1. Registration form

1.1 Details of applicant

Name, title(s)	Jonathan Ilgen, MD, MCR
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1.2 Title of research proposal

Comfort with uncertainty: Reframing our conceptions of how clinicians navigate complex clinical situations.

1.3 Abstract

Learning to take safe and effective action in settings of uncertainty is essential for patient safety and quality care. Understanding how experienced clinicians work comfortably when uncertain therefore offers an important opportunity to facilitate trainees' clinical reasoning development. The goal of this proposed research program is to gain deeper understanding of how experienced clinicians and trainees identify and respond to uncertainty in the moment. A secondary goal is to better understand interactions between supervisors and trainees in these moments of uncertainty, particularly how experienced clinicians help trainees define their scope of competent practice and preemptively identify ways to mitigate risk.

1.4 MSc (date and field) main applicant:

Master of Clinical Research, Oregon Health & Science University, Portland, OR, 2010.

1.5 Complete name dissertation supervisor(s)

Dr. Pim Teunissen

Dr. Glenn Regehr

Dr. Anique de Bruin

2. Research proposal

Description of the proposed research

max. 4.000 words (excluding references, including footnotes) for 2.1 and 2.2.
(use word count to specify number of words). Include details of:

2.1 Research topic (theoretical framework, research questions, hypotheses)

Authentic clinical reasoning requires practitioners to collect and interpret imperfect data in real time, and learning how to take safe and effective action in these complex and ambiguous settings is essential for patient safety and high-quality care.[1-3] For instance, as an emergency medicine (EM) physician, I often care for patients with undifferentiated clinical problems, and commonly initiate treatments that address my patients' symptoms (e.g., shortness of breath) and exam findings (e.g., low blood pressure) with limited information. The higher the illness acuity and complexity, the more likely I will be pressed into action, and the more often that these decisions take place before diagnostic testing or consultation with colleagues are possible. My patients' responses to these actions (or my decision to wait and watch) provide me with clues that differentiate one illness from another, and these expected or unexpected responses enable me to formulate subsequent diagnostic and treatment decisions. This is the lived experience of clinical work in settings of uncertainty.

Health professions educators often express concerns that trainees struggle with these dynamic situations rife with ambiguity and uncertainty,[2-4] observing that novice clinicians frequently strive to impose certainty on inherently ill-defined problems.[1,5-7] There are ongoing calls to help learners develop constructive responses to uncertainty and ambiguity,[4] yet ironically, current educational paradigms that emphasize the primacy of 'diagnostic solutions' and 'certainty' when teaching clinical reasoning may contribute to trainees' struggles.[6] To act with confidence while simultaneously remaining uncertain is a paradox that epitomizes expert practice, and understanding how experienced clinicians are able to work confidently when uncertain could offer an important first step toward providing educators with the guidance they need to support trainees' development of clinical reasoning.

Our research team recently completed a critical review exploring how the paradigm of 'comfort with uncertainty' manifests in clinical practice, using existing theories and frameworks as a lens to further reconceptualize and understand these experiences.[8] We found that 'uncertainty' has been defined in a multitude of ways in the medical literature, from individualized experiences of interpreting clinical parameters in practice, to uncertainty regarding a field's understanding of a disease process or illness, to the systemic uncertainties regarding data interpretation more generally.[1,9-17] Our review focused on the cognitive factors that shape individuals' experiences navigating uncertainty in practice, acknowledging that sociocultural factors are likely to influence these experiences as well. For the purposes of our analysis we defined 'certainty' as the confidence

in one's interpretation of a clinical situation and defined 'comfort' as the confidence in one's ability to act (or wait and watch). Accordingly, 'comfort with uncertainty,' was operationally defined as the phenomenological experience of having the confidence to act on a problem (or wait) in the absence of full confidence in one's understanding of the underlying cause of the issue. Seeking to understand this phenomenon of how individuals use comfort when managing ill-defined problems is importantly distinct from past work judging decision-making between individuals tackling well-defined problems, or how decisions were informed by probabilities of particular variables (e.g., Bayesian reasoning).[7,18,19]

We found two broad categories of problems to be manifestations of 'comfort with uncertainty' in the literature. The first, which we termed 'letting go of the need to know,' described instances that organized around comfort with a management plan in the face of uncertainty regarding the diagnosis, such as consciously suspending certainty regarding rare diagnoses in favor of prioritizing treatments for more common diseases. The second set of circumstances aligned within a category of 'feeling your way through a problem,' and described settings of greater ambiguity, complexity, and acuity where definitive management strategies are less clear. Our review suggests that comfort in these settings manifests as clinicians' feelings that a problem is within their realm of expertise,[20] and therefore signals clinicians' willingness to assume the risks inherent in initiating management strategies, acting with the confidence that training and skills will enable them to navigate these situations safely and effectively. A richer understanding of how these experiences of 'comfort' or 'discomfort' manifest in moments of uncertainty, however, requires further empirical exploration.

To understand how experienced clinicians are able to take safe and effective actions in settings of uncertainty requires a more nuanced understanding of how clinicians ascertain whether their knowledge and skills are sufficiently aligned with the problem at hand. Based on the previous review, I am hypothesizing that clinicians, in identifying problems that they are comfortable managing, create dynamic 'problem spaces'[21] where—despite remaining uncertain about their patient's symptoms or problems—they remain confident that they can safely manage a multitude of scenarios that might play out as they initiate treatment decisions. If so, this raises questions about how clinicians make these judgments in practice, or alternatively, determine that certain problems are beyond their capabilities and require assistance from others.

The focus of my research program will be to understand how the concepts of 'comfort with uncertainty' and 'problem spaces' are enacted in practice by exploring these phenomena from multiple practice and experiential perspectives. Because physicians' self-determinations of their skills and scope of practice are likely shaped by parameters such as their training, past experiences, and work context, we will perform a series of studies that will help to illuminate what 'comfort' means in particular populations of clinicians and unique practice settings.

Below I present a brief overview of the 4 studies I plan to pursue as part of this thesis. A more detailed description of the research approaches can be found in section 3b of this proposal.

<u>Study 1 research question</u>: How do experienced clinicians define their scope of practice in high resource settings?

I will begin by exploring the construct of 'comfort with uncertainty' in a context where resources are readily available and assistance from others is rapidly accessible. I am interested in how clinicians working in these resource-rich settings make in-the-moment judgments about which problems are within their scope of practice, when they feel compelled to enlist others' help to co-manage a problem, and how they determine when a problem should be triaged to others (and to whom). I will use a constructivist grounded theory approach to explore these questions,[22] triggering narratives with a critical incident technique (CIT)[23] that prompts experienced faculty participants to draw rich pictures[24] regarding complex events that they had tackled during a recently-completed shift. I will then elicit narratives from these participants as they reflect upon their experiences working through moments of uncertainty during these complex patient encounters, exploring their considerations of resource utilization, risk, and relationships with colleagues.

<u>Study 2 research question</u>: How do experienced clinicians define their scope of practice in low resource settings?

Building upon the work in Study 1, I will seek to understand how low-resource work contexts impact clinicians' perceptions of their scope of practice. Past work has demonstrated that workplace geography explains substantial variation in practice scope among family practitioners,[25,26] though the majority of these investigations examine these variations from a system perspective. I am interested in exploring how cognitive and sociocultural factors may shape decisions made by these practitioners in moments of uncertainty.

I work at a medical school that serves the largest rural footprint in the United States, a 5-state region referred to as WWAMI (Washington, Wyoming, Alaska, Montana, and Idaho). I will use a photo elicitation interview technique[27,28] to prompt clinicians who practice in rural settings to talk-aloud regarding how they would approach hypothetical time-limited clinical situations (e.g., epidural hemorrhage with cerebral edema). I will then use a CIT[23] to elicit participants' stories from their respective low resource practice settings, using a constructivist grounded theory approach[22] to explore how they navigated their perceptions of uncertainty and risk.

<u>Study 3 research question</u>: How does comfort with uncertainty evolve during training?

I will next turn my attention to how comfort with uncertainty is experienced by more novice trainees. Trainees likely experience uncertainty differently than their supervisors given that they are still learning the knowledge and skills germane to their specialty, and are continuously defining and refining their practice scope through work with supervisors.[9,11] The notion of *discomfort* in novice trainees is complicated by the nature of supervised work because graded responsibilities are intended to place learners into individualized zones of proximal development,[29] and their supervisors often have disparate approaches to seemingly-similar problems. Trainees may thus struggle to discern whether their 'discomfort' is a function of the problem itself (e.g., outside of

their practice scope), or a function of the supervised training experience (e.g., within their practice scope, and necessary for them to learn; or within their scope of practice but managed by their supervisor in a different way than they had experienced previously while working with other supervisors). In light of these complexities, it is likely that novices use maladaptive approaches to uncertainty, such as forging ahead with management decisions despite ongoing discomfort, or inappropriately experiencing comfort when failing to identify risks that are inherent to a given situation.

To explore these questions, I will again use a CIT[23] to explore how residents working in a high-resource setting identify problems as being within their scope of practice (or not) and the actions they take when encountering experiences that generate discomfort. Depending upon the results of Studies 1 and 2, I will likely use either a constructivist grounded theory approach or phenomenological approach (e.g., hermeneutic phenomenology, or interpretive phenomenological analysis) for this study.

Study 4 research question: How does comfort with uncertainty evolve when individuals transition from supervised to unsupervised practice?

To better understand how considerations of risk and practice scope evolve as a result of authentic, independent clinical experiences, this study will examine what happens to physicians' conceptualizations of 'comfort' as they transition from supervised training into independent practice. Work exploring surgeons' conceptualization of risk has identified proactive practice approaches that enable experienced providers to steer clear of problems that are misaligned with their skills, or how they preemptively put resources in place to help mitigate potential treatment complications.[20,30] Yet this luxury of pre-emptive risk avoidance is not available in many settings—such as caring for acutely ill patients with undifferentiated problems—and these experiences of risk are likely poignant during transitions from supervised work into independent practice. We will thus interview physicians from several fields during their first 3 months of practice after residency, using a CIT[23] to elicit narratives from providers who are working in both low- and high-resource settings. These narratives will be qualitatively analyzed in a similar fashion to Studies 1-3 described above.

2.2 Approach (method and setup)

Study 1: How do experienced clinicians define their scope of practice in high resource settings?

I will begin my program of research by focusing on experienced emergency clinicians who work in resource-rich care settings. These clinicians care for patients with problems that are complex, dynamic, and undifferentiated. Practice environments rich with resources—both material and personnel—enable these providers to problem-solve in real time, yet they are expected to be appropriate stewards of resources as well. Thus, clinicians frequently face choices about when they can handle problems independently, when to ask for help to co-manage problems, and when to triage problems to others. As an academic EM clinician educator, I am familiar with the types of patient problems and challenges that are encountered in this work setting.

Recognizing that many behaviors are driven by subconscious cognition, these in-the-moment management decisions will be complex to unpack retrospectively. I thus intend to explore this phenomenon by eliciting narratives that capture the intersection between cognition and emotion described by Leblanc and others.[31,32] I am interested in what was consciously available to participants in these complex moments of uncertainty, and how they *experienced* these events. Leblanc has described concepts of *eustress* and *distress* as manifestations of whether or not an individual perceives that her/his skillset is aligned, or not, with the current demands of a situation.[31] I thus anticipate that these participants' *feelings* of comfort or discomfort are used as important cues[33] to guide them towards problem spaces that align with their skills and past experiences and serve as triggers for when they ask or help.

I will use a constructivist grounded theory approach[22] and conduct semi-structured interviews of experienced emergency medicine faculty (>5 years in practice) at two tertiary academic medical centers. To explore how determinations of practice scope and resource utilization play out in these environments, I will use a CIT[23] to elicit narratives about decision-making immediately after the conclusion of faculty members' clinical shifts. Using an electronic medical record-generated list of patients they had seen during their shift as a prompt, we will use the technique of rich pictures[24] as a means to elicit story-telling and reflections from participants regarding complex, challenging situations they had encountered at work that day. Participants will be given 15 minutes to draw two pictures independently, the first describing a case where they felt 'challenged but confident' and the second where they felt 'challenged and concerned' about their ability to adequately take care of a patient's constellation of problems in that particular moment. We will use these drawings as a prompt to elicit narratives from our participants, beginning with concrete elements of the case (presenting symptoms, acuity, contextual influences), then exploring how the clinicians approached and experienced decision-making in these moments. We will use probing questions to explore clinicians' considerations of *risk*, the *resources* they considered drawing upon to buffer against risk (e.g., people, equipment, system), and the *emotions* they experienced in these moments (manifest consciously and/or as physical symptoms).

Guiding questions for the interview guide will include:

- Tell me more about the pictures you have drawn and describe the elements of each picture.
    - Tell me about the actors you have drawn in this 'challenged but confident' picture. What are their relationships to the problems you were managing in that moment?
        - Why do you think you felt 'challenged but confident' when managing this case?
    - Tell me about the actors you have drawn in this 'challenged and concerned' picture. What are their relationships to the problems you were managing in that moment?
        - What about this case made you feel 'challenged and concerned'? How did you attend to these potential risks?

- How do you tell whether a clinical problem aligns with your skills? How does it *feel* when problems seem to be going as anticipated, or when a problem seems to be veering off course?
- How do you respond when encountering problems that trigger a sense of *discomfort*?
- How do you determine *when* to refer patients to another clinician, and *to whom*?

I will conduct hour-long face-to-face interviews and audio-recordings of these interviews will be transcribed for analysis. As described by Cristancho and colleagues,[34] we will analyze participants' 'rich pictures' alongside the post-shift interviews as a means to triangulate themes from our participants' narratives to their reflective drawings. I will enlist a colleague with expertise in the arts who teaches a 'visual thinking strategies' course our school, and we will analyse the aesthetic data in 3 phases: 1) individual aesthetic analyses of each drawing; 2) a compare-and-contrast analysis of multiple drawings; and 3) a team analysis conducted in collaboration with other team members with a variety of professional backgrounds (AdB, GR, PT).

We will analyse data from participants' narratives iteratively alongside data collection and make subsequent modifications to the interview guide. I will analyse the narrative transcripts in conjunction with three experienced health professions researchers (AdB, GR, PT), coding data line-by-line using constant comparative analysis to organize transcripts into focused codes, key conceptual categories, and then major themes. Transcripts will be coded using Dedoose (SocioCultural Research Consultants, LLC, Manhattan Beach, California), facilitating analytic memoing and network displays as a means for the authorship team to discuss axial and selective coding. Key themes will be shared within the team to identify relationships between codes and categories, ultimately developing a conceptual framework reflecting the possible relationships between themes. We will share a written synthesis of these results to our participants, inviting feedback to ensure that our findings provide an accurate thematic representation of their experiences.

Study 2: How do experienced clinicians define their scope of practice in low resource settings?

I will expand upon the results of Study 1 by exploring how context impacts experts' perceptions of their scope of practice, risk, and resource utilization when encountering complex problems in low resource settings. To frame these discussions, I will begin by using a photo elicitation interview technique[27,28] that uses visual stimuli of prototypical 'rare, high risk events' (e.g., epidural hemorrhage with cerebral edema and impending herniation) as a means to prompt participants to think aloud regarding how they would approach and manage these hypothetical situations. I will then use a CIT[23] to explore participants' examples of high complexity incidents experienced in their own rural practice settings, using prompts to elicit narratives regarding how they approached and experienced these situations.

I will enroll experienced emergency medicine, internal medicine, and family medicine clinicians who work in the rural WWAMI region, using a constructivist grounded theory[22] approach to explore their

narratives. I will conduct hour-long interviews via video conferencing software (Zoom Video Communications, San Jose, CA), and audio-recordings of these interviews will be transcribed for analysis. We will analyse data iteratively alongside data collection and make subsequent modifications to the interview guide. I will analyse the transcripts in conjunction with three experienced health professions researchers (AdB, GR, PT), coding data line-by-line using constant comparative analysis to organize transcripts into focused codes, key conceptual categories, and then major themes. Transcripts will be coded using Dedoose (SocialCultural Research Consultants, LLC, Manhattan Beach, California), facilitating analytic memoing and network displays as a means for the authorship team to discuss axial and selective coding. Key themes will be shared within the authorship team to identify relationships between codes and categories, and to ultimately develop a conceptual framework that reflects the possible relationships between themes. We will share a written synthesis of these results to our participants, inviting feedback to ensure that our findings provide an accurate thematic representation of their experiences.

Our interview guide will include questions such as:

- What makes you worried when you see this picture [of a hypothetical high-risk problem]?
    - What would you do if you saw this case in your practice?
    - Who could you ask for help, and when would you do so?
    - What would you do if you had to act upon this problem immediately?
- Tell me about a case where you were worried that your patient had a problem that exceeded your abilities. When did you realize that you needed help? At what point did you ask for help? What did you do while waiting for help to arrive?
- Tell me about an experience of asking for help when things went well.
- Tell me about an experience of asking for help when things went poorly.
- Has asking for help changed how you think about your scope of practice?

Study 3: How does comfort with uncertainty evolve during training?

Clinicians-in-training likely approach and experience uncertainty in different ways than their more experienced supervisors. If 'comfort' and 'discomfort' are used as cues by clinicians use in settings of uncertainty, how do trainees interpret moments when they are 'out of sync' with their supervisors (e.g., feeling 'discomfort' but being told to move ahead by their supervisor, or feeling 'comfortable' and being told to slow down by their supervisor)? These moments of trainee-supervisor disconnect in settings of uncertainty have broad implications for training programs, namely: How do trainees identify the borders of their practice scope when still learning the core knowledge and skills germane to their specialty? Can trainees differentiate between instances of 'discomfort' resulting from inexperience from 'discomfort' arising from problems beyond the scope of their specialty? How do trainees interpret and navigate situations where their faculty members' 'discomfort with uncertainty' holds them back?

We will explore these issues of 'practice scope' and supervisor-trainee disconnect from the perspectives of emergency medicine residents. I will conduct semi-structured interviews of

emergency medicine trainees at two tertiary academic medical centers. Prior to the interviews, I will send participants three question prompts by email to stimulate reflection on these topics:
1) Think about a complex case where you felt challenged, but were able to manage the problems without much help from your supervisor or consultants;
2) Think about a complex case that made you feel uncomfortable and/or unsure what to do, and how you navigated that situation; and
3) Think about a case where you felt like you were being pushed to 'take a risk' that made you feel uncomfortable.

I will then conduct hour-long face-to-face interviews, using a CIT[23] to elicit stories from the trainees. Questions in our interview guide will include:

- How do you determine whether a patient has a problem that is appropriate for you to solve, or whether your patient has a problem that requires you to get help from others?
- How do you define your scope of practice? What are the differences between what you think your scope of EM practice *should be* (i.e. the idealized practice of EM) and your *actual* practice experiences during training?
- Tell me about a recent case when you felt challenged. What made you sense that this case was complex or challenging? How did you respond to these feelings?
- Tell me about a case where you felt like your attending was holding you back (i.e., you felt ready to act and your attending made you slow down, involve a consultant, or seek additional tests)?

Audio-recordings of these interviews will be transcribed for analysis. Depending upon the results of Studies 1 and 2, we will either use a constructivist grounded theory approach or use a phenomenological approach (e.g. hermeneutic phenomenology or interpretative phenomenological analysis) for this study. If a phenomenological approach is adopted, we will likely expand our research team to ensure that we have sufficient expertise with this methodology.

<u>Study 4</u>: How does comfort with uncertainty evolve when individuals transition from supervised to unsupervised practice?

Building upon the insights of how trainees experience comfort and discomfort with uncertainty in the context of supervised work experiences, we will turn our attention to exploring how physicians navigate uncertainty when transitioning to independent practice. We will enroll clinicians who are less than 3 months post-graduation, purposefully sampling to capture a diverse collection of transitional experiences. We will recruit clinicians who work in multiple practice settings (urban/academic vs. rural) and different fields (emergency medicine, internal medicine, family medicine).

I will use a constructivist grounded theory[22] approach to explore the phenomenon of comfort with uncertainty in these clinicians. Prior to the interview, we will email participants two questions to generate reflection prior to our interviews:

1) Think about your toughest case since graduating residency. What made it so challenging? What did you do?; and
2) Think about a case that you thought was within your scope of practice but made you feel uncomfortable. How did you proceed?

I will use a CIT[23] to conduct hour-long interviews using video conferencing software (Zoom Video Communications, San Jose, CA), beginning with the questions above, then using an interview guide with questions such as:

- How does your current scope of practice compare to what you thought it would be during residency?
- What do you do when a case makes you feel uncomfortable in your current practice setting?
- Tell me about an experience of asking for help when things went well.
- Tell me about an experience of asking for help when things went poorly.
- Has asking for help changed how you think about your scope of practice in your new practice setting?

Audio-recordings of these interviews will be transcribed for analysis using an approach similar to Studies 1-3.

2.3 Literature references

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2.4 Time plan

	Start Date	***End Date***	***Anticipated Funding***	***Anticipated Dissemination***
Conceptual Paper *"Comfort with uncertainty: Reframing our conceptions of how clinicians navigate complex clinical situations"*	*November 2016*	*June 2018*	*Society of Directors of Research in Medical Education (SDRME) review paper grant [received]*	*Oral presentation at SDRME, May 2018. Submit to Advances in Health Sciences Education, August 2018. Literature review for doctoral dissertation.*
Study 1 *"Comfort with uncertainty in high resource settings"*	*November 2018*	*July 2019*	*AAMC Western Group on Educational Affairs (WGEA)*	*Original article submitted to medical education journal. Oral presentations at medical education conferences (CCME, RIME, AMEE). Body of doctoral dissertation.*
Study 2 *"Comfort with uncertainty in low resource settings"*	*August 2019*	*April 2020*	*UW Center for Leadership & Innovation in Medical Education (CLIME) institutional grant.*	*Original articles submitted to medical education journal. Oral presentations at medical education conferences (CCME, RIME, AMEE). Body of doctoral dissertation.*
Study 3 *"Comfort with uncertainty in trainees"*	*May 2020*	*April 2021*	*Emergency Medicine Foundation / Council of Emergency Medicine Residency Directors (EMF/CORD) Education Research Grant*	*Original articles submitted to medical education journal. Oral presentations at medical education conferences (CCME, RIME, AMEE). Body of doctoral dissertation.*
Study 4 *"Comfort with uncertainty after transition to independent practice"*	*April 2021*	*January 2022*	*Emergency Medicine Foundation / Council of Emergency Medicine Residency Directors (EMF/CORD) Education Research Grant*	*Original articles submitted to medical education journal. Oral presentations at medical education conferences (CCME, RIME, AMEE). Body of doctoral dissertation.*
Doctoral dissertation	*February 2022*	*June 2022*		

2.5 Scientific setting

Main publications of applicant(s):

39 publications since 2009, selected articles included below.

12. **Ilgen JS**, Takayesu JK, Bhatia K, Marsh RH, Shah S, Wilcox SR, Krauss WH, Nadel ES. Back to the Bedside: The 8-year Evolution of a Resident-as-Teacher Rotation. *J Emerg Med.* 2011 Aug; 41: 190–195. PMID: 20619571
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14. **Ilgen JS**, Humbert AJ, Kuhn G, Hansen ML, Norman GR, Eva KW, Charlin B, Sherbino J. Assessing diagnostic reasoning: A consensus statement summarizing theory, practice, and future needs. *Acad Emerg Med.* 2012 Dec; 19: 1454-1461. PMID: 23279251
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2.6 Setting within Research Group

This doctoral research proposal is not part of a larger research program.

2.7 Output

Please see 2.4 above.

2.8 Societal & Scientific Relevance

(if applicable)
max. 1 page.
How can results be applied in other research areas?
How can results be applied in society, business, etc.?

This program of research is intended to transfer concepts and research methods from the cognition and social cognition literatures to better inform our understanding of how clinicians navigate uncertainty in practice. Its findings could potentially be applied to other settings such as education, business, and engineering where individuals enact plans while simultaneously remaining attuned to unresolved uncertainties.

3. Signature

Name: Jonathan Ilgen, MD, MCR

Place: Seattle, Washington, USA

Date: August 8, 2018