital rules and policies, hospital leadership and administration, and pay cuts. Coping with significant emotions and stress during the pandemic was an ongoing and evolving process for physicians, who relied on social support from colleagues, family and friends, therapists, and self-care practices (e.g., sleep, exercise). Some physicians also described engaging in emotional detachment. These varied emotional experiences had broad impacts on physicians and patients.

Discussion. Together these qualitative studies provide a comprehensive understanding of emotions, stigma, and patient care in the ED from key stakeholders in the diagnostic process (physicians, nurses, patients). Findings reveal that emotions are a ubiquitous experience that can be triggered in all stakeholders by a wide range of patient, provider, hospital, and system factors. Hospital and system factors largely elicited negative emotions, whereas patients and providers elicited a broader range of emotions. Some patient populations (i.e., those with mental illnesses or SUDs) tend to elicit negative emotions and were also subjected to stigma and discrimination, which our patients described as very negative experiences that may have interfered with the diagnostic process. Overall, our results demonstrate that the many different sources of emotion in the ED can have a negative impact on clinical judgments and decision making and influence patient care, experiences, and safety. Although physicians and nurses described strategies they employ to regulate their emotions and believed that they use them successfully, we are unable to determine whether their strategies mitigate risks to patient safety. Similarly, our data does not allow us to assess whether physicians' emotion coping strategies during COVID-19 were effective in mitigating risks to patient safety and physician well-being (e.g., burnout).

Conclusions. These studies provide the first data-driven models of emotions and emotion-eliciting factors (e.g., stigma) in the ED, perceived impacts of emotions on patient safety, and strategies employed to mitigate emotional influences. Our results highlight many opportunities to develop and implement interventions aimed at reducing unwanted negative emotional experiences and mitigating adverse effects of emotions on patient safety. These studies provide a strong foundation for the work that follows in Aims 2 and 3.

Aim #2. Determine the influence of affect on cognitive processing among health care providers assessing "patients" with and without mental illnesses in emergency contexts.

Principal Findings

Study 1 (physicians and nurses; mixed methods study (34)). Findings from Study 1 validate the effectiveness of the patient encounter recall method that we modified from the social cognitive and affective science literatures for use in eliciting emotions in emergency physicians and nurses. Our participants (n=94; 50 physicians, 44 nurses) generated 282 descriptions of patient encounters. Regardless of participant profession (physician versus nurse) and encounter description order, participants had a similar pattern of emotions in angry and mental health encounters, which were significantly (and vastly) different from those experienced in positive encounters. Compared to positive encounters, angry and mental health encounters elicited greater anger, sadness, anxiety, and fatigue and significantly less self-assurance, happiness, and engagement. Overall, 75% of participants indicated that their emotions influenced their clinical judgment and behavior in at least one of the encounters they described, with influences most common in angry encounters (63%), followed by mental health encounters (47%), and then positive encounters (39%).

In angry and mental health encounters, the influences were largely negative (e.g., not obtaining a complete medical history, not conducting a complete medical exam, ordering a less diagnostic but faster test to expedite discharge). In positive encounters, providers reported "going the extra mile" for patients and providing additional consultations and testing. Finally, linguistic analysis of patient encounter descriptions revealed that emotional tone was significantly more positive in positive encounters than in angry and mental health encounters, which did not differ from one another. Evidence of affect carryover (i.e., transfer) effects emerged for nurses but not physicians. Specifically, the emotional tone in nurses' descriptions of their mental health encounters was more negative if they described an angry (versus positive) encounter immediately before a mental health encounter.

Studies 2 and 3 (physicians; randomized experiments). Study 2 (n=82 physicians) tested the clinical cases that we designed to investigate the effects of emotionally evocative patient behaviors (irritable versus calm) and patient mental illness (present versus absent) on physicians' emotions, clinical judgments, and diagnosis in simulated patient encounters. Results revealed that irritable (versus calm) patient behaviors elicited considerable emotional reactions. Compared to calm patients, irritable patients led participants to report feeling significantly more anger, frustration, irritation, and uneasiness, and less happiness, pleasure, and empathy. Irritable patients also reduced physician engagement and, relative to calm patients, were judged to be poor historians, less cooperative, less likeable, less likely to adhere to treatment, and less likely to recover. We did not find reliable effects of the mental illness manipulation. The clinical cases proved to be very challenging to diagnose. Participants included the correct diagnosis in their differential in 31.9% of the cases, provided the correct final diagnosis for 18.8% of the cases, and provided a treatment plan appropriate for the correct diagnosis for 48.3% of the cases. We found no evidence that diagnostic error or treatment plan quality varied as a function of either patient emotional behavior or mental illness. Additionally, we found no differences in the total number of tests and imagining studies ordered as a function of these variables.

Based on the results of Study 2, feedback from our participants, and extensive collaboration and discussions with medical experts, we revised the clinical cases to reduce the difficulty level. To do this, we altered the clinical information in each case (i.e., physical exam results, clinical test and imagining results). We then conducted Study 3 (n=134 physicians) with these revised cases. As in Study 2, we found that irritable (versus calm) patients elicited considerable emotional reactions. Compared to calm patients, irritable patients led participants to report feeling significantly more anger, frustration, irritation, anxiety, and fatigue and less calmness, happiness, empathy, and engagement. Relative to calm patients, irritable patients were judged as significantly more likely to be exaggerating pain, to be poor historians; were judged to be less likeable, less cooperative, less likely to adhere to their treatment plan, less likely to return to work soon; and were perceived to have a more serious condition. As in Study 2, we did not find reliable effects of the mental illness manipulation. Participants included the correct diagnosis in their differential in 37.1% of the cases, provided the correct final diagnosis in 53.2% of the cases, and provided an appropriate treatment plan for 53.0% of the cases. We found no differences in these percentages or in the number of tests or imagining studies ordered as a function of patients' emotional behaviors or the presence versus absence of mental illness.

We conducted additional analyses in Study 3 to investigate whether an important individual difference variable related to emotions (i.e., physician intolerance for uncertainty) interacts with patients' emotional behaviors to predict participants' emotional reactions, engagement, patient assessments, and diagnoses. We found that, as participants' *intolerance* for uncertainty increased, participants reported feeling significantly more anger, anxiety, and fatigue, and significantly less engagement in response to irritable (versus calm) patients.

In addition, as *intolerance* for uncertainty increased, participants judged irritable (versus calm) patients to be less likeable, less reliable historians, and less likely to adhere to their treatment plan. Thus, intolerance for uncertainty *amplified* the negative effects of irritable patient behaviors. In addition, we found that participants were more likely to seek a specialty medical consultation when patients were irritable regardless of intolerance for uncertainty; however, when patients were calm, consultation seeking increased as intolerance for uncertainty increased. We found no effects on the total number of tests and imagining studies ordered or diagnostic accuracy.

Studies 4 and 5 (nurses; randomized experiments). Study 4 assessed the effects of integral affect on emergency nurses' clinical reasoning and judgments when assessing patients displaying irritable or calm behaviors (either with or without a mental illness) in the simulated encounters that we modified for nurses (n=130) (35). Compared to calm patients, irritable patients led nurses to experience significantly more negative emotions (anger, unease) and significantly less happy, calm, and empathic emotions. Participants were also significantly less engaged when assessing irritable patients. Participants judged irritable (versus calm) patients as more likely to have exaggerated their pain, more likely to be poor historians, and less likely to cooperate, return to work, and recover. Participants' patient handoffs varied based on patient behavior, with irritable (versus calm) patient handoffs more likely to contain negative patient descriptions and omit important clinical information (e.g., whether tests were ordered). Independent of patients' emotional behaviors, we found that patients with (versus without) a mental illness led participants to feel greater sadness and unease. Importantly, when a patient had a mental illness, participants were significantly less likely to recommend at least one test necessary to correctly diagnose the patient. Participants also judged these patients as significantly less likely to recover from their chief complaint that led to the emergency visit.

Study 5 investigated the effects of incidental affect *o*n emergency nurses' assessments of patients in a subset of the clinical cases used in Study 4 (n=160). Analyses are still in progress; however, initial results do not provide evidence for the affect carryover (i.e., transfer) effect that we hypothesized. That is, preliminary results suggest that regardless of whether participants wrote about a positive or an angry encounter or no encounter (control) at the outset of the study (the incidental affect manipulation task), assessments of the patients that followed were similar. Separate analyses of participants' written patient encounter descriptions were conducted (as in Study 1, Aim 2). We found that participants who wrote about an angry (versus positive) encounter reported feeling significantly more angry, sad, anxious, and fatigued and significantly less happy and self-assured. Participants also reported being significantly less engaged during their angry (versus positive) encounters. Many participants (59.4%) believed that their emotions did not influence on their clinical reasoning and decision making in the encounters they described; 28.7% reported that their emotions did have an influence, and 11.9% reported being uncertain. Among those who reported that emotions had an influence, they reported influences consistent with those reported in Study 1 (Aim 2).

Discussion. Across five studies, we found that emergency physicians and nurses experienced a range of emotions during their own patient encounters (Studies 1 and 4) and during simulated patient encounters (Studies 2–5). The majority of participants in Study 1 reported that their emotions influenced their clinical reasoning and behavior in at least one encounter they described – most frequently in encounters that elicited anger or frustration. These influences were largely negative (e.g., not obtaining a complete medical history). In a study with nurses (Study 4), we found that fewer nurses endorsed affective influences in their own encounters (compared to Study 1); however, those who did reported largely negative effects, consistent with Study 1. Importantly, in contrast to these findings, the results of our qualitative research (Aim 1) demonstrated that emergency physicians and nurses believed that they effectively employed emotional regulation and coping strategies that protect patients from affective biases that can compromise patient safety.

Together, the findings from our mixed methods and experimental studies (Aim 2) confirm that these self-reported beliefs are inaccurate, underscoring the value of methodological triangulation.

Regardless of whether participants described their own patient encounters or responded to simulated patient encounters, our studies consistently revealed that encounters that elicit anger, irritation, or frustration reduce physician and nurse engagement. In simulated encounters, irritable patients led emergency providers to make more unfavorable judgments (poor historian, pain assessment) and report greater expectations of negative outcomes (treatment nonadherence, poor prognosis). We found inconsistent effects of patient mental illness across studies; however, we did find that nurses were less likely to recommend tests necessary to diagnose patients with (versus without) mental illness (Study 4) – a finding with important implications that may contribute to diagnostic error and patient safety. Our lack of consistent effects of patient mental illness may reflect that our experimental manipulation was too subtle (which we did purposely, given stigma is known to have strong effects), was overpowered by our manipulation of patients' emotionally evocative behaviors, or both. Based on our qualitative findings with physicians, nurses, and patients (Aim 1) and our mixed methods study (Study 1, Aim 2), it is clear that stigma against this patient population is a significant concern and presents risks to patient safety. Thus, our experimental paradigm may have reduced the likelihood of obtaining effects.

Contrary to our hypotheses, diagnostic accuracy did not vary across simulated encounters. Designing the clinical cases and the interactive computer simulations for these studies was more challenging than we anticipated. Most other research investigating clinical decision making relies on brief written patient vignettes that are assessed and diagnosed by medical students or trainees (e.g., residents). Using experienced attending physicians in our research made it difficult to determine a priori how challenging each clinical case had to be to create variability in diagnostic accuracy. Our initial efforts resulted in cases that were too difficult; our subsequent efforts succeeded in creating cases that produced more variability, but diagnostic accuracy still did not vary as a function of patients' emotionally evocative behaviors or patient mental illness. Lack of variability in diagnostic accuracy may also be due to the specific cases we developed, some of which involved diagnoses that are encountered in the ED infrequently (e.g., malaria). We included these to increase diagnostic difficulty for our experienced physicians. Different effects may emerge with less experienced physicians and medical students, though case difficulty would need to be significantly altered.

Despite not finding effects of emotions or patient mental illness on diagnostic accuracy, findings obtained from other measures (e.g., engagement, judgments of patient as a poor historian, pain assessment, treatment adherence, prognosis) have important implications. Many of these judgments can influence how physicians and nurses treat patients, which can have important effects on patient care and safety. For example, if a physician does not perceive a patient to be a reliable and trustworthy historian, the information that the patient provides may be discounted, which can result in important information being ignored (and increase the likelihood of a diagnostic error). Patients might also be undertreated if physicians perceive them to be exaggerating their pain. Additionally, believing that a patient will not adhere to treatment could result in a suboptimal treatment plan. Further, it is well known in psychology that expectation effects can influence behavior (36). Thus, a physician's belief that a patient is unlikely to recover, for example, may be subtly communicated to a patient and, in turn, interfere with recovery.

Future research should consider the possibility that individual-level variables may moderate the effects of emotions on diagnostic accuracy and other variables. For example, in Study 3, we found that chronic differences in physicians' intolerance for uncertainty moderated the effects of patients' emotionally evocative behaviors on physicians' emotional responses to patients, engagement, ratings of patients as good historians, and intentions to seek a specialty consultation.

Likewise, in a pilot study conducted before our Aim 2 studies, we found that physicians reported greater positive affect (i.e., liking) in response to a nondepressed compared to a depressed patient and made significantly more diagnostic errors when evaluating the depressed patient if they ordered few diagnostic tests; however, diagnostic accuracy was similar under conditions in which physicians pursued a thorough diagnostic workup (37). Greater attention to individual-level variables may provide additional explanatory power for work in this domain.

Conclusions. Patients reliably triggered significant emotions during emergency physicians' and nurses' own recently experienced ED patient encounters and during computer-simulated patient encounters. Encounters that evoked anger, frustration, and irritation (versus encounters that did not) were consistently associated with decreased engagement, negative affect, and reduced positive affect. In simulated encounters, irritable patients were judged more unfavorably (poor historian, exaggerating pain) and were perceived as more likely to have negative outcomes (treatment nonadherence, poor prognosis), all of which can have downstream effects on patient treatment, care, and safety. Diagnostic accuracy did not vary across encounters.

Aim #3. Assess the influence of cognitive interventions that may mitigate the influence of affect-induced biases and improve the reliability of the diagnostic process.

Principal Findings

Emotion Attribution/Awareness Intervention: We used our patient recall task (Aim 2, Study 1) and our simulated patient encounters from Aim 2 (Studies 2–5) to test our first intervention. We expected that (1) in no intervention (control) conditions, the negative affect experienced by physicians when recalling an irritating/frustrating/angry patient encounter would transfer (i.e., carryover; incidental affect) to influence their patient assessments in the simulated encounter that followed (i.e., a patient behaving in either a calm or irritable manner; mental illness was not manipulated in this study) and (2) these effects would decrease in the intervention condition. Although data analyses are ongoing, initial results provide little to no support for these expectations. Regardless of intervention condition, our findings mirror those reported earlier in Aim 2. That is, irritable (versus calm) patients led physicians to experience significantly greater anger, frustration, irritation, uneasiness, fatigue, and discouragement as well as less calmness, empathy, happiness, confidence, self-assurance, and engagement. Clinical assessments were also impacted. The irritable patient was judged to be significantly more likely to be exaggerating pain, more likely to be a poor historian, and less likely to cooperate, adhere to treatment, recover, and return to work.

Very few effects of the intervention emerged – and those that did tended to achieve only marginal levels of statistical significance. Regardless of the patient's behavior (irritable versus calm), we found that those in the intervention (versus no intervention) condition reported less empathy ($p=.055$) and judged the patient to be more likely to be exaggerating pain ($p=.079$), less likely to adhere to treatment ($p=.06$), less cooperative ($p=.049$), and more likely to have a mental illness ($p=.025$). Though very preliminary, these findings hint at the possibility that this intervention may backfire and lead physicians to attribute their negative emotions *to the patient*, which can have a negative effect on patients.

Information Stop Rules. Data analysis is currently in progress, and no results are available at the time of this report.

Discussion. The research findings presented throughout this report demonstrate that emotions can impact emergency physicians' and nurses' clinical judgments and behavior with implications for patient safety. Thus, interventions to mitigate these influences are needed.

In the Aim 3 studies, we tested two cognitive interventions borrowed and adapted from the social cognitive and affective science literatures (26, 27). Although these interventions are based on established theory and research conducted outside of the medical domain, research has yet to test whether they are effective in mitigating affective influences in the clinical domain. We found that the first intervention, which acknowledged physicians' emotions and directed them to try not to let their negative emotions influence their thinking when assessing a patient, had little impact on the physicians' emotional experiences and patient assessments. However, nonsignificant trends in the data suggest that the intervention *may* have *increased* emotional influences rather than decreased them. To the extent that these trends emerge reliably with a more robust test of this intervention, they suggest caution in implementing this strategy, and they underscore the need for extensive research before introducing interventions into clinical practice, where potential for harm may exist.

The general lack of intervention effects may be related to our finding that only 17% of participants selected the correct option at the end of the study, in which we asked them to identify the instructions that they received earlier (i.e., the intervention). Although conscious awareness is not necessary for cognitive intervention effects to emerge (and sometimes awareness can be undesirable), our findings regarding this intervention are inconclusive. Our intervention may have been too subtle and not well attended to, or it is possible that this intervention is not effective in this context. Future research is needed to further test this and other cognitive interventions.

Findings from Study 1 (Aim 3) informed the methods that we employed in Study 2 in which we tested an information stop rule intervention. Given the possibility that our Study 1 intervention was too subtle and perhaps not attended to by many physicians, in Study 2 we integrated our intervention throughout each simulated patient encounter and required physicians to respond to the stop rule questions. Requiring active responses ensured that physicians were exposed to and interacted with the intervention. Upon completion of data analyses, we will be able to determine if this intervention worked as hypothesized.

Conclusions. Two cognitive interventions designed to mitigate the influence of physicians' emotions during simulated patient encounters were tested. Results of an emotion awareness/attribution intervention were inconclusive. Results of an information stop rule intervention are pending completion of data analysis. Additional research is needed to further develop and test cognitive interventions to mitigate affective influences on clinical decision making and behavior.

Significance (Aims 1-3). As the first large-scale investigation of the role of emotions on patient safety, this research provides a foundation for future investigations. This interdisciplinary work integrated theory, research, and methods from social cognitive and affective science with research in clinical decision making and patient safety making it a valuable and novel contribution to the literature and the field. Using a variety of research methods, measures, approaches, and participants, we demonstrated that emotions are a fundamental part of medical practice and can significantly influence clinical reasoning and behavior with implications for patient safety. Anger, frustration, and irritation in particular increase safety risks, making these emotions an important target for interventions. By providing theoretical and methodological scaffolding that cuts across disciplines, we anticipate our work will promote new investigations to advance knowledge and improve patient safety (38).

Implications (Aims 1-3). For decades, psychologists have been developing comprehensive theories of emotion and conducting studies to understand how emotions and other affective experiences influence information processing, judgments, and behavior. Despite this, the role of emotions in patient safety has largely been ignored. Our research makes clear that this cannot continue – emotions play an important role in the practice of medicine and can compromise patient safety.

We uncovered many sources of negative emotions in the ED, which highlight the need for additional research to (1) further advance our understanding of emotional influences and the effects of different emotions (including positive emotions) and (2) develop and test interventions to mitigate adverse effects. We employed methodological triangulation to gain a comprehensive understanding of emotions and emotional influences in the ED. Given that different methods have different strengths and weaknesses, future research should consider the use of multiple methods whenever possible. A comprehensive multi-method approach may facilitate the discovery of key findings, which may allow for faster testing and implementation in real-world clinical settings, where application of this work is critical. Our findings have implications for clinical training and practice by highlighting a need to increase awareness among healthcare providers about the ubiquity and effects of emotional experiences on patient safety. Best practices for how to successfully accomplish this need to be established in future work. Relatedly, shifts in the cultural norms that permeate the practice of medicine are needed to support meaningful and honest discourse about emotions and emotional influences.

6. LIST OF PUBLICATIONS AND PRODUCTS *(To Date).*

1. Isbell LM, Tager J, Beals K, Liu G. Emotionally evocative patients in the emergency department: a mixed methods investigation of providers' reported emotions and implications for patient safety. BMJ Qual Saf. 2020 Oct 1;29(10):803–14. doi: 10.1136/bmjqs-2019-010110. PMID: 31988259
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