PERCEPTIONS OF FAMILY MEDICINE RESIDENTS ON THE ROLE OF CLINICAL UNCERTAINTY IN LEARNING TO BECOME COMPETENT FAMILY PHYSICIANS

by

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Abstract

As the first point of patient care, Family physicians are known to experience greater levels of uncertainty in decision-making. Little is known about how Family Medicine residents perceive and experience uncertainty in their dual roles as learners and healthcare providers. While there is research to suggest that uncertainty can be productive for learning medical practice, no study has examined the role of uncertainty in resident learning. The purpose of this study was to explore how Family Medicine residents view, experience, and manage uncertainty while learning through practice.

A qualitative design was used to explore residents’ emotions, thoughts, opinions, and attitudes regarding their lived experiences of uncertainty. Over a two-week period, nine Family Medicine residents from one academic institution participated in individual, semi-structured interviews. Following verbatim transcription and member checking of interview summaries, the data was thematically analyzed to identify patterns in participants’ views and experiences of uncertainty.

Results showed that uncertainty was a common and potentially uncomfortable experience for participating residents. Over time, the residents recalled their uncertainty subsiding and changing in character as they gained confidence and comfort with uncertainty in their decision-making. Despite viewing uncertainty as integral to lifelong professional learning, the residents in this study recalled censoring their expressions of uncertainty based on their perceptions of how they thought their patients and supervisors would react.

In conclusion, the findings of this study suggest a need for medical education culture to be more accepting of residents’ uncertainty. A culture of acceptance towards uncertainty, in which residents and supervisors could speak freely about their professional limitations, has the potential to enhance patient safety as well as the quality and scope of clinical teaching and learning. Teaching medical learners to reflect in practice, by noticing uncertainty and suspending judgment, may help develop their ability to recognize professional weaknesses, self-limit practice in areas of limited competence, identify what must be learned, and locate external resources to resolve gaps in competence.
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List of Abbreviations

FM – Family Medicine
RA – Research Assistant
DFM – Department of Family Medicine
CSPC – Centre for Studies in Primary Care
PGME – Postgraduate Medical Education
PGY1 – Postgraduate Year 1
PGY2 – Postgraduate Year 2
KTI – Kingston Thousand Islands
BQ – Belleville-Quinte
Chapter 1

Introduction: Identifying the Research Problem

A Family Medicine resident sees a woman in her early seventies who is presenting with recurrent fevers and nearly forty pounds of unintentional weight loss. Recognizing her symptoms are vague but concerning, the resident begins to feel worried about the well-being of his patient. With such a broad differential diagnosis, the resident thinks his patient could have anything from an infection, an autoimmune disease, or a vasculitis, to any number of malignancies, like a lymphoma, a bone marrow cancer, or a multiple myeloma. The resident acknowledges that he has no idea where to even start in terms of what investigations to do, or how aggressively he should be working up his patient [Adam, case 10].

This experience of not knowing what to do or how to proceed with patient care is a common experience for medical learners (e.g., Fox, 1957; 1980; Farnan, Johnson, Meltzer, Humphrey, & Arora, 2008). I introduce this story to highlight two important realities about clinical uncertainty in learning to engage in medical practice: 1) As both learners and healthcare providers, residents may not yet have the medical knowledge and skills they need to confidently proceed with patient care; and 2) As both human beings and developing medical professionals, residents have concerns about the well-being of their patients and the safety of their decision-making. These realities may be even more exacerbated for Family Medicine residents. As the initial point of care for patients with undifferentiated medical problems entering the medical system, Family Medicine residents are responsible for evaluating the urgency of care required, establishing a diagnosis, and coming up with a safe management or treatment plan for each patient they see.
As patients, we trust our physicians to be competent in serving our medical needs. We trust them to have, and to be able to apply, current medical knowledge and skills to assess, diagnose, and treat us in a compassionate, patient-centered way. In making decisions about our care, we trust them to put our needs first as patients, and to practice within the boundaries of their individual and professional limitations. During each clinical encounter with a patient, physicians make numerous decisions in the process of assessment, diagnosis, treatment and/or referral (Croskerry, Petrie, Reilly, & Tait, 2014). In taking a patient’s history, the physician decides what questions to ask and what information is important in establishing a diagnosis. Based on the patient’s self-report and the physical examination findings, the physician decides whether or not (s)he has enough information to establish a diagnosis, if the patient needs to be sent for further diagnostic testing (ex. x-rays, blood work, etc.), or if the physician needs to look up information to make an informed, evidence-based decision. In thinking through the diagnosis for their patients, physicians consider the available evidence for various diagnoses and systematically rule out unlikely possibilities. And finally, after making a diagnosis, physicians decide on an appropriate management or treatment plan for their patients based on their current health status, individual needs, and lifestyle (ex. medication, rehabilitation, surgery, etc.).

In an ideal world, all patient care decisions would be made with complete certainty. Unfortunately, many decisions are not as clear-cut as patients or physicians would like them to be. Due to the complexity of the human body and disease, as well as the rapid advancement and limitations of medical information and technology, uncertainty is ubiquitous in the practice of medicine – even for experienced physicians (e.g., Ghosh, 2004; Montgomery, 2006; Schwartz, 2011). But do all physicians experience similar levels of uncertainty in their decision-making?

There are reasons to suggest that Family physicians, as generalists, experience greater levels of uncertainty in their practice. Compared to specialist physicians, who try to amass depth of knowledge about a certain organ (e.g. cardiology), surgical or non-surgical technique (e.g.,
radiology), or age range of patient (e.g., pediatric and geriatric), generalists focus on achieving breadth of knowledge about the human body and illness in order to serve patients of all ages presenting with undifferentiated medical problems (O’Riordan et al., 2011). As the first line of care for approximately 85 percent of Canadians entering the medical system (Statistics Canada, 2013), Family physicians are presented with the greatest array of undifferentiated signs and symptoms. Since they serve as the triage and diagnostician for every ailment a patient presents with, Family Physicians are often responsible for sorting through the relevant and irrelevant in a way that specialists may not have to. With so much uncertainty inherent in the generalist practice of Family Medicine, it is likely that as learners, resident Family physicians experience more profound levels of uncertainty when making patient care decisions.

As learners, residents face a difficult predicament. They have to care for their patients but often do not have the experience to know what to do. There is research to suggest that some physicians enter residency with limited practical experience in making patient care decisions (McGregor, Paton, Thomson, Chandratilake, & Scott, 2012). Yet the traditional model of residency training is workplace-based service; meaning that residents learn how to apply their foundational medical knowledge (acquired in medical school) by serving patients under the supervision of fully licensed and experienced physicians (van der Zwet et al., 2010). Through encountering and having to care for diverse patients with varied medical problems, residents are thought to accumulate the knowledge and experiences they need to confidently make decisions about patient care (Watling, Driessen, van der Vleuten, & Lingard, 2012).

Interestingly, despite the breadth of Family practice, Family Medicine residency programs are often much shorter in duration compared to other specialty training programs. Presently in Canada, the expected time for Family Medicine residents to complete the core training program is twenty-four months, with this being the shortest length of Family Medicine
training in the Western world (Organek et al., 2012). Worldwide, program length varies between two to five full-years (Tannenbaum et al., 2012).

Compared to their peers in other specialties, Canadian Family Medicine residents have the challenge of mastering wider breadth of medical knowledge in a shorter period of time (Jewell, Newton, & Dharmamsi, 2015). In a recent study examining preparedness for independent practice, a sample of Family Medicine residents felt that two years of training was not enough time to develop all of the required competencies (Jewell, Newton, & Dharmamsi, 2015). With such little time, each patient care experience likely matters as a potential learning opportunity. Therefore, how these residents manage and address their uncertainty in practice can potentially impact the development of their required competencies.

**My Introduction to Uncertainty**

Uncertainty in decision-making is something we all experience, and can relate to at some level. Uncertainty can be broadly defined as the experience of not knowing what to do when faced with a decision and feeling doubtful, confused, conflicted, or stuck. Uncertainty is uncomfortable when the stakes are low, and incredibly worrisome when the potential stakes or dangers are high. In medicine, a profession predicated on public trust, patient safety is a critical issue and the number one concern in making difficult decisions about people’s physical health and emotional well-being.

I was first introduced to the phenomenon of clinical uncertainty when asked to be a Research Assistant (RA) for a study examining how Family Medicine residents become engaged in self-regulated learning. This study, entitled “How Residents Learn: Understanding the Roles of Cues in Self-Regulated Learning” was co-developed by Dr. Jane Griffiths, Assistant Professor and Assessment Director for the Queen’s Department of Family Medicine (DFM), in partnership with Dr. Elaine Van Melle, Educational Research/Program Evaluation Specialist for the Queen’s Centre for Studies in Primary Care (CSPC). In Postgraduate Medical Education (PGME),
Workplace activities are recognized as starting points for resident learning (van de Wiel & Van den Bossche, 2013; Teunissen et al, 2007). Research suggests that uncertainty in clinical decision-making cues experienced physicians to engage in self-directed learning (Lee, King, & Eva, n.d.). However, it has not yet been determined if this is also true for resident physicians. The aim of the “How Residents Learn” study was to identify: a) the nature of the situations that cause residents to feel uncertain, and b) how residents go about using various human (ex. their preceptors) and online point-of-care resources (e.g., Up To Date) to address their learning needs.

As a graduate student, I was initially drawn to this project because of the topic and data collection methods. As someone with prior workplace learning experience (practicum placements) in a professional education program (teacher education), I know first-hand what it is like to experience uncertainty when making decisions that directly impact the academic success, mental or physical health, and overall well-being of students in my care. I also know what it is like to be dissatisfied with the quality of my own workplace learning experiences. For this reason, I have become increasingly interested in applied research that aims to add to our current understanding of how professional students learn through service in the workplace.

When Dr. Van Melle first told me about the “How Residents Learn” study, I was also intrigued by the innovative method being used to collect data. To gather information about the types of situations that prompt Family Medicine residents to experience uncertainty, and the resources that they use to acquire the information they need to make patient care decisions, Griffiths and Van Melle decided to adopt a method of systematic self-observation (SSO) previously used by Lee, King, and Eva (n.d.). This method relies on participants using a written set of questions to generate field notes about their experiences of uncertainty (see Figure 1). However, instead of having participants use Dictaphones to self-record their field notes, Griffiths and Van Melle opted to have participants use their own smartphones. Since residents commonly use their smartphones to access online point-of-care resources in clinic, it was more convenient
for them to use their own device to record their self-observations. While I had never considered smartphones as a data collection tool, I recognized the potential for monitoring and tracking data collection progress and providing timely feedback to participants about the quality of their observations.

Figure 1. Prompt card used by participants in the “How Residents Learn” study

The more I learned about this project, the more I wanted to be involved. As a novice academic relatively new to the field of medical education, I had concerns about making my own research relevant and gaining access to research participants. When Dr. Van Melle suggested that I build my Master’s research onto their study, I jumped at the opportunity.

Situating my Research

In August of 2014, I met with Drs. Griffiths and Van Melle to discuss my responsibilities as a Research Assistant (RA) for their “How Residents Learn” study, and how I intended to connect my Master’s research to their existing project. From the beginning, I knew that I was
interested in gathering residents’ perspectives on their service learning experiences through in-depth interviews. However, initially I wanted to ask residents questions that probed into their self-regulation processes. Specifically, I was interested in how they: (a) make sense of their uncertainty (self-monitoring phase) as feedback about their lack of knowledge, skills, and/or experiences; and (b) use the analyzed feedback to develop a personalized learning plan that involves using external resources to address identified gaps in knowledge and clinical skill.

Given the alignment between the objectives of “How Residents Learn” study, and my proposed study, we decided that the same group of Family Medicine residents would participate in both studies sequentially. In the “How Residents Learn” study, participants would each record a series of 10 Systematic Self-observations (SSOs) detailing: (a) a specific patient care situation that made them feel uncertain, (b) the external resources that they used to address their uncertainty, (c) how they went about their learning, and (d) whether or not they thought their learning was effective. Then, for my research, each participant would participate in an individual, semi-structured interview, in which they would have the opportunity to explain, in detail, how their feelings of uncertainty prompted them to engage in, and progress through, the stages of self-regulated learning. Thus the SSO data could be used as specific prompts to engage residents in conversation about their learning processes.

**Preliminary steps**

After meeting with Drs. Griffiths and Van Melle on September 9th 2014, I started recruiting residents from the Department of Family Medicine at Queen’s University to participate in both research studies (the “How Residents Learn” study and my Master’s research) sequentially. After three months, I was able to recruit a total of eleven participants. Five of these residents were in their first year (Postgraduate Year 1 [PGY1]), and six were in their second and final year (PGY2) of training. Each participant was responsible for completing: (a) 10 SSOs on a Family Medicine rotation over a one-month period, and then (b) an individual in-depth interview.
scheduled at their convenience. After each field note, participants were directed to email their recording to me. Upon receipt, I listened to each recording, provided the participant with feedback regarding the quality of their observation, and confirmed the number of recordings sent to date.

Hearing participants tell me over and over again just how common it was for them to experience uncertainty in their clinic day, sometimes multiple times with each patient, helped me to see the experience of uncertainty as a critical incident in shaping patient encounters. After residents recognize that they are unsure, or don’t know what to do, they have to decide how they are going to pursue the information they need to resume patient care; whether it be through various online point-of-care resources (e.g., Up to Date), consulting an allied health care professional (e.g., pharmacist), or reviewing the patient with their supervisor. But how do they make this decision? Hearing the sincerity in participants’ voices as they openly shared moments of uncertainty, and linked their experiences to specific deficiencies in their own medical knowledge and skills, made me wonder what it is like to experience uncertainty from the dual perspective of learner and healthcare provider. I wanted to know how Family Medicine residents, as learners, experience uncertainty, manage uncertainty, and view uncertainty in their developmental trajectory towards competence.

Looking to the medical education literature for answers to these questions, I found gaps in the research conducted on medical learners’ experiences with uncertainty. Most studies have focused on medical students’ and graduated physicians’ experiences, feelings, and reactions to uncertainty (e.g., Bovier & Perneger, 2007; Cristancho et al., 2013; Deketelaere, Kelchtermans, Struyf, & De Leye, 2006; Fox, 1957; 1980; Lingard, Garwood, Schryer, & Spafford, 2003). Much less attention has been focused on residents. Of the research that has been done on residents’ uncertainty, participants have included mostly Internal Medicine (Farnan et al., 2008; Green & Ruff, 2005), Pediatric (Timmermans & Angell, 2001), and Emergency Medicine
(Kennedy et al., 2009) residents. Given that Family Medicine residents may be unique in their experience of uncertainty, it is important to explore their views on uncertainty in learning their scope of practice (Evans & Trotter, 2009; Nevalainen, Mantyranta, & Pitkala, 2010; Thomson, 1978). I hope to situate the findings of this research in the literature on residents’ experiences with uncertainty in learning through practice.

**An Evolved Research Purpose**

According to Patton (2002), the purpose of applied research is to “contribute knowledge that will help people understand the nature of the problem in order to intervene” (p. 217). When I was first asked how I would integrate my research with the “How Residents Learn” study, I naively hung my hat on the wrong problem. Initially, I wanted to explore how experiences of uncertainty prompt Family Medicine residents to engage in self-regulated learning. While a study of this nature would increase our understanding of learning from a procedural perspective, it ignores residents’ perspectives on their learning experiences. Through my work as a Research Assistant (for the “How Residents Learn” study) and having the opportunity to hear residents describe the clinical situations that make them feel uncertain, I discovered the deeper problem: understanding how Family Medicine residents view uncertainty in relation to learning.

**Statement of the problem**

In the middle of a time-sensitive, one-on-one clinical encounter with an undifferentiated patient, Family Medicine residents may not have, or may not feel confident in their medical knowledge and/or skills to make safe and effective clinical care decisions. Yet, as residents, these physicians are expected to practice making clinical decisions independently, seeking help as needed. Less is known about clinical uncertainty from the perspective of Family Medicine residents. Of the research that has been conducted on residents, no one, to my knowledge, has explored the phenomenon of uncertainty from the perspective of developing Family physicians.
Purpose of my study

My exploratory study was designed to describe and analyze how Family Medicine residents perceive, experience, and manage uncertainty when making patient care decisions. The purpose was to explore residents’ perceptions on the role that uncertainty plays in their learning to become competent Family physicians. Three research questions guided my study:

1. As learners, what is it like for Family Medicine (FM) residents to experience uncertainty when making patient care decisions, and how have their experiences of uncertainty changed over time (as they progress from PGY1 to PGY2)?

2. What strategies, if any, do FM residents use to manage their uncertainty when caring for patients?

3. What role, if any, does uncertainty play in FM residents’ learning to become competent Family physicians?

Rationale

An increased understanding of how Family Medicine residents experience, manage, and view uncertainty in their learning through patient care has the potential to inform Family Medicine residency training from the perspective of residents, supervisors, and policy-makers. A more explicit awareness of the phenomenon may help residents, as learners, to normalize and appreciate the experience of uncertainty as a learning opportunity. Increased knowledge of the strategies that Family Medicine residents are using to manage their uncertainty may be beneficial in: (a) identifying potential gaps in the medical school and/or Family Medicine curriculum (related to decision-making), and (b) informing the approach supervisors take to mentor and educate learners on coping with uncertainty generally, and handling specific uncertainties when making patient care decisions. From a policy-making perspective, this understanding should provide a foundation for medical educators to make an informed decision about potentially implementing uncertainty training in the Family Medicine curriculum. Findings from this study
should add to the literature with respect to residents’ views on managing uncertainty, as learners, in a generalist practice.

**Organization of my thesis**

My thesis is comprised of five chapters. Chapter 1 introduced the topic of my research, including a brief description of the purpose and rationale for my study. Chapter 2 is a thematic literature review discussing: major stages and hurdles in learning to become a doctor, uncertainty in the practice of medicine, and uncertainty in learning medical practice. Chapter 3 describes how I conducted the research, including information on the participants and methods used to collect and analyze data. Chapter 4 presents the qualitative findings of my study. And finally, Chapter 5 offers a discussion of the findings in relation to my research questions and prior research, as well as the implication for practice, the limitations of my study, and directions for future research.
Chapter 2

Literature Review: Gaining Perspective on the Research Problem

Empirical research on the experience of uncertainty in resident learning is sparse despite studies of medical students’ uncertainty originating in the late 1950s (Fox, 1957). Over the last two decades, research on patient safety has revived interest in uncertainty and decision-making, but not from the experience of developing Family Medicine residents. In this Chapter, I review three areas of research as it pertains to the role of uncertainty in learning to become competent Family physicians. In the first section, I begin with an overview of the process to becoming a resident physician. Next, I discuss some of the challenges residents experience in learning through and from patient care. In the second section, I describe the phenomenon of uncertainty in medical practice and Family Medicine. Specifically, I first define what it means to feel uncertain in practice and then outline the types of uncertainty experienced by practicing physicians. Finally, in the third section, I review what is known about uncertainty from the perspective of medical learners, and situate my research in relation to similar studies.

The Stages and Hurdles of Learning to Become a Doctor

The path to becoming a doctor in Canada involves many stages and hurdles. After successfully completing three to four years of a university undergraduate degree, and, in most cases, the Medical College Admissions Test (MCAT), students can apply and be accepted to medical school. Medical school is a four-year professional education program leading to the designation of MD (Doctor of Medicine). The first two years of medical school typically involve course- and lab-based instruction in foundational concepts and preclinical sciences, such as basic and social sciences, diagnosis and treatment, life cycles (health and disease), chronic disease management, and complexity problems. This is followed by an additional two years of workplace
learning in clinical rotations, including but not limited to community medicine, internal medicine, general surgery, pediatrics, psychiatry, and obstetrics and gynecology.

In the fourth and final year of medical school, students are administered Part 1 of a two-part qualifying exam by the Medical Council of Canada (MCCQE-I). This one-day computer-based test assesses the medical knowledge and clinical decision-making skills that are needed to begin supervised clinical practice. Passing this exam enables medical students to apply to postgraduate residency-training programs in a specific area or specialty of medicine. There are numerous medical specialties, each with its own unique culture, terminology, professional knowledge and therapeutic interventions. The time to complete residency training depends on the program, with Family Medicine having the shortest duration (two year minimum) and sub-specialty training (e.g., Cardiac Surgery) taking up to six years to complete. Applications are made through the Canadian Resident Matching Service (CaRMS), a national, not-for-profit organization that uses a rank-order list to match applicants to an accredited residency program within Canada.

Once physicians begin postgraduate residency training, they are more commonly referred to as residents. All postgraduate residency programs are based on a situated model of learning in which residents acquire specific knowledge and skills while providing care for patients in the workplace (Yardley, Teunissen, & Dornan, 2012). Given that residents are still learners and not yet fully licensed practitioners (assuming they have not previously completed another postgraduate medical education program), staff physicians employed by the university supervise residents and oversee the care they provide to patients in clinics and hospital settings (Dolmans, Wolfhagen, Heineman, & Scherpbier, 2008). This transition from medical school to residency training involves a shift in students’ approaches to learning, from more passive recipients of knowledge to active, self-directed learners (Deketelaere et al., 2006).
After a minimum of one year of postgraduate clinical training, residents can complete Part 2 of the Medical Council of Canada Qualifying Exam (MCCQE-II). This exam requires residents to successfully complete a series of clinical stations. At each station, residents are observed by assessors who score their ability to appropriately examine a standardized (simulated) patient, answer questions about the patient, interpret the results of diagnostic investigations, make diagnoses, and write admissions orders. Successfully passing this exam enables residents to become licensed as a physician in Canada.

As both learners and healthcare providers, residents balance the dual responsibilities and tensions of acquiring the competencies required for certification by licensing (The College of Physicians and Surgeons of Ontario) and accrediting bodies (The Royal College of Physicians and Surgeons of Canada, The College of Family Physicians of Canada), and meeting the needs of patients in their care (Deketelaere et al., 2006). In their final year of postgraduate residency training, each resident completes a certifying exam in their medical specialty administered by either the Royal College of Physicians and Surgeons of Canada, or the College of Family Physicians of Canada. This is the final examination for certification to practice independently in a specialized area of medicine.

**Challenges of Learning-by-Doing**

In postgraduate residency training, resident physicians are expected to learn through attending to patients in the clinic or hospital setting. This apprenticeship model of workplace-based learning poses many challenges for new residents who are used to being passive recipients of knowledge in lecture and group observation settings. Because residents are responsible for assessing, diagnosing, and treating patients, and their learning experiences are dependent on the patients they see on any given day (van der Zwet et al., 2010), it is through having the opportunity to care for patients with diverse medical illnesses that residents develop the knowledge, skills, and experience they need to pass the licensing exams (Watling et al., 2012).
Residents are responsible for monitoring their experiences and creating opportunities to address gaps in their learning (Brydges & Butler, 2012). If these gaps are specific procedural skills or the ability to apply medical knowledge, residents may have to arrange a rotation in another specialty or geographic area where there is greater demand for those procedures or skillsets. Conversely, if residents need to acquire specific medical knowledge, independent self-study using textbooks, journal articles, or additional online resources, may be a more appropriate and feasible means of learning.

Beyond diversity in clinical experiences, a second challenge commonly faced by residents is learning ‘informally’ while caring for patients. Compared to ‘formal learning’ in medical school, where knowledge is thematically organized by courses of instruction and delivered in discrete lectures, learning from workplace experiences can be considered ‘informal’ in that it is less structured, and occurs concurrently with patient care (Swanwick, 2005). When residents are focused on taking a patients’ history, thinking through a differential diagnosis, making decisions about treatment, or performing a procedure, learning can be invisible, taken for granted, or not recognized as learning (Eraut, 2004). When learning is ‘implicit,’ and residents acquire knowledge without explicit awareness of what was learned (Reber, 1993), accurate self-assessment becomes challenging, as does any effort made to self-direct learning (Eraut, 2004). Fortunately, there are specific strategies for making implicit learning more explicit (deliberate) (Eraut, 2000).

While it is possible for learning to go unnoticed, not all workplace learning is implicit. Residents are thought to engage in ‘reactive learning,’ which is neither implicit nor self-directed (Eraut, 2004; Swanwick, 2005). Eraut (2004) describes reactive learning as emergent, “occur[ing] in the middle of the action, when there is little time to think” (p. 251). In the middle of a time-sensitive, one-on-one clinical encounter with a patient, residents may not have, or may not feel confident in their medical knowledge and/or skills to make safe and effective clinical care
decisions. As learners still in the process of acquiring the competencies needed for independent practice, reactive learning in the face of clinical uncertainty is another imminent and challenging experience for residents. At this moment, residents could benefit from guided critical analysis; a purposeful teaching strategy that helps make learning more explicitly recognized and articulated, and knowledge more readily retrievable for future use. Since reactive learning from uncertainty continues throughout physicians’ professional lives as they strive to maintain competencies, it may be important for residents to develop strategies for making learning more deliberate before they finish residency and transition to independent practice.

In 1957, sociologist Renée Fox first mentioned uncertainty in medical learning and practice, referring to it as a theoretical concept, an empirical phenomenon, and a human experience. In the context of medical students’ learning, Fox (1957) identified clinical uncertainty resulting from: (1) “Incomplete or imperfect mastery of available knowledge,” (2) “Limitations in current medical knowledge”, and (3) “Distinguishing between personal ignorance or ineptitude and the limitations of present medical knowledge” (p. 208-209). Fox (1957) was the first to suggest that: (a) personal knowledge and current medical knowledge can independently contribute to a physicians’ experiences of uncertainty, (b) student physicians, by nature of being learners, experience greater uncertainty (because the source of their uncertainty is more ambiguous), and (c) uncertainty is an opportunity for learning medical practice. More than fifty years later, Fox’s assessment of the types of uncertainty in medical education still holds. However; since then, more inclusive taxonomies of medical uncertainty have been suggested (e.g., Baresford, 1991; Han et al., 2011; Sommers, 2013). To this day, uncertainty is still an imminent and stressful reality of learning medicine through practice (Bovier & Perneger, 2007; Nevalainen, Kuikka, Sjöberg, Eriksson, & Pitkälä, 2012).
**Uncertainty in the Practice of Medicine**

According to the Merriam-Webster Online Dictionary (2014), uncertainty is “the quality or state of being uncertain [about] something that is doubtful or unknown” (Uncertainty, para. 1). Medical literature typically defines uncertainty as the subjective experience of not knowing that is accompanied by feelings of discomfort and stress. Degrees of uncertainty may range from a falling short of certainty to an almost complete lack of conviction or knowledge about an outcome or result (Han, Klein, & Arora, 2011; Sommers, 2013). When practicing medicine, physicians commonly experience situations where they do not know how to proceed with patient care (e.g., Cristancho et al., 2013; O’Riordan, 2011). In discussing physicians’ uncertainty related to a particular patient or case, Sommers (2013) descriptively defines clinical uncertainty as “the confusion, conflict, stuckness, unease, and/or discomfort an individual [physician] experiences when confronting a predicament in an individual patient who presents a diagnostic, therapeutic, general management, clinician-patient relationship, prognostic, ethical dilemma, or some combination of these dimensions” (p. 6).

Since the late 1950s, medical education scholars have identified uncertainty as a natural, inevitable, and stressful reality of practicing medicine (e.g., Bovier & Perneger, 2007; Luther & Crandall, 2011). Despite the rapid advancement of new and improved medical technologies, even the most current medical knowledge continues to change and have flaws. Further, new scientific discoveries, diagnostic tests, treatments, medications, and best practice guidelines make it challenging for experienced physicians to stay current on advances and trends in health care delivery. Even if physicians were able to master everything there is to know in their field, the practice of medicine is far from predictable. Our developing understandings of the complexity of genetics, the human body, and disease have shown that the same malady can affect individuals differently. With today’s illnesses becoming more complex (e.g., comorbid illnesses) and new diseases appearing suddenly and unexpectedly (e.g., severe acute respiratory syndrome [SARS]),
physicians are forced to face the inescapable reality of uncertainty when caring for patients (Montgomery, 2006). If uncertainty is a state of practice for physicians, it is likely that resident physicians must develop ways of managing this uncertainty.

Types of Uncertainty

Fox (1957) initially identified three types of uncertainty experienced by medical students: (1) uncertainty in personal knowledge, (2) uncertainty in current medical knowledge, and (3) uncertainty in differentiating personal ignorance from what is not known in the field.

Subsequently, researchers have independently suggested similar but more inclusive taxonomies (e.g., Baresford, 1991; Han et al., 2011; Sommers, 2013). For example, Baresford (1991) categorized physicians’ uncertainty into technical, personal, and conceptual uncertainty:

- **Technical uncertainty** arises from the exponential growth in medical knowledge, the limitations of the available scientific data, and the ability of the physician to “possess all the facts relevant to a given case” (p. 7); while

- **Personal uncertainty** stems from the physician-patient relationship, including a physician not knowing a patient’s wishes, values or concerns, whether a patients’ family members are “acting in the patients’ best interests” (p. 7), or if their attachment to their patient is interfering with their professional decision-making; and finally

- **Conceptual uncertainty** results from the challenges of prioritizing patients’ access to limited healthcare resources (incommensurability), and applying general criteria (e.g., guidelines) to context specific decisions regarding unique situations and patients.

Interestingly, Baresford’s technical uncertainty includes all three types of uncertainty as described by Fox (1957), while the addition of personal uncertainty and conceptual uncertainty relate to the physician-patient relationship and the complexity of medical practice respectively.

While recognizing the multiple meanings and varieties of uncertainty in health care, Han, Klein, and Arora (2011) took a more fundamental approach to categorizing a physician’s
uncertainty according to its source and issue. Sources of uncertainty included: (a) probability: uncertainty due to uncertain future outcomes, (b) ambiguity: uncertainty due to imprecise evidence, conflicting evidence, or a lack of scientific evidence, and (c) complexity: uncertainty due to the complex nature of the phenomenon. Conversely, issues or concerns related to uncertainty included: (a) scientific (disease-centered), (b) practical (system-centered) or (c) personal (patient-centered) (Han et al., 2011). This model incorporates many of the same types of uncertainty as identified by Baresford (1991), but provides greater clarity in disentangling the cause and topic of a physician’s uncertainty.

Similarly, Sommers (2013) analyzed the differing perspectives on uncertainty in the medical literature two years later, and identified three sources of uncertainty that are similar to both Fox’s and Baresford’s models, including: (a) uncertainty resulting from physicians not knowing certain medical knowledge, and/or their inability to reason, use decision strategies, apply knowledge, or monitor emotional reactions to uncertainty; (b) uncertainty arising from relationships, including physician-patient, physician-physician, and physician-staff (non-physician); and (c) uncertainty stemming from complex systems creating variation and instability in clinical decision-making. Given that over the last sixty years, at least three independent researchers have identified learning medical knowledge, medical roles and relationships, and complex systems as important variables related to clinical uncertainty, it seems appropriate to more closely examine the relationship between uncertainty and learning in developing physicians’ patient care experiences.

Based on a synthesis of the above-mentioned dictionary and research specific definitions, I define uncertainty as the subjective feeling of unease, discomfort, conflict, or confusion a physician experiences when (s)he lacks confidence in their knowledge of how to proceed with safe and effective patient care decisions. Implicit in my working definition is the notion that uncertainty varies on a continuum from awareness of complete ignorance to near sureness. Since
uncertainty can stem from both internal and external factors, it is expected that the nature of some individuals and medical specialties predispose certain types of physicians to experience greater or lesser uncertainty (e.g., Fox, 1957; Schneider, Wübken, Linde, & Bühner, 2014). For example, Family Medicine physicians have been recognized to experience greater uncertainty in their practice compared to physicians in other specialties (e.g., Evans & Trotter, 2009; Nevalainen, Mantyranta, & Pitkala, 2010; Thomson, 1978).

As the first point of care for patients of all ages, Family physicians must have breadth in their medical knowledge. When patients come to see a Family physician, their illness is often in an unrevealed state. It is the Family physician’s role to “manage the situation for the benefit of the patient” and make “decisions based on few firm facts” (Thompson, 1978, p. 343). Through relying on their own observations of the patient, and what the patient tells them about their experience of illness, Family physicians try to reach a reasonable decision about whether to order laboratory tests, make a diagnosis, prescribe treatment or refer the patient to a relevant specialist. The decision of whether or not to refer a patient to a specialist requires Family physicians to know their scope of practice and where the boundaries lie between their care and that of specialists’ (Forrest et al., 2002). Interestingly, despite the greater magnitude of uncertainty in Family medicine, studies examining residents’ experiences of uncertainty have tended to focus on Internal Medicine (Farnan et al., 2008; Green & Ruff, 2005), Pediatric (Timmermans & Angell, 2001), and Emergency Medicine (Kennedy et al., 2009) residents.

**Uncertainty in Learning the Practice of Medicine**

What do we know about learning from uncertainty, or uncertainty as a starting place for learning in the context of medicine? Fox’s (1957) initial research examined medical students’ experiences with uncertainty over the preclinical (years 1 and 2) and clinical years (years 3 and 4). She found that as students accumulate clinical experiences and responsibilities for patient care, they become increasingly aware of uncertainty and how to cope. Through observing and
interacting with more experienced physicians, students come to realize that uncertainty is a legitimate and inevitable reality of practicing medicine, and that even after years of independent practice, uncertainty still plagues even the most experienced physicians. As medical students develop greater medical knowledge and technical skills, some of their uncertainty is thought to subside as it becomes easier to differentiate what they should know (based on their level of training), from gaps in medical science. This gives students greater confidence in their ability to manage uncertainty (Fox, 1957, 1980).

According to Fox (1957), there is an important distinction between the type and magnitude of uncertainty experienced by medical students, and that of more advanced novice physicians. Medical students, in their third and fourth clinical years, have a very narrow and shallow scope of practice. They are responsible for taking patients’ histories and doing physical exams, but diagnoses and therapeutic management is left to more experienced physicians. The cases they are given are often classic examples of more obvious illnesses, making them somewhat protected from uncertainty. However, as medical students progress onto the next phase of their training, and take on a patient roster of their own, they begin to experience the full complexity of cases, and the responsibility for finding a solution (diagnosis and treatment) for their patient. When practicing more independently, uncertainty can have a deep emotional impact on learners (Fox, 1957). Decades later, uncertainty is still known to create stress for medical learners and experienced physicians (Bovier & Perneger, 2007; Nevalainen et al., 2010).

Fox (1957) recognized that experiences of uncertainty are also opportunities for student physicians to engage in learning medical knowledge and skills. She acknowledged that for medical students, uncertainty in patient care is compounded by the uncertainty of working independently, and having to take responsibility for directing their own learning. Learners face uncertainty in how much they should know, what they should learn, and how to manage their studies, and how to know if they are doing well (Fox, 1957). Based on Fox’s description of
uncertainty faced by different levels of medical students, one would expect residents, with greater individual responsibility for diagnosis, therapeutic management, and self-directed learning, to experience potentially more threatening or intense uncertainty in their practice and learning progress. However, research examining residents’ experiences of uncertainty is sparse in the medical education literature.

Of the research conducted on medical students’ experiences of uncertainty, most studies have either confirmed or aligned with Fox’s (1957) seminal findings. Uncertainty is known to cause feelings of threat, anxiety, and stress in medical students; specifically, uncertainty about one’s own professional skills and credibility, fear of making mistakes, coping with responsibility for patient care, and accepting oneself as a learner and developing doctor (Gosh, 2004; Nevalainen, Mantyranta, & Pitkala, 2010). Medical students try to maintain “the cloak of competence” (Guenter, Fowler, & Lee, 2011, p. 120), actively avoiding or disguising situations revealing their uncertainty, or, when dodging is impossible, deflecting the uncertainty to someone’s else’s shoulders (see also Lingard et al., 2003; Lingard, Garwood, Szauter, & Stern, 2001). Fortunately, over the course of medical school, students develop some tolerance to uncertainty (Nevalainen, Mantyranta, & Pitkala, 2010) that continues to build with clinical experience in residency (Farnan et al., 2008).

Managing Uncertainty in Residency

For residents, uncertainty is thought to emerge when they try to apply text knowledge learned in medical school to clinical situations with real-life people (Baresford, 1991; Timmermans & Angell, 2001). In managing uncertainty, residents will consult with other physicians as well as medical literature, but there appears to be a hierarchy in their approach to assistance. In fear of losing autonomy for patient care, revealing knowledge gaps, and risking being perceived as weak and bothersome to attending physicians, residents will first consult their peers and the literature for initial management of their uncertainty. If this approach fails, only
then will they speak to more senior residents before approaching attending physicians (Farnan et al., 2008). In deciding to approach a supervisor for clinical support, residents will plan their request for support, including justification for their request, and target their questions to specific individuals (Kennedy et al., 2009). Similar to medical students, residents also want to appear competent, and this is why they first attempt to address their uncertainty by searching the medical literature for evidence-based approaches to clinical care. Evidence-based medicine is “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients” (Sackett, 1979, p.3). These findings are positive indications of residents actively engaging in self-regulated learning, which is an important ability and outcome of undergraduate and postgraduate medical education curriculums (Brydges & Butler, 2012).

Residents have been found to take either a librarian or researcher approach to using medical literature according to their perspective on how current scientific evidence should be used to make medical decisions. Those who consult the evidence take a librarian approach when searching online databases and published handbooks, general textbooks, review articles, and protocols, focusing on the abstract and conclusion sections to save time. Conversely, residents who evaluate the evidence take a research approach by judging the methodology and findings of primary research and review articles, spending more time gathering evidence (Timmermans & Angell, 2001). Despite their best efforts, several barriers prevent residents from answering their clinical questions, including: electronic access to information sources in clinic settings, poor familiarity with online databases and inadequate search strategies, insufficient time to do online searches due to short patient visit times and competing clinic responsibilities, personal fatigue and burnout, and granted autonomy in decision-making authority by supervising physicians (Green & Ruff, 2005).

While time spent consulting the medical literature means time away from patients, reliance on colleagues for information to address uncertainty also has its challenges. Sometimes
the anecdotal advice residents receive from colleagues and supervisors may not align with the research literature (Schaafsma, Verbeek, Hulshof, & van Dijk, 2005). This is problematic for several reasons. If the incorrect advice is accepted as truth, patient safety could be compromised. If the advice contradicts with a resident’s tentative approach, this can create greater confusion and uncertainty for the resident and ultimately delays in patient care. Conflicting approaches to patient care may lead residents to over rely on superfluous lab testing and technology (van der Weijden et al., 2002), creating unnecessary worry for patients and costs to the health care system, and unresolved uncertainty for residents.

In deciding how to manage their uncertainty, it would make sense for residents to apply the same strategies they use for managing patient care. For example, an evidence-based approach would involve gathering and interpreting evidence about their own uncertainty to make an informed decision about management strategies. Interestingly, learning is not explicitly mentioned as a strategy for managing uncertainty. Similarly, interpreting or making sense of experiences of uncertainty has not been explored as a means of guiding learning.

The Role of Uncertainty in Residents’ Learning

In order to begin thinking about the role of uncertainty in residents’ workplace learning, it is imperative to clarify what I mean by the term ‘learning.’ Learning can be thought of as a process of acquiring medical knowledge and skills as well as an outcome (i.e., knowing medical knowledge and knowing how to do something). As a process, learning is thought to involve both external and internal interactions. Externally, a learner interacts with his or her social, cultural, and material environment; while internally, a learner actively tries to make sense of new and/or conflicting information based on an existing cognitive schema (mental representation of knowledge) that has been shaped by past learning experiences (Illeris, 2003). Experiential learning theory explains how individuals perceive information from their experiences, construct meaning of their perceived reality, and apply their knowledge to new experiences (Kolb, 1984).
How residents interpret and construct meaning of their experiences of uncertainty will likely influence how they actively go about addressing gaps in or clarifying their medical knowledge.

The role of uncertainty in residents’ learning through and from patient care is unclear. The relationship between uncertainty and learning is not explicitly discussed in the medical education literature. However, some clues can be drawn from studies examining how residents self-assess their learning during practice. Self-assessment can be enacted in preparation for practice, in practice, as well as on practice (Eva & Regehr, 2005). Self-assessment in practice involves ongoing monitoring during performance, while self-assessment on practice involves summative reflection on completed performances. According to Eva and Regehr (2005), a resident who is self-monitoring in practice may internally ask themselves questions along the lines of:

Is this coming out the way I expected? Am I still on the right track? Am I in trouble?
Should I be doing anything differently? Should I persist in the face of negative feedback from the situation (things are not going the way I thought they would)? Do I need to recruit additional resources (internal resources such as attention or external resources such as advice/assistance)? (p. S47)

It is possible that feelings of uncertainty serve as internal feedback to prompt residents to self-assess their approach to patient care and determine whether or not they need to consult external resources to address potential gaps or contradictions in their medical knowledge.

Donald Schön (1983) suggests that professional practice is laden with indeterminate zones of practice that require reflection. These areas of uncertainty prompt practitioners to transition from knowing-in-action to reflection-in-action. Knowing-in-action is described as the unreflective state of implicitly going about one’s work, applying procedural and tacit knowledge without conscious cognitive effort. This transition to reflection-in-action is thought to involve a “stepping up” of cognitive resources (Eva & Regehr, 2005, p. S51) in order to resolve cognitive
conflicts. Schön posits that cognitive conflicts are resolved through construction of well-formulated problems. Nevertheless, an understanding of how residents self-assess their uncertainty during patient care, so as to clearly identify problem(s) with their medical knowledge, (i.e., a knowledge gap or conflicting knowledge) remains elusive. Similarly, the process in which residents self-identify the moment in time when they transition from knowing-in-action to reflection-in-action is not well understood.

Summary

In summary, medical education research on clinical uncertainty has focused on medical students’ experiences, feelings, and reactions to uncertainty, and less attention has been given to residents (Farnan et al., 2008; Green & Ruff, 2005; Timmermans & Angell, 2001). This is problematic given the suggestion that residents experience greater uncertainty because of their responsibility for more independent patient care (Fox, 1957, 1980). Since Family physicians, as generalists, are thought to encounter greater uncertainty in their decision-making, it is concerning that research on resident uncertainty has been limited to medical specialties (Farnan et al., 2008; Green & Ruff, 2005; Kennedy et al., 2009; Timmermans & Angell, 2001).

Over the last 60 years, the prevalence of uncertainty in the medical literature has increased alongside the growing interest in evidence-based medicine and patient-centered care (Han et al., 2011; Sommers, 2013). Unfortunately, discourse on uncertainty continues to carry a negative undertone. This is because uncertainty is predominantly viewed as a negative and stressful experience that has to be dealt with or managed to ensure patient safety (Bovier & Perneger, 2007; Nevalainen et al., 2010). Since Fox’s seminal work in 1957, very few researchers have considered the possibility that uncertainty can be a positive opportunity for learning medical practice and improving patient care (Lee, King, Eva, n.d.). It is probable that recognized and acted upon uncertainty can have a positive effect on residents’ learning. However, the relationship between uncertainty and learning medical knowledge is still not well understood,
thus exposing a need to examine the role of uncertainty in residents’ learning to be competent
Family physicians through and from patient care.
Chapter 3

Conducting the Research

In this Chapter, I briefly describe my approach to the research, as well as the method that I used to address my research questions (see Chapter 1). This includes a description of the research setting, participants, recruitment, data collection, data analysis, and reporting of findings. The chapter ends with a brief summary of the steps that I took to build trustworthiness and credibility as researcher.

My Methodological Approach

A qualitative approach was used to gather Family Medicine residents’ self-reported emotions, thoughts, opinions, and attitudes regarding their lived experiences of uncertainty while learning how to care for patients. Qualitative research is an interpretative, naturalistic approach to inquiry about our world. When doing qualitative research, we strive to make sense of the meanings people attribute to their experiences of social phenomena (Denzin & Lincoln, 2008). While this study explores a phenomenon, and how individuals “perceive it, describe it, feel about it, judge it, remember it, make sense of it, and talk about it with others” (Patton, 2002, p. 104), my study is not a phenomenology. My intention was not to describe the essence of what it means to live a life of uncertainty as a Family Medicine resident, but rather to better understand how residents construct meaning of their experiences of uncertainty in learning through practice. The former would require many lengthy conversations with residents (VanManen, 1997), which is something they could not give me, and I could not expect of them, because of their limited time outside of clinical practice and independent study. In contrast, the latter could be accomplished through in-depth, semi-structured interviews, where residents could voice, in their own words, stories (narratives) of their experiences of uncertainty. Personal narratives offer a window into the meanings that people attribute to their experiences (Patton, 2002). The language and emotion that
participants use to voice their experiences is telling, and my role as a researcher was to accurately interpret and represent their stories in my descriptive report of the research findings (Sandelowski, 1991). In transcribing conversations into written text, carefully selecting quotes that exemplify the themes that have emerged from participants’ stories, and then describing findings and connections amongst themes, I tell a story that illuminates the educational implications for uncertainty in learning Family Medicine.

**The Research Setting**

I conducted my research in the Department of Family Medicine (DFM), at Queen’s University. As previously mentioned in the Introduction (Chapter 1), I was given the opportunity to build my Master’s research onto an existing study that was happening in the DFM through the Centre for Studies in Primary Care (CSPC). The CPSC is a research facility focused on improving primary health care practice, delivery, and education at the local and national levels (CSPC, “Home,” n.d.). The CSPC supports educational research that focuses on improving the quality of Family Medicine training and curriculum (CSPC, “Family Medicine Education Research,” n.d.), providing an environment for medical students, Family Medicine residents, graduate students, allied health professionals, research trainees, and practicing Family physicians to receive research training (CSPC, “Research,” n.d.).

Queen’s University offers a two-year core program in primary care medicine at four sites: Kingston-Thousand Islands, Belleville-Quinte, Peterborough-Kawartha and Bowmanville-Oshawa-Lakeridge. The Kingston-Thousand Islands (KTI) site was selected as the setting for the “How Residents Learn” study, as well as my research, for reasons of convenience and access to residents. Kingston is the home of the CSPC, as well as the Faculty of Education. In balancing the dual roles of Research Assistant (for the “How Resident Learn” study) and Principal Investigator (for my own research), it was important for me to have close access to Dr. Griffiths and Dr. Van Melle in the CPSC, my supervisor, Dr. Klinger, in the Faculty of Education, and my participants
who practice in Family Medicine clinics (e.g., The Queen’s Family Health Team located within
the Department of Family Medicine) and university hospitals (Kingston General Hospital, Hotel
Dieu Hospital, and Providence Care) located in Kingston and surrounding rural areas (e.g.,
Napanee).

Participants

The Queen’s Family Medicine program seeks prospective residents who are “committed
to Family Medicine and who bring a variety of experiences and talents that will help enhance
their own development as a physician and their colleagues’ learning as well” (Schultz, 2014, 3rd
paragraph). Each year, the KTI site accepts fifty new residents into the core Family Medicine
(FM) program. The two-year program is based around core FM rotations, complemented by
rotations in Internal Medicine, Surgery, Obstetrics and Gynecology, Pediatrics, Psychiatry,
Emergency Medicine, and Palliative Care Medicine or Care of the Elderly.

In second year, residents complete twenty-four weeks of community-based core rotations.
Training is mostly workplace-based learning, with residents completing clinical duties four days
per week. Two half-days are scheduled each week for faculty-led and resident-directed
teaching/learning sessions. In clinic, residents collaborate with a team of healthcare providers,
including nurses, nurse practitioners, pharmacists, social workers and administrators to provide
care to a population of over 12,000 patients from a wide variety of social and economic
backgrounds (Queen’s University Department of Family Medicine, “PGY1 Core Family
Medicine Rotations,” n.d.).

Participant Recruitment

Given the alignment between the objectives of the “How Residents Learn” study, and my
own research, and my dual roles as Research Assistant and Principal Investigator respectively, I
opted to recruit FM residents who were willing to participate in both studies sequentially. This
meant that each participant was responsible for completing: (a) 10 SSOs on a Family Medicine
rotation over a one-month period for the “How Residents Learn” study and then (b) an individual in-depth interview scheduled at their convenience for my Master’s research. Prior to recruitment, ethical approval was obtained from the Queen’s University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board for both studies (for my letter of approval, see Appendix A).

Because of the large time commitment that comes with participating in two studies sequentially, I anticipated that recruitment would be challenging. To help with recruitment, we intentionally kept the inclusion criteria broad. KTI Family Medicine residents were eligible to participate if they:

- Were in either first- or second-year of the core Family Medicine program,
- Were currently on a Family Medicine rotation and would remain on this rotation for at least another 30 days, and
- Had a smartphone with audio-recording capacity (e.g., iPhone, Blackberry or Android)

To recruit participants, I used multiple sequential strategies, including: email invitations, presentations, and a financial stipend (Table 1). After two months, and having only recruited two residents, we decided to broaden our inclusion criteria to include residents from the Belleville-Quinte site.

Drs. Griffiths and Van Melle had wanted a total of 12 participants, with an even mix of first- and second-year residents. However, in the end, I was only able to recruit 11 participants; of which, 5 were in first-year (3 males, 2 females) and 6 were in second-year (3 males, 3 females). Eleven participants would still provide a total of 110 SSOs, and a wealth of detailed information during interviews. Since it is not the intention of this research to generalize findings to the larger population, I felt that the number of participants was not as significant as the quality or depth of information that was collected. And given the large time commitment required for participation, I assumed that those who volunteered their time would be interested in their own learning as
residents, and therefore rich informants. In qualitative research, sample adequacy is more important than sample size. When data saturation is reached, and the research questions are answered, the sample is considered to be adequate (Bowen, 2008; Marshall, 1996). During interviews, if I did not reach data saturation, my plan was to recruit additional participants.

Table 1

*The Steps and Strategies used to Recruit Participants*

<table>
<thead>
<tr>
<th>Step</th>
<th>Strategy</th>
<th>Date</th>
<th>Participants recruited</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Email invitation</td>
<td>Sept. 9</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Presentation at BIG Briefs to PGY1s</td>
<td>Sept. 23</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Dr. Griffiths’ forward + email invitation</td>
<td>Oct. 11</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Presentation at Belleville-Quinte site</td>
<td>Oct. 29</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Dr. Griffiths’s forward + email invitation + $100 stipend</td>
<td>Nov. 4</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Condensed email invitation + $100 stipend</td>
<td>Nov. 20</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Presentation at Academic Day PGY1s</td>
<td>Nov. 26</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Presentation at Academic Day PGY2s</td>
<td>Nov. 28</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>11</strong></td>
</tr>
</tbody>
</table>

**Participant Orientation**

After expressing interest in participating either in person or through email, the recruited residents met with me individually at the Department of Family Medicine (220 Bagot St. or 115 Clarence St.). This meeting was an opportunity for these residents to ask clarifying questions about the studies (the “How Residents Learn” study and my research) and their potential involvement, review and sign the separate letters of information and consent forms (see Appendix
B and C), and receive instructions for data collection steps and timelines for completing the 10 SSOs and the semi-structured, in-depth interview. During their orientations, all 11 residents agreed to participate in both studies and signed both consent forms.

**Method**

Following completion of data collection for the “How Residents Learn” study, I contacted each of the 11 participants to schedule their individual interviews. In my email, I clarified the purpose of the interview and explained that I would be asking them questions about their personal experiences of uncertainty, how they manage their uncertainty in practice, and their views on uncertainty in relation to learning. Nine of the 11 residents agreed to participate in an interview at this time; of whom 5 (3 males, 2 females) were in their first-year, and four (2 males, 2 females) were in their second-year of training. Eight of the participants were from the Kingston Thousand Islands (KTI site), and one participant was from the Belleville Quinte (BQ) site. Of the participants from the KTI site, many had experience practicing in rural community settings similar to the participant situated in the BQ area. The attrition was due to participants having moved on from their Family Medicine placement to a new elective rotation in a different city. With the transition, two residents felt that they did not have time to participate in an interview.

**Development of the Interview Guide**

The interview guide (see Appendix D) was developed in consultation with my supervisor, Dr. Klinger, and Dr. Elaine Van Melle. During our meeting, we discussed my research questions, potential interview topics, and my approach to conducting interviews. Since my research questions were exploratory in nature, I prepared a set of open-ended interview questions based on topics that I wanted to discuss with participants. However, during the interviews, I was careful not to rely on the questions verbatim. Instead, I let participants take the lead in sharing their perspectives and experiences, and referred to my questions as needed in seeking clarification and
bringing the conversation back on topic. This helped me ensure that the same lines of inquiry were discussed with each person (Patton, 2002)

**Interviews**

The semi-structured interviews were conducted over a two-week period in a study room (018) located in the New School of Medicine Building at Queen’s University. I purposefully selected this location because of its familiarity and neutrality. It is located centrally on Queen’s main campus, near the Health Sciences library and Kingston General Hospital, yet removed from the Department of Family Medicine and postgraduate training because of its use for Undergraduate Medical Education. Each interview lasted between 25 to 45 minutes.

Interviews took the form of informal conversations with participants. By this point in time, I had already met with participants at least once (during their orientation), and had been in close email correspondence with them over the last month to monitor and track their completion of 10 SSOs (for the “How Residents Learn” study). My interactions with participants as a Research Assistant up to this point helped to establish a track record of my accountability and professionalism as a graduate student. Before each interview, I reminded participants of my neutral position as a graduate student, thanked them for their interest in contributing to my Master’s research, and asked whether or not they were comfortable with our conversation being recorded for transcription purposes.

During interviews, I periodically summarized what participants had told me in my own words to check the accuracy of my interpretations. This provided participants an opportunity to elaborate on, or clarify, their narratives. Once participants had addressed all of the topics on the interview guide, I gave them the opportunity to share anything that they felt was important for me to know about their experiences of uncertainty that we had not discussed already. I also asked if they had any questions that they wanted to ask me.
In bringing the interview to a close, I thanked participants for their conversation and the time they devoted to my research. I asked participants if they would be willing to review a summary of their interview to ensure that I had accurately interpreted their perspectives. All nine participants agreed to review their summary. Before leaving the room, I provided each participant with their research stipend (for participating in the “How Residents Learn” study, as well as my Master’s research). After each participant left the room, I wrote reflexivity notes about the context (time, place, environment), and content of the interview, including reflections on: the overall quality of the interview, information that stood out to me, and any emerging questions, ideas, or themes.

Transcription and Interview Summaries

A local transcriptionist transcribed the interviews verbatim and I checked each transcript for accuracy, making revisions as needed. In the three weeks following interviews, I emailed each participant a summary of their reported experiences and perceptions from our conversation. Each of the 9 participants confirmed that they had reviewed their summary and that I had accurately captured their experiences and viewpoints. One participant provided two minor content amendments.

Data Management

NVivo 10 for Windows software (QSR International Pty Ltd, 2012) was used for data management and coding. All transcription files were entered into NVivo 10 as word documents. Electronic copies of all transcription files and audio-recordings were also stored on my password-protected computer.

Data Analysis

In qualitative research, the distinction between data collection and analysis is blurred (Patton, 2002). During interviews, themes started to emerge from participants’ narratives. While the first two interviews were generative and emergent, by the third interview, I began noticing
themes. Themes continued to emerge until about the fifth interview, and by the seventh interview, I had hit data saturation and was no longer noticing new insights through participants’ narratives. For the remaining two interviews, I was careful to maintain an open mind and to actively listen for perspectives that potentially disconfirmed dominant insights.

All interview transcripts were thematically analyzed in an iterative manner. In the first reading, I made note of recurring topics in the margins and tried to comprehend the general perceptions and views of residents. From these topics, I generated my initial coding scheme. My next step was to go through each transcript, one by one, paragraph by paragraph, applying the coding scheme and creating new codes as needed. A total of 14 broad codes represented the data.

After coding each transcript, I read through the data within each code checking for internal homogeneity and external homogeneity (Patton, 2002). If subcategories were apparent and meaningful (i.e., brought further clarity to the category), I sub-coded the data accordingly. Following completion of coding, relationships amongst codes became apparent and themes emerged (a list of codes, categories and themes are found on page 38).

**Reporting Findings**

I have organized the findings so as to provide answers to my three research questions. Participant quotes that exemplify the most predominant themes are used as titles. Direct quotes are also used as evidence to substantiate my descriptions of participants’ perceptions and experiences of uncertainty (Patton, 2002). To protect the identity of participants, each individual was assigned a pseudonym.

**Building Trustworthiness and Credibility as a Researcher**

In conducting a qualitative inquiry, I was a subjective instrument in collecting, analyzing, and interpreting the data (Patton, 2002). To improve the quality and credibility of my findings, I took deliberate actions to build trustworthiness as a researcher. Throughout recruitment, data collection, and data analysis, I wrote reflexive journal entries that serve as a personal audit trail of
my actions, thoughts and ideas. During interviews with participants, I frequently asked clarification questions and repeated back summaries of their narratives to check for understanding. Following transcription, I prepared interview summaries for each participant and asked participants to check the content and my interpretations for accuracy. Lastly, while analyzing the interview data, I discussed the codes, categories and themes with my supervisor.

In the following Chapter, I will discuss the major findings from the participant interviews. And finally, in Chapter 5, I will interpret and discuss the findings in relation to previous research on clinical uncertainty and resident learning.
Chapter 4

Results

A total of fourteen broad codes represented the data. In reviewing these codes for similarities and differences, five categories and four themes emerged (Table 2). Using the aim of the study and the research questions as the foundation for analysis (see Chapter 1), I analyzed the interview content to identify patterns in how these Family Medicine residents experience, manage, and view uncertainty in their learning. The themes I present are the commonly expressed views and experiences of participants.

The major findings are organized as answers to my three research questions. Experiences or perceptions were considered common if the majority of participating residents expressed them.

Table 2

*Codes, Categories and Themes*

<table>
<thead>
<tr>
<th>Codes</th>
<th>Categories</th>
<th>Themes</th>
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</thead>
<tbody>
<tr>
<td>Prevalence of uncertainty</td>
<td>Experiencing uncertainty</td>
<td>Uncertainty is a common and potentially uncomfortable experience for FM residents.</td>
</tr>
<tr>
<td>Feeling uncertain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Addressing uncertainty</td>
<td>Managing uncertainty</td>
<td>FM residents strategically approach managing their uncertainty according to their assessment of how patients and supervisors will react.</td>
</tr>
<tr>
<td>Interacting with peers</td>
<td></td>
<td></td>
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<tr>
<td>Interacting with patients</td>
<td></td>
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<tr>
<td>Interacting with preceptors</td>
<td></td>
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</tr>
<tr>
<td>Reluctant to share uncertainty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nature of uncertainties</td>
<td>Uncertainty changes over time</td>
<td>As FM residents gain confidence and become more comfortable with uncertainty, the nature of their uncertainty changes.</td>
</tr>
<tr>
<td>Med. school vs. residency</td>
<td></td>
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<tr>
<td>Projecting into practice</td>
<td></td>
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<tr>
<td>Preceptor shares uncertainty</td>
<td>Learning about uncertainty</td>
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<tr>
<td>Education on uncertainty</td>
<td></td>
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<tr>
<td>Role of uncertainty in learning</td>
<td>Function of uncertainty in learning</td>
<td>Uncertainty cues FM residents to gaps in their medical knowledge and/or clinical skills.</td>
</tr>
<tr>
<td>Tips for learning in residency</td>
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</table>
during interviews. Less common views are included and noted only when they add further insight to the residents’ narratives. For each theme, direct quotes were also used as evidence and clarification to substantiate my descriptions of residents’ perceptions and experiences of uncertainty (Patton, 2002). To protect the identity of participants, each individual was assigned a pseudonym and referenced according to their year of training (Y1 = first year, Y2 = second year).

**Question: As learners, what is it like for Family Medicine residents to experience uncertainty when making patient care decisions?**

*Daily for Sure, if Not Hourly.*

According to the residents participating in this study, uncertainty is a common and potentially uncomfortable experience. The residents experienced uncertainty with nearly every patient encounter. Feeling unconfident about a patient’s criticality, and knowing their inexperience and incompetence could negatively impact a patient’s outcomes, made the residents feel uncomfortable with their uncertainty.

Given that participating residents were in the process of learning the knowledge and skills they needed to practice independently, it is not surprising that they frequently felt uncertain when making patient care decisions. Throughout the interviews, both first and second year residents spoke about how common it was for them to feel uncertain. For example, Thomas, a first year resident noted that with “almost every patient there's certain points where I feel uncertain.” Similarly, Tory, a second year participant stated, “I experience uncertainty on a daily basis and possibly at some level with every single patient I see. Very rarely am I, ‘This is 100 percent this, and I'm so sure there's absolutely no chance that I could be wrong.’”

For many of these residents, feeling uncertain was an uncomfortable experience when they realized that patients could be negatively impacted by their lack of experience and competence. Participants described feeling “uncomfortable” [Max, Y1], “uneasy” [Andrew, Y1],
“worried” [Tory, Y2], or “scared,” [Julia, Y1] when they recognized the potential for their patient to have a negative outcome (e.g., cancer, losing their driver’s license), and the residents didn’t feel confident in their medical decision-making. As Tory [Y2] explained:

I find the reason that I'm uncertain about something […] is because I'm worried that there's something big that I'm missing; something that might really affect the person, as opposed to something benign. You know, someone comes in with a cold and you're like, ‘oh, could it be pneumonia? Maybe?’ You're not as worried because you can give [them] good instructions on when to come back. But, certain things that are more worrisome, or could really sneak up on people, those are the ones that make me more nervous, and that's because I'm afraid of an adverse outcome that could result because of my perceived lack of knowledge or my lack of knowledge.

Besides feeling uncomfortable out of concern for their patients’ outcomes, these residents were also troubled by the self-doubt that uncertainty raises internally. Several participants noted that uncertainty also made them feel “unsettled” [Joel, Y2] or “uneasy” [Adam, Y1] because it called into question their medical knowledge and/or clinical decision-making skills.

Interestingly, the residents recalled feeling more “comfortable” with their uncertainty when they were confident in their assessment of a patient’s criticality, but unsure about the diagnosis or what the treatment plan should be. For example, Linda, a first year resident described feeling comfortable with knowing something was seriously wrong with one of her patients: “I was comfortable with not knowing what was going on. I thought it was something bad going on, but I was comfortable knowing that.” Similarly, Max [Y2] wasn’t “uncomfortable” when he didn’t know how to care for his patient with recurrent cellulitis. He explained that because it was a chronic issue, he didn’t feel uncomfortable with his uncertainty:

I don’t think I was uncomfortable per se, I just didn’t know what to do. I think for me there is a difference between feeling uncomfortable if she was dying in front of me and I
didn’t know what to do – then I’d feel uncomfortable right? But this has been a chronic issue and it wasn’t really something I was really too uncomfortable with. Obviously I wanted to help her out, but I didn’t feel uncomfortable, but I did feel uncertain. Therefore, it would appear that the incompetence to recognize or rule out potential red flags makes residents feel more uncomfortable than the inability to come up with an accurate diagnosis or treatment plan when caring for a patient.

**Question: What strategies, if any, do FM residents use to manage their uncertainty when caring for patients?**

*I think [uncertainty] is a prevalent thing in medicine, and it’s always there. You just need to have approaches to dealing with it.*

Participating residents strategically approached the management of their uncertainty based on their assessment of how the patient and supervisor would react. When interacting with patients, the residents would censor their uncertainty according to the patient’s age, personality, criticality, and apparent frustration. Similarly, when deciding how much uncertainty to express to supervisors, context mattered. The residents would consider the department they were working in, the rapport they had with the supervisor, the urgency of the patient care situation, and the nature of their uncertainty.

**Strategies for managing uncertainty when interacting with patients.**

Participating residents explained that when they were interacting with a patient and they were uncertain about their plan, they tried to “remain calm” [Linda, Y1], and not let their uncertainty “come off on” the patient through their “body language or what [they]’re telling them” [Nathan, Y2]. In most cases, these residents preferred to be “forthcoming” [Andrew, Y1] and “honest” [Tory, Y2] in divulging their uncertainty to patients. As Tory [Y2] described:
I find with patients, I always try to be honest if there is something I'm not sure about. [For example,] if it’s a dose of a medication, and I tell the patient ‘you know, I don't prescribe this often. Let me just double check to make sure the dose is correct’ […] If I’m seeing something and I want a second opinion, I try to be very open with the patient as well, and say ‘you know, I’m not worried about it. I think this is fine, but let me get my supervisor to have another look and make sure, absolutely, we have a good plan in place.’ I find patients are very reassured by that as well, because they realize that you are trying to do the best job possible, and that sometimes you need the second pair of eyes, and that you are still a learner.

However, there were specific situations in which participants purposefully censored their uncertainty when interacting with patients. As Linda and Julia explained, if they suspected that something was seriously wrong with a patient, and they felt that “the patient would be negatively impacted by thinking that their physician doesn’t know what's going on” [Linda, Y1], they were less open about their uncertainty:

I can't realistically tell her that there's nothing wrong, but I also don't think that this is stage four Cancer and she’s going to die from it, or anything like that. So I'm looking and trying to think in my mind, ‘OK, what could this be? What am I going to tell her?’ Balancing [that] I don't want to be paternalistic and tell her ‘Oh it's nothing. We'll take care of it,’ and I don't want to be causing her unnecessary sleepless nights by saying I'm worried [Julia, Y1].

Similarly, participants recalled being more reserved about their uncertainty when they could see that their patient was frustrated with their medical problem. Thomas [Y1] provided an example of this when he said:

I oftentimes will see how frustrated the patient is with his or her own question, before divulging if I'm unsure about something. So, I can think of a few patients in particular
where they were frustrated with whatever medical question they had brought in to me already. So them hearing from me that I don't know what’s going on is just going to make things worse.

In other instances in which participants chose not to voice their uncertainty, they remembered making their decision according to how they thought specific patients would react, based on their personality and/or age. For instance, Julia [Y1] described her approach for gauging how much uncertainty to reveal to patients:

Some patients want their doctor to be a little more paternalistic and say, ‘This is what we're doing.’ Like some older patients expect that and almost will think you're a bad doctor if you don’t tell them what the answer is. [Whereas with the] more younger generation it’s like, ‘Well no. I’m in control of what happens to me and let's talk about this together.’ So gauging how much uncertainty your patient wants you to display to them is also a learning curve. […] It depends on age, but also personalities, because there’s the whole spectrum across the age range. So it’s just kind of putting out feelers a little to see how much people want to be engaged in making decisions.

The role of context when expressing uncertainty to supervising physicians.

Context mattered to the residents in deciding how much uncertainty to express to supervising physicians. Fearing being perceived by some supervisors as “weak” for showing too much uncertainty, the residents strategically approached getting the information they required to confidently implement patient care. Both patient situations and supervisors influenced the residents’ decisions to push their thinking, censor their uncertainty, and, in some cases, seek help from other healthcare providers.

As long as their patient was not in any immediate danger, the residents felt strongly about trying to be autonomous in coming up with a management plan before seeking help from their supervisor or another staff physician. For instance, Max [Y1] explained that when he gets stuck
and does not know what to do next with a patient, he will “try to push [his] brain to keep thinking about ‘what am I going to do? What am I going to do? What am I going to do? What’s my next step of attack? If this, then what?’ […] because [it] build[s] that skill, that clinical competence.” Likewise, Sasha [Y2] will “calm [her]self down and figure out, ‘OK, what’s the next step? Where can I go?’” Andrew [Y1] similarly described pushing his thinking to avoid “anchoring” on a diagnosis prematurely by “ignor[ing] evidence that doesn’t support your position.”

While some of the residents, Like Max and Andrew, believed that trying to be autonomous was “the best way to learn” [Andrew Y1], others felt compelled to independently come up with a defensible plan because that is what supervisors “want” [Thomas Y1, Julia, Y1] when residents approach them for help. For example, Andrew [Y1] viewed coming up with a plan as an opportunity to “float [his] ideas to get some feedback on [his] thought process to see if [he’s] heading in the right direction.” Whereas Julia, another first year resident, occasionally perceived having to come up with a plan as being forced into a difficult position by preceptors:

Part of the training is learning how to come to a plan and defend it, even though you know that there are other options. And some preceptors can be hard on you if you don't have a plan, and sometimes you really don't know. But getting over that uncertainty to an action, at the end of the day, is what you have to do. But it's hard as a learner when you're like, ‘I just don't have the experience. I don't have the knowledge to make this choice safely. You have to help me do this because I don't know.’

Given that participating residents had varying views on trying to be independent, it is not surprising that they also had different thresholds for consulting their supervisor about their uncertainty. Even though all of the residents wanted to feel like they could go to their preceptor for help at any point in time, many described situations in which they were hesitant to ask for support in their decision-making. This may have been because they were afraid to be seen by their preceptors as “weak,” “not any good,” [Julia, Y1], “stupid” [Max, Y1], not “confident,” or
“lacking knowledge” [Tory, Y2]. In addition, some participating residents, like Sasha [Y2], thought that expressing uncertainty could “reflect negatively on [her] end of report.” When deciding whether or not to broach their uncertainty with their supervising physicians, the residents would take into consideration the department they were working in, the rapport they had with the supervisor, the urgency of the patient care situation, and the nature of their uncertainty.

Participating residents perceived certain departments to be more or less accepting of uncertainty. For example, Julia [Y1] explained her frustration about not knowing how much uncertainty to reveal to preceptors when working in surgical settings or the Emergency Department:

> It can be very frustrating to not know how much uncertainty to show, because in some settings, like surgical settings or in the Emergency Department, preceptors are use to making decisions and sticking with it, and making big decisions quickly. They tend to look down on uncertainty. They see it as a weakness. […] But then in Family Medicine and in Psychiatry for example, there is more tolerance for uncertainty, and I think that also goes with the territory that there isn't a right answer for a lot of things.

Likewise, Thomas [Y1] found divulging his uncertainty to be “tricky” when working in Internal Medicine because “You don't know how that particular person will respond.” These residents had identified a challenge in terms of expressing uncertainty across different contexts and personnel. As Sasha [Y2] noted, “it’s very staff dependent.” There were individual differences in the way preceptors reacted to the residents’ uncertainty. The residents’ rapport with certain preceptors influenced their decision to approach these physicians for help in resolving their future uncertainties. These findings suggest that the expression of uncertainty might change for these residents based on their growing comfort or discomfort with specific preceptors.

Another factor that participating residents considered when deciding how much uncertainty to reveal to preceptors, was the criticality of the patient care situation. Andrew
commented that from his experience, “if it’s a more acute situation, like what happened last night [very sick patient in the Intensive Care Unit], people don't really have time or patience for that. And when you seem uncertain [and] indecisive, it makes people question your credibility and their confidence in you. If it’s not an acute situation, then people are more forgiving.” Again, this statement highlights participants’ concerns about being perceived as incompetent for expressing uncertainty in their decision-making in urgent contexts.

Although the residents recognized the potential risks they posed to patients when concealing their uncertainty from preceptors, all participants could identify specific situations in which they were typically unwilling to ask for help in making a decision. Several individuals noted that they were reluctant to go to their preceptor if “it’s something simple that [they] should know” [Max, Y1], because they “have been taught it before and either forgotten it or just not practiced it, or not seen it enough” [Sasha, Y2]. For example, Tory [Y2] recalled times where she has internally struggled with uncertainty around managing routine medical issues:

This is the bread and butter of what I do. I should know this. I really, at this point, should not be asking for help. I'll be on my own in three months and there will be no one to ask, and these are such simple things that I really should be comfortable with by now.

Similarly, Tory also noted she would be hesitant to ask for guidance on topics for which she had previously sought similar advice. Like Tory, other participants explained that they would try and look up the information they needed online, or go to another health professional, to avoid a negative comment or evaluation from their supervisor.

Once again, the context mattered for these residents. In these cases, the potential impact on how preceptors would perceive the resident’s competence, on concepts and practices considered more routine or previously considered, influenced the resident’s decision to express uncertainty. As Joel [Y2] summarized, “To be totally honest about it, I think that most of us as
residents are reluctant to admit uncertainty when we think that it is going to impact the way our preceptor will think of us or evaluate us.”

**Question: How have participants’ experiences of uncertainty changed over time since starting residency?**

_You learn to become a lot more comfortable with uncertainty._

Over time, participating residents became less uncertain, and noticed the quality of their uncertainty change. Through gaining experience and being mentored by more experienced physicians, these residents developed confidence in their decision-making and some comfort with uncertainty. Despite these changes in competence, the residents nearing the end of their training still had concerns about managing uncertainty post graduation – once they are out in practice.

During the interviews, participating residents were asked to explain how their experiences of uncertainty have changed over time. In doing so, the residents often made comparisons between their experiences learning in clerkship (3rd and 4th year of medical school) and residency. They explained that while it is possible for medical students to become aware of uncertainty during clerkship rotations, the amount of uncertainty they experience depends on the responsibility they take for independently trying to make patient care decisions, and comparing their decisions to those of more experienced physicians. This is because medical students see patients alongside residents and attending physicians who have more decision-making authority. There are fewer risks for medical students when expressing thoughts or opinions due to this lack of decision-making power. Thus medical students do not have a lot of investment in the patients they observe. They may not know what to do in a variety of medical presentations, but they feel much more free to explore their developing knowledge without risk. Uncertainty was not something they often thought about as medical students. This changes as one enters residency, and the residents “feel a lot more ownership” [Andrew Y1] towards patients, decisions, and
subsequent actions. As a result, the residents continue to think about their decisions and actions, and this thinking increases uncertainty. There can be important patient consequences based on their decisions, and the residents feel the weight and import of their decisions.

When reflecting on their transition to residency training, participants described a heightened level of uncertainty that came with having to apply the knowledge they had learned in medical school to independently make patient care decisions for the first time. For example, Sasha [Y2] highlighted the struggle she had with uncertainty when starting residency training: “It’s not that the medical knowledge wasn’t there, I just wasn’t able to apply my medical knowledge to the clinical situation. I wasn’t confident in how to go about it in terms of finding a management plan. I wasn’t used to that uncertainty.” This perceived inability to apply medical knowledge suggests a possible disconnect between what medical students are learning, how they are learning, and opportunities to practice applying what they have learned.

In the first few months of training, participants remember feeling uncertain about almost everything, including: their “scope [of practice]” or “role” as a resident, and “where [they] fit in to the hierarchy with the staff physician, and how much autonomy [they] actually have” [Andrew, Y1]; whether or not they are “being safe [with patients]” [Joel, Y2]; and “the basic mechanics of doing a pap” [Julia, Y1] or other common examinations. As may be expected, the skills and knowledge obtained during residency resulted in reduced uncertainty regarding patient decisions and actions. And within months, participants noticed their uncertainty shifting to be about “the actual medicine; […] making those hard decisions and learning what the best thing is for people with a given problem” [Julia, Y1]. As Joel [Y2] summarized “the character of the uncertainty has definitely changed.” Over time, the focus on uncertainty moved from large overall issues about the residents’ increasing responsibility and their potential impact on patient safety to be more focused on specific details and actions of patient-centered care, “fine tuning points” [Joel, Y2].
The residents in the second (final year) year of training described different forms of uncertainty. These uncertainties were focused on the next level of responsibility in which the residents would soon have complete independence in making patient care decisions and running their practice. Some were heavily focused on the “business professional side of things” [Nathan, Y2], including how to take over or set up a practice, and how to bill patients.

Over time, as these residents accumulated experience caring for patients presenting with diverse medical problems, they became more confident in their decision-making. Both Sasha and Joel illustrated this point when they said, “Seeing more and more patients, not even studying or anything like that, but just getting more experience has made me more and more confident” [Sasha, Y2] and “The more you see, the more you get used to, what the standard [of care] is for that kind of a presentation.” [Joel, Y2]. Tory [Y2] also commented that in addition to gaining experience through seeing “volumes” of patients, having your supervisor encourage you to make independent decisions is also helpful for getting used to uncertainty. On retrospection, the second year residents identified a gradual release of responsibility that enabled them to prepare for their independent practice.

In addition to gaining confidence in their decision-making, these residents also became more comfortable with uncertainty over time. Through having conversations with more senior physicians whom they had built a rapport with, the residents learned that they were not alone in experiencing uncertainty, and that “you’re never going to know everything” [Nathan, Y2] and for many, this was quite reassuring. For example, Joel [Y2] and Thomas [Y1] both emphasized this when saying, “I think it’s definitely reassuring as a trainee to hear trained doctors, or graduated doctors, say that there are still times where they don't know either, and times that they have uncertainty. That's definitely reassuring” [Joel, Y2] and “I think I became a little more comfortable actually that my preceptor was unsure, so having someone much more experienced
than myself also sit in that territory of not knowing what’s going on, I was able to sit there a bit more comfortably” [Thomas, Y1].

However, for some participants, the realization that uncertainty is not exclusive to new trainees was a double-edged sword. While the residents felt reassured to know uncertainty affects all physicians, regardless of years of experience, the fact that they would always face uncertainty was troubling. Julia [Y1], illustrated this point when she said: “It’s comforting to know that it’s not unique to my stage of training and that it’s something that all physicians face to some extent. But, it can also be a little bit unsettling to know that it won't go away.”

Interestingly, participating residents viewed these conversations with supervisors or more experienced physicians as informal education on how to deal with uncertainty. Although none of the residents could recall having received any formal education on managing uncertainty in clinical decision-making, they all received the same message about uncertainty from more senior physicians, and that is: As residents, you have to learn how to deal with uncertainty because it doesn’t go away with experience. Tory [Y2] provided an example of conversations she has had with preceptors that highlights this message: “Preceptors certainly talk a lot about uncertainty and uncertainty in medicine and how to deal with it, because they do recognize it in their learners as a huge issue, and they sort of tell you, ‘This doesn't go away necessarily.’” Tory also went on to say that she had similar conversations with some of the younger staff, and the message being conveyed is still the same. Tory and others acknowledged that the preceptors did reassure them that it would get better over time. However, as Andrew [Y1] clarified, even though it is reassuring for participants to know that their preceptors also experience uncertainty, not all preceptors may be comfortable sharing their uncertainties with residents:

I think it depends on the person. The preceptors I have right now in Family Medicine, they’re pretty collegial and open and honest, and if they encounter circumstances where
they don’t know what to do, they're pretty forthcoming about that. I've certainly had other cases where that's not the case.

**Increasing concern about uncertainty in transitioning to practice**

Even though the residents gained confidence in their decision-making, and became more comfortable with uncertainty during residency, all participating residents, including those nearing the end of their training, were worried about experiencing uncertainty after graduation. They expressed concern about being the physician who is ultimately responsible for their patients, and not having the support of their supervisor when making patient care decisions:

I think it will be very different from the uncertainty I have now, because now, at the end of the day, I still know there is someone else more responsible than me; someone who is looking over my notes, looking over my shoulder, who is going to look at all the tests when I look at them, and make any decisions and correct any mistake I make. […] I think it'll be very scary [Tory, Y2].

Given that participants were concerned about having to make patient care decisions independently, it is not surprising that many wanted to start working in a group practice setting. As Linda [Y1] concluded, “I don't think I’d like to be in an independent practice straight away. I think I'd like to work in a group practice, so that you have supports there to consult if you need it.”

**Question: What role, if any, does uncertainty play in residents’ learning to be competent Family physicians?**

*I think it’s a huge role.*

The residents participating in this study unanimously agreed that uncertainty plays an important role in their learning: it helps them to identify gaps in their medical knowledge and/or clinical skills. In fact, several residents went so far as to say that it plays a “huge” [Tory, Y2;
Nathan, Y2; Joel, Y2] or “big” [Thomas, Y1] role. They explained that because patients come to them with undifferentiated medical problems “varying from benign to life threatening”, their first responsibility is to “tease that out” [Adam, Y1] by looking for potential red flags signaling “dangerous pathologies” [Linda, Y1]. “In Family Medicine, where there’s such a broad range of topics” [Sasha, Y2], “you can never know everything about a particular patient that comes through the door” [Thomas, Y1], “so there’s always some degree of uncertainty” [Andrew, Y1]. The residents thought that feeling uncertain helped “promote [their] learning” by “expos[ing] shortcomings in [their] knowledge or training” [Andrew, Y1]. Since medicine is “always changing […] you really need to be open to not knowing and acknowledge that, and then be able to seek [information] out” [Sasha, Y2]. Joel’s comment eloquently summarizes the participating residents’ views on the role of uncertainty in learning Family practice:

Well I think it’s a huge role. I think you have to pay attention to it and notice uncertainty when it happens because that's how you learn; not only as a resident, but [also] for the rest of your career. I think Family doctors continue to learn for their whole careers; so if you don't pay attention to moments of uncertainty, you'll never get any better, right? And medicine is always changing, so you do have to continue to learn all the way along.

Since participating residents thought that uncertainty functions to promote lifelong learning, it makes sense that they also held the opinion that it is important to learn to accept uncertainty as a Family physician. “At some point you have to be okay with some level of uncertainty” [Linda, Y1].

**Summary of the Results**

Through multiple readings of the interview transcripts, patterns in nine Family Medicine (FM) residents’ perceptions and experiences of uncertainty emerged. As an instrument in the data collection and analysis, I identified four major themes in the data:
1. Uncertainty is a common and potentially uncomfortable experience for FM residents;

2. FM residents strategically approach managing their uncertainty according to their assessment of how patients and supervisors will react;

3. As FM residents gain confidence and become more comfortable with uncertainty, the nature of their uncertainty changes; and

4. Uncertainty cues FM residents to gaps in their medical knowledge and/or clinical skills.

In Chapter 5, the final segment of my thesis, I discuss the main findings in relation to my research questions, and relevant literature on medical learners’ perceptions and experiences of clinical uncertainty. Further, I explain the significance of my findings and the implications for practice, as well as the limitations of my study, and directions for future research.
Chapter 5

Discussion

For nearly sixty years, clinical uncertainty has been a topic of medical education research. While earlier studies examined medical learners’ uncertainty from a sociological perspective, more recent research has been motivated by growing societal concerns for public safety, accountability, and transparency in medical decision-making (e.g., Fox, 1957, 1980; Farnan et al., 2008; Nevalainen et al., 2012). Despite countless articles problematizing uncertainty in medical education and practice, the vast majority of discussion has been based on commentary (e.g., Luther & Crandall, 2011; O’Riordan et al., 2011). Empirical research on the experience of uncertainty in residents’ learning is sparse. Even though the dominant discourse portrays uncertainty as negative experience that has to be dealt with (e.g., Schneider et al., 2014; Kazandjian & Lipitz-Synderman, 2011), there is a body of research that suggests uncertainty can be productive for residents’ learning (Lee, King, Eva, n.d.). However, of the research that has been conducted, no study has examined the role of uncertainty in residents’ learning. Since Family physicians, as generalists, are known to experience greater uncertainty in practice (e.g., Evans & Trotter, 2009; Schneider et al., 2010) it seemed prudent to explore uncertainty from the perspective of Family Medicine residents. The aim of this current research study was to better understand how Family Medicine residents view, experience, and manage uncertainty while learning how to make patient care decisions. In the discussion that follows, I summarize the answers to my research questions and then highlight the implications of these findings for subsequent learning, practice, and research in postgraduate medical education.
How FM Residents Experience Uncertainty

According to the nine residents I interviewed (5 Postgraduate Year-1 [PGY1] and 4 PGY2), uncertainty was a very common, and potentially uncomfortable experience, occurring to some extent with every patient encounter. Feeling uncertain about the criticality of patients’ medical issues made these residents feel more uncomfortable than having insufficient medical knowledge to make accurate diagnoses. Further, in retrospect, participating residents thought that they did not experience the full weight of uncertainty until they began initiating patient care decisions on their own, and for many individuals, this was not until they started residency. This finding challenges previous research that found medical clerks commonly experience and are troubled by uncertainty from their first patient encounter (Light, 1979; Lingard et al., 2003; Nevalainen et al., 2010).

Over time, as the residents gained experience and comfort with uncertainty in decision-making, they recalled feeling less uncertain, and noticing the character of their uncertainty change. This change was from large overall issues about the residents’ increasing responsibilities and their potential impact on patient safety to be more focused on specific details and actions of patient-centered care. From these data, it is not clear if the lessening uncertainty was due to increased knowledge and skills, confidence, or comfort with uncertainty, or potentially a combination of all three. However, previous studies have similarly suggested that residents’ uncertainty decreases over time for one of two reasons, either: 1) the physician advances in clinical training and accumulates knowledge and clinical skills, or 2) the physician learns to tolerate and cope with clinical uncertainty (Bovier & Perneger, 2007). In either case, experiential learning appears to be a means of alleviating residents’ concern over uncertainty in decision-making.
How FM Residents Manage Uncertainty

Even though the residents in this study preferred to be open and honest about their uncertainty, they reported censoring their expressions of uncertainty based on their perceptions of how they thought their patients and supervisors would react. These residents emphasized personal concerns about being “seen” as weak or not sufficiently competent, and this would result in poor evaluations from supervisors. Consequently, they often tried to demonstrate greater autonomy in their decision-making by: a) coming up with a defensible plan for their patient before considering seeking help from their supervisor, and b) sequentially consulting resident colleagues and online literature, and then more senior physicians, before finally seeking support from their supervisor (see also Farnan et al., 2007). These findings are consistent with prior studies, which have also found that medical learners and novice qualified doctors will shy away from expressing the full extent of their uncertainty to preserve professional credibility from supervisors and to avoid worrying patients (Kennedy et al., 2009; Tallentire, Smith, Skinner & Cameron, 2011).

For the residents in this study, the decision of whether or not to involve their supervisor in their decision-making was complex (see also Kennedy et al., 2009). While these residents did not want their uncertainty and perceived incompetence to negatively impact patients’ outcomes, supervisors’ perceptions of their physician competencies, or any formal evaluations they receive, they did, however, want to learn from their experiences of uncertainty.

Given that residents are learners, they should be encouraged to ask for help. Further, as supervisors, more experienced physicians have responsibilities for scaffolding residents’ medical knowledge and clinical skills. So the question remains: why is it difficult for residents to ask for help when their role is to learn while doing no harm to patients? This is a question that remains for future investigation.
How FM Residents View Uncertainty

While it was clear from the interviews that these residents were not always comfortable with their uncertainty or the sharing of that uncertainty, they did see the benefits of uncertainty to support their learning. In this regard, these residents viewed uncertainty as integral to learning across the training and practice continuum. They thought that recognizing and acknowledging uncertainty, when making patient care decisions, helped residents and fully licensed physicians to identify gaps in their medical knowledge and clinical skills (see also Lee, King, & Eva, n.d.). This aligns with Schön’s (1983) notion that uncertainty cues physicians to transition from ‘knowing-in-action’ (tacit knowledge) to reflection-in-action. However, this finding also suggests residents may have difficulty progressing to the next stage of reflective thought, which is identifying or coming to terms with why they are feeling uncertain (the nature of the problem) (Schön, 1983). For example, Tory [Y2] could not pinpoint why she was uncertain about managing routine medical issues (see page 55-56). Was she uncertain because something was new and/or different about these seemingly routine cases? Or, had she not retained the medical knowledge and skills developed through similar past experiences? Perhaps she had the knowledge to know what to do, but could not apply it to new patients and situations? Regardless, not knowing or feeling embarrassed about the source of uncertainty in decision-making may prevent residents like Tory from seeking help from supervising physicians. Future research should investigate when uncertainty is energizing and positive for residents’ learning and when it is debilitating. Such investigations may shed light on how residents distinguish incompetence from ‘acceptable’ uncertainty in clinical decision-making.

Implications

Perhaps not surprisingly, the residents in this study reported substantial increases in their uncertainty along with concurrent shifts in responsibility and independence. At the start of
residency, the added responsibility of independently initiating patient care under supervision likely made participating residents feel greater uncertainty in their ability to safely apply their medical knowledge and skills to care for actual patients (Baresford, 1991; Timmermans & Angell, 2001). Further, in the final months of residency, and in preparing for their transition to practice, participating second-year residents likely felt even more responsibility for patients as decision-making support from supervisors was withdrawn even further (Bovier & Perneger, 2007). Therefore, it is possible that more graduated responsibility for decision-making between clerkship and residency, and continued progressive independence in clinical training, may allow medical learners to experience more gradual changes in uncertainty (Kennedy, Regehr, Baker & Lingard, 2005). This may help medical learners to experience less stress associated with uncertainty, and consequently make more seamless transitions from medical school to residency, and residency to practice (Bovier & Perneger, 2007; Nevalainen et al., 2010; Takayesu et al., 2014).

However, with the recent social and economic pressures to ensure safe and efficient health care and residents’ well-being, medical students’ participation in clinical situations has become more restricted (Kennedy et al., 2005). Consequently, this has limited medical students’ opportunities to learn about “the reasoning and judgment involved in taking responsibility for decisions about patient care” (Young, Williamson & Egan, 2014, Introduction para. 2). While simulating responsibility for decision-making is challenging with the obvious limitations of computerized and standardized patients, this may provide earlier opportunities for medical students to independently experience uncertainty without potentially posing harm to patients in the medical system. Conversely, limiting students’ responsibilities for decision-making, and consequently their exposure to uncertainty, could negatively affect the development of their ability to safely practice independently (Kennedy et al., 2005).
The ability to self-regulate learning is critical for safe independent practice. The development of a self-regulated professional is a major goal of undergraduate and postgraduate medical education (Brydges & Butler, 2012). However, to effectively self-direct learning, one must be able to accurately self-assess gaps in medical knowledge and skills (Glasziou, Sawicki, Prasad, & Montori, 2011). Accurate self-assessment in practice continues to be a challenge for medical students and residents (Langendyk, 2006; Nothnagle, Anandarajah, Goldman & Reis, 2011). Changes in the prevalence and type of uncertainty may be a useful indicator for aiding medical learners to more accurately self-assess their development of physician competencies in practice. There is research to suggest that developing medical learners’ abilities to frame questions, based on their self-assessment of learning needs, may enhance their expressions of uncertainty and the quality of teaching they receive from supervising physicians (Egan, 2001; Wolpaw, Côté, Papp, & Bordage, 2012).

Residents’ abilities to express and manage their uncertainty are affected by the culture of the learning environment in which they work. Even within a competency-based medical education framework that is dependent on the assessment and evaluation of residents, there is research to suggest that efforts to establish a safe and supportive learning environment can assist medical learners to solve their own clinical problems (Young, Williamson & Egan, 2015). According to Benbassat (2013), “The main challenge of contemporary medical education is to promote a clinical medical learning environment, where errors and uncertainties are acknowledged rather than denied, and trainees are trusted and supported, rather than judged and, occasionally, derided” (p. 533). The results of this current study add to the growing literature supporting psychologically safe clinical learning environments where residents and supervisors feel comfortable sharing their uncertainties.

A culture of acceptance towards uncertainty, in which residents and supervisors could speak freely about their professional limitations, has the potential to enhance patient safety as
well as the quality and scope of clinical teaching and learning (Young et al., 2015). If residents feel safe to express the full extent of their uncertainty without judgment, supervisors could use the results of residents’ self-assessment to more purposefully direct their teaching, potentially enhancing the learning experience for trainees (Wolpaw et al., 2012). However, for residents to feel safe expressing their uncertainties, they must see more experienced role models enacting the same behaviours without negative consequences (e.g. disparagement or negative evaluations) (Cruess, Cruess, & Steinart, 2008). Helping supervising physicians to reframe moments of uncertainty as teaching and learning opportunities may assist in removing stigma associated with clinical uncertainty.

A medical education culture more accepting of clinical uncertainty may be valuable for scaffolding medical learners’ abilities to self-regulate their learning in practice. According to Brydges and Butler (2012), medical learners enter clerkship and residency with little experience in self-regulating learning in practice. When teaching medical learners to reflect in practice, it may be valuable to help them develop the skills to notice uncertainty and suspend judgment, recognize professional weaknesses, self-limit practice in areas of limited competence, identify what must be learned, and locate external resources to resolve gaps in competence (Eva & Regehr, 2005; 2007; Epstein, Siegel, & Silberman, 2008). Perhaps the ability to recognize and safely manage uncertainty in decision-making is an unwritten competency expected of resident physicians (Tannenbaum et al., 2011).

Although clinical uncertainty is often perceived as a negative and stressful experience to be minimized or dealt with (e.g., Schneider et al., 2014; Kazandjian & Liptitz-Synderman, 2011), the residents in this study viewed uncertainty as integral to lifelong professional learning. Participating residents thought that recognizing and acknowledging uncertainty when caring for patients helped them to identify gaps in their medical knowledge and clinical skills. This furthers Lee, King, and Eva’s (n.d.) recent finding that uncertainty also cues experienced Family
physicians to seek out and use external resources that address self-identified gaps in clinical competence. The growing evidence that recognizing and acknowledging clinical uncertainty, in practice, may help to engage developing and experienced Family physicians in self-regulated learning (Lee et al., n.d.; Egan, 2001; Wolpaw et al., 2012) may have important educational implications for postgraduate residency training.

**Recommendations**

Based on the results of this study, there are three recommendations that may improve postgraduate training and subsequent practice. Since this research was exploratory, the recommendations are tentative. Nevertheless, these suggestions may create opportunities that enhance the learning experience for resident physicians.

First, program directors should consider ways to encourage supervising physicians to view uncertainty as a potential learning opportunity for residents. This may help these more experienced physicians to feel comfortable discussing uncertainty and sharing their own uncertainties with developing physicians. Such opportunities for dialogue may help residents to feel more comfortable with uncertainty in decision-making.

Second, supervising physicians should encourage medical learners to pay attention to and express their uncertainty when learning through practice. If developing physicians were encouraged to actively look for changes in the quantity and quality of uncertainty they experience over time, it may help them to monitor their learning and self-assess changes in competence. A learning environment more accepting of uncertainty could foster self-regulation in practice, acknowledgment of personal professional limitations, and more purposeful teaching from supervisors and allied health professionals.

Third, there should be mechanisms for helping residents learn how to take action on their uncertainty in practice. Since uncertainty is known to have a profound emotional impact on medical learners leading to stress, anxiety, and burnout (Bovier & Perneger, 2007; Sommers,
2013), it may be useful to provide residents with targeted education on how to positively channel uncertainty for their own learning when making patient care decisions. In the medical education literature, there are many advocates for residents to receive specific training on how to deal with uncertainty in practice (e.g., Hall, 2002; Luther & Crandall, 2011; Volpintesta, 2012). Given that participants perceived certain supervisors to be uncomfortable sharing their uncertainties with residents, pre-arranged opportunities for mentorship on uncertainty management may be helpful for mitigating excessive worry and self-doubt throughout residency and in transitioning to practice (Gosh, 2004; Nevalainen, et al., 2010).

**Limitations and Directions for Future Research**

Although important findings have emerged from this study, there are limitations that should be considered. First, this research explored the experience of uncertainty in a small sample of residents, in one Family Medicine program, at a single institution. Future research should investigate if residents in other Family Medicine programs and medical specialties perceive, experience, and manage uncertainty in similar ways. For example, it would be valuable to survey a broader sample of residents from Family Medicine programs across Canada to determine if the results of this study are generalizable. It would also be useful to conduct focus group interviews with residents from different postgraduate programs to determine the extent to which physician specialty influences residents’ views and experiences with uncertainty in learning through practice. Finally, it would be important to determine if there are medical schools and residency programs in Canada that: a) actively address uncertainty in decision-making and support medical learners with managing their uncertainty, and b) emphasize the positive aspects of uncertainty for learning.

This study was also limited in that only one researcher analyzed the data. Since I was the only person to code and make sense of the data, it is possible that my lens as an educator (with no medical training) may have imposed certain biases on my interpretations. However, my lens as an
educator could have also provided a perspective on clinical uncertainty that differs from the viewpoints of medical experts and sociologists. In future research it would be valuable to collaborate with a supervising physician to study supervisors’ perceptions on the role that uncertainty plays in resident learning and the ways in which residents experience and manage uncertainty in practice. Such research would provide an opportunity to compare developing and experienced physicians’ views on uncertainty in learning medicine in the 21st Century.

Beyond addressing the limitations of my study, future research could also unpack and advance some of the research findings. For instance, it is not clear whether participating residents’ uncertainty lessened over time due to increased confidence, competence, or comfort with uncertainty. Further, it would be useful to follow up with these residents post graduation to see if their views and experiences of uncertainty have changed. For instance, participating residents expressed concern about practicing independently post-graduation, and not having the support of their supervisor when making patient care decisions. It is unknown how newly licensed physicians view and manage uncertainty in the first year of practice.

**Significance of this Study**

Clinical uncertainty is pervasive in medical practice and at the heart of primary care (e.g., Evans & Trotter, 2009; O’Riordan et al., 2011; Schneider et al., 2010). As the first line of care for approximately 85 percent of Canadians entering the medical system (Statistics Canada, 2013), the decisions and subsequent actions of Family physicians can have a tremendous impact on the health and well-being of our population. The ways in which developing Family physicians learn to perceive, experience, and manage clinical uncertainty when making patient care decisions has implications for patient outcomes, expenditure of healthcare resources, and physicians’ mental health. Resident uncertainty has been found to result in delays of care and patient harm, excessive test ordering, and resident anxiety, stress, and burnout (Bovier & Perneger, 2007; Farnan et al., 2008; Iwashyna, Fuld, Asch, & Bellini, 2011; Takayesu et al., 2014).
Empirical research examining clinical uncertainty from residents’ perspectives is sparse in the medical education literature. Although my research is exploratory, this study provides current insight on the ways in which Family medicine residents perceive uncertainty in relation to learning Family practice. Specifically, the results of this study add to the growing body of literature suggesting that even though uncertainty can be uncomfortable, the experience can be productive for physicians’ learning across the training continuum, from medical school to continuing professional development (Egan, 2001; Fox, 1957; 1980; Lee, King, & Eva, n.d.; Wolpaw et al., 2012).

Having the opportunity to build my research onto the “How Residents Learn” study strengthened the credibility of my findings. Since I had already established a positive relationship with the residents prior to the interviews, they likely felt more comfortable expressing authentic responses to my probing questions. If I had not known the residents prior to the interview, they probably would have been more guarded in their responses. In addition, unlike most studies that use retrospective techniques for data collection, I attempted to recreate residents’ in-the-moment thinking about their experiences of uncertainty during interviews. By providing specifics from their own systematic self-observations of moments of clinical uncertainty, I re-engaged residents in their own thinking about decision-making, and their own views on uncertainty and learning. For this reason, I believe that my data provides rich, detailed accounts of residents’ experiences, revealing how residents view and manage uncertainty while learning through practice.
References


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Appendix A: Ethics Letter of Approval

QUEEN’S UNIVERSITY HEALTH SCIENCES & AFFILIATED TEACHING HOSPITALS RESEARCH ETHICS BOARD-DELEGATED REVIEW

July 29, 2014

Miss Jessica Rich
Faculty of Education
Queen’s University

Dear Miss Rich

Study Title: EDUC-010-14 Recognizing and Acting on Moments of Uncertainty: A Multiple-Case Study Exploring How Family Medicine Residents Self-Regulate their Learning in Clinical Practice

File # 6013115

Co-Investigators: Dr. D. Klinger

I am writing to acknowledge receipt of your recent ethics submission. We have examined the protocol, interview protocol, sample questions, recruitment script, letter of information (July 20, 2014) and consent form (July 20, 2014) for your project (as stated above) and consider it to be ethically acceptable. This approval is valid for one year from the date of the Chair’s signature below. This approval will be reported to the Research Ethics Board. Please attend carefully to the following listing of ethics requirements you must fulfill over the course of your study:

**Reporting of Amendments:** If there are any changes to your study (e.g. consent, protocol, study procedures, etc.), you must submit an amendment to the Research Ethics Board for approval. Please use event form: HSREB Multi-Use Amendment/Full Board Renewal Form associated with your post review file # 6013115 in your Researcher Portal (https://eservices.queensu.ca/romeo_researcher/)

**Reporting of Serious Adverse Events:** Any unexpected serious adverse event occurring locally must be reported within 2 working days or earlier if required by the study sponsor. All other serious adverse events must be reported within 15 days after becoming aware of the information. Serious Adverse Event forms are located with your post-review file 6013115 in your Researcher Portal (https://eservices.queensu.ca/romeo_researcher/)

**Reporting of Complaints:** Any complaints made by participants or persons acting on behalf of participants must be reported to the Research Ethics Board within 7 days of becoming aware of the complaint. Note: All documents supplied to participants must have the contact information for the Research Ethics Board.

**Annual Renewal:** Prior to the expiration of your approval (which is one year from the date of the Chair's signature below), you will be reminded to submit your renewal form along with any new changes or amendments you wish to make to your study. If there have been no major changes to your protocol, your approval may be renewed for another year.

Yours sincerely,

[Signature]

Chair, Health Sciences Research Ethics Board
July 29, 2014

Investigators please note that if your trial is registered by the sponsor, you must take responsibility to ensure that the registration information is accurate and complete
Appendix B: Letter of Information

Project Title: Recognizing and Acting on Moments of Uncertainty: A Multiple-Case Study Exploring How Family Medicine Residents Self-Regulate their Learning in Clinical Practice

Dear Kingston Family Medicine Residents,

You are invited to participate in the following research study entitled, A Multiple-Case Study Exploring How Family Medicine Residents Self-Regulate their Learning in Clinical Practice. This research is being conducted by Jessica Rich (Master of Education, Candidate) under the supervision of Dr. Don Klinger in the Faculty of Education at Queen’s University in Kingston, Ontario. This study has been granted clearance according to the recommended principles of Canadian ethics guidelines and Queen’s policies.

What is this study about? The purpose of this multiple-case study is to explore and describe how family medicine residents self-regulate their learning after becoming aware of situational cues associated with feelings of uncertainty in the clinical workplace. At this stage in the research, self-regulated learning will be generally defined as “self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals” (Zimmerman & Schunk, 2011, p.1). In particular, I am interested in exploring how PGY-1, PGY-2 and PGY-3 family medicine residents: (a) make sense of feelings of uncertainty (self-monitoring phase) as feedback about their knowledge and/or skills; and (b) use the analyzed feedback to develop a personalized learning plan that involves using external resources to address identified gaps in knowledge and clinical skills.

What will this study require? If you agree to participate in this research you will be contacted for an individual interview. Interviews will be conducted at the Department of Family Medicine (220 Bagot St.) or over Skype if you are practicing out of town at the time of data collection. Interviews will last a maximum of one hour, and will be recorded in digital audio files. After the interview, I may request an additional follow-up conversation to seek further clarification about the interview transcript if needed (maximum 30 minutes). If meeting in person is not feasible or agreeable, I will converse with you over the phone, Skype, or through email. The total estimated time for participation is a maximum of 1.5 hours.

Is participation voluntary? Your participation is completely voluntary and choosing not to participate will not result in any adverse consequences. There are no known physical, psychological, economic, or social risks associated with this study. Further, you are free to choose, without reason or consequence, to refuse to answer any questions. You may withdraw from the study at any time with no negative consequences. If you withdraw from the study, you may choose to have your data removed. No remuneration will be provided for participation.

What will happen to my responses? The interview recording will be transcribed and then the recording will be destroyed. All electronic files will be password protected. Paper and audio data will be secured in a locked cabinet. I will maintain copies of the transcripts for a minimum of 5 years and may use the data (with names removed) in subsequent research. Confidentiality will be protected to the extent possible. None of the data will contain your name or the identity of your place of work. To protect your identity a pseudonym will replace your name on all data files and in any dissemination of findings. This research may result in publications of various types, including journal articles or other professional publications.
What if I have concerns? Any questions about study participation or a request to withdraw from the study may be directed to Jessica Rich at jessica.rich@queensu.ca or my supervisor Dr. Don Klinger at 613-533-6000 x 77273 or don.klinger@queensu.ca. If you have any concerns about your rights as a research participant please contact - Dr. Albert Clark, Chair of the Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board at (613) 533-6081.

Sincerely,

Jessica Rich, BScH, BEd (OCT)
Master of Education Candidate
Faculty of Education, Queen’s University
Appendix C: Consent Form

Recognizing and Acting on Moments of Uncertainty: A Multiple-Case Study Exploring How Family Medicine Residents Self-Regulate their Learning in Clinical Practice

Name (please print clearly): ____________________________________________________

1. I have read and retained the Letter of Information and have had any questions answered to my satisfaction.

2. I understand that I will be participating in the study called Recognizing and Acting on Moments of Uncertainty: A Multiple-Case Study Exploring How Family Medicine Residents Self-Regulate their Learning in Clinical Practice. I understand the purpose of this research is to explore and describe how family medicine residents self-regulate their learning after becoming aware of situational cues associated with feelings of uncertainty in the clinical workplace. I understand that participation in this study will entail a maximum of 1.5 hours of my time involving: an audio-recorded interview (maximum 60 minutes), and a follow-up conversation to seek further clarification about the interview transcript if needed (maximum 30 minutes).

3. I understand that my participation in this study is voluntary and I may withdraw at any time without adverse consequences. I understand that if I withdraw from the study, I may choose to have my data removed. I understand that the data may also be published in professional journals or presented at academic conferences. I understand that every effort will be made to maintain confidentiality to the extent possible now and in the future.

4. I am aware that any questions about study participation or a request to withdraw from the study may be directed to Jessica Rich at jessica.rich@queensu.ca or my supervisor Dr. Don Klinger at 613-533-6000 x 77273 or don.klinger@queensu.ca. If you have any concerns about your rights as a research participant please contact - Dr. Albert Clark, Chair of the Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board at (613) 533-6081.

Please sign one copy of this Consent Form and return to the researcher.
Retain the second copy for your records.

I have read the above statements and had any questions answered. I freely consent to participate in this study.

Participant’s Signature: ____________________________ Date: ____________________________
E-mail address: ____________________________ Phone: ____________________________

If you would like a summary of the results of this study, please check this box □
Appendix D: Interview Guide

Thank you

- I want to thank you for your involvement in this project
- It has been an incredible learning opportunity for me, and
- The data that you have provided in your voice notes has been very rich
- So again, thank you for your continued investment. I really appreciate it.

Reminder about audio-recording for transcription purposes

Voice note experience

- First off, can you tell me a little bit about your experience with recording voice memos on your smartphone?
  - Did it make you more aware of situations in which you were not sure what to do?

Jumping off point – use of voice note data

My intention for our conversation today is to get even further into some of the experiences you have shared in your voice notes.

- There is one instance in particular that I would like to discuss
  [Give participant enough info to begin recalling the story, and add details as needed]

- Can you elaborate on what you were experiencing when you were unsure of what to do during this case?
  *Try not to ask all of these:
  - What thoughts were going through your mind?
  - How did you feel in this instance?
    - What was your comfort level? (With this experience of not knowing what to do)
    - What was your stress level?
  - Is this situation representative of instances where you don’t know what to do?
  - How often do you experience situations like this? (Where you don’t know what to do?)
  - Has the nature of these experiences changed over time or have they been relatively stable throughout your time in residency?
    - From starting residency (July 1) until now?
    - From PGY1 to PGY2?
      - In terms of frequency
      - In terms of complexity of situations
Culture of uncertainty in the FM residency program

Now shifting focus to your experience as a learner in the Family Medicine residency program: [by “learner” I mean as a developing family physician]

• How do others react to instances when you as a learner indicate that you are unsure what to do next during a patient encounter?
  o Think of both patients and your supervisors
• When you are unsure about what to do, how comfortable are you sharing this with your supervisor?
  o How willing are you to admit that you don’t know?
  o Is it an easy conversation with them when you do?
• Are there conditions under which you are more reluctant to voice that you are unsure of what to do?
• Do your supervisors ever share instances with you when they are unsure about what to do?
• Have you received any education on how to manage uncertainty when caring for patients?
  o Either informal or formal sessions?
  o In medical school or residency?
• What role, if any, does uncertainty play in your learning to become a competent family physician?

Reflecting on learning in the FM residency program:

• What has been the biggest surprise to you as a learner since starting your family medicine residency training?
  o Something that you really didn’t expect (about your learning experiences)
• From a learner’s perspective, what would be your top advice for someone starting residency training in family medicine?
  o In terms of how to deal with/manage your learning
  o In terms of what to expect

Projecting into practice

• When you go out into (independent) practice, what do you think it will be like to experience uncertainty?

That’s all my questions. Is there anything else you would like to add?

Before ending interview:

Thank you for your conversation. It was incredibly rich, and I have certainly learned a lot from talking with you.

• When I am going through the transcripts and I come across something I don’t fully understand, could I contact you for a brief follow-up conversation?
• My plan is to prepare a 1-pg summary of the findings of your interview. Would you mind reading it to ensure I have captured your true opinions, thoughts, and emotions?