



**UNIVERSITY OF LEEDS**

**Understanding and enhancing tolerance of uncertainty in  
emergency departments.**

**Emily Elizabeth Parker**

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of Philosophy**

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## Abstract

Intolerance of uncertainty is associated with burnout rates and risk-averse approaches to patient management among doctors. Doctors working in the emergency department (ED) are exposed to high levels of uncertainty, often making admission or discharge decisions with only symptom-based diagnoses. However, the majority of efforts to enhance uncertainty tolerance has focused on general practitioners or medical school students. This PhD therefore aimed to develop understanding of uncertainty tolerance in the ED, and the factors contributing to uncertainty being appraised, and responded to, positively or negatively.

The studies in this thesis were theoretically underpinned by an integrative model of uncertainty tolerance developed by Hillen and colleagues (2017). Hillen and colleagues (2017) propose that where uncertainty is consciously perceived, the subsequent appraisals or responses can range from positive to negative. Research in this thesis aimed to elucidate the factors influencing the valence of responses in an ED context and patient safety outcomes associated with uncertainty tolerance.

A systematic, scoping review (study 1) synthesises existing evidence identifying sources of uncertainty, responses to uncertainty, factors influencing such responses and outcomes of uncertainty tolerance in the ED. This review was also conducted to understand where existing efforts to enhance uncertainty tolerance have focused. To establish public preference on the responses to uncertainty identified in the scoping review, a survey study was conducted (study 2). To explore the factors associated with uncertainty tolerance in an NHS context, ED doctors were interviewed, drawing on experience of uncertain

admission and discharge decisions (study 3). Finally, a modified e-Delphi survey was conducted with experts to identify important functions for UT interventions based on findings from the previous chapters (study 4). Findings from this thesis provide novel suggestions for stakeholders seeking to enhance the uncertainty tolerance of ED doctors while developing, and critiquing, uncertainty tolerance theory in a clinical context.

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## List of abbreviations

BF	Beth Fylan
ED	Emergency Department
GL	Gemma Louch
HT	Hilary Thomson
IUS	Intolerance to Uncertainty Scale
NHS	National Health Service
NIHR	National Institute for Health and Care Research
PRU	Physician Reaction to Uncertainty
PSTRC	Patient Safety Translational Research Centre
RL	Rebecca Lawton
UT	Uncertainty tolerance



# Chapter 1

## Introduction

*“Medicine's ground state is uncertainty. And wisdom - for both the patients and doctors - is defined by how one copes with it.”* (Atul Gawande, 2002).

### 1.1 Chapter summary

The aim of this thesis is to explore how doctors and patients in the ED can be supported to respond positively to uncertainty and to explore how intervention priorities can meet the needs of doctors and patients. This chapter uses existing literature to rationalise the need for research exploring how uncertainty is tolerated in Emergency Department (ED) contexts. Key concepts from patient safety literature, uncertainty tolerance theory and methodological frameworks which this thesis draws upon are outlined and methodological justification is provided for each research study reported in this thesis.

### 1.2 Uncertainty and clinical decision-making

Uncertainty has long been considered an inherent component of clinical decision-making (Beresford, 1991). In diagnosing a patient, doctors proceed based on hypotheses. Rather than achieving absolute certainty, inference and observation reduce uncertainty enough to yield confidence in hypotheses and therapeutic decisions (Kassirer, 1989). Clinical decision-making is a complex process, combining knowledge and experience to initiate critical thinking and intuition from which a course of action is decided (Helou et al., 2020). A wealth of literature is dedicated to understanding these processes (e.g. Norman, 2005) but despite the complexity of medicine, such literature has considered

uncertainty a tacit element of the clinical decision-making process, rather than a central component.

When engaging in clinical decision-making, a failure to recognise and acknowledge uncertainty can lead to diagnostic error and failing to seek relevant information from patients (McKenna and Martin-Smith, 2005). Conversely, where uncertainty is recognised, it can prompt appropriate information gathering and inform specific decision-making approaches such as prioritising concerns and seeking further evidence (Brugnach et al., 2008; Cristiancho et al., 2016; Falzer and Garman, 2009). The extent to which uncertainty impacts the clinical decision-making process can vary between doctors and for the same doctor in different situations (Hillen et al., 2017). For example, amongst trainee doctors, a simulation study focused on trauma resuscitations demonstrated elevated subjective and physiologic stress responses to more complex clinical scenarios, reducing diagnostic performance and immediate recall (Harvey et al., 2012).

An aversion to uncertainty amongst doctors of multiple specialities has also been associated with increased referrals, admissions and excessive test-ordering (Allman et al., 1985; Lawton et al., 2019; Pines et al., 2009; 2010). Evidence suggests that this is because when patient management decisions are uncertain, rather than considering the available evidence, an increased fear of missing a low probability diagnosis drives risk-averse decision-making amongst doctors. For example, when the cause of chest-pain is uncertain, doctors may order imaging to rule out acute coronary syndrome, despite considering a positive result unlikely and the test potentially unnecessary (Kanzaria et al., 2015). The risk of catastrophic outcomes of acute coronary syndrome, could increase the fear of missing this diagnosis, even when it is of



low probability, and therefore the uncertainty is difficult to accept without medical investigation.

Being admitted to hospital by a doctor responding too cautiously to uncertainty may also expose patients to the risks of being in hospital without benefit. For instance, research estimates 10% of hospitalised patients may be affected by at least one adverse event (Schwendimann et al., 2018), have a 4.7% chance of healthcare associated infection (Guest et al., 2019), and potential for immune system dysregulation increasing the risk of readmission (Goldwater et al., 2018). A recent observational cross-sectional study (San Jose-Saras et al., 2023) quantified the association between inappropriate hospital admissions (defined as overuse of health services whereby the potential harm to a harm patient exceeds potential clinical benefit and measured by the appropriateness evaluation protocol (Gertman and Restuccia, 1981) and adverse events. After adjusting for confounding variables, patients inappropriately admitted to hospital had a risk of an adverse event three times higher than those admitted appropriately. Furthermore, the adverse events developed following inappropriate admissions resulted in intensive care unit stays two days longer than adverse events following appropriate hospital admissions.

It is no surprise then, that the most recent guidance from the General Medical Council (2018) requires graduating doctors to, '*recognise complexity and uncertainty*' (p. 11), '*manage the personal and emotional challenges of coping with...uncertainty*' (p. 10), '*learn to develop confidence in managing these situations*' (p. 11) and '*recognise how treatment and care can place an additional burden on patients and make decisions to reduce this burden where appropriate*' (p. 12). In addition, the James Lind Alliance, an organisation which

develops research agendas based on the priorities of patients, suggests a clear need for research to understand the differences in the decision-making processes of doctors of different grades to inform interventions to decrease over-investigation (Smith et al., 2017).

Despite this, and a wealth of literature suggesting years of clinical experience can influence how doctors respond to uncertainty (Baldwin et al., 2005; Lawton et al., 2019; Nevalainen et al., 2014; Smulowitz et al., 2021), there has been scant attention paid to understanding how doctors develop more effective responses to uncertainty and whether this process can be supported through organisational, team or individual-level interventions. The evidence is particularly limited for emergency medicine doctors, who work in a department with high levels of uncertainty and where most (approximately three out of four) emergency decisions (known to be influenced by uncertainty) to admit patients to hospital are made (Baker, 2022). Indeed, most existing research that focuses on responses to clinical uncertainty is positioned in general practice and medical school contexts (Strout et al., 2018).

### **1.3 Uncertainty in an Emergency Department context**

Central to emergency medicine, is the decision to admit, refer or discharge a patient; a process laden with uncertainty and risk. De Groot and Thurik (2018) define risk as having knowledge about the probability of each outcome (e.g. knowing there is a 2% likelihood of an adverse event following discharge), and uncertainty as knowing the possible outcomes but not the likelihood of each. When making a 'disposition' decision (deciding to discharge or admit a patient to hospital), often doctors in the ED cannot elicit sufficient medical history to understand the probability of an outcome and, even with knowledge of

likelihood, a low chance of a catastrophic patient outcome could still cause increased fear and stress amongst doctors.

Disposition decisions are influenced by a multitude of interacting factors including clinical factors (e.g. diagnosis, severity and treatment response), patient factors (e.g. age, level of education, comorbidities and prior hospitalisations), social factors and clinician factors (Alahmary et al., 2023; Dinh et al., 2016). Unlike other environments, such as primary care, ED doctors often have insufficient information about patients to inform management decisions and unlike other hospital environments, prolonged observation to aid the progression toward certainty is not always possible (Platts-Mills et al., 2020). Due to symptom severity, patients are not always able to disclose medical histories and response to treatment can be unpredictable (Dhawale et al., 2017). Consequently, there is perhaps no context as important as the ED, to strive toward constructive responses to uncertainty.

As well as an unpredictable risk of poor patient outcomes, the needs of patients presenting to EDs in the UK are becoming increasingly complex, with the number of patients presenting with five or more health conditions rapidly increasing (Steventon et al., 2018). Pressures in UK EDs are showing no signs of alleviating following the COVID-19 pandemic. Trolley waits (the time between an ED doctor deciding admission is required and the patient actually being admitted) of over 12 hours for ED patients to be seen were seven times more frequent in 2021/22 than in 2019/20 and there was a reduction in the number of ED patients being seen within 4 hours from 81% in 2019/20 to 74% in 2021/22. That an increasing number of patients are treated in inappropriate environments is further evidence of the pressures faced within EDs, while reducing instances of 'corridor care' is outlined as a priority by NHS England (2020). Given this

level of demand on emergency healthcare, it is important that staff wellbeing and retention is considered in the ED. Simpkin-Begin et al. (2022) conducted a survey study with over 2000 doctors and reported that low tolerance of uncertainty (defined as less positive cognitive, emotional and behavioural responses to uncertainty) is associated with higher rates of burnout, reduced job satisfaction and lower levels of engagement. Therefore, efforts to understand and embrace uncertainty are a potential focus for interventions that aim to enhance wellbeing as well as promote patient safety.

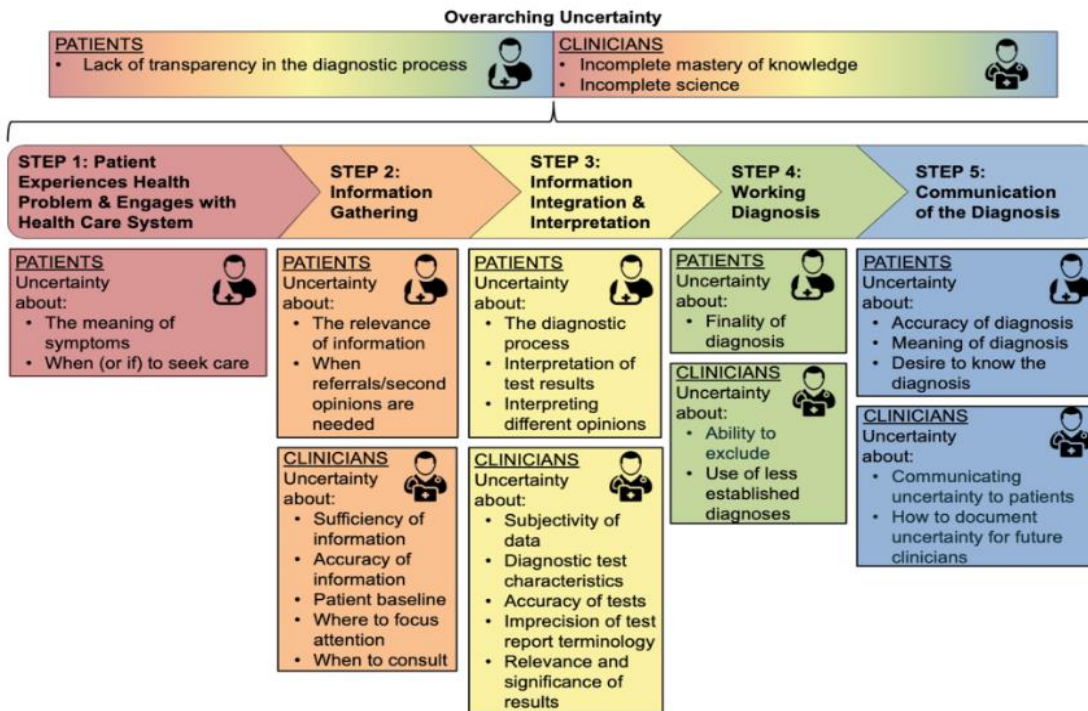
For reasons outlined above, uncertainty is inevitable in ED contexts where doctors are working in high-stakes environments, making complex decisions with limited information. To understand decision-making in this context further, the author of this thesis conducted twelve hours of observations in the ED of one large, NHS trust in the North of England. Observation notes are summarised in Appendix 1.1. Observations highlighted many non-linear influences on acute admissions and the influence of wider contexts, such as community healthcare and primary care pathways. The observation period highlighted that decision-making in the ED is often not only influenced by circumstances of the ED itself, but also by the wider hospital or health service. This is supported by research demonstrating that inadequate access to primary care can increase admission decisions from the ED (Lewis Hunter et al., 2016). This may stem from organisational-level factors (e.g. a shortage of GPs), individual-level factors (e.g. the patient is not registered with a GP) and wider system factors (e.g. increased use of remote primary care services). Furthermore, hospital bed availability may influence the decision to admit a patient. When bed space in the hospital is reaching maximum capacity,

admission rates have been found to decrease with increased intervention provided in the ED (Mery and Kahn, 2013).

A recent review of healthcare generally (Meyer et al., 2021), mapped the experiences of uncertainty amongst patients and clinicians onto stages of the diagnostic process model developed by the National Academies of Science, Engineering and Medicine. Meyer et al. (2021) focused on diagnosis, which as previously acknowledged, is only one clinical factor influencing disposition and therefore other elements of decision-making are absent from this example (Dinh et al., 2016). The review presented a visual overview of the uncertainty experienced by doctors and patients during these 5 steps of diagnosis: 1) patient experiences a problem and engages with healthcare system; 2) information gathering; 3) information integration and interpretation; 4) working diagnosis; 5) communication of the diagnosis (see Figure 1.1). This overview suggests that even in the final stages of diagnosis, uncertainty can prevail, with doctors needing to communicate and document persistent uncertainty.

**Figure 1.1**

Summary of findings from Meyer et al. (2021) mapping the experiences of uncertainty throughout the diagnostic process to the steps of the National Academies of Sciences, Engineering and Medicine's Diagnostic Process Model.



*Note.* Exact image taken from <https://doi.org/10.1016/j.pec.2021.07.028> with permission from the journal: <https://creativecommons.org/licenses/by-nc-nd/4.0/>.

Whilst steps 2-3 in Figure 1.1 generally serve the purpose of reducing uncertainty, the final two steps demonstrate a need for doctors to engage in strategies allowing them, and the patients they care for, to tolerate, not just reduce, any remaining uncertainty. Arguably, this is more essential in the ED than in most other healthcare contexts, because here, the doctor's goal is not to reach a definitive diagnosis, but to establish if a hospital admission is necessary (Platts-Mills et al., 2020). This means that often, uncertainty persists for patients and clinicians following a discharge decision.

While reducing uncertainty is important and is the main focus of many clinical practices and investigations, the focus of this thesis is on tolerating uncertainty. In early safety science literature, Rasmussen (1982) conceptualised unintentional human errors as either errors in execution (attention-based slips or memory-based lapses where the action is not executed as planned) or errors in thinking (rule-based or knowledge-based mistakes where the action is carried out as planned but there are errors in judgement or the action is based on incorrect thinking). While knowledge-based mistakes occur in familiar situations, rule-based mistakes (e.g. decision-making failures and errors in judgement) occur in uncertain situations. Due to less experience-based learning (i.e. exposure to patients) and rule-based learning (i.e. through teaching) (Arocha and Patel, 1995), novice healthcare staff may be less able than experienced healthcare staff to gather and select relevant, or appropriate amounts of, information (Patel et al., 1994). This means despite steps 2-3 in Figure 1.1 being focused on reducing uncertainty, the extent to which doctors tolerate uncertainty still plays a role in gathering and interpreting information. A lower tolerance of uncertainty could result in uncertain situations being avoided and redundant information being gathered. This thesis considers patient management throughout the entire patient-clinician encounter in the ED.

## **1.4 Theoretical foundation**

The complexity of EDs challenges the ability of doctors to approach decision-making according to traditional, analytical models. Attempting to rationalise clinical decision-making assumes the perspective that certainty is achievable (Simpkin & Schwartzstein, 2016). For example, substantive rationality suggests the value of an action is based on the desirability of its subsequent outcomes,

and this assessment of desirability guides decision-making (Djulgovic & Guyatt, 2017). This approach to decision-making resonates with aspects of everyday life but becomes difficult for doctors working in a system as complex as healthcare (Sanderson & Gruen, 2006). In EDs, patients, families and doctors may disagree with how much value they assign to the risks of certain outcomes, and factors beyond the doctor's control (e.g. whether community care is available for older patients), make the outcome of a decision hard to predict. For this reason, when conceptualising uncertainty in the ED to inform strategies for effective responses, it is necessary to draw upon theories of decision-making which acknowledge the influence of uncertainty on decision-making and account for contextual influences, not just the cognitive processes of individual doctors.

Until recently, there was no unified definition of uncertainty tolerance (abbreviated to UT throughout this thesis) in healthcare or theory-informed studies. In 2017, Hillen and colleagues developed a conceptual, integrative model of UT (see Figure 1.2) that brought together existing measures of UT, and the earlier concept, 'ambiguity tolerance.' This model is used throughout this thesis as a foundation for further research, guiding study design.

Study findings will contribute to the further development of the model relevant to ED contexts. For example, Hillen et al. (2017) acknowledge potential factors that influence UT among patients and healthcare professionals and suggest five overarching categories potential factors could relate to: characteristics of the uncertainty stimulus (e.g. the source of uncertainty); characteristics of individuals (e.g., personality traits or abilities); situational factors (e.g., aspects of the clinical encounter including time available and informational support); cultural factors (e.g., values and norms); and social factors (e.g., institutional

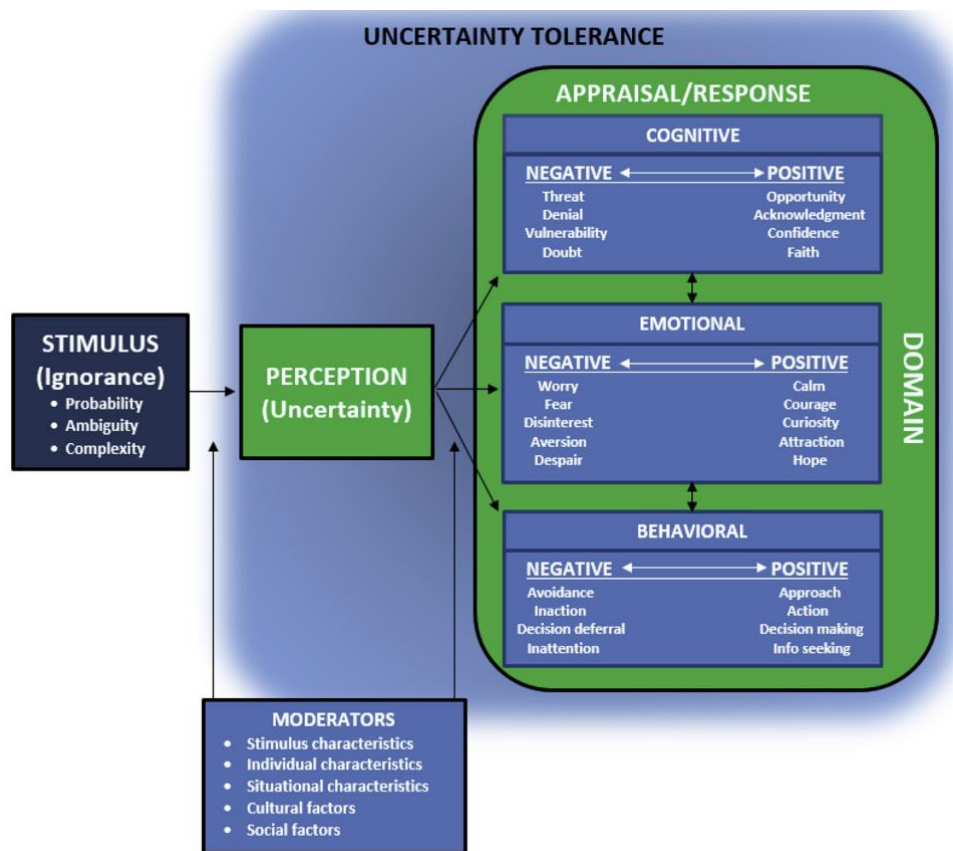


resources and processes). An example of how this thesis will contribute to the further development of the model relevant to an ED context, is to elucidate the factors that influence the valence (positive or negative) of ED doctors' appraisals of uncertainty and emotional or behavioural responses to uncertainty.

The authors of the model define UT as, '*a set of negative and positive psychological responses – cognitive, emotional and behavioural – provoked by the conscious awareness of ignorance*' (p.70). Uncertainty has long been defined as a conscious state within which an individual is aware of their imperfect understanding (Mishel, 1988; Smithson, 2012). Whilst it is important to acknowledge that doctors are not always conscious of their lack of knowledge or uncertainty, and that this can sometimes lead to patient safety incidents (Roland, 2017), it is the conscious perception of uncertainty that triggers manifestations of cognitive, emotional and behavioural responses such as defensive practice, rumination and anxiety (Hillen et al., 2017), ultimately leading to longer term outcomes such as burnout (Simpkin-Begin et al., 2022). It is therefore important to highlight that the over-confidence which is associated with naivety amongst doctors with less clinical experience (Kruger and Dunning., 1999), is not the focus of this thesis. In this scenario, doctors are unaware of a deficit in their skills and knowledge and uncertainty is not consciously perceived.

**Figure 1.2**

*Integrative model of uncertainty tolerance (Hillen et al., 2017).*



Note. Exact image taken from <https://doi.org/10.1016/j.socscimed.2017.03.024> with permission from the journal: <https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode>.

Hillen et al. (2017) distinguish between three sources of uncertainty in clinical contexts. This includes probability (referring to risk, and coming from an indeterminacy of future outcomes e.g. a 20% probability of serious symptom progression), ambiguity (refers to indecisiveness arising from a lack of credibility, reliability or adequacy including inconsistency, conflicting information, and a lack of information e.g. two doctors disagreeing about the benefits of a hospital admission) and complexity (incomprehensibility arising from multiplicity

of causes and difficulty in comprehension e.g. a need to bring complex clinical guidelines together to decide the appropriate course of action); a taxonomy developed earlier by Han and colleagues (2011). For this reason, the definition of uncertainty proposed by Hillen et al. (2017) that uncertainty is, '*a fundamental metacognitive state consisting of the conscious awareness of ignorance*' (p. 64) acknowledges risk as a branch of uncertainty. Existing research suggests ambiguity and complexity can be reduced by collecting more information or increasing comprehension (Meyer et al., 2021), whilst probability, for example being unable to predict patient deterioration at discharge, is irreducible and therefore is tolerated, or not. However, ambiguity and complexity can also be the focus of UT research. For example, instances where too much information is collected to reduce ambiguity may be driven by a low tolerance for uncertainty.

Hillen and colleagues (2017) proposed that where uncertainty is consciously perceived, the subsequent appraisals or responses can range from positive to negative. The valence of such manifestations is what constitutes the tolerance of an individual. It may be that uncertainty is viewed as a challenge and provokes curiosity, which would be considered high UT. Conversely, uncertain situations may trigger anxiety, cause an individual to doubt themselves and lead to decision avoidance, reflecting a low UT. The model is flexible, allowing UT to be conceptualised as both trait- and state-dependent. Taking a trait-focused approach, individual differences in UT can be explored. Taking a state-focused approach, contextual factors influencing decisions (e.g. the decision to admit or discharge a patient), such as the team dynamic or the availability of bed space in the hospital, could be considered as 'moderators' of how any uncertainty surrounding them is appraised or responded to.

Whether UT is a stable, personality trait or a more complex, modifiable construct pertaining to a multitude of contextual and individual factors (i.e. state), has been debated in the literature and influences how researchers choose to measure UT. For example, Buhr and Dugas (2002) considered intolerance of uncertainty as a general tendency to respond to uncertainty in a particular way and proposed the Intolerance of Uncertainty Scale (IUS) with a four-factor structure: uncertainty is stressful and upsetting, uncertainty leads to the inability to act, uncertain events are negative and should be avoided, and being uncertain is unfair. Researchers measuring UT in this way are focused on measuring differences between individuals, rather than within the same individual across contexts and therefore employ a more trait-based approach to exploring UT.

Of particular relevance to doctors, is the Physicians' Reactions to Uncertainty (PRU) scale, developed by Gerrity and colleagues (1990; 1995). The PRUS scale focuses on four components of UT: anxiety about uncertainty, concerns about bad outcomes, reluctance to disclose uncertainty to patients and reluctance to disclose mistakes to other doctors. Existing research has either focused on specific components within the scale, or averaged scores across all components to establish a doctor's UT (Lawton et al., 2019; Pines et al., 2010). Despite focusing on a clinical environment, by employing a positivist methodology, studies using scales such as PRUS may not account for the potential modifiability and complexity of UT. Qualitative, longitudinal research of medical students suggests UT is dynamic and can be influenced by experience (Stephens et al., 2021) and certain clinical presentations, such as chest pain,

can trigger increased fear of missing low probability diagnoses (Kanzaria et al., 2015). Consequently, scales measuring UT in the context of clinical practice could be considered reductive. Whilst evidence of individual differences in UT exist within the same context (Lawton et al., 2019), when developing strategies to enhance UT, it is also necessary to consider wider, contextual factors.

The Hillen et al. (2017) model has not yet been used to explore how uncertainty is experienced when making admission and discharge decisions in ED and subsequently, to develop a theory-based intervention. This thesis considers the experience of ED doctors through the lens of this model, acknowledging that contextual factors as well as the differences in individual doctors influence responses to uncertainty in the ED. This distinguishes the UT model from traditional theories of clinical decision-making in situations of uncertainty, which focus on cognitive processes of individual doctors to reduce, or manage, uncertainty. For example, information-processing models use hypothetico-deductive approaches involving four stages: cue recognition, hypothesis generation, cue interpretation and hypothesis evaluation (Tanner et al., 1987). Such theories are useful to understand metacognitive processes however they do not account for how such processes evolve across a doctor's career, or how they depend on socio-cultural and environmental influences, therefore not accounting for existing, empirical evidence suggesting such relationships (Lawton et al., 2019).

Other theories aiming to describe clinicians' ability to manage uncertainty have considered the metacognitive processes involved in clinical decision-making as more dynamic concepts, evolving over time. For example, intuitive-humanist models (Benner, 1984) do not consider hypothesis generation, rather they illustrate how novice clinicians rely on procedures and guidelines whilst

experienced clinicians rely on intuition, defined as, '*understanding without a rationale*' (Benner and Tanner, 1987, p. 23). O'Neil et al. (2005) developed a clinical decision-making model incorporating the benefits of both the previously described hypothetico-deductive model and a novice-to-expert clinical reasoning model. This model acknowledges both hypothesis generation and the pattern recognition employed by experienced clinicians. Despite placing emphasis on the evolution of clinical decision-making over a clinician's career, these traditional models still do not account for contextual factors relevant to ED which may impact a doctor's ability to manage uncertainty, such as limited resources and time.

A recent review of conceptual models of clinical uncertainty management (Helou et al., 2020), found three key approaches to decision-making amongst doctors: intuitive approaches (using patterns based on knowledge from past experiences, sense-making from existing mental models and cognitive representations of a situation), protocol-driven approaches (relying on rules and decision-aids such as guidelines) and team-based approaches (incorporating perspectives of colleagues and service users to reach consensus). Although such research provides invaluable insight into how doctors manage patients, these theories do not account for how willing, or able, doctors are to engage in such strategies and how helpful such strategies are in situations of irreducible uncertainty for alleviating negative responses such as over-investigation and burnout. Whether an individual doctor is engaging in uncertainty management strategies too much, or too little, and if the doctor's cognitive appraisals and emotional responses driving such strategies are positive, or negative, is the focus of this thesis and it is this, which constitutes UT.

Despite providing the most comprehensive model of UT in healthcare, Hillen et al. (2017) acknowledged that their model should be used as a platform for further investigation, not an all-encompassing explanation of UT. The model suggests that moderating factors can influence the thoughts, feelings and behaviours ED doctors have in response to uncertain patient management decisions but does not explain what these factors could be in an ED context. Given that existing, empirical evidence suggests low UT amongst ED doctors can negatively impact patient outcomes, staff wellbeing and financially burden the health-service, a theoretical model of UT amongst ED doctors approaching patient management decisions is needed to inform approaches to mitigate such negative outcomes. Without an underpinning understanding of UT in ED contexts, it is difficult to recommend appropriate support mechanisms for doctors and patients facing uncertainty.

## **1.5 Thesis aim and objectives**

The aim of this thesis is to establish areas of focus for intervention development seeking to enhance UT amongst ED doctors and identify intervention priorities meeting the needs of doctors and patients in uncertain situations in the ED. This thesis has five main research objectives.

- To understand how uncertainty in the ED is responded to and establish what factors influence this.
- To identify individual-level outcomes (patient-centred and staff-centred) and organisational-level outcomes of clinical uncertainty and how it is tolerated.
- To assess whether existing interventions and tools used to manage uncertainty in the ED are contributing to enhanced UT.

- To apply empirical findings to shape existing UT theory within the context of ED disposition decisions.
- To establish consensus on, and prioritise future interventions aiming to enhance UT in the ED.

## 1.6 Methodological approach

### 1.6.1 Methodological framework

Given this thesis is situated in a context as complex as the ED, it is structured to meet the actions specified in the most recent complex intervention development guidance from the Medical Research Council (Skivington et al., 2021). The guidance distinguishes intervention development (or identification) from subsequent stages (including feasibility testing, implementation and evaluation) and places great emphasis on context (including wider system factors) and stakeholder engagement (see Figure 1.4). The 'development' phase is described as the process between the initial idea for an intervention and formal pilot testing (Hoddinott et al., 2015). Given a lack of evidence on the potential areas of intervention focus for enhancing UT in the ED, this thesis is positioned within this phase.

The framework briefly outlines the development phase for interventions but largely draws from guidance published earlier by O'Cathain and colleagues (2019a) which aims to guide researchers, particularly novices, in approaching complex intervention development. To develop the guidance, researchers first undertook a review of published approaches to intervention development (O'Cathain et al., 2019b), that offered researchers guidance on specific ways to develop interventions. Further qualitative work was conducted (Turner et al., 2019) which, together with the review, informed an e-Delphi consensus exercise

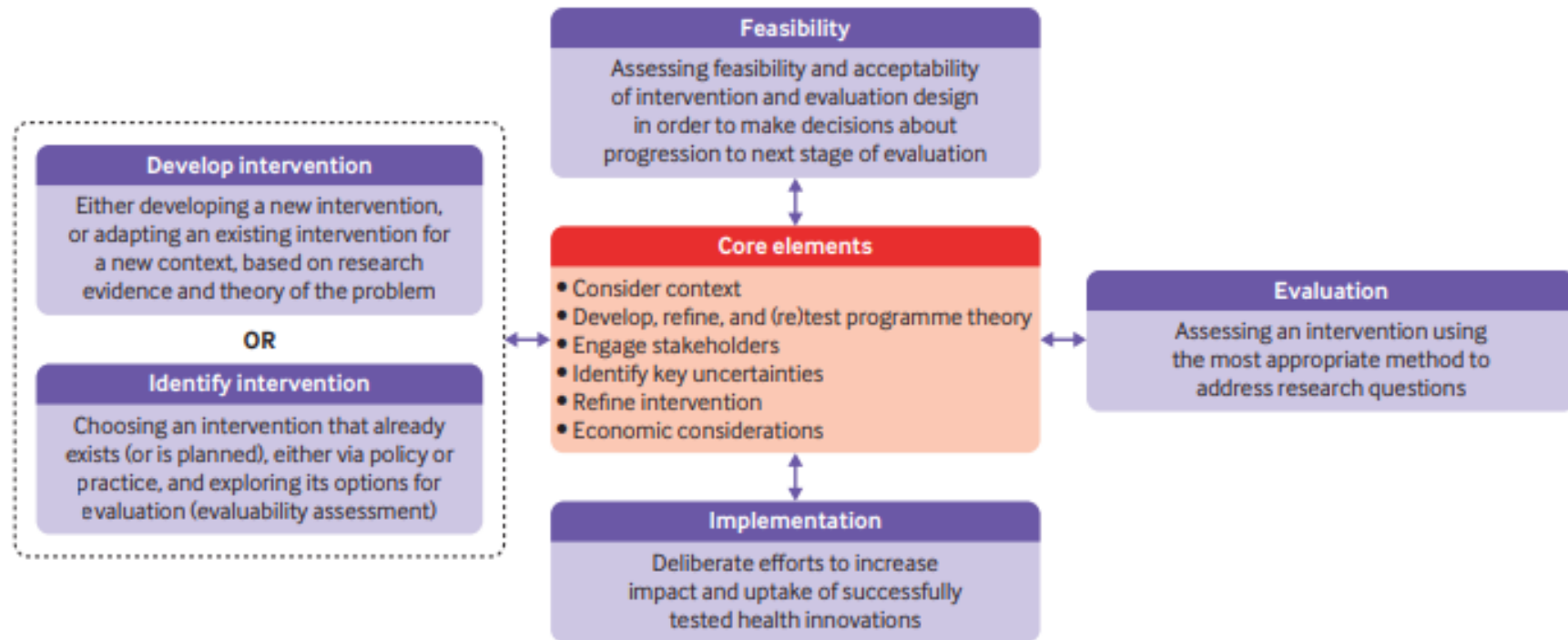


with experts that assessed the importance of certain elements for intervention development. The guidance poses a series of actions for intervention developers to consider but acknowledges that not all may be feasible or relevant.

Key actions suggested for intervention developers by O’Cathain and colleagues (2019a) include: plan the development process (e.g. identify the problem to target and refine understanding of this throughout), involve relevant stakeholders and consider the most appropriate mechanisms for such involvement, establish decision-making processes within the research team, review published evidence to understand the evidence-base and identify existing interventions, draw on existing theories, articulate programme theory, understand context, undertake primary data collected to understand the context, consider future barriers and facilitators to future implementation, design and refine the intervention and finally, end the development phase. Section 1.7 outlines the purpose of each thesis chapter in relation to these stages and describes the type of research and associated research methods utilised.

**Figure 1.3**

Framework for developing and evaluating complex interventions (Skivington et al., 2021).



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To inform future intervention development, this thesis prioritises establishing the function of UT interventions, over the form. Functions of complex interventions determine the desired effect of an intervention (e.g., increasing patient involvement in treatment decision-making or empowering senior doctors to demonstrate leadership that promotes psychological safety), and informs how researchers can monitor fidelity across multiple delivery settings and forms (i.e. the intervention content, delivery length and mode of delivery which can vary based on contextual factors) (Esmail et al., 2020; Hill et al., 2020).

### **1.6.2 Research paradigm**

This thesis takes a pragmatic epistemological and ontological position to research and intervention development whilst acknowledging healthcare as a complex, adaptive system (McDermott, 2014). Pragmatism values applied approaches to understanding practical issues overachieving ideal, generalisable and theoretical understanding (Long et al., 2018). As the Hillen et al. (2017) model was not developed specifically for ED contexts, research throughout this thesis does not expect the theoretical underpinning of the model to be fully generalisable to an ED context but uses the model to shape approaches to research. This aligns with another element of pragmatism which suggests imported knowledge from different contexts can shape observation (Biesta, 2010).

In recognising contextual influences on UT and acknowledging individual differences when exploring the concept, this thesis prioritises continual learning (Long et al., 2018). UT theory is developed throughout the thesis but is based on understanding the experiences of relevant stakeholders rather than achieving theoretical purity. The major underpinning of pragmatism is that

knowledge is based on experience (Kaushik and Walsh, 2019) and whilst this knowledge may not reflect reality objectively, it is constructed to manage individuals' existence in their roles (Goldkuhl, 2012). Given the research focus of this thesis is the thoughts, feelings and behaviours associated with decisions and to generate applicable knowledge to solve problems associated with these responses, this thesis prioritises the input of those with experience of making decisions to achieve knowledge.

Pragmatists consider reality to be complex and that the process of acquiring knowledge is not exclusively objective or subjective (Goles & Hirschheim, 2000). As a result, pragmatism offers flexibility in methodology by embracing quantitative and qualitative research designs, as well as inductive and deductive reasoning styles (Feilzer, 2010). This allows the researcher to make methodological and design decisions based on suitability for the research question. The studies in this thesis were informed by emerging findings and therefore research questions were generated over three years and pragmatism allowed a multi-method approach to addressing each.

## **1.7 Outline of thesis**

Given the pragmatic epistemological position of this thesis, research methods for each study in this thesis were informed by the research objectives (Fielzer, 2010). Further justification of methodological approaches is given in each chapter. The structure of this thesis and how each chapter contributes to intervention development are presented below.

### **1.7.1 Mapping the evidence on how healthcare professionals, patients, families and carers in the emergency department experience uncertainty: a scoping review**

Chapter 2 outlines a systematic scoping review which aimed to establish the current scope of knowledge on UT in ED contexts and identify existing interventions to enhance UT in an ED context. Existing evidence addressing sub-constructs of UT (e.g., responses to uncertainty such as how it is communicated, or factors influencing such responses such as years of clinical experience) is synthesised, alongside evidence of more distal outcomes of UT (e.g., burnout and the quality of care received by patients). In doing so, the review rationalises UT interventions and suggests potential areas of focus for UT interventions. Findings of the review also informed further development of the Hillen et al. (2017) theory of UT in relation to an ED context, summarising evidence of associations between UT, outcomes pertaining to patients, staff and the organisation, and contextual factors specific to an ED context. The expansion of this model continues throughout the entire thesis with the findings from each chapter suggesting potential areas of focus and outcomes of interest for UT interventions.

### **1.7.2 The public perspective on how uncertainty is tolerated by ED doctors**

Chapter 3 invites the public perspective on how ED doctors manage uncertainty and summarises involvement and engagement of service users in shaping the direction of this thesis, and future UT research. In doing so, the chapter addresses gaps identified by the scoping review in Chapter 2. This includes whether the UT of service users is associated with preferences for uncertainty management in the same way as doctors (e.g. higher UT is associated with lower admission rates). This chapter presents a cross-sectional, hypothetical scenario study, conducted with 318 members of the public to

establish the preferences of the general public with regard to hospital admission in uncertain situations. It also summarises their preferences for involvement in uncertain disposition decisions and communication of diagnostic uncertainty in the ED, considering whether this varies according to patient characteristics such as age, UT (trait) and education level. Wider patient and public involvement and engagement (PPIE) across all studies is also considered in this chapter, including how thesis aims were shaped collaboratively with public contributors.

### **1.7.3 A qualitative exploration of how junior doctors and registrars respond to uncertainty in the Emergency Department and the factors they perceive to influence this.**

Chapter 4 presents study findings from 14 semi-structured interviews with doctors working within the ED of one, large NHS acute trust. This study was informed by a specific patient-management decision identified in Chapter 2; uncertain disposition decisions made by doctors with a range of clinical experience (1-25 years). Using a combined theory-based (Hillen et al., 2017), deductive approach and inductive approach (acknowledging unforeseen phenomena) to analysis, this chapter identifies moderators (factors influencing UT) in the context of admission and discharge to narrow the focus of potential interventions and inform programme theory development. Ultimately, this chapter builds understanding of context and contributes primary data to an evidence gap identified via the scoping review in Chapter 2.

### **1.7.4 Establishing doctors' priorities for interventions to enhance uncertainty tolerance in the context of disposition decisions in the Emergency Department: a modified e-Delphi survey.**

Chapter 5 builds on the previous scoping review work (Chapter 2), public preferences gathered on uncertain disposition decision-making (Chapter 3) and qualitative findings (Chapter 4) to provide national consensus on, and prioritise, the approaches and interventions required to support doctors to tolerate the uncertainty associated with disposition decisions. The doctors interviewed in chapter 4, discussed more severe negative appraisals and responses to uncertainty when reflecting on discharge decisions than admission. At this stage, the uncertainty associated with discharging patients was identified as the focus of UT intervention functions explored in the final study.

Due to the absence of existing research suggesting intervention components that are likely to be successful in enhancing UT for ED doctors disposition decisions (Chapter 2), it was necessary to gather expert opinion to establish priorities for intervention components. A questionnaire-based, two-stage, modified, electronic Delphi method was used to elicit the views of 23 experts (ED doctors and researchers of clinical uncertainty). The chapter focuses on tolerating the uncertainty associated with a discharge decision as these were identified in Chapter 4 as triggering the most anxiety, and avoidable admission decisions, amongst ED doctors. Potential UT intervention functions that achieved consensus as being important amongst ED doctors, were then grouped into 'packages' that the research team, ED consultants and public contributors believed could be delivered together and prioritised by 11 ED doctors.

### **1.7.5 Discussion**

This final chapter synthesises the findings from the whole thesis, evaluating their contribution to the five main research objectives. This includes general

discussion of how findings from this thesis have developed the Hillen et al. (2017) model in an ED context. Despite no evidence advocating the use of theoretical frameworks in intervention development, developing theory to identify what is important, relevant, and feasible can inform the content, delivery and goals of an intervention (Dalgetty et al., 2019). Development of UT theory, alongside critical consideration of the application of UT theory to ED contexts, is therefore followed by possible directions for future research and intervention developers to maximise the benefit from findings in this thesis.

Table 1.1 maps each thesis chapter to research objectives. Methodological strengths and limitations are considered and implications for future research and clinical practice are discussed. Key findings are considered through the lens of UT theory, allowing theoretical development specific to a UK ED context.



**Table 1.1***Contribution of thesis chapters to research objectives.*

Research objectives	Thesis Chapter					
	1	2	3	4	5	6
To understand how uncertainty in the ED is responded to and establish what factors influence this.		✓		✓		
To identify individual and organisational-level outcomes of uncertainty and how it is tolerated.		✓	✓	✓	✓	
To assess whether existing interventions and tools used to manage uncertainty in the ED are contributing to enhanced UT.		✓		✓		
To apply study findings to shape existing UT theory within the context of ED disposition decisions.		✓	✓	✓	✓	✓
To establish consensus on, and prioritise future intervention functions aiming to enhance UT in the ED.			✓		✓	

## **Chapter 2**

# **Healthcare professionals' and service users' experiences of uncertain diagnoses and patient management in the Emergency Department: a scoping review and narrative synthesis**

### **2.1 Chapter summary**

Chapter 1 introduced UT theory and highlighted the importance of UT for patient safety and staff well-being and retention. In chapter 1, the need for interventions to enhance UT in ED contexts was also articulated. This chapter reports on a scoping review of healthcare professionals and service users' experiences of uncertainty throughout clinician-patient encounters in an ED context. Due to the heterogeneity of review questions to encompass all components of UT as defined by Hillen et al. (2017), findings were synthesised narratively. Implications for theory and further research are outlined, including how the findings informed future chapters in this thesis.

### **2.2 Introduction**

As emphasised in the previous chapter, uncertainty is ubiquitous and pervasive throughout clinician-patient encounters in the ED. Patients are often unknown to healthcare professionals in EDs, and time constrains the opportunity for prolonged observation to aid the progression toward certainty (Platts-Mills et al., 2020). In addition, many patients are discharged from the ED with symptom-based diagnoses (e.g. chest pain) rather than pathological explanations of the cause of their symptoms (e.g. lung cancer), resulting in

lingering uncertainty for clinicians and service users following an encounter (Wen et al., 2015).

The anxiety that comes with perceiving uncertain situations as beyond one's control can trigger maladaptive responses indicative of low UT, such as avoiding uncertain decision-making (e.g. deferring decisions to other colleagues) (Helmich et al., 2015). While existing evidence is inconclusive as to how doctors' UT influences test-ordering, treatment, referrals, or admission decisions (Strout et al., 2018), there is a growing evidence base demonstrating an association of low UT with burnout, reduced job satisfaction and less engagement at work (Simpkin-Begin et al., 2022). In a survey study examining need for cognitive closure and clinical practice amongst obstetricians and gynaecologists, a high need for cognitive closure reduced the number of screening questions asked to women and reduced engagement with specialists (Raglan et al., 2014). In a retrospective survey study, patient's attending appointments with GPs with lower UT, rated their experience of being listened to, and overall experience, lower than those attending appointments with GPs with higher UT (Simpkin-Begin et al., 2022). For patients and families, unresolved uncertainty has been associated with negative impacts on quality of life, psychological wellbeing, family functioning and symptom burden (Giammanco & Gitto, 2016; Kim et al., 2012; Northouse et al., 2012; Rolland, 2005; Sammarco, 2001; Song et al., 2011).

In light of this previous research, there have been calls for interventions to mitigate the negative responses to clinical uncertainty among doctors and patients (Kim and Lee, 2018; Miller and McGuire, 2023; Platts-Mills et al., 2020; Stephens et al., 2021; White and Williams, 2017). Despite a strong rationale for

such initiatives, evidence-based UT interventions have focused on specific diagnoses such as recognising uncontrollable aspects of a diagnosis and identifying coping strategies to increase UT and quality of life for patients with multiple sclerosis (Rahimi et al., 2023). It is difficult to apply such findings to develop interventions within ED contexts where progression toward diagnoses unfolds over time and establishing pathological diagnoses is often not established (Wen et al., 2015). It is therefore necessary to synthesise evidence that conceptualises uncertainty throughout an ED attendance from multiple perspectives to direct research aiming to develop interventions to mitigate negative manifestations of uncertainty.

A preliminary search for existing systematic and scoping reviews was conducted in March 2020 in relevant databases, including the Joanna Briggs Institute Evidence Synthesis, the Cochrane Database of Systematic Reviews, PROSPERO, CINAHL, MEDLINE, PsycINFO, Scopus, Web of Science and on Google Scholar. No systematic or scoping review focusing on UT in an ED context was identified. The search retrieved two scoping reviews synthesising evidence of how doctors manage uncertainty, however they were situated in GP (Alam et al., 2017) and surgical (Tubbs et al., 2016) contexts. Similarly for service users, three reviews were identified that focused on uncertainty in contexts other than the ED. Oishi and Murtagh (2014) systematically reviewed the challenges service users and healthcare professionals perceive to exist due to uncertainty within palliative care settings. Uncertainty management strategies among families of those with progressive neurological disease (Tams et al., 2016) and among patients and families of those with existing diagnoses, including cancer and diabetes (Zhang et al., 2020) have been systematically

reviewed. This evidence does not consider the concept of uncertainty pre-diagnosis and can therefore not be applied to many ED service users.

The preliminary search identified one scoping review in an ED context which focused on the clinical reasoning of doctors. However, this review devoted little attention to uncertainty as an element of decision-making (Pelaccia et al., 2020).

More recently, Brun et al. (2023) conducted a scoping review focused on the impact of UT on clinical reasoning across all clinical contexts. One of the conclusions from this review was that the majority of research to date has focused on the influence of UT on decisions by health professionals to investigate symptoms and undertake tests, with no research focused on how clinical reasoning processes are impacted by UT. Brun et al. (2023) only included articles in their review that were explicit in their conceptualisation of UT, resulting in only eight articles retrieved across all clinical contexts. This meant that for articles considering the cognitive, emotional or behavioural responses to uncertainty (encompassing probability, ambiguity and complexity), where UT was not explicitly discussed, evidence was not considered by Brun et al. (2023). The scoping review presented in this chapter is broader in its focus, including all evidence sources in which uncertainty is consciously perceived in the ED, regardless of whether responses were conceptualised as indicative of tolerance or not.

Aside from scoping and systematic reviews in this field, Platts-Mills et al. (2020) conducted a literature review of UT among ED doctors and concluded that doctors would benefit from awareness of their own UT and increased ability to communicate uncertainty with patients. This review focused on UT as a trait,

suggesting doctors' might not be able to change UT as a personality trait, but can increase awareness of it and reflect on personal strengths and weaknesses. The review in this thesis builds on the work of Platts-Mills et al. (2020) by conducting a systematic search, acknowledging the uncertainty experienced by groups other than doctors and acknowledging state-based factors influencing UT.

Broadening the scope of evidence to include healthcare professional groups in addition to doctors (e.g., ED nurses and GPs working in the ED), where clinical decision-making research and identified reviews have focused, is also necessary to address evolving healthcare team roles and responsibilities. Despite being limited, knowledge of encouraging positive responses to uncertainty is more advanced for doctors than any other group involved in patient management decisions. Doctors are primarily responsible for patient management decisions in EDs, however, changing working practices have led to emergency nurse practitioners engaging in more autonomous decision-making (Bagley, 2017; Smyth & McCabe, 2017) and doctor associates demonstrating similar patient assessment as foundation year two doctors (Halter et al., 2020).

Furthermore, patient involvement and decision-making engagement are increasingly recognised as vital to patient-centred care (Davis et al., 2011; O'Hara & Lawton, 2016; Vahdat et al., 2014). A systematic review conducted by Flynn et al. (2012) considered patient involvement in decision-making beneficial to the quality of care within EDs and suggests no reason such involvement is not feasible. Patients and families also consider the involvement of family and friends in decision-making paramount to the quality and safety of care, particularly in times of serious illness, when those close to the patient can relay

key information regarding symptom history (Jenkinson et al., 2002). This review, therefore, will move away from the traditional medical model, which only considers doctor decision-making, to include other ED healthcare professionals, as well as patients, families and carers, which this review will term 'service users'. Including service users' experiences of uncertainty in the ED will develop understanding of whether UT interventions should be patient-focused.

Additionally, by establishing the outcomes of responses to uncertainty among ED healthcare professionals and service users', will develop understanding of how UT interventions may yield positive outcomes for all groups.

This chapter synthesises evidence on UT in ED contexts using the definition of UT provided by Hillen et al. (2017) (i.e. cognitive appraisals, emotional states and behavioural responses to consciously perceived uncertainty). It is the first review of clinical UT in an ED context that includes evidence focused on responses to uncertainty that Hillen et al. (2017) consider sub-constructs of UT (e.g., fear as an emotional response and acknowledgement as a cognitive appraisal). By including such studies, this review aims to answer unresolved questions about the composition of a UT intervention, highlighting contextual and individual-level factors that could drive change. This will help generate areas of focus for evidence-based interventions which mitigate negative responses to the inevitable uncertainty faced in ED contexts.

### **2.3 Review aim and research questions**

The objective of this review is to understand the sources of uncertainty and how uncertainty shapes the experience of, and outcomes for, healthcare professionals and service users in the ED and to describe the range and type of existing support for healthcare professionals and service users to tolerate

uncertainty. The first three research questions are informed by the Hillen et al. (2017) model of UT, allowing components of UT to be understood in an ED context. Findings will inform an agenda for future research and future intervention development.

### **Research Questions:**

1. What *sources* of clinical uncertainty in the ED have been identified in the literature?
2. According to existing research, how do healthcare professionals and service users *respond* to clinical uncertainty and what *factors* influence this?
3. What *outcomes* of clinical uncertainty in EDs have been identified in the literature?
4. What *interventions or tools* have been implemented or used to manage uncertainty in the ED and do they address the sources, factors and outcomes identified by existing research?

A scoping review is appropriate due to the broad and complex research questions and the lack of existing reviews on this topic and in this context (Mays et al., 2001). A conceptual understanding of UT is relatively new in the literature (Hillen et al., 2017) and therefore the way researchers have defined and measured uncertainty and UT is varied, which has implications for conducting a systematic review, further rationalising this approach. The research questions aim to establish the current scope of knowledge about the concept of uncertainty within an ED context within the academic and grey literature, rather than assessing the effectiveness of interventions or quality of evidence (Amog et al., 2022). The relatively new conceptualisation of UT in the literature also rationalises searching for grey literature on the topic. With publication often



taking between 2 to 11 months from article acceptance (Floyd et al., 2011), a grey literature search could reveal highly relevant, unpublished research in the field relevant to the Hillen et al. (2017) model of UT.

Unlike systematic reviews, this review is not intended to directly influence clinical practice and is instead focused on mapping how the concept of uncertainty in the ED has been researched and identifying key characteristics and factors related to how staff and service users experience uncertainty in the ED. This will inform new directions for research, identify gaps in existing literature and establish the need for further interventions (Tricco et al., 2016).

## **2.4 Methods**

This review followed the most recent guidance from the Joanna Briggs Institute (Peters et al., 2020) on the conduct of scoping reviews and is reported according to the PRISMA extension for scoping reviews (Tricco et al., 2018). A protocol was drafted prior to running searches. Following feedback from one clinical and one public contributor, the protocol was revised and made available on the Open Science Framework on the 27th May 2020 (<https://osf.io/4hfyd/>).

### **2.4.1 Eligibility criteria**

Academic articles and grey literature were required to satisfy inclusion criteria pertaining to the population, concept, and context of interest to be included in the review. The population of focus was any group involved in or affected by patient management decisions in EDs. The concept of interest was uncertainty experienced by an individual in the ED or how individuals manage or respond to uncertainty. Specifically, this review focuses on uncertainty about diagnoses, prognosis, causal explanations, and treatment recommendations (including

whether admission is required for further medical intervention or observation), which Han et al. (2011) term 'scientific' uncertainty and this review terms 'clinical' uncertainty. Finally, eligible studies must be situated in a major ED context in acute care.

Due to the differing approaches researchers have taken to measuring clinical uncertainty, primary research using qualitative, quantitative, and mixed methodologies are included. Secondary studies, literature reviews, discussion papers, commentaries and editorials which summarise or interpret findings of primary research were not included as individual studies within them were screened for inclusion. Case reports and retrospective studies which assume an experience of uncertainty, without explicitly measuring it, were excluded. Due to funding restrictions, only articles with a full text available in English were included. Due to the long history of decision-making research, no time limit was imposed. Further detail and justification of exclusion criteria is provided in table 2.1.

**Table 2.1***Inclusion and exclusion criteria with justification*

	Inclusion Criteria	Exclusion Criteria	Justification
Population	Those involved in or affected by patient management decisions in EDs.	Children are excluded but studies in the paediatric ED setting, where ED staff, adult parents and caregivers are experiencing uncertainty, are included.	The decision-makers are the focus of this review. Those without consent are excluded.
	To this end, studies involving emergency doctors (of all grades), emergency nurse practitioners, any other HCPs within EDs including students, patients, families, relatives and carers are included.	Conclusions about participants within EDs are not distinct from other HCPs or patients, or less than a quarter of the sample is made up of those in an ED.	EDs are a unique environment and contextual factors are important to distinguish from other settings when considering uncertainty and uncertainty management. Findings and conclusions specific to ED are the focus of this review.
		Paramedics	The focus is on populations who primarily make decisions within an ED context and not before or after a patient presents at an ED.

Table 2.1 (continued).

	Inclusion criteria	Exclusion criteria	Justification
Concept	<p>Focus of study is on uncertainty being experienced by an individual in the ED, or a way in which individuals manage or respond to uncertainty.</p> <p>The review uses the definition of 'scientific uncertainty' offered by Han et al. (2011) which encompasses uncertainty about diagnosis, prognosis, causal explanations and treatment recommendations. To ensure this is encapsulated, studies must consider patient management decisions.</p> <p>All reported outcomes of clinical uncertainty pertaining to healthcare professionals, service users or the organisation are included.</p>	<p>Where the focus is practical (system-centred) uncertainty or personal (patient-centred). For this reason, articles concerned with uncertainty surrounding wait times, patient arrivals, when to wash hands, litigation issues and role ambiguity are excluded.</p> <p>Studies without a self-report or validated measure of uncertainty or UT.</p> <p>Where the focus is the development, validation or testing of a decision tool, risk stratification tool or clinical recommendation with no regard or measurement for how they impact uncertainty or confidence.</p>	<p>The interventions needed to manage such types of uncertainty would differ from scientific uncertainty.</p> <p>Rather than assuming uncertainty from lack of knowledge, variation in practice or retrospective categorisation of patient notes by external doctors, this review focuses on the experience of consciously perceived uncertainty by HCPs and service users.</p>

Table 2.1 (continued).

Inclusion criteria	Exclusion criteria	Justification
Concept (continued).	Studies attributing ED attendances to uncertainty experienced at home are excluded, unless the uncertainty is considered upon arrival at the ED or at discharge whilst still in the ED.	This review is focused on experienced uncertainty and efforts to manage it taking place in the ED.
	Studies where uncertainty is not a central focus of aim or rationale. Studies focused on diagnostic error.	This review summarises evidence and knowledge focused on uncertainty, rather than that which consider it a tacit element of decision making.

Table 2.1 (continued).

	Inclusion criteria	Exclusion criteria	Justification
Context	<p>The contextual focus is a major ED within an acute care setting with no limit on geographic location or healthcare system.</p> <p>The term, 'major', refers to adult and paediatric EDs attached to hospitals or trauma centres which provide a 24-hour service, rather than departments which only handle cases specific to a specialty or attend to minor injuries and illnesses.</p>	<p>Where the ED has been used as recruitment site but the contextual focus is elsewhere e.g. a survey about home care.</p> <hr/> <p>Psychiatric, surgical and dental emergency services are excluded.</p>	<p>Focus is on uncertainty experienced in the ED and how individuals can be supported to manage uncertainty in the ED, not elsewhere.</p> <hr/> <p>Specialty specific EDs.</p>

Table 2.1 (continued).

	Inclusion criteria	Exclusion criteria	Justification
Concept (continued).	<p>Due to the connection of trauma centres and EDs and the 24-hour operating style of both, articles focused on trauma centres are included.</p> <p>As long as the focus of the study is a major ED, studies conducted elsewhere (i.e. data not collected physically in an ED) are included.</p> <p>Studies which simulate an ED environment based on real-life situations, are included.</p>	<p>Prehospital care.</p> <p>Medical school.</p>	<p>Focus is major EDs attached to an acute hospital, not all of emergency care.</p> <p>Focus is on consciously perceived uncertainty within the ED.</p>
Study design	<p>Primary research utilising qualitative, quantitative and mixed methods are included, due to the various ways research has approached measuring uncertainty. Protocols for upcoming studies are included due to a focus on where research efforts are focused.</p> <p>No time limit imposed.</p>	<p>Case reports and retrospective studies if uncertainty was not consciously perceived at the time.</p> <p>Articles not in the English language or without full text available.</p>	<p>They are not framed around an individual's experience of uncertainty, rather they focus on advocating a certain clinical pathway based on an assumption uncertainty existed.</p> <p>Funding restrictions.</p>

### **2.4.2 Information sources**

A comprehensive search of bibliographic databases and grey literature was executed from conception to 25th January 2021. To detect relevant studies, MEDLINE, PsycINFO, Web of Science, Scopus, CINAHL and Cochrane Database of Systematic Reviews were searched. To increase sensitivity, grey literature databases were also searched from conception to 25th January 2021 including Health Management Information Consortium (HMIC) and ProQuest. To further identify grey literature, search engines (Google and Google Scholar) were used, however due to their functioning, the search strategy was simplified (see Appendix 2.1). Due to large numbers of search results on the web engines, articles were sorted by relevance and the first 100 results of each search were screened for inclusion (Carr et al., 2011). To supplement the search, hand searches of relevant journals and websites were carried out and key authors in the field were contacted to identify unpublished, relevant literature. Backward citation searches were conducted for all studies which passed full-text screening.

### **2.4.3 Search**

A three-facet (population, concept and context) search strategy for bibliographic and grey literature databases was drafted through discussion between the research team and input from a research librarian, emergency medicine consultant and members of a specialist emergency care patient group. The search strategy included synonyms of “uncertainty”, “emergency department”, “healthcare professionals” and “patients” and is fully outlined in Appendix 2.1 with the MEDLINE strategy shown in table 2.2 below. MESH terms were available for diagnostic uncertainty, but not uncertainty related to



patient management. Therefore, the search terms for the concept of interest (i.e., ‘uncertainty’) were kept broad to ensure a search not weighted too heavily toward one type of uncertainty. Where grey literature could be accessed through a database, the same search strategy was applied but for web engines with more limited function (e.g. Google Scholar), the search was simplified. Websites and journals were hand searched using the same key terms as web search engines. The final search results were exported into EndNote (2013), and duplicates were removed before screening. Where possible, searches were limited to English language due to funding restrictions and animal studies were filtered out.

## **Table 2.2**

*Search strategy for MEDLINE database and number of results.*

- 
- |   |  |
|---|--|
| 1 | (Emergenc* ADJ2 (unit* or room* or department* or care* or medic* or ward* or treatment* or health* or nurs* or doctor* or doctor* or patient* or clinician* or registrar* or intern*)).tw. (164463) |
| 2 | (Urgent ADJ2 (care or medical care or health*)).tw. (3276)   |
| 3 | (trauma ADJ2 (centre* or center* or department* or unit* or ward*)).tw. (18219)  |
| 4 | (accident ADJ2 emergency).tw (4668)  |
| 5 | “A&E”.tw (22580)   |
| 6 | “Hospital emergency service”.tw (129)  |
| 7 | ED.tw (61312)  |
| 8 | (ER not (“estrogen receptor” or “endoplasmic reticulum”)).tw (38796)   |

- 9 Emergency services, psychiatric/ (2433)
- 10 Emergency service, hospital/ (67621)
- 11 Emergency medicine/ (13414)
- 12 Pediatric emergency medicine/ (264)
- 13 Trauma centers/ (10465)
- 14 Emergency nursing/ (7066)
- 15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 12 or 13 or 14 (299293)
- 16 (Uncertain\* or Doubt\* or indecisi\* or ambigu\* or unpredictab\* or ambivalen\*).tw (264912)
- 17 Differential diagnosis\*.tw (114019)
- 18 Uncertainty/ (12376)
- 19 Delayed diagnosis/ (6180)
- 20 Diagnosis, differential/ (448174)
- 21 Diagnostic errors/ (37495)
- 22 Diagnosis, computer-assisted/ (22431)
- 23 16 or 17 or 18 or 19 or 20 or 21 or 22 (820148)
- 24 (Patient\* or parent\* or famil\* or relative\* or carer\* or caregiver\* or caregiver\* or inpatient\* or in-patient).tw (8641967)
- 25 (Doctor\* or GP or clinician\* or doctor\* or resident\* or intern\* or general practitioner\*).tw. (1748784)
- 26 ((Doctor adj1 (associate\* or assistant\*)) or PA).tw. (79873)
- 27 (nurs\* or HCP or practitioner or staff).tw (678401)

- 28 Family/ (75312)
- 29 Caregivers/ (35973)
- 30 Patients/ (20765)
- 31 Doctors/ (88503)
- 32 Nurses/ (38746)
- 33 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 (9934126)
- 34 15 and 23 and 33 (11136)
- 35 Limit 33 to (English language and humans) (8919)
- 36 (Updating searches from May 13th 2020 to January 25th 2021)
- limit 35 to dt=20200513-20210125 (172; 2 duplicates)

---

*Note.* A&E= Accident & Emergency; ED=Emergency Department; ER= Emergency room; dt=date; GP= General Practitioner; HCP= Healthcare professional; tw= title, abstract and keyword search; /= medical subject heading symbol; \*= unlimited truncation symbol

#### **2.4.4 Selection of evidence sources**

Level 1 screening (titles and abstracts) was conducted on CADIMA software (Julius Kühn-Institut, 2021) which allowed two reviewers to independently assess abstracts against the population, concept and context inclusion criteria outlined in section 2.4.1. To establish consistency between reviewers, a random subset of 164 materials (10% of those assigned to the second reviewer) were initially screened by two reviewers (EP and GL) before abstract review. The results of this process were discussed, and the screening criteria were amended to exclude case reports because both reviewers found the conceptual

focus not to be an individual's conscious experience of uncertainty, rather they focused on issuing general guidance or reflections on uncertain patient management based on diagnostic errors. Reviewers also decided to exclude retrospective, quantitative studies at this stage. This study type focused on instances in which uncertainty was not consciously perceived at the time but was later assumed due to case complexity or time to decision for example. The titles and abstracts of all potential articles ( $n= 16400$ ) were screened by the primary reviewer (EP), with 10% ( $n=1640$ ) having been screened by a second reviewer (GL). Inter-rater reliability was found to be strong ( $k=0.88$ ).

Searches were subsequently updated and the primary reviewer (EP) screened the additional 1291 results, with the second reviewer screening 10% ( $n=130$ ) Combined with the original searches, the overall kappa value was moderate-strong ( $k=.791$ ). Any disagreements were resolved through discussion. All studies which passed Level 1 screening ( $n=339$ ) were then full-text screened by the primary reviewer (EP) with 20 corroborated by the third reviewer (BF) and another 20 by the fourth reviewer (RL). This process achieved strong ( $k= .8$ ) and moderate ( $k= .694$ ) kappa values respectively, with disagreements resolved in research team meetings.

#### **2.4.5 Data charting process**

An initial data charting form based on the research questions was drafted by the primary reviewer (EP). The form was initially trialled on four studies with different designs and rationales and each sent to a member of the research team for consolidation (GL, BF and RL) and a public contributor who has expertise with older patient groups (HT). HT assessed the data extraction for one material focusing on uncertainty experienced by patients and agreed all

important information pertaining to the experience of patients had been captured. Members of the research team suggested the addition of some data charting items including distinct data charting items for interventional and non-interventional studies. Iterations made to the data charting form were discussed between the research team in monthly meetings.

#### **2.4.6 Data items**

Studies were initially split into two categories depending on whether they had an aim to enhance understanding of how uncertainty is experienced in the ED (category 1) or whether they evaluated the impact of a tool or behaviour (e.g. test, protocol or decision-aid) on uncertainty experienced in the ED (category 2). Within category 1, data were extracted for study characteristics (e.g. authors, title, journal, year of publication, country), purpose, methodological considerations (e.g. participants, sample size, setting, method of analysis), locus of uncertainty (e.g. patients or clinicians), definition of uncertainty, clinical focus, stage of patient journey, measurement of uncertainty, theoretical underpinnings, items relevant to research questions (e.g. source of uncertainty, responses and influencing factors, outcomes, key contribution to uncertainty literature) and suggestions made by authors for future research and practice.

Using a separate spreadsheet, extra items were charted for studies in category 2 pertaining to design (e.g., intervention type, materials, delivery, length, target population, feature of routine practice or implemented) and effectiveness (e.g., impact on uncertainty, mechanism of impact, barriers and facilitators). Items were charted verbatim where possible with minimal paraphrasing. Data extracted from grey literature such as theses used the same charting form, but only higher-level findings were extracted. The final data

charting forms, inclusive of all item definitions, can be found in appendix 2.2.

The review did not include study quality assessment due to a focus on synthesising the available evidence, rather than assessing the quality of available evidence.

### **2.4.7 Synthesis of results**

Key characteristics of studies are first presented as frequencies and percentages in table 2.3. Further detail on individual studies including their methodology, purpose and key contribution to the uncertainty literature are presented in supplementary file 1. A narrative synthesis approach was taken to further describe research findings and topic discussions pertaining to research questions 1-3, with analysis highlighting key concepts within existing research (Popay et al., 2006). This approach allows disparate evidence materials with varied methodology and objectives to be arranged into more homogenous categories. Narrative syntheses are generally descriptive (illustrating the current state of knowledge) rather than involving researcher interpretation of the meaning of knowledge. However, scoping reviews with an objective of informing or developing theory often require qualitative content analysis to identify key factors related to a construct (Pollock et al., 2023).

Scoping reviews do not seek to combine quantitative and qualitative data, rather existing evidence materials are identified and presented in a way which develops understanding on the current state of knowledge for the topic of interest (Peters et al., 2021). Qualitative and quantitative evidence was synthesised narratively following an approach suggested by Lucas et al., (2007). Firstly, studies of all designs were grouped according to the way in which they address research questions. For example, all studies acknowledging

the same response to uncertainty were grouped and all studies suggesting clinical experience as a factor which influences such responses were also grouped. Brief summaries were then produced for individual studies in relation to the component of the Hillen et al. (2017) model of UT they focused on. Individual study commentaries were then synthesised in relation to the grouping of interest.

Deductive content analysis was conducted on extracted data about sources of uncertainty, responses to uncertainty and moderating factors, using definitions from Hillen et al. (2017) defined in appendix 2.2. In some cases, data could not be categorised according to these definitions and options for 'other' and 'insufficient detail' existed in every domain to facilitate the recording of this. Inductive content analysis (Vears et al., 2022) was then conducted on these data. Inductive content analysis was also used to form sub-categories within broader constructs of the Hillen et al. (2017) model. For example, the Hillen et al. (2017) model acknowledges situational factors as influencing the perception and response to uncertainty. Hillen et al. (2017) offered examples of situational factors including patient-clinician communication and time available, however these examples are not exhaustive. Where data was considered to be a situational factor, it was deductively mapped to 'situational factors' but inductively analysed to illustrate further sub-categories, acknowledging factors specific to an ED context.

Critical consideration of findings within scoping reviews is typically reserved for assessment of the availability and scope of existing knowledge (Munn et al., 2018). The utility of more complex synthesis in future was established for each research question and is outlined in the discussion.

To address RQ4, key information about the impact of a tool or strategy on uncertainty (interventional studies) are presented in a table and existing efforts to influence the experience of uncertainty in the ED are compared to the experience of uncertainty outlined by the conceptual model in a figure. Findings from RQ1-3 formed a coding framework with which interventional studies could be analysed using deductive content analysis. This allowed efforts to support healthcare professionals and service users in the ED to be mapped onto the issues identified by non-interventional studies, and gaps for interventions to be identified. Finally, using recommendations from authors of included studies as well as a comparison of issues relating to uncertainty and existing initiatives identified by the review, implications for research are highlighted in the discussion.

## **2.5 Findings**

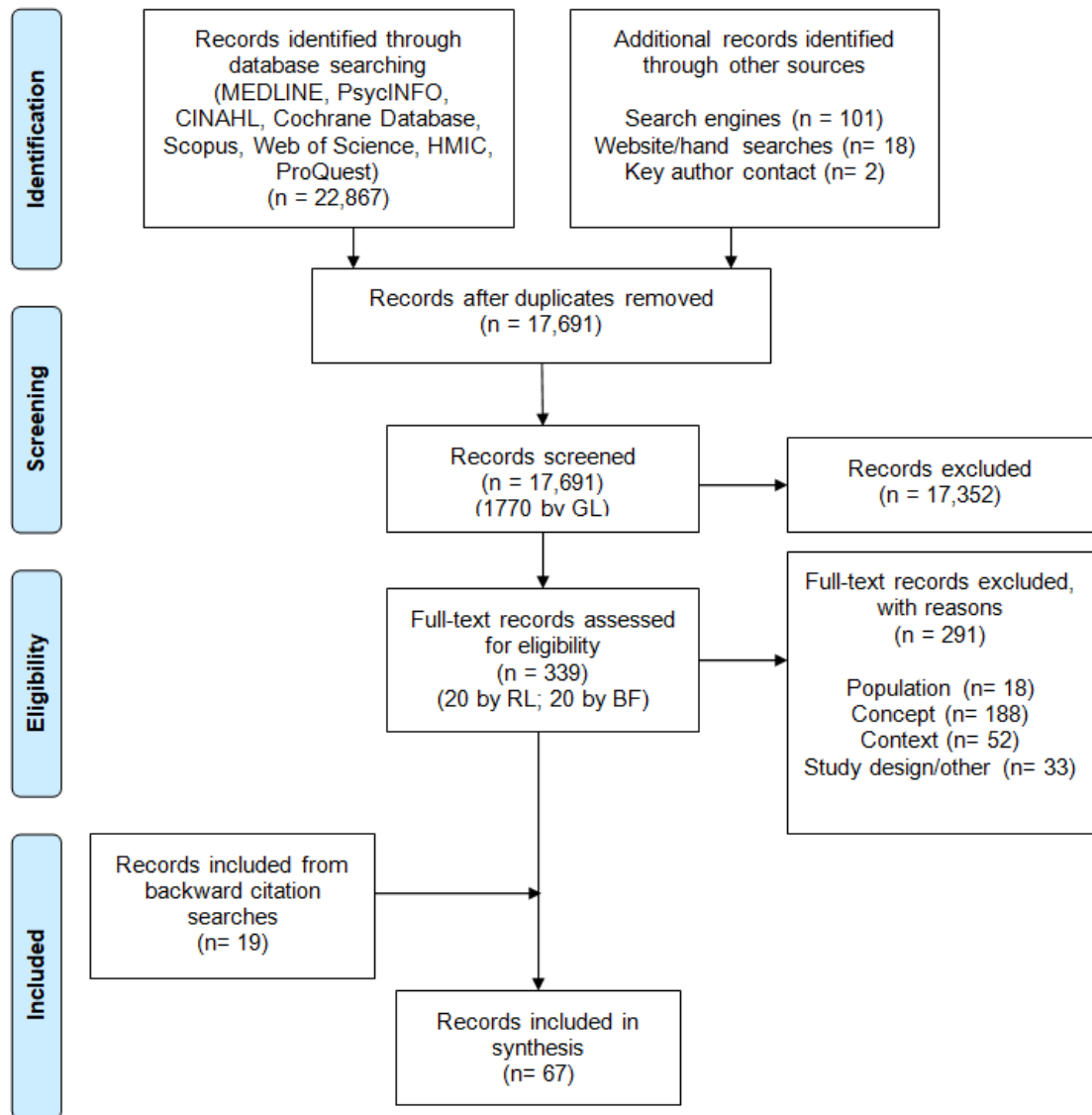
### **2.5.1 Selection of materials**

After duplicates were removed, the abstracts of 17691 materials were screened using the criteria outlined in section 2.4.1. Three hundred and thirty-nine materials were full text screened, of which 291 were not eligible for inclusion. Specific reasons for exclusion of full-text records are provided in appendix 2.3. Backward citation searches of 48 eligible materials revealed 19 further eligible materials, resulting in 67 materials included in this review (see Figure 2.1). This included 65 academic articles (including one unpublished manuscript) and two theses.



Figure 2.1

PRISMA diagram



## 2.5.2 Characteristics of evidence materials

Key characteristics of the 67 included materials are summarised in Table 2.3. Thirty-eight studies developed understanding of how uncertainty is experienced in the ED (category 1) and 29 evaluated the impact of a tool or intervention (e.g., decision aid or clinical imaging test) on uncertainty experienced in the ED (category 2). Studies were conducted across the USA ( $n= 43$ ), Canada ( $n= 7$ ),

the UK ( $n= 5$ ), Switzerland ( $n= 4$ ), Australia ( $n= 2$ ), Sweden ( $n= 2$ ), Singapore ( $n= 1$ ), France and Morocco ( $n= 1$ ), Japan ( $n= 1$ ) and The Netherlands ( $n= 1$ ).

Due to a lack of reporting on further contextual information, whether research was conducted in rural or urban settings could not be deduced. However, of those that specified ( $n= 21$ ), an overwhelming majority of research was conducted in urban, university-affiliated hospitals ( $n= 16$ ), with remaining materials either unspecified or including research across multiple EDs, of which few were community and rural ( $n= 5$ ) (Omary et al., 1995; Rising et al., 2019; Steill et al., 1992; 1995; Takayesu et al., 2014). Across both categories, most studies were conducted with healthcare professionals or service users in one ED ( $n=37$ ), with others conducted across a range of two-22 hospitals ( $n= 22$ ). The remaining eight studies were conducted online or at training events with doctors across multiple emergency medicine residencies.

As illustrated by Table 2.3, in over 79% of materials across both categories, the locus of uncertainty was ED doctors. Most of these ( $n= 33$ ) included doctors of multiple, or all grades, while seven non-interventional and seven interventional studies focused exclusively on senior registrars and consultants, and three non-interventional and two interventional studies focused solely on foundation-year doctors and junior registrars. An overwhelming majority (82.76%) of interventional studies focused on reducing uncertainty or managing uncertainty for doctors specifically. Across both categories, a considerably smaller amount of research attention was dedicated to other clinicians (including nurses, doctor associates and respiratory therapists) working in EDs (7.46%) and service users (including patients and legal guardians) (13.43%).

**Table 2.3**

*Key characteristics of included academic articles and grey literature according to the category of material, expressed as frequencies and percentages of the total in each category.*

Characteristics of materials in category 1	<i>n</i> / 38 (%)	Characteristics of materials in category 2	<i>n</i> / 29 (%)
Type of evidence material		Type of evidence material	
Primary research article (peer-reviewed)	35 (92.11)	Primary research article (peer-reviewed)	29 (100)
Thesis	2 (5.26)		
Primary research article (unpublished)	1 (2.63)		
Year of publication		Year of publication	
1988-2000	6 (15.79)	1988-2000	3 (10.34)
2001-2010	8 (21.05)	2001-2010	10 (34.48)
2011-2020	21 (55.26)	2011-2020	16 (55.17)
2021	2 (5.26)		
Unpublished	1 (2.63)		
Country		Country	
USA (one across USA and Canada)	24 (63.16)	USA (one across USA and Canada)	19 (65.52)

Table 2.3 (continued).

Characteristics of materials in category 1	<i>n</i> / 38 (%)	Characteristics of materials in category 2	<i>n</i> / 29 (%)
Canada	5 (13.16)	Canada	2 (6.90)
UK	3 (7.89)	UK (one across UK and Republic of Ireland)	2 (6.90)
Switzerland	3 (7.89)	Other (Australia, France and Morocco, Switzerland, Sweden, Japan and The Netherlands)	6 (20.69)
Other (Singapore, Sweden, Australia)	3 (7.89)		
Design		Design	
Quantitative	26 (68.42)	Quantitative	26 (89.66)
Qualitative	8 (21.05)	Qualitative	1 (2.63%)
Mixed-methods	4 (10.53)	Mixed-methods	2 (5.26)
Methodology		Methodology	
Prospective observational with questionnaire/survey	14 (36.84)	Before and after study/Pre-post test	23 (62.07)
Interviews	7 (18.42)	Randomised controlled trial	3 (10.34)
Survey	6 (15.79)	Cluster randomised trial	1 (3.45)

Table 2.3 (continued).

Characteristics of materials in category 1	<i>n</i> / 38 (%)	Characteristics of materials in category 2	<i>n</i> / 29 (%)
Multi-methodology (e.g. survey followed by interviews)	4 (10.53)	Randomised controlled waitlist trial	1 (3.45)
Retrospective design with prospective survey	4 (10.53)	Randomised prospective study	1 (3.45)
Vignette study	2 (5.26)		
Group concept mapping	1 (2.63)		
Locus of uncertainty		Locus of uncertainty	
Doctors	29 (76.32)	Doctors	24 (82.76)
Patients	5 (13.16)	Patients	2 (6.90)
Multiple groups	2 (5.26)	Multiple groups	2 (6.90)
Family members or carers	1 (2.63)	Family members or carers	1 (3.45)
Nurses	1 (2.63)		
Sample size		Sample size	
≤ 20	7 (18.42)	≤ 20	5 (17.24)
21-60	14 (36.84)	21-60	2 (6.90)
61-100	3 (7.89)	61-100	1 (3.45)

Table 2.3 (continued).

Characteristics of materials in category 1	<i>n</i> / 38 (%)	Characteristics of materials in category 2	<i>n</i> / 29 (%)
>100	11 (28.95)	>100	6 (20.69)
Reported sample is for clinician-patient encounters only	3 (7.89)	Reported sample is for clinician-patient encounters only	14 (48.28)
		N/A (Protocol)	1 (3.45)
Measure of uncertainty or UT (materials with multiple measures are recorded multiple times)		Measure of uncertainty or UT	
Prompted and self-reported in interviews, focus groups or surveys	11 (28.95)	Uncertainty reported on Likert scale	13 (44.83)
PRUS (full scale or subscale)	9 (23.68)	Percentage/decimal probability estimates	10 (34.48)
JPI risk taking subscale	6 (15.79)	Survey item asking participants if they are uncertain	3 (6.90)
Uncertainty reported on Likert scale	6 (15.79)	Uncertainty reported on visual analogue scale	2 (6.90)
Risk threshold deduced (e.g. reporting acceptable level of risk to avoid admission)	4 (10.53)	Other	1 (13.79)

Table 2.3 (continued).

Characteristics of materials in category 1	<i>n</i> / 38 (%)	Characteristics of materials in category 2	<i>n</i> / 29 (%)
Percentage/decimal probability estimates	4 (10.53)		
Hypothetical gambling task	3 (7.89)		

*Note.*

Materials in category 1 enhance understanding of how uncertainty is experienced in the ED (sources of uncertainty, responses to uncertainty and influencing factors). Materials in category 2 evaluate the impact of a tool or behaviour (e.g. test, protocol or SDM) on uncertainty experienced in the ED. Of the two materials in category 1 which measured uncertainty amongst multiple groups, one included nurses, patients and managers/executives and the other included senior doctors and patients. In category 2, materials which measured uncertainty experienced by multiple groups, one included nurses, doctor associates and medical students and the other included nurses, doctors and respiratory therapists.

Measures of uncertainty and UT were categorised as 'other' when they appeared in only one material per category. Other measures in category 1 included a modified Doctor Reaction to Uncertainty Scale based on the Hillen et al. (2017) model of UT, the Intolerance of Uncertainty Scale (Freeston et al., 1997), the Decisional conflict scale and Anxiety from uncertainty scale (Bovier and Perneger, 2007). In category 2, the other measure was an uncertainty communication checklist (Rising et al., 2019).

PRU scale= Physician Reaction to Uncertainty scale (Gerrity et al., 1990; 1995); JPI= Jackson Personality Inventory (Jackson et al., 1972)

### **Characteristics of non-interventional studies developing understanding of how uncertainty is experienced in the ED (category 1; $n= 38$ )**

Non-interventional studies mostly set out to understand how particular factors influenced the perception of uncertainty and responses to uncertainty ( $n= 17$ ). Eight non-interventional studies focused on understanding relationships between UT (or variations such as propensity for risk-taking) and disposition decisions or patient preference for such decisions. As the definition of UT described in chapter 1 and employed throughout this thesis acknowledges risk as a component of uncertainty, these studies were included. Twelve studies developed understanding of how perceptions of uncertainty or UT (or variations such as risk-taking propensity) influences information seeking behaviour (e.g. test-ordering). Finally, two studies focused on how UT influenced burnout rates.

Most non-interventional studies employed a quantitative study design ( $n= 26$ ). In the UK, a small amount of research has focused on developing understanding of uncertainty ( $n= 3$ ), of which one is peer-reviewed (Lawton et al., 2019), one is unpublished (Budworth et al., unpublished), and one thesis which was the only UK research to employ a qualitative design (Adams, 2013).

Quantitative studies tended to have a more particular focus than qualitative and mixed-method studies. All mixed-method studies ( $n= 4$ ) focused on general uncertainty, for example, exploring patients' conceptualisations of uncertainty in the ED (Rising et al., 2019) and how doctors perceive their skills in communicating diagnostic uncertainty (Rising et al., 2018). All but one of the eight qualitative studies were similarly broad with only Chan et al. (2019) conducting interviews specifically about antibiotic prescribing behaviour for patients with upper respiratory tract infection. Conversely, quantitative, non-

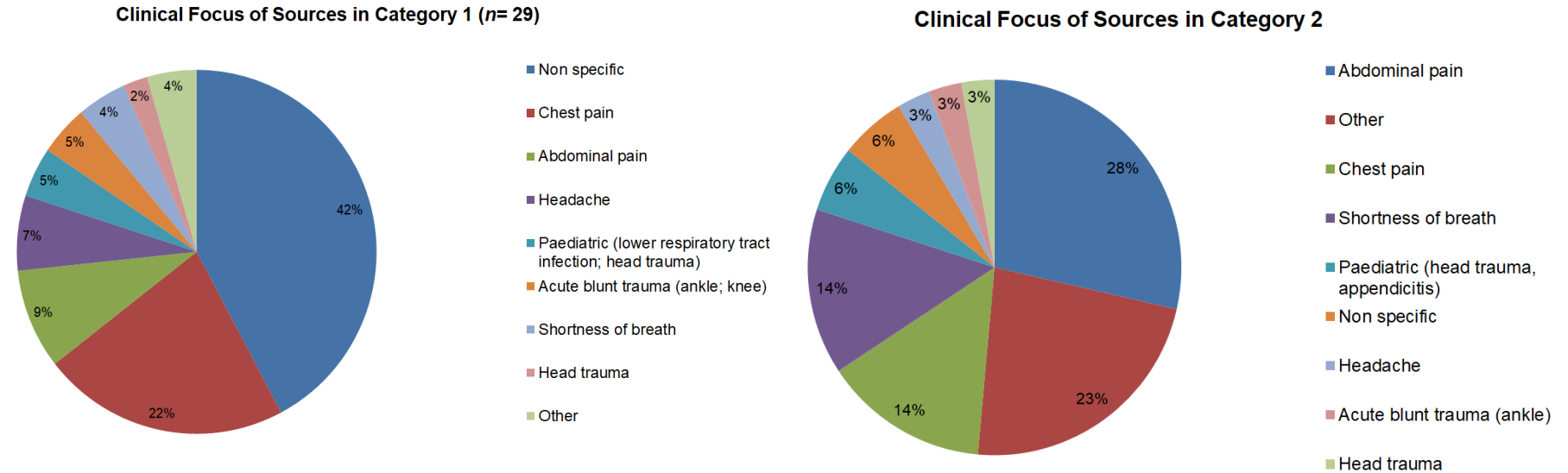


interventional studies tended to use surveys or questionnaires to measure uncertainty or UT and correlate these measures with behavioural outcomes particular to a clinical presentation such as chest pain (e.g. disposition decision-making for patients presenting with chest pain (Chen et al., 2014)). Figure 2.2 compares the clinical focus of non-interventional studies to interventional studies.

As shown in Figure 2.3, until 2013, all studies developing understanding of how uncertainty is experienced in the ED meeting the inclusion criteria for this review were quantitative, with qualitative research becoming more prevalent from 2019. Of these, seven were interview studies asking clinicians to reflect on how uncertainty is generally managed (Chan et al., 2019; Han et al., 2021; Ilgen et al., 2020a; Ilgen et al., 2020b; Ilgen et al., 2021; Salhi, 2015), or communicated (Miao et al., 2020) and one used a group concept mapping approach with patients to explore the types of uncertainties experienced in the ED (Rising et al., 2019). The other, and only UK-based qualitative research used semi-structured interviews, observations, and secondary data analysis to understand how information gathering of ED doctors varies depending on diagnostic complexity (Adams et al., 2013).

**Figure 2.2**

*Pie charts displaying the clinical focus of materials in each category, presented as percentages.*

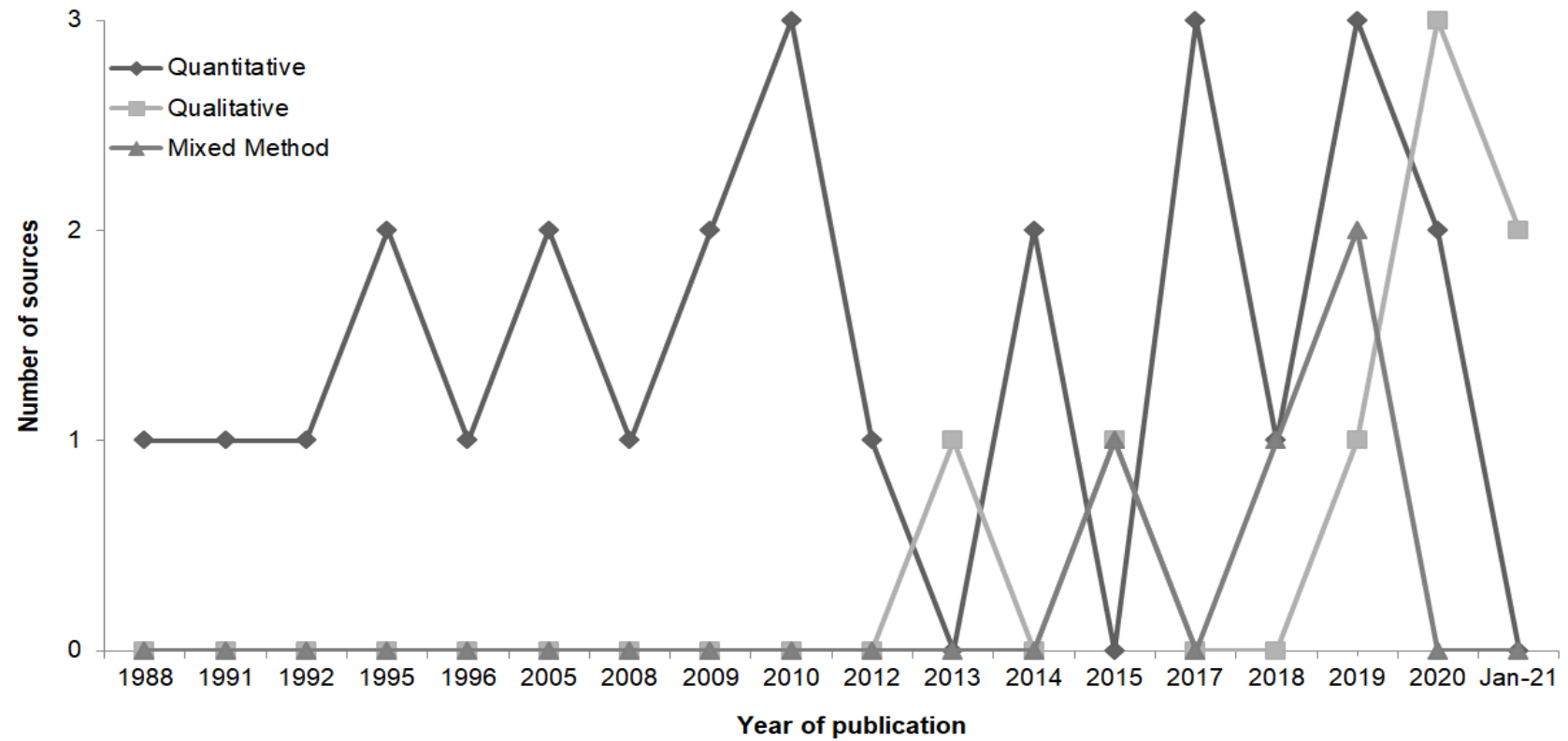


*Note.* Evidence materials with multiple focuses are reported multiple times.

Clinical focuses were categorised as 'other' when they appeared in only one material per category. For clinical focuses in category 1, this included collapse, nausea, vascular and neurological problems, trauma, mechanical problems, miscarriage/gynaecological problems, allergies/rashes, upper respiratory tract infection, pain management and dental problems. In category 2 this included clinically suspected nephrolithiasis and psychogenic non-epileptic seizures, symptomatic hypotension, undifferentiated hypotension and suspected sepsis, skin and soft tissue infection and asthma.

**Figure 2.3**

*The date of publication and frequency of quantitative, qualitative, and mixed-method studies in category 1.*



*Note.*

The date recorded for one unpublished material (Budworth et al., unpublished) is the date of data collection.

### **Characteristics of materials evaluating the impact of a tool or intervention on uncertainty experienced in the ED (category 2; $n= 29$ )**

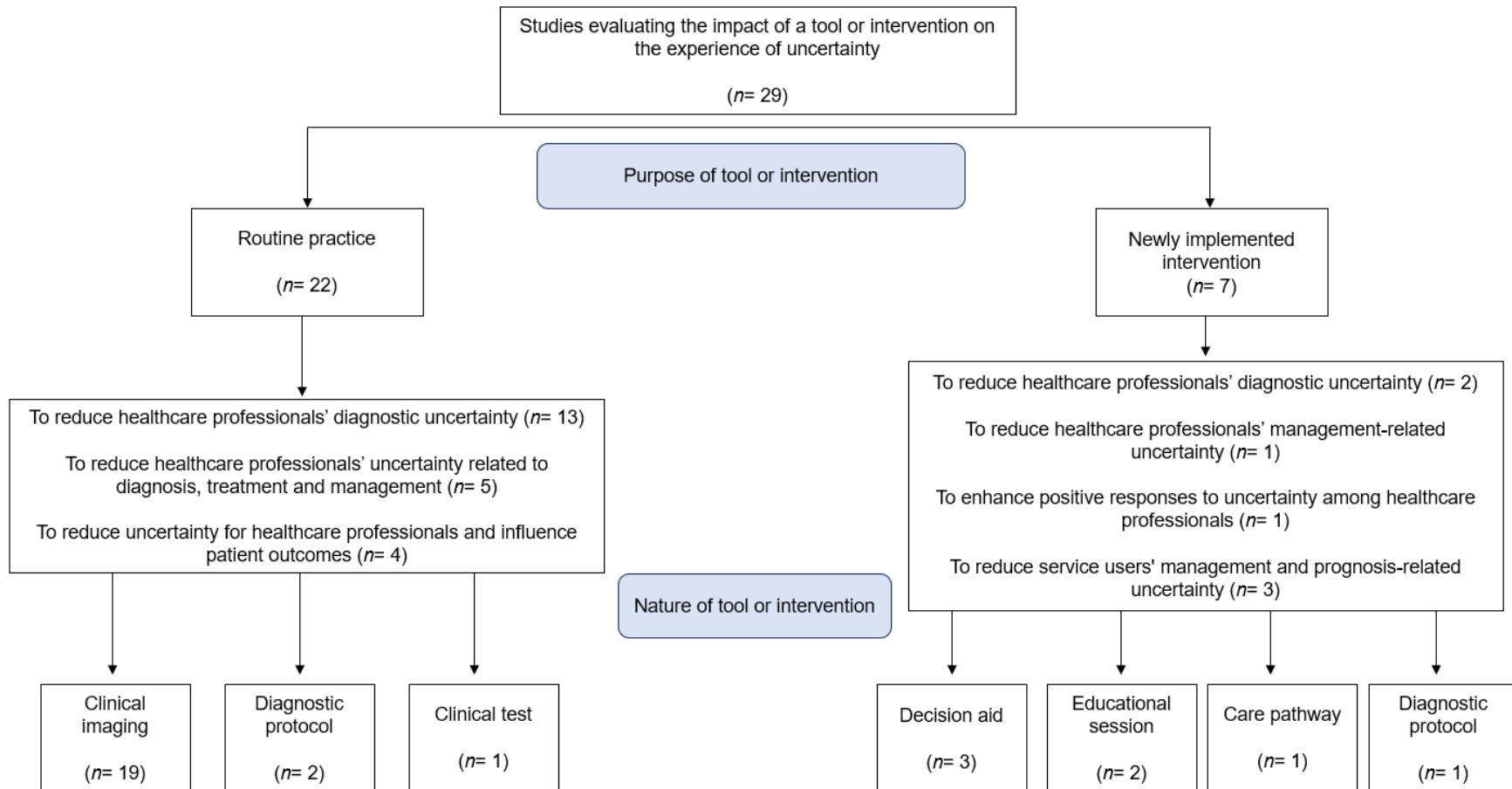
Figure 2.7 shows the frequency of studies evaluating the impact on uncertainty of aspects of routine practice and newly implemented interventions, as well as detailing the intended impact on uncertainty and the nature of the tool or intervention. This figure, along with the measures of uncertainty or UT highlighted in table 2.3, reveal that no interventional study was concerned with altering healthcare professional or service users' UT (including risk and ambiguity tolerance), with most focused on reducing the amount of uncertainty. The remaining interventional studies ( $n= 11$ ), although not focused on UT as an overall construct, aimed to influence responses to uncertainty. Given the theoretical underpinning of this review, which defines UT as encompassing cognitive, emotional, and behavioural responses to uncertainty (Hillen et al., 2017), it is important to acknowledge interventions which focused on specific responses to uncertainty.

While most interventional studies ( $n=22$ ) measured the impact on certain practices that are routine (e.g., clinical imaging, diagnostic protocols and clinical tests already used) on uncertainty, seven studies measured the impact of newly implemented interventions on the experience of uncertainty. This included a diagnostic protocol offering a clinical investigation framework for patients presenting with chest pain (Ahn et al., 2017), decision-aids shown to patients presenting with chest pain facilitating admission or discharge decisions (Hess et al., 2016; 2017), a decision-aid shown to caregivers of patients with minor head trauma to facilitate shared-decision making (Hess et al., 2018), an educational session for doctors on psychogenic non-epileptic seizures which measured the impact on uncertainty (O'Sullivan et al., 2013), a teaching module on

communicating diagnostic uncertainty (McCarthy et al., 2020) and a care pathway to decrease uncertainty in the management of patients with asthma (Olajas-Clow et al., 2009). The focus of newly implemented interventions was to reduce uncertainty specific to one clinical presentation. Only one study aimed to alter responses to uncertainty more generally; a protocol for an online teaching course to improve doctors' diagnostic uncertainty communication skills at discharge (McCarthy et al., 2020).

**Figure 2.4**

*Characteristics of interventions and tools influencing the experience of uncertainty in the ED*



### 2.5.3 Key findings

Supplementary file 1 details the key contributions provided by individual studies to the review questions. Review questions were informed by the Hillen et al. (2017) model of UT and therefore the existing scope of literature is viewed through the lens of this model however within each sub-review question, evidence is summarised inductively where data did not map onto constructs of the Hillen et al. (2017) model (e.g. distal outcomes of uncertainty).

The first three review questions are addressed by evidence in category 1 ( $n=38$ ). The majority of these studies ( $n=21$ ) focused on the differences in amount of uncertainty perceived and/or responses to uncertainty depending on particular factors, while eight considered the influence of UT (and variations such as risk tolerance) on disposition decisions, six considered the influence of UT (and variations of measure) on testing and treatment decisions and two considered outcomes of low UT. Studies in category 2 ( $n=29$ ), are exclusively considered at the end of this section as they address the final two review questions regarding interventions or tools used to manage uncertainty. Given the different constructs of UT each address, findings are now presented in order of review questions.

#### **What sources of clinical uncertainty in the ED have been identified in the literature?**

No studies conceptualised the source or type of uncertainty according to an existing theory, however where sufficient detail was reported by measures of uncertainty or UT within studies, the source of uncertainty was deductively analysed according to the three sources in the Hillen et al. (2017) model discussed in the previous chapter (section 1.4):

- Probability (referring to risk, and coming from an indeterminacy of future outcomes e.g. a 20% probability of serious symptom progression)
- Ambiguity (refers to indecisiveness arising from a lack of credibility, reliability or adequacy including inconsistency, conflicting information, and a lack of information e.g. two doctors disagreeing about the benefits of a hospital admission);
- Complexity (incomprehensibility arising from multiplicity of causes and difficulty in comprehension e.g. a need to bring complex clinical guidelines together to decide the appropriate course of action).

In 23 of 38 non-interventional studies, sufficient information was provided to conceptualise the source(s) of uncertainty according to the taxonomy outlined above. Accounting for multiple sources in some studies, this included probability ( $n= 16$ ), ambiguity ( $n= 18$ ) and complexity ( $n= 14$ ). Figure 2.5 shows that overall, ambiguity was the most prevalent source of uncertainty in non-interventional studies. Ambiguity was mostly associated with having insufficient information to inform disposition decisions such as borderline test results (e.g. Padalecki et al., 2017), and decisions to gain further information in the context of temporal impermanence, for example if acknowledging that despite a patient currently being low risk, symptoms could progress (e.g. Ilgen et al., 2020). Probability and the inability to assess risk, was most frequently present in studies that focused on perception of clinical risk and how this influenced disposition decisions (e.g. Brown et al., 2010; Schriger et al., 2018). Examples of complexity as a source of uncertainty included considering side effects and comorbidities when prescribing pain relief and antibiotics (Chan et al., 2019).

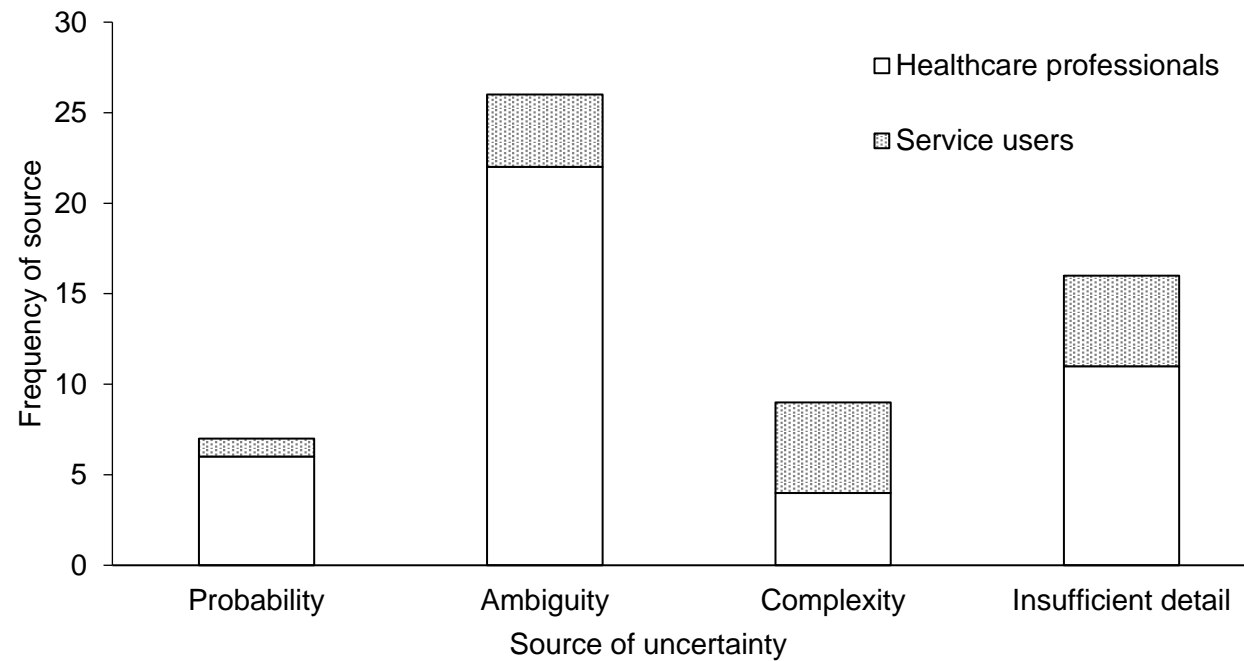


Inferring the source(s) of uncertainty was simpler for quantitative studies, where the same uncertain scenarios were presented or focused on for all participants. Conversely, the sources of uncertainty in studies which measured UT (physician reaction to uncertainty scale) and risk-taking propensity (JPI risk-taking subscale), were difficult to infer as these scales include items such as, *'I enjoy taking risks'* and *'I usually feel anxious when I am not sure of a diagnosis'* which allude to uncertainty generally, without a specific source. In these cases, where the decision was not discussed in detail, the source of uncertainty could not be inferred. Most often, all three sources of uncertainty were present, particularly in interview studies. While quantitative studies focused on one decision, qualitative studies (e.g. Han et al., 2021) allowed participants to discuss uncertainty more generally and therefore raised many sources of uncertainty.

It is important to acknowledge that, as few studies were theoretically informed by UT theory (Budworth et al., unpublished; Han et al., 2021) and sources were not conceptualised in the same way as Hillen et al. (2017), the presence of one source of uncertainty does not suggest the absence of others. For example, Perry et al. (2005) assessed doctor's comfort with not ordering head CT for patients presenting with acute headache. The lack of information available to doctors before testing could be considered ambiguity, but despite the study not discussing this, acute headache can suggest many diagnoses (complexity), with risk of multiple serious diagnoses (probability).

**Figure 2.5.**

*Frequency of sources of uncertainty in non-interventional studies split according to the locus of uncertainty.*



*Note.* The total number in this chart is larger than the amount of non-interventional studies ( $n= 38$ ) because where multiple sources were present, the study was recorded multiple times.

**According to existing research, how do healthcare professionals and service users respond to clinical uncertainty and what factors influence this?**

21/38 non-interventional studies discussed responses which could be mapped onto domains of the Hillen et al. (2017) model, with nine highlighting cognitive appraisals, five highlighting emotional responses, two considering consequence-focused behavioural responses (mitigating and palliating the consequences of an uncertain situation) and 15 focused on behavioural responses for which the focus (source or consequence) could not be deduced. Hillen et al. (2017) distinguish between source-focused (behaviours aimed at avoiding or altering an uncertain situation) and consequence-focused (behaviours aimed at mitigating the consequences of an uncertain situation). To deduce this, the rationale for behaviours is required, which two studies specified as mitigating consequences. However, for most behavioural responses, it was unclear if individuals in the ED were acting to avoid/alter uncertainty or reduce consequences of it.

Across 21 non-interventional studies, the review identified 33 different responses, of which 11 were cognitive appraisals, seven were emotional responses and 15 were behavioural responses to uncertainty (see table 2.4). This does not include studies that explored associations between measures of UT and disposition decisions, as decisions to admit or discharge are considered an outcome of UT, rather than a response to uncertainty in the decision-making process and are discussed in the next section.

**Table 2.4***Responses to uncertainty identified by non-interventional studies*

Response type	Response to uncertainty
Cognitive appraisals	<ul style="list-style-type: none"> <li>• Acceptance and adjusting epistemic expectations (shifting from a naïve view of knowledge as either right and wrong, to a view of knowledge as pluralistic, relative, and provisional) (Han et al., 2021; Khorram-Manesh et al., 2019).</li> <li>• Confidence (level of confidence about the limits of medical knowledge and clinical judgement (Chan et al., 2019; Han et al., 2021; Perry et al., 2002; Salhi, 2015).</li> <li>• Openness (open to the unknown and acknowledging positive aspects of uncertainty e.g. enabling meaningful engagement with colleagues) (Han et al., 2021).</li> <li>• Opportunity (uncertainty allowing work to be approached in a flexible way, understanding the uniqueness of patient presentations, personalised medical care and lack of definitive answers). Han et al., 2021).</li> <li>• Ordering uncertainty (e.g., mentally rehearsing steps, making the process logical, maintaining, or deviating from the history-physical-laboratory sequence) (Ilgen et al., 2021a; Sklar et al., 1991).</li> </ul>

- 
- Projection (moving forward with more intentionality by considering what resources may be needed downstream and mentally constructing simulations of evolving problems to assess if knowledge and skills are sufficient or progressing too far to manage alone) (Ilgen et al., 2020; 2021b).
  - Investing greater cognitive resource into uncertain situations and monitoring with greater attention (Ilgen et al., 2021b).
  - Avoidance (avoiding the uncertainty associated with a patient not being prescribed medication or the potential criticism associated with errors due to high UT) (Chan et al., 2019; Khorram-Manesh et al., 2019).
  - Compartmentalising psychological responses (separating emotions from analytical decision making) (Han et al., 2021).
  - Self-affirmation (e.g. acknowledging positive values). (Han et al., 2021).
  - Self-forgiveness (e.g., absolving from guilt and blame and caring less about negative evaluation from other clinicians and patients) (Han et al., 2021).

Emotional  
responses

- Fear (Ilgen et al., 2020; Kanzaria et al., 2015).
- Worry (Ilgen et al., 2020).
- Insecurity (Ilgen et al., 2020).
- Sense of failure when certainty not established (Rising et al., 2018).
- Guilt (Khorram-Manesh et al., 2019).
- Stress (Khorram-Manesh et al., 2019).
- Discomfort (Ilgen et al., 2021a; 2021b).

Consequence-  
focused  
behavioural  
responses

- Communicating uncertainty to patients in a way perceived to reduce negative emotions for patients (Miao et al., 2016).
- More comprehensive reporting of the diagnostic process to increase confidence in hindsight (Adams, 2013).

Behavioural  
responses with  
unclear focus

- Seeking information and borrowed comfort from colleagues (observing supervisors' affective reactions, aligning plans with how others approach the same problem and calibrating appraisals). (Ilgen et al., 2021a; 2021b).
- Handing decisions over to colleagues and specialists when no solution can be reached (Ilgen et al., 2021b).
- Seeking excessive information from testing to solve a clinical dilemma or support decision (Adams, 2013; Andruchow et al., 2012; Hautz et al., 2020; Kanzaria et al., 2015; Khorram-Manesh et al., 2019; Padalecki et al., 2017; Perry et al., 2002; Pines et al., 2009; 2010; Salhi, 2015; Stiell et al., 1992; 1995).
- More comprehensive reporting of contraindications (Corradi-Della-Acqua et al., 2019).

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*Note. All responses to uncertainty in this table were by ED doctors, excluding one survey study of patient preferences for testing as a mechanism for information seeking in uncertain circumstances (Padalecki et al. (2017), one survey study of ED nurses contraindication reporting rates in uncertain circumstances (Corradi-Della Acqua et al., 2019) and one interview study with doctors, nurses and patients about the communication of diagnostic test information in uncertain clinical encounters (Miao et al., 2016).*

It is important to acknowledge the relationships between responses highlighted by these studies. Three qualitative studies suggested inter-relationships between responses. This included cognitive responses such as confidence and openness increasing doctors' willingness to communicate openly with colleagues and patients about uncertainty (behavioural) (Han et al., 2021). Cognitive appraisals were also associated with emotional responses by Ilgen et al. (2020) who suggest that when projection of an uncertain situation concluded a doctor could not manage the situation, they felt fear, worry, and insecurity. Ilgen et al. (2021b) conceptualised discomfort as a cognitive, emotional, and physical experience that triggers cognitive appraisals (including investing greater cognitive resource into uncertain situations and monitoring with greater attention) and behavioural responses (including seeking information and borrowed comfort from colleagues and handing over patients).

Two quantitative studies associated emotional responses with information seeking behaviours. 68.9% of ED doctors surveyed by Kanzaria et al. (2015) reported fear of missing a low probability diagnosis (emotional response) as driving excessive image ordering (behavioural response). Khorram-Manesh et al. (2019) suggest that newer doctors having difficulties in managing stress from uncertainty (emotional response) use too many resources in uncertain situations. One further quantitative study highlighted associations between responses. Perry et al. (2002) report that doctors with less confidence in their own clinical judgement (cognitive appraisal), seek excessive information before making a decision in uncertain situations.

The extent to which healthcare professionals and service users in the ED responded to uncertainty in the ways specified by table 2.4, depended on several factors outlined by table 2.5. Table 2.5 includes an additional three



studies that despite not considering specific responses to uncertainty, measured UT on quantitative scales and reported associations between factors and UT scores. They are included under the 'characteristics of the individual' section. Outcomes (e.g. admission and discharge decisions) associated with lower and higher UT scores, are outlined in the next section (which includes an additional five studies that did not report factors influencing UT or specific responses to uncertainty).

**Table 2.5.**

Factors influencing the cognitive (C), emotional (E) and behavioural (B) responses to uncertainty identified.

	C	E	B	Influence of factor on responses to uncertainty
<b>Characteristics of the individual</b>				
Years of clinical experience	X	X	X	Years of clinical experience was reported to influence cognitive, emotional, and behavioural responses to uncertainty in the ED. In qualitative studies, doctors with greater clinical experience, were considered to respond to uncertainty with greater epistemic maturity, humility, flexibility, and openness (Han et al., 2021) and less scepticism about judgements of their own comfort in managing uncertain situations (Ilgen et al., 2021a). Across qualitative and quantitative studies, doctors with less experience were thought to engage in redundant and less strategic approaches to information gathering, seeking

excessive clinical information to guide decisions (Ilgen et al., 2021a; Khorram-Manesh et al., 2019).

Conversely, Hautz et al. (2020) and Stiell et al. (1992) reported no association between physician experience and diagnostic resource consumption and use of radiography respectively. Regarding cognitive appraisals, junior doctors were considered less confident than senior doctors in not prescribing antibiotics for URTI due to succumbing to external pressures (Chan et al., 2019) and deviated from the conventional history-physical-laboratory sequence almost half as often as experienced doctors (Sklar, 1991). In a vignette-based, survey study, years of experience among ED doctors was largely correlated with UT generally ( $r = -.50$ ), explaining 26.4% of variance in UT scores (Lawton et al., 2019).

UT	X	Five of the studies measuring UT on a quantitative scale, observed the influence of UT on behavioural responses to uncertainty. This included information seeking via test-ordering (Andruchow et al., 2013; Pines et al., 2009; 2010), time taken to make
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disposition decisions (Bailey, 2010) and comprehensiveness of reporting of contraindications (Corradi-Dell Acqua et al., 2019).

Scores on the stress from uncertainty subscale of the Physicians' Reaction to Uncertainty Scale (PRUS) did not predict test-ordering, imaging use or use of cardiac markers across three studies (Andruchow et al., 2013; Pines et al., 2009; 2010). It is possible the impact of stress from uncertainty was diluted in one study where the decision was shared with specialists, physician associates and doctors with more experience (Andruchow et al., 2013). However, UT (measured by the Intolerance to Uncertainty Scale) did significantly correlate with decision-making time for doctors managing patients with low ambiguity (Bailey, 2010) and nurses with higher scores on the anxiety due to uncertainty subscale of PRUS showed higher contraindication rates (reporting of CIs when prompted) ( $p = .017$ ). (Corradi-Dell Acqua et al., 2019).

Patient demographics

X

Patient demographics influenced behavioural responses to uncertainty. In a hypothetical scenario-based study, patient demographics (including race, annual income

and medical insurance status) influenced preferences for decision-making (Padalecki et al., 2017). For scenarios involving headache/lumbar puncture, chest pain/cardiac rule-out, and CT imaging for appendicitis, 25% of patients would accept a high-risk tolerance of adverse outcomes to avoid further testing. For the scenario involving headache and avoiding lumbar puncture, individuals whose annual income was > \$40,000/yr and those with Medicaid were more risk tolerant. For scenario 2, involving chest pain and cardiac rule-out admission, patients with Medicaid or self-pay were more likely to be risk tolerant. For scenario 3 (avoid CT for appendicitis), Hispanics were more likely to accept such risk than White patients.

**Characteristics of  
the uncertainty  
stimulus**

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Severity of potential  
consequences

X

The severity of potential consequences associated with a clinical presentation, influenced behavioural responses to uncertainty among ED doctors, including communication with patients (Miao et al., 2016), and comfort with not ordering diagnostic tests (Pines et al., 2002). Abnormal test results with and without life-limiting diagnostic implications, were communicated differently to patients (Miao et al., 2016) and Pines et al. (2002) reported only 10.5% of ED doctors were 'very comfortable' with performing no tests even when their clinical judgement was that the patient was low risk, due to high mortality associated with a missed diagnosis of subarachnoid haemorrhage. Stiell et al. (1995) found perception of clinical risk did not predict test-ordering for patients with acute knee injuries.

Speed of progression

X X X

In a qualitative interview study, ED doctors discussed rapidly progressing problems as a driver of discomfort (conceptualised as a cognitive, emotional and physical experience) (Ilgen et al., 2020).

Case complexity	X	<p>Case complexity (including perceived situational uncertainty, familiarity, and difficulty among ED doctors) was found to impact diagnostic resource consumption in the ED more than physician characteristics and patient acuity (Hautz et al., 2020). Additionally, Adams et al. (2013) suggest ED doctors use different clinical reasoning approaches depending on the complexity of clinical presentations. More complex cases required a combined approach of hypothetic deductive and probabilistic reasoning which enabled the physicians to deal with the degree of uncertainty, whereas less complex cases were approached deterministically.</p>
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### **Cultural factors**

<hr style="border: 0.5px solid black; margin-bottom: 5px;"/> Perceived practice norms	X	<p>Perceived practice norms were considered to influence information seeking in two studies (Chan et al., 2019; Salhi, 2015). A belief that symptomatic management was the standard of care drove antibiotic prescribing behaviour among ED doctors in a qualitative interview study (Chan et al., 2019). Doctors in another interview study discussed the goal of emergency medicine to rule-out life threatening diagnoses, rather than reach a</p>
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diagnosis, as rationalising the need for quantitative diagnostic evidence to facilitate conversations with patients (Salhi et al., 2015).

Beliefs about patient expectations

X

Beliefs about patient expectations influenced what ED doctors consider 'enough' information seeking. Doctors believed patient expectations of medical science exceed the reality of technology and resources available in ED (Salhi, 2015).

### **Social factors**

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Judgements about the abilities of ED team members abilities.

X X X

Judgements about the abilities of ED doctors' team members influenced discomfort as a cognitive, emotional and physical experience in two qualitative studies. When doctors sensed colleagues would be able to help them tackle a situation effectively, discomfort was mitigated, but increased when they sensed colleagues were not coping (Ilgen et al., 2020; Ilgen et al., 2021b).

### **Situational factors**

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Informational and emotional support available.	X	X	X	Where material resources were known entities in the doctor's environment, and could be accessed easily and quickly, doctors in one interview study reported more comfort as a cognitive, emotional and physical manifestation of uncertainty (Ilgen et al., 2021b).
Time pressure			X	Adams (2013) highlighted the 4-hour directive as limiting how strategically ED doctors could gather information, however this was adapted to over time. Conversely, doctors in another study described relying on diagnostic tests more heavily under time constraints, allowing communication that patients' concerns have been addressed in uncertain situations (Salhi, 2015).
<b>Organisational factors</b>				
Wider system efficiency		X		Difficulties arranging follow-up for patients with no diagnosis increased negative emotional responses to communicating uncertainty at discharge among ED doctors (Rising et al., 2018).

Staffing	X	A lack of available specialists increases test-ordering behaviour among ED doctors. (Khorram-Manesh et al., 2019).
Structures and processes	X	ED doctors expressed concern that hospital guidelines and policies discourage the use of clinical judgement and encourage excessive antibiotic prescribing (Chan et al., 2019).

## **What outcomes of clinical uncertainty in EDs have been identified in the literature?**

While the conceptual model of UT only describes outcomes of uncertainty in terms of the cognitive, emotional, and behavioural responses of the individual perceiving uncertainty, Hillen et al. (2017, p. 73) suggest further research is needed to clarify outcomes of UT and postulate these could include things further removed in time and space from the immediate and individual responses, for example:

- *Patient experiences of care (e.g., extent and nature of patient-clinician communication, extent of patient engagement and informed and shared decision making)*
- *Patient outcomes (termed ‘technical health outcomes’ by Hillen et al. (2017) (e.g., morbidity, mortality, health-related quality of life)*
- *Quality of care (e.g., underutilization, overutilization, appropriate utilization of health services)*

10/38 non-interventional studies considered outcomes beyond cognitive, emotional, and behavioural responses of those perceiving uncertainty. As suggested by Hillen et al. (2017), studies identified outcomes associated with service user experience of care ( $n= 2$ ), technical health outcomes ( $n= 2$ ) and quality of care ( $n= 7$ ). Further, studies in this review identified outcomes associated with the wellbeing of doctors ( $n= 3$ ) and patient length of stay ( $n= 3$ ). It is important to consider that some of these outcomes were associated with trait measures of UT rather than a specific response to uncertainty (Baldwin et al., 2005; Budworth et al., unpublished; Kuhn et al., 2009; Lawton et al., 2019; Nightingale et al., 1988; Pearson et al., 1995; Pines et al., 2010 Takayesu et al.,

2014), while some were associated with a specific cognitive, emotional or behavioural response and not a trait measure of UT (Boland et al., 2017; Ilgen et al., 2021; Kanzaria et al., 2015; Khorram-Manesh et al., 2019; Miao et al., 2020). Outcome categories are now discussed in turn.

### **Quality of care**

In two interview studies (Khorram-Manesh et al., 2019; Ilgen et al., 2021) and one survey study (Kanzaria et al., 2015), ED doctors self-reported an over-utilisation of resources when uncertainty was responded to with negative emotions. This included when doctors could not legitimise their own comfort in an uncertain situation, could not manage stress and were fearful of missing diagnoses. Despite not specifying an over or under-utilisation of resource, four studies considered the influence of UT, measured on quantitative scales, on variation in disposition decisions, suggesting influence on the appropriateness of hospital admissions. Measured by the Physicians' Reaction to Uncertainty Scale (PRUS) (Gerrity et al., 1990; 1995), UT partially mediated the relationship between experience and risk-averse decision-making in a cross-sectional, vignette study with ED doctors (Lawton et al., 2019).

Conversely, prospective, observational studies measuring stress from uncertainty (SUS), a subscale of PRUS, among ED doctors reported no association between SUS and admission rates for patients with chest pain (Pearson et al., 1995; Pines et al., 2010). In these studies, it was scores on the risk-taking subscale of the JPI risk-taking scale that predicted admission rates, with more risk-averse doctors having a higher likelihood of admitting patients. However, similar associations were not evidenced in a prospective, observational study of senior doctors deciding to admit or discharge paediatric patients with lower respiratory tract illness, with neither risk-aversion nor

discomfort with diagnostic uncertainty (another subscale of PRUS) significantly associated with admission rates. However, in line with Lawton et al. (2019), admission rates were generally higher for ED doctors scoring above the median on discomfort with diagnostic uncertainty than those scoring below the median.

### **Patient experience of care**

Two studies invited service user perspectives on their experience of care dependent on how ED healthcare professionals responded to uncertainty. In a qualitative interview study, patients in the ED reported increased uncertainty when doctors communicated with less transparency, and dissatisfaction with their care when patients had desire for information (Miao et al., 2020). In a prospective survey study, parents and carers who perceived being offered less options by ED healthcare professionals, rated their experience less positive than those perceiving more options (Boland et al., 2017).

### **Patient outcomes**

Despite variation in admission rates and resource utilisation reported in some studies, patients discharged by risk-seeking doctors (measured by the JPI risk-taking subscale), did not have higher mortality rates four to six weeks after being evaluated in the ED (Pearson et al., 1995). There was also no association between risk-seeking and re-attendance to the ED within 48 hours (Pearson et al., 1995) or UT (measured by a modified PRUS) and re-attendance within 30-days (Budworth et al., unpublished).

### **Wellbeing of healthcare professionals**

Three prospective survey studies revealed significant associations between UT (measured by PRUS and modified PRUS) and burnout for ED doctors, with lower UT associated with higher burnout rates (Budworth et al., unpublished;

Kuhn et al., 2009; Takayesu et al., 2014). However, when considering subscales of PRUS in isolation, Kuhn et al. (2009) only report this association between burnout and a concern for adverse outcomes. In this study, subscales measuring anxiety because of uncertainty, reluctance to disclose uncertainty to patients, or reluctance to disclose mistakes to other physicians, did not predict burnout among ED doctors (Kuhn et al., 2009).

### **Patient length of stay**

Finally, one study reported a longer median length of stay for patients admitted by ED doctors that chose the gamble with less anticipated regret in a hypothetical gambling task (Nightingale, 1988). The gamble with less anticipated regret involved greater expenditure of healthcare resources to avoid potential regret.

### **Outcomes associated with uncertainty being perceived, rather than responses to uncertainty.**

Three studies reported outcomes of uncertainty being present, rather than responses to uncertainty. Technical health outcomes included an association between patients judged with higher clinical uncertainty by ED doctors and mortality rates (Green et al., 2008). Additionally, patients re-attending the ED within 30 days reported uncertainty about the perceived quality of care they received and uncertainty about whether their symptoms required escalation as driving decisions to re-attend (Rising et al., 2019). Regarding utilisation of resources, threshold for admission was lower for ED doctors experiencing who were uncertain how to manage dyspnoeic patients (Green et al., 2008) and older patients (Chan et al., 2019).

**What interventions or tools have been implemented or used to manage uncertainty in the ED and do they address the sources, factors and outcomes identified by existing research?**

As highlighted previously in figure 2.4, 29 studies evaluated the impact of a tool or intervention on how healthcare professionals or patients experienced uncertainty. This included evaluations of how elements of routine practice in the ED, including clinical imaging ( $n= 19$ ), diagnostic protocols ( $n= 2$ ) and clinical tests ( $n= 1$ ), and how newly designed and implemented interventions, including decision aids ( $n= 3$ ), educational sessions ( $n= 2$ ), a care pathway ( $n=1$ ) and a diagnostic protocols ( $n=1$ ), influenced how healthcare professionals ( $n= 26$ ) and patients ( $n= 3$ ) experience uncertainty. Most of these studies primarily aimed to reduce uncertainty ( $n= 24$ ) and further details are provided in supplementary file 1.

Four studies explored the impact of imaging on clinical management plans, considered by this review as an outcome of responses to uncertainty:

1. Abdominal CT scanning reducing the number of patients admitted by 17% and the number of patients judged to require surgery by 7.5% (Rosen et al., 2003).
2. Ultrasound changing the management of patients with skin and soft tissue infections in 22.9% of cases, including 13.8% from medical to surgical, and 9.1% from surgical to medical (Lam et al., 2018).
3. CT scanning revealing alternative diagnoses for 40% of patients with suspected nephrolithiasis, with decisional outcomes changing from discharge to admission for six patients and from admission to discharge for five patients (Ha et al., 2004).

4. Bedside ultrasonography changed planned management in 23.8% of cases for which clinicians were uncertain, and 1.2% of cases judged with certainty. Changes for cases judged with uncertainty, were five times more likely to be considered appropriate in hindsight, than inappropriate (Mower et al., 2019).

With 24/29 interventional studies aiming to reduce uncertainty in the ED and four focused on outcomes of uncertainty (the quality of care received by patients regarding clinical management), this review only identified one interventional study that aimed to enhance positive responses to uncertainty in the ED. This was a study protocol for a scenario-based, online teaching course to improve doctors' diagnostic uncertainty communication skills at discharge (McCarthy et al., 2020). Communication (as a behavioural response to uncertainty), and the ability of ED doctors to communicate efficiently (as a characteristic of the individual influencing responses to uncertainty) are therefore, the only factors and responses identified within non-interventional studies, that have received research attention by intervention developers in an ED context.

## **2.6 Discussion**

This scoping review aimed to understand the sources of uncertainty and how uncertainty shapes the experience of, and outcomes for, healthcare professionals and service users in the ED. The review also aimed to describe the range and types of existing support for healthcare professionals and service users to tolerate uncertainty. Synthesis of existing evidence on this topic was conducted to identify gaps in evidence that future chapters in this thesis could address and to inform the development of UT interventions in an ED context. It



is understood that this is the first theoretically informed systematic, scoping review to understand how uncertainty is responded to in an ED context.

### **2.6.1 Summary of evidence**

The majority of existing evidence in this field was conducted in the US, with only five studies identified from the UK, of which one employed qualitative methodology (Adams et al., 2013). Research meeting the inclusion criteria of this review, became more prevalent post 2011, with qualitative studies emerging from 2013. Most quantitative research identified in this review, employed prospective observational study designs, measuring the behaviour of ED doctors in uncertain conditions, while the majority of qualitative studies were interview studies allowing ED doctors to discuss uncertain cases and how they approached the management of them.

While no studies conceptualised the source of uncertainty using the same taxonomy as Hillen et al. (2017) (i.e. probability, ambiguity and complexity), it was possible to infer the source using definitions of each source of uncertainty in most cases. Ambiguity was the most prevalent source of uncertainty reported in the literature, particularly the temporal component of symptom progression creating uncertainty about potential future consequences. This is unsurprising in a time-pressured clinical context where patient contact is limited, and observation is not always possible (Platts-Mills et al., 2020). A survey conducted in the USA, found 37% of patients were discharged from an ED with an uncertain diagnosis (Wen et al., 2015). This corroborates a high prevalence of ambiguity in the ED, as with symptom-based diagnoses, the potential consequences of symptom progression are difficult to deduce.

Most studies acknowledged more than one source of uncertainty, creating issues for establishing conclusions about how sources of uncertainty are responded to differently. This was particularly the case for qualitative, interview studies, where participants shaped the discussion and reflected on multiple sources of uncertainty. For example, doctors in an interview study in the US, discussed uneasiness in predicting progression for problems that are insufficiently predictable (Ilgen et al., 2020a). Probability and ambiguity can be inferred in this instance, but as findings are viewed through the lens of the author's analysis, this was more difficult to consider than in quantitative studies where the source of uncertainty was often more controlled. Disentangling the dimensions of probability, ambiguity and complexity has also been noted as challenging by other researchers reviewing the uncertainty literature across multiple clinical contexts (Scott et al., 2023).

Cognitive appraisals, emotional responses and behavioural responses to uncertainty were identified across multiple populations in the ED. An overwhelming majority focused on behavioural responses, particularly information seeking. This may reflect a greater interest in outcomes of UT associated with resource-use and quality of care than other outcomes identified in this review such as burnout. The behavioural responses identified are supported by a recent review of the strategies clinicians employ to cope with uncertainty across multiple clinical contexts (Scott et al., 2023).

In support of Hillen et al. (2017), a range of factors pertaining to the individual, the uncertain stimulus, the culture of practice, social factors and the situation were identified as influencing appraisals and responses to uncertainty. Most often, these factors were years of clinical experience, with less experienced clinicians' generally exhibiting responses to uncertainty considered

to be negative (e.g., less confidence and more excessive information seeking). In line with observations conducted by the researcher (see appendix 1.1), the wider service in which decisions were being made was also evidenced as influencing responses to uncertainty. This review identified organisational factors including the availability of specialist doctors, hospital policies and lack of adequate follow-up options, as factors influencing how ED doctors appraised and responded to uncertainty.

Outcomes beyond appraisals (e.g. avoidance) and responses (e.g. excessive information seeking) were also identified. This review suggests that different responses to uncertainty, can lead to varied quality of care, patient experience of care and clinician wellbeing. Importantly, despite higher UT being associated with reduced information seeking when considering responses and influencing factors, the studies included in this review found that when patients were discharged by doctors with higher UT this was not associated with poorer outcomes for patients. The potential impact on service users of how healthcare professionals respond to uncertainty, makes the involvement of patients and the public in UT research important, given potential impacts on their care identified by this review (Saini et al., 2020).

This review highlighted burnout among ED doctors as consistently associated with UT (Budworth et al., unpublished; Kuhn et al., 2009; Takayesu et al., 2014). Researchers have advocated for the wellbeing and mental health of the ED workforce to be a key priority when addressing issues such as retention (Daniels et al., 2023). Findings from this review suggest a role for UT interventions in striving for improvement in clinician wellbeing.

This review highlighted a lack of existing interventions aiming to enhance positive responses to uncertainty among healthcare professionals or patients in the ED. Most existing support for uncertainty management in the ED is focused on reducing diagnostic uncertainty experienced by ED doctors, with only one intervention identified measuring a change in a response to uncertainty (McCarthy et al., 2020).

### **2.6.2 Implications for theory**

The majority of studies included in this review conceptualised responses to uncertainty as a state rather than a trait. The multitude of factors identified in this review as influencing uncertainty (aside from characteristics of the individual), support the notion that UT is determined by situational and contextual factors (Herman et al., 2010). With vignette studies measuring responses to a particular clinical scenario, and the PRU scale (Gerrity et al., 1990; 1995) being used to measure reactions to clinical uncertainty (rather than uncertainty generally), there is a stronger evidence base for UT as a state in the ED. Conversely, studies measuring risk-taking propensity (e.g. with the JPI risk-taking scale), conceptualised UT as a trait.

There were notable differences in the responses associated with state and trait measures of UT, with trait-based measures more consistently associated with excessive information seeking than state-based measures. While Hillen et al. (2017) suggest the integrative model of UT can be used to inform trait and state-based research of UT, Zwaan and Hautz (2020) call for the distinction between situational uncertainty as a state, and doctors UT as a trait. However, this review has identified potentially modifiable factors such as cultural norms in medical practice, and social relationships within an ED team, that not only

influence the amount of uncertainty a clinician is exposed to, but also their tolerance of it.

The extent to which factors influence uncertainty being appraised and responded to negatively or positively, will be considered in the general discussion (chapter 6). However, this review has provided support for the categories of factors suggested by Hillen et al. (2017) as modifying responses to uncertainty. This review has allowed situational and contextual factors specific to an ED context to be identified as potential focuses for UT interventions. Outcomes of UT were also elucidated that future interventions could measure e.g., patient experience of care and burnout among ED doctors.

Importantly, this review supports the suggestion by Hillen et al. (2017) that the cognitive appraisals, emotional and behavioural responses to uncertainty are often inter-related. Most studies that inferred these relationships, employed qualitative designs. Positive cognitive appraisals including confidence, increased transparency of uncertainty communications (Han et al., 2021). Conversely, negative appraisals such as projection of uncertainty flagging a perception that the situation could not be managed triggered negative emotions among doctors, including fear, worry and insecurity (Ilgen et al., 2020). Discomfort, a response initially considered negative, was identified by Ilgen et al. (2021b) as vital for signalling positive behavioural responses needed to be engaged in (e.g. communicating with colleagues). This highlights an advantage of qualitative research in this field, in that intentions of behaviours can more easily be assigned valence (i.e. positive or negative in nature).

### **2.6.3 Strengths and limitations**

Despite previous reviews considering uncertainty management among healthcare professionals' (Alam et al., 2017; Oishi and Murtagh, 2014; Tubbs et al., 2016; Tams et al., 2016; Zhang et al., 2020), this is the first theoretically informed (Hillen et al., 2017) scoping review to synthesise evidence focused on how uncertainty is experienced by healthcare professionals and service users in an ED context. The search strategy for this review was comprehensive, encompassing eight databases and extensive grey literature searching, with double screening of a percentage of materials, providing reassurance that key materials were captured.

However, the findings of this review should be interpreted with limitations in mind. Where uncertainty was not a focus of the purpose or design of a study and was not mentioned in the title or abstract, it would likely have been missed. This could have disproportionately excluded qualitative studies that did not set out to explore uncertainty in the ED, but uncertainty was a concept acknowledged in study findings. For example, an interview study exploring doctors' experiences of involving patients in decisions, with thematic analysis generating one sub-theme about uncertainty management, could have been missed. This means the responses to uncertainty, and outcomes of such responses in the ED, identified by this review may not be an exhaustive list.

In this review, the conceptualisation of UT was broad (cognitive, emotional, and behavioural responses to uncertainty). This resulted in studies being included that were not underpinned by theory. Inclusion criteria also required participants to have consciously perceived uncertainty, based on the definition of UT proposed by Hillen et al. (2017). This means uncertainty needed to be self-reported or measured. While this is not likely a limitation for the breadth of non-interventional studies, this review does not acknowledge interventions that

likely have an impact on responses to uncertainty (e.g., guidelines from the Royal College of Emergency medicine or decision-aids) that did not measure the impact on uncertainty (Zwaan and Hautz (2020)). There are likely to be a range of interventions that do have an impact on uncertainty but are not described as such.

The review methodology deviated from the protocol in places, with notable findings revealed by included studies developing the data extraction form and the synthesis of results relying more on an approach developed by Lucas et al. (2007) than the originally proposed narrative synthesis guidance for systematic reviews (Popay et al., 2006). The complexity of UT and heterogeneity of review questions and included study designs, made grouping key findings according to review questions and sub-constructs of UT, the most effective synthesis method. Furthermore, unlike systematic reviews, scoping reviews are iterative and flexible in nature, with logical adjustments to review questions and methodology permitted (Levac et al., 2010; Peters et al., 2021).

#### **2.6.4 Implications for research**

This review highlights several gaps in evidence that need to be addressed to develop understanding of, and enhance, UT in an ED context. As scoping reviews do not generally critically appraise research findings (Munn et al., 2018), a systematic review focused on UT interventions in the ED is required. However, given the lack of interventions identified by this review, it is perhaps more useful to review UT interventions across multiple clinical contexts. To do so, would require advancements in the field of UT, particularly in how it is measured. This review was not restricted to a single scale of UT measurement, and incorporated multiple sources of uncertainty, including risk and ambiguity

(Han et al., 2011). In doing so, the diversity of approaches to measuring responses to, and tolerance of, uncertainty was highlighted. Future research should develop, and advocate for, use of a validated UT measure, aligning to the Hillen et al. (2017) model of UT. This could support researchers evaluating interventions and identify factors influencing UT, as the current literature employs different subscales and scales measuring slightly different constructs (e.g., discomfort from uncertainty and risk-seeking propensity) (Gerrity et al., 1990; 1995; Jackson et al., 1972) making synthesis and critical appraisal complex.

As shown by Figure 2.3, until 2013, all studies developing understanding of how uncertainty is experienced in the ED were quantitative, with qualitative research becoming more prevalent from 2019, perhaps due to increased frameworks and models to draw upon. This made it difficult to ascertain the intention of behavioural responses and therefore the valence of them. For example, it was often unclear from quantitative studies if information seeking from colleagues and testing was redundant and a mechanism for decision deferral, or a positive response, progressing toward decision-making. This is reflected in the findings where it was difficult to categorise behavioural responses into source and consequence-focused responses as it was unclear if responses were aiming to mitigate uncertainty, or the consequences of it. For example, communicating uncertainty to patients could be a mechanism for understanding patient preference, reducing uncertainty in a treatment decision, or it could be a way of ensuring the patient was aware of the ownership they need to take over future progression of their symptoms, effectively safety netting the uncertainty.



Despite communication of uncertainty and shared decision-making with patients featuring in multiple studies identified by this review, it is unclear from existing evidence how patients prefer these management styles to be executed. Inviting the patient perspective to understand the optimal approaches to patient engagement in managing uncertainty warrants further research.

### **2.6.5 Conclusions**

Existing efforts to enhance positive appraisals and responses to uncertainty are dominated by tools and strategies aiming to reduce diagnostic uncertainty and how doctors respond to uncertainty, with little attention devoted to the impact of this on patient experience of care. Despite associations between higher UT and enhanced doctors' wellbeing, improved patient experiences of care and appropriate utilisation of resources, UT as a psychological construct, is not the focus of any existing interventions in an ED context. While this review has identified target appraisals and responses to uncertainty, and factors influencing such responses that future UT interventions could focus on, evidence of this in a UK context is lacking. Furthermore, it is unclear if enhancing the UT of service users would positively influence patient safety as no studies measured the UT of patients and associated outcomes. Subsequent chapters in this thesis build on these evidence gaps to inform intervention development.

## Chapter 3

### The public perspective on how uncertainty is tolerated by ED doctors

#### 3.1 Chapter summary

Chapter 2 highlighted that despite service users' experience (Boland et al, 2017) and the quality of care received by patients (Ilgen et al., 2021; Kanzaria et al., 2015; Khorram-Manesh et al., 2019; Lawton et al., 2019; Pearson et al., 1995; Pines et al., 2010) being dependent on the way ED doctors respond to uncertainty, the extent to which existing UT research has invited the patient and public perspective is limited. Service user preference for how ED doctors respond to uncertainty in the ED is also unclear from existing evidence.

While existing literature has suggested an association between risk-averse decision-making and lower UT among ED doctors, it is unclear if, or how, the UT of service users influences preferences for disposition decisions and management of uncertainty by ED doctors (e.g. how uncertainty is communicated, and how patients are involved in decisions). Therefore, at this stage it is important to consider whether UT interventions in an ED context should focus on patient UT and how this may influence the patient-clinician encounter and disposition decisions by ED doctors. This chapter therefore has three aims:

1. To understand public preference for patient-facing behavioural responses to uncertainty identified in chapter 2 as positive (involving patients in decisions and communicating uncertainty to patients).

2. To understand if the UT of service users influences preferences for uncertainty management and decision-making.
3. To invite patient and public perspective on the direction of this thesis in light of the findings in this chapter.

### **3.2 Introduction**

Patients can experience harm when interacting with healthcare in various ways. This can include harm due to over-treatment (e.g., the benefits of hospital admission or further treatment are outweighed by adverse consequences), general harm from healthcare (e.g., hospital-acquired infections or loss of independence from a hospital stay) and psychological harm (e.g., feeling unsafe in a healthcare setting or not trusting healthcare professionals) (Vincent et al., 2014). As highlighted by the evidence synthesised in the previous chapter, risk-averse decision-making (including increased admission rates and excessive information seeking) and avoidance of transparency with patients (including no communication of uncertainty), is indicative of low UT amongst ED doctors. Risk-averse decision-making exposes patients to greater risk of harm from over-treatment and general harm from healthcare, and lack of transparency in patient-clinician encounters may increase psychological harm due to anxiety. This suggests a role for UT interventions in reducing patient harm and enhancing patient experience in the ED. However, it is unclear from existing evidence, what responses to uncertainty patients in the ED view positively.

Understanding public perception for the appropriateness of, and desire for, transparent communication of uncertainty and involvement in decisions, is important given the recent surge in interventions developed to promote communication of uncertainty (McCarthy et al., 2020) and the potential anxiety

some patients may feel when faced with uncertain healthcare decisions that they do not feel equipped to be involved in (Rosenbaum, 2015). Eliciting patient preference for uncertainty management may help guide patient management decisions for which scientific evidence has not provided a beneficial solution and may support the tailoring of UT interventions to increase patient satisfaction (Brennan and Strombom, 1998).

Establishing patient preference is particularly important for interventions focused on decision-making as evidence suggests variation in how patients consider the communication of uncertainty and involvement in decisions across multiple clinical contexts. For example, in a survey study asking members of public how involved they want to be in decisions about their own treatment, English participants desired higher levels of involvement than Swedish participants (Fredriksson et al., 2018). In another cross-sectional study, how involved patients with advanced colorectal cancer were with treatment decisions depended on age, education level, family income and marital status (Gu et al., 2023).

It is also important that research highlights patient preference to doctors as often in existing research, it has surprised clinicians. In a survey study situated in a general practice context, 51.9% of patients preferred shared decision-making, followed by passive (26.3%) and active (21.8%) roles in decision-making (Ambigapathy et al., 2016). This study was conducted in Malaysia, where there is a cultural perception that patients prefer passive roles. Doctors in this study underestimated the desire of patients to be involved in decision-making.

In an ED context, most patients in three US states surveyed by Schoenfeld et al. (2018) expressed a preference for being involved in decision-making (85%–

92%, depending on whether decision was about treatment, testing or disposition). The importance of communication is also highlighted in a qualitative study with service users in the ED, who emphasised the importance of doctors communicating directly with them to avoid unproductive thoughts catastrophising their illness (Ostervang et al., 2021). However, the need for this to be tailored to patient preference and need, is highlighted by intervention developers (Rising et al., 2020).

While the evidence outlined develops understanding of patient preference for how uncertain clinical decisions are approached by ED doctors, it does not consider focusing on the UT of service users with UT interventions in an ED context. Chapter 2 identified a hypothetical scenario-based survey in which Lawton et al. (2019) identified the UT of ED doctors to partially mediate the relationship between greater years of clinical experience and more risk-tolerant decision making. There has been a surge in the attention devoted to shared decision-making from an academic and policy perspective (Grudzen et al., 2016; Probst et al., 2017) and interventions to promote transparency of uncertainty communication (McCarthy et al., 2020; Rising et al., 2020) are becoming more common. It is therefore important to establish if UT influences preferences for decision-making and uncertainty management and hence, service users should be the focus of UT interventions.

This chapter builds on existing evidence of patient preference by exploring whether, as well as patient demographics, the UT of service users influences preference for disposition decision-making, communication of uncertainty and involvement in decision-making. In doing so, it establishes if UT interventions in the ED focused on service users UT, could yield the benefits identified in the previous chapter of enhancing doctors' UT. At the end of this chapter, there is a

summary of the patient and public involvement and engagement (PPIE) conducted to inform the future of UT research and the scope of this thesis.

### **3.3 Study aims and research questions**

This study aimed to establish public preference for patient-facing responses to uncertainty identified in the previous chapter (communication of uncertainty and involving patients in decision-making) and preferences for disposition decision-making. It also explored if the UT of service users influences such preferences. In doing so, this study guides the population of interest for UT interventions in the ED and tailors UT interventions for ED doctors to the preferences of service users.

#### **Research questions:**

- 1) What role do members of the public prefer to play in uncertain disposition decision-making in the ED?
- 2) How do members of the public prefer doctors to communicate uncertainty to them in the ED?
- 3) Do members of the public prefer risk-tolerant or risk-averse approaches to disposition when the doctor is uncertain?
- 4) Do preferences for patient management differ as a function of UT and demographics?

This study was conducted in the first lockdown of the COVID-19 pandemic in the UK. Opportunistically, this survey also addressed questions about healthcare seeking behaviour in a pandemic, however data pertaining to these questions is not reported in this thesis.

### **3.4 Method**

### 3.4.1 Study design

This was a cross-sectional, hypothetical, scenario-based, questionnaire study, allowing the perspectives of the public to be safely gathered in this thesis during the COVID-19 pandemic. Participants expressed their preferences after being asked to imagine themselves in a vignette describing a clinical presentation in which ED doctors were uncertain about the best course of action. A between-subjects design was employed to minimise participant burden, with each participant seeing only one of three vignettes.

### 3.4.2 Participants

The study received ethical approval from the School of Psychology Research Ethics Committee at the University of Leeds (no: PSYC-33; date: 04/05/20).

A convenience sample of participants was recruited online via social media (Facebook and Twitter), the University of Leeds newsletter, the Care Opinion platform (<https://www.careopinion.org.uk/>) and patient forum email addresses (including patient panel members and lay leaders of the Yorkshire Quality and Safety Research Group). Inclusion criteria required participants to be over the age of 18 (to reflect on experience in an adult ED), to reside in the UK (to draw upon experience within an NHS ED) and be fluent in English (to engage with the questionnaire effectively as Qualtrics software uses Google translate which is prone to error). Any person who was currently working, or has worked, as a healthcare professional was excluded from the study. This is because the study aimed to measure what people *would* do in particular circumstances, not what they know they *should* do, and clinical knowledge could impact this. Participants were entered into a prize draw to win one of three Amazon vouchers worth £100, £50, and £25.

### 3.4.3 Questionnaire design

In a previous cross-sectional, vignette-based study exploring ED doctor decision-making (Lawton et al., 2019), two ED consultants developed four vignettes for which there was no 'correct' management plan and multiple courses of action could be considered clinically acceptable. One of these vignettes was adapted for the current study, with clinical language omitted. The vignette was developed with input from the Sheffield Emergency Care Forum, a patient panel with a special interest in ED research. For example, the original scenario developed by Lawton et al. (2019) was introduced with:

"...is referred to the Emergency Department by his GP for assessment of back pain with left leg numbness and difficulties with opening his bowels and passing urine with no incontinence".

This was changed to:

*"You are struggling with lower back pain. This has happened before but this time, your left leg has also started to feel numb, and you are having trouble going to the toilet. You go to see your GP and they refer you to the Emergency Department."*

The vignette was re-produced three times, with a different source of uncertainty (probability, ambiguity, and complexity) in each (see appendix 3.1) (Han et al., 2011). Participants in the probability condition saw a scenario in which there was a 19% chance of a serious condition. In the ambiguity condition, two ED doctors had conflicting opinions on the cause of symptoms and in the complexity condition, the participants symptoms could have indicated multiple diagnoses.



Participants then indicated their preference for management in a situation where the ED doctor was uncertain (see appendix 3.1). The first question related to communication of uncertainty and participants indicated if they would prefer no communication of uncertainty, implicit communication of uncertainty with the most likely diagnosis highlighted, implicit communication of uncertainty with all potential diagnoses highlighted, or explicit communication of uncertainty. These options were chosen as they reflect the communication strategies reported in existing health research focused on uncertainty (Cox et al., 2024; Dahm et al., 2023; Medendorp et al., 2021). Secondly, participants indicated their desire to be involved in the decision to be admitted or discharged. Participants selected their preference for involvement from three options: one in which the patient was autonomous, one in which the patient shared the decision with the doctor, and one in which the doctor made the decision. These options reflect existing shared decision-making literature (Schoenfeld et al., 2018). Finally, participants selected their preference for the patient management decision from four options based on those developed by Lawton et al. (2019), with two options considered risk-tolerant (discharge with safety netting and referred to GP) and two options considered risk-averse (further testing performed to inform decision and immediate admission to hospital with urgent scans ordered).

To measure UT, participants completed the Intolerance to Uncertainty (IUS) scale (Buhr and Dugas, 2002). The IUS scale includes 27 items relating to the idea that uncertainty is unacceptable, leads to frustration, and creates an inability to take action, reflecting negative cognitive appraisals, emotional responses and behavioural responses to uncertainty suggested by Hillen et al. (2017). To reduce participant burden, a shortened version of the IUS scale was

used in the current study (see appendix 3.1). Carleton et al. (2007) reduced the 27-item IUS scale to the IUS-12 scale, with 12 items. The IUS-12 retained internal consistency and correlated highly with IUS scores in testing. Seven items in the scale relate to prospective anxiety (fear and anxiety based on future events) and five relate to inhibitory anxiety (uncertainty that inhibits action or experience). Ratings for each item were summed, with higher scores indicating lower UT (maximum score= 60) and lower scores indicating higher UT (minimum score= 12).

### **3.4.4 Procedure**

The survey was hosted online using Qualtrics software (<https://www.qualtrics.com/uk/>) for three months between July and September 2020. Participants who accessed the link were shown the participant information sheet (see appendix 3.2) which described the study purpose, procedure, remuneration, ethical provisions, and researcher contacts. This included notifying participants that following study completion, they could not withdraw their data due to responses being anonymised. Participants who chose to continue, then completed an online consent form and were asked to confirm they were over the age of 18, lived in the UK, were fluent in English and had no experience working as a healthcare professional.

Potential participants meeting the inclusion criteria were then asked to imagine themselves in the uncertain scenario presented and respond to three questions, indicating their preferences for how the ED doctor manages their case. They also completed the IUS-12 measure of UT and provided demographic information shown to influence UT by existing research (age, education level). The survey took approximately 15 minutes to complete.

### 3.4.5 Analysis

Completed responses were exported to SPSS for data analysis. To understand public preference for behavioural responses to uncertainty in the ED, descriptive statistics of the number of participants choosing each response are first presented. To establish predictors of public preference (UT and demographics), multinomial logistic regression was employed. This was due to the preference choices as the dependent variable, being categorical variables with three-four options (e.g., autonomy in decision, shared decision-making and doctor-led decision-making). Individual effects of interactions between predictor variables were examined. When assumptions for multinomial logistic regression were violated, descriptive statistics are focused on.

## 3.5 Results

### 3.5.1 Participants

318 members of the public completed the questionnaire. Only complete responses were exported to SPSS and analysed. Participant demographics and IUS-12 scores are described in table 3.1.

**Table 3.1**

*Participant demographics*

<b>Gender</b>	Male	71
	Female	245
	Prefer to self-describe	0
	Not specified	4
<b>Age</b>	Mean	41.46 years
	Range	18 to 84 years

<b>Education</b>	No formal education	4
	O Levels/GCSE	38
	A Levels	37
	Other vocational qualifications	27
	Degree or Higher degree	210
	Prefer not to say	2
<b>Employment</b>	Employed	232
	Student	30
	Retired	22
	Unemployed (looking for job)	7
	Homemaker	6
	Unable to work	4
	Other (carers)	12
	Prefer not to say	1
<b>Ethnicity</b>	White	296
	Mixed/ Multiple ethnic groups	8
	Asian/Asian British	6
	Black/African/Caribbean/Black British	2
	Other ethnic group	4
	Prefer not to say	2
<b>Income</b>	£0-£25,999	84
	£26,000-£47,999	96
	£48,000 or over	104

	Prefer not to say	34
IUS-12 score	Mean	31.58
	Range	12-58

### 3.5.2 Preferences for uncertainty management

A fully adjusted linear regression model, with all demographics and IUS-12 scores was initially conducted. Holding everything else constant, there was no sig difference in the IUS-12 scores of participants in each source of uncertainty condition ( $p > .05$ ) with no significant difference between probability and ambiguity ( $p = .09$ ), between ambiguity and probability ( $p = .08$ ) or between complexity vs. probability ( $p = .09$ ),

#### How do members of the public prefer doctors to communicate uncertainty to them in the ED?

Table 3.2 shows the number of participants who selected each of the communication strategies as their preference. Most participants chose implicit communication of uncertainty with a list of potential diagnoses communicated to them (61.95%). More participants chose no communication of uncertainty, with testing conducted to progress to certainty before a diagnosis is suggested (17.30%), than explicit communication of uncertainty (13.52%) or implicit communication of uncertainty with only the most likely diagnosis expressed (7.23%).

#### What role do members of the public prefer to play in uncertain disposition decision-making in the ED?

The majority of participants wanted to express their preferences to the doctor along with the doctor expressing their opinion on the best course of action regarding admission or discharge, before reaching an agreement together (57.55%). Nearly a third of participants expressed a preference for the ED doctor accepting their decision without input from the doctor themselves (29.25%) and the remaining participants desired the doctor to make the decision on their own (13.21%).

**Do members of the public prefer risk-tolerant or risk-averse approaches to disposition when the doctor is uncertain?**

As only two participants selected referral to GP, these responses are recorded with participants who chose to be sent home with pain relief medication and advice about what to do if symptoms don't improve ( $n= 45$ ) in the 'discharge' category. Most participants chose further testing and admission if after observation in the ED, symptoms did not improve with pain relief (75.79%). The remaining participants chose to be discharged with appropriate advice or a referral to their GP (14.80%) or to be immediately admitted to hospital with an urgent scan requested (9.12%).

**Table 3.2**

*Preference for uncertainty management strategies and disposition decision-making and mean IUS-12 scores*

Preference	Number of participants	Mean IUS-12 score (Standard Deviation)
<b>Communication of uncertainty</b>		
No communication	55	32.89 (10.08)
Implicit (likely diagnosis)	23	33.87 (9.26)

Implicit (potential diagnoses)	197	31.56 (8.92)
Explicit communication	43	28.79 (9.27)
<b>Preference for involvement</b>		
Patient-led	93	32.13 (9.21)
Shared decision-making	183	31.21 (9.15)
Doctor-led	42	31.98 (10.48)
<b>Decision preference</b>		
Discharge (including discharge with medication and referral to GP)	47	31.07 (11.03)
Admission pending results	241	31.39 (8.93)
Immediate admission	29	33.97 (9.78)

### **Do preferences for patient management differ as a function of UT and demographics?**

A multinomial logistic regression was performed to model the relationship between IUS-12 scores, age of participants and education level with communication preferences. The model with the variables, was a significantly better predictor of communication preferences than the model without the variables,  $\chi^2(9, n= 318) = 27.03, p= .001$ . The model explained 9.3% (Nagelkerke R<sup>2</sup>) of the variance in preferences for uncertainty communication. IUS-12 scores had a significant main effect on communication preference ( $\chi^2 (3, n= 318) = 8.20, p= .042$ ), as did level of education ( $\chi^2 (3, n= 318) = 11.78, p= .008$ ). Participants' age did not have a significant main effect on communication preference,  $\chi^2(3, n= 318) = 5.77, p= .124$ .

No communication of uncertainty was the reference response category in the multinomial logistic regression model. Whether the participant was educated to degree level significantly predicted a preference for either implicit communication of uncertainty with potential diagnoses or no communication of

uncertainty ( $p = .007$ ). As education level changed from no degree, to degree, the change in odds of preferring implicit communication with potential diagnoses compared to preferring no communication of uncertainty was .42. In other words, participants educated to degree-level were 2.38 times more likely than a person with no degree to prefer implicit communication of uncertainty with potential diagnoses than no communication of uncertainty.

Intolerance to uncertainty significantly predicted whether explicit communication of uncertainty or no communication of uncertainty was preferred ( $p = .012$ ). As intolerance of uncertainty increased by one point on the scale, the change in odds of preferring explicit communication was .942. This reflects a preference for no communication of uncertainty among participants more intolerant to uncertainty.

Despite no significant main effect, participants' age significantly predicted whether implicit communication of uncertainty with potential diagnoses or no communication of uncertainty was preferred ( $p = .034$ ). The odds ratio shows that as age increased by 1 year, the change in odds of preferring implicit communication was .978. This suggests older participants were more likely to prefer no communication of uncertainty. Participants' age also significantly predicted whether explicit communication of uncertainty or no communication of uncertainty was preferred ( $p = .038$ ). The odds ratio shows that as age increased by 1 year, the change in odds of preferring explicit communication was .971, further suggesting a preference for no communication of uncertainty among older patients.

### **Preference for involvement**



In a multinomial logistic regression model with participants' age, IUS-12 scores, and education level as the factors and preference for involvement as the dependent variable, the model did not explain a significant amount of variation ( $p = .154$ ). However, this analysis did suggest a significant difference in preferences for shared decision-making and doctor-led decision-making between participants with and without a degree-level education. As both variables were categorical, a Chi-square test was conducted. There was a significant association between participants preference for involvement in decision making within the ED and whether they had a degree level education,  $\chi^2 (2) = 7.71, p = .022$ . However, the effect size was only small-medium with a Cramer's V value .156. Table 3.3 shows that participants educated to degree-level, preferred higher levels of involvement in uncertain disposition decision-making than participants educated below degree-level.

**Table 3.3**

*Percentage of participants who preferred levels of involvement in decision-making according to level of education.*

	No. of participants (%)	
	Educated below degree-level	Educated to degree-level
Doctor-led decision	20.80%	9.50%
Shared decision-making	52.80%	60.50%
Patient-led decision	26.40%	30%

### **Decision preference**

As a predictor variable, IUS-12 scores significantly interacted with the log of itself in this regression model. This violates the assumptions for logistic regression and therefore inferential statistics are not reported.

## **3.6 Discussion**

### **3.6.1 Key findings and comparison to wider literature**

This study aimed to identify public preference for behavioural responses to uncertainty among ED doctors and to understand if UT influences preferences for uncertainty management among patients. Given the association between UT and disposition decision-making identified among doctors in the previous chapter, it was important to establish if this association exists for patients in the ED so that UT interventions can be developed with relevant target populations in mind.

Most participants advocated for implicit communication of uncertainty, with the doctor highlighting potential diagnoses, rather than explicit communication of uncertainty (e.g. 'I don't know), implicit communication with only the most likely diagnosis highlighted, or no communication of uncertainty.

A preference for implicit communication of uncertainty has a strong evidence base in existing literature exploring patient preference across clinical contexts, and in the ED. In a qualitative interview study, patients with endometriosis emphasised that communication of diagnostic uncertainty would have supported them in taking ownership of management of their condition, including considering the option of seeking second opinions (Bontempo, 2023). Furthermore, in line with findings from the current study, people with endometriosis highlighted that communicating uncertainty alone would not be perceived as supportive, and such communication should be accompanied by suggested courses of action. In the current study, explicit communication of uncertainty without mention of diagnoses to consider, was not favourable. This is further supported by a scoping review of practice recommendations for clinicians' communication of uncertainty which suggests using more implicit wording (e.g. 'it could be') rather than explicit wording (e.g. 'I don't know) to avoid detrimental effects to patient trust, patient-perceived competence of clinicians, patient confidence, patient trust, patient anxiety, and patient adherence across primary care and paediatric clinical contexts (Bhise et al., 2018; Medendorp et al., 2021; Ogden et al., 2002; Stortenbecker et al., 2019).

Participants with a higher level of education chose implicit communication of uncertainty with potential diagnoses highlighted significantly more than no communication of uncertainty. This may be explained by a perceived increase in control when doctors are transparent about all lines of inquiry. Meyer et al.

(2019) interviewed paediatric clinicians in the US who reported that patients from lower educational backgrounds tend to show greater acceptance of uncertainty and explicit communication of uncertainty causes patients from professional backgrounds to experience loss of control.

Although a preference for no communication of uncertainty was thought to reflect lower acceptance of uncertainty, considered through the lens of Meyer et al. (2019), no communication of uncertainty in this study perhaps exposed participants to more uncertainty than having potential diagnoses presented to them. This is supported by the finding in the current study that older participants preferred no communication of uncertainty over implicit communication with potential diagnoses and explicit communication. A wealth of evidence exists suggesting older people have a higher tolerance for uncertainty and less belief in the value of worrying than younger people (Basevitz et al., 2008; Kachmaryk et al., 2014). Conversely, it may be that older people have higher UT generally, but lower UT in a clinical context and therefore do not want to acknowledge clinicians' uncertainty.

Participants with a higher intolerance for uncertainty were also less likely to desire explicit communication of uncertainty than no communication of uncertainty. While this study is the first to consider UT and preferences for communication of uncertainty among service users, this is in line with quantitative measures of UT among ED doctors. The Physician Reaction to Uncertainty scale (PRUS) (Gerrity et al., 1990; 1995) includes two subscales measuring reluctance to disclose uncertainty to patients and reluctance to disclose mistakes to other doctors with higher reluctance associated with lower UT.

A large majority of participants in the current study expressed a preference for shared decision-making rather than doctor or patient-led decision-making. This is in line with existing evidence of patient preference for treatment decision-making in outpatient clinics (Deber et al., 2007), medical decisions in the ED (Schoenfeld et al., 2018) and decisions in a primary care context (Ambigapathy et al., 2015). Participants educated to degree-level, preferred higher levels of involvement in uncertain disposition decision-making than participants educated below degree-level. This conflicts findings from Ambigapathy et al. (2015) which reported no association between education level and preference for involvement among Malaysian primary care patients. However, the authors acknowledge that Malaysian culture enforces a more passive role of patients in clinical encounters. Aligned with findings of the current study, a prospective survey study with colorectal cancer patients found that patients with a degree-level education were more involved in making treatment decisions than patients with lower levels of education, who were more likely to have family members or doctors make decisions (Gu et al., 2023).

Preferences for disposition decision-making were not significantly associated with IUS-12 scores however, the mean intolerance to uncertainty score was lower among patients who chose discharge, indicating higher risk-tolerance among this group. This is the first study to explore this association in service users and evidences a reduced influence of UT regarding disposition decision-making than is evidenced among ED doctors (Lawton et al., 2019).

### **3.6.2 Strengths and limitations**

This is the first study to explore associations between the UT of service users and preferences for how doctors respond to uncertainty. No association

between UT and disposition decision-making was identified, suggesting that in terms of patient outcomes and quality of care, UT interventions would be better placed focused on ED doctors. However, it is important to view the findings of the current study with limitations in mind. Existing evidence that associated the UT of ED doctors to decision-making (Lawton et al., 2019), measured the UT of doctors with measures specific to clinical practice (e.g. PRU scale). In the absence of a measure for service user UT specific to clinical contexts, IUS-12 was used which measures trait intolerance to uncertainty. It is therefore unclear if tolerance of health-related uncertainty among service users would yield different results.

Conducting this research throughout early lockdowns of the COVID-19 pandemic, made an online survey the safest option for gathering public perspective. However, this did result in preferences for decisions being explored based on hypothetical scenarios and not real-world experience. Existing evidence suggests patients and the public overestimate their healthcare utilisation in hypothetical scenarios, suggesting that in a real-world scenario, more participants would have advocated to be discharged (Wong et al., 2018). To reduce participant burden, only one scenario was included (focused on back pain that could potentially indicate cauda equina but was likely not serious). It is unclear if participants would respond differently to scenarios presenting other clinical presentations. Furthermore, the online nature of this study limited participation to those with no communication needs and those fluent in English.

### **3.6.3 Implications for the next stage of research**

Designing this study, revealed a lack of measures considering the tolerance, or intolerance, of health-related uncertainty for service users. Despite the

association between doctors' UT and disposition decision-making reported by Lawton et al. (2019) informing the current study, it is difficult to conclude that this is not the case for service users as Lawton et al. (2019) chose the PRU scale to measure UT, conceptualising UT as a state whereas the IUS-12 scale used in the current study measures trait intolerance for uncertainty. To fully understand if interventions that enhance the UT of service users could reduce preferences for risk-averse decision making, a measure of health-related UT is required.

This chapter rationalises the development of shared decision-making interventions and those that encourage doctors to implicitly communicate uncertainty to patients by aligning these functions with public preference. In the previous chapter, confidence as a cognitive appraisal of uncertainty was identified as influencing transparency of communication and therefore interventions to enhance doctors' confidence in approaching uncertainty could support this goal. There was no significant association between intolerance of uncertainty among the public and preferences for disposition decision-making, suggesting greater utility of UT interventions focused on healthcare professionals. Despite the UT of service users not being evidenced as associated with decision-making in the ED, the variation in preferences for uncertainty management identified by the current study rationalises patient and public involvement in the development of UT interventions for ED doctors. Furthermore, the outcomes of doctors' UT identified in the previous chapter included the quality of care received by patients and patients' experience of care. UT interventions focused on ED doctors, will therefore ultimately impact patients and the public. It is therefore important to involve these groups

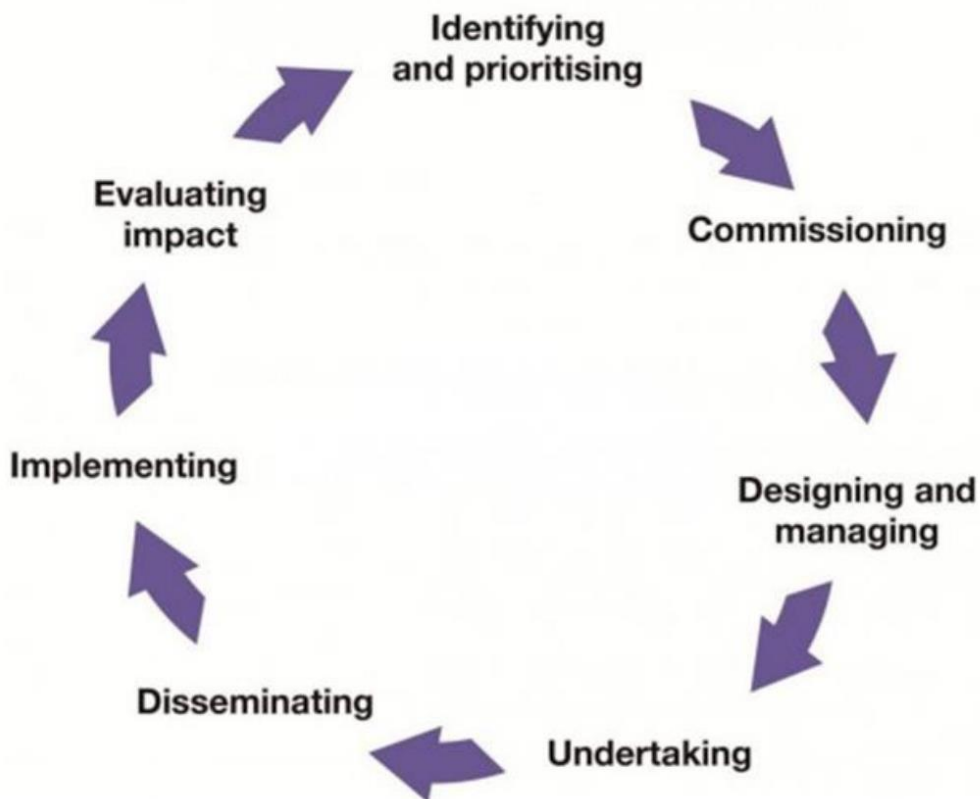
throughout all stages of intervention development (UK standards for Public Involvement, 2019).

### 3.6.3.1 Patient and Public Involvement and Engagement

In a briefing note for researchers, INVOLVE (2012) suggest seven stages of the research cycle to consider involving patients and the public in health and social care research (see Figure 3.1). This section outlines the involvement and engagement of patients and the public at each stage of the research cycle for research included in this thesis, before evaluating the approach taken.

#### Figure 3.1.

*Stages in the research cycle to involve patients and the public (INVOLVE, 2012).*





**Table 3.4**

*Patient and Public Involvement and Engagement shaping the research in this thesis.*

Stage of the research cycle	Involvement and engagement in this thesis
Identifying and prioritising	<p>During the COVID-19 pandemic, I presented a plain English summary of the rationale for this thesis to a citizen participation group. I then virtually attended a session with the citizen participation group who advocated for research to develop tools, guidelines, and interventions to support staff make uncertain decisions. The group were particularly interested in encouraging transparent communication of decision-making processes and uncertainty, while acknowledging this could induce anxiety for certain patients. They advocated for interventions with a particular focus on junior staff. While members of the group desired transparency in the grade of doctors (e.g. signalled with uniform colours), they considered it a priority that new healthcare professionals are confident in managing uncertainty.</p> <p>Suggestions from patient panels also inform directions for future research in the general discussion chapter (chapter 6) and future intervention development (chapter 5).</p>

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	<p>I regularly engaged with lay leaders from the NIHR Yorkshire and Humber Patient Safety Translational Research Centre (PSTRC) about the direction of my research, with uncertain discharge decisions highlighted as the most concerning patient management decision for which tolerance should be enhanced.</p>
Commissioning	<p>One lay leader from the NIHR Yorkshire and Humber PSTRC (HT) provided ongoing support throughout the thesis. This included developing an appropriate, and engaging, PPIE strategy and signposting to relevant stakeholder groups (e.g., NHS trust boards).</p>
Designing and managing	<p>Suggestions from the citizen participation group, lay leaders from the NIHR Patient Safety Translational Research Centre and Sheffield Emergency Care Forum (a patient panel with a special interest in ED research), shaped the study materials used throughout this thesis, including survey scenarios in chapters 3 and 5, and the interview topic guide used in chapter 4. Members of the Sheffield Emergency Care forum piloted the survey study included in chapter 3 and commented on the protocol for the scoping review in chapter 2, developing the search strategy.</p>

Undertaking	While recruitment was generally supported by ED staff, one lay leader from the NIHR Yorkshire and Humber PSTRC supported data extraction of studies included in the scoping review in chapter 2, and the analysis of qualitative interview data in chapter 4.
Disseminating	One lay leader from the NIHR Yorkshire and Humber PSTRC co-designed an infographic, summarising key findings to disseminate (see appendix 3.3).
Implementing and evaluating impact	The Yorkshire Quality and Safety Research Group (YQSR) patient panel supported the research team in highlighting the patient experience when interpreting results and potential outcomes of implementation. In evaluating the PPIE of this thesis, it was suggested that an equality impact assessment could have enhanced the quality of studies.

### **3.6.3.2 Next chapter**

The current chapter supports evidence identified in the scoping review (chapter 2) which suggests interventions to enhance UT among ED doctors could yield positive outcomes for patient experience. By identifying service user preference for transparency from ED doctors managing uncertainty, and involvement in disposition decision-making, this chapter suggests a focus on encouraging positive responses to uncertain disposition decision-making, would align with patient preference. It is unclear from existing evidence summarised in chapter 2, how doctors in the UK cognitively appraise, emotionally respond, and behaviourally respond, to uncertain admission and discharge decisions. The next chapter includes a qualitative exploration of ED doctors responding to uncertain admission and discharge decisions, and the factors doctors perceive to influence the valence of such responses.

## Chapter 4

### **A qualitative exploration of how junior doctors and registrars respond to uncertainty in the Emergency Department and the factors they perceive to influence this.**

#### **4.1 Chapter summary**

The scoping review in chapter 2 identified the quality of patient care as a well-evidenced outcome of the UT of doctors, with an overutilisation of resources, and consequently increased risk of patient harm from healthcare, associated with lower UT among ED doctors. The review also highlighted difficulties in deducing the valence of responses from quantitative evidence alone. For example, it is sometimes difficult to understand if behaviours (e.g., increased testing or involvement of seniors) are indicative of approaching uncertainty positively and safely, or indicative of uncertainty avoidance and decision deferral. Qualitative studies, of which none have focused on UT in an UK setting, provide an opportunity to form an in-depth understanding of the underlying rationale for behaviours, potentially highlighting the cognitive appraisals and emotional responses driving such behaviours.

This chapter reports on an interview study with junior and middle grade ED doctors, discussing experiences of uncertain admission and discharge decisions and the factors influencing responses to uncertainty. Implications for theory and further research are outlined, including how the findings informed future chapters in this thesis.

## 4.2 Introduction

The importance of constructive responses to clinical uncertainty indicative of UT amongst ED doctors was covered by the previous two chapters. Chapter 2 revealed UT and associated manifestations, including a concern for poor patient outcomes, reluctance to disclose uncertainty to patients and reluctance to disclose mistakes to colleagues, are a greater predictor of burnout than age, practice environment and level of training amongst ED doctors (Kuhn et al., 2009; Takayesu et al., 2014). A recent large-scale survey conducted by the Royal College of Emergency Medicine (2021), reported 50% of EM doctors are considering reducing their working hours and 26% are considering a career break or sabbatical in the next two years. These decisions were ascribed to burnout and workload pressures in 35% and 32% of cases respectively. Whilst staffing levels are key to driving necessary change in this respect, interventions directly focused on UT, could also contribute to reduced burnout levels across the EM workforce.

Notably, measures of propensity for risk and UT were not associated with adverse patient events. Specifically, higher UT or propensity for risk-taking was not associated with patient death 4-6 weeks after discharge (Pearson et al., 1995) or re-attendance and re-admission rates (Budworth et al., unpublished; Pearson et al., 1995). Such findings corroborate suggestions that premature closure of decisions and diagnoses are more likely to cause adverse patient events including misdiagnoses and incorrect treatment than behaviours more aligned with comfort in the presence of uncertainty (Kovacs and Crosskerry, 1999). Therefore, efforts to embrace uncertainty are a potential focus for interventions aiming to enhance physician wellbeing without contributing to adverse patient events.

Furthermore, the previous chapters suggest the way ED doctors respond to uncertainty can influence patient and family experiences of uncertainty. For example, communication of uncertainty by ED doctors can influence decisional conflict (Boland et al., 2017), anxiety (Platts-Mills et al., 2020) and satisfaction (Miao et al., 2020) amongst patients. This suggests efforts to enhance positive responses to uncertainty amongst ED doctors, could indirectly, positively impact the way service users experience uncertainty. Despite this, the previous chapter highlighted that to date, no interventions exist with the specific aim of supporting ED doctors to tolerate uncertainty associated with admission and discharge decisions.

The Hillen et al. (2017) model of UT suggests moderating factors can influence UT and is flexible in contextualising such factors as an individual's propensity (trait) or contextual (state). Clinical experience, as previously mentioned, influenced UT and often, diagnostic test results are more frequently relied upon as a means of delivering information to patients in brief, uncertain encounters (Salhi, 2015). However, such contextual influence on uncertainty management has not been related to ultimate patient management decisions and doctor's UT within existing literature. Given the lack of evidence reported in Chapter 2 considering how contextual factors influence cognitive, emotional and behavioural responses to uncertainty, potential areas of focus for UT interventions remain unidentified.

Quantitative evidence associating UT with burnout and resource use provides a rationale for further understanding physician UT (Budworth et al., unpublished; Kuhn et al., 2009). It does not, however, provide an in-depth exploration of the underpinning mechanisms of UT, including what factors contribute to this experience. Existing qualitative research in the field has

focused on how contextual factors influence the trajectory of admission decisions made in the ED, but had not focused on uncertainty (Pope et al., 2017). As highlighted by chapter 2, qualitative explorations focused on UT, have been conducted in the USA. It is unclear how UT may manifest differently in a UK, state-funded, healthcare context.

Han and colleagues (2021) suggest a temporal evolution of UT over a doctor's career, with UT increasing due to greater epistemic maturity, humility, flexibility, and openness. Chapter 2 also highlighted existing quantitative evidence suggesting a greater propensity to admit patients in the face of uncertainty is found amongst more junior staff populations and that this is a result of junior doctors showing lower UT than their more experienced colleagues. Lawton et al. (2019) asked physicians to select the patient management decision they deemed appropriate after reading clinical vignettes designed to have a range of possible management choices. The study also measured participants' UT using the 'Physicians Reactions to Uncertainty' scale (Gerrity et al., 1990) and found UT to partially mediate the relationship between experience and management choice amongst emergency physicians. Those doctors who were lowest in UT chose the most risk-averse management option, which usually involved further tests and admission to hospital. However, as reported in Chapter 2, evidence of the relationship between UT and clinical experience is conflicting and warrants further research (Baldwin et al., 2005; Pearson et al., 1995).

This chapter aims to address these gaps by conducting a qualitative exploration of junior and middle grade doctors' perceptions of how they respond to uncertain admission and discharge decisions and the facilitators and barriers they perceive to experiencing positive cognitive, emotional, and behavioural



manifestations of uncertainty when making patient management decisions.

Understanding these experiences will offer potential areas of focus for interventions focused on: a) ensuring a context which allows uncertainty to be tolerated (state); b) developing UT at an individual-level (trait) and, c) contextual factors which could undermine the success or implementation of any intervention aiming to enhance UT.

### 4.3 Research questions and aims

The current study aimed to explore junior and middle grade doctors' experiences of uncertain admission and discharge decisions in EDs. The data were examined through the lens of the Hillen et al. (2017) model of UT, allowing the researcher to both learn from and shape this model within the context of ED patient management decisions. Drawing upon this model also allows for consideration of how contextual factors influence responses to uncertainty as well as the differences in how individual doctors respond to uncertainty in the ED, an ultra-adaptive environment where individuals need to be empowered to manage uncertainty, rather than rely on rules and protocols (Vincent and Amalberti, 2016).

To address the study aim, the following research questions were posed:

- 1) What are the *sources* of uncertainty experienced by doctors when making admission and discharge decisions in the ED?
- 2) How do junior and middle grade doctors experience and *respond* to uncertain admission and discharge decisions in the ED?
- 3) What *factors* do junior and middle grade doctors perceive to influence their response to uncertain admission and discharge decisions in the ED?

## **4.4 Methodology**

The study received ethical approval from the School of Psychology Research Ethics Committee at the University of Leeds (no: PSC-859; date: 06/12/19). An amendment was submitted to alter the data collection period due to Covid-19 restrictions and this was granted (PSYC-78; date: 21/07/20). Approval from the Health Regulation Authority was also granted (IRAS ID: 276345; date: 01/04/20).

### **4.4.1 Research design**

A qualitative methodology was chosen, reflecting the research questions' focus on understanding the experience of managing uncertainty from the perspective of doctors themselves. Qualitative methods are useful to explore the contributory factors to certain behaviours, particularly when the existing evidence base is limited (Al-Busaidi, 2008; Pope et al., 2002) and provide a person-centred approach to uncovering thoughts and actions of individuals (Renjith et al., 2021). Whilst quantitative methods have established relationships between factors such as experience and management of uncertainty, they have not established in-depth explanations of why this relationship occurs or any other factors which contribute to the behaviour of ED doctors in circumstances of uncertainty. Therefore, a qualitative approach to exploring the responses (cognitive, emotional and behavioural) to uncertainty and the influencing factors, can complement the existing quantitative research by providing a more detailed understanding.

Specifically, semi-structured interviews were chosen. Semi-structured interviews typically utilise a flexible topic guide which can be developed iteratively throughout data collection and supplemented by relevant probes

(DeJonckheere and Vaughn, 2019). This provided the researcher the opportunity to ensure elements of UT as a construct were discussed, whilst allowing the patient management decisions discussed to be participant-led and contextual influences on decisions to naturally manifest in discussion. Semi-structured interviews provide the opportunity to gain insight into individual cognitive and emotional appraisals about a particular topic (DeJonckheere and Vaughn, 2019). Given the potentially sensitive nature of discussing patient management decisions which in hindsight, were uncertain, a data collection method which protected participant anonymity was suitable.

#### **4.4.2 Setting**

Participants were recruited between July 2020 and October 2020 within the ED of one large, acute NHS trust in the North of England, UK. This recruitment window allowed for two rotations of junior doctors to be contacted. The study site was in an urban location and serves a population of approximately 500,000 patients.

#### **4.4.3 Eligibility criteria**

Eligibility criteria required participants to be working in the ED of the participating NHS trust at the time of the study. Doctors of the grade FY-2 and above were eligible to take part due to ED rotations for junior doctors including the responsibility of admission and discharge decisions, however consultants were excluded. This was in response to Chapter 2 findings suggesting with greater experience, physicians can better tolerate uncertainty, therefore highlighting a greater need to develop an understanding of how junior staff can be better supported to manage uncertainty.

#### 4.4.4 Recruitment

Purposive sampling was used to seek maximum variation in the grade and gender of doctors interviewed whilst ensuring all participants contacted met the eligibility criteria. This sampling technique is useful for accessing participants most likely to have experience and knowledge relevant to the research focus (Kelly, 2010), which is important when sample size is smaller for in-depth studies and resource needs to be used effectively (Palinkas et al., 2015). Using the departmental rota for junior doctors and registrars as a sampling frame, 67 potential participants were emailed, inviting them to take part. It was originally anticipated that 16-20 interviews would generate data rich and holistic enough to reflect the complexity of the phenomena of interest (Sim et al., 2018).

The invitation email included the study information sheet and consent form for participants to consider. Access to the information sheet allowed participants to understand the purpose of the study, how any personal data and data generated from the interviews would be handled and gave my contact details, should they be interested in arranging a suitable time to be interviewed. Following a two-week period, potential participants who had not responded to the invite were emailed a reminder invitation. Due to the nature of email recruitment and only requiring a response from doctors should they want to take part, the reasons for lack of responses were not captured.

Toward the end of data collection, theoretical sampling was utilised to ensure an adequate representation of grade and gender. This was in response to demographic influences on responses to uncertainty highlighted in Chapter 2. To achieve this, face-to-face invitations were issued toward the end of data collection to potential participants of grades and genders which were underrepresented in the sample.

#### 4.4.5 Interview guide

A topic guide was developed by the research team, which included an EM consultant who is also clinical lead of a major ED. Discussion points in the topic guide drew on the integrative model of UT outlined in chapter 1 (see figure 4.1), however interviews were largely participant led, with doctors encouraged to explore their individual experiences within the remit of the topic guide.

The topic guide was flexible and was further developed alongside data collection to account for emergent data. For example, safety netting was identified consistently as a key behavioural response in the face of uncertain discharges by early interviewees, therefore in subsequent interviews the mechanisms by which doctors acquire this skill were also explored. Ultimately, the topic guide was designed to make participants feel part of an extended conversation, whilst still yielding relevant data. Questions within the interview were asked in plain English, avoiding the need for terminology to be clarified.

First, a general question regarding the participant's career in medicine was asked, easing them into the interview and building rapport between the researcher and participant before potentially sensitive questions were asked. Central to the schedule was the discussion of two specific situations: an instance of admission from the ED; and an instance of discharge which, in hindsight, the doctor was unsure was correct. Focusing on specific situations, whilst still allowing the participants to choose what they discussed, allowed the questions to guide participants through an experience and to recall specific thoughts, feelings and behaviours and key influences before, during and after the patient management decision was made.

For each of the two patient management decisions discussed, prompts existed surrounding the context of the case, anything they perceived to influence the outcome and how they were thinking, feeling and behaving throughout the decision-making process. These questions allowed the mechanism of UT to be understood in these specific circumstances, from the subtype of uncertainty, the response to it and any factors they perceived to influence how they managed the uncertainty. Subsequently, any coping mechanisms used were explored as well as any support which wasn't available the physician would have found beneficial.

Whilst designing the study, research aims, and the interview topic guide were presented to a patient panel and citizen participation group. This resulted in the addition of prompts surrounding patient factors, particularly social factors, and complex care needs, which could contribute to uncertain patient management decisions. As public contributors, they also expressed more frequent experience of hearing about unsafe discharges compared to unsafe admissions. This was explored further from the doctor's perspective in interviews.

## Figure 4.1

### *Interview topic guide*

#### **Introduction**

Could you tell me about your career in medicine so far and how you came to be working in A&E?

#### **Account (Alternate order with participants)**

Can you tell me about a time you admitted a patient but afterwards thought it might not have been necessary? Please do not refer to patients by their name if discussing specific cases OR,

Can you tell me about a time you discharged a patient but afterwards thought admission would have been more appropriate? Please do not refer to patients by their name if discussing specific cases.

Prompts to explore what was different about this admission or discharge compared to those with no uncertainty surrounding them.

- What do you think influenced this patient management decision?

I will prompt around the situational, social, cultural and individual factors which impacted this decision.

- Tell me about the process of arriving at this decision to admit the patient. How were you thinking and feeling?

I will prompt to understand the cognitive, behavioural and emotional responses to uncertainty in this situation.

- What helped you cope with this uncertainty?

Prompts to explore if support was provided, what led to the later thoughts of uncertainty and if any individual strategies were used to cope.

#### **Closing Questions**

1. How do you find working in A&E generally?
2. How prepared do you feel for making challenging patient management decisions in A&E? If so, why? If not, why?
3. Is there anything else you would like to add about anything we have discussed during this interview?

### **4.4.6 Piloting the interview**

The topic guide was piloted with an EM registrar, who met the eligibility criteria but who was independent of the study, to evaluate clarity and relevance

of questions and identify any areas of misunderstanding. Following this pilot, the topic guide was considered suitable, however the recruitment materials only included the term 'junior doctors.' Despite this term being used officially to encompass junior doctors and doctors in training, the pilot interviewee commented on this as not common practice in referring to registrars. The pilot interview therefore led to changes in the recruitment materials to address this.

#### **4.4.7 Procedure**

Data were collected using qualitative interviews which ranged from 25 to 57 minutes ( $M= 39$  minutes) in length and were audio recorded. Audio recordings were supplemented with field notes, capturing anything relevant to the participant or research questions which was discussed before or after the recording took place. Other than one occasion where the rota changed unexpectedly, the interviews took place within the doctors' shift time, with an ED consultant, who was also a member of the research team, covering for participants on the ward for the duration of interviews, ensuring patient care was not impacted. Interviews took place in a private staff training room within the ED with only the interviewer and interviewee present.

Participants were first informed that the interview would be recorded and transcribed for research purposes and made aware that the intention was not to judge any decisions made or assess performance but to explore factors that influence such uncertain decisions so as to provide better support in such circumstances. Face-to-face interviews were conducted to emphasise this and build trust between the researcher and participants. Prior to the interview, the information sheet was presented, written consent was gained, and demographic information was collected. As the interviewer, I had no prior relationship with



participants however they were made aware that the study would contribute to my PhD project which aims to support doctors in managing uncertainty.

Following the interview, participants were debriefed, given a £20 shopping voucher as a gesture of gratitude and provided their personal contact details if they requested a summary of findings.

#### **4.4.8 Analysis**

Framework analysis (Ritchie & Spencer, 1994) was used to analyse data within the interview transcripts, an approach which is useful for managing large datasets, particularly interview data where themes are generated through comparison both between transcripts and within cases (Gale et al., 2013). This approach has been described as the 'codebook approach' to thematic analysis, sharing qualitative research values typical of reflexive thematic analysis (Braun and Clarke, 2016) but applying a more structured approach to coding which is useful for applied research where information needs are established prior to analysis (Braun and Clarke, 2021). This combined deductive and inductive approach to analysis aligns with research questions which loosely draw on existing theory but acknowledge and encourage the exploration of unforeseen phenomena in relation to participants perspectives (Gale et al., 2013).

Framework analysis often results in the conceptualisation of themes as domain summaries, allowing the theoretical model of UT (Hillen et al., 2017) to inform themes early in development and the analysis to organise concepts generated from the data around categories within the model, as shared topics rather than shared meaning (Braun & Clarke, 2021). Framework analysis typically involves five stages: familiarisation; identifying a framework; indexing; charting; and mapping and interpretation (Ritchie & Spencer, 1994).

During the final stage of interpretation, data were further interrogated, identifying one meta-theme which incorporates data mapping onto the model of UT (Hillen et al., 2017) but also data not captured by the model. This integrative theme represents overarching perspectives throughout the data set which were unforeseen (Gale et al., 2013) and explains phenomena which underpin the entire dataset. Rather than relating to the specific cases discussed by participants, the meta-theme encapsulates a concept that permeates the entire data set and underpinned discussions reflecting an impact on all other themes.

#### Analytical process

Familiarisation with the data had already started during data collection as the researcher had independently conducted interviews and transcribed them. To further immerse in the data set, the researcher re-listened to audio recordings, transcripts were read numerous times and summaries of each transcript were produced discussing key themes and relationships. Preliminary codes were inductively generated at the familiarisation stage and continued into the subsequent step of identifying a framework. The combined deductive and inductive approach this study took to analysis meant that the coding framework already included concepts within the integrative model of UT (Hillen et al., 2017) however open inductive coding generated further codes early in the familiarisation stage which further categorised the data and allowed for greater specificity within an ED context. This ensured analysis was framed around the research questions but allowed flexibility for the perspectives of participants to be incorporated into the analytical framework.

For example, within the pre-existing moderator, 'individual characteristics', *clinical experience in the ED* was identified as influencing UT. This was distinct from the model and many sub-themes were generated corresponding to this

factor such as lack of acknowledgement of uncertainty in clinical education and stronger relationships with the team. This inductive analysis resulted in an overarching theme which explores the temporal changes in UT perceived by ED doctors.

Two transcripts were independently coded by members of the research team (EP, RL and BF) followed by discussion which informed the development of the working, analytical framework. Following the coding of ten transcripts, no new codes were generated meaning code saturation had occurred and the working analytical framework became the analytical framework. Categories and sub-codes were transferred into NVivo 12 to maintain an audit-trail and assist with indexing all transcripts, where each passage of text meaningful to the research questions was assigned an appropriate code. This process revealed commonalities between certain codes which could then be categorised together.

A framework matrix was then generated with each row representing an individual participant and each column representing a code. The data from each participant relevant to each code was summarised in each cell of the matrix, whilst still retaining the meaning of the data. The matrix made it possible to see all relevant data associated with a category of the integrative model of UT (Hillen et al., 2017) and the generated sub-categories, highlighting commonalities and differences between and across participants. The structure of the matrix was governed according to the inductive-deductive analytical framework which had been iteratively developed throughout earlier stages and allowed for relationships between themes to be highlighted, resulting in the generation of one, integrative meta-theme which encapsulates participants reflections of how their approach to uncertainty changed over time and the

differences between participants responses to uncertainty based on grade, which is presented in section 3.5.2.

Themes were finalised by discussion with the research team and doctors independent of the study with ED experience. This included finalising theme names which are more literal for theory-driven, deductively-generated themes but for the meta-theme, reflects the meaning of participant-led discussion. Feedback from doctors with ED experience was sought at multiple points throughout the analytic process including the development of the coding framework early in analysis and also, interpretation of the data, once preliminary findings were generated. This resulted in changes to the analytical framework, for example defensive practice was not considered to be influenced by the '*culture of medicine*' until codes and their definitions, alongside quotes, were consolidated with stakeholders. The structure of meta-themes was influenced by consultation sessions, with stakeholders highlighting the ED specialty as unique in the importance of teamwork when approaching clinical uncertainty. This highlighted the increased confidence in speaking to team members and increased knowledge of external departments who can be contacted for support as contributing to the relationship between clinical experience and UT. Preliminary findings were presented to participants digitally, with positive respondent feedback received.

Throughout the design and analysis of this study, the lay leader affiliated with the workforce engagement and wellbeing research theme within the NIHR Yorkshire and Humber Patient Safety Translational Research Centre (HT) provided invaluable insight, particularly due to their expertise in older patients with complex needs. For example, when social care and safeguarding concerns were identified in the data as sources of uncertainty and influences on

admission and discharge decisions, HT provided consolidation on the available safety netting procedures in the region allowing me to establish if existing barriers are due to system inadequacies or lack of knowledge amongst doctors of available services.

## **4.5 Findings**

### **4.5.1 Participants**

14 face-to-face interviews were conducted with ED doctors from the grade FY2 to specialty doctor. Participant characteristics are shown in Table 4.1.

**Table 4.1****Participant demographics**

Characteristic		
Gender	Male	8
	Female	6
Age	Mean	31.29 years
	Range	24 to 48 years
Grade	FY2	3
	FY3	1
	ST1 GP Trainee	1
	ST3	1
	ST4	3
	ST5	2
	ST6	1
	Specialty Doctor	2
Years' clinical experience	Median	6 years
	Range	1 to 25 years
Years' ED experience	Mean	3.36 years
	Range	2 months to 7 years

*Note.* ST= Specialty trainee, FY= Foundation year.

Findings are first presented in relation to domains of the Hillen et al. (2017) model (i.e. stimulus termed 'sources of uncertainty', moderators termed 'factors' and appraisal/responses), with descriptive accounts of participants' perceptions of the sources of uncertainty, how they responded to uncertainty and the factors they perceived to influence these responses. Subthemes within these categories, shown in bold, extend the model, acknowledging findings specific to admission and discharge decisions in the ED. The Hillen et al. (2017) model was critically applied to the data and consequently, where domains of the model were not supported, including no positive emotional responses to uncertainty being reported, this is also highlighted. Second, one meta-theme is presented which was generated from inductive and deductive analysis revealing perceptions of UT as an evolving construct, underpinned the entire data set. This meta-theme represents perceptions about changes to UT throughout a doctor's career and how this influences the relationship between other contextual factors and the experience of uncertainty.

#### **4.5.2 Sources of uncertainty**

Consistent with the Hillen et al. (2017) model of UT, the three higher order themes representing sources of uncertainty are presented with seven secondary and 17 tertiary subthemes. Figures accompany each subtheme, providing thematic maps encapsulating the sources of uncertainty in the cases participants chose to discuss. Some sources of uncertainty were discussed in relation to specific cases, however some of the sources were discussed more generally in relation to patient management decisions in the ED.

##### **Probability as a source of uncertainty**

Inherent to the admission and discharge decisions discussed, was the **unpredictability of future outcomes** for patients (see Figure 4.2).

Consideration of this unpredictability was generally focused on symptom progression amongst patients who presented with symptoms which were not severe at the time but had the potential to progress. This uncertainty was almost exclusively perceived when discharging patients and the potential for symptoms to progress while the patient was at home, in particular where progression of symptoms could bear life-threatening consequences.

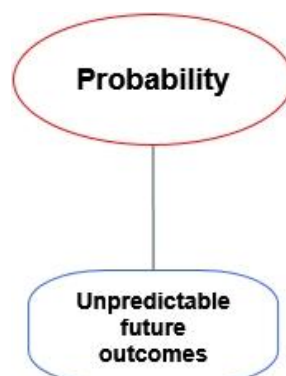
Conversely, where a patient presented with symptoms which would not pose significant consequences and could be managed should symptoms become worse, less uncertainty was associated with the patient management decision whilst making it, as well as in hindsight.

*'With chest pain...it's one of the ones where if you make a wrong decision, the consequences could be very bad ...I would probably be more easy-going about making a decision about someone who's come in with a leg pain because it's not something that is really likely to be deadly...'*

P6: ST6

**Figure 4.2**

*Map of subthemes relating to 'probability' as a source of uncertainty.*





Alongside consideration of the severity of potential consequences was the speed of potential progression, meaning uncertainty was present after discharging patients for whom symptoms could progress quickly, leaving less time to mitigate potential consequences. This interacted with the risk of severe consequences actually happening, meaning patient presentations which had the potential for severe consequences that could occur quickly but the risk of this occurring was low, had more uncertainty surrounding the patient management decision.

*'I don't think there is a high chance but I would say if it were to happen, if it got stuck and got infected, she would be very unwell ... it's that quick to come and flare up and become really serious that you need to be in intensive care.'*

P12: FY2

Strategies to reduce uncertainty such as gathering medical history and patient accounts could often not mitigate the uncertainty associated with unpredictable future outcomes. This was perceived to be due to clinical symptoms varying between patients, meaning the uncertainty associated with unpredictable outcomes was often irreducible.

*'I have found that sometimes patients don't describe having a real pain and then end up having a heart attack, or sometimes people describe a pain, you expect them to have a heart attack and they don't.'*

P7: ST5

As well as being uncertain of how symptoms could progress and the clinical consequences of this, the unpredictability of how patients would manage their existing symptoms, even if they didn't progress, created uncertainty, particularly surrounding discharge. One view emphasised that uncertainty about the

patients ability to manage at home was often greater than the uncertainty associated with missing something important in the clinical examination within hospital.

*'...it's all based on a theoretical risk, it's not the same as you know, am I sending someone home who's got a bleed on their head. It's more, could they have another accident at home or could they you know, fall when they go home'*

P6: ST6

This uncertainty as a result of unpredictable future outcomes following a discharge decision was exacerbated by the potential for litigation issues and the personal consequences to the doctor themselves however this concern was not expressed often.

*'Because I think well I'd rather admit them and they get sent home after a day rather than don't admit them, they've got something really serious and I end up in a coroner's court or something like that.'*

P12: FY2

Whilst the perspectives on unpredictable outcomes for patients were mostly discussed in relation to potential symptom progression following discharge, some doctors also discussed unpredictable outcomes surrounding admission decisions. However, this uncertainty was not related to exacerbation of existing symptoms, but the development of new illness as a result of being in hospital.

*'Especially in the pandemic, definitely... you have to explain, you know, you don't want to be in hospital if you can avoid it, you're going to pick something up from other patients, from the environment...especially with the elderly... they end up getting hospital pneumonias and all sorts.'*

P8: ST4

However, this uncertainty associated with admission was often reduced due to the benefits of the care provided in hospital and the perceived low risk of hospital-acquired infection should the patient be discharged by a ward soon after.

*'It's very difficult to think oh god, what if they got an infection but I think my mind set is...if they are discharged the next day, the likelihood of them getting an infection in hospital, in 24 hours, isn't that high.'*

P13: FY2

### **Ambiguity as a source of uncertainty**

A number of issues were raised in relation to the ambiguity of practice when making the decision to admit or discharge, including the consideration of **conflicting information**, the **credibility** of information and having **insufficient information** to inform such decisions (see Figure 4.3).

Often the advice or medical opinions on the correct course of action in the ED conflicted between doctors within the team. Uncertainty was experienced when the view of the doctor was that admission or medical intervention was required but the colleague they asked for advice advocated discharge. One view given by a junior doctor emphasised the conflicting opinion of their consultant as a source of uncertainty.

*'...the consultant wanted to send her home and I was just like, I think she lives alone, she's very tearful, she had knee pain, both knees were causing pain to her, she had stairs at home and I was a bit concerned she wasn't going to be able to manage'*

## P14: GP Trainee ST1

However, one contrasting view was that as a junior, the advice of a senior does not create uncertainty, even when it conflicts their own judgement, as they would proceed with the advice to due to the greater experience of their senior.

*'I'm like, right okay fine, they're a senior, I trust them, they've been a doctor for 10, 15, 20 years, I've been a doctor for a year and two months, they know their stuff... if this is their judgement then I'll trust them.'*

## P11: FY2

Contrasting opinions between physicians were not only present within the ED team but also across departments. Uncertainty often occurred as a result of advice from specialty doctors which conflicted the doctors own judgement. However, similar to discussion within the ED team, uncertainty was only perceived by ED doctors when they thought admission was appropriate and the specialty doctor thought the patient should be discharged.

*'And it's not such because I want to send her home, it was because somebody who was the surgeon above me has told me to do that. So it just made me feel uneasy, but I can't force them to give her a surgery.'*

## P12: FY2

Uncertainty was not only created as a result of advice from hospital specialty doctors, but also existed when patients arrived to the ED with suggestions from a General Practitioner (GP). This was discussed by an ED doctor who considered discharge appropriate but admitted based on diagnostic suspicions from the patient's GP, leading the ED doctor to doubt the admission on reflection.

*'He had seen his GP and his GP sent him in and I think...if it was just me and I'd seen him I would have said, you're okay, it's probably just something viral, you can go home. But I think because he had a GP letter who was worried about chest pain...afterwards, I was like, actually, maybe I should have just sent him home because if it was just me and I'd seen him without the letter, I would have just sent him home.'*

P3: Specialty Doctor

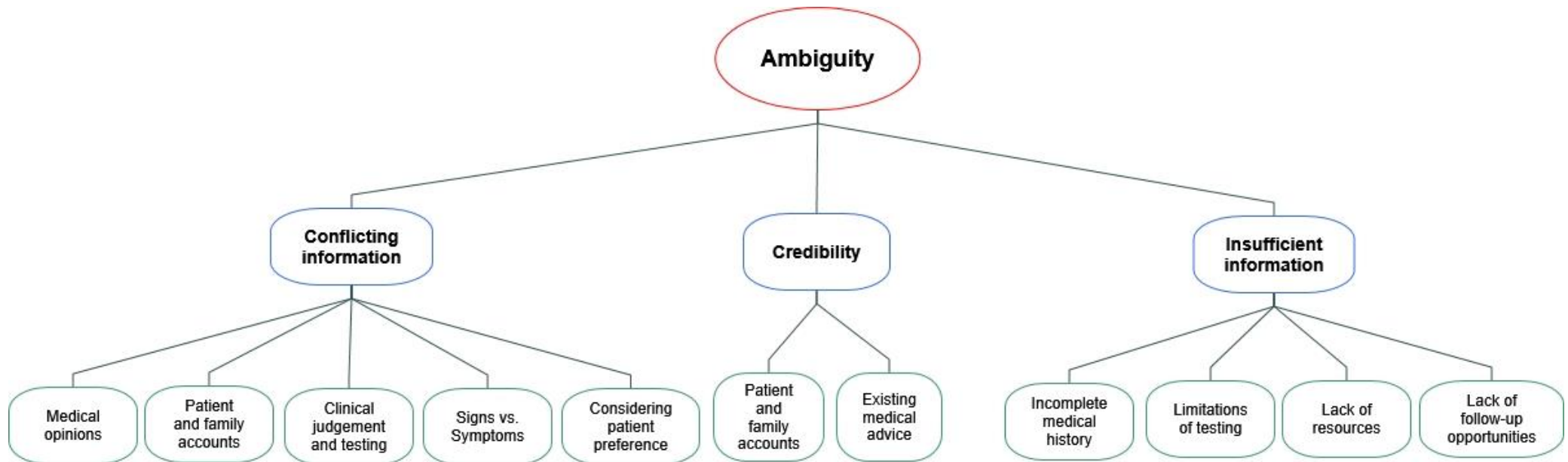
Conflicting medical opinions surrounding admission and discharge decisions were described as inevitable by doctors and views highlighted that there is no absolute course of action to take as an ED doctor, creating ambiguity surrounding the accuracy of decisions.

*'But everyone's got a different opinion. Some people will be like oh yeah, absolutely fine, send them home...everybody gives different advice because they've seen different things.'*

P8: ST4

**Figure 4.3**

*Map of subthemes relating to ambiguity as a source of uncertainty*



As well as the advice of other clinicians conflicting with the doctor's judgement and creating ambiguity in the decision-making process, uncertainty surrounded the discharge process when the ED doctor advised admission and the patient preference was to be discharged.

*'The only doubts you get is when they want to leave because you can't hold them against their will. If they want to go back home...that does make you feel horrific because they're going back to an abusive relationship.'*

P8: ST4

Conversely, one registrar recalled encouraging a junior to make the decision based on the patient's preference, even when it conflicted their own judgement. In this situation, the patient's preference provided valuable information to inform the decision, reducing uncertainty.

*'If that patient has capacity and they say no, I want to go home, I understand the risks, then fine, so be it...And the doctor was like well erm, I've sort of said to him that he doesn't look quite right...I was like, well that's the patient's decision, that they want to go home'*

P10: ST3

As previously discussed, ambiguity existed in the patient management decisions made as a result of patient preference and the advice of colleagues conflicting with the clinical judgement of the doctor themselves. Ambiguity also arose when the doctors own judgement was conflicted by test results or the indications of scoring systems and guidelines. The contrasting suggestions of test results and protocol-driven guidance meant that the doctor had more options to consider than if clinical judgement alone had guided the decision.

*'The one who did get me was a lady who, her leg looked like a roaring cellulitis, but when you did the Wells score for DVT, she actually scored quite highly for a DVT.'*

P4: ST4

Uncertainty was also perceived by doctors when the information given to them by the patient themselves and the accounts from family and friends conflicted. When the information provided by service users was inconsistent, uncertainty as a result of ambiguity ensued.

*'...for her, it was the story that she gave me that was changed between her, her mum and her dad.'*

P6: ST6

Certain cases and the signs and symptoms which patients present with were also discussed as sources of uncertainty. One doctor suggested that ambiguity is low for patients who are well and patients who are severely unwell but between those extremes, is a selection of patient presentations for which the correct course of action is ambiguous.

*'...it's a very narrow band between the patients who are very well and they obviously just go home and the people who are really sick and are obviously coming in. So there's only a narrow band in between where it's kind of like, do they need to come in, do they not.'*

P3: Specialty Doctor

Clinical signs and symptoms also created ambiguity when they conflicted each other. This occurred when the patient looked and felt well but test results



indicated worrying symptoms. When this occurred, one doctor described feeling a continued sense of ambiguity about similar presentations in the future.

*'There was a lady whose history just sounds like a PE [pulmonary embolism]. She looked really well, her heart tracing is normal. She really wanted to go home... And the troponin came back as over ten thousand which was really unexpected.'*

P1: ST4

As well as processing conflicting information, some doctors also expressed doubting the **credibility** of the information they had available to them as creating ambiguity. Perspectives on this included doubting the patient's account of their pain or history, questioning the clarity or accuracy of what family members told the doctors and being sceptical of the pending diagnoses which patients have been referred to ED with. Considering the potential for patient accounts to include misinformation was described as important when collecting medical history by one doctor.

*'...you need to take into account that, yeah, you hear what the patient wants you to hear ... Some groups of patients may give misinformation deliberately or symptoms that may not exist on the current presentation...'*

P5: Specialty Doctor

Another doctor agreed that in some situations, doubting the credibility of the patient's account does occur and emphasised that this is dependent on the way in which patients communicate their history.

*'Sometimes if they [the patient] are too vocal, it's almost like, they're too vocal, it can look like they're putting it on.'*

P3: Specialty Doctor

Although ED is often the first point of contact with the health service for patients with acute clinical issues, patients often arrive as instructed by their GP. Whilst one doctor disagreed with the previous quotes suggesting a lack of credibility in patients' accounts in some cases, they did portray the credibility of existing medical advice which the GP has suggested as ambiguous. This was due to the limited information GPs have in some situations to inform the diagnosis they are querying.

*'You see quite a lot of, especially throughout the coronavirus pandemic, the GPs would send a lot of people in without actually having seen them with like a possible, serious diagnosis and then you'll see them and within a minute it'll be clear that that's not going on. So yeah, question the diagnosis they've been sent in with.'*

P9: FY3

The third source of ambiguity discussed by doctors was the need to make admission and discharge decisions with **insufficient information** available to them. There were four main instances emphasised by participants where this occurs and can cause uncertainty, shown by Figure 4.3. The first was when the medical history of the patient was incomplete. Without sufficient medical history, establishing whether a patient presentation is indicative of an acute emergency or a chronic, manageable condition, is difficult.

*'...when I began A&E, I began with nights...it's harder to get collateral history at night time compared to usually, so you don't really know that persons*

*baseline sometimes, you don't know if it's a short term confusion, a long term confusion.'*

P11: FY2

A number of issues were raised in relation to gathering a complete medical history including the ability of the patient to communicate, language barriers between the patient and doctor and the absence of family members in the ED, particularly throughout the covid-19 pandemic, to assist with both these communication barriers.

*P7: 'So in certain cases, maybe there is a language barrier or it is not quite clear from the history, I tend to admit them and then think, oh, they probably would have been okay going home...'*

*EP: 'And what do you mean about the history not being clear?'*

*P7: 'Sometimes there's a little bit of a language barrier here... Sometimes they do speak really good English, sometimes they don't and sometimes the family try to help and translate but now with Covid, it's been more difficulty to get family in...I've had two occasions where I couldn't find a translator.'*

P7: ST5

The second issue discussed in relation to insufficient information, was the **limitations of clinical testing** meaning a diagnosis could not be completely ruled in or out. This was centred around chest pain, a case mentioned frequently by doctors as having uncertainty associated with it, where tests can come back negative for cardiac-related diagnoses but not completely rule them out and the clinical testing used can indicate a plethora of diagnoses.

*'Literally anybody who has chest pain tends to get a D-dimer now and a D-dimer test, it's quite sensitive if you've got a blood clot but it's raised for loads of reasons. If I break my leg it will be raised, if I've got an infection it will be raised.'*

P12: FY2

As well as the lack of clarity provided by clinical testing, another issue perceived to create ambiguity as a result of insufficient information for ED doctors, was the lack of testing they have available to them.

*'And often you're having to make a decision in A&E with not many tests at your disposal, just based on your kind of, clinical impression.'*

P5: Specialty Doctor

This lack of resources is particularly important in terms of uncertainty in emergency medicine as the ED is unique in the lack of information patients often arrive with in the first instance. Whereas specialty wards and clinics may have existing test results and pending diagnoses suggested by other clinicians, ED doctors often have to base decisions on the limited information they can collate within the department.

*'In hospital medicine you have the benefits of having a plan from the day team, you have lots of investigations that have already happened, so you're making the judgement on the basis of the [existing] diagnosis.'*

P13: FY2

Aside from the ambiguity experienced when making patient management decisions within the ED, a perceived lack of follow-up opportunities meant ED doctors experienced lingering ambiguity surrounding patient outcomes and how appropriate their decision was, once the patient left the department. This

creates a sense of uncertainty where often the only thing which provides reassurance is the lack of information provided in the form of complaints or notification of adverse events.

*'I guess that's the weird thing about A&E. Because we don't have that GP style follow up, you don't see people for weeks on end. You often send people home and you never know what happens...I haven't had many complaints.'*

P6: ST6

As well as causing ED doctors to experience ambiguity following the patient's departure from ED, this uncertainty as a result of lack of follow-up opportunity was considered whilst making the decision to admit or discharge. One view emphasised this anticipated ambiguity in relation to how a patient is managing at home as guiding an admission decision.

*'I was a bit worried that we wouldn't be able to check up on her to check that things were going in the right direction if we let her go home.'*

P9: FY3

### **Complexity as a source of uncertainty**

Features of the cases discussed which made them hard to comprehend or reach certainty meant complexity was inherent to admission and discharge decisions (see Figure 4.4). As EM is a generalist specialty, ED doctors described their exposure to an array of patient presentations which included cases in which symptoms were non-specific or patients had comorbidities, meaning uncertainty was present because of **multiplicity in potential cause and explanations**. This complexity as a result of **non-specificity** was differentiated from the experience of identifying clear diagnoses by one doctor.

*'So there are certain things that are like barn door... But when it's really vague, I've got this vague feeling... it could be anything.'*

P8: ST4

The potential for **multiple causes** of the patient's arrival at ED instilled a fear of missing something important in the diagnostic process amongst ED doctors. This was described by one registrar as being particularly pertinent when the patient's pain is associated with an area of the body in which multiple organs are situated.

*'...there's just so much in the abdomen [laughter]. Yeah you know, there's like loads of different organs in the abdomen... if someone hasn't got a diagnosis, I just feel that there is, is there something that I could be missing?'*

P10:ST3

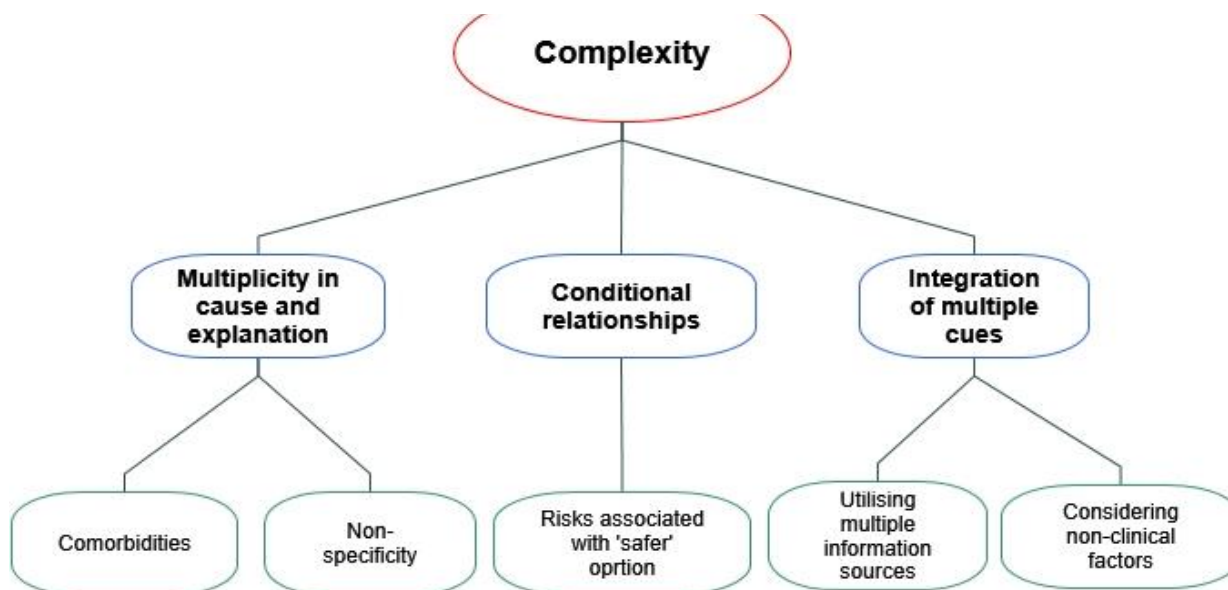
Another doctor highlighted the same experience of complexity and fear of missing something when caring for trauma patients and elderly patients with comorbidities.

*'...and a lot of the time a lot of elderly patients have a lot of comorbidities. There could be more going on there than you think there is and you might not have thought about x, y, z.'*

P13: FY2

**Figure 4.4.**

Map of subthemes relating to 'Complexity' as a source of uncertainty



This complexity associated with management decisions for patients with multiplicity to consider was often discussed as creating a lingering sense of uncertainty following the patient's departure from ED. As a result of time pressures in the ED, a sense of uncertainty in the diagnosis or decisions made about complex patients was often present due to the inability to reach a conclusive diagnosis when there were multiple options to consider.

*'I see somebody, I get some of the results back, I've treated you for a heart attack and actually the results I got back here, confirm you had a heart attack, that's fine, I wouldn't be so fussed following them up but the ones that are maybe a bit more of a diagnostic difficulty...we give them...a whole range of treatment to cover a whole range of things so you're not always sure exactly which it was....'*

P4: ST4

Whilst admission and testing is often the option with the least uncertainty associated, the **conditional relationship** whereby such medical intervention, often considered the safer option, could potentially carry risk, created complexity in some cases. One doctor considered this complexity to be an element of the decision making process for elderly patients.

*P13: 'I think I would always err on the side of caution and I think I'll always be happier to admit people and it be kind of pointless...'*

*EP: 'You said erring on the side of caution with admission there. Do you think there is ever a time when admission is not erring on the side of caution?'*

*P13: '...I think it is those vulnerable people and it is those elderly people who are so prone to getting infections in hospital.'*

P13: FY2

Another doctor highlighted the added complexity of considering risks associated with testing. Despite testing potentially reducing ambiguity by providing clinical information to inform patient management decisions, there is also complexity present in deciding whether to conduct tests in certain situations.

*'...you have to put them a cannula in and shoot loads of contrast up their arm into their lungs and if that cannula bursts for some reason you can cause people a lot of damage...And also, it's a massive amount of radiation and you don't really need to be exposed to it in the majority of cases...'*

P12: FY2

Another element of complexity highlighted by ED doctors when making patient management decisions, was the need to consider and **integrate**



**multiple cues.** This included pulling multiple information sources together to make a decision, as well as the added complexity of considering non-clinical factors when assessing a patient. In relation to **utilising multiple information sources**, views centred on two main issues, both focused on the use of guidelines. Many doctors expressed the need to combine guidelines with other information such as clinical judgement and patient preference, due to the individual needs of each patient being hard to conceptualise in a uniform set of guidelines.

*'Sometimes it just doesn't, not all patients fit a guideline. That's the problem and yeah, you can follow an algorithm down but it doesn't work with every patient...'*

P8: ST4

Another perspective on the complexity of using guidelines centred on the intricacy of interpreting them, whereby often, slight ambiguity within the account of patients could lead to significant changes in patient management decisions due to consulting different guidelines. One doctor attributed their experience of discharging a patient with a bleed on the brain to being directed to the wrong guideline by the patient and family account they were given and expressed the need to be able to combine guidelines to practice efficiently.

*'There is a head injury guideline that says if someone has hit their head and then had a fit you should scan it. But the story I had was that she had a fit and then hit her head. Which is more like, well people can have faints with shaking, doesn't mean she needs to have a scan of her head...'*

P6: ST6

The need to integrate multiple cues was also highlighted by most doctors when considering non-clinical factors such as social care needs and safeguarding concerns of patients, adding another element to the decision making process. One doctor felt this occurred in cases where from a medical point of view, certainty existed that the patient can be discharged but for non-clinical reasons, the case became complex and required intervention.

*'...especially in the elderly, you have to have a bit more awareness of other social factors. It's not just I've come with this pain here and right okay medically we think that's fine, you definitely don't need to come into hospital for that...'*

P2: ST5

This source of uncertainty was supported by another perspective from a junior doctor who emphasised the complexity in having to deliberate the benefits and risks of discharge when comparing clinical and non-clinical factors.

*'...if they do go home and then they have a big fall, would I feel more guilty? You know, it's really difficult to know which one is worse really because the risks are different, one's quite medical, and others are quite social.'*

P13: FY2

### 4.5.3 Appraisals and responses to uncertainty

Whilst reporting their experience of uncertainty, ED doctors discussed appraisals and responses to uncertain admission and discharge decisions which aligned with the three domains of the Hillen et al. (2017) model. Here, we summarise each of these in turn: cognitive, emotional and behavioural.

Participants recalled cognitive appraisals and emotional responses to uncertainty which in turn, elicited certain behaviours and decisions to admit or discharge. Where uncertainty was cognitively appraised positively, participants were more likely to engage in behaviours which reduced uncertainty, or the consequences associated with it. No positive emotional responses to uncertainty were perceived, however negative emotions were exclusively related to discharge, with admission eliciting no emotive responses. Such negative emotions, like negative appraisals, were perceived as driving admission decisions. Behavioural responses were acknowledged as being in response to certain appraisals and emotions but also to reduce them. For example, involving family members in the decision to discharge a patient was perceived to reduce the worry associated with unpredictable future outcomes.

#### **Cognitive appraisals**

Cognitive appraisals were recalled as driving decisions to admit or discharge as well as being experienced after the decision had been made. Some doctors described thinking about uncertainty in positive ways when reflecting on their practice. This included an acknowledgment and *acceptance of the inevitability of uncertainty*, approaching uncertainty with *confidence*, *considering the risks and benefits* associated with decisions and framing uncertain situations as an *opportunity to learn*. Appraising uncertainty positively often led to uncertainty

management strategies being utilised. Conversely, where such positive appraisals did not exist, the ability of the doctor to utilise strategies was diminished. Specifically, a lack of acceptance of uncertainty led to internal attribution of uncertainty and feelings of embarrassment in admitting uncertainty to a colleague.

**Acceptance of uncertainty** as an element of practice was framed positively by doctors as often, positive behavioural responses, which are outlined in section 3.5.3.3, occurred as a result of this acceptance. Reasons given for uncertainty being inevitable and a need to acknowledge uncertainty, centred on the nature of emergency medicine. One view emphasised that the requirement for ED doctors to be generalists, meant that uncertainty can exist due to a lack of knowledge on particular conditions and consequently, in disclosing uncertainty to specialists, ED doctors acknowledged its presence.

*'...there are sometimes I'm just like...I need somebody that sees abdomens every day to come and feel this tummy and this patient, thank you very much  
[laughter].'*

P10: ST3

Another perspective on the inevitability of uncertainty in emergency medicine led to the external attribution of uncertainty. Rather than viewing uncertainty as an indication of weakness in ones abilities, some doctors acknowledged that due to various factors in the emergency department, certainty cannot always be reached. One specialty trainee attributed uncertainty to the nature of generalist practice and the pressures faced in EDs.

*'So back when I first started a few years ago, I was really scared. I don't like to not know. Like but now, I just accept that probably don't know what happens to*

*patients, I accept that now, that we only have a limited time in A&E, we have limited resources, we're not the specialists.'*

P1: ST4

The positive repercussions of accepting uncertainty appeared to be a lack of negative cognitive appraisals and emotional responses and a promotion of positive behavioural responses. This was supported by the view of a relatively junior doctor who offered a perspective which indicated uncertainty aversion by a lack of acceptance that it will occur. Conflicting the external attributions of uncertainty by more senior doctors, this doctor avoided disclosing uncertainty to senior colleagues due to fear that being uncertain would reflect poorly on them.

*'You also feel a little embarrassed to ask for help, not ask for help but ask a senior's opinion because you are a doctor and you should know.'*

P14: GP Trainee ST1

Although acceptance of uncertainty was generally described as the catalyst for positive behaviours in the face of uncertainty, such as information seeking, one doctor described this acceptance of inherent uncertainty as initiating increased fear of missing.

*'You cannot be an expert at everything, especially in A&E. You can never say, well, it's difficult to be 100% certain. There is still an off chance you are missing something or it is a strange presentation. This is why you try not to miss it.'*

P5: Specialty Doctor

As well as acceptance, another positive cognitive appraisal of uncertainty was that where patient management decisions have an element of uncertainty to them, an **opportunity to learn** exists. This was highlighted by doctors

suggesting they prefer to take ownership of complex decisions as it promotes skill development and where discussions with seniors need to take place, doctors gain feedback on their initial clinical judgement and its appropriateness. One view was that an alternative clinical opinion on the correct course of action and the ambiguity associated with this, promoted reflection on one's own practice which can be taken forward as a learning point.

*'I do remember occasions where I've gone to check if they're okay to be discharged and actually they've gone like, no actually, you should really admit this one. And I think I probably take it as a learning point...I probably reflect on that and think about why that is...'*

#### P3: Specialty Doctor

Approaching uncertain patient interactions with **confidence** was also a positive cognitive appraisal amongst some doctors. Displaying confidence in the way they handled an uncertain case, was perceived to initiate further positive behavioural responses by doctors such as implicit communication of uncertainty to patients and less requirement for specialty referral to eliminate uncertainty. One specialty doctor reflected on this confidence as something which meant doubting themselves was less likely to occur than when confidence was lower earlier in their career.

*'...and if there was any kind of uncertainty they'd have all been being admitted for somebody else to have had a look at it or at least discussed with somebody more senior to get reviewed. Whereas now...you just become a bit more reliant on backing your own kind of decisions I suppose the more senior you get.'*

#### P2: ST5

The final cognitive appraisal perceived by doctors which was generally positive in valence was the **deliberation** of risks and benefits surrounding a decision. This was framed positively, as in some cases, particularly those involving vulnerable patients, this included the consideration of risks associated with admission, meaning where risks of admission outweighed the potential benefits, unnecessary admission was avoided. Considering the risks associated with admission led doctors to question their own reasoning for admitting a patient, reducing the impact of biases such as perceiving admission as safe. This deliberation was discussed by one doctor as encompassing not only the risks and benefits to the patient, but to the health service as well, emphasising that this is a necessary cognitive process in a health service with limited resources.

*‘So you’re kind of balancing benefits to the patient versus benefits to the hospital and you know, beds and time and yeah, obviously you could send every single, you could do an American approach of scanning and doing blood tests on every single patient but that’s not realistic in the NHS...’*

P6: ST6

Although considering the risks and benefits of both admission and discharge was perceived to contribute to more comprehensive decisions by doctors, most doctors did perceive themselves to consider the risks of admission less than those of discharge. The risks associated with discharge were not only considered higher for the patient themselves, due to unpredictable outcomes surrounding symptom progression or ability to manage a condition, but also for the doctor themselves. This was due to the perception amongst doctors that the consequences they would face should a discharge lead to an adverse event,

are significantly greater than those associated with an admission leading to adverse events.

*'I can't say I do often think about the risks [of admission]. I think a lot of the time you get into the mind-set of, right, at least I'm bringing them in to a place of safety.... it was more just if I send her home and she falls, I'm probably in more trouble than if she was to pick up a hospital acquired bug...'*

P4: ST4

Cognitive appraisals which were generally perceived as negative included *focusing on the worst-case scenario in terms of diagnosis, doubting decisions made in hindsight and consideration of anticipated emotions*. Such appraisals were perceived to elicit defensive practice. For example, considering how a discharge decision would make the doctor feel in future was generally associated with negative emotions which in turn, drove admission decisions.

Dwelling on the **worst-case scenario** for patients whilst managing uncertainty was generally perceived to elicit defensive practice, particularly for patients presenting with chest pain. One doctor suggested that the potential catastrophic consequences associated with discharging a chest pain patient, causes them to test and admit patients in excess. However, it is important to mention that where the contextual factors of the situation allowed the worst case scenario to be ruled out, this usually resulted in the associated uncertainty surrounding a discharge being tolerated.

*'I think I probably, personally tend to over-admit patients to be on the safe side and over investigate them in terms of, I tend to think of the worst possible scenario...if you rule it out, the patient is safer.'*

P5: Specialty Doctor



As well as considering the worst-case scenario for patients whilst making the decision to admit or discharge a patient, this was also considered in hindsight. Following the decision to discharge, dwelling on the worst case scenario was discussed as a negative manifestation of uncertainty by doctors, carrying negative emotions such as anxiety. One doctor perceived this to happen frequently when **doubting decisions**, they had made early in their career.

*'...your first kind of go to is right okay, worst case scenario what's going to happen, and if it's a big PE or the extent then the consequences of that could be quite bad and that's always your go to... if I have made a mistake what are the consequences of that going to be erm and certainly that used to happen ...regularly like every week when you're a junior.'*

P6: ST6

Doubting decisions in hindsight was discussed by other participants as well, but this was exclusively a result of discharge decisions, not admission. These expressions of doubt were recalled by some doctors to take place at home when thinking about the decisions they had made at work and were often associated with negative emotions such as worry. Whilst most doctors maintained confidence in their judgement when a colleague challenged their decision to admit a patient, doctors doubted their management of a patient when no investigations had been carried out or the patient had been discharged and this was challenged by a colleague.

*'I didn't do any investigations so I was just like, did I do the right thing. I mean I think I did do the right thing because it was just one day history but you just think about it I guess, a little more than others...One of my seniors was just checking on the patients with me and I said I sent the man with constipation*

*home and he said, oh did you. And then for that split second I was like, oh, why did he say that?*

P14: GP Trainee ST1

Although doubt was generally reflective of low UT, there was one perception that the doubt associated with a discharge decision prompted action, which led to positive patient safety outcomes. This perception came from a doctor who made a complex decision to discharge a patient whilst the department was busy but when they had time to reflect, doubt meant the uncertainty associated with the decision was acknowledged.

*'And I sent her home and then kind of doubted myself half an hour later, called her back and she actually did have a bleed on her brain.'*

P6: ST6

The final cognitive appraisal perceived by doctors was the **consideration of anticipated emotions**. Thinking about how a decision would make them feel in future was conveyed as driving decisions to admit. This was generally discussed negatively, as the emotions which drove decisions were negative in valence, such as guilt, regret and worry, meaning decisions to admit were often made to avoid future negative manifestations of uncertain discharges. Anticipated emotions were only considered for discharge decisions and were associated with fear of having missed something or the unpredictability of symptom progression for patients.

*'Yeah definitely and sort of even just before I go home. I think if I discharge this person, I'm going to feel like crap and I've not done them justice sort of letting them go home when there's something going on.'*

P8: ST4

More positively however, considering how they would feel in the future and using this to drive decisions did serve a protective purpose for doctors, reducing the negative manifestations of uncertainty faced in the future. One doctor perceived thinking about future emotional responses to serve as the threshold for discharge decisions which allowed discharge of low risk patients and admission of patients with risk of life threatening symptom progression.

*'I don't worry about it when I go home very often. I think that's probably my threshold isn't it, in terms of making the risk. Is this going to be something that if I go home I'll have a nagging doubt in my mind? I don't consciously ask that but I think that probably is the threshold.'*

P6: ST6

## **Emotional responses**

Doctors' emotional responses to uncertain patient management decisions were almost entirely negative (e.g. **worry, discomfort** and **fear**) and almost exclusively in response to discharging a patient and the associated unpredictability of symptom progression. Conversely, when considering patients they had admitted to hospital but later thought discharge would have been more appropriate, doctors did not recall emotive responses to uncertainty, even when patients were discharged shortly after by specialist wards. Reasons given for this **absence of negative emotional response** to admission included the safety net provided by a ward doctor assessing the patient, reducing the worry associated with missing something and access to further, immediate diagnostic investigations. This benefit of admission outweighed the negative feelings associated with unnecessary resource use.

The most frequent emotional responses to uncertain discharges were feelings of **anxiety**, **fear** and **worry**. Participants reflected on feeling worried about a patient they had discharged in hindsight, due to fear of having made a mistake or missed something significant.

*EP: 'When you mentioned thinking about patients you have discharged at home, what kind of feelings do you have?'*

*P8: 'I just tend to get quite anxious, I just get a bit, I start pondering different things in my head and yeah, I do tend to get a bit worried sometimes about things that may have been or might have been missed.'*

P8: ST4

This **worry** about unpredictable patient outcomes should a discharge occur, was also perceived by doctors as a driver for the admission decision made. Such potential for symptom progression created concern for one doctor about a patient who at the time of presentation to ED, was deemed potentially fit for discharge on reflection.

*'I just felt a bit uneasy letting her go home because she was quite elderly and just worried that it would get worse. It wasn't that she was actively, like really unwell but it was sort of more of a prevention thing. She could maybe have had tablet antibiotics, oral antibiotics, and gone home.'*

P9: FY3

An emotional response of **fear** was almost exclusively a result of the unpredictable patient outcomes often faced when discharging a patient. However, one doctor associated fear with a discharge decision which occurred due to ambiguous patient accounts. Although this uncertainty resulted in positive patient safety outcomes as perceived by the doctor due to the patient

being recalled, when recalling the case, highly emotive language was used suggesting the negative emotional response to the uncertain discharge persisted.

*'Yeah, there was one scary one I think one that probably sticks in my mind, the most scary one... the thing that scared me is it's so dependent on what the patient told you, being slightly different from one story to the next if that makes sense?'*

P6: ST6

Another negative response to discharges perceived by doctors was **discomfort**. Discomfort was described as a 'feeling' by doctors. This was primarily perceived to be a result of a patient self-discharging in a situation where doctors felt a risk of symptom progression existed and believed admission was required.

*'I felt a bit uncomfortable with him taking himself home... There's obviously the risk that if he becomes so drowsy that he stops breathing. So yeah, that made me feel a bit uncomfortable.'*

P9: FY3

Similar to worry, feelings of discomfort were perceived by doctors to drive admission decisions. One doctor highlighted that uncertainty does not necessarily always lead to discomfort as an emotional response, distinguishing between uncertain discharge decisions which they were comfortable with making and those that they were uncomfortable with and would therefore require specialist input via admission.

*'There is those that, it's sort of a really fine line between yeah I feel comfortable, I don't know what's going on but you're going home or, I don't know why, all your bloods are fine, your obs are fine, but I don't feel comfortable.'*

P8: ST4

The only negative emotional response discussed surrounding admission of a patient was **frustration** associated with the lack of follow up opportunities afforded to ED doctors. This was highlighted by one doctor when reflecting on a complex case for which, as a result of insufficient information due to the patients drowsiness and lack of medical history, a diagnosis was not established.

*'...which can be really frustrating in A&E because I'd say nine times out of ten when I see a patient...I know I need to treat it with this, this and this. But patients like that, especially when you don't necessarily get the follow up, it can be quite frustrating'*

P4: ST4

When considering patients they had admitted but later thought discharge would have been appropriate, doctors did not perceive emotive responses to the uncertainty, even when patients were discharged shortly after by specialist wards. Reasons given for this **absence of negative emotional response** to admission included the safety net provided by a ward doctor assessing the patient reducing the worry associated with missing something. This benefit of admission outweighed the negative feelings associated with unnecessary resource use.

*'...at least they're in a place of safety. At least they've not gone. You feel bad because you're wasting resources and obviously doctors upstairs have a lot to do but, a lot to get done, a lot of patients to see but you feel like you've kind of*

*covered yourself a little bit because they'll be discharged by somebody else and a second pair of eyes have seen them..'*

P8: ST4

Emotions surrounding admission decisions were considered as being experienced to a lesser extent than those experienced by the doctor should they have discharged the patient. This doctor emphasised that no anxiety was associated with a chest pain admission which was potentially unnecessary, due to the decision reflecting their general 'risk-averse' approach to practice.

*EP: 'Okay. How does that make you feel?'*

*P7: 'Okay. I wouldn't have changed my practice. I probably looking back, I probably would have still wanted to rule out because I'm still kind of risk-averse. I'm not there thinking oh my god I should have just discharged them, I admitted another one...'*

P7: ST5

### **Behavioural responses**

Doctors perceived themselves to engage in numerous behaviours in the face of uncertainty, considered both positive and negative in nature. Consistent with a distinction made by Hillen et al. (2017), some behaviours were aimed at reducing the uncertainty present (source-focused responses) and some at mitigating the consequences associated with uncertainty (consequence-focused responses) (see Table 4.2).

### **Source-focused behavioural responses to uncertainty and decision outcomes**

Other than following patients up, source-focused responses to uncertainty were primarily carried out prior to decision-making and almost exclusively served the purpose of gathering information from various sources. However, admission and discharge decisions were also perceived as ways of reducing uncertainty by some doctors, allowing access to extra time for symptoms to manifest or specialist input. Consequently, the two source-focused responses to uncertainty perceived by doctors were *decision-making* and *information seeking*.

**Decision-making** in the face of uncertainty was predominantly discussed as decisions to admit patients. Reasons given for admission were gaining access to specialist opinion and allowing more time in hospital for the clinicians to reach certainty. Gaining specialist judgement and allowing more time for investigations or for symptoms to manifest could ultimately be considered information seeking as both allow more informed decisions about patient care to occur. Accessing further clinical opinion was considered important for mitigating the potential cognitive biases the ED doctor could display when uncertain.

Due to limited time in the ED, admission was often a response to uncertainty to allow time for more information to surface. This included allowing the patient time to disclose medical history, should they be reluctant to in the ED, allowing observation of pain development, allowing time for family preference to be established for patients without capacity and allowing further investigation. The already existing time pressures in ED were heightened when doctors were busy and therefore a response to uncertainty when working under high pressure was perceived to be admission by some doctors.



*'Yeah I think there's definitely been times when I think... If I just admitted this person, it would be offloading it to the medics to make that decision to discharge because I don't have the time to go fully more into depth about their problem.'*

P10: ST3

Despite admission being the perceived strategy for managing uncertainty generally, discharge was perceived by two doctors as allowing symptoms to develop and diagnoses to become clearer. The key difference between responding to uncertainty by admitting or discharging a patient was whether investigations to rule out life threatening diagnoses had taken place. Where they had, the associated uncertainty, particularly risk-associated, had been reduced and the remaining uncertainty around non-urgent conditions could be tolerated. Particularly with the knowledge that allowing time for the patients symptoms to develop may reduce uncertainty and a decision in the future, whether that be with the influence of HCPs from non-urgent or urgent care, may therefore be more informed. Importantly, this strategy was discussed as accompanying follow up care such as GP appointments.

*'...unless they're actively really unwell requiring a hospital admission, you can give it a bit of time and then things normally become a bit more clear. So then, the symptoms they are having will manifest in a slightly different way and it will become more clear what is going on and then you can deal with it as then.'*

P9: FY3

**Information seeking** was frequently discussed by participants as a strategy for reducing uncertainty. Strategies included calling the family members of patients to establish the patients home setting and medical history, consulting

guidelines, eliciting medical history from the patient, checking learning resources such as e-learning, seeking the opinion of colleagues, following patients up and ordering clinical tests. Establishing medical history through communication with the patient and in some situations, family members, was described as the most important information to source. Generally, these strategies were perceived positively by doctors, reducing the uncertainty they experienced. For example, despite follow-up opportunities being limited in ED, following patients up reduced lingering doubt as to whether admission was appropriate and allowed doctors to learn whether the patient benefitted from admission, informing future decision making.

*EP: 'And why do you try to follow them up?'*

*P5: 'It's just to check progress and if for admission, you admitted for safety and you aren't sure...or admitted patient and didn't really feel that it was a major problem, but they had full medical or surgical assessment, full specialty assessment and then you can see what comes up and what they ordered. It's a learning experience as well because you cannot be an expert at everything, especially in A&E.'*

*P5: Specialty Doctor*

Other strategies such as clinical testing and discussion with colleagues were generally perceived positively, although in some situations were perceived to reflect low UT. Doctors felt clinical testing elicited invaluable information, often allowing emergency conditions to be ruled out and discharge decisions to be tolerated. However, some doctors described cases in which they 'over-investigated.' These cases were generally discussed as having limited information from other sources such as medical history.

*'But in certain situations we don't have anyone to translate... in that situation where they are kind of pointing at their chest and you cannot get a full history, then I tend to over investigate them and keep them in hospital.'*

P7: ST5

Discussing uncertainty with colleagues was another strategy perceived positively by doctors, eliciting advice from more experienced colleagues and specialists which similar to following patients up, provided learning opportunities to reduce uncertainty in the future. However, some doctors perceived some instances where advice was sought as depicting low UT, with discussion allowing uncertain decisions and the associated responsibility to be deferred to other doctors or sometimes solely serving the purpose of providing reassurance for doctors. Although indicative of low UT, receiving reassurance on uncertain decisions was emphasised as important for junior doctors.

*'...most times if I'm asking a question it'll be for, do you agree with this, this is what I'm planning to do, tell me that I'm right [laughter]... I don't know, it's just, you just sort of want validation on the decision...'*

P9: FY3

### **Consequence-focused behavioural responses to uncertainty and decision outcomes**

As well as strategies to reduce the uncertainty present, doctors perceived some behaviours they engaged in to reduce the consequences associated with irreducible uncertainty. These consequences were often the negative manifestations of uncertainty for the doctor and patient themselves. Often, these strategies reflected that of source-focused responses but were engaged in to mitigate consequences of uncertainty rather than progress toward

certainty. This generally depended on whether the uncertainty present was reducible and if contextual factors, such as workload, allowed the uncertainty to be reduced. Where this was not possible, admission and discussion with patients and colleagues were not utilised to reach certainty, but to share responsibility over potential consequences with other healthcare staff and patients themselves. Such strategies included *admission, consulting seniors and specialists, documenting decision-making processes, safety netting and involving patients in decisions made*. Discharge without other strategies, such as safety netting, was not perceived to reduce uncertainty-related consequences. However, decisions to admit were often a consequence-focused response to uncertainty, with admission perceived as the ‘*safer*’, ‘*more cautious*’ option.

This was often perceived positively by doctors, allowing patients extra, often necessary, medical care and reducing negative emotional reactions amongst doctors. However, some doctors perceived themselves to be ‘over-cautious’ in the face of uncertainty. Ensuring the patient is in a clinical setting mitigated the negative manifestations of uncertainty associated with unpredictable symptom progression, such as worry. Doctors viewed **admission** as a preventative measure for symptom progression, allowing benefits of treatment faster than follow up care or medication would provide.

*‘I suppose even yesterday I admitted someone... It wasn’t that she was actively, like really unwell but it was sort of more of a prevention thing. She could maybe have had tablet antibiotics, oral antibiotics, and gone home. Don’t know, maybe*

*I was just being overly cautious.’*

Admission was often perceived as the appropriate strategy to reduce the consequences of discharging a patient with an inconclusive diagnosis due to lack of information from other sources, such as medical history. Rather than admitting patients due to a need for further care, doctors often perceived admission as the only option of avoiding a discharge they considered unsafe due to limited information.

*'So often you're in a situation where you've seen a patient, they might not have given much of a history and you're in a situation where you have a lack of clinical information for them and it wouldn't be safe to make a clinical judgement to discharge them if that makes sense.'*

P11: FY2

As well as avoiding the potential adverse events for patients associated with an uncertain discharge, admission was often described as mitigating concern for the consequences an adverse event could have for the doctor themselves, such as litigation issues. The potential for career problems as a result of discharging a patient who then goes on to experience symptom progression often guided admission decisions.

*'I think well I'd rather admit them and they get sent home after a day rather than don't admit them, they've got something really serious and I end up in a coroner's court or something like that. Because yeah, at the end of the day, it's my professional reputation...'*

P12: FY2

Furthermore, admission was often a strategy for avoiding negative manifestations of uncertainty such as future worry. This was perceived as a

learned response based on how previous discharge decisions have made doctors feel and was based on anticipated emotions.

*'I don't worry about it when I go home very often. I think that's probably my threshold isn't it, in terms of making the risk. Is this going to be something that if I go home I'll have a nagging doubt in my mind?'*

P6: ST6

Another consequence-focused response, which also served as source-focused, was **discussion with senior colleagues and specialist doctors**. Despite discussion often eliciting a reduction in uncertainty and therefore being perceived positively, doctors often felt discussion was prompted by a need for decisions to be more defensible. This was only discussed as a need for uncertain discharge decisions due to the perception that discharges are more likely to be questioned in future and therefore the way in which decisions are documented is important. Due to increased credibility, senior doctors were the preferred group to confer with when uncertainty exists around a discharge.

*'I probably wouldn't ask the advice of someone the same grade, probably not, especially for important stuff... I feel like, you should always confer with someone of a higher grade so then if anything comes back, it's a lot more defensible.'*

P3: Specialty Doctor

Some doctors discussed feeling embarrassed when experiencing uncertainty, as discussed in the previous theme. Despite perceiving a positive culture within the ED team, doctors often felt that specialty wards preferred certainty when discussing a patient being admitted to their ward. To mitigate this perceived judgement, one doctor recalled notifying specialist wards of

incoming patients for whom uncertainty existed, justifying the admission decision. This was the only consequence-focused response associated with admission, other than admission itself.

*'With the softer admissions, if I think they're going to be thinking why the hell has he admitted that, I'll sometimes just give a courtesy call to say I know this is a soft admission but I'm admitting this lady because she lives on her own and I think she's potentially drinking a bit more and that's why she's fallen.'*

P4: ST4

Junior doctors emphasised the importance of discussion with seniors, perceiving the response positively as it allowed for responsibility over the decision to be shared, mitigating negative manifestations of uncertainty for the junior doctor such as guilt or worry. This reasoning for discussion was exclusive to discharge decisions, with decisions to admit more frequently being made independently.

*'... usually if we're uncertain, we always discuss with a senior and then I guess that burden is off our mind. We always, like once we have a discussion with the senior, we write it down like, discussed with senior X and then that burden is off our mind. It's kind of a shared responsibility at that point.'*

P14: GP Trainee ST1

Another consequence-focused response to uncertainty which allowed responsibility over the decision to be shared was **involving the patient** themselves in the decision, establishing their preferences and educating them of the risks and benefits associated with each possible decision.

*'Normally, if I'm in doubt, I am either very honest with the patient and say I am not quite sure there's anything wrong. I can not 100% guarantee. And then make a decision together and then if they don't want the investigations, then fine.'*

P7: ST5

Sharing management decisions with the patient involved disclosure of uncertainty to them. Another instance uncertainty was disclosed to the patient as a consequence-focused response was during **safety netting** at discharge. Similar to shared decision making, safety netting was described as placing trust in the patient to take ownership of their care and therefore allowed any associated uncertainty to be tolerated between the doctor and patient, rather than solely the doctor. Safety netting by communicating to the patient that they should access further healthcare should symptoms persist or get worse, was perceived as vital for tolerating the often-irreducible uncertainty surrounding a discharge. This was primarily discussed as a mechanism to tolerate the uncertainty associated with unpredictable symptom progression. Doctors felt safety netting provided an opportunity to educate patients, reducing the patients uncertainty simultaneously.

*'But also, what I do is I safety net people before they go home. So I let them know what the signs of a heart attack are, what the signs of a blood clot are, what the signs of aortic dissection are because in a way, knowledge is power...your patient deserves to get the knowledge as well and just talking to them and telling them that it's not anything to worry about is not actually educating your patient.'*

P12: FY2



Central to safety netting and the accompanying disclosure of uncertainty to patients, was the rule-out of life-threatening diagnoses. Should serious diagnoses be ruled out, the remaining uncertainty was centred on non-urgent conditions, which ED doctors perceived to tolerate and felt empowered to communicate the remaining uncertainty to patients. When considering probability as the source of uncertainty in these situations, the rule-out of emergency diagnoses meant that despite future outcomes being unpredictable, the severity of associated consequences were reduced.

*'Sometimes if I'm discharging somebody when I really feel like there isn't anything there, but I can't sort of give them a full, absolute diagnosis, but I say to them then, I say to them, there isn't an emergency issue here...And I hope that that reassures them, to say look, I can't give you an absolute, pin point diagnosis for your reason for your chest irritation, but I can tell you that it's not this, this and this.'*

P10: ST3

As well as communicating safety netting advice to patients, doctors felt that arranging follow up appointments for patients with inconclusive diagnoses served as a safety net, mitigating the worry associated with uncertain discharges. For one junior doctor, arranging community healthcare was central to discharging patients.

*'I think everyone I have discharged, I've thought they could go home safe and be managed in the community. I think the trick with that is just making sure you're safety netting.'*

P11: FY2

Doctors emphasised the importance of **documenting uncertain decision making**. This was a behavioural response primarily focused on mitigating potential consequences to the doctor themselves should an adverse event occur. One doctor recalled learning this response following being questioned about their decision making and feeling that had they documented a justification of the decision, it would not have been questioned.

*'So yeah that's my learning point going forward is for my decision making, to be better at documenting it as to the reason why I made that decision.'*

P10: ST3

A perception existed that documenting a decision guided by validated, recommended guidelines, strengthened the justification of it. Being able to rely on guidance was perceived positively by doctors, despite the arbitrary nature of guidelines not always promoting patient-centred care. This was only discussed as necessary for discharge decisions where scoring systems suggested a patient was low risk for a certain diagnoses and guidelines advocated discharge. Relying on protocols for discharge advice was also perceived to increase confidence in communicating to the patient the reason for discharge from ED. One doctor emphasised the ability of guidelines to 'offload' risk. Similar to shared decision making with patients and discussion with colleagues, reliance on protocols for decision making allowed responsibility for unpredictable future outcomes to be reduced for the doctor.

*'...guidelines as well is something we're very heavily reliant on and I guess if there were guidelines that can help you take some of that risk away from you, and putting it on a guideline...that's quite a good way to offload it.'*

P6: ST6

**Table 4.2**

Behavioural responses to uncertainty and mechanisms of reducing uncertainty or the associated consequences.

Behavioural response	Mechanism of impact
<b>Source-focused</b>	
Admission	Allows access to specialist opinion or further testing. Allows time for symptom progression or patient and family preference to be established for long-term care plan.
Discharge	Allows time for non-urgent symptoms to manifest.
Information seeking (medical history)	Provides clinical information which informs decision and reduces uncertainty.
Information seeking (discussion with colleagues)	Reduces uncertainty associated with own judgement should colleagues provide supporting advice.
Information seeking (consulting guidelines, scoring systems etc.).	Provides standardised guidance which reduces uncertainty and need for clinical judgement.
Following patients up	Checking on patient after decision reduces the uncertainty experienced in hindsight of a decision.
<b>Consequence-focused</b>	
Admission	Reduced worry associated with unpredictable future outcomes for patient (e.g. symptom progression) and doctor (e.g. litigation issues).
Conferring with seniors and specialists	Can be documented and strengthens defensibility of discharge decision should an adverse event occur or decision be questioned.
Safety netting	Reduced worry associated with unpredictable future outcomes for patient following discharge (e.g. symptom progression) and doctor (e.g. litigation issues).

Use of scoring systems and guidelines	Strengthens defensibility of decision and partially removes responsibility of uncertainty from doctor.
Shared decision making with patients and families	Partially removes responsibility of uncertainty from doctor.

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### **Associations between cognitive appraisals, emotional responses and behavioural responses to uncertainty**

Despite the categorisation in earlier subthemes of responses to uncertainty according to cognition, emotion and behaviours, these reactions were not always distinct and interacted with each other to promote certain responses. Notably, behaviours including admission, shared decision-making with patients, speaking to colleagues and safety netting were carried out to mitigate negative emotions such as worry. Cognitive appraisals were also influenced following certain behavioural responses. For example, decisions were perceived to have less doubt and more confidence surrounding them should consequence-focused responses have been enacted, particularly discussion with trusted, senior colleagues.

*'I'll discuss it probably with a registrar or a consultant...In fact, I usually just need someone to be like yeah you're right, who'll agree with me basically, just for that extra confidence.'*

P1: ST4

Perhaps the most important association to consider in relation to admission and discharge decision-making was that in circumstances where consequence-focused responses such as safety netting could not be enacted, for reasons outlined in the next section, admission generally occurred. Whilst source-focused behavioural strategies reduced the uncertainty present, consequence-

focused behavioural responses were perceived to reduce the valence of negative cognitive appraisals and emotional responses to an uncertain discharge. Should these behaviours not be performed, the uncertainty surrounding a discharge was too high, with negative manifestations such as worry, doubt and discomfort surrounding it. Consequently, admission generally occurred in these circumstances.

*‘So anyone you do discharge you’re like right okay, fine, they’re unwell but they’re okay to go home and the GP can follow them up or the, some sort of safety netting there. Then you’re like okay, that’s fine.’*

P11: FY2

#### **4.5.4 Factors influencing the response to uncertainty**

In cases where admission was later deemed unnecessary, a number of interrelated barriers to successful UT were perceived to drive the admission decision. Factors are organised around six categories: Patient characteristics; cultural factors; organisational factors; situational factors; social factors; individual characteristics of the doctor. Here, examples of the factors within each category most relevant for addressing the focus of this thesis are presented. Detailed overviews and illustrative quotes are provided in table X. Categories are highlighted in bold, with specific factors italicised.

Clinical experience, as an overarching factor, generated the meta-theme, *‘Uncertainty tolerance as an evolving work-trait’*, which is discussed following the factors. This factor is presented distinct to others due to clinical experience underpinning the influence many other factors had on UT and decision-making. Barriers to UT either pertained to the specific case and context, or the individual

doctor's general UT. Due to the emphasis on clinical experience as a factor perceived to drive UT by participants, this factor was analysed in more detail.

One factor pertaining to **the patient** themselves, was whether the patient had *social-care needs*. For older patients, or patients who were perceived to not be able to manage at home, the decision to discharge a patient increased in complexity and drove admission decisions.

*'I think with elderly patients especially, we are more keen to send them home. But if they are alone, we find that they're difficult, they might find it difficult to manage and we can just admit them for social reasons. Although like, it does take up a space in the bed, there's nothing we can really do until we get like social care involved but it could be a reason to admit them.'*

P14: GP Trainee ST1

The uncertainty surrounding a patient's welfare was too high to tolerate for doctors. This was often dependent on the *time of day*, a particularly important **situational factor**. Overnight, assessments from specialist teams were not accessible and the only way to access them was perceived to be an admission decision.

*'...if it was in the middle of the daytime and you could arrange for, you know, the daughter to check in with them that evening or the GP to see them the next day or something, you know. There's other things you can put in as safety nets for that person...So it's more of a theoretical risk and in a day you have other structures around them to protect them which you don't necessarily have at night.'*

P6: ST6

Night-time also increased negative manifestations of uncertainty due to **organisational factors**, particularly a lack of adequate *care pathways* in place, acting as support structures for older patients at night-time.

Another **situational factor** perceived to considerably influence UT was *workload*. When the ED department was busy, doctors perceived having a greater propensity for admission, primarily due to not having time to reduce uncertainty or prepare a discharge. This encouraged doctors to defer decisions by admitting to specialty wards.

*'...unfortunately it's probably, definitely down to being like, oh my god it's the middle of the night, we're all really busy. If I just admitted this person, it would be offloading it to the medics to make that decision to discharge.'*

P10: ST3

However, one contrasting view was that high workload resulted in the discharge of a patient as the distractions hinder clinical reasoning, resulting in missing a serious diagnoses. In this case though, the uncertainty was consciously perceived after discharging the patient and when workload reduced, allowing the doctor time to reflect on the case.

*'I think its human nature that if you're rushed off your feet and you're stressed and there's demands on the decisions than if you sat down and thought about it with more time on your hands, if that makes sense.'*

P6: ST6

An **organisational factor** with similar influence on uncertainty management was the *limited time and resources* available to ED doctors to reach certainty. Across EDs within the NHS, four-hour windows to reach decisions, combined

with wait-times for testing, drove admission decisions in an effort to ensure patients were with clinical teams should an adverse event occur. This was opposed to the alternative of discharging patients who hadn't received enough clinical investigation and observation to rule out potentially serious diagnoses.

*'The four hour target is a nightmare, an absolutely nightmare...if they're anywhere near four hours you need a decision. It's where are they going, who are you admitting to, where can we send them... if it's a medical problem, it's a really easy out to say well I don't know, send them to the medics and then off they go, they're somebody else's problem.'*

P8: ST4

**Cultural factors** within the ED team and wider clinical practice were perceived to influence UT. Many participants felt that the departmental *team culture* influenced how they responded to uncertainty, with the general perception that a positive culture promoted psychological safety, and consequently increased UT, particularly amongst junior doctors.

*'...because we're quite a close knit team... I know in A&E we try to help in the sense that one, they [junior doctors] know the backup is there which takes some of the uncertainty away.'*

P2: ST5

This positive culture within the team was generally attributed to the encouragement to ask questions and approachability of seniors, instilling awareness amongst junior doctors that they can tackle uncertainty as a team.

*As a junior...the hospital I worked at gave hardly any support to juniors... consultants like if you go ask them a question you feel like you're causing them a burden so you're scared of actually approaching a senior. But here ...you just*



*feel like with the consultants, they always have time for you no matter how busy they are. So I feel more supported now here...'*

P1: ST4

*'So from a doctoring point of view, I think the fact we use first names when we talk to the consultants, that we have a, like a friendly environment, you have a coffee with these people, you get to know them, rather than being a clear hierarchy, I think makes that more possible talking to, being able to raise concerns with them.'*

P6: ST6

The responsibility of tolerating the uncertainty surrounding unpredictable future outcomes could be shared between the doctor and senior colleagues, or perhaps more responsibility taken by the senior, making it easier for the doctor to tolerate.

An example of a **social factor** perceived to influence responses to uncertainty was participants' *perceptions of how their colleagues practice*. A key strategy employed to deal with uncertainty was the involvement of clinical colleagues in decisions. When exhibiting low UT in a certain context, doctors perceived themselves to approach seniors they consider risk-averse or thorough in their practice and who would likely come and see the patient. Conversely, when uncertainty surrounding a discharge decision was perceived to be tolerated, doctors described approaching seniors they consider risk-tolerant to yield advice which reaffirmed their preference to discharge.

*'You'll start to get to know the other seniors who you'd go to if you wanted a second opinion...if you've got a really complicated patient that, who I think is going to need a bit more time or you want someone to necessarily review, you*

*straight away, you would think of people you're not going to go and necessarily ask...if you want a really quick question, and just for them to agree because you want to send them home, there's equally people you probably approach.'*

P2: ST5

The final category of factors encompasses the **individual characteristics** of the doctor. An example of this is *the perception of hospitals as safe places*. Generally, doctors perceived admission, and the accompanying opportunity for specialist input, as the safer option compared to discharge. This perception, reinforced by a lack of feedback of any negative consequences, in turn, drove decisions to admit in future as these choices avoided negative thoughts and feelings. The propensity to admit patients for reasons pertaining to safety was attributed to ensuring the patient was in a clinical setting should they deteriorate but also, reduced ownership of any decision to discharge and the associated uncertainty due to unpredictable future outcomes.

*'It is usually by default for the physician that it is safer to admit the patient, they are going to be in a place of safety if anything dramatic happens so.'*

P5: Specialty Doctor

Conversely, some doctors perceived hospitals to be unsafe environments for certain patient groups, particularly the elderly. This perception manifested as more efforts to avoid admission and more conversations with patients and families about the risk of admission.

*'... hospitals are not safe places so unless there's a physical reason to admit you to hospital for something or that I need to send you to a ward for, I don't like just sending you there for us to watch you for a bit longer or get someone else to see you...using the elderly as a good cohort, yeah, they're not safe places.'*

P2: ST6

**Table 4.3**

*Factors influencing the response to uncertain admission and discharge decisions in the ED.*

Factor type	Factor	Influence on UT with illustrative quote.
Patient characteristics	Decision making capacity and willingness	<p>When clearly expressed, <i>patient preference</i> facilitates shared responsibility with patient.</p> <p><i>‘Admitting if that patient has capacity and they say no, I want to go home, I understand the risks, then fine, so be it (ST3).’</i> P10</p> <p>If patient has borderline <i>capacity</i> or no capacity, there is a barrier to shared responsibility. Family involvement can help.</p> <p><i>‘The decision making, especially when people are vulnerable or confused or don’t have capacity, it feels very much like it’s your decision, along with kind of, influence from the family and your seniors. But yeah, I think when someone does have capacity, it’s easier (FY2).’</i> P13</p>
	Social care and needs	<p><i>Social care needs</i> create an increased need for safety netting and follow-up. When this is not possible the complexity drives admission due to uncertainty about the patient’s</p>

welfare being too high to tolerate.

*'I think with elderly patients especially, we are more keen to send them home. But if they are alone, we find that they're difficult, they might find it difficult to manage and we can just admit them for social reasons. Although like, it does take up a space in the bed, there's nothing we can really do until we get like social care involved but it could be a reason to admit them (GP Trainee ST1).'* P14

Situational  
characteristics

Time of day

Reduced access to specialists, ED seniors and community support at *night time* make consequence-focused responses difficult, resulting in admission.

*'...if it was in the middle of the daytime and you could arrange for, you know, the daughter to check in with them that evening or the GP to see them the next day or something, you know. There's other things you can put in as safety nets for that person...So it's more of a theoretical risk and in a day you have other structures around them to protect them which you don't necessarily have at night (ST6).'* P6

## Workload

High *workload* means less opportunity to seek sufficient information to be comfortable about discharge, increasing chance of admission. There is also less time to be transparent with patients about decision-making process.

*'I feel assured when they come and see the patient themselves as well. But I appreciate that's not feasible all the time because as a senior, they are already balancing other things and then if I come and dump something to them, then they need to come and it makes it harder (FY2).'* P12

## Hospital bed capacity

More discussion with seniors and more consideration of risks of admission when hospital is reaching maximum *bed capacity* to avoid admission. This results in more uncertain discharges taking place increasing the need to safety net and follow-up.

*'...juniors will often admit more and we often have an email that comes out saying bed spaces are critical at the moment, if you're thinking about admitting a patient, please discuss with a senior (ST3).'* P10

## Cultural factors

## Culture within the team

A positive *culture within the ED team* and good leadership promotes psychological safety and facilitates an awareness

that decisions can be made as a team. This also reduces negative emotions associated with acknowledging uncertainty and asking for support. Where teams don't give positive feedback, this hinders the growth in confidence associated with uncertainty.

*'As a junior...the hospital I worked at gave hardly any support to juniors... consultants like if you go ask them a question you feel like you're causing them a burden so you're scared of actually approaching a senior. But here ...you just feel like with the consultants, they always have time for you no matter how busy they are. So I feel more supported now here... (ST4)' P1*

Inter-departmental culture

Where ward doctors were perceived to be accessible and supportive and *inter-departmental culture* was positive, this promoted information seeking from specialists and allowed responsibility to be shared.

*'...and because it was only me and him on, there wasn't a third person to discuss with and sort of do a consensus decision, we spoke to the orthopaedic registrar...So yeah I think that's a good thing, pretty much all the specialities, there is a registrar*

*on who can help you with that decision making (ST4).’ P4*

All-knowing culture of medicine

The *culture of medical practice* promoting the perception that doctors should know everything hindered acknowledgement of, and disclosure of uncertainty to colleagues and patients. The perception that modern medicine promotes over-investigation.

*‘I think as soon as you show any signs of weakness, like you don’t know what you’re doing, they kind of pounce on that...It’s just because I think sometimes you say you’re a junior doctor and they lose a bit of confidence, when you say you don’t know what’s going on....(Specialty Doctor)’ P3*

*‘I’ve probably actually become more careful with my decision making here in the UK because we’ve got every blood test that we need, we’ve got all the imaging modalities generally to hand... I feel, this is a big statement I think but I think we probably over investigate people in the UK (ST3).’ P10*

Social factors      Perception of colleagues

*Perception of colleagues* practice influenced who doctors asked for help. Colleagues perceived to have high UT were consulted for patients whom the doctor thought could be



discharged and conversely, colleagues perceived to have low UT for patients with more uncertainty present.

*'You'll start to get to know the other seniors who you'd go to if you wanted a second opinion...if you've got a really complicated patient that, who I think is going to need a bit more time or you want someone to necessarily review, you straight away, you would think of people you're not going to go and necessarily ask...if you want a really quick question, and just for them to agree because you want to send them home, there's equally people you probably approach (ST5).' P2*

Relationships within the team

Generally, stronger relationships with the team promoted asking for help and shared responsibility.

*'So you know who to ask, you know who not to ask and you know who you are quite, I guess, friends with, chummy with or whatever but they're more like a friend where you can approach them and they're really cool with it (GP Trainee ST1).' P14*

Organisational factors

Time and resources

*Restricted time to arrange follow-up care and limited resources to seek adequate information to rule-out serious diagnoses means uncertainty*

associated with discharge is not managed and can result in admission.

*'The four hour target is a nightmare, an absolutely nightmare...if they're anywhere near four hours you need a decision. It's where are they going, who are you admitting to, where can we send them... if it's a medical problem, it's a really easy out to say well I don't know, send them to the medics and then off they go, they're somebody else's problem (ST4).'* P8

#### Care pathways

Lack of follow-up information after discharge (due to disconnected *care pathways*) can drive an admission decision for uncertain cases. This also hinders the opportunity to learn to tolerate uncertainty surrounding discharge.

*'... A few months ago, received an email just saying that unless you've got a valid reason to check someone's records, you shouldn't be. So as a result I just routinely now wouldn't check, unless I've got a specific, real reason that I need to look it up. I think it's sort of one of those, it's a bit of a grey area (ST4).'* P4

Guidance on *decision-making pathways* for complex patients exists making discussion with

seniors when discharging mandatory. This empowers juniors to ask for help and promotes shared responsibility.

*'There is another thing that the college of Emergency Medicine do which is that they have this list of high risk presentations that have to be discussed with a senior... I imagine the reason they've done that is because they are deemed the things where we miss stuff and people can die from it (ST6).'* P6

#### Rotation system

Frequent *rotations* mean new trusts can seem unfamiliar. Less knowledge of safety netting structures available and less psychological safety with team members can hinder discussion. ED rotations in FY2 are the first time doctors are exposed to triaging patients and making discharge decisions. This sudden increase in responsibility was perceived to be associated to low UT.

*'So A&E is the first time I am clerking people and seeing them for the first time, I didn't get that opportunity. So I think having more opportunities to see things like that in your early years training could make a big difference (FY2).'* P11

## Staffing levels

Where *staffing level* is low, less opportunity exists for discussion with seniors to share ownership of decision.

*'I think, apart from at night time, I've had someone to approach and talk to... there is one shift this week where there was only one registrar. I think the other ones were on fellow days or were on leave and things like that but I guess that's just a thing with the rota really. We had a lot of SHO's, one registrar and three consultants. In terms of just the rota, just making sure there's a lot of registrars on day time, as well as night time, does help (FY2).'*

P11

Individual characteristics of the doctor

Personal experience of healthcare

UT depends on doctor's own *personal experience* with illness and the healthcare system, such as experiencing adverse events within their family. This manifested in negative emotions and perceived defensive practice. *'...one of my family members died from biliary sepsis because she just put off getting seen by A&E and getting her gallbladder removed. So I worry as such, that one day this 40 or 50 odd year old who's got a really good quality of life and is independent, could get biliary sepsis because she's just been continuously told to go home...(FY2)'* P12

## Personality traits

Doctors perceived *personality traits* such as preference for team working to facilitate satisfaction with ED career and increased UT. '*...this is going to sound really bad but I think the way I work is that I genuinely like working by myself...I'm probably not a great team player. And sometimes I feel like a burden if the most senior person in the department is not trying to sort it out themselves (Specialty Doctor).*' P3

## Perception of the safety of hospitals

The general *perception that hospitals are safe places* drove admission decisions and increased UT surrounding uncertain admissions. Doctors who did not have this perception engaged in more conversations with patients and families to avoid admission. '*It is usually by default for the physician that it is safer to admit the patient, they are going to be in a place of safety if anything dramatic happens so (Specialty Doctor).*' P5

*'... hospitals are not safe places so unless there's a physical reason to admit you to hospital for something or that I need to send you to a ward for, I don't like just sending you there for us to watch you for a bit longer or get someone else to see you...using the elderly as a*

*good cohort, yeah, they're not safe places (ST5).'* P2

Belief in patients to take ownership of health

*Beliefs about the power dynamic in patient-doctor relationships impacted responses to uncertainty. Where doctors held the belief that disclosure of uncertainty would reduce the trust patients had in them, communication was hindered. Where doctors thought decisions and responsibility should be shared, more trust was held in safety netting.*

*'...I think that nets cast quite wide for people who have a much higher risk and they're quite happy discharging lots of things, that's always, yeah, it's a big kind of net that they would expect people to take note of that and come back...(ST6)'* P6

Clinical experience and skills.

Increased experience and clinical knowledge influenced the amount of uncertainty experienced and the ability to manage it.

The ability to communicate uncertainty effectively facilitated safety netting and involving patients and families in decision-making. *'So, there's being upfront and explaining to them that we're uncertain which I think is important but there's also not explaining your whole line of thinking and how you ended up at that point to them*

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*because you don't want to cause unnecessary worry and concern (ST5).' P2*

This increase in UT is discussed by a meta-theme.

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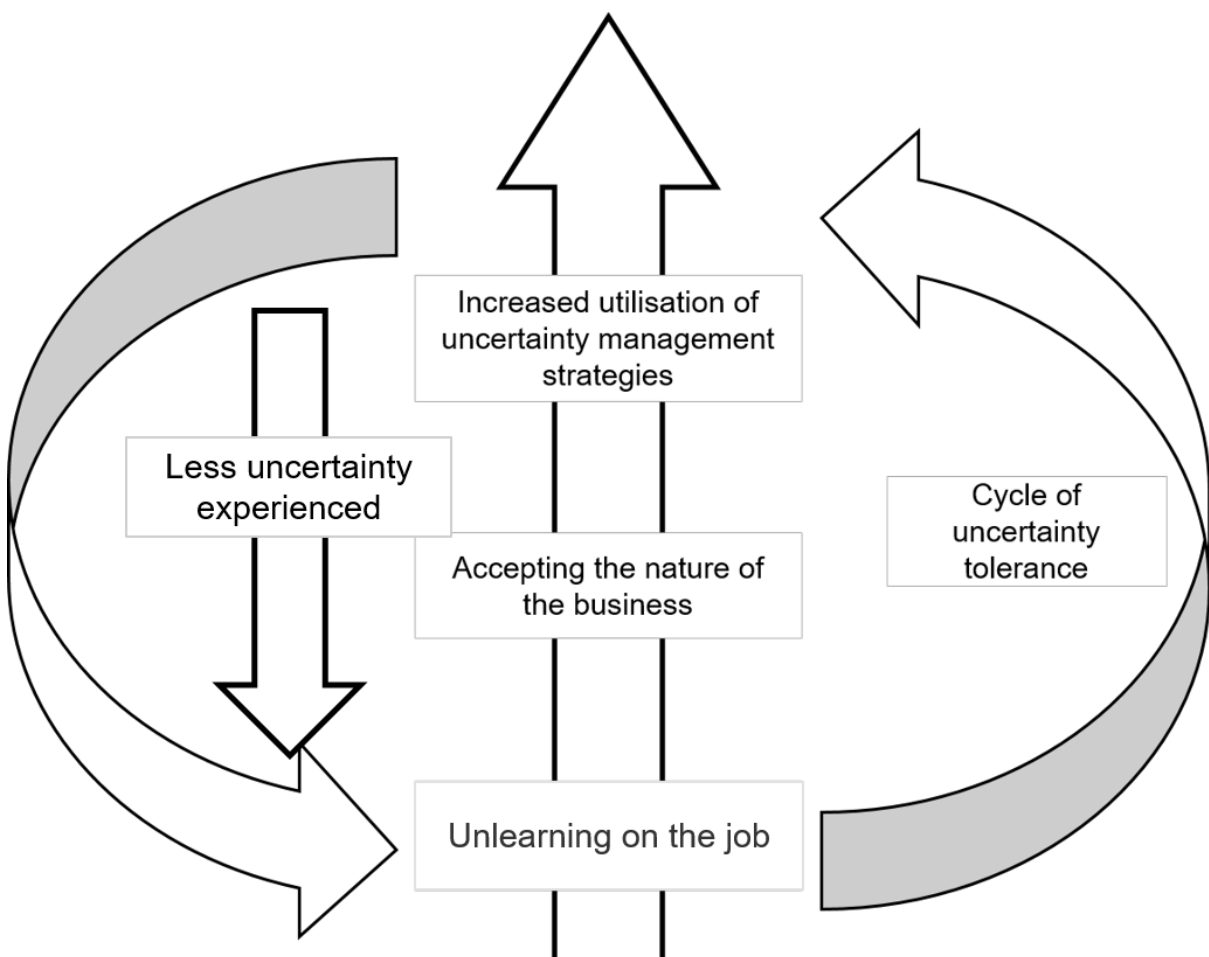
*Note.* FY= Foundation year. ST= Specialty trainee. P=Participant number. EP= interviewer's initials. UT= Uncertainty tolerance. ED= Emergency Department.

### Uncertainty tolerance as an evolving work-trait.

Further to the factors considered thus far that related to specific patient cases, one overarching meta-theme was generated. All doctors reflected on how their experience informed their level of UT. The five subthemes within this theme, shown in Figure 4.5, acknowledge UT as a work-trait, which shows a general increase over time, but with some instances of quite dramatic fluctuation, usually in response to particular events.

**Figure 4.5**

*Illustration of the theme, 'Uncertainty-tolerance as an evolving work-trait.'*





The theme encapsulates five subthemes (unlearning on the job, accepting the nature of the business, increased use of uncertainty management strategies, cycle of UT, less uncertainty experienced).

**Unlearning on the job**, reflects the perception amongst doctors that, in general, medical training and examinations promote information seeking as a quest for certainty, instilling the belief in doctors that medical intervention is usually required, with little acknowledgement of the irreducible uncertainty. For example, medical school and professional specialty exams require appropriate clinical testing to be chosen during patient cases and focus less on the potential benefits which in some cases, not intervening might have. This was perceived to discourage patient-centred care and encourage over-investigation by doctors. Despite the general perception that they weren't prepared, some doctors did consider training to promote transparency with patients and reflection on their own practice, facilitating uncertainty management.

*'I think we also, we're trained inherently from med school even, to over investigate if I'm honest...You're just trained to get the right tick box answers...it's the same with the exams right the way through... rather than thinking about the patient in front of you and actually is this test going to change my decision...'* ST5 (P2)

Moving away from medical education an **acceptance** that risk and uncertainty is often persistent started to develop, and the focus of practice was perceived to become less about eradicating uncertainty and more about considering which risks are appropriate to take. This awareness that uncertainty is often irreducible manifests in fewer attempts to reduce ambiguity, particularly when life-threatening diagnoses have been ruled out, but uncertainty remains.

This meant that inevitably, there would be some uncertainty around other less urgent aspects of the patient's reason for presenting which more senior doctor perceived themselves to tolerate. This uncertainty was tolerated less by junior doctors, particularly one participant who had chosen General Practice as a specialty.

*'I've had a few cases that I've thought about at home. Especially some cases that you just, there's nothing for me to do as an A&E doctor but there is more for somebody to do as a GP for that patient.... I think about those uncertainties.'*

GP Trainee (P14)

Experience in the ED also taught doctors to reconsider the idea that 'one size fits all' when approaching clinical decisions, becoming more patient-centred in their care and also appreciating variation in the practice of colleagues and acknowledging the benefits of this. It was suggested that an ED team that includes doctors with different UT is beneficial for patient safety and departmental function due to a need for what would be considered risk-averse practice for some patients but for the minor presentations, doctors with high UT can ensure effective patient flow. This understanding of variation in UT led doctors to acknowledge their personal threshold.

Doctors attributed their increased UT over time to **greater utilisation of uncertainty management strategies**. In particular, stronger relationships within the team promoted psychological safety and consequently, doctors were more willing to ask for help. More experienced doctors also discussed placing more trust in patients to return to hospital if they need to, thus casting safety nets wider.

*'I think when I was younger, I was terrified of everything... Whereas now, I'm fairly confident that actually, even if I don't pick up everything...they will just turn back up in A&E again. That's not a bad thing.'*

Specialty Doctor (P3)

Despite a general increase in UT, as described in previous subthemes, participants drew on occasions where they became less tolerant to uncertainty throughout their career which the final subtheme, **cycle of UT**, encapsulates. Such occasions were generally described as temporary although some doctors perceived long-lasting reductions in UT. Permanent decreases in UT were associated almost exclusively with adverse events, they had been involved in. In response, doctors perceived themselves to be more cautious particularly for those patient presentations which were the same or similar to those of patients they have cared for who went on to experience adverse events.

*'I had a patient who was a serious incident recently where they died... with those cases...I probably would now think could it be this, this rare thing that I've seen once and that's probably not helpful because you have to balance up rareness vs. risk.'*

ST6 (P6)

A temporary reduction in UT was also associated initially with increased responsibility, particularly when becoming a senior decision maker. This made some participants more anxious in the face of uncertainty due to feeling more responsible for the decisions made. Finally, a reduction in UT was perceived to occur at the start of specialty trainee 3 (ST3) year following a mandatory year in anaesthetics and ICU during specialty trainee 2 (ST2) where ED contexts became less familiar.

Doctors also perceived the reductions in the experience over time to be, in part, due to them having **less uncertainty to tolerate**. This was because of both greater knowledge and greater confidence in clinical judgement over time. Increased clinical knowledge as a result of greater exposure to patients, contributed to the development of pattern recognition which guided clinical decisions. This knowledge was perceived to be a result of learning from colleagues over time and receiving feedback, albeit limited, on clinical decision-making and judgement. Test results arriving whilst the patient was still in ED was considered a mechanism of feedback by doctors as this allowed their initial clinical judgement to be confirmed or, in some cases, challenged.

Doctors also perceived the complexity of practice to lessen as greater knowledge (e.g. of guidelines, previous cases) allowed multiple sources of information to be pulled together with ease. Improved knowledge of available support external to the department, such as community healthcare, over time also allowed more avenues to be considered and less uncertainty associated with a binary admission or discharge decision. However, this reduction in complexity was not perceived to occur for patients with mental health, safeguarding or social care concerns.

Over time, doctors perceived greater confidence in their clinical judgement and experienced less uncertainty arising from self-doubt. This was described as 'trusting your gut' as to whether something is not quite right when a patient presents. This resulted in less information needed to guide an admission or discharge decision. Doctors with less experience described experiencing gut feelings but having less confidence in them. As a result, gut instinct alone often did not reduce uncertainty, or the associated negative manifestations, and efforts to reduce ambiguity were still necessary. Due to experiencing uncertainty

more and having less confidence in their own decision-making, junior doctors sought more information and more often.

*'...when I had that inkling feeling, I didn't act on it. And I think, especially as a junior, it's difficult to know when that feeling is appropriate or if it's just you being over cautious.'* FY2 (P13)

## **4.6 Discussion**

### **4.6.1 Key findings**

This study identifies barriers to effective UT amongst ED doctors, perceived to drive unnecessary admission decisions. Findings suggest an individual doctor's general approach to uncertain admission and discharge decisions is influenced by years of clinical experience, with those who have worked in ED longer experiencing less uncertainty and having ways to manage it when they do. A lack of training advocating UT means that doctors must learn how to do this 'on the job'. These findings are consistent with previous research.

This study also highlights contextual factors that inhibit effective UT, for doctors of all UT levels including social factors (e.g. strong relationships within the team promoting UT), situational characteristics (e.g. high workload hindering UT via less opportunity to involve colleagues and patients in decisions), cultural factors (e.g. the all-knowing culture of medicine hindering UT via less confidence amongst doctors in disclosing uncertainty to colleagues and patients), patient characteristics (e.g. social-care needs decreasing UT surrounding discharge decisions) and organisational factors (e.g. decision-making pathways promoting the involvement of senior colleagues and increasing UT amongst junior doctors).

This study identified several factors influencing the ability of an ED doctor to tolerate uncertainty in a given context (state) or in their practice generally (work-trait). Perceived avoidable admissions resulted from factors acting as barriers to doctors utilising strategies to lighten the burden of uncertainty (e.g. shared decision-making) and reduce anticipated regret (e.g. safety netting). Potential intervention areas to enhance UT include: 1) increasing the consideration of UT in medical education, supervision and training; 2) supporting mechanisms for strategies which allow discharge decisions to be tolerated; 3) shifting culture toward acceptance of clinical uncertainty and reduced legal consequences for ED doctors who discharged low-risk patients.

Doctors indicated that to tolerate an uncertain discharge, they needed to engage in strategies that reduced the negative thoughts and feelings associated with uncertainty (e.g. fear, rumination). In the presence of perceived barriers to this, or where an individual doctor's UT was low regardless of such strategies, admission was perceived to be more likely.

Worry and fear were the primary responses to the unpredictability of symptom progression, particularly when consequences for patients could be severe. Factors which acted as barriers to UT and drove admission decisions, usually acted by not allowing these negative thoughts and feelings to be mitigated. For example, a team culture which did not promote psychological safety acted as a barrier to junior doctors involving seniors in decisions, a strategy which reduced the fear associated with uncertain discharge decisions. An association between low UT and information processing biases that initiate worry, such as overestimating the threat of uncertainty have been reported by previous research (Dugas et al., 2005). Consequently, the perceived worry and fear amongst doctors in the current study could be a result of overestimating the

potential consequences associated with discharge and underestimating those associated with admission.

The seminal work of Lerner and Keltner (2001) highlighted that risk aversion was the appraisal tendency associated with worry and fear. In other words, when people are anxious or worried, they tend to be more risk averse in their thoughts and actions. Taken together, these findings suggest that future research concerned with enhancing UT could focus on reducing fear and risk aversion associated with uncertainty by addressing the barriers identified within this study (e.g. the culture of medicine promoting a quest for certainty and the notion of all-knowing doctors).

All participants reflected on the importance of involving colleagues and patients when managing uncertainty. An awareness that ED colleagues are there to help should it be needed is an important factor suggested by previous interviews with ED doctors which reported 'sharing with colleagues' as a frequently used strategy to mitigate potential consequences of uncertainty<sup>13</sup>. The success of this strategy was attributed to promoting mutual feelings of trust, support and self-worth and reducing isolation (Han et al., 2021). The current study supports this, particularly emphasising the reduced isolation which comes with shared responsibility for an uncertain decision between doctors and service users.

#### **4.6.2 Strengths and limitations**

This is the first study to draw on a theoretical model of UT (Hillen et al., 2017) when considering the experiences of ED doctors. Findings support the model in highlighting contextual and trait-based factors influencing UT and lend support to an existing review (Strout et al., 2018) demonstrating complex, inconsistent

relationships between UT and clinical experience, whilst proving a potential explanation for discrepancies in the trend.

The current study has limitations to consider. First, the invitation included an information sheet describing the focus of the study as uncertainty management. This may have led doctors with generally higher UT to be more inclined to respond. Moreover, the current study may not have produced an exhaustive list of contextual factors influencing UT, particularly as participants were recruited from one trust and the discussion was participant-led. For example, personal (e.g. risk of litigation) and system-centred (e.g. processes of care) uncertainty (Han et al., 2011) were not discussed in much detail and it is possible doctors are not aware of all organisational influences on their decision-making. One doctor who was consulted as a stakeholder highlighted decision fatigue as initiating liberal approaches to admission, a factor not highlighted by participants in the current study.

#### **4.6.3 Theoretical implications**

The Hillen et al. (2017) model accounted for the experience of uncertainty in the ED in part. It was possible to organise perceptions according to sources of uncertainty (probability, ambiguity and complexity), responses to uncertainty (cognitive, emotional and behavioural) and influencing factors. The model did not however, account for the complexity of assigning valence to particular responses, with responses not conforming to the negative-to-positive scale proposed by Hillen et al. (2017). For example, discussion with specialists was perceived to be positive in some cases such as where an acceptance of the limits of doctors' own knowledge necessitated asking for support with complex patients. Conversely, some participants perceived their discussions with seniors



and specialists to be a means of decision deferral with some suggesting they would approach seniors they thought would assess the patient themselves when a case was uncertain.

This is supported by qualitative research about medical students' UT in relation to anatomy education in which information seeking was perceived to result in both action (e.g. decision-making) and inaction (Stephens et al., 2021). This suggests a need to acknowledge the intentions of, and the distal outcomes of behaviours when establishing the nature of a response to uncertainty. The complexity of establishing what is indicative of positive and negative UT, resonates with philosophical perspectives of UT (Reis-Dennis et al., 2021). Such perspectives suggest that neither low nor high UT is more desirable than the other for physicians as both have benefits and drawbacks and what is important is that excessive tolerance or intolerance is avoided.

Hillen et al. (2017) propose the model can be used flexibly, taking either a trait-focused or state-focused approach to understanding UT. Despite the current study not focusing on UT as a trait, the general perception individual doctors' UT develops over time and that discrepancies between individual doctors' approach to uncertainty management will always exist, supports the notion that UT is, at least partially, trait-dependent. However, it is important to consider that the differences between junior and more senior doctors were mitigated by contextual factors in this study. For example, where workload was high or safety-netting structures were reduced at night, it was not possible for senior doctors to reduce or tolerate uncertainty. This suggests that for decision-making in the ED, UT is affected by an individual's propensity (trait) and contextual factors (state).

Furthermore, Hillen et al. (2017) suggest that which responses *constitute* UT and which *result* from UT is unclear. In this study of admission and discharge decisions in the ED, we have been able to unpick this distinction. However, it was unclear if the ultimate decision to admit or discharge a patient should be considered a behavioural response to uncertainty, or an outcome of UT. Here UT *constitutes* the cognitive appraisals and emotional responses to uncertainty, whilst the downstream outcomes such as decisions to admit are driven by thoughts and feelings and are therefore a *result* of UT. The perceived relationship between thoughts, feelings and behaviours in these uncertain cases suggests that interventions focused on avoiding negative cognitive and emotional appraisals of uncertainty (e.g. educational acknowledgement that EM practice is not about eliminating risk, but assessing when risks are appropriate to take) could trigger positive behavioural responses to uncertainty (e.g. appropriate decision-making). Conversely, promoting positive behavioural responses (e.g. allowing shared decision-making with patients) could trigger more positive cognitive and emotional appraisals of uncertainty and avoid negative behavioural responses (e.g. admission decisions which are solely based on avoiding anticipated emotions).

Notably, doctors did not perceive any emotional response to uncertain admission decisions due to a general perception that patients were in a safe place should symptoms progress and the associated reduction in responsibility held by the doctor themselves over such risks following an admission. In contrast, worry, fear and discomfort were associated with discharging patients. The current study suggests such negative responses to uncertainty are a result of various factors including the culture of medicine promoting a quest for certainty and the notion of all-knowing doctors. Accepting uncertainty as

inherent to clinical practice and promoting management strategies to doctors and medical students could therefore reduce negative emotional consequences and have a positive impact on the behavioural strategies utilised.

The perceived reduction in uncertainty experienced by senior doctors was due to increased knowledge and ability to draw on previous decision-making to inform choices. Feedback from test results and colleagues contributed to this. Traditionally, excessive testing has been associated with low UT amongst doctors (Lawton et al., 2019) but until feedback on decisions is made more accessible in EDs, this study suggests researchers should be cautious when advocating reduced testing in EDs. Doctors perceived the ability to rule-out serious diagnoses as pivotal in establishing uncertain admission or discharge decisions. Ultimately, reducing uncertainty to a tolerable level by eliciting information from patients and clinical testing was perceived to reduce the need for hospital admission. Furthermore, the opportunity to have one's clinical judgement confirmed by test results also contributed to increased confidence amongst ED doctors. Therefore, until the opportunities for feedback are strengthened in EDs, which previous work has suggested is beneficial for ED doctors' cognition, emotion and behaviour (Croskerry, 2000), testing affords doctors an often irreplaceable opportunity for feedback.

#### **4.6.4 Implications for practice**

All participants reflected on changes in how uncertainty is experienced across a doctor's career. The general increase in ED doctors' UT has already been suggested by existing quantitative (Lawton et al., 2019) and qualitative (Han et al., 2021) research. The current study also sheds light on the perception that UT can decrease at certain points throughout a doctor's career including

involvement in an adverse event, returning from other specialty rotations and following an increase in decision-making responsibilities. These novel findings suggest time points at which interventions might be appropriate.

The opportunities senior doctors have had to develop confidence in managing uncertainty need to be more readily available to junior doctors. Most notably this includes feedback on decisions, particularly decisions to discharge patients. Greater exposure to the knowledge that discharge decisions did not pose patient safety risks, could enhance UT amongst junior doctors when discharging future patients. The distinction between responses to admission and discharge decisions reported in this study suggest a perception exists amongst doctors, or perhaps patients, that admission is safer than discharge. Providing automated feedback which constitutes longer-term outcomes for patients who have been admitted and discharged could ensure the risks of admission are considered and discussed with patients more often, as they were perceived to be when hospital was reaching full capacity.

For doctors of all grades to effectively manage uncertainty, the work environment must encourage and facilitate responses to uncertainty which, in turn, reduce the negative thoughts and feelings associated with a discharge decision. This means the factors that are inhibiting successful uncertainty management identified by this study, such as a lack of safety netting structures at night for patients with social care needs, require attention. It is unclear if this could enhance UT amongst doctors (via awareness of supportive structures), reduce the impact of low UT on admission rates by providing doctors with low UT further options, or both.

A need for clinical education to place greater, and more direct, emphasis on addressing uncertainty was made clear. As well as providing clinical knowledge

which reduces uncertainty in practice, doctors would benefit from being aware of their approach to uncertainty and risk management (Reis-Dennis et al., 2021) and learning how to manage situations in which clinical knowledge is not enough to eliminate uncertainty. Promoting strategies such as shared decision-making and communication of uncertainty to patients at discharge could also mitigate the uncertainty experienced by patients and families (Meyer et al., 2021). Further suggested areas of focus were identified in collaboration with an ED consultant after considering the findings together.

#### **4.7 Conclusions and next chapter**

The current study has identified negative appraisals and responses to uncertainty, as well as factors influencing such responses, for future UT interventions to target. Together with findings from the previous chapters, a multitude of intervention functions are suggested. However, with varying strengths of evidence supporting each, it is important to invite the perspective of end-users (ED doctors working in a UK NHS context) in the next chapter. A lack of negative emotional responses to uncertain admission decisions, suggest that to reduce burnout rates among ED doctors, tolerating uncertain discharge decisions should be the focus of UT interventions. Furthermore, doctors interviewed in the current study highlighted that decisions to admit patients were often a mechanism for avoiding the negative emotions associated with discharging patients. This suggests an intervention to enhance the UT of doctors when making discharge decisions, could reduce over-admission of patients. For this reason, the next chapter focuses on discharge decisions.

## Chapter 5

### **Establishing doctors' priorities for interventions to enhance uncertainty tolerance in the context of disposition decisions in the Emergency Department: a modified e-Delphi survey.**

#### **5.1 Chapter summary**

This chapter presents a consensus exercise conducted with an expert panel to establish the importance of potential UT intervention functions. Experts were all ED doctors with at least 12 months' experience of working in an adult ED and one also had research expertise in the topic of clinical UT. A questionnaire-based, two-stage, modified, electronic Delphi (e-Delphi) method was used to establish consensus. A third survey round required experts to prioritise intervention functions based on their appraisal of the potential impact on UT.

So far, this thesis has argued the need for enhancing UT for ED doctors by identifying positive outcomes, including reduced burnout, improved patient experience and quality of care. Additionally, previous chapters have identified a range of potential functions for interventions to enhance UT. Chapters 2 and 4 identified factors that could be the focus of UT interventions (e.g., a lack of acknowledgement of irreducible uncertainty in medical education) and the potential responses and appraisals these could influence (e.g. confidence in managing uncertain situations). However, the evidence base provided in this thesis is exploratory in nature, with chapter 2 revealing a lack of existing UT interventions in an ED context. Given no evidence exists on how to successfully enhance UT for ED doctors and the evidence base for potential intervention functions is weak, further exploration of potential intervention functions (e.g., psychological safety within an ED team or facilitated shared decision-making

with patients) is required. This was explored from the perspective of ED doctors (one with research expertise in clinical UT). Thus, the study aimed to establish consensus and prioritise intervention functions for enhancing UT among ED doctors working in the NHS.

As introduced in chapter 1, intervention functions, rather than form, were the focus of this study. Intervention functions describe the goal or purpose of an intervention rather than the tools or processes employed to achieve such goals or purposes (i.e., the form of an intervention) (Hill et al., 2020). Rather than considering the form (e.g. whether a shared decision-making tool is digital, or paper based) of an intervention, this study considers intervention functions (e.g. shared decision-making or encouraging reflection on personal approach to uncertainty), with form being variable across contexts (Hawe et al., 2004). This was considered appropriate to inform UT interventions that could span multiple patient populations, NHS trusts, clinical presentations, and constructs of UT (e.g. enhancing positive cognitive appraisals, emotional responses, and behavioural responses).

This chapter also details which of the intervention functions that achieved consensus as being important, were also prioritised by the expert panel. This chapter meets the actions outlined in the development phase of complex intervention development guidance discussed in Chapter 1 (O’Cathain et al., 2019a) by:

- 1) Identifying existing interventions.

Chapter 2 identified no existing interventions explicitly focused on enhancing the UT of ED doctors. However, there may be existing interventions with the same function as statements in this survey (e.g.,

shared decision making with patients or role-modelling). In the absence of a focus on enhancing UT or evaluating the impact of UT, these interventions would not be captured in this thesis and therefore, experts in this study were asked how aware they were of existing initiatives with the same function.

2) Drawing on an existing theory.

The Hillen et al. (2017) model of UT is used to guide doctors in their prioritisation of intervention focuses in the final survey round.

3) Understanding context and considering barriers and facilitators to future implementation.

Free-text comments from ED doctors are analysed to develop an understanding of context and identify barriers and facilitators to implementation (e.g. rating an intervention focus as low importance due to not being feasible).

## 5.2 Introduction

UT is a complex psychological construct with theory developed throughout this thesis evidencing how interventions could be focused on multiple factors and target many thoughts, feelings, and behaviours. Learning from previous chapters has suggested that the underlying logic of a UT intervention in an ED context, could:

- a) Focus on reducing the factors triggering negative responses to uncertainty (e.g., poor team culture, a lack of efficient safety netting structures, the perception of admission as safe).



- b) Focus on enhancing factors that have a positive impact on responses to uncertainty (e.g., increasing the exposure of more junior doctors to the elements of practice senior doctors cite as developing their UT).

By enhancing the factors highlighted by previous chapters as facilitating positive responses to uncertainty, or reducing those that have negative impacts on responses to uncertainty, interventions would therefore aim to:

- a) Enhance UT by promoting the positive behaviours (i.e., communicating uncertainty to patients and colleagues) that can mitigate negative emotions (e.g., fear) and cognitive appraisals (e.g., doubt) associated with uncertain decision-making.
- b) Enhance UT by promoting positive cognitive appraisals (e.g., acceptance of the inevitability of uncertainty and reduced negative anticipated emotions) that lead to negative behavioural responses (e.g., avoidance and decision deferral).

What is important to establish is which of those targets (i.e. factors and responses to uncertainty) based on expert opinion, could yield the most positive impacts and be the most feasible to deliver in an ED context. The scoping review in chapter 2 highlighted a lack of UT research in UK EDs, with only three exploratory studies (Adams, 2013; Budworth et al., unpublished; Lawton et al., 2019) and two interventional studies which did not measure UT (O'Sullivan et al., 2013; Sala et al., 2007). The factors influencing how uncertainty is tolerated by ED doctors identified by the scoping review (chapter 2) and interview study (chapter 4) include contextually dependent factors such as workload, relationships within the team, culture, and resources. This makes the application of international findings to intervention development in the UK

potentially inappropriate and the expert opinion of a national sample important to consider.

Findings from the previous chapters, support the notion proposed by Hillen et al. (2017) that UT, as defined by responses to uncertainty, can be trait and state dependent. This is a vital assumption of the logic of intervention functions proposed in this chapter as some functions focus on developing UT as a trait among ED doctors, while some focus on enhancing UT in specific states e.g., when the preferences of patient and family members can not be elicited. Another assumption, grounded in interview study and scoping review findings, is that the UT of ED doctors generally increases with experience and therefore, senior doctors are well positioned to develop the UT of junior doctors. Finally, the difficulties faced in distinguishing probability, ambiguity and complexity in uncertain decisions within the literature reviewed in chapter 2, and the cases discussed in chapter 4, alongside mutually exclusive responses to uncertainty across these three sources of uncertainty, suggests it is unhelpful to consider these sources separately. Therefore, intervention functions proposed in this chapter are assumed to benefit responses to all sources of uncertain patient management decisions.

This chapter describes a Delphi study which sought the collective opinion of experts on the function of UT interventions, including whether developing UT interventions is more important for specific clinical presentations identified as triggering uncertainty than others (e.g., chest pain and abdominal pain), and the function of the intervention (e.g., enhancing communication skills or improving psychological safety within a team).

Delphi surveys allow a systematic approach to determining the level of agreement amongst experts and are particularly useful for topics with a small

evidence base. This approach has not previously been used to identify components of UT interventions, but it is commonly used to prioritise the focus of future intervention development or research. For example, Purdy et al. (2010) employed a Delphi approach to establish consensus amongst 36 clinicians on the conditions (e.g. dementia) identified by a literature search that should be the focus of interventions to reduce hospital admissions and future research.

Consensus exercises such as the Delphi method, are particularly useful when a research area is limited, has no set standard (e.g. no existing UT interventions to draw upon) and when collective expert opinion could facilitate researcher decision-making (Jorm, 2015). While all potential areas of focus for interventions in this Delphi survey are evidence-based, albeit to different extents, in a pressured NHS with limited resource to implement interventions (Quirk et al., 2018), prioritisation is essential. This will inform the future development of interventions aiming to enhance UT in UK NHS EDs, ensuring they meet the needs of ED doctors.

### **5.3 Research aim**

The aims of this e-Delphi survey study were to:

- 1) determine the perspectives of ED doctors' and stakeholders with research expertise in clinical UT on which of the potential areas of focus for UT interventions identified by previous chapters in this thesis should be considered in future practice and,
- 2) to prioritise those which reach consensus for future design and implementation.

By gathering expert views on this topic, the study will offer researchers, policy makers, healthcare managers and educational bodies key areas of focus for initiatives to support ED doctors tolerate uncertainty.

## **5.4 Methods**

### **5.4.1 Study design**

This study utilised a questionnaire-based, two-stage, modified, electronic Delphi (e-Delphi) method to elicit the views of, and move toward consensus on, a panel of experts by experience on potential areas of focus for UT interventions in an ED context. This chapter also discusses an additional survey which asked experts to prioritise UT intervention functions that achieved consensus as being important using a ranking task. The Delphi method offers a systematic approach for establishing the level of consensus among experts on a given topic (Richards et al., 2022), using an iterative process of two or more survey rounds (Purdy et al., 2010; Taylor, 2019), with controlled feedback presented between rounds (Nasa et al., 2021; Nowack et al., 2011). Delphi rounds typically consist of questionnaire items which expert participants rate on agreement or importance (Howarth et al., 2019). In addition, between rounds, experts receive feedback detailing the responses of all experts in the previous round, allowing them additional insight into expert opinion and the option to adjust their rating based on group opinion (Barrios et al., 2021; Howarth et al., 2019).

The method is increasingly utilised in healthcare research. It has allowed expert views to inform the development of clinical scoring systems (e.g. Sciubba et al., 2020), toolkits for clinical decision support (e.g. Douillet et al., 2020), formulate practice recommendations (e.g. Guckenberger et al., 2020) and

identify intervention priorities (e.g. Sahle et al., 2022). Given the opportunity to collate expert views, the method is beneficial for establishing consensus on a particular topic when empirical evidence is limited, and research findings are inconsistent (Barrios et al., 2021).

The Delphi method was chosen above other consensus exercises, such as the nominal group technique, because it can be administered online and completed anonymously without face-to-face interaction. A consensus method allowing anonymity was chosen to minimise the impact of power dynamics on experts' consideration of their position or amending their position following feedback (Hall et al., 2018; Khodyakov and Chen, 2020). Furthermore, the critical source of ED doctors' perspectives in this thesis was an interview study conducted with doctors working in the ED of one NHS trust (chapter 3). Therefore, an approach allowing online participation facilitated a geographically dispersed sample of experts, drawing on experience from NHS trusts with possible variation in the factors influencing UT identified in this thesis so far (e.g., psychological safety in teams and safety netting structures).

Generally, the first round of Delphi surveys involves 'idea generation', using exploratory questions to prompt open-ended responses from experts, which form the items to be rated in subsequent rounds. Due to extensive scoping work (chapter 2) and perspectives of ED doctors (chapter 3) and public contributors (chapter 4) a list of potential areas of focus for interventions had already been generated, making the first round obsolete and so it was omitted. This modification of the Delphi method is considered pragmatic and acceptable within existing literature (Hsu and Sandford, 2007; Taylor, 2019). This study establishes consensus over two rounds, which existing Delphi studies have suggested consensus would be reached by (e.g. Gensichen et al., 2009) and

reflects the approach taken by other published Delphi surveys in an ED context (MacDonald-Nethercott et al., 2016). Omitting idea generation from this study makes this approach a modified e-Delphi survey.

A final additional survey round allowed experts to choose three priorities for intervention functions from those which achieved consensus as being important. Experts were asked to prioritise based on which they thought could have the most positive impact on UT and were prompted with a tick box exercise as to which cognitive, emotional and/or behavioural responses to uncertainty they considered each function could influence. This prioritisation task was included because importance ratings for potential impact on tolerating uncertainty at discharge did not necessarily acknowledge feasibility and the role of contextual factors in implementation. Furthermore, items that achieved consensus in the first Delphi round did not appear in the second round. As the first round had a larger sample size than the second round, importance ratings could not be directly compared to elicit the most important intervention functions. Existing research has followed up Delphi rounds with a ranking task and used this to compare clinician priorities with those with lived experience of a service or disease (Richards et al., 2022). In this study, a patient-facing prioritisation survey was formulated and presented to two experienced public contributors affiliated with the NIHR Yorkshire and Humber Patient Safety Translational Research Centre. Many survey items required expert knowledge and lived experience of medical education and interpretation of clinical guidelines, and public contributors considered this inappropriate for service user input. For this reason, only experienced ED doctors or those with expertise in clinical UT were invited to take part in this study.

## **5.4.2 Participants**

The study received ethical approval from the School of Psychology Research Ethics Committee at the University of Leeds (no: PSYC-555; date: 06/06/22).

### **5.4.2.1 Definition of 'expert'**

The Delphi approach requires contributors to be experts on the given topic, defined as having personal or professional experience and knowledge (Trevelyan et al., 2015). Experts were defined as ED doctors with experience making discharge decisions in an ED context or experts in clinical UT. The interview study outlined in chapter 3 highlighted that some junior doctors are unaware of safety netting options and organisational structures to support discharge decisions, suggesting a lack of knowledge. For this reason, doctors needed at least one year of experience in an ED to contribute to this study, meaning foundation-year doctors who had undertaken short rotations in an ED were excluded. Existing Delphi studies in an ED context have utilised similar approaches to eligibility (e.g. Richards et al., 2022).

### **5.4.2.2 Recruitment**

Experts were identified and purposively sampled via staff networks (e.g. via regional co-ordinators of Black, Asian and minority ethnic groups), emergency medicine professional bodies (e.g. Royal College of Emergency Medicine), a list of UK authors in the field of clinical UT identified by a scoping review (chapter 2) and Twitter. Study advertisements included a QR code or direct link to the survey meaning participants did not need to contact the lead researcher personally. An existing evaluation of approaches to recruitment in Delphi studies suggests YouTube videos, personalised invitations, regular updates, and a dedicated study website as strategies for effectively recruiting and

retaining healthcare professionals (Hall et al., 2018). Therefore, a YouTube video was included in the introduction to the survey detailing the purpose and potential impact of the study (<https://youtu.be/pEAmPtpk9uE>). Where possible, invitations were personal, referencing the relevant expertise or published research which justified the invitation. However, this was not possible for social media advertisements and invitations issued via gatekeepers of professional bodies or staff networks. Due to funding restrictions, a website was not developed. However, the study titled 'Enhancing Support for Uncertainty Responses in the ED' (EnSUR-ED) had a dedicated email address to issue updates.

From a series of workshops with healthcare professionals, Young and Bagley (2016) recommend that to retain healthcare professionals across multiple rounds of involvement in research, they should feel a sense of ownership of the project. To achieve this, experts could choose to be personally acknowledged in any study outputs (Lux and Osborne, 2004) and invited to subsequent workshops to build on findings. This was included in study advertisement posters and invitations (see Appendix 5.1). Hall et al. (2018) also attribute higher retention rates to fewer Delphi rounds with shorter periods between them. For this reason, this study was a two-stage e-Delphi study with three weeks between rounds to allow for analysis and feedback development.

#### **5.4.2.3 Sample size**

There is no consensus on the appropriate size of expert panels in Delphi studies (Keeney et al., 2001), with large variation in previous research. It has been suggested that a panel of 12 expert participants is satisfactory (Murphy et al., 1998; Vogel et al., 2019). Earlier research has shown that a panel of 20 experts provides a robust estimate in a Delphi exercise (Akins et al., 2005), and



a previous Delphi study with the aim of prioritizing interventions related to admission-rates, involved 36 participants (Purdy et al., 2010). Despite this debate, it is agreed that heterogeneity of sample contributes to appropriateness of sample size, with international studies (Taylor, 2019) requiring a larger sample size, for example.

As a heterogeneous sample of experts was desired, any person expressing an interest in the study who met the criteria of 'expert' (doctors who have worked in a UK ED for at least 12 months or expertise in the field of UT in the context of clinical decision-making) were eligible to participate. Anticipating a dropout rate of around 20% per round based on similar studies (e.g. Vogel et al., 2019), resulted in a target sample size of 30 experts to achieve 20-30 experts overall across two rounds of the e-Delphi consensus exercise.

### **5.4.3 Survey development**

49 potential functions for interventions and six potential presenting complaints were identified from research in Chapters 2-4. Some of the statements had more underpinning evidence than others but given the recent progression in UT research outlined in Chapter 2 and a lack of systematic reviews exploring UT interventions, a statement with only one source of evidence does not necessarily make the suggestion redundant. For this reason, all suggestions were included, allowing this study to provide further clarity on potentially impactful suggestions. Table 5.1 describes the origin of each statement in the first round of the e-Delphi survey. Statements appear more than once where they were evidenced across multiple studies.

**Table 5.1**

*Origin of statements in round 1 of e-Delphi survey.*

Thesis Chapter	Statement	Response (R) to uncertainty or influencing factor (F) this statement is focused on
<b>Chapter 2: Healthcare professionals' and service users' experiences of uncertain diagnoses and patient management in the Emergency Department: a scoping review and narrative synthesis</b>	Chest pain, abdominal pain and headache flagged as most common clinical presentation for which uncertainty is present in clinical decision-making literature based in the ED.	N/A
	Teach doctors to communicate uncertainty, equipping them with phrases and skills to apply when discharging patients.	Confidence in communicating uncertainty (R)
	Senior doctors are available to consult at all times.	Sufficiency of staff and specialists (F)
	Doctors are aware of the patient's own tolerance for risk and uncertainty.	Challenge perceptions of patient expectations (F)
	Help trainees distinguish situations where anxiety is developmentally appropriate (e.g.	Experience and UT as a skill (F)

they're anxious because they are being challenged and they should interpret this anxiety as a signal to ask for help from colleagues) and where it is a maladaptive and unnecessary response to uncertainty.

Patients are aware of the limitations of testing and further medical investigation and, after considering the risks and benefits of potential management options, support the decision to discharge.

Equip doctors with the skills to effectively reflect on their own practice in a way which promotes pattern recognition over time.

Help trainees to respond to their anxiety around discharging patients in ways other than over-testing or admitting patients.

Doctors are supported by highly sensitive and reliable guidelines and decision rules advocating no medical intervention for low-risk patients.

Challenge perceptions of patient expectations (F)

Experience and UT as a skill (F)

Challenge perceived practice norms (F)

Guidelines and policies (F)

Follow-up care, including community discharge teams and specialist care pathways, are more readily, and consistently, available.	Safety netting (R)
Doctors are more aware of safety netting strategies they can utilise.	Safety netting (R)
Recognise that trainees may struggle to establish the legitimacy of their own clinical judgement and help them validate their judgements.	Experience and UT as a skill (F)
Train doctors to acknowledge uncertainty and identify what cues to act upon in uncertain situations.	Acknowledgement (R)
Teach doctors classifications (e.g. low/medium/high) or percentages of the initial probability and likelihood of diseases and prompt them to refine their understanding of these probabilities and likelihoods based on the patients they have seen in their career.	Experience and UT as a skill (F)
Encourage doctors to consider if an uncertainty management approach is	Appropriate information sought and reduced decision deferral (R)

appropriate by considering the source and reducibility of the uncertainty they face and use this to inform patient management (e.g. is it uncertainty which could be associated with misdiagnosis and require more resource use or is it just lack of knowledge or misinterpreted information?)

Use of testing and imaging, for which evidence suggests can reduce admission rates by ruling out serious diagnoses, is encouraged.

Clinical decision units and/or observation units are available, with sufficient bed space.

Teach doctors to communicate uncertainty, equipping them with phrases and skills to apply when discharging patients.

Patients are aware of the limitations of testing and further medical investigation and, after considering the risks and benefits of potential management options, support the decision to discharge.

Appropriate information sought (R)

Investing greater mental resource (F)

Shared decision-making (R)

Communication of uncertainty with patients (R)

**Chapter 3: The public perspective on how uncertainty is tolerated by ED doctors.**

(This chapter supports the following statements from a public perspective)

Train doctors to acknowledge uncertainty and identify what cues to act upon in uncertain situations.

Place more emphasis on how to incorporate a patient's preferences, values and goals into the consideration of risks and benefits of various outcomes to establish the approach most appropriate for them.

**Chapter 4: A qualitative exploration of how junior doctors and registrars respond to uncertainty in the Emergency Department and the factors they perceive to influence this**

Abdominal pain, headache, chest pain, mental health concerns and any complaint among older patients were flagged as cases with the most uncertainty.

N/A

Teach doctors to communicate uncertainty, equipping them with phrases and skills to apply when discharging patients.

Confidence in communicating uncertainty (R)

Senior doctors are available to consult at all times.

Sufficiency of staff and specialists (F)

Encourage trainees to discuss why a decision was made, rather than what decision was made.

Document decision-making (R)

Patients clearly understand any discharge instructions given.	Increased belief in patients to take ownership of own care (F)
Ensure trainees have adequate and appropriate clinical exposure which includes a range of patient acuity and complexity.	Experience and UT as a skill (F)
Culture within the ED team promotes psychological safety and facilitates an awareness that decisions can be made as a team.	Team culture (F)
Doctors are aware of the patient's own tolerance for risk and uncertainty.	Challenge perceptions of patient expectations (F)
Help trainees distinguish situations where anxiety is developmentally appropriate (e.g. they're anxious because they are being challenged and they should interpret this anxiety as a signal to ask for help from colleagues) and where it is a maladaptive and unnecessary response to uncertainty.	Experience and UT as a skill (F)
Support trainees when they perceive a mismatch between their own interpretation of a situation and the interpretations of others on	Confidence (R)

the care team. For example, providing doctors with strategies to respond to uncertainty which comes from other doctors having a different opinion to them on how to manage a patient.

Encourage trainees to reflect on their own personal risk thresholds and the factors which influenced risk-averse decisions they have made.

Experience and UT as a skill (F)

Prompt doctors to consider whether further medical investigations would have an impact on the certainty of any diagnostic impressions.

Acceptance (R)

Support trainees' growth toward independent practice, encouraging them to gather and filter cues towards judgement that they can trust and respond to.

Confidence (R)

Patients are aware of the limitations of testing and further medical investigation and, after considering the risks and benefits of potential management options, support the decision to discharge.

Challenge perceptions of patient expectations (F)



Address areas of uncertainty for trainees more directly during clinical supervision.	Experience and UT as a skill (F)
Services (e.g. ambulance, 111, GP, hospital, social care) are better integrated, making reasons for attendance and options for care outside of hospital clearer.	Safety netting (R)
Equip doctors with the skills to effectively reflect on their own practice in a way which promotes pattern recognition over time.	Experience and UT as a skill (F)
Help trainees to respond to their anxiety around discharging patients in ways other than over-testing or admitting patients.	Challenge perceived practice norms (F)
Focus on developing an acceptance that practice does not need to be about completely eliminating uncertainty, but more about considering which risks are appropriate to take.	Acceptance (R) and all-knowing culture of medicine (F)
When responsibility increases and doctors become senior decision makers, they receive	Confidence (R)

training on uncertainty tolerance to build confidence.	
Encourage doctors to explore how guidelines provide a framework, not a manual, of care.	Deliberation and confidence (R)
Expose trainees to more case studies where unnecessary admission and over-testing contributed to adverse patient outcomes.	Experience and UT as a skill (F)
Strategies are in place to protect against or recover from decision fatigue during shifts.	Workload (F)
Involve junior doctors in the creation of medical education and training modules so that they reflect their lived experience and guides them on what to do if they are uncertain e.g. when to involve a senior.	Experience and UT as a skill (F)
Give trainees more feedback on their admission and discharge metrics which includes patient outcomes so doctors can understand whether patients benefitted from their decisions.	Experience and UT as a skill (F)
Doctors and patients have a greater awareness of the inevitability of uncertainty	Acceptance (R)

and the benefits of diagnosis with unknown aetiology, rather than premature closure.

Place more emphasis on how to incorporate a patient's preferences, values and goals into the consideration of risks and benefits of various outcomes to establish the approach most appropriate for them.

Confidence and shared decision-making (R)

Following involvement in an adverse event, individual doctors receive training on uncertainty tolerance to build confidence.

Confidence (R)

Practice guidelines place more emphasis on whether the care a patient needs can be provided only via hospital admission or elsewhere.

Deliberation (R)

Encourage use of the space provided in the ED medical notes for free text, where the doctor can describe their clinical reasoning leading to discharge (e.g., when clinical evidence is low).

Document decision-making (R)

Patients who are still experiencing uncertainty after discharge are identified and receive a post-discharge follow-up.	Safety netting (R)
Guidelines acknowledge doctors' level of confidence in their own clinical judgement and only advocate rigid adherence to them when doctors are low in confidence.	Deliberation (R)
Specialist opinion (e.g. from surgeons) is obtained before or in conjunction with imaging and test results.	Informational and emotional support (F)
Encourage strategies for weighing the risks and benefits of various interventions, rather than learning, and strictly adhering to, specific patient management pathways.	Deliberation (R)
Clinical decision rules emphasise the expectation of ED is to only manage the presenting complaint and pathways are improved to manage uncertainty relating to anything else.	Workload (F)
When returning to the ED after a mandatory training year in anaesthetics and ICU, doctors	Confidence (R)

receive training on uncertainty tolerance to build confidence.

Disseminate guidelines which give example clinical scenarios in which there are multiple plausible, and satisfactory, patient management approaches. Each of which are equally valid.

Experience and UT as a skill (F)

Work with legal advisors to better understand the medico-legal aspects of decision-making by individual doctors. For example, better defining the liability of doctors and organisations when a patient is discharged who, at the time, was considered to have a very low likelihood of catastrophic outcomes.

Change the expectation of all-knowing culture of medicine (F)

Encourage doctors to give non-medical factors (e.g. the emotional burden to patients and societal costs of resource use) more consideration when advocating admission or discharge.

Shared decision-making (R)

**Wider literature, observations, and clinician engagement**

Fever (flagged as a symptom presenting high uncertainty in observations and clinician engagement).

N/A

Doctors and patients have a greater awareness of the inevitability of uncertainty and the benefits of diagnosis with unknown aetiology, rather than premature closure (flagged in wider UT literature).	Acceptance (R)
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*Note.*

*The responses and factors noted in the right column indicate the primary focus of intervention functions. Due to interactions between responses to uncertainty, there may be more than one relevant response that is not captured in this table. For example, functions focused on improving acceptance, may also reduce decision deferral.*


Round 1 of the e-Delphi survey was developed with two ED consultants also working as clinical academics, with a special interest in uncertainty research. The survey was subsequently piloted with two ED consultants. Five statements were re-phrased following this process to make them more appropriate for a clinical audience. After discussion among the research team, one suggestion was not applied which was to use the term 'low risk' when describing patients in the question, 'For patients with the potential for catastrophic, but unlikely, clinical outcomes how important is it to develop initiatives to help ED doctors tolerate uncertainty when discharging adult patients with [insert presenting complaint]. The rationale for omitting the words 'low risk' was that when making uncertain decisions, doctors may consider a patient being low risk, but this is not certain for them.

#### **5.4.4 Procedure**

Surveys were created and distributed via JISC online surveys (<https://www.onlinesurveys.ac.uk>). Experts accessed the first round of the e-Delphi survey using a link which was open for two weeks. Accessing the link, took potential participants to an introductory page, inviting them to take part and outlining the purpose of the survey. Subsequently, potential participants were shown the participant information sheet, which described the study purpose, procedure, remuneration, ethical provisions, and researcher contacts. This page included a timeline of when participants could expect to receive further contact and where in that timeline their involvement currently sat. Table 5.2 shows an example of this table, from the beginning of round 1. At the end of round 1, the status was updated to acknowledge the round 1 deadline had been met by another star.

**Table 5.2.**

Study timeline shown to experts.

Date	Study stage	Status
12th August 2022	<b>Round 1 opens (e-Delphi survey)</b> Experts rate agreement with 55 statements	
26th August 2022	Deadline to complete round 1	
12th September 2022	Experts receive summary of round 1 findings, alongside their own ratings.	
12th September 2022	<b>Round 2 opens (e-Delphi survey)</b> Experts re-rate statements which did not achieve consensus in light of receiving the summary of findings. Any further statements suggested by experts in round 1 (which have been added to round 2) are rated for the first time.	
3rd October 2022	Deadline to complete round 2	
10th October 2022	Experts receive findings from round 2.	
10th October 2022	<b>Prioritisation task opens.</b> Experts are shown a summary of statements which achieved consensus and are asked to identify priorities for future interventions. Further information will be provided here to	



help the decision, including the evidence  
base for what outcomes they could achieve  
(e.g. reduced hospital admissions).

24th October 2022 Deadline to complete final round.

7th November 2022 Experts are informed of final study findings  
and how they will be carried forward.

Participants who chose to continue, then completed an online consent form and were subsequently screened to assess eligibility. This required participants to confirm they were over the age of 18, lived in the UK and had worked in a UK adult ED for at least 12 months and/or have expertise in the topic of UT in clinical environments. If participants confirmed all three criteria, they provided demographic information and an email address to receive future study information and links. Email addresses were stored alongside response data to provide tailored feedback between rounds, however following round 3 invitations being distributed, they were stored separately.

Prior to completing the consensus exercise, participants were introduced to the concept of UT by accessing a YouTube video created by the research team: <https://youtu.be/pEAmPtpk9uE>. A video transcript was also provided which could be accessed throughout the survey to remind participants of the definition of UT.

In round 1, participants rated the importance of 55 statements using a 5-point Likert scale ranging from not at all important (1) to very important (5) with statement order randomised for participants. This included six statements focused on which presenting complaints experts consider UT interventions important for. For example:

“For patients with the potential for catastrophic, but unlikely, clinical outcomes how important is it to develop initiatives to help ED doctors tolerate uncertainty when discharging adult patients with [insert presentation e.g. chest pain]?”

The other 49 statements focused more on the cognitive, emotional, or behavioural functions of interventions specific to UT, or the factors an intervention could influence. For example:

“To reduce the negative thoughts, feelings, and behaviours doctors exhibit in response to discharging adult patients from the ED, how important is it that medical education, training, and professional bodies [insert intervention function e.g. teach doctors to communicate uncertainty, equipping them with phrases and skills to apply when discharging patients].”

“To help trainee doctors (foundation years and specialty trainees) develop their uncertainty tolerance when discharging adult patients, how important is it that senior doctors [insert intervention function e.g. give trainees more feedback on their admission and discharge metrics which includes patient outcomes so doctors can understand whether patients benefitted from their decisions]?”

“To support doctors in tolerating uncertainty when discharging adult patients, how important is it that [insert intervention function e.g. doctors and patients have a greater awareness of the inevitability of uncertainty and the benefits of diagnosis with unknown aetiology, rather than premature closure]?”

For each statement, there was an option to respond 'don't know' to ensure the 5-point scale was ordinal and to avoid neutrality and lack of clarity being conflated. There was additionally an option to add free-text comments to explain ratings or provide feedback on the framing of statements. In round 1, additional open-ended questions were included which asked participants to specify ideas (of presenting complaints and intervention functions) which the survey had not covered.

In round 2, experts rated the importance of 44 statements. This included 29 re-rated statements from round 1 and 15 new statements suggested by experts in round 1. The new suggestions were particularly beneficial given the limited research to date in the field of UT interventions. Only experts who had completed round 1 were invited to round 2. Invitations were distributed by emails individually, to preserve anonymity and attach reminders of previous ratings. Reminder invites were sent following one week.

The 29 re-rated statements were those that had not achieved the pre-specified consensus criterion. Consensus is a widely debated methodological issue in Delphi studies (Barrios et al., 2021). Despite agreement that achieving consensus is a defining feature of Delphi studies, what is accepted as consensus and the preferable method to reach it, is widely debated (Boulkedid et al., 2011; Von der Gracht, 2012). In a systematic review exploring definitions of consensus, Diamond et al. (2014) reported a wide range of accepted consensus (50-97%), with a median threshold of 75%. Barrios et al. (2021) found that above the 75% consensus, agreement progressively becomes stronger over rounds, and below the 75% consensus, agreement becomes weaker across rounds. In this study, a 75% consensus threshold for either responses 1-2 on the Likert scale (1= not at all important; 2= slightly important)

or responses of 4-5 on the Likert scale (4= fairly important; 5= very important) was employed.

Statements were also re-rated by experts if, in round 1, the free-text comments they supplied conflicted with their rating, implying an incorrect score. However, this only occurred for statements which did not achieve consensus and would have been re-rated regardless of this. For cases where experts responded to statements, 'do not know', these responses were discounted and if the statement still achieved consensus, they did not appear in round 2. If the consensus threshold was not reached without these responses, the statement was re-rated but only by experts who answered, 'do not know.'

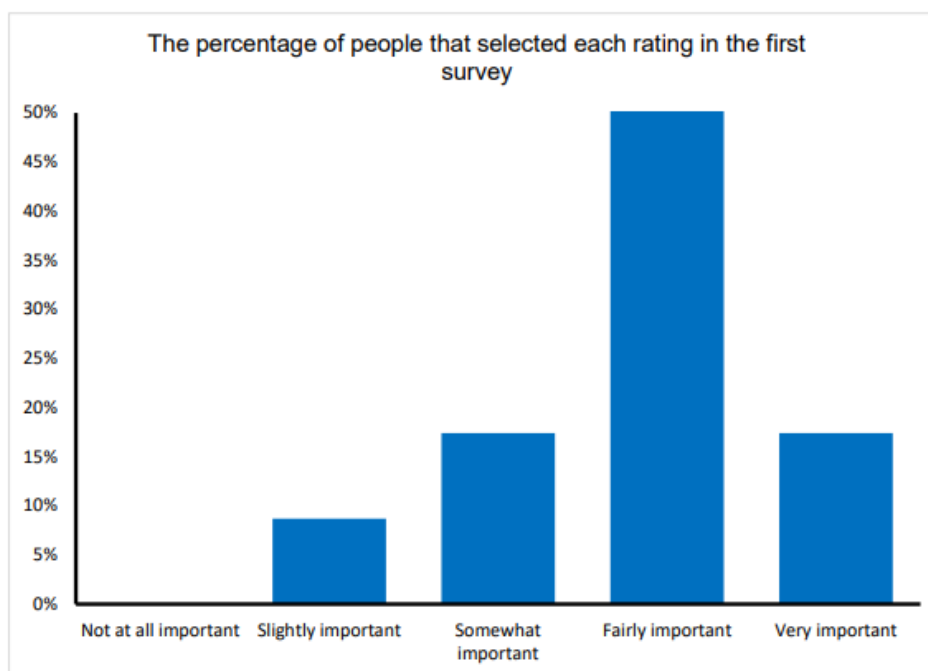
While completing round 2, experts could review their own scores from round 1, as well as the distribution of scores overall (see Figure 5.1 for an example) and free-text responses provided by all experts. Turnbull et al. (2018) reported no difference in how participants exposed to numerical or qualitative feedback were influenced. Due to the complex nature of this topic, experts were shown both.

In the final survey round, experts from the Delphi exercise were asked to identify three priorities from the areas of focus for UT interventions which received consensus. Following a consensus exercise with a prioritisation task was necessary as the importance scores between rounds cannot be compared due to different sample sizes. For example, an item which did not achieve consensus in round 1, but then achieved 100% consensus as being important in round 2, cannot be regarded as more important than an item which received 85% consensus in round 1. Previous Delphi studies have used similar techniques (Richards et al., 2022).

**Figure 5.1**

*Example of the feedback provided to experts between round 1 and 2.*

Q2) For patients with the potential for catastrophic, but unlikely, clinical outcomes how important is it to develop initiatives to help ED doctors tolerate uncertainty when discharging adult patients presenting with *headache*.



Explanations for ratings provided by experts in the first survey

Rationale for considering this very/fairly important.	Rationale for considering this less/not important.
<p>Decision assistance tools are important for headache. Doctors need to be made aware of statistics regarding negative outcomes to have confidence in their decision making.</p> <p>Certain diagnoses which headache indicates, carry risk of death.</p> <p>Long term complications related to headaches can be prevented with current diagnostic methods.</p>	<p>None provided.</p>

**Your response last time was: 3**

Please re-rate this statement for importance in the survey.

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The 38 potential focuses for interventions were categorised into eight intervention functions considered to be deliverable as a package, through discussion within the research team and consultation with two ED consultants and two public contributors. These eight categories (see Figure 5.2 for an example) were presented to experts followed by five questions per category which guided prioritisation (see appendix 5.2 for all statements included in the survey):

- 1) Please indicate if this intervention focus is in your top three priorities.
- 2) Is this your highest, second highest or third highest priority? Please make sure this is not the same answer as you give for another priority.
- 3) How would this influence uncertainty tolerance amongst ED doctors when discharging patients? You can choose as many or as few as you deem relevant. This would make doctors discharging patients from the ED... [checklist of cognitive appraisals, emotional responses and behavioural responses associated with the Hillen et al. (2017) model of UT].
- 4) Please indicate the extent to which the focus for this intervention is already met in emergency medicine practice.
- 5) Finally, please choose which outcomes you think initiatives to meet this goal could have. You can choose as many or as few as you deem relevant [checklist of outcomes identified by previous thesis chapters].

Following completion of three rounds, experts received a summary of study findings and were entered into a prize draw for either a £100, £50 or £25 Amazon voucher.

## Figure 5.2

*Example of an intervention category alongside functions which achieved consensus as being important for UT interventions to achieve.*

**Intervention 8: Uncertainty is highlighted as an inevitable component of emergency medicine with appropriate coping mechanisms taught to doctors.**

This intervention would include the following aims:

- Medical education and training focuses more on developing an acceptance that practice does not need to be about completely eliminating uncertainty, but more about considering which risks are appropriate to take.
- Junior doctors are involved in the creation of medical education and training modules so that they reflect their lived experience and guides them on what to do if they are uncertain e.g. when to involve a senior.
- Doctors are trained to acknowledge uncertainty and identify what cues to act upon in uncertain situations.
- Doctors are encouraged to explore how guidelines provide a framework, not a manual, of care.
- Senior doctors address areas of uncertainty for trainees more directly during clinical supervision.
- Trainees have adequate and appropriate clinical exposure which includes a range of patient acuity and complexity.

### 5.4.5 Analysis

For every statement in each Delphi round, the mean and standard deviation of importance ratings, the mode rating and percentage of experts who rated the statement as each score (1-5) were calculated. Where 75% or more experts chose 1-2 or 4-5, consensus was achieved for considering a statement not important or important for UT respectively. Statements which achieved 70% consensus were categorised as near consensus and below 70% as not achieving consensus. For statements that appeared in both rounds, the difference in consensus (%) was also calculated. The mean differences between ratings in round 1 for experts who only completed one round and

experts who completed two rounds of the e-Delphi survey were analysed using a t-test. This was to ascertain if, with 100% response rate across rounds, results would have been fundamentally different. For each statement in the e-Delphi survey, the difference in strong support for each statement (4-5 on the Likert scale) rated by experts with 10 or more years' experience working in an adult ED compared to less than 10 years' experience, was determined using the  $\chi^2$  test (Taylor et al., 2019). Ten years was the median years of clinical experience in both rounds of the e-Delphi survey, with 12 ED doctors and 11 ED doctors in the high experience and lower experience groups respectively in round 1, and eight ED doctors in each group for round 2. In the prioritisation task, each time an intervention was rated as the highest priority for UT, second highest priority and third highest priority, it was scored three, two or one points respectively.

Free-text comments were qualitatively analysed using inductive content analysis (ICA) (Elo and Kyngas, 2008). ICA can be distinguished from deductive content analysis as the appropriate approach when little existing research could guide analysis (Vaismoradi et al., 2013). In the case of the free-text comments, it was unclear how participants would use this space to rationalise ratings. For example, they may have discussed feasibility, acceptability, originality, or impact on UT. This would have made using a theory or existing literature as a lens to consider the data through difficult. ICA was chosen over thematic analysis due to the direct relevance and desired practical application of findings to clinical practice, rather than a theoretically focused aim (Vears et al., 2022). The five stages of ICA are outlined in Table 5.3.



**Table 5.3**

*Working example of coding process informed by stages outlined by Vears et al., (2022).*

Stage of ICA	Description	Example of coding
Read and familiarise	Comprehending the data to become familiar with it and understand what the text is about.	N/A
First round coding- identify big picture meaning units	Categorise content in a way that speaks to research questions.	<ol style="list-style-type: none"> <li>1. “Rationale for considering a clinical presentation an important focus of UT interventions”.</li> <li>2. “Rationale for <i>not</i> considering a clinical presentation an important focus of UT interventions”.</li> </ol>
Second-round coding— developing subcategories and fine-grained codes	Take a closer look at data within big-picture categories to produce subcategories.	<ol style="list-style-type: none"> <li>1. Unpredictable progression; Unlikely to reach a diagnosis in ED.</li> <li>2. Considered routine care, No potential for adverse patient outcomes.</li> </ol>

Refining the fine-grained subcategories

Compare and refine subcategories, establishing if they are similar and should be collapsed or more specific.

Some subcategories were collapsed within the big-picture categories above as what they referenced aligned with the conceptualisation of uncertainty discussed throughout this thesis.

1. High uncertainty associated with clinical presentation.
2. Low uncertainty associated with presentation.

Synthesis and interpretation

Staying closer to the phenomenon investigated than in thematic analysis, produce a practically relevant answer to research questions.

Despite separating the subcategories within the big-picture units above, the coding schema developed in the previous step revealed that rationales for high and low importance ratings often had opposite interpretations of the same rationale.

In the example outlined above, the overall category of, 'Uncertainty associated with the clinical presentation' was the final category.

To sense-check, findings were presented to the Royal College of Emergency Medicine sustainable working practice committee and two emergency medicine consultants.

## 5.5 Results

### 5.5.1 Expert panel

Twenty-three ED doctors took part in round 1 of the e-Delphi survey and, of these, 16 completed round 2, yielding a 69.67% response rate. Table 5.4 outlines the demographics of experts in each round. All experts were ED doctors, with one also having research experience in clinical uncertainty. Doctors completing both rounds had worked in the EDs of 29 hospitals, with broad geographical distribution across the UK. Despite a reduction in sample size, and consequently heterogeneity of sample, there was no significant difference between the mean ratings in round 1 of participants completing both rounds ( $M= 4.16$ ,  $SD= 0.32$ ) and those who completed round 1 but did not complete round 2 ( $M= 3.87$ ,  $SD= 0.58$ ),  $t(7.66)= -1.22$ ,  $p= .259$ , suggesting those who did not complete round 2 would have scored similarly to those who did.

**Table 5.4**

*Demographics of experts in both e-Delphi rounds.*

	Round 1 ( $n= 23$ )	Round 2 ( $n= 16$ )
Age in years ( $n$ , %)		
25-34	10 (43.5%)	8 (50%)
35-44	9 (39.1%)	5 (31.25%)

45-54	3 (13%)	3 (18.75%)
55-64	1 (4.3%)	0 (0%)
65 and over	0 (0%)	0 (0%)
Gender ( <i>n</i> , %)		
Male	15 (65.2%)	11 (68.75%)
Female	8 (24.8%)	5 (31.25%)
Prefer to self-describe	0 (0%)	0 (0%)
Ethnicity		
White	21 (91.3%)	14 (87.5%)
Mixed/Multiple ethnic groups	0 (0%)	0 (0%)
Asian/Asian British	2 (8.7%)	2 (12.5%)
Black/African/Caribbean/Black British	0 (0%)	0 (0%)
Other ethnic group	0 (0%)	0 (0%)
Years of clinical experience		
Range	1-30	1-28
Mean (SD)	15.22 (10.35)	9.69 (6.5)
Category of expertise ( <i>n</i> , %)		
Worked as a doctor in an adult ED for at least 12 months	23 (100%)	16 (100%)

Expertise in uncertainty tolerance research	1 (4.35%)	1 (6.25%)
UK hospitals where at least 12 months of ED experience gained	44	29
Region of hospital where ED experience gained ( <i>n</i> , %)		
<b>England</b>		
Yorkshire and The Humber	8 (18.18%)	7 (24.14%)
South West	3 (6.81%)	2 (6.9%)
North East	1 (2.27%)	1 (3.45%)
South East	2 (4.55%)	3 (10.34%)
North West	3 (6.81%)	3 (10.34%)
East Midlands	0 (0%)	0 (0%)
Northern Ireland	4 (9.09%)	2 (6.9%)
East of England	5 (11.36%)	2 (6.9%)
London	8 (18.18%)	6 (20.69%)
West Midlands	1 (2.27%)	0 (0%)
<b>Scotland</b>	8 (18.18%)	2 (6.9%)
<b>Wales</b>	1 (2.27%)	0 (0%)

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Note.

*Most experts had experience in more than one hospital. Percentage figures for UK regions portray the percentage of the total number of hospitals.*

## **5.5.2 Consensus exercise**

### **5.5.2.1 Quantitative analysis**

Figure 5.3 shows the number of statements in each round. Of the six presenting complaints and 49 intervention functions detailed in round 1 (see appendix 5.2), one presenting complaint and 25 intervention functions were considered important by 75% or more doctors in round 1. As consensus was established for the importance of these intervention functions and clinical presentation (chest pain), they were not included in the second round to reduce participant burden. The remaining five clinical presentations and 24 functions were re-rated in round 2, alongside 12 new clinical presentations and three new intervention functions suggested by the expert panel in round 1. The final list of potential intervention functions which reached the consensus threshold ( $\geq 75\%$ ) as being important comprised five presenting complaints and 38 intervention functions. No statements reached consensus as being not important, however 13 presenting complaints and 14 intervention functions did not reach consensus across both Delphi rounds.

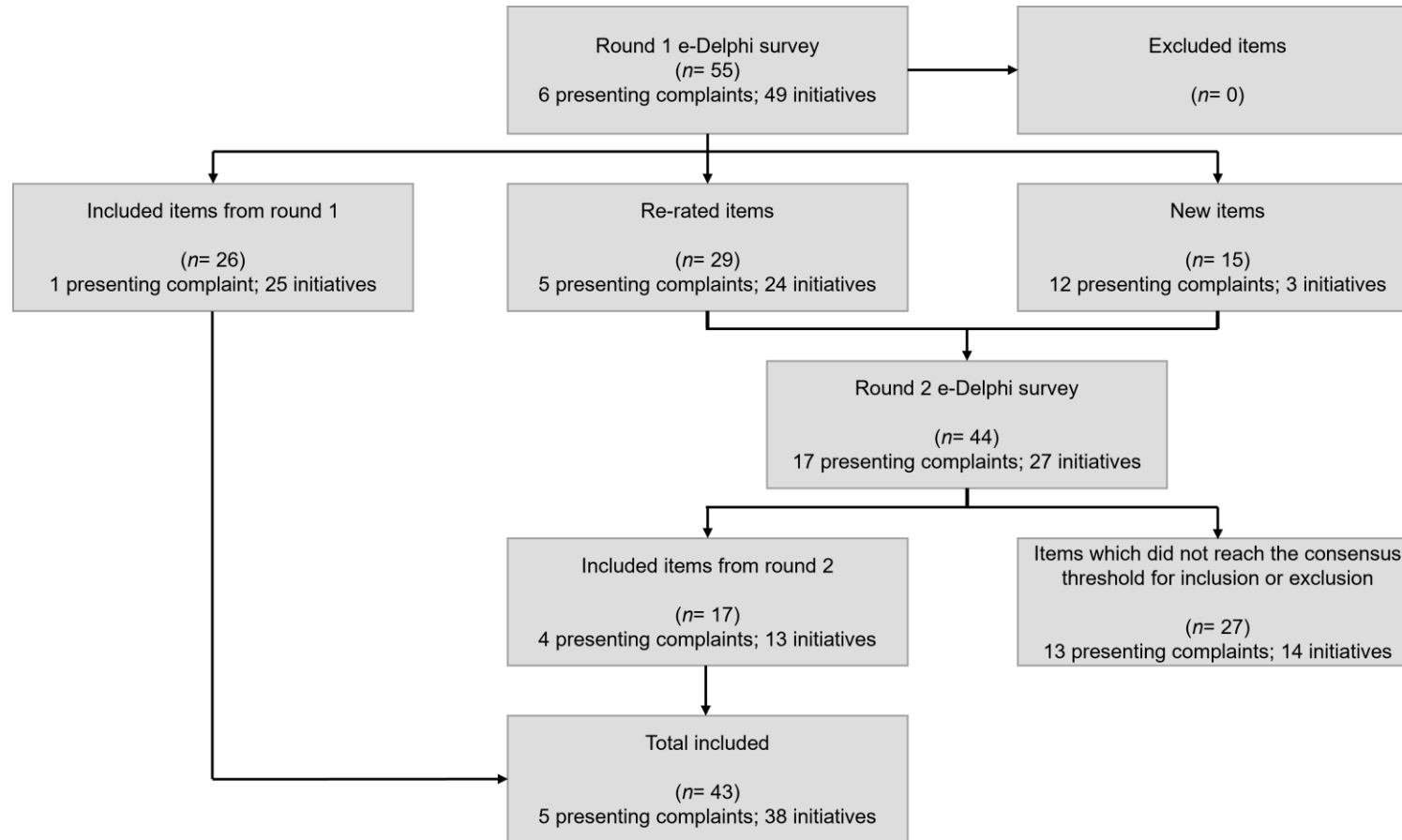
Round 1 required the expert panel to rate the importance of interventions to support doctors to tolerate uncertainty when discharging patients with chest pain, abdominal pain, headache, mental health concerns, and breathlessness, as well as patients over 65 years old (see appendix 5.2 for round 1 survey items). Only chest pain reached consensus as being an important clinical focus in round 1. The panel suggested 12 further clinical presentations that would be important focuses for interventions. These included: syncope, breathlessness,

lower back pain, pregnancy complications, intoxication, skin conditions, vomiting, seizures, head injuries, vertigo, paraesthesia, and weakness. Of those in round 2, only two reached the consensus threshold as considered important clinical focuses (syncope and breathlessness). The three intervention functions suggested by experts in round 1, all reached consensus in round 2 as being important UT intervention functions. They are marked by an asterisk (\*) in table 5.5. Appendix 5.3 provides greater detail on each statement, including the frequency of Likert scale ratings and the percentage change in consensus between rounds for statements appearing in both.

The intervention functions with the highest degree of consensus as being important for UT included teaching doctors to communicate uncertainty when discharging patients, having sufficient senior doctors on shift to consult, and encouraging doctors to discuss, and hence, acknowledge why a decision is being made rather than only the decision itself. These three intervention functions achieved 100% consensus as being important functions of UT interventions. A high degree of consensus (95.7%) was also established for interventions with the goals of ensuring patients understand discharge instructions, ensuring trainees have clinical exposure spanning a range of patient acuity and complexity and finally, the ED team promotes psychological safety (see table 5.5). These six intervention functions reached consensus in the first round.

**Figure 5.3**

*Flowchart of items (survey statements) included in each of the Delphi rounds.*





Of those that reached consensus in round two, four intervention functions reached 93.8% consensus as being important for UT. Three of these were focused on developing trainee doctors in a way that enables them to recognise maladaptive responses to uncertainty, encourages reflection on personal risk thresholds, and considers how to respond positively to ambiguity when colleagues have differing opinions. Interventions to support doctors navigating uncertainty because of different opinions had the highest mean score and lowest standard deviation of intervention functions in round two (*Mean (SD)*= 4.69 (0.60)). The fourth intervention function was focused on the clinician-patient relationship, suggesting doctors should be aware of the patient's own UT, although this function did have the joint highest variation of importance ratings in round 1, achieving consensus in round two (*Mean (SD)*= 4.69 (1.67)).

Other intervention functions with the largest variation in importance ratings included:

1. Specialist opinion (e.g. from surgeons) is obtained before or in conjunction with imaging and test results (*Mean (SD)*= 2.38 (1.67)).
2. Advocate discharge as the default position unless using guidelines where the benefits of admission are established as outweighing the risks (*Mean (SD)*= 3.69 (1.66)).
3. Clinical decision units and/or observation units are available, with sufficient bed space (*SD*)= 3.644 (1.55)).

Importance ratings for two intervention functions were significantly different between experts with ten or more years' experience of working in an adult ED and experts with less than ten years' experience of working in an adult ED. The intervention function regarding clinical decision units and/or observation units being available for ED patients had the greatest

variation according to clinical experience. No doctors in the greater experience group considered this an important function for UT interventions, while all doctors in the lower experience group rated this important ( $\chi^2=16$ ,  $p<.001$ ). Working with legal advisors to better understand the medico-legal aspects of clinical decision-making was also significantly different between experience groups, with less experienced doctors considering this significantly more important than doctors in the greater experience group ( $\chi^2=4.27$ ,  $p=.04$ ). Reaching near significance in the difference between experience groups, was the intervention function suggesting trainees should receive more feedback on their admission and discharge metrics which includes patient outcomes ( $\chi^2=2.65$ ,  $p=.10$ ). Doctors with less experience considered this more important than doctors with more experience (see Figure 5.4).

**Table 5.5**

*Descriptive statistics for importance ratings and extent of agreement with items in e-Delphi survey.*

Item	Mode	M (SD)	% agree	Consensus established (round)
Importance ratings for UT interventions focused on the following patient presentations.				
Abdominal pain	5	4.56 (0.51)	100%	Yes (2)
Headache	4	4.13 (0.81)	87.6%	Yes (2)
Chest pain	5	4.39 (0.99)	87%	Yes (1)
Syncope*	4	4 (0.82)	81.3%	Yes (2)
Breathlessness*	4	3.75 (1.06)	75.1%	Yes (2)
Mental health concerns	5	3.81 (1.42)	68.8%	Near

Fever	4	3.75 (1)	62.5%	No
Pregnancy*	4	3.69 (1.49)	62.5%	No
Head injury*	4	3.44 (1.46)	62.5%	No
Vertigo*	4	4.06 (0.93)	62.5%	No
Low back pain*	4	3.56 (1.21)	56.3%	No
Seizures*	4	3.06 (1.29)	50%	No
Intoxicated*	3 and 4	3.38 (1.26)	50%	No
Older patients	3	3.5 (1.26)	50%	No
Weakness*	3	3.31 (1.08)	43.8%	No
Paraesthesia*	3	2.94 (1.29)	31.3%	No
Skin conditions*	1, 2 and 3	2.56 (1.26)	25%	No

Vomiting*	3	2.94 (0.93)	18.8%	No
Importance ratings for potential areas of focus for interventions aiming to enhance UT.				
Teach doctors to communicate uncertainty, equipping them with phrases and skills to apply when discharging patients.	5	4.91 (0.29)	100%	Yes (1)
Senior doctors are available to consult at all times.	5	4.87 (0.34)	100%	Yes (1)
Encourage trainees to discuss why a decision was made, rather than what decision was made.	5	4.70 (0.47)	100%	Yes (1)
Patients clearly understand any discharge instructions given.	5	4.74 (0.54)	95.7%	Yes (1)
Ensure trainees have adequate and appropriate clinical exposure which includes a range of patient acuity and complexity.	5	4.65 (0.57)	95.7%	Yes (1)
Culture within the ED team promotes psychological safety and facilitates an awareness that decisions can be made as a team.	5	4.61 (0.58)	95.7%	Yes (1)

Doctors are aware of the patient's own tolerance for risk and uncertainty.	5	4.63 (0.81)	93.8%	Yes (2)
Help trainees distinguish situations where anxiety is developmentally appropriate (e.g. they're anxious because they are being challenged and they should interpret this anxiety as a signal to ask for help from colleagues) and where it is a maladaptive and unnecessary response to uncertainty.	5	4.5 (0.63)	93.8%	Yes (2)
Support trainees when they perceive a mismatch between their own interpretation of a situation and the interpretations of others on the care team. For example, providing doctors with strategies to respond to uncertainty which comes from other doctors having a different opinion to them on how to manage a patient.	5	4.69 (0.60)	93.8%	Yes (2)
Encourage trainees to reflect on their own personal risk thresholds and the factors which influenced risk-averse decisions they have made.	5	4.44 (0.63)	93.8%	Yes (2)

Prompt doctors to consider whether further medical investigations would have an impact on the certainty of any diagnostic impressions.	5	4.39 (0.94)	91.3%	Yes (1)
Support trainees' growth toward independent practice, encouraging them to gather and filter cues towards judgement that they can trust and respond to.	5	4.65 (0.65)	91.3%	Yes (1)
Patients are aware of the limitations of testing and further medical investigation and, after considering the risks and benefits of potential management options, support the decision to discharge.	5	4.48 (0.67)	91.3%	Yes (1)
Address areas of uncertainty for trainees more directly during clinical supervision.	5	4.39 (0.66)	91.3%	Yes (1)
Services (e.g. ambulance, 111, GP, hospital, social care) are better integrated, making reasons for attendance and options for care outside of hospital clearer.	5	4.81 (0.83)	87.5%	Yes (2)

The ability of the primary care system to act as a reliable mechanism for follow-up is improved.*	5	4.44 (1.09)	87.5%	Yes (2)
Equip doctors with the skills to effectively reflect on their own practice in a way which promotes pattern recognition over time.	4 and 5	4.19 (1.05)	87.5%	Yes (2)
Help trainees to respond to their anxiety around discharging patients in ways other than over-testing or admitting patients.	5	4.26 (0.92)	87%	Yes (1)
Focus on developing an acceptance that practice does not need to be about completely eliminating uncertainty, but more about considering which risks are appropriate to take.	5	4.52 (0.90)	82.6%	Yes (1)
Patients and families do not view uncertainty as a weakness in a doctor's abilities.	5	4.48 (1.04)	82.6%	Yes (1)
Doctors are supported by highly sensitive and reliable guidelines and decision rules advocating no medical intervention for low-risk patients.	5	4.26 (1.10)	82.6%	Yes (1)



When responsibility increases and doctors become senior decision makers, they receive training on uncertainty tolerance to build confidence.	5	4.26 (1.01)	82.6%	Yes (1)
Follow-up care, including community discharge teams and specialist care pathways, are more readily, and consistently, available.	5	4.17 (1.54)	82.6%	Yes (1)
Doctors are more aware of safety netting strategies they can utilise.	5	4.22 (0.10)	82.6%	Yes (1)
Recognise that trainees may struggle to establish the legitimacy of their own clinical judgement and help them validate their judgements.	4	4.35 (0.78)	82.6%	Yes (1)
Encourage doctors to explore how guidelines provide a framework, not a manual, of care.	4	4.09 (0.95)	82.6%	Yes (1)
Expose trainees to more case studies where unnecessary admission and over-testing contributed to adverse patient outcomes.	5	4.31 (0.79)	81.3%	Yes (2)
Strategies are in place to protect against or recover from decision fatigue during shifts.	5	4.65 (0.93)	78.3%	Yes (1)

Train doctors to acknowledge uncertainty and identify what cues to act upon in uncertain situations.	5	4.78 (0.80)	78.3%	Yes (1)
Involve junior doctors in the creation of medical education and training modules so that they reflect their lived experience and guides them on what to do if they are uncertain e.g. when to involve a senior.	5	4.22 (1.0)	78.3%	Yes (1)
Give trainees more feedback on their admission and discharge metrics which includes patient outcomes so doctors can understand whether patients benefitted from their decisions.	5	4.04 (1.33)	78.3%	Yes (1)
Doctors and patients have a greater awareness of the inevitability of uncertainty and the benefits of diagnosis with unknown aetiology, rather than premature closure.	4	4.35 (0.93)	78.3%	Yes (1)
Place more emphasis on how to incorporate a patient's preferences, values and goals into the consideration of risks and benefits of various outcomes to establish the approach most appropriate for them.	4	3.96 (0.88)	78.3%	Yes (1)

Seniors are supported and challenged to be less judgemental of catastrophic patient outcomes in the ED.*	4	4.5 (1.21)	75%	Yes (2)
Specialist doctors in the hospital, outside of the ED (e.g. intensivists and anaesthetists), are less judgemental of adverse events in the ED.*	5	4.13 (1.36)	75%	Yes (2)
Advocate discharge as the default position unless using guidelines where the benefits of admission are established as outweighing the risks.	5	3.69 (1.66)	75%	Yes (2)
Following involvement in an adverse event, individual doctors receive training on uncertainty tolerance to build confidence.	4 and 5	3.81 (1.38)	75%	Yes (2)
Practice guidelines place more emphasis on whether the care a patient needs can be provided only via hospital admission or elsewhere.	4	3.63 (1.41)	75%	Yes (2)
Encourage use of the space provided in the ED medical notes for free text, where the doctor can describe their clinical reasoning leading to discharge (e.g. when clinical evidence is low).	5	4.19 (1.33)	68.8%	Near

Teach doctors classifications (e.g. low/medium/high) or percentages of the initial probability and likelihood of diseases and prompt them to refine their understanding of these probabilities and likelihoods based on the patients they have seen in their career.	5	3.94 (1.24)	68.8%	Near
Encourage strategies for weighing the risks and benefits of various interventions, rather than learning, and strictly adhering to, specific patient management pathways.	5	3.94 (1.24)	68.8%	Near
Clinical decision rules emphasise the expectation of ED is to only manage the presenting complaint and pathways are improved to manage uncertainty relating to anything else.	5	4.06 (1.24)	68.8%	Near
When returning to the ED after a mandatory training year in anaesthetics and ICU, doctors receive training on uncertainty tolerance to build confidence.	5	4.13 (1.20)	68.8%	Near

Disseminate guidelines which give example clinical scenarios in which there are multiple plausible, and satisfactory, patient management approaches. Each of which are equally valid.	4	3.88 (1.09)	68.8%	Near
Work with legal advisors to better understand the medico-legal aspects of decision-making by individual doctors. For example, better defining the liability of doctors and organisations when a patient is discharged who, at the time, was considered to have a very low likelihood of catastrophic outcomes.	5	3.75 (1.39)	62.5%	No
Encourage doctors to give non-medical factors (e.g. the emotional burden to patients and societal costs of resource use) more consideration when advocating admission or discharge.	5	3.94 (1.12)	62.5%	No
Encourage doctors to consider if an uncertainty management approach is appropriate by considering the source and reducibility of the uncertainty they face and use this to inform patient management (e.g. is it uncertainty	4	3.75 (1.18)	62.5%	No

which could be associated with misdiagnosis and require more resource use or is it just lack of knowledge or misinterpreted information?).

Use of testing and imaging, for which evidence suggests can reduce admission rates by ruling out serious diagnoses, is encouraged.	5	3.69 (1.35)	56.3%	No
Clinical decision units and/or observation units are available, with sufficient bed space.	5	3.44 (1.55)	50%	No
Patients who are still experiencing uncertainty after discharge are identified and receive a post-discharge follow-up.	4	3.19 (1.28)	50%	No
Guidelines acknowledge doctors' level of confidence in their own clinical judgement and only advocate rigid adherence to them when doctors are low in confidence.	4	3.06 (1.44)	43.8%	No
Specialist opinion (e.g. from surgeons) is obtained before or in conjunction with imaging and test results.	1	2.38 (1.67)	31.3%	No

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Notes.

*Importance was rated on a scale of 1= not at all important; 2= slightly important; 3= somewhat important; 4= fairly important; 5= very important.*

*M= Mean; SD= standard deviation.*

*The column 'percentage agree' presents the percentage of experts choosing 'very important' or 'fairly important.'*

*The consensus threshold for inclusion was set at 75% agreement for 'very' or 'fairly important.' 'Near' consensus is defined as items which would have been included should one more expert have agreed with the item.*

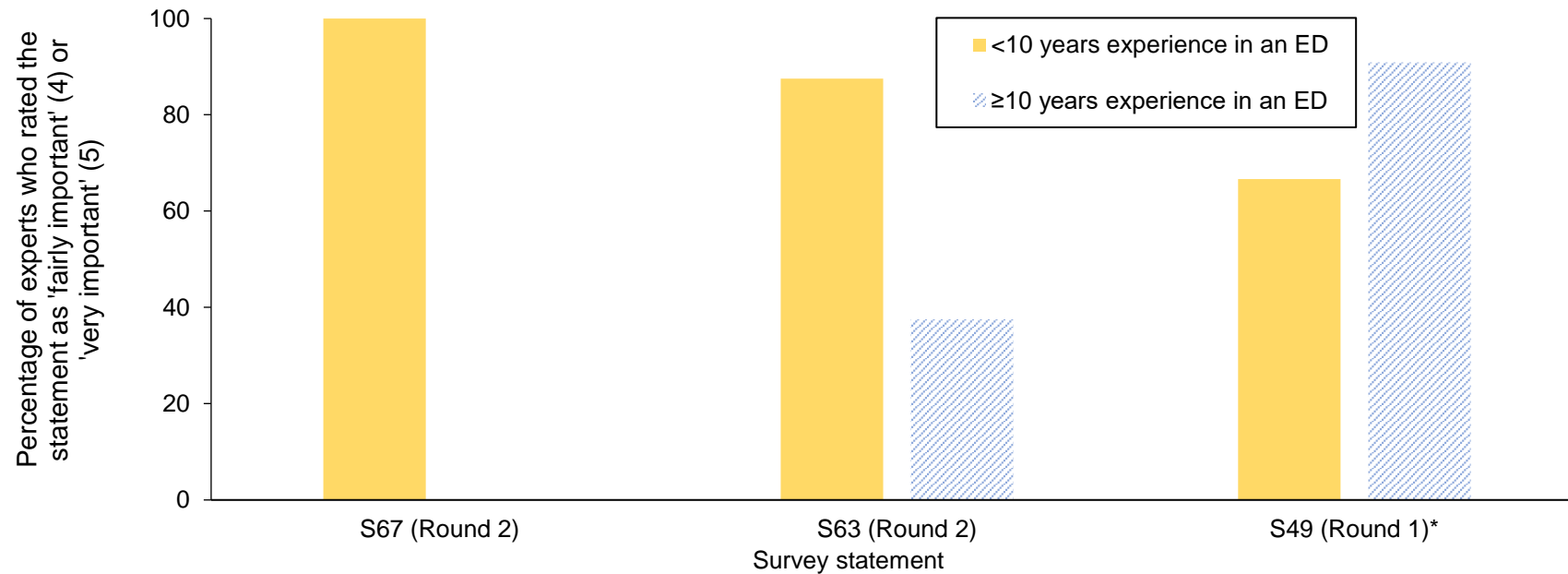
*Items are grouped into a) presenting complaints and b) focus for initiatives and are presented in descending order of consensus within these groups.*

*There were 23 experts in round 1 and 16 experts in round 2.*

*An asterisk (\*) indicates a new item suggested by experts in round 1 and therefore only shown in round 2.*

**Figure 5.4**

Survey statements with significant differences in agreement according to years of experience in an ED.



*Note.* S67. Clinical decision units and/or observation units are available, with sufficient bed space; S63. Work with legal advisors to better understand the medico-legal aspects of decision-making by individual doctors. For example, better defining the liability of doctors and organisations when a patient is discharged who, at the time, was considered to have a very low likelihood of catastrophic outcomes; S49. Give trainees more feedback on their admission and discharge metrics which includes patient outcomes so doctors can understand whether patients benefitted from their decisions.



### 5.5.2.2 Sensitivity analysis

As shown in table 5.5, when the consensus threshold was reduced to  $\geq 70\%$ , no further statements reached consensus as being important clinical focuses or functions of UT interventions. This is due to a smaller expert panel in round 2 ( $n= 16$ ) than in round 1 ( $n= 23$ ) resulting in the difference between one expert rating an item as 3 or 4 changing the consensus from 68.8% to 75% in round 2. Reducing the consensus threshold to  $\geq 65\%$  added an additional expert's responses to high ratings of importance (4-5 on the Likert scale) and this resulted in one clinical focus (mental health concerns) and six intervention functions being added to the list of important focuses. These are labelled in table 5.5 as 'near' consensus.

### 5.5.2.3 Inductive content analysis

Free-text comments accompanying ratings for clinical presentations that UT interventions could focus on are now presented. 57 comments accompanied high importance ratings (4-5 on the Likert scale) and 22 comments rationalised lower importance ratings (1-3 on the Likert scale). Inductive content analysis generated seven categories rationalising where, clinically, UT interventions should focus, which are now discussed.

#### **Alignment with existing intervention functions**

Experts rated the importance of UT interventions focused on chest pain and abdominal pain highly due to corroborating where existing decision tools and support are focused. This included additional guidance issued by professional bodies.

*'Chest pain and abdominal pain are the "big ticket" items...as is reflected by RCEM rules on discharge discussions with seniors for certain patients in these groups.'* (P13)

In contrast, when an intervention function was considered to contradict a successfully implemented intervention, experts cautioned of the difficulty in changing behaviour and subsequently rated the clinical focus less important. One expert raised this point relevant to sepsis.

*'[Think Sepsis campaign] has completely skewed risk stratification of this. Anything contradicting...is unlikely to be successful even if evidence-based'*. (P9)

### **Sufficiency of existing management tools and strategies**

Experts who rated headache, syncope, and mental health concerns as important focuses for UT interventions did so due to the inability of existing strategies and interventions to support doctors to tolerate uncertainty sufficiently. Despite being able to draw on existing support (e.g., safety netting strategies and decision tools) confidently, discharging those patients was still considered *'uncomfortable'* (P4).

*'The unpredictability of mental illness results in... safety netting advice...not possible/will not be followed'*. (P23)

On the other hand, some experts considered existing interventions (including robust clinical pathways, risk stratification tools, NICE guidelines) as sufficient facilitating discharge for patients presenting with chest pain, a head injury, and seizures.

*'Everywhere I have worked, there has been a well-established pathway in conjunction with other specialties for the appropriate and timely investigation, but not over-investigation, of seizures.'* (P11)

### **Perception of current UT levels associated with presentation.**

Often, clinical presentations were rated highly as important focuses for UT interventions due to a perception of general risk aversion among emergency medicine doctors associated with this presentation. This included a perception that patients presenting with chest pain are exposed to *'unnecessary intervention'* (P17), and patients with abdominal pain are *'incorrectly risk stratified and unnecessarily admitted'* (P9). This was linked by one expert to the uncertainty associated with such presentations driving high error rates and subsequently a *'positive feedback loop of less risky decision-making'* (P8). Positive outcomes of enhancing UT for certain presentations associated with clinician-patient interactions and system pressures also contributed to higher importance ratings. One expert discussed this regarding head injuries.

*'There has been...a creep in...minor head injury investigation...with a tendency to over investigate. This results from intolerance of uncertainty, or perhaps perceived risk of inaction but can also lead to a misplaced confidence on the back of early 'normal' neuroimaging and discharge. Increasing tolerance of uncertainty...improve patient-clinician communication.'* (P18)

Conversely, where experts considered ED doctors to be generally risk-tolerant regarding certain cases, importance ratings were lower.

*'Doctors are better at overtly risk stratifying patients with abdominal pain and inherent in that is accepting some risk.'* (P11)

### **Uncertainty associated with the clinical presentation.**

Free-text comments rationalising importance ratings most often referred to the level of uncertainty associated with a clinical presentation. This included clinical presentations for which:

- 1) Clinical investigations were considered: *'unhelpful'* (P7) in reducing ambiguity.
- 2) Progression was unpredictable (e.g. *'[chest pain] has the widest spectrum of both potential acuity and severity'* (P22))
- 3) There was a potential for *'long-term complications or death'* (P21)
- 4) A diagnosis in ED *'often not found'* (P18) and so uncertainty persists post-disposition decision.

These rationales were mostly associated with chest pain and abdominal pain.

On the other hand, UT interventions designed to focus on presenting complaints experts considered to have more certainty associated with them, were rated lower in importance. This was the case when ED doctors perceived specialist teams (e.g. mental health teams) to have responsibility for the uncertainty associated with a presentation. This meant tolerating the associated uncertainty was *'not a priority for ED doctors'* (P9). In contrast to uncertain clinical presentations where diagnoses are often not established in the ED, intoxicated patients were rated low importance as a focus of UT interventions as patients *'almost always resolve simply with time i.e., they sober up'* (P11), reducing uncertainty at discharge. When *'catastrophic outcomes'* (P11) were not considered a potential, (e.g., skin conditions), importance ratings were also lower.

### **Exposure to presentation in the ED**

The frequency with which clinical presentations are encountered by ED doctors was also cited as a rationale for importance ratings. High importance ratings were rationalised for chest pain and abdominal pain by five experts because they are, '*extremely common presentations*' (P1). Meanwhile, UT interventions for presentations perceived to be '*seldom seen in ED*' (P1) were rated lower in importance, including suggestions from experts in round 1: skin conditions and pregnancy complications.

### **Appropriateness of UT intervention.**

The final category rationalising importance ratings of clinical focuses for UT interventions, included free-text comments suggesting that enhancing UT could have significant positive outcomes, such as avoiding admissions or unnecessary tests (high importance ratings).

*'There can be a tendency to over-admit or investigate older patients due to factors such as frailty and social care needs, rather than uncertain...diagnoses...Tolerating a bit more uncertainty may benefit the patient and wider health system.'* (P16)

Conversely, when UT was not considered the most important construct or skill to focus on for a particular presentation, importance ratings were lower.

*'With low back pain...it is usually fairly clear cut...who needs...imaging and who does not. The challenge...isn't really uncertainty, its communication.'* (P16)

Importantly, four experts considered designing UT interventions with a specific clinical presentation inappropriate. Instead, these experts rated all clinical focuses equally as important and used free-text comments to explain that all patients presenting to the ED pose a level of uncertainty that requires tolerance. In doing so, experts advocated for interventions that enhance UT as

a psychological construct generally in doctors, influencing responses to all uncertain decision-making.

*'Whatever the presenting issue...you can find a catastrophic outcome for most of them. It's the overall ability to tolerate uncertainty in all of them that is important...you need to be able to live with your decisions for each one.'* (P20)

### **5.5.3 Ranking task**

38 intervention functions reached consensus as being important for UT interventions. These functions mapped onto coping mechanisms influencing responses to uncertainty already highlighted by the model developed throughout this thesis. For example, three of the functions were about guidelines and decision rules supporting decisions traditionally considered to reflect high UT (e.g. when a discharge decision could mitigate the risks associated with admission). They are deliverable in a complex intervention with one function (i.e., enabling rule-based decision-making as a coping mechanism in a way which promotes UT) and were therefore, grouped into intervention package 3 (see table 5.5).

Eleven of the 16 experts who completed both rounds of the e-Delphi survey specified three intervention packages they perceived could have the most positive influence on UT. Experts were asked to reflect on cognitive, emotional, and behavioural responses to uncertainty identified throughout this thesis and the Hillen et al. (2017) model of UT when making this decision. They were shown statements to support this reflecting high UT (e.g., this would empower doctors to discuss uncertainty transparently; doctors would feel less stressed and overwhelmed when making uncertain discharge decisions; doctors would

defer less uncertain decisions). Table 5.6. shows how many times each intervention package was prioritised by experts.

**Table 5.6**

*Number of experts who ranked each intervention package the highest priority (1), second highest priority (2) and third highest priority (3).*

Intervention package in order of priority	Priority		
	1	2	3
8) Uncertainty is highlighted as an inevitable component of emergency medicine in education and training, with appropriate coping mechanisms taught to doctors.	4	1	3
1) Support doctors to make admission and discharge decisions that incorporate the patient's own tolerance of uncertainty, patient preference and patient goals.	2	2	1
4) Doctors are supported within their team when making uncertain decisions.	2	1	3
2) Service users share the decision, and associated uncertainty, with the doctor.	0	4	1
5) Alternatives to admission and discharge (e.g. follow-up care) are available and efficient.	2	0	2
6) Doctors and patients are aware of the risks associated with an admission which a decision to discharge can mitigate.	0	2	0

- |   |   |   |   |
|---|---|---|---|
| 3) Doctors are supported by guidelines that highlight situations in which an admission may not be beneficial. | 0 | 1 | 0 |
| 7) Doctors are aware of, and can reflect on, the way they respond to uncertainty.                             | 1 | 0 | 1 |

An intervention package was awarded three points each time an expert rated it as priority 1, two points for priority 2, and one point for priority 3. Consequently, intervention package eight was the highest priority (with 17 points), followed by intervention package one and intervention package four (with 11 points each). Intervention package two received 10 points, and four experts commented that it served a similar purpose to intervention package one. Consequently, these intervention packages are considered together throughout the rest of this thesis.

Experts were asked to indicate the extent to which the goal of intervention packages they prioritised has already been achieved in UK EDs. No expert considered any of the intervention goals as being met sufficiently. For the highest priority intervention, five experts (62.5% of those who prioritised it) said they were not aware of any existing efforts made to achieve this goal and three (37.5%) reported some efforts, but with room for improvement. Most of the experts prioritising the second, third and fourth highest ranked interventions said they were aware of some efforts to achieve this function, but there is room for improvement.

Experts were asked which of the outcomes associated with high UT identified throughout this thesis, they perceived each intervention could be associated with (e.g., burnout rates among ED doctors, reduced avoidable admissions,



improved patient satisfaction). Highlighting uncertainty as inevitable in emergency medicine education and training (intervention 8), with coping mechanisms included in education and training, was considered to improve ED doctors' job satisfaction, reduce burnout rates, and increase transparency in the patient-clinician encounter, building trust among patients. Perceived outcomes of other prioritised interventions did not encompass staff and service user experience in the same way, with functions associated with shared decision-making (interventions 1 and 2) perceived to trigger more patient-focused outcomes, and functions associated with ED team culture (intervention 4) perceived to elicit more doctor-focused outcomes.

## **5.6 Discussion**

### **5.6.1 Key findings**

This is the first published study (to my knowledge) that has established consensus among experts on the functions of UT interventions in any clinical context. Importantly, experts advocated for UT interventions in an education and training context, that enhance UT as a general work-trait, rather than interventions focused on specific decisions (e.g., disposition decisions for patient with chest pain).

### **5.6.2 Strengths and limitations**

A strength of this study was the considerable expertise and wisdom of the expert panel in relation to tolerating uncertainty in an ED (Trevelyan et al., 2015), with diversity in gender, geographical location, and years of clinical experience. The expert views gathered in this study therefore include variation in skill-level and NHS trust experts have worked in, reducing the likelihood of

contextual factors specific to one ED team reducing the generalisability of findings in the UK (Forster and Von der Gracht, 2014).

Another strength of this study is the appropriateness of methods for addressing the research aims. While there is debate around consensus, and the arbitrary cut-offs across several Delphi rounds are debated (Boulkedid et al., 2011; Von der Gracht, 2012), the intention of this chapter was to highlight particularly important intervention functions for UT. The intention was not to produce a comprehensive list of guidance to be rigidly followed by clinicians. The study was successful in collating expert views on evidence-based suggestions for the function of UT interventions in an ED context.

A potential limitation for the study is that to reduce participant burden, the e-Delphi survey included only two rounds, rather than continuing until consensus was established that a statement is important or not important. Terminating a Delphi study based on the number of rounds, may lead to invalid results (Schmidt, 1997). In a few cases, variation in importance ratings increased, rather than consensus being approached across rounds (see appendix 5.3). A complex phenomenon such as UT, potentially requires additional rounds to establish consensus. To mitigate this, it is important to acknowledge that no presenting complaint or intervention function reached the consensus threshold as not being important and not to discount those near to the consensus threshold.

Despite no significant difference, experts who only completed the first round of the Delphi survey, did score statements lower on average than experts completing both rounds suggesting slightly less intervention functions and clinical presentations would have reached consensus as being important with a 100% retention rate. As previously discussed, while the results of this study are

not intended to rigidly prescribe and discount certain UT intervention functions, it is important to acknowledge the small sample size of 16 experts in the Delphi survey across both rounds. This results in the adjustment of one or two experts' views, having an impact on whether a statement reached the consensus threshold.

Given the complexity of UT as a psychological construct, the option to rationalise ratings in free-text comments was important. Making this optional for participants, was to minimise burden in an already long survey. However, in some cases no qualitative data was provided by an expert, making it difficult to ascertain if low importance ratings were based on concerns for feasibility, or expected influence on UT.

The decision to use a 5-point Likert scale to indicate importance was based on feedback from experts when piloting the survey. While this limitation would need to be considered with any scale, it is important to acknowledge evidence that reports different amounts of e-Delphi survey statements reaching consensus thresholds depending on the Likert scale points (3, 5 or 9) (Barrios et al., 2021). This potentially warrants further research where the same intervention functions are rated, but with a different number of Likert scale points.

While the expert panel had strengths in diversity of experience, location and gender, most participants were White, with just two people identifying as South Asian. Despite efforts to recruit experts identifying as Black, African, Caribbean or Black British, none were recruited. While existing research measuring trait intolerance of uncertainty suggests no differences between Black and White individuals, in a quantitative study exploring trait UT and symptoms of common

mental disorders, Sadeh and Bounoua (2023) suggest an aversion to uncertainty (consistent with low UT) in Black community members, is a stronger predictor of mental health symptoms than it is for White community members. This suggests it is possible that Black experts may have prioritised intervention functions believed to influence wellbeing to a greater extent than White experts did, and this reinforces the importance of acknowledging Black expert's views on this topic.

### **5.6.3 Conclusion**

Experts in this consensus exercise and prioritisation task identified intervention functions for future intervention developers to build upon. Prioritised interventions were perceived to have positive outcomes for both staff wellbeing and patient safety. Despite experts in the survey indicating they were not aware of existing efforts aligned with the interventions they prioritised, there is a wider literature on UT in medical education, shared decision-making, patient involvement in patient safety, and psychological safety that can be drawn upon to develop interventions aligned with the preferences of ED doctors.

Intervention functions considered to have the greatest potential for enhancing UT for ED doctors, were those that developed UT as a skill and were based on learning from how senior doctors have developed UT throughout their career, highlighted in the previous chapter. There was a preference for UT interventions that developed UT as a trait, influencing all uncertain decision-making in the ED, compared to those that allow uncertainty to be better tolerated in a particular state. We cannot however conclude that such UT interventions would develop UT as a trait outside of decisions made at work (e.g., financial decisions), due to the contextual focus of this thesis on patient management

decisions in the ED. Focusing on UT as a trait at work, is comparable to the conceptualisation of professional behaviours and competencies defined by the General Medical Council (2018) as essential for good practice, and those considered by the public as valuable traits of a doctor, including the ability to listen and patience (Grundnig et al., 2022).

## Chapter 6

### General Discussion

#### 6.1 Chapter summary

This chapter provides an overview of the five thesis objectives introduced in chapter 1 and reflects on how studies in this thesis have addressed them. Key findings are summarised and considered in the context of wider literature and a theoretical understanding of UT as a construct in an ED context is presented. Mechanisms for the dissemination of research findings from this thesis are presented before implications for policy and practice are highlighted, limitations of this thesis and potential opportunities for future research and intervention development are considered.

#### 6.2 Research questions and summary of key findings

Previous research has associated low UT amongst doctors of multiple specialities with higher burnout rates, increased referral and admission rates and excessive test-ordering (Allman et al., 1985; Lawton et al., 2019; Pines et al., 2009; 2010; Ringberg et al., 2014). Evidence suggests that this is because doctors with lower UT have increased fear of missing low probability diagnoses and this fear drives risk-averse decision-making, rather than consideration of available evidence. Admission decisions driven by excessive caution may expose patients to the risks of being in hospital, such as healthcare associated infection and immune system dysregulation, without benefit (Goldwater et al., 2018; Guest et al., 2019).

It is no surprise then, that the most recent guidance from the General Medical Council (2018) requires graduating doctors to, '*recognise complexity and uncertainty*' (p. 11), '*manage the personal and emotional challenges of coping*

*with...uncertainty*' (p. 10) and *'learn to develop confidence in managing these situations'* (p. 11). Despite this, no interventions with the specific aim of supporting ED doctors to tolerate uncertainty associated with admission and discharge decisions have been implemented in the ED. In response to this evidence gap, this thesis sought to contribute to the development of interventions that enhance the UT of ED doctors by identifying potential functions of UT interventions in an ED context. Consequently, this research was guided by the following objectives:

1. To understand how uncertainty in the ED is responded to and establish what factors influence this.
2. To identify individual-level outcomes (patient-centred and staff-centred) and organisational-level outcomes of clinical uncertainty and how it is tolerated.
3. To assess whether existing interventions and tools used to manage uncertainty in the ED are contributing to enhanced UT.
4. To apply empirical findings to shape existing UT theory within the context of ED disposition decisions.
5. To establish consensus on, and prioritise future interventions aiming to enhance UT in the ED.

The key findings of each chapter and how they relate to these objectives will now be discussed in turn. Section 6.4 later in this chapter, summarises the responses to uncertainty in the ED, any factors that influence such responses and outcomes of these responses to uncertainty in the ED reported across existing evidence and throughout this thesis.

### **6.2.1 Chapter 2 – Key findings from the scoping review**

Existing literature in this context identified outcomes of UT associated with the quality of patient care, wellbeing of ED doctors and patient experience of care. Importantly, the review also identified no impact of higher UT among ED doctors on patient safety, with no adverse events associated with discharge decisions made by risk-tolerant doctors (Budworth et al., unpublished; Pearson et al., 1995). This rationalises the development of UT interventions in an ED context.

A considerable number of the existing studies on uncertainty in the ED have concentrated on progressing understanding of how uncertainty manifests and influences patient management decisions in the ED. More limited attention has been devoted to interventions to make such influence positive. Furthermore, most existing interventions supporting ED doctors to manage uncertainty have focused on reducing doctors' uncertainty relevant to one clinical presentation (e.g., Ahn et al., 2017; Hess et al., 2016; 2017; 2018 O'Sullivan et al., 2013), with only one intervention identified measuring a change in a response to uncertainty (McCarthy et al., 2020). To advance the understanding of where UT interventions in an ED context should focus, UT theory (Hillen et al., 2017) can inform approaches to understanding decision-making in an ED context, to highlight contextual factors and responses to uncertainty that could be the focus of UT interventions.

### **6.2.2 Chapter 3- Key findings from the public survey and PPIE**

Involvement of the general public in this research has highlighted public acknowledgement and advocacy of the need for ED doctors who are confident in managing uncertainty, particularly in using patient-facing techniques to do so, such as safety netting with patients. This was supported in the survey study



where most participants advocated for implicit communication of uncertainty, with the doctor highlighting potential diagnoses, rather than explicit communication of uncertainty (e.g. 'I don't know), implicit communication with only the most likely diagnosis highlighted, or no communication of uncertainty. Furthermore, participants expressed strong preference for sharing the decision to be admitted or discharged with ED doctors. Generally, it was evident that for patients to feel satisfied with the care they receive, they require transparency in the communication of uncertainty.

However, this came with certain considerations. Stakeholder engagement highlighted that some patients may experience anxiety when told by a doctor that they are uncertain. This was supported by the survey study, where 17.3% of participants expressed a preference for no communication of uncertainty from the ED doctor. A preference for no communication of uncertainty was higher among older participants and those educated below degree-level. Similarly, people without a degree preferred lower levels of involvement in the decision-making process than those with a degree. This highlights an important finding, that while the call for shared decision-making and transparent communication across the clinical literature is valid and in line with patient preference, researchers and doctors must consider the potential inequalities introduced by these strategies and how practice can be in line with the preferences of all patients.

Should shared decision-making become standard practice, the health of those who find it easier to be involved in decision-making (e.g., those with higher health literacy), may be disproportionately increased compared to those who find it more difficult to be involved in decisions. However wider literature suggests that where shared decision-making interventions are tailored to the

needs of groups with lower literacy levels, they have the potential to increase knowledge, reduce decisional conflict and increase preferences for involvement in decision-making among those with lower literacy levels to a greater extent than those with higher (Durand et al., 2014).

### **6.2.3 Chapter 4- Key findings from the interview study with ED doctors**

The ED doctors interviewed in this research expressed a perceived need for interventions that support them to tolerate uncertainty and the potential benefits of enhancing UT for doctor wellbeing, patient safety, and system function. Decisions to admit patients were considered a cautious response to the uncertainty associated with discharging patients, and a mechanism to avoid the negative manifestations of uncertainty that doctors experience following a discharge decision with uncertainty surrounding it (e.g., doubt and anxiety). Doctors highlighted the widespread cultural norms among medical professionals and patients that predominantly promotes risk-averse approaches to patient management and consequently, admission decisions and excessive test-ordering in the face of uncertainty. Doctors perceived this culture to be characterised by an inability to tolerate uncertainty among junior doctors, particularly a lack of acceptance of the inevitability of uncertainty in emergency medicine, compounded by medical education that does not prepare doctors to tolerate risk and uncertainty.

In response to this, ED doctors stressed the importance of opportunities to learn from feedback on decisions made in the ED, observe role models with variable UT, be encouraged to reflect on personal approaches to uncertain decision-making and reduce the expectation of a 'one size fits all' approach to

patient management. Furthermore, doctors stressed the influence of the environment in which they work on the perceived positivity with which they responded to uncertain decision-making. For example, doctors reflected on teams in which they did not feel psychologically safe as hindering the development of their UT. Other contextual influences on UT highlighted across interviews, were high workload, characteristics of the patient and the availability of efficient safety netting structures. Therefore, as well as interventions at an individual-level promoting UT among doctors, doctors also advocated for state-based interventions to enhance UT in the ED.

#### **6.2.4 Chapter 5- Key findings from the e-Delphi survey and ranking task**

Potential intervention functions identified by the research in previous chapters, were presented to experts in a Delphi consensus exercise and ranking task. None of the proposed intervention functions received consensus as being not important, while consensus was reached on the importance of 38 intervention functions to enhance UT. Experts prioritised interventions focused on education and training to promote coping strategies, involvement of service users in uncertain decision-making and ensuring a psychologically safe ED team culture. Regarding clinical focus, there was consensus that UT interventions should focus on the uncertainty associated with chest pain, abdominal pain, headache, syncope, and breathlessness. However, qualitative data revealed a general feeling among experts that UT interventions should not be restricted to a specific clinical presentation and should focus on developing UT among doctors in a way which they can apply to all patient management decisions.

### 6.3 UT interventions in the context of wider literature

The three prioritised areas of focus for UT interventions in the context of discharge decisions in the ED were:

1. Medical education and training to acknowledge uncertainty to a greater extent and promote positive coping strategies.
2. Ensure the skills and context for efficient involvement of patients and families in decision-making.
3. Ensure a psychologically safe team culture which promotes learning.

This is the first study to focus on UT interventions as a mechanism for reducing hospital admissions in an ED context. Generally, interventions to reduce ED pressures have focused on reducing ED utilisation, advocating for stronger community care, better advanced care planning in long-term care services and higher acuity outpatient clinics (Searle et al., 2023; Wadhwa & Duncan, 2018). Findings from this thesis are novel in their focus on individual-level and team-level interventions to influence the decision-making of ED doctors in the face of uncertainty as a means for reducing admissions to hospital.

Doctors highlighted the need for medical education and training to acknowledge uncertainty to a greater extent and promote coping strategies as the key priority for UT interventions. Although not focused on discharge decision-making, or an ED context, Patel et al. (2023) conducted a scoping review of medical education interventions that evaluate their impact on UT. The review concluded that interventions including simulation, reflection, and problem-based learning-based curricula, have reported positive impacts on at least one domain of UT (cognitive, emotional or behavioural) (Patel et al.,

2023). It is important for future intervention development in this field that UT measures are advanced so that researchers focus on advancing UT across multiple domains.

In a recent narrative review, Scott et al. (2023) synthesised strategies for coping with uncertainty across the literature for doctors of all specialties. Strategies include reflection on personal responses, adopting an analytical approach, acceptance of the inevitability of uncertainty, external attribution of uncertainty, anticipating uncertainty, employing safety netting, sharing uncertainty with colleagues and patients and viewing uncertain cases as an opportunity (Scott et al., 2023). Although not specific to ED doctors, UT literature has generally focused on enhancing the positivity of responses to risk-tolerant decisions, as those have more uncertainty and negative manifestations of such uncertainty associated with them. It is therefore no surprise that the strategies synthesised by Scott et al. (2023) reflect the statements in the Delphi consensus exercise in the previous chapter, and those that are summarised in the integrative model in the next section. This thesis has also provided public support for those strategies which are patient-facing, including communication of uncertainty and shared decision-making, in the context of disposition decisions in the ED.

## **6.4 UT theory in an ED context**

This thesis set out to apply empirical findings and wider literature to shape existing UT theory within the context of ED disposition decisions. The Hillen et al. (2017) model of UT provided a useful theoretical foundation that informed research questions, an interview topic guide and analytical coding frameworks throughout this thesis. By acknowledging constructs spanning the source of

uncertainty, moderating factors, and cognitive, emotional and behavioural responses to uncertainty, the Hillen et al. (2017) model provided a more comprehensive, foundational understanding of UT in ED contexts than more narrowly focused decision-making theories could have. For example, the risk as feelings theory suggests risky decision-making is informed by emotions to a greater extent than cognition (Loewenstein et al., 2001). While findings from this research have supported this in part (e.g., where fear was cited as the rationale for excessive information seeking), studies also highlighted the impact of cognitive appraisals, such as anticipated emotions, as driving behaviour and decisional outcomes. By focusing too narrowly on emotional responses to uncertainty, this thesis may not have provided as comprehensive an account of manifestations of uncertainty among ED doctors, or the state and trait-based factors that influence such manifestations.

Figure 6.1 shows an adaptation of the Hillen et al. (2017) model based on the findings reported throughout this thesis. The overarching constructs (sources of uncertainty, cognitive appraisals, emotional responses, behavioural responses, and moderators) are generally the same as Hillen et al. (2017) proposed, with more detailed moderators provided relevant to an ED context. Probability, ambiguity, and complexity provided useful definitions of uncertainty to map findings of this thesis onto, however it was generally difficult to consider them as mutually exclusive constructs. Because decisions in the ED often had more than one source of uncertainty present, it was difficult to ascertain if different sources of uncertainty led to different appraisals of uncertainty and subsequently, decisional outcomes.

The categories of moderating factors proposed by Hillen et al. (2017) generally match those in figure 6.1. However, throughout this thesis,

organisational factors such as wider system pressures and trust-level policies were highlighted as influencing responses to uncertainty. Therefore, an additional category of 'organisational factors' was added. This was likely due to the context of this research being EDs, and the multitude of dependencies the function of this department has with other specialties and health and care services (Edwards, 2018).

The main difficulty in considering the construct of UT through the lens of the Hillen et al. (2017) model, was concerning the breadth of UT and which responses should be considered as constituting UT, as opposed to resulting from it. Hillen et al. (2017) consider decision-making a behavioural response to uncertainty, highlighting decision deferral as the response with opposing valence. In the context of admission and discharge decisions in the ED, decision-making is often risk-averse and therefore not always a positive response. Decision deferral was highlighted by ED doctors as a rationale for admission decisions in a time-pressured environment, and therefore in this situation, decision deferral is a response to uncertainty, and admission is the decisional outcome resulting from it. It made conceptual sense throughout this thesis, to consider patient management decisions a more distal downstream manifestation of uncertainty, and the thoughts, feelings and behaviours that contribute to that decision as constituting an individual doctor's UT.

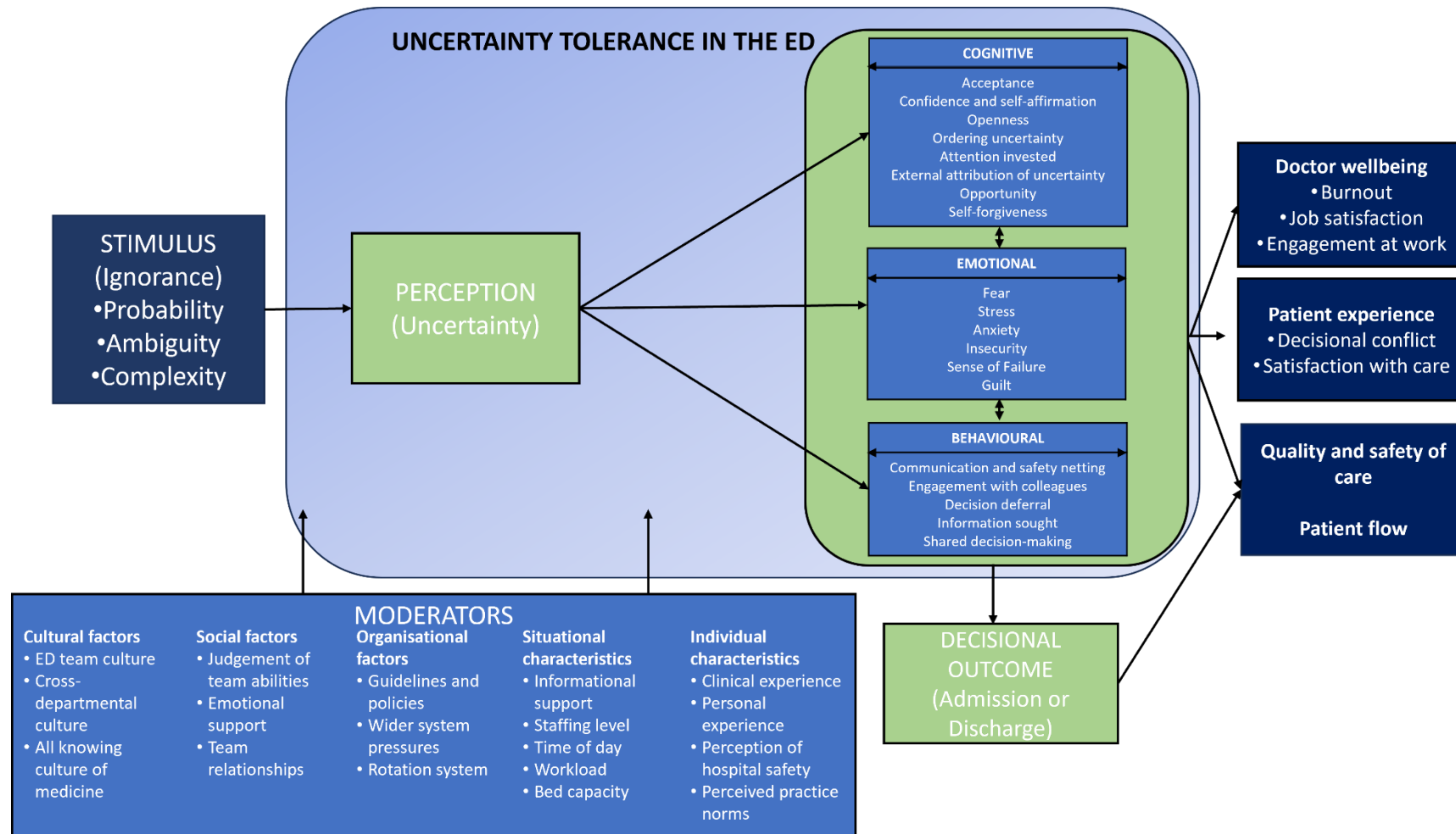
An important reflection of the findings in this thesis was the decision to maintain the double-edged arrows between domains of responses to uncertainty (cognitive, emotional, and behavioural). Responses to uncertainty were not only influenced by trait and state-based moderators but were also the result of other responses. For example, ED doctors highlighted cognitive appraisals of uncertainty that were confident and open, as contributing to

communication of uncertainty with patients. Conversely, where doctors engaged with colleagues about uncertainty (behavioural response), they perceived reduced emotions of fear. Importantly however, no positive emotions were perceived by ED doctors in this research, or reported across the literature, in the face of uncertainty. It was also difficult to assign valence to responses more generally, as often responses considered positive by the Hillen et al. (2017) model (e.g., information seeking), were perceived as over-cautious responses by ED doctors. Therefore, it was more reflective of the experience of ED doctors in this research to consider the extent to which responses were engaged in, rather than assigning a positive or negative valence to such responses, as the valence was considered more contextually specific.



**Figure 6.1**

*Integrative model of uncertainty tolerance in the ED. Adapted from Hillen et al. (2017).*



The final addition to the Hillen et al. (2017) model of UT in the adaptation shown in Figure 6.1, is the inclusion of more distal outcomes, such as burnout among ED doctors and patient satisfaction. The inclusion of outcomes in the model, although not constituting UT, sets out clearly the range of stakeholders who should be interested in the implications for policy and practice of UT among ED doctors. It is also intended to support future researchers to make distinctions more clearly between responses to uncertainty and more distal outcomes.

It is important to express caution that the research informing the detail in Figure 6.1 was conducted exclusively in ED contexts. While the decisions made in maternity settings and general practice are similarly fast-paced and fraught with uncertainty, we cannot conclude from this thesis that the same responses are observed among doctors working in these specialties, or the same contextual factors are having any influence. This is particularly the case for clinical contexts considered to be more protocol-driven than ED (e.g., surgery) (Vincent & Amalberti, 2016).

## **6.5 Research dissemination and plans**

Research presented in this thesis has provided novel findings that advance theoretical awareness of UT and sub-constructs of the psychological construct, as well as contributing to evidence gaps in the emergency medicine literature. The outcomes associated with higher UT identified in this thesis, including the wellbeing of ED doctors and the quality of care received by patients, means the targeted dissemination of evidence to the relevant audience is important for maximising the benefits of this knowledge (National Institute for Health Care and Research, 2022; The United States Agency for Healthcare Research and Quality, 2022). There is also an ethical responsibility to disseminate positive,

inconclusive, or negative research findings, maximising the social value of new knowledge that can shape policy and practice (Ravinetto and Singh, 2022) and allowing those engaged with, and participating, in the research to see the impact of findings.

Academic publication in peer-reviewed journals remains the benchmark dissemination mechanism for researchers (Ravinetto and Singh, 2022). Of the research presented in this thesis, the qualitative, interview study (chapter 4) is currently being rewritten after receiving positive feedback from reviewers at the Emergency Medicine Journal (EMJ). The decision to publish in this journal was informed by discussions with ED doctors, who highlighted EMJ as a frequently accessed source of information. The other three studies will be written up for publication following submission of this thesis, targeting journals with a decision-making focus likely to be accessed by both the scientific community (given the theoretical development throughout this thesis), ED doctors, service users and medical educators.

Peer reviewed publications are often not the most effective mechanism for communicating research findings to those who will maximise benefit from them (Horby, 2022). Findings from this thesis were also disseminated via presentations at conferences, policy working groups and educational interventions for junior doctors. Table 6.1 highlights dissemination of findings from this thesis through approaches other than peer-reviewed publication.

Event	Research	Outcome and audience
NIHR Patient Safety Translational Research Centres (PSTRC) 2021 symposium	A qualitative exploration of how junior doctors and registrars respond to uncertainty in the	Oral presentation to academics

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	Emergency Department and the factors they perceive to influence this.	
NIHR PSTRC PhD Network event 2021	A qualitative exploration of how junior doctors and registrars respond to uncertainty in the Emergency Department and the factors they perceive to influence this.	Oral presentation to academics
Health Services Research UK Conference 2021	A qualitative exploration of how junior doctors and registrars respond to uncertainty in the Emergency Department and the factors they perceive to influence this.	Oral presentation to academics
Knowledge Exchange for electronic clinical reasoning and educational simulation tools (University College London)	Healthcare professionals' and service users' experiences of uncertain diagnoses and patient management in the Emergency Department: a scoping review and narrative synthesis; A qualitative exploration of how junior doctors and registrars respond to uncertainty in the	Oral presentation to GPs, pharmacists and medical educators

	Emergency Department and the factors they perceive to influence this.	
Royal College of Emergency Medicine Sustainable Working Practice Committee meeting	All research in this thesis.	Oral presentation and notes for policy makers in the RCEM interested in wellbeing and retention
Society for Improving Diagnosis in Medicine Conference (Utrecht University Hospital)	Establishing doctors' priorities for interventions to enhance uncertainty tolerance in the context of disposition decisions in the Emergency Department: a modified e-Delphi survey.	Poster presentation
Physician associate undergraduate course (University of Bradford)	All research in this thesis.	Educational sessions
NHS England Enhance programme for foundation doctors (East of England)	Establishing doctors' priorities for interventions to enhance uncertainty tolerance in the context of disposition decisions in the Emergency Department: a modified e-Delphi survey.	Training video and notes provided for the enhance programme for foundation doctors, which enhances generalist skills alongside foundation-year placements

Care Opinion website	The public perspective on how uncertainty is tolerated by ED doctors	Blog post targeted at service users
NIHR PSTRC website	The public perspective on how uncertainty is tolerated by ED doctors	Blog post targeted at academics and service users

## 6.6 Implications for practice and policy

Findings throughout this thesis highlight that low UT among ED doctors can drive decisions to admit patients. It can therefore be proposed that interventions to enhance UT, could improve patient flow through the health and care service by reducing hospital bed capacity and reducing blockage in the ED. This of course, must be supplemented by improved support, and better joined up care including primary medical and community services, which aligns with the commitments set out in the NHS Long Term Plan (NHS England and NHS Improvement, 2019). This would support patients to avoid ED attendances and provide ED doctors with adequate options for patients who require medical attention, but not in a hospital setting.

The Better Care Fund is funding paid by the Department of Health and Social Care (DHSC) to local authorities, pooled with NHS funding, with the objective of providing the right care, at the right place, at the right time. DHSC and the Local Government Association are placing increased emphasis on reducing admissions to hospital, and the often-subsequent long-term care which follows (Harlock et al., 2020). The policy framework for this funding advocates for interventions to reduce delays in discharge to usual places of residence. The findings throughout this thesis highlight that interventions to increase admission avoidance could focus on enhancing the UT of those making such decisions.

It is vital that to achieve reduced admissions to hospital as an outcome of UT interventions, a context is needed in which ED doctors are encouraged to employ clinical judgement and not disciplined for choosing less resource intensive approaches to care where they consider it unnecessary. A just culture whereby learning from errors is encouraged, rather than blaming doctors, is important for promoting this behaviour (van Baarle et al., 2022), as ED doctors in this research highlighted risk-averse practice norms and instilled fear of blame as restricting the development of their UT.

The NHS Long Term Workforce Plan (NHS England, 2023) sets out embedding the right culture and improving retention as a key priority for workforce policy. The findings from this thesis illustrate a strong evidence base for the association between UT and burnout among ED doctors (Budworth et al., unpublished; Strout et al., 2018). The Royal College of Emergency Medicine (RCEM), who have shown interest in the findings of this thesis, are particularly focused on retaining ED doctors, and acknowledge the impact of emotional exhaustion on low retention rates (Daniels et al., 2023). UT interventions should therefore be a consideration for NHS England and RCEM as a mechanism to reduce burnout and consequently improve retention. Investing in the UT of existing ED doctors and subsequently reducing burnout, could also impact future retention rates by reducing staff shortages for other clinicians and consequently improving organisational culture (NHS England, 2023).

A key finding from the interview study in this thesis, was that ED doctors do not feel the medical education they received prepared them to tolerate uncertainty. Given the requirement for graduating doctors to be able to '*manage the personal and emotional challenges of coping with...uncertainty*' (p. 10) (General Medical Council, 2018), medical educators should consult UT

literature in an educational context to consider how to promote UT among medical students and ED doctors in specialty training (e.g. Stephens et al., 2021).

## 6.7 Limitations

Limitations of individual studies have been discussed in-depth within previous chapters. Four overarching limitations relevant to the interpretation of key findings are discussed below.

### 1. Generalisability

The scoping review in chapter 2, summarised international research. However, subsequent studies informed by this review, were restricted to the UK. While the e-Delphi survey reported in chapter 5, did include expert views from across the UK, the qualitative interview study in chapter 4 which informed statements in the e-Delphi survey, was limited to one NHS trust. It is therefore possible that factors other than those identified in this thesis influence the UT of ED doctors, and therefore suggestions for potential intervention functions identified in the previous chapter, are potentially not exhaustive. However, the intervention functions prioritised, provide a useful foundation for researchers to develop UT interventions and are also informed by international research (chapter 2). It is the *form* of the intervention (i.e., the content, delivery, and format) that could be designed with specific contexts in mind (Hill et al., 2020).

### 2. PPIE

The PPIE conducted throughout this research included a combination of consistent collaboration from individuals and groups, and one-off consultation sessions with others. What almost all PPIE in this thesis had in common, was that patient and the public involved, were experts in healthcare research. In the



interest of practicality, as well as the complex nature of UT, existing patient panels and expert groups were consulted. Study design would have benefitted from wider involvement with members of the public who were not research literate. This would have provided the researcher with an opportunity to enhance the diversity of views included in this thesis and not have limited them to those with the literacy level, finances and confidence needed to be a member of such panels.

### 3. The impact of COVID-19

The research discussed throughout this thesis, commenced in October 2019. By February 2020, the COVID-19 pandemic was impacting work practices in the UK. The pandemic placed the NHS under immense pressure, with staff redeployed to meet demand in other specialties and departments (Wyatt et al., 2021), and healthcare professionals working in amplified states of fear, anxiety and exhaustion (Lloyd et al., 2023), reducing the time they had to engage with research. While awaiting governance approval for the face-to-face qualitative, interview study discussed in chapter 4, non-COVID-19 related research was halted to prioritise COVID-19 projects (Wyatt et al., 2021), delaying data collection for studies in this thesis. During a lockdown, an online survey study was conducted with members of the public (chapter 3) to ensure the thesis captured public perspective. In hindsight, a qualitative, interview study with ED patients reflecting that in chapter 4 with ED doctors, would have provided richer insight to patient preference. However, an online study was the safest way to continue this research, and a large sample size was achieved. There has been limited research as to how COVID-19 influenced the UT of ED doctors, however the interview study in chapter 4, which was conducted during the pandemic, highlights sources of uncertainty attributable to the pandemic and some doctors

reflected on only being able to admit life-threatening patients, potentially developing their UT associated with discharge decisions.

#### 4. Use of a single theoretical framework to shape research

The Hillen et al. (2017) model of UT is the most comprehensive model of UT across the literature and for this reason, it was chosen to guide study design and analysis throughout this thesis. However, use of the framework may have limited study design and the scope of findings. For example, there is no existing, validated measure of UT which samples the full spectrum of cognitive, emotional and behavioural responses to uncertainty reflected in the model. This made it difficult to synthesise existing evidence using quantitative measures of UT and made qualitative research difficult to triangulate with quantitative research. Developing a measure that encompasses the full spectrum of UT, is an important step for future research.

Furthermore, in some instances, it was difficult to define the boundaries of sub-constructs of UT. In particular, whether disposition decision-making was a behavioural response to uncertainty aiming to reduce uncertainty or mitigate the consequences of uncertainty, or an outcome of UT following a decision-making process characterised by an individual doctor's UT, was difficult to ascertain. This could have contributed to different interpretations of the same construct across studies with different methodologies.

## **6.8 Future research**

The research in this thesis provides a foundation for future intervention development to build upon and was situated in the 'development' phase of intervention development. Skivington et al. (2021) distinguish intervention development (or identification) from subsequent stages (including feasibility

testing, implementation, and evaluation). Before UT interventions can be tested, implemented, and evaluated, the functions prioritised in this thesis, should form the basis of intervention design considerations. The content, mode of delivery and format of educational interventions, patient involvement tools and team culture initiatives, should be designed in a contextually sensitive way, specific to an ED in which implementation is desired (Esmail et al., 2020; Hill et al., 2020).

Given a lack of existing UT interventions to adapt and learn from, designing the form of prioritised interventions in this thesis would benefit from involvement of end-users, taking a co-designed approach (Slattery et al., 2020). The agents of change for prioritised interventions include medical educators, policy-makers, ED doctors, service users and hospital managers (see appendix 3.3). Co-design workshops could provide an effective, creative space for collaboration between stakeholders, encouraging the consideration of different perspectives in design (Langley et al., 2018). This could potentially reduce research waste, by ensuring interventions have meaningful benefits for all stakeholders and are feasible to deliver from multiple perspectives (Slattery et al., 2020).

## **6.9 Concluding comments**

The research conducted in this thesis identified intervention functions for enhancing the complex psychological construct of UT among ED doctors. ED doctors perceive the need for education to acknowledge uncertainty in a way that promotes positive responses and appraisals among ED doctors as the highest priority. Another priority is for interventions to promote shared decision-making and implicit communication of uncertainty to patients, which this thesis has identified as public preference. Finally, the culture of ED teams should promote psychological safety and learning to encourage positive

responses to uncertainty. While interventions already exist promoting psychological safety in clinical teams, and involvement of patients in management decisions, this thesis has revealed no interventional studies that have evaluated an impact on UT. Given the outcomes of UT identified throughout this thesis, including quality of care, the wellbeing of ED doctors and resource pressures, this thesis rationalises greater research and policy attention devoted to ensuring ED doctors can tolerate uncertainty.

## Table of appendices

### Chapter 1

- 1.1 Researcher notes from shadowing ED doctors

### Chapter 2

- 2.1 Full search strategy
- 2.2 Data extraction form including item definitions
- 2.3 Summary of all studies included in scoping review
- 2.4 PRISMA flowchart rationalising the exclusion of full-text articles

### Chapter 3

- 3.1 Survey including scenario and IUS-12 scale
- 3.2 Participant Information Sheet
- 3.3 Infographic

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- 5.1 Study advertisement poster
- 5.2 Frequency and mode of importance ratings and consensus results for statement in the e-Delphi survey
- 5.3 Evolution of importance ratings across two rounds of the e-Delphi survey

## Appendix 1.1

### Researcher notes from shadowing ED doctors

	Notes
Staffing	<ul style="list-style-type: none"> <li>• Rota is checked by consultant at beginning of morning shift with sickness (related to COVID-19) expressed as concern.</li> <li>• Patients asking researcher for help to go to the toilet and for drinks. No other staff are available to support patients with these tasks. Patients with carers and family are more supported in this sense and healthcare professionals can devote less attention to these tasks.</li> </ul>
Interaction with other services	<ul style="list-style-type: none"> <li>• ED was busy due to GPs working on the COVID-19 vaccine booster programme.</li> <li>• Patients were present with police officers due to the police mental health service being full. A police presence created stress for other patients.</li> <li>• Triage nurses highlight that the NHS 111 service often increases ED attendance for patients with minor concerns.</li> <li>• Triage nurses perceive increased ED attendances on Monday mornings to be related to the UT of GPs who suggest hospital attendance for patients they are concerned about as an excessive measure.</li> <li>• When specialist doctors are busy and can not respond to bleeps from ED doctors, they were often calling back when ED doctor was busy in a consultation.</li> </ul>
Work environment	<ul style="list-style-type: none"> <li>• Handover conducted in the central zone with a station and screen, surrounded by patient bays.</li> <li>• Staff highlight that they need a private room to conduct this handover without distractions but are restricted to computers with software on them that shows patient records, patient length of stay and pressures in each area of the ED.</li> <li>• This location made it difficult for the whole team to hear discussions. Consultants generally only addressed juniors about patients they had managed.</li> <li>• Family members approach healthcare professionals to review patients while they are busy reviewing notes,</li> </ul>

- conducting handovers and communicating with pharmacists and other specialists regarding allergies.
- Clocks have the incorrect time on them.
  - In the green zone (low risk patients), the doctors spend a lot of time locating information across multiple software programmes. There is also no 'Ctrl+F' function on medical records which doctors express desire for and doctors working here are not in close proximity to necessary equipment, spending a lot of time locating equipment such as blood pods from other wards.
- Team culture and psychological safety
- Consultants asked junior doctors to raise any specialist doctors that had acted as barriers to effective patient management.
  - Consultants asked team if they were missing any equipment so they can address it.
  - For one patient who had normal test results, doctors advocated discharge, but nurse was concerned about how the patient looked. Nurse spoke up and expressed a need for doctor examination and admission.
- Learning culture
- In the small staff kitchen, a bulletin board shows teams of staff to co-ordinate education and training timings.
  - Junior doctor approaches consultant to check an X-ray but gives correct diagnosis. Consultant asks junior, 'why did you choose this plan?'
  - Consultants discussed which sections to put junior doctors in for the day on the rota based on how busy sections of ED were and the UT of the doctor. This was discussed with patient flow in mind and not learning opportunities.
- Work preferences
- When discussing the rota, ED doctors expressed preferences to work in the High Dependency Unit or RESUS, rather than the green zone which functions more like a general practice.
- Signalling to healthcare professionals and service users
- Consultants are wearing a different colour of scrubs to other ED doctors.
  - The bays and rooms have infection status on the door.

### Barriers to discharge

- The average length of stay discussed at the morning handover was 5 hours 38 minutes.
- Some patients were waiting for specialists to make decisions (e.g. surgeons in theatre) or awaiting assessments from occupational therapists and mental health teams.
- Social care concerns and awaiting confirmation from friends and family that patient can stay with them.
- Awaiting senior doctors to review uncertain cases.
- All patients are being tested for COVID-19 before being moved.
- Patient with mental health concerns refusing the doctor permission to examine them.
- Social care services unable to support patients with behavioural needs.
- Communication needs (e.g., older patients with confusion and patients with concerning symptoms who cannot speak English).
- Blood sample was lost for one patient.
- Consultant perceived fatigue as a cause of junior doctors on night shift ordering tests for symptoms that were not of concern to senior doctors.

### Responses to uncertainty

- Junior doctors flagged a patient with 'worrying' chest pain symptoms but normal test results (ambiguity) and requested seniors to review the patient.
- Whenever patients are sent home by a triage nurse or doctor in the green zone, they are issued safety netting advice to return or call 111 if symptoms progress.
- Treatment protocols were frequently checked in the green zone (minor cases).

### Sources of uncertainty discussed in team

- A lack of trust in the serious symptoms a patient was describing (ambiguity)
- Junior doctors flagged a patient with 'worrying' chest pain symptoms but normal test results (ambiguity)
- Ambiguity in interpreting test results e.g. D-dimer is raised in pregnancy regardless of other conditions.

### Interactions with patients

- Patients appeared reassured by blood test results and accepting of discharge with test results communicated.



## Patient flow

- Triage nurses with at least two years' experience in an ED categorise patient arrivals. If categorised as minor, patient sent to X-ray, minors or green zone. More concerning cases are triaged to the amber zone or HDU/RESUS. The same day emergency care unit is staffed by GPs and is for patients who are neither categorised as minor nor concerning (e.g. young people with chest pain).
- Triage nurses also decide who needs blood tests (e.g. a patient with foot pain would not need one) and turn away patients who should access other services (e.g. dentistry).

## Appendix 2.1

### Full search strategy (excluding Medline which is in body of thesis)

APA PsycInfo 1806-May Week 2 2020

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- 1 (Emergenc\* ADJ2 (unit\* or room\* or department\* or care\* or medic\* or care or ward\* or treatment\* or health\* or nurs\* or doctor\* or doctor\* or patient\* or clinician\* or registrar\* or intern\*).tw (16995)
- 2 (Urgent ADJ2 (care or medical care or health\*).tw (524)
- 3 (trauma ADJ2 (centre\* or center\* or department\* or unit\* or ward\*).tw (1070)
- 4 (accident ADJ2 emergency).tw (494)
- 5 "A&E".tw (1654)
- 6 'Hospital emergency service'.tw (26)
- 7 ED.tw (18572)
- 8 (ER not ('estrogen receptor' or 'endoplasmic reticulum')).tw (3902)
- 9 Emergency medicine/ (305)
- 10 Emergency services/ (8285)
- 11 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 (41141)
- 12 (Uncertain\* or Doubt\* or indecisi\* or ambigu\* or unpredictab\* or ambivalen\*).tw (112352)
- 13 Differential diagnosis\*.tw (10931)
- 14 Exp Uncertainty/ (9181)
- 15 Differential diagnosis/ (8661)
- 16 Computer assisted diagnosis/ (1573)
- 17 12 or 13 or 14 or 15 or 16 (128343)
- 18 (Patient\* or parent\* or famil\* or relative\* or carer\* or caregiver\* or care-giver\* or inpatient\* or in-patient\*).tw (14695459)
- 19 (Doctor\* or GP or clinician\* or doctor\* or resident\* or intern\* or general practitioner\*).tw. (523865)
- 20 ((Doctor adj1 (associate\* or assistant\*)) or PA).tw. (17924)
- 21 (nurs\* or HCP or practitioner or staff).tw (184993)
- 22 Family/ (48218)
- 23 Caregivers/ (28229)

- 24 Patients/ (24894)  
 25 Doctors/ (21111)  
 26 Nurses/ (26516)  
 27 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 (1856604)  
 28 11 and 17 and 27 (766)  
 29 Limit 27 to English language (702)  
 30 Search update  
 limit 29 to up=20200513-20210125 (21)  
 After duplicates: extra 18

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*Note.* ADJ= adjacent; A&E= Accident & Emergency; ED=Emergency Department; ER= Emergency room; Exp= explode to include narrower index terms; GP= General Practitioner; HCP= Healthcare professional; tw= title, abstract and keyword search; \*= unlimited truncation symbol

Web of Science (1900-May 13th 2020)

- 
- 1 (TI= (Emergenc\* near/1 (unit\* or room\* or department\* or care\* or medic\* or care or ward\* or treatment\* or health\* or nurs\* or doctor\* or doctor\* or patient\* or clinician\* or registrar\* or intern\*)) AND LANGUAGE: (English) (57356))
- 2 (AB= (Emergenc\* near/1 (unit\* or room\* or department\* or care\* or medic\* or care or ward\* or treatment\* or health\* or nurs\* or doctor\* or doctor\* or patient\* or clinician\* or registrar\* or intern\*)) AND LANGUAGE: (English) (107879))
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- 4 (AB=(urgent near/1 (Care or "medical care" or health\*)) (2294))
- 5 ((TI=(trauma NEAR/1 (centre\* or center\* or department\* or unit\* or ward\*)) AND LANGUAGE: (English) (3200))
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- 7 (TI= (accident near/1 emergency)) AND LANGUAGE: (English) (1586))
- 8 (AB= (accident near/1 emergency)) AND LANGUAGE: (English) (2949))
- 9 (TI= "A&E") AND LANGUAGE: (English) (1918))
- 10 (AB= "A&E") AND LANGUAGE: (English) (15250))
- 11 (TI= "hospital emergency service\*") AND LANGUAGE: (English) (64))

- 12 (AB= "hospital emergency service\*") AND LANGUAGE: (English) (112)
- 13 (TI= "ED") AND LANGUAGE: (English) (11097)
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- 15 (TI= ("ER") not ti=("estrogen receptor" or "endoplasmic reticulum")) AND LANGUAGE: (English) (32093)
- 16 (AB= ("ER") not AB=("estrogen receptor" or "endoplasmic reticulum")) AND LANGUAGE: (English) (75025)
- 17 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 (309972)
- 18 (TI=(Uncertain\* or Doubt\* or indecisi\* or ambigu\* or unpredictab\* or ambivalen\*)) AND LANGUAGE: (English) (137976)
- 19 (AB=(Uncertain\* or Doubt\* or indecisi\* or ambigu\* or unpredictab\* or ambivalen\*)) AND LANGUAGE: (English) (704696)
- 20 (TI= "differential diagnosis\*") AND LANGUAGE: (English) (15517)
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- 22 18 or 19 or 20 or 21 (820020)
- 23 17 AND 22 (5758)
- 24 (TI=(patient\* OR parent\* OR famil\* OR relative\* OR carer\* OR care giver\* OR care-giver\* OR inpatient\* OR in-patient\* OR doctor\* OR gp OR clinician\* OR doctor\* OR resident\* OR intern\* OR "general practitioner\*" OR nurs\* OR hcp OR practitioner OR staff)) AND LANGUAGE: (English) (3699693)
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- 27 (AB= ( doctor near/0 ( associate\* OR assistant\* ) )) AND LANGUAGE: (English) (1959)
- 28 24 or 25 or 26 or 27 (11428851)
- 29 23 and 28 (3799)
- 30 Search update
- 29 refined by: PUBLICATION YEARS: ( 2020 )

Timespan: 2020-2021. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI. (685)

After duplicates: extra 466

*Note.* AB= Abstract; A&E= Accident & Emergency; ED=Emergency Department; ER= Emergency room; GP= General Practitioner; HCP= Healthcare professional; TI=title; \*= unlimited truncation symbol

Scopus Search ran 13th May 2020

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(( TITLE-
ABS ( uncertain* OR doubt* OR indecisi* OR ambigu* OR unpredictab*
OR ambivalen* )) OR ( TITLE-ABS ( "DIFFERENTIAL
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ABS ( emergenc* W/1 ( unit* OR room* OR department* OR care* OR
medic* OR care OR ward* OR treatment* OR health* OR nurs* OR do
ctor* OR doctor* OR patient* OR clinician* OR registrar* OR intern* ))
) OR ( TITLE-ABS ( urgent W/1 ( care OR "MEDICAL
CARE" OR health* )) ) OR ( TITLE-
ABS ( trauma W/1 ( centre* OR center* OR department* OR unit* OR w
ard* )) ) OR ( TITLE-ABS ( accident W/1 emergency ) ) OR ( TITLE-
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service" ) ) OR ( TITLE-ABS ( "ED" ) ) OR ( TITLE-ABS ( "ER" AND
NOT ( "estrogen receptor" OR "endoplasmic reticulum" ) ) ) ) AND ( TITLE-
ABS ( patient* OR parent* OR famil* OR relative* OR carer* OR caregi
ver* OR care-giver* OR inpatient* OR in-
patient* OR doctor* OR gp OR clinician* OR doctor* OR resident* OR
intern* OR "general
practitioner*" OR nurs* OR hcp OR practitioner OR staff ) ) OR ( TITLE-
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TO ( LANGUAGE , "English" ) )
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(5601) AND NOT INDEX(MEDLINE): (2044)

Search update

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OR ambivalen* )) OR ( TITLE-ABS ( "DIFFERENTIAL
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ABS ( emergenc* W/1 ( unit* OR room* OR department* OR care* OR
medic* OR care OR ward* OR treatment* OR health* OR nurs* OR do
ctor* OR doctor* OR patient* OR clinician* OR registrar* OR intern* ))
) OR ( TITLE-ABS ( urgent W/1 ( care OR "MEDICAL
CARE" OR health* )) ) OR ( TITLE-
ABS ( trauma W/1 ( centre* OR center* OR department* OR unit* OR w
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ard\* )) OR ( TITLE-ABS ( accident W/1 emergency ) ) OR ( TITLE-ABS ( "A&E" ) ) OR ( TITLE-ABS ( "hospital emergency service" ) ) OR ( TITLE-ABS ( "ED" ) ) OR ( TITLE-ABS ( "ER" AND NOT ( "estrogen receptor" OR "endoplasmic reticulum" ) ) ) AND ( TITLE-ABS ( patient\* OR parent\* OR famil\* OR relative\* OR carer\* OR caregiver\* OR care-giver\* OR inpatient\* OR inpatient\* OR doctor\* OR gp OR clinician\* OR doctor\* OR resident\* OR intern\* OR "general practitioner\*" OR nurs\* OR hcp OR practitioner OR staff ) ) OR ( TITLE-ABS ( doctor W/0 ( associate\* OR assistant\* ) ) ) AND NOT INDEX ( medline ) AND ( LIMIT-TO ( LANGUAGE , "English" ) )

(235)

Extra after duplicates: (138)

*Note.* ABS= abstract; A&E= Accident & Emergency; ED=Emergency Department; ER= Emergency room; GP= General Practitioner; HCP= Healthcare professional; W/=within; \*= unlimited truncation symbol

CINAHL search ran 13<sup>th</sup> May 2020

- 
- 1 TI(Emergenc\* N1 (unit\* or room\* or department\* or care\* or medic\* or care or ward\* or treatment\* or health\* or nurs\* or doctor\* or doctor\* or patient\* or clinician\* or registrar\* or intern\*)) (45804)
  - 2 AB(Emergenc\* N1 (unit\* or room\* or department\* or care\* or medic\* or ward\* or treatment\* or health\* or nurs\* or doctor\* or doctor\* or patient\* or clinician\* or registrar\* or intern\*)) (76038)
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  - 13 TI ED (10300)

- 14 AB ED (29596)
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- 16 AB ER not ("estrogen receptor" or "endoplasmic reticulum") (6161)
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- 20 (MH "Emergency Nurse Practitioners") (659)
- 21 (MH "Trauma Centers") (6550)
- 22 (MH "Doctors, Emergency") (4363)
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- 33 (MH "Diagnostic Errors") (11969)
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- 36 S23 AND S35 (8650)
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OR practitioner OR staff) ) OR ( TI(( doctor N0 ( associate\* OR assistant\* ) ) ) OR ( AB( doctor N0 ( associate\* OR assistant\* ) ) ) OR (mh "Patients" or MH "family" or MH "nurses" or MH "caregivers" or MH "doctors")

38 36 AND 37 (5972)

39 Limit to English, humans and exclude MEDLINE: 849

40 Search update

EM 20200513-20210121 (39): (79)

Extra after duplicates: (54)

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*Note.* ABS= abstract; A&E= Accident & Emergency; ED=Emergency Department; ER= Emergency room; GP= General Practitioner; HCP= Healthcare professional; MH= subject heading; N=next to; \*= unlimited truncation symbol

PROQUEST search ran 13<sup>th</sup> May 2020

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((uncertain\* OR doubt\* OR indecisi\* OR ambigu\* OR doubt\* OR unpredictab\* OR ambivalen\* OR differential) AND ((emergenc\* NEAR/1 (unit\* OR room\* OR department\* OR care\* OR medic\* OR ward\* OR treatment\* OR health\* OR nurs\* OR doctor\* OR doctor\* OR patient\* OR clinician\* OR registrar\* OR intern\*)) OR (urgent NEAR/1 (care OR medical OR health\*)) OR (trauma NEAR/1 (centre\* OR center\* OR department\* OR unit\* OR ward\*)) OR (accident NEAR/1 emergency) OR ER OR ED) AND (patient\* OR parent\* OR famil\* OR relative\* OR carer\* OR caregiver\* OR care-giver\* OR inpatient\* OR in-patient\* OR doctor\* OR gp OR clinician\* OR doctor\* OR resident\* OR intern\* OR practitioner\* OR nurs\* OR hcp OR practitioner OR staff OR doctor\*)) OR pub((uncertain\* OR doubt\* OR indecisi\* OR ambigu\* OR doubt\* OR unpredictab\* OR ambivalen\* OR differential) AND ((emergenc\* NEAR/1 (unit\* OR room\* OR department\* OR care\* OR medic\* OR ward\* OR treatment\* OR health\* OR nurs\* OR doctor\* OR doctor\* OR patient\* OR clinician\* OR registrar\* OR intern\*)) OR (urgent NEAR/1 (care OR medical OR health\*)) OR (trauma NEAR/1 (centre\* OR center\* OR department\* OR unit\* OR ward\*)) OR (accident NEAR/1 emergency) OR ER OR ED) AND (patient\* OR parent\* OR famil\* OR relative\* OR carer\* OR caregiver\* OR care-giver\* OR inpatient\* OR in-patient\* OR doctor\* OR gp OR clinician\* OR doctor\* OR resident\* OR intern\* OR practitioner\* OR nurs\* OR hcp OR practitioner OR staff OR doctor\*)) OR ab((uncertain\* OR doubt\* OR indecisi\* OR ambigu\* OR doubt\* OR unpredictab\* OR ambivalen\* OR differential) AND ((emergenc\* NEAR/1 (unit\* OR room\* OR department\* OR care\* OR medic\* OR ward\* OR treatment\* OR health\* OR nurs\* OR doctor\* OR doctor\* OR patient\* OR clinician\* OR registrar\* OR intern\*)) OR (urgent NEAR/1 (care OR medical OR health\*)) OR (trauma NEAR/1 (centre\* OR center\* OR department\* OR unit\* OR ward\*)) OR (accident NEAR/1 emergency) OR ER OR ED) AND (patient\* OR parent\* OR famil\* OR relative\* OR carer\* OR

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caregiver\* OR care-giver\* OR inpatient\* OR in-patient\* OR doctor\* OR gp OR clinician\* OR doctor\* OR resident\* OR intern\* OR practitioner\* OR nurs\* OR hcp OR practitioner OR staff OR doctor\*)) (1981)

Search updated to 25th January 2021: (extra 20)

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*Note.* A&E= Accident & Emergency; ED=Emergency Department; ER= Emergency room; GP= General Practitioner; HCP= Healthcare professional; \*= unlimited truncation symbol

HMIC search ran 13<sup>th</sup> May 2020

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- 1 (Emergenc\* ADJ2 (unit\* or room\* or department\* or care\* or medic\* or ward\* or treatment\* or health\* or nurs\* or doctor\* or doctor\* or patient\* or clinician\* or registrar\* or intern\*)).tw. (4052)
- 2 (Urgent ADJ2 (care or medical care or health\*)).tw. (280)
- 3 (trauma ADJ2 (centre\* or center\* or department\* or unit\* or ward\*)).tw. (135)
- 4 (accident ADJ2 emergency).tw (1762)
- 5 "A&E".tw (943)
- 6 "Hospital emergency service".tw (3)
- 7 ED.tw (516)
- 8 (ER not ("estrogen receptor" or "endoplasmic reticulum")).tw (38796)
- 9 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 (5588)
- 10 (Uncertain\* or Doubt\* or indecisi\* or ambigu\* or unpredictab\* or ambivalen\*).tw (5394)
- 11 Differential diagnosis\*.tw (47)
- 12 10 or 11 (5440)
- 13 (Patient\* or parent\* or famil\* or relative\* or carer\* or caregiver\* or care-giver\* or inpatient\* or in-patient).tw (105799)
- 14 (Doctor\* or GP or clinician\* or doctor\* or resident\* or intern\* or general practitioner\*).tw. (58232)
- 15 ((Doctor adj1 (associate\* or assistant\*)) or PA).tw. (406)
- 16 (nurs\* or HCP or practitioner or staff).tw (73265)
- 17 Patients/ (10734)
- 18 Nurses/ (12892)
- 19 Doctors/ (8544)

17 13 or 14 or 15 or 16 or 17 or 18 or 19 (175302)

18 9 and 12 and 17 (73)

19 Search update

Limit 18 to last three years- 1

After duplicates: 0

*Note.* ADJ= adjacent; A&E= Accident & Emergency; ED=Emergency Department; ER= Emergency room; GP= General Practitioner; HCP= Healthcare professional; .tw= title, abstract and keyword search; \*= unlimited truncation symbol

Cochrane database of systematic reviews search ran 14<sup>th</sup> May 2020

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- 1 MeSH descriptor: [Uncertainty] this term only (150)
- 2 MeSH descriptor: [Delayed Diagnosis] this term only (23)
- 3 MeSH descriptor: [Diagnosis, Differential] this term only (1382)
- 4 MeSH descriptor: [Diagnostic, Errors] this term only (274)
- 5 MeSH descriptor: [Diagnosis, Computer-Assisted] this term only (685)
- 6 Uncertain\* OR doubt\* OR indecisi\* OR ambigu\* OR unpredictab\* OR ambivalen\* (22371)
- 7 1 OR 2 OR 3 OR 4 OR 5 OR 6 (24602)
- 8 Patient\* OR parent\* OR famil\* OR relative\* OR carer\* OR caregiver\* OR care-giver\* OR inpatient\* OR in-patient\* (1072092)
- 9 Doctor\* OR GP OR clinician\* OR doctor\* OR resident\* OR intern\* OR general practitioner\* (298969)
- 10 "Doctor associate\*" OR "doctor assistant\*" (194)
- 11 Nurs\* OR HCP\* OR practitioner OR staff (79582)
- 12 MeSH descriptor: [Family] this term only (1465)
- 13 MeSH descriptor: [Caregivers] this term only (2131)
- 14 MeSH descriptor: [Patients] this term only (370)
- 15 MeSH descriptor: [Doctors] this term only (875)
- 16 MeSH descriptor: [Nursing] in all MeSH products (3283)
- 17 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16 (1169166)
- 18 (Emergenc\* near2 (unit\* OR room\* OR department\* OR care\* OR medic\* OR ward\* OR treatment\* OR health\* OR nurs\* OR doctor\* OR doctor\* OR patient\* OR clinician\* OR registrar\* OR intern\*)) (24388)

- 19 (Urgent near2 (care or medical care or health\*)) (748)
- 20 (Trauma near 2 (centre\* OR center\* OR department\* OR unit\* OR ward\*)) (2033)
- 21 (accident near2 emergency) (543)
- 22 "A&E" (1339)
- 23 "hospital emergency service" (50)
- 24 "ED" (18960)
- 25 "ER not ("estrogen receptor" OR "endoplasmic reticulum")) (12542)
- 26 MeSH descriptor: [Emergency Services, Psychiatric] this term only (49)
- 27 MeSH descriptor: [Emergency Services, Hospital] this term only (2239)
- 28 MeSH descriptor: [Emergency Services, Emergency Medicine] this term only (269)
- 29 MeSH descriptor: [Pediatric Emergency Services] this term only (5)
- 30 MeSH descriptor: [Trauma Centers] this term only (184)
- 31 MeSH descriptor: [Emergency Nursing] this term only (72)
- 32 19 OR 19 OR 20 OR 21 OR 22 OR 23 OR 24 OR 25 OR 26 OR 27 OR 28 OR 29 OR 30 OR 31 (52929)
- 33 7 AND 17 AND 32 (3062)
- 34 Search update to January 25<sup>th</sup> 2021  
Extra 186

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*Note.* A&E= Accident & Emergency; ED=Emergency Department; ER= Emergency room; GP= General Practitioner; HCP= Healthcare professional; MeSH= Medical subject heading; \*= unlimited truncation symbol

Google searches ran January 25<sup>th</sup> 2021

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Uncertainty "Emergency Department" (6,040,000)

Uncertain "Emergency Department" (5,050,000)

Uncertainty "A&E" (977,000)

Uncertain "A&E" (773,000)

Uncertainty "urgent care" (3,200,000)

Uncertain "urgent care" (3,100,000)

Uncertainty "Emergency Room" (8,430,000)

Uncertain “Emergency Room” (127,000,000)

Total sent to Level 1 screening (first 100 of each search were screened): (17)

After duplicates: (14)

Google Scholar searches ran January 25<sup>th</sup> 2021

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Uncertainty “Emergency Department” (111,000)

Uncertain “Emergency Department” (108,000)

Uncertainty “A&E” (11,900)

Uncertain “A&E” (8,500)

Uncertainty “urgent care” (14,700)

Uncertain “urgent care” (14,100)

Uncertainty “Emergency Room” (74,200)

Uncertain “Emergency Room” (70,200)

Total sent to Level 1 screening (first 100 of each search were screened): (84)

After duplicates: (82)

Website and hand searching (after duplicates)

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NHS England	0
NHS Improvement	0
WHO	0
Institute of healthcare improvement	0
The Health Foundation	1
Agency for Healthcare Research & Quality	0
NIHR	0
Open Grey	4
NICE Evidence Search	3
Public Health England	0
The Kings Fund	0
NHS Digital	0
Nuffield Trust	0
ARC	2

GMC	0
Royal College of Emergency Medicine	0
<hr/>	
Hand searches of journals (after duplicates)	
<hr/>	
EMJ	3
BMJ Q&S	3
BMC	1
Annals of Emergency Medicine	0
Journal of Patient Safety	0
Journal of Emergency Nursing	0
JBI Evidence Synthesis	1

## Appendix 2.2

### Data extraction form including item definitions.

#### Interventional studies.

Refers to any evaluation of how an intervention or tool impacts the experience of uncertainty.

Examples are from a study included in this review (Hess et al., 2016).

Main Category	Subcategory	Definition	Example
Author(s)		Author(s) of the study/source. If greater than two authors use 'et al.'	Hess et al.
Title		Full title of the article/source.	Shared decision making in patients with low risk chest pain: prospective randomized pragmatic trial.
Year		Year of publication	2016
Journal		Journal in which study/source is published.	BMJ

Country		Country in which study was conducted or source was published.	USA
Purpose		What is the purpose of the study, specific to uncertainty?	To compare the effectiveness of shared decision making with usual care in choice of admission for observation and further cardiac testing or for referral to outpatient evaluation in patients with possible acute coronary syndrome.
Routine or implemented?		Is the intervention or tool evaluated by this study part of routine practice (e.g. CT scan) or an implemented intervention (e.g. co-produced decision-aid)?	Implemented
Participants	Locus	Whose uncertainty or UT is being measured?	Despite the rationale being ED clinicians admitting patients due to uncertainty from potential adverse events, uncertainty is only measured amongst patients.
	Target	Who is receiving the intervention?	Decision-aid used collaboratively by clinicians (emergency doctors, nurse practitioners, and doctor assistants) and patients with chest pain.

	Sample size	How many participants make up the group experiencing uncertainty and the group receiving the intervention?	361 doctors 898 patients
Conceptualisation of uncertainty	Clinical focus	What patient presentation or symptom set is the study concerned with?	Cardiac stress testing for patients presenting with chest pain.
	Definition of uncertainty	How the authors define uncertainty.	No definition provided.
	Source or type of uncertainty discussed	Where the uncertainty is coming from and what it is about.	Judgement of probability for progression to heart attack (prognostic uncertainty).
	Stage of patient journey	When is the uncertainty experienced throughout the patient's experience?	Decision to admit patient for testing and observation.
	Measurement of uncertainty or UT	How is uncertainty known to exist?	The decisional conflict scale includes 16 items that are scored from 0-4; the items are summed, divided by 16, and then multiplied by 25. The scale is from 0-100, where higher scores are



			reflective of increased patient uncertainty about the choice.
Theory used in design		Any theoretical underpinning to the intervention design.	No theoretical underpinning explicitly reported.
Description of the intervention	Design	The study design e.g. quasi, randomised controlled trial.	Multicentre, pragmatic, parallel, randomized controlled trial.
	Type of intervention	Does the intervention seek to reduce or cope with uncertainty?	Reduce decisional conflict amongst patients.
	Intervention materials	Any materials and stimuli used in intervention delivery.	A decision aid shown to patients which gives them diagnostic information, communicates their precise risk of experiencing a heart attack using natural frequencies and a pictograph and gives options for management. Options include admission, follow-up as an outpatient, schedule own appointment with GP or no involvement in decision.

Delivery	How is the intervention delivered and by whom.	The treating clinician, after evaluating the patient and the results of the initial ECG and cardiac troponin tests, then used the decision aid to educate the patient about the results of the two tests, the potential need for observation and further cardiac testing, subsequent cardiac troponin testing to definitively rule out acute myocardial infarction, if required, and their personalized 45 day risk for acute coronary syndrome. The clinician then engaged the patient in selecting the management option most closely aligned to his or her values and preferences.
Length and contact	How long is the intervention delivered for and how much contact does it require.	Delivered as part of routine care. Collaborative use of the decision-aid by treating clinicians and patients took 1.3 minutes longer than usual care on average.
Setting of the intervention and study	Where is the study situated and where is the intervention delivered?	This trial was across 6 geographically diverse EDs in the USA. The decision-aid is for use within the ED.

Effectiveness	Results reported in relation to uncertainty.	Use of a decision-aid with patients at low risk of acute coronary syndrome increased patient knowledge of their risk and reduced decisional conflict amongst patients.
Impact	The specific impact on uncertainty.	Patients in the decision aid arm reported significantly less decisional conflict (decision conflict scale: decision aid, 43.5 (SD 15.3) v usual care, 46.4 (SD 14.8); mean difference -2.9, -4.8 to -0.90) than patients in the usual care arm.
Reported outcomes	All outcomes reported in the study.	Patients randomized to the decision aid had greater knowledge of their risk of acute coronary syndrome; Use of the decision aid did not significantly impact patients' trust in their doctor; Patients randomized to the decision aid were more engaged in the decision making process, as indicated by higher OPTION scores; A significantly lower proportion of patients randomized to the decision aid decided, with their clinician, to be admitted to the ED observation unit and a significantly lower proportion underwent cardiac stress testing

within 30 days; No deaths of cardiac or unknown cause occurred in either arm; The rate of coronary angiography, coronary revascularization, admission to hospital, readmission to hospital, repeat emergency department visits, or outpatient clinic visits did not differ between study arms.

A greater proportion of clinicians in the decision aid arm found the information to be extremely helpful and 62.9% would want to use a decision aid for other decisions.

Suggestions for research.

Any suggestions made by the authors as a direct result of findings for future research.

While the findings from this multicentre trial suggest that the decision aid might be effective across a variety of clinical settings, further implementation studies are needed to determine how best to incorporate it in care pathways, how emergency clinicians, cardiologists, and primary care clinicians can best work together to ensure incorporation and implementation of informed patient preferences into admission, testing, and follow-up decisions, and how to ensure patient

Practice and policy implications	Any suggestions made by the authors as a direct result of findings for future research.	preferences guide decision-making both during and after the ED encounter.
		<p>Healthcare policy to encourage, and perhaps incentivize, risk communication and that incorporates informed patient preferences in emergency care decisions about testing and follow-up might also be needed to align financial incentives with the best interests of patients.</p> <p>Clinicians should consider whether our current perception of the degree to which patients are engaged in decision making as part of usual practice respects patient autonomy and supports interaction with professional judgment.</p>

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### Non-interventional studies

Refers to sources which develop understanding of how uncertainty in the ED is experienced and what factors influence this.

Examples are from a study included in this review (Kuhn et al., 2009)

Main Category	Subcategory	Definition	Example
Purpose		Purpose of the source, specific to uncertainty.	To assess the role of uncertainty tolerance in predicting career burnout.

Study type		Does the source report original research or is it a review/discussion?	Primary research
Study design		If primary research, is it qualitative, quantitative, mixed method etc.	Quantitative
Methodology		The specific research method used e.g. survey, interviews.	Survey study
Population	Locus of uncertainty	Who is consciously perceiving uncertainty?	Doctors
	Sample	Who is the source about?	193 doctors (12.3 +/-8.6 years EM experience).
Setting		If primary research, where did the study take place?	Doctors surveyed from university and community residency programmes.

Context	Where are the findings related to?	EDs across the USA
Stage of patient journey	At which stage of the patient journey is the uncertainty present?	Not specific but whilst in ED.
Clinical focus	What patient presentation or symptom set is the study concerned with?	Not specific.
Definition of uncertainty	How the authors define uncertainty.	Authors define ambiguity tolerance as an internal process that influences the way in which a person structures information about ambiguous situations when confronted by an array of unfamiliar, complex or incongruent cues.
Measurement of uncertainty or uncertainty tolerance	How is uncertainty known to exist?	Self-report PRUS (physicians' reactions to uncertainty scale) (Gerrity et al., 1990; 1995) which measures anxiety about uncertainty, concern for bad outcomes, reluctance to disclose uncertainty to patients and reluctance to disclose mistakes to other doctors.

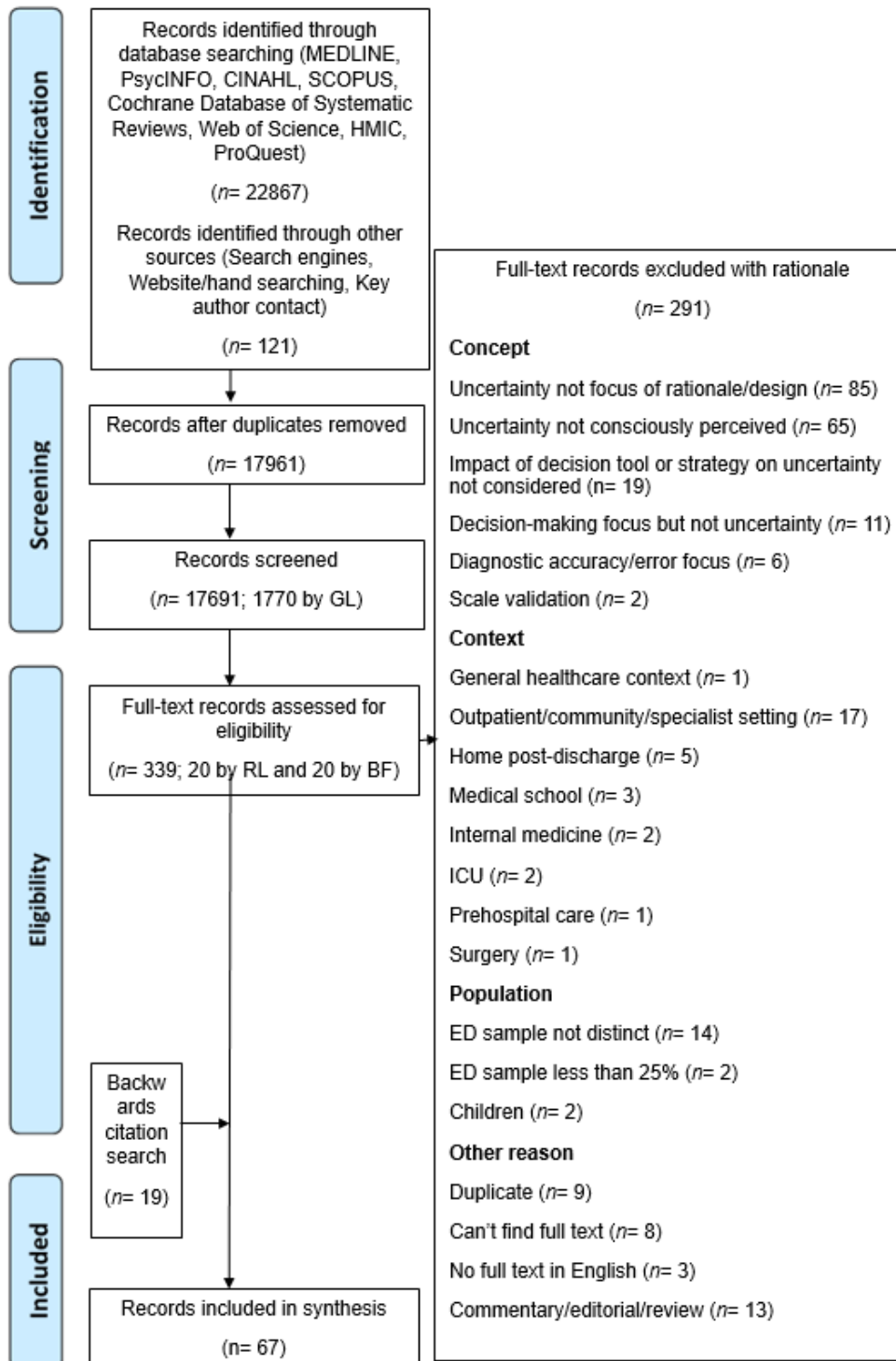
Theory used in design		Any theoretical underpinning to the study design.	None reported.
Key findings	Source or type of uncertainty	Where the uncertainty is coming from and what it is about.	Not specific to a process within ED. UT is measured for clinical uncertainty generally.
	Factors influencing the perception or experience of uncertainty	Any factors influencing the amount of uncertainty experienced or the ability to make decisions in context of uncertainty.	Poor UT because of a 'concern for bad outcomes', rather than 'anxiety about uncertainty generally', 'reluctance to disclose uncertainty to patients' or 'reluctance to disclose mistakes to other doctors', is strongly related to doctors experiencing emotional exhaustion. It is also a greater predictor than age, practice environment and training.
	Response to uncertainty	The concept of tolerance. (Cognitive, emotional and behavioural responses to uncertainty).	N/A



Relationship between factor(s) and response(s)	Any associations between factors and responses to uncertainty discussed.	N/A
Outcomes of uncertainty	Any outcomes related to patients, staff or the health service of experiencing clinical uncertainty.	Burnout is an outcome of high anxiety due to concern for bad outcomes. Dangers of burnout include job turnover, absenteeism, low morale and deterioration of care quality provided.
Key contribution to literature	The key finding which contributes to theory development and suggests focus for potential future UT interventions.	High anxiety caused by concern for bad outcomes was the single biggest predictor of burnout, as defined by emotional exhaustion. Doctors do not have intolerance for uncertainty except as it pertains to bad outcomes, suggesting they are comfortable with ambiguous states in general and handle uncertainty without increased stress except as it pertains to bad outcomes for patients.
Suggestions for future research and practice.	Any suggestions made by the authors as a direct result of findings.	Associations between doctors' UT and patient satisfaction, the quality of care, and utilisation of resources warrants further exploration.

## Appendix 2.3

### PRISMA flowchart rationalising the exclusion of materials at full text screening.



## Appendix 3.1

### Survey including scenario and IUS-12 scale

You are struggling with lower back pain. This has happened before but this time, your left leg has also started to feel numb, and you are having trouble going to the toilet. You go to see your GP and they refer you to the Emergency Department. This is because there is a possibility your symptoms are being caused by a rare condition affecting the nerves of the lower back which can become serious if not treated.

The doctor in A&E examines you and confirms you are in a stable condition, and you can move your muscles normally. However, when the doctor feels your lower back, it feels sore, and your lower leg feels slightly numb.

Probability condition	Ambiguity condition	Complexity condition
<p>The doctor has seen patients with similar symptoms in the past who had acute back strain, which can be treated at home. They have also seen patients with similar symptoms who had the serious condition your GP is worried about. The doctor is unsure whether testing you for the condition your GP is worried about will benefit you. They find research which shows: Of the patients who come to hospital suspected of having this serious nerve condition, 19% have it.</p> <p>The doctor who examined you is now uncertain what to do.</p>	<p>The doctor thinks you have acute back strain which can be treated at home. They ask another doctor on shift for their opinion. The other doctor agrees this could be right but thinks there could be another, more serious reason for your symptoms.</p> <p>The doctor who examined you is now uncertain what to do.</p>	<p>Usually, the doctor would be confident to test for the nerve condition your GP is worried about. However, after looking at your medical history, they notice you have had problems going to the toilet in the past which means your back pain might be a separate, less serious problem.</p> <p>The doctor who examined you is now uncertain what to do.</p>

#### Question 1)

Please indicate your preferred option for how the A&E doctor communicates with you in this situation:

- The doctor admits they are uncertain what is causing your symptoms by stating, 'I do not know what is causing your symptoms.'

- The doctor tells you a list of potential diagnoses which could potentially be causing your symptoms by stating, 'your symptoms could be due to acute back pain but could also be due to a more serious nerve condition.'
- The doctor tells you the most likely diagnoses for your symptoms by stating, 'you are probably suffering from acute back pain.'
- The doctor does not tell you they are uncertain and waits until tests have been performed to tell you, 'You have acute back pain.'

**Question 2)**

Please indicate your preferred option for how the doctor decides what to do:

- The doctor asks if you are happy to go home for the time being with information about what to do if your symptoms don't go away, or if you would like to have further tests in hospital. The doctor then goes ahead with whatever you choose.
- You have a conversation with the doctor where you tell them what you would like to happen, they tell you what they consider the best option and you reach an agreement based on both of your opinions.
- The doctor makes the decision on their own based on what they think is the best option and tells you what will happen.

**Question 3)**

Please indicate which decision you would prefer the A&E doctor to make:

- Send you home with pain relief medication and advice about what to do if symptoms don't improve
- Refer you to your GP
- Perform further testing such as a scan of your bladder and wait to see if your symptoms improve with strong medication. Send you home or to another hospital ward based on scan results and whether pain relief works.
- Order an urgent scan (e.g. MRI) and admit you to hospital immediately.

**Question 4)**

Please indicate if you have ever been in hospital due to problems with your back, bowel and/or bladder:

- Yes
- No
- Prefer not to say

**IUS-12 scale (Carleton et al., 2007)**

Please rate each item based on how well it describes you where: 1= not at all characteristic of me and 5= entirely characteristic of me.

- Unforeseen events upset me greatly.
- It frustrates me not having all the information I need.
- One should always look ahead so as to avoid surprises.
- A small, unforeseen event can spoil everything, even with the best of planning.
- I always want to know what the future has in store for me.
- I can't stand being taken by surprise.
- I should be able to organise everything in advance.
- Uncertainty keeps me from living a full life.
- When it's time to act, uncertainty paralyses me.
- When I am uncertain, I can't function very well
- The smallest doubt can stop me from acting.
- I must get away from all uncertain situations.

## **Appendix 3.2**

### **Participant Information Sheet**

#### **Public response to medical uncertainty and preferences for uncertainty management in A&E.**

Please take the time to read the following information before deciding to take part in the survey. If you have any further questions, please email the researcher.

#### **What is the purpose of this study?**

The survey is hoping to find out how the general public would prefer doctors in Accident & Emergency (A&E) Departments to deal with them when the doctor is unsure what is wrong. It is also interested in what healthcare services people would access in certain situations when they don't know what is wrong with their own health.

#### **What will I do?**

The online survey can be completed in approximately 10 minutes. There will be some questions related to yourself and questions about how uncertainty makes you feel. The survey will also present you with three stories or scenarios. One will be a situation in which the doctor who has examined you in Accident & Emergency (A&E) is uncertain and two will relate to your own health seeking behaviour in response to uncertainty. Following completion of the entire survey, you will be entered into a prize draw for either a £100, £50 or £25 Amazon voucher should you wish, by entering your email address. The prize will be drawn within in the next three months.

#### **Why have I been asked to take part?**

You have responded to an advertisement relating to the current study and are eligible to take part if you are over 18 years old, a resident in the UK and are fluent in English. Unfortunately, if you work clinically as a healthcare professional or ever have in the past, you are not eligible to take part.

#### **Will I receive anything for taking part?**

By entering your email address into the last question of the survey, you will be entered into a prize draw to win one of three prizes. These prizes include a £100, £50 or £25 Amazon vouchers. This is optional and you do not have to enter this information but only those who input email addresses will be entered into the prize draw. The prize will be drawn within in the next three months.

#### **What if I decide I no longer want to take part?**

Following completion of the survey, you will not be able to withdraw your responses as the survey is anonymous and does not include any identifiable information from which to identify your data.

#### **Will anyone be able to see my information?**

Your responses to the survey will be kept completely confidential and not used for any purpose other than this research. You are not required to enter your name or any other identifiable information in the survey. Should you wish to be entered in the prize draw or receive a summary of the results from this survey,

you will enter your email address and this information will be stored separately to any responses within the survey. Email addresses will only ever be retrieved by the research team to send the Amazon voucher prize to the winners or distribute a summary of findings (within the next three months) and following this, email addresses will be destroyed. Any reports or publications which come from this survey will not include any identifiable information. If you would like to know more about how the University of Leeds will protect your data visit this link: <https://dataprotection.leeds.ac.uk/wp-content/uploads/sites/48/2019/02/Research-Privacy-Notice.pdf>

**Are there any risks of taking part?**

There is the potential for some of the hypothetical scenarios to be distressing or stressful, particularly if you have direct experience of the situations. Should this be the case, you do not need to continue with the survey and you can stop it at any time. Should you continue to feel upset about any aspect of the survey, you can contact members of the research team using the email addresses at the bottom of this page or consider a discussion with your GP.

**Who is funding the research?**

This research is funded by the National Institute for Health Research, Yorkshire and Humber Patient Safety Translational Research Centre.

**Who has reviewed the study?**

This study has been reviewed and granted ethical approval by the University of Leeds, School of Psychology Research Ethics Committee (Ref No: PSYC-71, Approval Date: 06/07/20).

**Who can I contact for further details or if I have a question?**

Emily Parker (Chief Investigator) Email: [ll14eep@leeds.ac.uk](mailto:ll14eep@leeds.ac.uk)  
Professor Rebecca Lawton (Supervisor) Email: [r.j.lawton@leeds.ac.uk](mailto:r.j.lawton@leeds.ac.uk)

Finally, I would like to thank you for reading this information and taking the time to complete this survey.

## Appendix 3.3 Infographic

# EnSUR-ED

## Enhancing Support for Uncertainty Responses in the Emergency Department

FUNDED BY



National Institute for Health and Care Research




Yorkshire Quality and Safety Research Group




UNIVERSITY OF LEEDS

*Supporting Emergency Department doctors to tolerate uncertain admission and discharge decisions.*

### CHALLENGE



Doctors in the Emergency Department (ED) need to make complex, time-pressured decisions such as whether to admit or discharge a patient.



In some cases, the uncertainty associated with this decision can trigger negative emotions (e.g. anxiety), thoughts (e.g. doubt) and behaviour (e.g. avoidance).



Doctors with a lower tolerance for uncertainty are more likely to experience these negative thoughts, feelings and behaviours in uncertain situations.



Evidence suggests uncertainty tolerance can be developed as a trait, but can also depend on the context uncertainty is experienced in.



We need to develop uncertainty tolerance amongst ED doctors and ensure a working environment which supports this development.

### THE RESEARCH



Researchers from the NIHR Patient Safety Translational Research Centre explored uncertainty tolerance in the Emergency Department by:

- Interviewing ED doctors about uncertain admission and discharge decisions
- Categorising and summarising 67 relevant evidence sources
- asking the public what they want to happen in uncertain scenarios
- reaching consensus with ED doctors on the priority areas of focus for interventions to support them with tolerating uncertainty



## KEY FINDINGS

Bespoke interventions that enhance uncertainty tolerance in the ED do not currently exist. If developed, evidence suggests these interventions could:

1. reduce burnout among doctors, improve confidence and job satisfaction;

3. improve the patient and family experience;



2. improve health service operational efficiency;

4. and critically, patient safety would not be compromised.

## RECOMMENDATIONS

The areas of focus for interventions which ED doctors prioritised require multiple people to implement. This includes medical educators, policy-makers, healthcare managers and doctors themselves.



### MEDICAL EDUCATORS

- Medical education and professional training should place more focus on the inevitability of uncertainty, developing an acceptance of risks which are appropriate to take rather than eliminating risk.
- Involve junior doctors in the development of education and training, acknowledging their experience of uncertainty management.
- Education should acknowledge the limitations of testing and develop the communication skills needed when making and communicating uncertain discharge decisions.
- Prepare doctors for decision-making that incorporates patient preference, values and goals as well as clinical risks.



### POLICY-MAKERS AND HEALTHCARE MANAGERS

- Ensure doctors have sufficient time to acknowledge and manage uncertainty, with senior doctors available to trainees at all times.
- Acknowledge decision fatigue and its impact on uncertain decision-making during resourcing and staffing decisions.
- Ensure doctors have opportunities for feedback on their decisions.



### DOCTORS AND THE ED TEAM

- Promote psychological safety and awareness of support within the team for uncertainty management.
- Ensure patients clearly understand information provided at discharge.
- Address areas of uncertainty more directly in supervision with trainees and make trainees aware of wider services they can use for follow-up and safety netting.

For more information, visit: [bit.ly/3t6TXAX](https://bit.ly/3t6TXAX)



## Appendix 5.1

### Study advertisement poster

**NIHR** | Yorkshire and Humber  
Patient Safety Translational  
Research Centre

  
**UNIVERSITY OF LEEDS**

**Are you a doctor with at least 12 months experience of working in an NHS adult Emergency Department?  
Or, do you have research expertise in the field of clinical uncertainty ?**

If the answer to either (or both) is yes, you are in a position to help researchers at the NIHR Yorkshire & Humber Patient Safety Translational Research Centre.



 **SCAN ME**

This study is interested in identifying **how doctors can be supported to make uncertain discharge decisions** in the ED.

It involves three surveys (one every two weeks) where you will let us know how important you consider a number of potential intervention focuses.

Ready to take part or need more information? **Scan the QR code above** or **follow the link below.**

You can choose to be acknowledged as an expert collaborator in outputs from this study and be entered into a prize draw.



**ENSUR-ED**

ENHANCING SUPPORT FOR UNCERTAINTY RESPONSES IN THE ED

## Appendix 5.2

### Frequency and mode of importance ratings and consensus results for statement in the e-Delphi survey

No.	Item	Mode rating	% agree	Round consensus was established	% change in consensus between rounds	Not at all important	Slightly important	Somewhat important	Fairly important	Very important
<hr/> Importance ratings for uncertainty tolerance interventions focused on the following patient presentations.										
1	Abdominal pain	5	100%	2	+26.1%	0	0	0	7	9
2	Headache	4	87.6%	2	+13.7%	0	1	1	9	5

3	Chest pain	5	87%	1	N/A	1	0	2	6	14
4	Syncope*	4	81.3%	2	N/A	0	1	2	9	4
5	Breathlessness*	4	75.1%	2	N/A	1	1	2	9	3
6	Mental health concerns	5	68.8%	Not achieved	-0.8%	1	2	2	4	7
7	Fever	4	62.5%	Not achieved	+27.7%	0	2	4	6	4
8	Pregnancy*	4	62.5%	Not achieved	N/A	3	1	2	6	4
9	Head injury*	4	62.5%	Not achieved	N/A	3	1	2	6	4
10	Vertigo*	4	62.5%	Not achieved	N/A	0	0	5	6	4
11	Low back pain*	4	56.3%	Not achieved	N/A	1	2	4	5	4
12	Seizures*	4	50%	Not achieved	N/A	3	2	3	7	1
13	Intoxicated*	3 and 4	50%	Not achieved	N/A	2	1	5	5	3

14	Older patients	3	50%	Not achieved	+6.5%	2	0	6	4	4
15	Weakness*	3	43.8%	Not achieved	N/A	1	2	6	5	2
16	Paraesthesia*	3	31.3%	Not achieved	N/A	3	2	6	3	2
17	Skin conditions*	1, 2 and 3	25%	Not achieved	N/A	4	4	4	3	1
18	Vomiting*	3	18.8%	Not achieved	N/A	1	3	9	2	1

Importance ratings for potential areas of focus for interventions aiming to enhance uncertainty tolerance.

19	Teach doctors to communicate uncertainty, equipping them with phrases and skills to apply when discharging patients.	5	100%	1	N/A	0	0	0	2	21
----	--	---	------	---	-----	---	---	---	---	----

20	Senior doctors are available to consult at all times.	5	100%	1	N/A	0	0	0	3	20
21	Encourage trainees to discuss why a decision was made, rather than what decision was made.	5	100%	1	N/A	0	0	0	7	16
22	Patients clearly understand any discharge instructions given.	5	95.7%	1	N/A	0	0	1	4	18
23	Ensure trainees have adequate and appropriate clinical exposure which includes a range of patient acuity and complexity.	5	95.7%	1	N/A	0	0	1	6	16
24	Culture within the ED team promotes psychological safety and facilitates an awareness that decisions can be made as a team.	5	95.7%	1	N/A	0	0	1	7	15

25	Doctors are aware of the patient's own tolerance for risk and uncertainty.	5	93.8%	2	+33%	0	1	0	3	12
26	Help trainees distinguish situations where anxiety is developmentally appropriate (e.g. they're anxious because they are being challenged and they should interpret this anxiety as a signal to ask for help from colleagues) and where it is a maladaptive and unnecessary response to uncertainty.	5	93.8%	2	+24.3%	0	0	1	6	9
27	Support trainees when they perceive a mismatch between their own interpretation of a situation and the interpretations of others on the care team.	5	93.8%	2	+19.9%	0	0	0	6	9



For example, providing doctors with strategies to respond to uncertainty which comes from other doctors having a different opinion to them on how to manage a patient.

28	Encourage trainees to reflect on their own personal risk thresholds and the factors which influenced risk-averse decisions they have made.	5	93.8%	2	+19.9%	0	0	1	7	8
29	Prompt doctors to consider whether further medical investigations would have an impact on the certainty of any diagnostic impressions.	5	91.3%	1	N/A	1	0	1	8	13
30	Support trainees' growth toward independent practice, encouraging	5	91.3%	1	N/A	0	0	1	7	14

them to gather and filter cues towards judgement that they can trust and respond to.

31	Patients are aware of the limitations of testing and further medical investigation and, after considering the risks and benefits of potential management options, support the decision to discharge.	5	91.3%	1	N/A	0	0	3	8	13
32	Address areas of uncertainty for trainees more directly during clinical supervision.	5	91.3%	1	N/A	0	0	2	10	11
33	Services (e.g. ambulance, 111, GP, hospital, social care) are better integrated, making reasons for attendance and options for	5	87.5%	2	+22.3%	0	1	0	1	13

	care outside of hospital clearer.									
34	The ability of the primary care system to act as a reliable mechanism for follow-up is improved.*	5	87.5%	2	N/A	1	0	1	3	11
35	Equip doctors with the skills to effectively reflect on their own practice in a way which promotes pattern recognition over time.	4 and 5	87.5%	2	+17.9%	1	0	1	7	7
36	Help trainees to respond to their anxiety around discharging patients in ways other than over-testing or admitting patients.	5	87%	1	N/A	0	1	2	9	11
37	Focus on developing an acceptance that practice does not need to be about	5	82.6%	1	N/A	0	1	3	2	17

completely eliminating uncertainty, but more about considering which risks are appropriate to take.

38	Patients and families do not view uncertainty as a weakness in a doctor's abilities.	5	82.6%	1	N/A	1	0	2	5	14
39	Doctors are supported by highly sensitive and reliable guidelines and decision rules advocating no medical intervention for low-risk patients.	5	82.6%	1	N/A	1	1	3	6	13
40	When responsibility increases and doctors become senior decision makers, they receive training on uncertainty tolerance to build confidence.	5	82.6%	1	N/A	1	0	3	7	12

41	Follow-up care, including community discharge teams and specialist care pathways, are more readily, and consistently, available.	5	82.6%	1	N/A	1	2	1	7	12
42	Doctors are more aware of safety netting strategies they can utilise.	5	82.6%	1	N/A	1	0	3	8	11
43	Recognise that trainees may struggle to establish the legitimacy of their own clinical judgement and help them validate their judgements.	4	82.6%	1	N/A	0	0	3	10	9
44	Encourage doctors to explore how guidelines provide a framework, not a manual, of care.	4	82.6%	1	N/A	1	0	2	14	5
45	Expose trainees to more case studies where	5	81.3%	2	+16%	0	0	2	5	8

unnecessary admission  
and over-testing  
contributed to adverse  
patient outcomes.

46	Strategies are in place to protect against or recover from decision fatigue during shifts.	5	78.3%	1	N/A	0	1	2	3	15
47	Train doctors to acknowledge uncertainty and identify what cues to act upon in uncertain situations.	5	78.3%	1	N/A	0	0	2	4	14
48	Involve junior doctors in the creation of medical education and training modules so that they reflect their lived experience and guides them on what to do if they are uncertain e.g. when to involve a senior.	5	78.3%	1	N/A	0	2	3	6	12

49	Give trainees more feedback on their admission and discharge metrics which includes patient outcomes so doctors can understand whether patients benefitted from their decisions.	5	78.3%	1	N/A	2	2	1	6	12
50	Doctors and patients have a greater awareness of the inevitability of uncertainty and the benefits of diagnosis with unknown aetiology, rather than premature closure.	4	78.3%	1	N/A	0	1	2	10	8
51	Place more emphasis on how to incorporate a patient's preferences, values and goals into the consideration of risks and benefits of various	4	78.3%	1	N/A	0	2	3	12	6

	outcomes to establish the approach most appropriate for them.									
52	Seniors are supported and challenged to be less judgemental of catastrophic patient outcomes in the ED.*	4	75%	2	N/A	1	0	2	1	11
53	Specialist doctors in the hospital, outside of the ED (e.g. intensivists and anaesthetists), are less judgemental of adverse events in the ED.*	5	75%	2	N/A	1	2	1	2	10
54	Advocate discharge as the default position unless using guidelines where the benefits of admission are established as outweighing the risks.	5	75%	2	+22.8%	4	0	0	5	7



55	Following involvement in an adverse event, individual doctors receive training on uncertainty tolerance to build confidence.	4 and 5	75%	2	+14.1%	2	1	1	6	6
56	Practice guidelines place more emphasis on whether the care a patient needs can be provided only via hospital admission or elsewhere.	4	75%	2	+14.1%	3	0	1	8	4
57	Encourage use of the space provided in the ED medical notes for free text, where the doctor can describe their clinical reasoning leading to discharge (e.g., when clinical evidence is low).	5	68.8%	Not established	+7.9%	1	1	2	3	8

58	Teach doctors classifications (e.g. low/medium/high) or percentages of the initial probability and likelihood of diseases and prompt them to refine their understanding of these probabilities and likelihoods based on the patients they have seen in their career.	5	68.8%	Not established	-5.1%	1	1	3	4	7
59	Encourage strategies for weighing the risks and benefits of various interventions, rather than learning, and strictly adhering to, specific patient management pathways.	5	68.8%	Not established	-5.1%	1	1	3	4	7
60	Clinical decision rules emphasise the	5	68.8%	Not established	+16.6%	0	3	1	5	6

expectation of ED is to only manage the presenting complaint and pathways are improved to manage uncertainty relating to anything else.

61	When returning to the ED after a mandatory training year in anaesthetics and ICU, doctors receive training on uncertainty tolerance to build confidence.	5	68.8%	Not established	+12.3%	1	0	3	5	6
62	Disseminate guidelines which give example clinical scenarios in which there are multiple plausible, and satisfactory, patient management approaches. Each of which are equally valid.	4	68.8%	Not established	+1.1%	1	0	4	6	5

63	Work with legal advisors to better understand the medico-legal aspects of decision-making by individual doctors. For example, better defining the liability of doctors and organisations when a patient is discharged who, at the time, was considered to have a very low likelihood of catastrophic outcomes.	5	62.5%	Not established	+10.3%	1	3	2	3	7
64	Encourage doctors to give non-medical factors (e.g. the emotional burden to patients and societal costs of resource use) more consideration when advocating admission or discharge.	5	62.5%	Not established	+23.4%	0	2	4	3	7

65	Encourage doctors to consider if an uncertainty management approach is appropriate by considering the source and reducibility of the uncertainty they face and use this to inform patient management (e.g. is it uncertainty which could be associated with misdiagnosis and require more resource use or is it just lack of knowledge or misinterpreted information?).	4	62.5%	Not established	+23.4%	1	1	3	8	2
66	Use of testing and imaging, for which evidence suggests can reduce admission rates by ruling out serious diagnoses, is encouraged.	5	56.3%	Not established	+17.2%	2	0	5	3	6

67	Clinical decision units and/or observation units are available, with sufficient bed space.	5	50%	Not established	+6.5%	3	1	4	2	6
68	Patients who are still experiencing uncertainty after discharge are identified and receive a post-discharge follow-up.	4	50%	Not established	+28.3%	2	3	3	6	2
69	Guidelines acknowledge doctors' level of confidence in their own clinical judgement and only advocate rigid adherence to them when doctors are low in confidence.	4	43.8%	Not established	-4.0%	3	3	3	4	3
70	Specialist opinion (e.g. from surgeons) is obtained before or in conjunction with imaging and test results.	1	31.3%	Not established	-3.5%	8	2	1	2	3

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Notes.

*The column 'percentage agree' presents the percentage of experts choosing 'very important' or 'fairly important.'*

*The consensus threshold for inclusion was set at 75% agreement for 'very' or 'fairly important' and the threshold for exclusion was 75% agreement that the item is 'not at all' or 'slightly' important.*

*Items are grouped into a) presenting complaints and b) focus for initiatives and are presented in descending order of consensus within these groups.*

*Numbers stating "do not know" are not presented.*

*There were 23 experts in round 1 and 16 experts in round 2.*

*'N/A' in the '% change in consensus' column means the item was only present in one round i.e. item reached consensus in round 1 or was a new item suggested by experts (indicated by an asterisk).*

*For items which did not meet consensus, round 2 responses are presented.*

### Appendix 5.3

#### Evolution of importance ratings across two rounds of the e-Delphi survey

*Descriptive statistics for importance ratings of the 29 items in both rounds of the e-Delphi study depicting how importance ratings changed and whether ratings moved toward or away from consensus.*

<b>Presentation</b>	<b>Importance</b>	<b>Round 1 (n=23)</b>	<b>Round 2 (n=16)</b>
Abdominal pain	<i>M</i>	4	4.56
	<i>SD</i>	0.85	0.51
	Range	3	1
Headache	<i>M</i>	3.83	4.13
	<i>SD</i>	0.83	0.81
	Range	3	3
Mental health concerns	<i>M</i>	3.70	3.81
	<i>SD</i>	0.93	1.42
	Range	3	4
Fever	<i>M</i>	3.22	3.75
	<i>SD</i>	0.90	1
	Range	3	3



Older patients	<i>M</i>	3.48	3.5
	<i>SD</i>	0.95	1.26
	Range	3	4
<b>Potential area of focus for interventions</b>	Importance	Round 1 ( <i>n</i> =23)	Round 2 ( <i>n</i> =16)
Doctors are aware of the patient's own tolerance for risk and uncertainty.	<i>M</i>	4	4.63
	<i>SD</i>	1.67	0.81
	Range	3	3
Help trainees distinguish situations where anxiety is developmentally appropriate (e.g. they're anxious because they are being challenged and they should interpret this anxiety as a signal to ask for help from colleagues) and where it is a maladaptive and unnecessary response to uncertainty.	<i>M</i>	3.78	4.5
	<i>SD</i>	1.17	0.63
	Range	4	2
Support trainees when they perceive a mismatch between their own interpretation of a situation and the interpretations of others on the care team. For example, providing doctors with strategies to respond to uncertainty which comes from other doctors having a different opinion to them on how to manage a patient.	<i>M</i>	4.35	4.69
	<i>SD</i>	0.98	0.60
	Range	3	1
	<i>M</i>	4.17	4.44
	<i>SD</i>	0.94	0.63

Encourage trainees to reflect on their own personal risk thresholds and the factors which influenced risk-averse decisions they have made.	Range	3	2
Services (e.g. ambulance, 111, GP, hospital, social care) are better integrated, making reasons for attendance and options for care outside of hospital clearer.	<i>M</i>	4.30	4.81
	<i>SD</i>	1.06	0.83
	Range	3	3
Equip doctors with the skills to effectively reflect on their own practice in a way which promotes pattern recognition over time.	<i>M</i>	4.13	4.19
	<i>SD</i>	1.22	1.05
	Range	3	4
Expose trainees to more case studies where unnecessary admission and over-testing contributed to adverse patient outcomes.	<i>M</i>	3.78	4.31
	<i>SD</i>	1.13	0.79
	Range	4	2
Advocate discharge as the default position unless using guidelines where the benefits of admission are established as outweighing the risks.	<i>M</i>	3.39	3.69
	<i>SD</i>	1.67	1.66
	Range	4	4

Following involvement in an adverse event, individual doctors receive training on uncertainty tolerance to build confidence.	<i>M</i>	3.70	3.81
	<i>SD</i>	1.40	1.38
	Range	4	4
Practice guidelines place more emphasis on whether the care a patient needs can be provided only via hospital admission or elsewhere.	<i>M</i>	3.74	3.63
	<i>SD</i>	1.36	1.41
	Range	4	4
Encourage use of the space provided in the ED medical notes for free text, where the doctor can describe their clinical reasoning leading to discharge (e.g., when clinical evidence is low).	<i>M</i>	4.13	4.19
	<i>SD</i>	1.42	1.33
	Range	4	4
Teach doctors classifications (e.g. low/medium/high) or percentages of the initial probability and likelihood of diseases and prompt them to refine their understanding of these probabilities and likelihoods based on the patients they have seen in their career.	<i>M</i>	3.92	3.94
	<i>SD</i>	1.00	1.24
	Range	3	4
Encourage strategies for weighing the risks and benefits of various interventions, rather than learning, and strictly adhering to, specific patient management pathways.	<i>M</i>	4.26	3.94
	<i>SD</i>	1.05	1.24
	Range	3	4
	<i>M</i>	3.57	4.06

Clinical decision rules emphasise the expectation of ED is to only manage the presenting complaint and pathways are improved to manage uncertainty relating to anything else.	<i>SD</i>	1.31	1.24
	Range	4	3
When returning to the ED after a mandatory training year in anaesthetics and ICU, doctors receive training on uncertainty tolerance to build confidence.	<i>M</i>	3.61	4.13
	<i>SD</i>	1.59	1.20
	Range	4	4
Disseminate guidelines which give example clinical scenarios in which there are multiple plausible, and satisfactory, patient management approaches. Each of which are equally valid.	<i>M</i>	4	3.88
	<i>SD</i>	0.95	1.09
	Range	3	4
Work with legal advisors to better understand the medico-legal aspects of decision-making by individual doctors. For example, better defining the liability of doctors and organisations when a patient is discharged who, at the time, was considered to have a very low likelihood of catastrophic outcomes.	<i>M</i>	3.39	3.75
	<i>SD</i>	1.53	1.39
	Range	4	4
Encourage doctors to give non-medical factors (e.g. the emotional burden to patients and societal costs of resource use) more consideration when advocating admission or discharge.	<i>M</i>	3.65	3.94
	<i>SD</i>	1.34	1.12
	Range	4	3
	<i>M</i>	3.91	3.75

Encourage doctors to consider if an uncertainty management approach is appropriate by considering the source and reducibility of the uncertainty they face and use this to inform patient management (e.g. is it uncertainty which could be associated with misdiagnosis and require more resource use or is it just lack of knowledge or misinterpreted information?).	<i>SD</i>	1.08	1.18
	Range	4	4
Use of testing and imaging, for which evidence suggests can reduce admission rates by ruling out serious diagnoses, is encouraged.	<i>M</i>	3.65	3.69
	<i>SD</i>	1.43	1.35
	Range	4	4
Clinical decision units and/or observation units are available, with sufficient bed space.	<i>M</i>	3.39	3.44
	<i>SD</i>	1.62	1.55
	Range	4	4
Patients who are still experiencing uncertainty after discharge are identified and receive a post-discharge follow-up.	<i>M</i>	2.96	3.19
	<i>SD</i>	1.11	1.28
	Range	4	4
Guidelines acknowledge doctors' level of confidence in their own clinical judgement and only advocate rigid adherence to them when doctors are low in confidence.	<i>M</i>	3.61	3.06
	<i>SD</i>	1.47	1.44
	Range	4	4

Specialist opinion (e.g. from surgeons) is obtained before or in conjunction with imaging and test results.	<i>M</i>	2.78	2.38
	<i>SD</i>	1.59	1.67
	Range	4	4

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## Notes.

*Importance was rated on a scale of 1= not at all important; 2= slightly important; 3= somewhat important; 4= fairly important; 5= very important.*

*M= Mean; SD= standard deviation. Those highlighted in grey represent means which moved further toward the mode in round 1 following receipt of group feedback.*

*Items which reached consensus in round 1 or were new items only included in round 2 are not presented.*

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