PhD Thesis

A mixed-methods evaluation of telephone based digital triage used in urgent care within the United Kingdom

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A thesis submitted for the degree of Doctor of Philosophy in Health Sciences

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March 2023

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Acknowledgements

I would like to thank my supervisors Dr Helen Atherton, Prof Jeremy Dale and Dr Gary Abel for their support and encouragement over the last three and a half years.

Helen, thank you for being so supportive throughout the PhD. I always felt clearer and more positive after every time we met. I have learnt a lot from your pragmatic approach, your people skills and the amazing team you have built. Thank you for always highlighting opportunities to me, including the fantastic opportunity I had to visit Monash University in Melbourne to disseminate my findings. I could not have asked for a better supervisor.

Jeremy, thank you for motivating me, your belief and perseverance in all aspects of the project, particularly in the NHS Digital data application, for which we finally did get the data. Thank you for all the knowledge you brought to this project, including how findings may translate to service delivery. Thank you for the contacts you have introduced me to and the many opportunities to present my work that you have encouraged.

Gary, thank you for spending a lot of time and patience to support me with using Stata and the use of statistical methods. Thank you for all your advice in how to approach a routine data study and for highlighting opportunities including the HES data training I attended. I have been very lucky to have had your support with the specialist knowledge needed for this project.

I want to thank members of Helen's wider team, including Carol for her support with the systematic review, and Jo P for her help with supporting the dissemination workshop. A big thank you to Helen McGowan for helping me with sending participant vouchers for the qualitative study, other practical matters and moral support! I would like to thank Medical School students Liz Sellars and James Barry for their hard work in supporting the systematic review, as second screeners and reviewers.

I want to thank the other PhD students that have provided moral support and friendship, including Julia W, Julia G, Armina, and Nicky. I'd like to thank Francesca in the PGR support team for her help.

I’d like to thank Sumera, Alistair and Carlene from the project partner Advanced Health and Care and the participants that took part in this research who all made this project possible.

I’d like to thank my family and friends for their moral support, and finally, I’d like to thank my husband Adam, for supporting me when times were hard, and for doing more of the household cleaning recently! I could not have done this without you.

Declaration

This thesis is submitted to the University of Warwick in support of my application for the degree of *Doctor of Philosophy*. It has been composed by myself and has not been submitted in any previous application for any degree.

[redacted]

Vanashree Sexton

24 March 2023

Publications

Parts of this PhD research have been published:

Sexton V, H Atherton, J Dale, G Abel (2023) A cross-sectional study of clinician-led secondary triage in England's urgent care delivery. BJGP (accepted) - Chapter 3

Sexton V, Dale J, Bryce C, et al.(2022) Service use, clinical outcomes and user experience associated with urgent care services that use telephone-based digital triage: a systematic review BMJ Open 2022;12 – Chapter 2

Sexton V, J Dale & H Atherton (2021) An evaluation of service user experience, clinical outcomes and service use associated with urgent care services that utilise telephone-based digital triage: a systematic review protocol. BMC Systematic reviews, 10, 25 – Chapter 2

Conferences

Parts of this research have been delivered via oral presentation at:

Society for Academic Primary Care: South-West (SWSAPC), (Birmingham UK 2023): A mixed-methods evaluation of two-step telephone based digital triage in England's urgent care.

RCGP/Wonca conference (London 2022): An evaluation of England's "two-step" digital triage model in the delivery of urgent care

Society for Academic Primary Care: South-West (SWSAPC), (Warwick Medical School – online 2021): A cross-sectional study of clinician-led secondary triage in England's delivery of urgent care

Society for Academic Primary Care: annual scientific meeting (online - 2021): An evaluation of service user experience, clinical outcomes and service use associated with urgent care services that utilise telephone based digital triage: A systematic review.

HSR-UK (health service research UK) annual conference (online - 2021) A cross-sectional study of clinician-led secondary triage in England's delivery of urgent care

Funding Statement

The project is part-funded by industry partner Advanced health & care ltd (https://www.oneadvanced.com/solutions/solutions-by-sector/health-and-care/). Advanced Health and Care provided routine data used in some parts of this PhD, however, this research has been designed and conducted independently of Advanced Health and Care.

Competing interests

In addition to his University role, Prof Jeremy Dale (JD) is Director of Clinical Knowledge Unit at Advanced Health and Care. JD played no part in the retrieval or analysis of the data.

Abstract

Background

Telephone-based urgent care in England typically involves an initial ‘primary’ triage conducted by a non-clinician in the NHS 111 telephone service. Approximately 50% of these patients are subsequently referred for ‘secondary’ clinician-led triage. This ‘two-step’ model contrasts with other parts of the UK and other countries, where patients typically undergo a single clinician-led triage.

Digital triage is widely used in these services by call takers to support the provision of referral and/or self-care advice, based on the patient’s symptoms. Despite wide adoption, there is limited evaluation of patterns of triage outcomes and patient experience, particularly in the context of England’s two-step triage.

Methods

Convergent mixed methods, including analyses of routine data from four urgent care providers in England to evaluate patterns of triage outcomes, including clinicians’ overriding (decision to upgrade or downgrade the urgency level) from: 1)primary triage outcome and 2)digitally recommended triage outcome generated by the clinician in secondary triage. Semi-structured interviews and thematic analysis were used to explore callers’ experiences of ‘two-step triage’ and ‘direct clinician triage’ in England and Northern Ireland respectively.

Results

Non-clinician triage was risk averse, with over 70% of calls being subsequently downgraded in urgency following secondary triage. However, urgency appeared to be underestimated in primary triage in some calls. In secondary triage, there was variation between services and clinicians in how likely they were to upgrade/downgrade calls. Complexity and delays in two-step triage, and variation in call takers conduct of triage was evident in patients’ experiences.

Discussion

This research indicates inefficiency in two-step triage. Well-resourced secondary triage may help promote the efficient use of urgent and emergency care by patients following triage. Further research is required to investigate variation in triage outcomes between secondary triage providers and individual clinicians. Service providers should monitor calls where variation between call takers is most evident.

Abbreviations

APC – Admitted patient care

CASP - Critical Appraisal Skills Programme

CI – Confidence interval

CQC - Care quality commission

DARS – Data access request service

DSPT – Data security and protection toolkit

ECDS – Emergency Care dataset

ED – Emergency Department

GDPR – General data protection regulation

GP – General practitioner

HES – Hospital Episode Statistics

IMD - Index of multiple deprivation

LEP - limited English language proficiency

LSOA - Lower Super Output Area

MMAT - Mixed Methods Appraisal Tool

NHS – National Health Service

NICE – National Institute of clinical excellence

OOH – Out of hours

OR – Odds ratio

PPI – Patient and public involvement

PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analyses

PICOS - population, interventions, comparators, outcomes and study designs

RR – Rate ratio

SHD – Swedish Health Direct

1 Introduction chapter

1.1 Chapter overview

This PhD project investigated the use of telephone-based digital triage in urgent care using a mixed methods approach. This chapter sets the scene; it starts by describing how urgent care is delivered in England and how its delivery has changed over the last few decades.

The chapter goes on to describe the background literature, the UK-based urgent care setting in which the research was conducted, the participating service providers and the software based digital triage tools evaluated. Finally, the overall PhD project design and thesis structure is presented.

1.2 Background to urgent care triage in England

1.2.1 Urgent care definition and current set-up in England

Within England, urgent care has been previously defined as “the range of responses that health and care services provide to people who require – or who perceive the need for – urgent advice, treatment or diagnosis”(1). Urgent care is delivered by a wide range of organisations, including general practices, out-of-hours centres, ambulance services and telephone helplines. Urgent care forms a part of wider primary care, which provides “care for patients with a first presentation of a medical complaint”(2).

1.2.2 NHS 111 service in England

In England, the national NHS 111 telephone service provides an entry point for patients seeking care advice. The service operates 24/7 but is predominantly used by patients out-of-hours (OOH, outside of usual working hours), when general practices are typically closed. The service is delivered in calls centres, by non-clinical call handlers, who are not medically trained.

When patients call the NHS 111 service, they undergo telephone triage; telephone triage has been described as “a process by which people with a healthcare problem are given advice or directed to another relevant service via telephone”(3, 4).

The NHS 111 telephone service triages over 50,000 calls daily(5) of which approximately 24% calls are referred directly to emergency care, 8% to another service (for example, a dental service or pharmacy), 15% to self-care whilst 50% calls are identified as needing urgent clinical attention and subsequently referred to an urgent care provider(6).

The referral routes for patients triaged by NHS111 are presented in Figure 1.

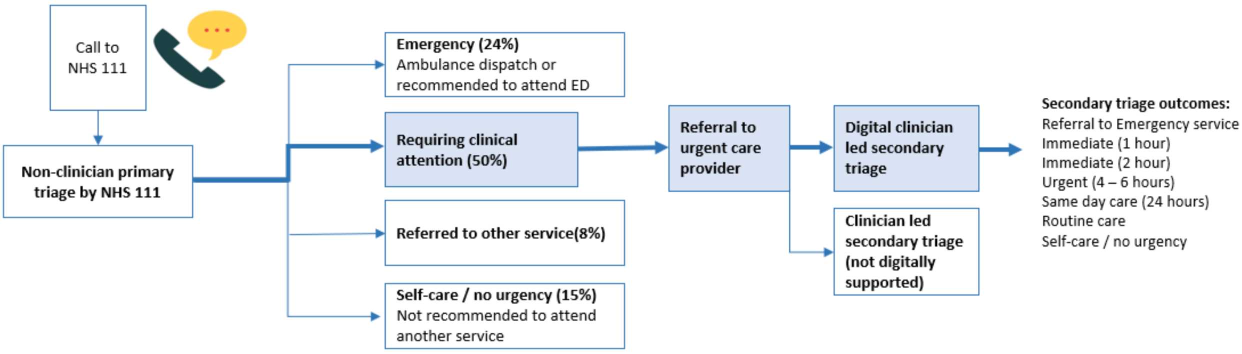


Figure 1: Referral routes for patients triaged by NHS111; approximate percentages provided(6). Blue referral route represents patients referred to secondary, digitally supported, clinician led triage.

The approximately 50%(6) of calls that are referred to an urgent care provider undergo a second clinician-led triage (referred to as “secondary triage”). These are patients who have been identified as requiring clinical attention by the NHS 111 service, and who thus undergo two levels of triage: the initial “primary” non-clinician triage conducted initially by NHS111 followed by the “secondary” clinician led triage; these are a key population of focus in this thesis.

However, some patients in England undergo clinician-led triage accessed via other routes. These patients are also represented in this research and are described in the two sections below (Alternative routes to clinician led triage in England/ differing models of urgent care delivery).

1.2.3 Alternative routes to clinician led triage in England.

Whilst patients typically access urgent care via the NHS 111 telephone service in England, in some cases patients may contact an urgent care provider directly or be referred from another service. At the time of conducting this PhD research, the 119-telephone service(7) had been introduced (in 2020) to help manage demand from patients with Covid-19 specific concerns and is an example of an alternative route to clinician led triage.

Another route of entry is patients who “self-triage” by entering their symptoms into the web-based NHS111 online service(8). Similar to the telephone service, patients who use the online service may be advised to access care via the emergency service, given self-care advice or may receive a call back from a clinician who then conducts triage, without the patient needing to speak to a non-clinical operator.

1.2.4 Differing models of urgent care delivery

Internationally most health systems do not use non-clinician led triage(9), instead patients typically undergo one triage assessment with a clinician(10), for example via telephone triage services such as Australia’s HealthDirect(11), Denmark’s medical help line (MH1813) and the AskMayoClinic telephone service(12) based in the USA.

In this thesis, this single triage model is referred to as “direct clinician triage”. Unlike most other countries, England uses a different triage model referred to as “two-step” where, as described above, typically patients undergo an initial non-clinician triage followed by a secondary clinician led triage assessment.

This thesis focusses on telephone based digital triage in urgent care delivered in the UK (England and Northern Ireland). The focus is on the two-step model used in England; however, the qualitative study additionally explores callers’ experiences of direct clinician triage in Northern Ireland (NI).

1.2.5 “Digital triage” within telephone-triage

This PhD research explores the use of digital triage, which is well established in telephone-based services that deliver urgent care(9). The process of digital triage involves the call taker (non-clinician or clinician) using a digital triage tool. Digital triage tools are a type of computer-based clinical decision support system (CDSS) which are used to support clinical decision making(13).

The digital triage tool is used by the call taker to assess the patients symptoms through a series of questions in order to generate algorithm-based care advice. The triage outcome (sometimes referred to as a disposition) generated is based on the severity of the patient’s symptoms and includes an urgency level and defined timescale. The advice subsequently given to the patient is based on the triage outcome and takes the form of signposting the patient to a local service to receive care within a defined timescale or providing self-care advice when appropriate.

Many telephone triage services, including NHS 111 and the subsequent secondary triage that is evaluated in this PhD project are delivered using digital triage. In the NHS 111 service, non-clincians use a digital triage tool called “NHS pathways” to triage patients(14).

Although digital triage is widely used, some urgent care helplines continue to use triage protocols (paper-based guidelines)(3) that the call taker refers to in assessing the patient. Protocol based triage is conducted in a similar way to digital triage, to refer to the patient to an appropriate care level of care; however, it may be less structured in its use of questions and answers and is not automatically electronically recorded as is usually the case in digital triage tools.

1.2.6 Potential benefits of digital triage

Digital triage (and the use of protocols) has the potential to improve consistency and safety of telephone-based care by enabling services to deploy a standardised process. However mixed attitudes towards this had been described early in the implementation of triage protocols and nurse led triage(15) including those arguing that the use of protocols is essential due to the high risk nature of telephone based care, whilst others suggest risks resulting from the prescribed nature of the interaction between the call taker and patient(15). The latter has been echoed in a recent study exploring the use of the Pathways digital triage tool by non-clincians, in which the structured nature of the digital triage tool impacted on call takers' communication and interaction with the patient, and appeared to compromise patient safety in some cases(4).

One benefit of digital triage (as compared to paper-based protocols) is that it may be scaled up to a national level, as done in the case of the NHS 111 telephone service, more easily. In addition, it can be designed for use by a mixed workforce, which is also evident in England's NHS 111 service. This large-scale standardisation has potential to improve consistency of care advice given and therefore patient safety, however there is limited evidence of this, which is further discussed in the background literature section of this chapter.

1.2.7 Care settings considered in the thesis.

This research is focused on the use of telephone based digital triage in the urgent care setting, which forms a part of primary care. NHS England defines primary care is as providers of "the first point of contact in the healthcare system, acting as the 'front door' of the NHS"(16). Primary care includes care provided by general practice, community pharmacy services as well as urgent care services such as the NHS 111 telephone service.

Urgent care provided by telephone based digital triage may also be delivered in the emergency care setting, for example for the triage of non-emergency calls by ambulance services. This setting was included in the systematic review that is presented in chapter 2.

Finally, some parts of this thesis, including the background literature presented in this chapter refer to the routine care setting. Routine care refers to care provided by general practice within their usual opening hours, and therefore includes, for example, triage of same day appointments within general practice.

1.2.8 The changing landscape of primary and urgent care

As described in the section above, telephone-based services such as NHS 111 are considered to be part of primary care. Internationally, primary care is known to be central to well performing health systems and functions as a “gatekeeper” for patients’ access to more costly secondary care services(17). In the past several decades there has been increasing demand on primary care and emergency care, including hospital based emergency departments (EDs) (3). This is due to multiple factors, including an ageing population with more complex healthcare needs, and increasing financial pressures on health care providers(18, 19).

In response to increasing pressures, over the last several decades, many developed countries, including England, have introduced wide scale organisation changes and initiatives within primary care(9). Service re-organisation has included two key trends: 1) centralisation of services, which may provide efficiency through scale, for example through the development of national urgent care telephone services and 2) workforce substitution, through the development of roles in nursing and non-clinical staff within care services(9).

Workforce substitution offers the potential to free up clinical resources, including general practitioners’ (GP) time(14), some have suggested it could result in cost savings through careful deployment of a less costly workforce(20). However, deployment of a less costly workforce does not necessarily translate to cost-savings; evaluations of cost effectiveness on the health system are challenging and evidence to date is mixed(20). Some have argued that triage is best conducted by more experienced clinical professionals, as whilst they are ‘more costly’ to employ, overall they may make better decisions, resulting in less patient contacts with care services, and overall lower costs to the health system(21). These trends and associated challenges in both centralisation and workforce substitution are particularly evident in services that provide urgent care, which have developed and changed greatly over the last few decades(9).

1.2.9 The shift from general practice co-operatives to centralised telephone helplines for urgent care.

In England, prior to the introduction of centralised telephone triage (prior to 1998), urgent care was provided by GPs working in a rota-based co-operative covering a geographical region during ‘out-of-hours’, outside of usual business operating hours. In 1998, NHSDirect, a centralised nurse led urgent care telephone service was introduced in England.

NHSDirect serves as an example of centralisation and workforce substitution, where nurses replaced the traditional role of GPs’ direct provision of telephone assessment and advice to patients seeking urgent care. In 2010, the NHS 111 telephone service was introduced in England and over time replaced NHSDirect(9). As described earlier in this chapter, calls received by NHS 111 are answered and triaged by non-clinical call handlers, an example of workforce substitution through the replacement of nurse led triage. As well as addressing increased demand and cost pressures, the introduction of NHSDirect and NHS 111 telephone services have aimed to improve patients’ access to urgent care, by providing a single, clear route of entry(8).

1.2.10 Aims of telephone triage

In response to rising pressures on primary care and the health service overall telephone triage services have been introduced to help manage demand through directing patients to receive appropriate care, for example to avoid unnecessary burden on emergency services and emergency departments.

For example, the NHS 111 telephone service was introduced as a gatekeeping service, aimed to direct patients to the “right service, first time”(22). However, evidence on both the appropriateness of advice given to patients, and the impact on wider healthcare services in triage services like NHS 111 is limited and mixed to date(10). These are discussed further in the background literature section of this chapter.

1.2.11 Impact of Covid-19 on urgent care delivery

The research conducted in this PhD took place after the start of the Covid-19 pandemic. Prior to the pandemic, digitisation of primary care was an NHS priority(23), however, shifts towards this were greatly accelerated following the start of the pandemic. This included greater promotion of self-triage via NHS 111 online(24) to help prevent pressures on other parts of the health system, for example, by discouraging patients from attending ED in person unless necessary. NHS111 online incorporated Covid-19 advice and formed part of the strategy for managing patient demand during the pandemic, its use was promoted as the first port of call, alongside media messaging to reduce demand and "protect" the NHS(25). The context and impact of Covid-19 is discussed in more detail in the quantitative and qualitative study chapters, and the discussion chapters (chapters 3, 6 and 7 respectively).

1.3 Background literature: patient centred outcomes

Background literature relating to telephone based urgent care triage is outlined in this section. This background is focussed on patient centred outcomes relating to digital triage, to align with the PhD research questions which are patient (rather than staff or health system) focussed.

1.3.1 Patterns of use

Studies describing patterns of telephone based digital triage service use have been conducted internationally, in services such as England's NHS 111, and similar services in Scotland (NHS 24), Denmark (medical help line MH1813), Australia (HealthDirect) and USA (Ask MayoClinic telephone service)(11, 12, 26-29). There have been some consistent findings across studies including the increase in service demand and use of these services over time(30), higher proportions of callers being female, more affluent, and higher proportions of calls being about younger age groups(12, 29, 30).

A Scotland based study of NHS 24 routine data examined patient characteristics, including presenting symptoms and whether service use varied based on time of day. Their findings showed that the service was used as intended, with 82.6% of calls being made out-of-hours. They reported a wide range of presenting symptoms; the most common being ‘abdominal problems’ (12.2% of calls), followed by dental problems (6.8% of calls) and rash or skin problems (6% of calls). The study additionally reported that service use declined with age in patients aged over 35 years(27).

A Denmark based study investigated the characteristics of patients who make repeated calls to an urgent out of hours care telephone service; they reported age, income, ethnicity and co-morbidities to be associated with repeat calls(26). As the authors suggest, these types of findings may help with understanding the needs of different patient groups, which could feed into the design of digital triage tools and training provided to supplement clinical decision making.

These studies provide useful insights into how patients access urgent care at the point of entry; however, no studies have reported on the characteristics of patients that are referred for further clinician led secondary triage, within England’s two-step triage model. Whilst one study of NHS 111 early in its implementation reported that 28% of calls were passed on for secondary triage(31), it did not describe the characteristics of these patients. In addition, no previous studies have explored the patterns of triage outcomes or associations with higher urgency triage outcomes within the two-step model.

Whilst this two-step model is not widely adopted outside of England(32), research into its effectiveness will be useful to an international audience who may consider adopting this model.

Based on the research gaps outlined in this section, one focus of the PhD project was to describe the types of patients that are referred for clinical attention and undergo ‘secondary triage’; this was chosen as it enables insight into the effectiveness of ‘primary’ triage and the overall two-step triage model.

1.3.2 Patient service use and health outcomes following triage.

Understanding the impact of telephone based digital triage on wider health care service use and health outcomes is needed to determine its effectiveness and safety, and to provide insight on how digital triage tools and service delivery can be improved.

A 2004 systematic review evaluated the impact of telephone consultation on patient outcomes including safety and health care service use(3). Of the nine included studies, four investigated the use of GP telephone consultations (not digitally supported) in comparison to usual face to face care in routine and OOH settings; two older studies investigated telephone consultations, delivered by non-clinical staff using protocols (not digitally supported); one study was based in a paediatric ED, the other study was based in the ambulatory setting and investigated triage conducted by an office clerk; three studies investigated nurse led digital triage through the use of “computer assisted algorithms”.

Of the three studies investigating nurse led digital triage: two investigated OOH calls digitally triaged by nurses in comparison to GP telephone triage within an OOH service: one investigated calls during evening and weekends (Lattimer et al. 1998, also discussed in more detail later in this section). The other was an adjunct study, conducted at the same OOH service, which investigated calls made overnight. The former study reported on GP routine visits, showing a significant reduction in routine GP visits associated with nurse triage. Both studies reported a slight (but non-significant) increase in ED visits, no difference between groups in hospital admissions and no significant difference in mortality, though both lacked power to detect differences in mortality(3).

The third study investigated nurse led digital triage in comparison to usual care provided by GPs in patients requesting same day appointments. They reported that nurses were able to manage 25.5 % of calls over the phone, without face to face contact The number of same day appointments was reduced with nurse triage, however there was an increased number of routine appointments at the practice, increased nursing time spent and a small significant increase in the use of local out-of-hours services and ED attendance (33). The authors concluded that nurse led triage did not reduce subsequent care contacts and costs.

Overall, no evidence of adverse events related to telephone consultation and triage was reported in this systematic review(3), however the authors suggest that results are interpreted with caution due to the diverse range of interventions and variable quality of studies(3). This review highlights mixed findings relating to patients' health care service use following telephone triage.

Since this systematic review, further studies based in routine general practice settings have been conducted. For example: a cluster randomised controlled trial compared 'offsite' nurse led digital triage using NHS Direct to a "usual care" comparator group: nurse led triage based on clinical judgement and protocols (not using digital triage). They found patients who were in the digitally triaged group, were less likely to have their problem resolved by the nurse and consequently were more likely to require a GP appointment. The authors reported no difference in out-of-hours or emergency department service use following triage between the two groups(34).

A more recent (2014) and larger cluster randomised controlled trial (the Esteem trial) investigated service use and health outcomes following triage of same day appointment requests in the routine care setting. This was a large-scale trial conducted in England across 42 general practices, including over 20,000 patient same day appointment requests. Patients calling to request same day GP appointments were randomised into three groups: 1) GP telephone triage group: patients received a call back from a GP who provided care advice over the phone (not using digital triage); 2) Nurse triage: patients received a call back from a nurse, who triaged patients using a digital triage tool and 3) Usual care provided by practices(35).

Findings from the Esteem trial showed around 50% of patients in the usual care group had just one primary care contact following their appointment request, compared with lower proportions in the intervention groups: 23% in the GP triage and 12% in the nurse triage group; an indication that usual care may be more effective. In the GP triage group, results showed a 33% increase (RR 1.33 CI: 1.30 – 1.36) in primary care contacts, increased face-to-face consultation with a nurse, and reduced GP face to face consultations. In the nurse triage group, there was a larger 48% increase in primary care contacts (RR 1.44 CI:1.44-1.52), a small increase in GP telephone consultations, and a small increase in nurse face to face consultation. Overall, in the nurse triage group there was a reduction in GP workload, however the authors report no reduction in service provision costs related to the nurse led triage. Overall Campbell et al. report a re-distribution of workload, rather than a reduction in workload that may have been expected(35).The authors reported no significant difference between the three groups in ED attendance or hospital admission. There were 8 patient deaths during the study period (5 in the GP triage group, 2 in the nurse triage group and 1 in usual care), however none of the deaths were deemed to be related to the interventions. Whilst these findings may indicate equivalent safety of nurse led digital compared to usual care, the authors acknowledge that the study did not have sufficient power to detect safety outcomes related to triage and suggest this should be investigated in future research(36).

A small number of studies investigating service use following triage have been conducted in the urgent care setting, for example, a randomised controlled trial conducted by Lattimer et al. in 1998 investigated the effectiveness and safety of nurse led telephone based digital triage operating within a GP cooperative in England(37). This trial compared two groups, which were allocated at specific blocks of time: the nurse led triage intervention, which was facilitated using a “computer based primary care call management system” and the usual care group, where care was provided by an on-call GP. Their analysis of 14,492 calls during the study period, (7308 in the usual care arm and 7184 in the intervention arm) showed that around 50% of calls could be managed by nurses without referral to a GP. In addition, a reduction of 69% in GP telephone advice, a 23% reduction in GP home visits and a 38% reduction in patient general practice attendance during the intervention (nurse triage) period was reported. Lattimer et al. reported no significant difference between the number deaths, hospitalisation or ED attendance(37). The authors emphasise that results relate to their particular triage implementation, including the selection of six nurses who were trained for a six week period on the use of the digital triage tool, which should be considered in the interpretation of results(37).

A 2011 study evaluated the impact of NHS 111 on urgent and emergency health care service use, following its introduction at four pilot sites in 2011(38). The authors reported no overall change in service use across primary care, ED attendance or 999 calls could be attributed to NHS 111. There was, however, a small increase in ambulance incidents – an increase of 2.9% (95% CI 1% - 4.8%) in monthly ambulance activity (11).

To date, very few studies have focussed on patient health outcomes following telephone based digital triage. A study conducted in a paediatric out of hours call centre investigated the frequency of triage under-referral with subsequent hospitalisation within 24 hours of triage. The authors reported five instances where a child was initially given a non-urgent disposition, and was subsequently hospitalised within 24 hours; reporting an overall rate of under-referral resulting in hospitalisation in 1 in 481 calls (95% CI: 1/152 – 1/1538)(39).

A recent study of NHS 111 explored service use following triage including patients' compliance with the advice that they were given by the service using data linkage(40). In this study 3,631,069 calls triaged by the service were analysed. Their findings highlighted a lack of compliance, for example, of all triaged patients who subsequently attended ED (who were triaged to any urgency level by NHS 111 n= 78056), 10%(n=78056) were classified as non-urgent by NHS 111 and of those (38.6%, n = 301,677) were later admitted into hospital(40).

Another recent data linkage study investigated hospitalisation and 28-day mortality in patients who had been triaged by the Danish medical helpline 1813 (MH1813)(41). Overall, this study included 6869 calls; 7.3% of patients were hospitalised within 48 hours of the triage call and 0.7% died within 28 days. The authors specifically investigated associations between socioeconomic status with triage advice of face-to-face care, hospitalisation and 28-day mortality. They reported lower odds of being triaged to face-to-face care associated with low household income, no difference in odds of hospitalisation but greater odds of mortality associated with low education level(41).

Previous studies have limitations in their assessment of health care service use following triage; older studies have typically assessed service use, for example GP visits or ED attendance, through patients' self-reported use of services or intentions, captured through surveys or telephone follow ups with recent service users(42-44). These findings are likely subject to recall bias and service use intentions may not translate to actual service use. In addition, older studies have collected primary data and so have been limited by sample size in their ability to investigate associations in service use and patient outcomes. There are now more readily available routine datasets, which recent studies have utilised(40, 41, 45). They have the potential to allow for robust analyses of health care service use and health outcomes following triage.

1.3.3 Patient experience of telephone based digital triage.

There has been limited research into callers' experiences of urgent care delivered through telephone based digital triage; previous studies have largely focussed on experience of the call taker who conducts digital triage, rather than the patient experience(46, 47) (14).

Studies of patient experience have predominantly been survey based and reported on patient satisfaction(32, 48). A systematic review that included patient satisfaction outcomes relating to telephone triage (including both digital triage and triage that is not digitally supported) reported satisfaction to be good in three studies that assessed this outcome(3).

Patient experience of NHS 111 was investigated through a postal survey, which formed part of a mixed methods study during its pilot at four sites across England in sites in 2010(49). Results showed that 73% of patients were very satisfied with the service. A more recent 2017 study of NHS 111 also included some analysis of patient satisfaction with 65% to 70% reported as being "very satisfied" with the service(14).

A mixed methods study of NHS 24, Scotland's urgent care non-clinician led telephone helpline that was introduced in 2002, investigated patients' experiences of and attitudes towards the service(28). This study included a survey and telephone interviews with both previous service users and non-users. Overall, the survey results showed high satisfaction amongst participants who had used NHS 24, with over 80% reporting they were satisfied or very satisfied. This study additionally reported common facilitators including: the convenience of accessing care advice without needing to leave home, particularly by callers with young children and patients who were located far away from urgent care facilities; and being able to access care advice more quickly, compared to a routine GP appointment. Whilst most interviewees expressed satisfaction in this study, the authors highlight that the initial triage questions were a common area of dissatisfaction. The authors report that interviewees generally understood the need for these triage questions, however users reported feeling that the questions were "lengthy, repetitive, and prescriptive"(28).

Other reasons for dissatisfaction included: concerns that staff did not have access to the patient's existing medical records, the length of time to receive a visit and not being sufficiently informed of the expected wait time, and NHS 24 staff being perceived to have ”poor local knowledge” in terms of signposting the patient to nearby services(28). They reported barriers to service use including difficulty talking over the phone, preference for face-to-face contact, and preferred alternatives, such as speaking directly to a patient’s own GP.

A recent study exploring patient experience of Swedish Healthcare Direct (SHD), a national nurse led telephone based digital triage service, was conducted by Björkman et al(50). The study involved the analysis of patient experiences as posted on three Swedish online forums; the authors described this as a ‘netnographic’ study design. Their findings highlighted predominantly negative patient experiences, which were categorised into three key themes: 1) problems relating to patients’ access to services, including reports of long telephone queues and difficulties with getting through to a call taker; 2) “bidirectional scepticism” which related to doubts and mistrust on advice given by the service, as well as patient’s feelings of being scrutinised by the nurse performing the triage in terms of exaggerating or downplaying their symptoms; 3) Performance of the nurses, which included both positive and negative experiences, including recommending other members of the public to contact the service and questioning the competency of the nurses respectively.(50)

This study of SHD presents informative findings, particularly as many other studies of patient experience have been survey based, and surveys have been shown to overestimate user satisfaction(51). However, it is likely that this study has only captured the views of a narrow group of users, as those who are very unsatisfied with services may be more likely to post their experiences online.

Evidently, there is limited research investigating the patient experience of urgent care delivered through telephone based digital triage. Most qualitative studies to date have focussed on staff experience of digital triage through interview studies and observation. Based on this, patient and additionally carer experiences formed a key focus of this PhD project.

1.3.4 Challenges in evaluating digital triage research.

Overall, previous studies show a mixed picture of patient outcomes related to digital triage, which likely result differing contextual factors between urgent care services, including differing: levels of clinical supervision; types of professionals delivering services; and staff training and professional development and level of integration with local services. Another factor is the wide range of services that utilise telephone based digital triage for the provision of urgent care, for example national helplines (e.g., NHS 111) and smaller scale services operating within a smaller area.

In addition, interpreting results from different countries is challenging due to differing features of health systems, for example healthcare pricing models; some countries are "fee-for-service" whereas others do not charge patients, and in doing so may unintentionally incentivise patients' use of care services(52). Another example is the differing models of urgent care triage delivery, with England utilising predominantly non-clinician led triage (32), whereas nurses typically conduct triage in other countries(10). This type of health system difference is important to consider in the interpretation of the literature.

Much of the research presented in this chapter has been conducted in England, in part this may reflect England's investment in large scale implementations of urgent care telephone services; England's previous NHSDirect service had been described to be the largest scale implementation worldwide(53). In comparison other countries have more fragmented services and correspondingly smaller scale implementations, for example, a 2003 research paper described the USA as having "at least 500 formalized nurse triage or advice systems"(54).

Another complexity is that 'digital triage' encompasses a broad range of interventions and there is there is no widely accepted system of classifying their design or content. Additionally there is no regulation to control when and how digital triage tools are used, although steps are being made towards this, for example by England's Care Quality Commission, England's independent regulator of health and social care(55). The lack of classification and regulation presents a challenge to the identification and comparison of studies investigating the use of these tools.

1.3.5 Summary of background literature

Whilst urgent care services widely use telephone based digital triage, there is limited evidence of the related patterns of service use and triage outcomes, patient experience, patients subsequent use of the healthcare system and health outcomes. Many studies discussed are old and have limited relevance to the current organisation of urgent care. For example, previous older studies have demonstrated decreased GP workload (37, 56) related to nurse led triage; however these studies were conducted when GPs were fully responsible for all aspects of the management and care provision to patients seeking care out of hours, which is no longer the case due to workforce shifts(52).

The impact of telephone based digital triage on other parts of the healthcare system (ED attendance and hospital admissions) have been investigated by a small number of studies, with mixed findings, with some studies reporting a small increase in ED attendance(33) or an increase in hospitalisations(38) whilst others reporting no significant difference in these service use outcomes(34, 36).

Previous studies have not raised safety concerns related to the use of telephone based digital triage; however, one of the largest trials conducted was not sufficiently powered to detect mortality rates(36). There is a lack of evidence on long term outcomes(53), however this may be challenging to assess due to the wide range of problems presenting to urgent care services. Overall, there is a need for more robust analyses of patient health outcomes.

Most studies investigating patient experience have been conducted using surveys, capturing very limited in-depth patient experience data. There is consistent evidence from quantitative and qualitative studies that certain patient groups are under-represented in their use of services, reasons for under-representation have not been investigated by previous studies.

Overall, previous studies have varying designs and methodological quality; the key gaps in the evidence include the impact of telephone based digital triage on patients' use of health care services and clinical outcomes following triage, in-depth understanding of patient experience, and understanding why certain sub-groups, such as males and older age groups, are under-represented in service use.

1.4 Rationale for PhD research

The background literature presented in this chapter has highlighted that many previous studies were conducted early in the implementation of services utilising digital triage. There is a need to evaluate services that are well established and reflect how urgent care is currently being delivered.

Based on the background literature, this PhD project aimed to build upon findings from previous studies through an extensive systematic review which evaluated the last 20 years of evidence relating to telephone based digital triage in urgent care, the analysis of large routine datasets of secondary triage call records, and a qualitative element which aimed to build upon understanding the patient experience in depth.

1.5 Research aim, questions, and design

1.5.1 Aim

The overall PhD aim was to understand how digital triage functions in the provision of urgent care in England’s two-step model, including the patterns of triage outcomes and patient experience; to develop recommendations for research and service delivery improvement.

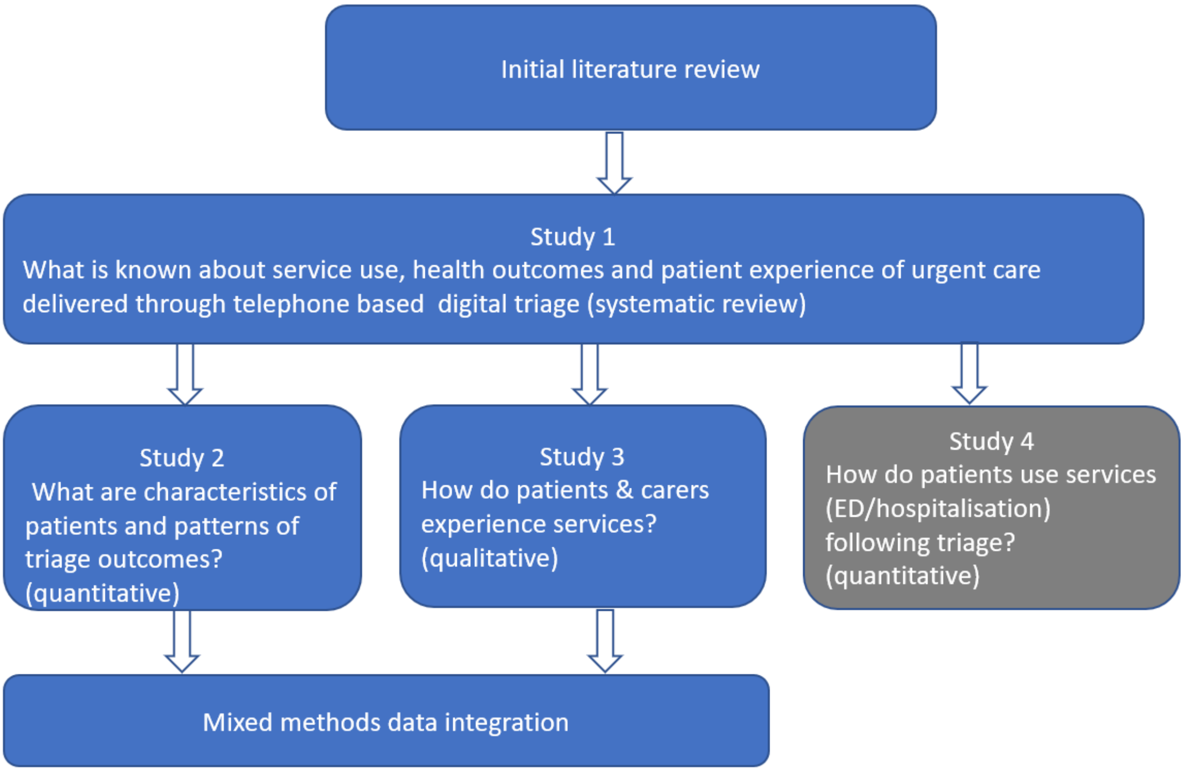
1.5.2 Overview of design

A mixed methods design was chosen to better understand how digital triage impacts patient outcomes through a greater breadth and depth of analysis through the corroboration of quantitative and qualitative elements(57).

The mixed methods approach enables research questions to be answered more deeply(58, 59), through exploring contradictions and connections between the data collected through different designs. This serves to provide a panoramic view of the research landscape(58). This was felt to be important in this research it was expected that the quantitative study may highlight patterns in digital triage, for example greater utilisation or higher urgency levels in certain patient groups group, however it is not possible to understand the reasons behind this using quantitative data alone. It was expected that gathering in-depth qualitative data may help to explain reasons behind patterns seen in the quantitative study. For example, certain patient groups may describe difficulty with their health concern or access to healthcare, which may explain differences seen in patterns of service use in these patients.

This mixed methods approach also enables the strengths and weaknesses of solely quantitative and qualitative data to be balanced in order to generate new insights and levels of analysis(57).

A predominantly convergent design was used, with both quantitative and qualitative elements being conducted concurrently. Findings from the systematic review fed into shaping both quantitative and qualitative studies. The systematic review, qualitative and quantitative findings were integrated using triangulation.
The design of the research is shown in the figure below.



The background literature, as reported in this chapter, was used to define a more focussed systematic review question. The systematic review then fed into the empirical study aims and designs, which were conducted in parallel. Mixed methods integration of findings from studies 1, 2 and 3 was conducted after the separate individual analyses of the respective studies. A study protocol, including the rationale, design, and data application process of Study 4 is reported in Appendix 1; however, this study was excluded from this thesis due to delays in receiving the routine patient outcomes dataset from NHS digital.

1.5.3 Key research questions

Study number	Research question(s)	Method
1	How does telephone based digital triage affect patient experience, clinical outcomes and health care service use in patients using non-general practice based urgent care services?	Systematic review
2	What are the characteristics of patients that undergo clinician led telephone based digital triage in England based services? What are the patterns of triage outcomes in these services?	Secondary data analysis of routinely collected data
3	How do patients experience urgent care delivered through telephone based digital triage?	Semi-structured Interviews Telephone / Video call
4	What patient health and service use outcomes are associated with the use of clinician led telephone based digital triage?	Secondary data analysis of routinely collected data (excluded from thesis)

1.6 Overview of patient public involvement (PPI) & stakeholder involvement

A patient and public involvement (PPI) panel of 8 participants was set up for this research project. Their involvement was sought at various stages of the project including at an early stage of research design, including: 1) the acceptability of use of routine data without consent for quantitative studies 2) topics for discussion in the qualitative study, as well as to providing feedback on the recruitment posters in the qualitative study. Finally, members of the panel were invited to attend a research findings dissemination event.

The project partner was Advanced and Care Ltd, who provide the 'Odyssey' digital triage tool to UK based urgent care providers. The data captured within the Odyssey digital triage tool was evaluated in this research and is discussed in further in the section below.

Five UK-based urgent care providers participated in the PhD research, as summarised in Table 1.

Table 1 Participating service providers.

Service provider	**Location**	**PhD component**
Bardoc https://www.bardoc.co.uk/	England	Quantitative
GTD Healthcare https://www.gtdhealthcare.co.uk/	England	Quantitative
Mastercall http://www.mastercall.org.uk/out-of-hours	England	Quantitative
Practice plus group https://practiceplusgroup.com/	England	Quantitative & qualitative
Dalriada urgent care http://www.dalriadacare.org/	Northern Ireland	Qualitative

1.7 The ‘Odyssey’ digital triage tool

In the PhD project, one particular digital triage tool (Odyssey) has been the focus, rather than examining all the tools offering urgent care triage in England.

Urgent care providers across England and Northern Ireland, who all use the Odyssey digital triage tool for clinician-led triage, which is supplied by Advanced Health and care (https://www.oneadvanced.com/) were recruited for this PhD research.

The Odyssey digital triage tool was evaluated in this PhD; it was provided by the industry partner for the PhD. This type of data is not typically available to researchers or publicly accessible. Another reason for this research being based on Odyssey is due to it being widely used and it is the only digital triage tool in England that has been accredited by the National Institute of Clinical Excellence (NICE)(60).

The Odyssey digital triage tool has been implemented in different ways across England and Northern Ireland. At the England based sites, Odyssey is used by clinicians to support secondary triage whilst in the Northern Ireland site it is used by clinicians in ‘direct clinician triage’. The quantitative study explores the use of Odyssey in England whilst the qualitative study explores its use in both England and Northern Ireland.

During triage using Odyssey, initially, a question set is selected by the clinician based on the patients main presenting symptom. The software then presents a set of questions, each question has up to 10 pre-set answers which may be selected by the clinician. Each answer carries a weighting that contributes to the digitally recommended triage outcome.

1.8 Research team members

Several team members supported this PhD research. The overall project design and conduct were supported by three academic supervisors: Dr Helen Atherton, Prof. Jeremy Dale and Dr Gary Abel. Additionally, Dr Carol Bryce supported the systematic review and qualitative design and analyses. Two medical students within Warwick Medical School supported the conduct of the systematic review: James Barry and Elizabeth Sellars. Samantha Johnson, specialist librarian in Warwick Medical School supported the literature searches conducted in the review.

1.9 Thesis structure

The thesis has eight chapters including this introduction chapter, as summarised in Table 2. Chapter 2 outlines the systematic review methods and findings. Chapter 3 describes the quantitative study which investigated characteristics of patients and patterns of triage outcomes in England. Chapter 4 describes the methods used in the qualitative study which explored patient and carers' experiences of these services. Chapter 5 presents the findings and discussion from the qualitative study. Chapter 6 syntheses findings across the studies using a mixed methods approach, including stakeholder feedback. Finally, chapter 7 presents the discussion and recommendations for future research and service delivery.

Chapter	PhD component
Chapter 1	Introduction
Chapter 2	Systematic review
Chapter 3	Quantitative study (characteristics of patients and triage outcomes)
Chapter 4	Qualitative study methods (caller experiences of digital triage)
Chapter 5	Qualitative study analysis and discussion (caller experiences of digital triage)
Chapter 6	Mixed methods synthesis & stakeholder feedback
Chapter 7	Discussion and recommendations for research and service delivery

Table 2 Summary of thesis chapters

1.10 Chapter summary

This chapter has introduced the urgent care setting, within wider primary care and the central role that telephone based digital triage plays in urgent care delivery. The key gaps in the evidence relating to patients' experience, service use and health outcomes were presented. These key gaps fed into the research questions and design. The participating stakeholders, PPI group and research team members were introduced. Finally, the thesis structure was introduced.

2 Systematic review chapter: a review of service use, clinical outcomes and caller experience associated with urgent care services that utilise telephone based digital triage.

2.1 Chapter overview

This chapter presents the systematic review, the first element of the PhD to be conducted, which informed the design of the subsequent quantitative and qualitative studies. The background literature presented in the previous chapter highlighted the need for an up-to date evaluation of telephone-based digital triage within urgent care. To address this need, this extensive review investigated what is already known about service use, clinical outcomes and user experiences related to urgent care delivered using digital triage.

This chapter starts by introducing the review question and objectives and details the review registration and publication. This is followed by a justification of decisions made to select the method, the methods that were used, and the synthesised findings. Finally, a discussion is presented which includes a comparison to other literature and the strengths and weaknesses of the review. Finally, conclusions of the review are presented, and how they have fed into the wider PhD project are discussed.

2.2 Review question and objective

The objective of the systematic review was to inform the other studies conducted in the PhD, including their design, focus and interpretation of findings. A review question was designed to evaluate the evidence relating to how digital triage functions in urgent care, taking a patient-centred approach, rather than being staff focussed; this was to address a key gap in the literature, based on knowledge of the background literature, as presented in the introduction chapter.

The following review question was developed: what is known about the service use, clinical outcomes and caller experiences associated with urgent care delivered using telephone based digital triage?

There were four key aims of the review, these included:

1) to describe the patterns of service use and triage outcomes

2) to evaluate what is known about patients and carers' experiences

3) to evaluate patients' service use following triage, including their subsequent use of primary care and emergency care

4) to evaluate patient's clinical outcomes following the use of triage, including hospital admissions and mortality

2.3 Registration and publication of review

This review is registered on Prospero (2020 CRD42020178500), the protocol(61) and full systematic reviews(62) were published in 2021 (BMC systematic reviews journal) and 2022 (BMJ open journal) respectively. This chapter presents a comprehensive version of the review, including detailed information on how the review was conducted and a justification of the method.

2.4 Justification for method

2.4.1 Selection of review type

The decision to use a systematic review and the review design (mixed methods review) was led by the review question and knowledge of the background literature as presented in the introduction chapter. As studies exploring urgent care triage were known to be heterogeneous in design and the question sought evidence about patients experiences, a mixed-methods review was selected, as it enables all types of evidence from empirical studies (quantitative, qualitative, and mixed design) to be included.

Consideration was given to the type of review (Scoping review vs. Systematic review) in relation to the review question. Scoping reviews aim to answer questions that are broader in nature, for example to identify characteristics of a concept, or to examine how research is conducted for a particular topic or as precursor to a systematic review(63); whilst a systematic review is typically narrower in scope, and aims to address a more precise clinically significant question(63). Systematic reviews additionally include a critical appraisal element (risk of bias assessment) and a synthesis of findings from individual studies leading to the generation of a summary(63). A systematic review was chosen, as it allowed the narrow review question defined to be addressed and enabled a thorough evaluation of individual studies, including a quality assessment. A systematic review was felt to be most suitable approach to develop a detailed understanding of the evidence for the first stage of the PhD project.

2.4.2 Scoping searches

Scoping searches are conducted prior to starting a full systematic review and can help to determine the feasibility and value of conducting a review(64). Scoping searches were conducted and fed into the development of the both the review question and the search strategy. The scoping searches identified a very broad body of literature relating to the use of digital triage in urgent care, which highlighted the need to refine the review question. Following these initial scoping searches the review question was refined to focus on patient centred outcomes, which also addressed a key evidence gap. Studies that only investigated staff focussed outcomes, for example, studies looking solely at experiences of staff members, or inter-rater comparisons of urgency level between different professional types (e.g., nurses vs general practitioners) were intentionally excluded from the review.

2.4.3 Approach to evidence synthesis

A narrative synthesis approach was selected to summarise findings from the included studies. Narrative synthesis has been described as a ‘synthesis of findings from multiple studies that relies primarily on the use of words and text to summarise and explain the findings’(65). The scoping searches helped with selecting and refining this approach. The approach was chosen as many studies of digital triage in urgent care delivery were diverse in terms of design and outcomes.

2.5 Method

This section details the methods that were used to conduct each stage of the review. The review has been reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework(66); this framework was designed to support transparent reporting of the conduct and resulting findings of systematic reviews(67). The PRISMA checklist, as reported in the published review, was used to confirm that all the standard and necessary elements of a review are present; this checklist is included in Appendix 2.

In line with the PRISMA guidelines, the protocol was registered on PROSPERO (2020 CRD42020178500). The protocol detailing the rationale and methods was additionally published in the BMC Systematic reviews journal in 2020(61).

2.5.1 Inclusion criteria

Eligibility criteria specifying the types of studies to be included were developed using the population, interventions, comparators, outcomes and study designs (PICOS) search tool(68); this search tool is a modified version of the PICO tool which has been widely used for quantitative reviews; the modified PICOS tool can be used to better identify studies of mixed designs, including qualitative studies(68).

The eligibility criteria developed for this review are specified below:

1. *Population:* studies that investigated the use of digital triage in the general population or within population sub-groups (for example older age groups, children, or patients with a specific condition) were included. The population defined was intentionally broad to align with the PhD project aim, which considered the whole service user population.
2. *Interventions:* studies assessing telephone based digital triage, which met each of the criteria specified below were included:
    a. Studies conducted in services that provide urgent care, this included for example, local telephone-based services; centralised telephone advice services such as NHS 111; urgent care triage implemented within the emergency care setting, where non-emergency calls undergo secondary triage (studies conducted in the in-hours general practice setting were excluded from the review)
    b. Studies that evaluated digital triage systems that were designed for use by the general population (condition specific services/condition specific digital triage tools were excluded)
    c. The use of digital triage resulting in triage outcomes (for example: referral to a local service, such as ED, GP, ambulance dispatch, and in some cases self-care advice)
3. Outcomes: studies that evaluated at least one of the following outcomes were included: characteristics of patients and patterns of triage outcomes; patients' use of healthcare services following triage; clinical outcomes (including hospitalisations and mortality); and caller (patient and/or carer) experience.

All empirical study types (including qualitative, quantitative, and mixed methods studies) published over a 20-year period, between 01 March 2000 – 01 April 2020 were included. A 20-year time-period was chosen as the delivery of urgent care was remodelled over this time, for example with changes of workforce mix(9, 69); the time period was selected to enable a thorough review spanning changes in urgent care delivery over the last two decades. Studies published in English were included in the review.

2.5.2 Search strategy

The search strategy was designed with the guidance of an academic support librarian (Sam Johnson) based within Warwick Medical School. Searches were completed in five research databases: Medline, Embase, Web of Science, CINAHL, and Scopus. Search terms relating to digital triage and urgent care (excluding in-hours general practice) were developed. As an example, the Medline search terms are presented below. The search was restricted to include studies that were published in English only. Electronically published (Epub) studies ahead of print were included and reference hand-searches were completed for all included full texts.

Search terms used for Medline search

Concept	Search terms
Care setting	Primary care.mp OR Primary Health Care/ OR After-Hours Care/ OR Out of hours.mp OR Emergency care.mp OR Emergency Medical Services/ OR Urgent care OR Ambulatory Care AND
Triage	Triage.mp OR Triage/ OR Telephone consultation.mp AND

Digital	Digital OR Computer OR Software OR Online OR Internet OR Web OR Computerised OR Computerized OR electronic OR ECDS* OR CCDS* OR Decision Support Systems, Clinical/ OR Decision support*

2.5.3 Study selection and data extraction

Articles were de-duplicated prior to study screening and selection. Two reviewers (the PhD candidate and research fellow/medical students within WMS) screened studies independently at both title and abstract screening and at full text screening stages using Covidence software. Any disagreements between the reviewers were resolved through discussion and where necessary a third reviewer was consulted (Dr Carol Bryce, Warwick Medical School). A PRISMA flow chart showing the numbers of studies at each stage is presented in the results section (Figure 2).

Following study selection, data extraction was conducted. A data extraction form was developed and piloted to confirm that key elements of studies could be captured. A list of data extraction fields are shown below in box 1. For each included study, data were extracted independently by two reviewers: the PhD candidate extracted data from all studies; two medical students at WMS, James Barry and Elizabeth Sellers acted as the second reviewers, with discrepancies being resolved through discussion with a third reviewer(Dr Carol Bryce). In addition, study authors were contacted where clarifications or further information regarding the study were required.

Box 1

Data extraction form variables

The following information was extracted and entered into the data extraction form:

1. Author
2. Publication year
3. Country
4. Study design
5. Care setting
6. Participants
7. Intervention details
8. Type of care service staff conducting triage (doctor/nurse/paramedic/non-clinician),
9. Comparator
10. Outcomes
11. Effect of intervention
12. Contextual factors, (for example: staff experience and training, time that the service has been in place, level of support available to call takers).

2.5.4 Quality assessment

Quality assessment (including assessing the risk of bias) was conducted by two reviewers using the Mixed Methods Appraisal Tool (MMAT)(70). The MMAT was chosen as it specifies differing quality assessment criteria modified to appraise differing study designs: quantitative, qualitative and mixed study types. Other assessment tools are study design specific, for example the Cochrane risk-of-bias which is designed for randomised controlled trials(71) or the Critical Appraisal Skills Programme (CASP) which provides different quality appraisal checklist specific to different study designs(72). The MMAT was also chosen as it is a robust tool created by a research group that has been further piloted and refined by methodological experts(73).

The quality assessment conducted using the MMAT for each study was used to provide context of the findings in the synthesis rather than to exclude studies(74). Studies were categorised as high, medium, or low quality according to the number of MMAT criteria met;

studies were categorised as high if all five MMAT criteria were met, medium if three or four criteria were met or low quality if two or less criteria were met. Whilst this approach to summarising the strength of each study is not defined within the original tool, it has been developed and used in other systematic reviews(75).

Summarising the strength of evidence in this way was also felt to be important in this review particularly as the outcomes reported by the included studies were expected to be heterogeneous. For example, studies of patients' service use following triage, may report use of different service types (e.g., general practice, EDs, ambulance dispatch), therefore summaries including the strength of evidence were expected to help with better understanding and summarising the evidence and its strength in different outcome areas. The summary category (high/medium/low) was also required to present the strength of evidence using a visual summary, as described further in the following data synthesis section.

2.5.5 Data synthesis

A narrative synthesis(74) approach was selected due to the expected diversity of study designs that would be included in the review. This approach included: generating an initial preliminary synthesis, exploring relationships between findings across studies, assessment of the robustness of the evidence and summarising the main findings (74).

Statistical meta-analysis was not conducted, as the heterogeneity of the included studies meant that this was not possible. However, to present comparisons between studies visual summary tables were created. These tables grouped key findings by study using a subgroup analyses method which can be used to present findings within narrative synthesis(74). This involved creating a table of the main findings together with an indication of agreement within each study.

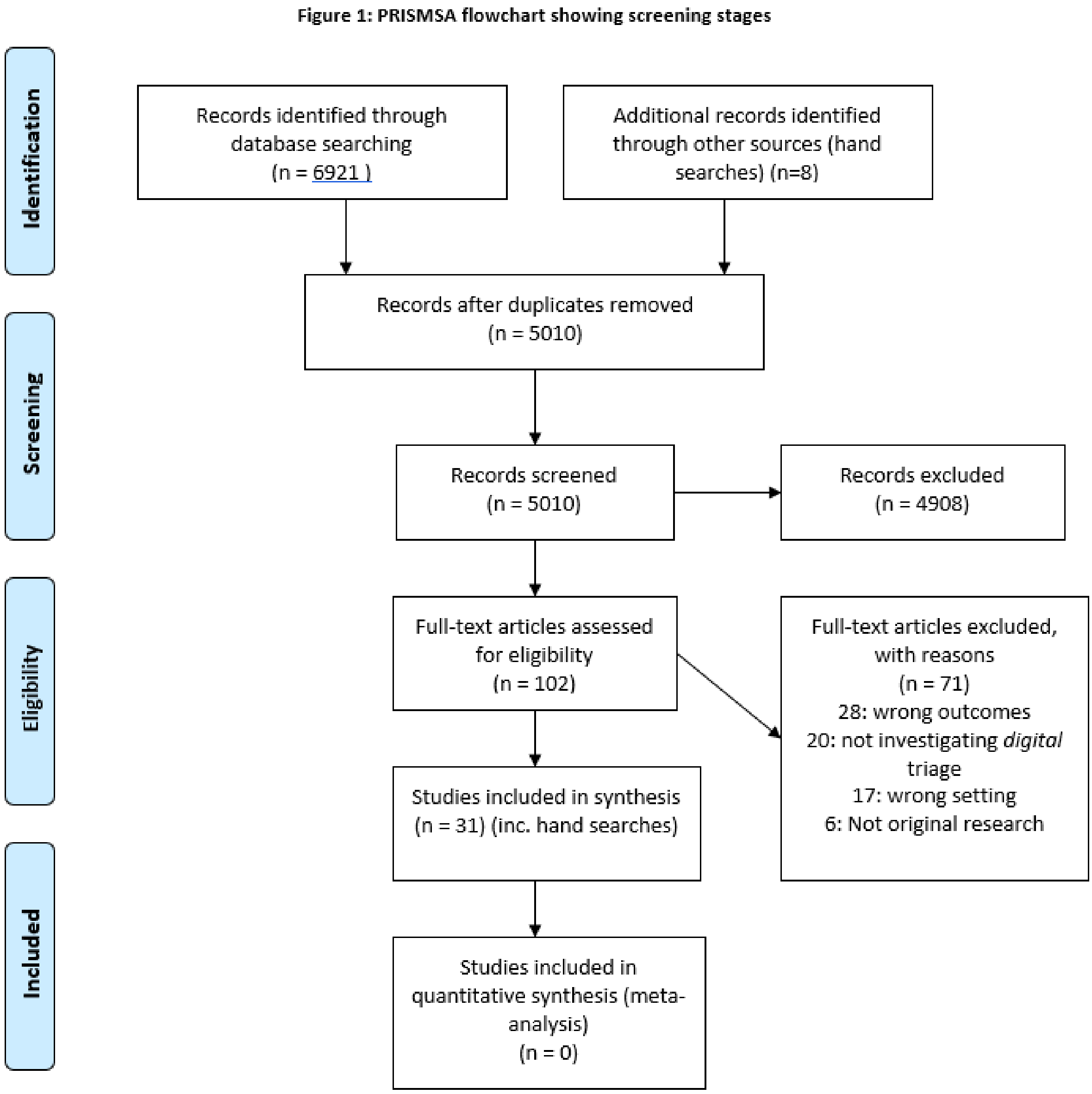
The visual summaries were additionally modified to demonstrate the strength of evidence as assessed using the MMAT in response to a suggestion from peer review of the systematic review publication. See Figure 3 and Figure 4.

In some cases, a visual summary was not possible due to the heterogeneity of outcomes, in these cases findings were summarized in text.

2.6 Results

Searches of the five research databases resulted in 6921 records; after removing duplicates, there were 5010 records, these were screened at title and abstract level. Following title and abstract screening, 102 records were included for screening at the full text stage. Of these, a final 31 studies were eligible and were included in the review. The number of studies at each of these stages is presented in the PRISMA flowchart (Figure 2).

Figure 2 PRISMA flowchart showing screening stages



***This flowchart is also presented in the published review** (Sexton, V., et al. (2022). "Service use, clinical outcomes and user experience associated with urgent care services that use telephone-based digital triage: a systematic review." BMJ Open **12**(1): e051569, doi:10.1136/ bmjopen-2021-051569**)**

The majority of the studies included were of quantitative design (n=25)(27, 29, 30, 32, 38, 43, 48, 76-93) these quantitative studies took different methodological approaches, they included: analyses of routine data (n=16)(27, 29, 30, 38, 76-81, 83, 85, 89, 90, 92, 93), surveys(n=6)(32, 48, 82, 84, 86, 88), controlled trials (n=2)(43, 91), and a descriptive study (n=1)(87). There were fewer studies of qualitative design (n=4)(50, 94-96) and mixed methods design(n=2)(28, 97).

Studies were mainly conducted within the UK (n=17)(27, 28, 30, 32, 38, 77, 78, 82-85, 87, 91, 92, 94, 95, 97), with fewer numbers from Sweden (n=4)(48, 50, 96, 98), Australia (n=4)(43, 86, 89, 93), USA (n=3)(29, 76, 79), Netherlands (n=2)(81, 88), Japan (n=1)(90) and Portugal (n=1)(80). Most studies investigated the whole population of patients using the service(n=24)(27, 28, 30, 32, 38, 43, 48, 50, 76, 78-82, 84, 87-91, 93, 95-97), however some investigated particular patient subsets, including: patients in younger age groups(77, 92), older adults(78, 80), parents of children(86), male patients(94) or patients with limited English language proficiency(LEP)(29).

The majority of studies investigated services where digital triage was conducted by nursing staff(n=26)(27, 29, 30, 43, 48, 50, 76-89, 92-97), fewer studies evaluated non-clinician led triage (n=3)(28, 32, 38), or a mix of staff types: nurses and paramedics (n= 1)(91), or non-clinical call handlers and nurses (n=1)(90).

Most studies were of named national or regional services based within call centres, including England’s current NHS 111 service(32, 38) and former NHS Direct(30, 50, 77, 78, 82, 84, 85, 92, 94, 95, 97), Scotland’s NHS24(27, 28), the Ask Mayo Clinic (AMC) that operates in the USA(29, 76, 79), Portugal’s Linha Saude 24(80), Swedish Health Direct(48, 50, 96), and Australia’s Health Direct(89). Two studies evaluated smaller scale ‘unnamed’ implementations (43, 93); three were based within general practice cooperatives(81, 87, 88). Two studies were based in the emergency care setting, one was conducted in an English ambulance service(91) and one was conducted within an emergency telephone service in Japan(90). Characteristics of the 31 included studies are presented in Table 3.

Following the quality assessment using the MMAT, 19 studies were rated as high quality(27-30, 38, 50, 78, 80-82, 85, 88, 89, 91-96), eleven were medium quality (32, 43, 48, 76, 77, 79, 83, 84, 86, 87, 90) and one was identified as low quality(97). Overall, qualitative studies were rated as higher quality and the quantitative studies were more variable in quality. There were a range of reasons for quantitative studies being rated as lower quality, including lack of adequate accounting of confounding factors(43, 84, 89, 90) and studies with a risk of non-response bias (32, 48, 56, 86). One mixed methods study lacked description of the integration of qualitative and quantitative elements(97). In two of the qualitative studies details about how the findings were derived from the data were lacking and could have been expanded (95, 96). Appendix 3 presents the quality assessment results.

Table 3 Characteristics of included studies (31 studies)

***This table is also presented in the published review** (Sexton, V., et al. (2022). "Service use, clinical outcomes and user experience associated with urgent care services that use telephone-based digital triage: a systematic review." BMJ Open **12**(1): e051569, doi:10.1136/ bmjopen-2021-051569**)**

Main outcome area	Author Year Country Reference	Study design	Sample / data size	Urgent or Emergency care	Staff type conducting triage	Participants & service name	Comparator	Quality
Caller experience	Björkman 2018 Sweden	Qualitative: 'Netnographic' method using information from online forum posts	Data collected from 3 online forums	Urgent	Nurse	General population	None	High
Caller experience	O'Cathain 2014 England	Quantitative: Survey	Survey sent to 1200 patients from 4 pilot sites, 1769 responded and were included for analysis	Urgent	Non-clinical call handler	General population	None	Medium

Caller experience	McAteer 2016 Scotland	Mixed methods: survey and interviews	Survey: Age and sex-stratified random sample of 256 adults from each of 14 Scottish GP surgeries, final sample was 1190. Interviews: 30 semi-structured interviews	Urgent	Non-clinical call handler	General population (NHS 24 users and non-users)	Interviewees (from survey respondents) grouped into satisfied users, dissatisfied users and non-users	High
Caller experience	Rahmqvist 2011 Sweden	Quantitative: Survey	Random sample of 660 callers, made at one call centre site in October 2008	Urgent	Nurse	General population	1) Cases: those who disagreed with nurse advice and felt they needed higher level of care; 2) Controls: those who disagreed with nurse advice OR felt they needed higher level of	Medium

							care; 3) other callers	
Caller experience	Goode 2004 England	Qualitative: Interview study	60 interviews	Urgent	Nurse	General population	None	High
Caller experience	Winneby 2014 Sweden	Qualitative: Interview study	8 semi-structured interviews	Urgent	Nurse	General population	None	High
Caller experience	Goode 2004 England	Qualitative: Interview study	10 semi-structured interviews	Urgent	Nurse	Interviews focussed on men	None	High
Patterns of triage advice	Payne 2001 England	Quantitative: Routine data analysis	56,450 calls	Urgent	Nurse	General population	None - Comparisons within digital triage call data	High
Patterns of triage advice	Elliot 2015 Scotland	Quantitative: Routine data analysis	1,285,038 calls	Urgent	Nurse	General population	None - Comparisons within digital triage call data	High

Patterns of triage advice	Zwaanswijk 2015 Netherlands	Quantitative: Routine data analysis	895 253 patients	Urgent	Nurse (general practice cooperative)	General population	Some comparison with non-digital triage	High
Patterns of triage advice	Njeru 2017 USA	Quantitative: Routine data analysis	587 cases 587 controls	Urgent	Nurse	Those aged over 18 - (callers with and without limited English proficiency)	Patients with limited English proficiency compared to English proficient	High
Patterns of triage advice	Jacome 2018 Portugal	Quantitative: Routine data analysis	148,099 calls	Urgent	Nurse	General population (Older age groups 65+)	None - Comparisons within digital triage call data	High
Patterns of triage advice	Hsu 2011 England	Quantitative: Routine data analysis	402,959 calls	Urgent	Nurse	Older age groups (aged over 65 years)	None	High
Patterns of triage advice	Cook 2013 England	Quantitative: Routine data analysis	358 503 calls	Urgent	Nurse	children aged 0–15 (<1, 1–3 and 4–15 years))	Comparisons between age groups	Medium

Patterns of triage advice	North 2010 USA	Quantitative: Routine data analysis	20,230 calls	Urgent	Nurse	General population (those with subscription and insurance)	Three comparison groups: 1. Triaged callers;2. ED attendances 3. Office (GP) visits. (Comparison of hospitalisation in these groups)	Medium
Patterns of triage advice	North 2011 USA	Quantitative: Routine data analysis	Over the three-year period: 105,866 adult calls (65% of the total calls). Of these, 14,646 (14%) were made by a surrogate on behalf of the patient.	Urgent	Nurse	General population (aged over 18)	Surrogate vs. self calls	Medium
Service use following triage	Lattimer 2000 England	Quantitative descriptive: Cost effectiveness	>14000 Control group (n = 7308 calls) Intervention	Urgent	Nurse (within general practice cooperative)	General population	Usual care (referral to a GP) compared to	Medium

		report from controlled trial	group i.e. Nurse telephone consultation (n=7184 calls)				nurse led digital triage	
Service use following triage	Munro 2000 England	Quantitative: Routine data analysis	Study corresponds to the 1st year of operation, where 68 500 NHS direct calls from the 1.3 million people served.	Urgent	Nurse	All contacts with these immediate care services (at time spanning before and after introduction of call centre based service)	Service use in regions where digital triage service was introduced, compared to regions with no implementation	High
Service use following triage	Dale 2003 England	Controlled trial	635 triaged calls 611 non-triaged calls	Emergency	Nurse and paramedic (within emergency control room)	General population, calling the emergency service for non-emergency concerns (only those aged 2+)	The control group not offered triage was compared with calls digitally triaged either by nurses or paramedics.	High

Service use following triage	Foster 2003 England	Quantitative: Routine data analysis & data linkage	4493 calls, of which 193 were advised to go to ED	Urgent	Nurse	General population	Three comparison groups: 1. Callers triaged to A&E who attended 2. Callers triaged to A&E who did not attend 3. Callers with different triage outcome who attended A&E.	Medium
Service use following triage	Mark 2003 England	Mixed methods (routine data analysis + interviews)	Numbers of calls analysed across three years: 5126 (year 1998) 5702 (1999) 4698 (2000)	Urgent	Nurse	General population	n/a	Low
Service use following triage	Sprivulis 2004 Australia	Quantitative: Routine data analysis & data linkage	13 019 presentations to ED of which 842 were identified	Urgent	Nurse	General population - all patients who contacted the digital triage	1. Patients who were digitally	High

			as having contacted Health- Direct within the 24 h period prior to presentation.			service during the one year study period	triaged prior to attending ED 2. Patients who were not digitally triaged	
Service use following triage	Dunt 2005 Australia	Quantitative: four trials including surveys (self-reported service use)	Random sampling (350 households per trial site)	Urgent	Nurse	General population	2 sites using "standalone" telephone triage which used "call centre software" 2 embedded telephone triage sites using paper based protocols	Medium
Service use following triage	Munro 2005 England	Quantitative: Surveys (care providers)	571 surveys sent (188/297) responses from GP cooperatives, (35/35) for ambulance services and (200/239) for	Urgent	Nurse	Surveys sent to care providers (general use of services following NHS direct	n/a	Medium

			emergency departments			implementations)		
Service use following triage	Stewart 2006 England	Quantitative: Routine data analysis & data linkage	3312 calls to call centre-based service, and 14,029 patients who attended ED	Urgent	Nurse	Children and young adults aged under 16	1) Patients advised through digital triage to attend ED 2) Patients given alternative referral advice, through digital triage, but who still attended ED 3. Patients referred to ED by their GP 4.Self-referrals to ED	High
Service use following triage	Byrne 2007 England	Quantitative: Survey	268 callers	Urgent	Nurse	General public with 3 symptom types (abdominal pain or cough	None	High

						and/or sore throat)		
Service use following triage	Morimura 2010 Japan	Quantitative: Routine data analysis	26,138 telephone consultations	Emergency	Nurse and call handler	General population	None	Medium
Service use following triage	Huibers 2013 Netherlands	Quantitative: Questionnaires	7039 questionnaires returned (from a total of 13,953 sent)	Urgent	Nurse	General population (users who had a telephone contact with a nurse)	None	High
Service use following triage	Turner 2013 England	Quantitative: Routine data analysis	400,000 calls to call centre-based service in first year of operation analysed	Urgent	Non-clinician	General population	Matched sites: 1. Intervention sites: four digital pilot sites 2. Control sites (North of Tyne, Leicester, Norfolk)	High
Service use following triage	Turbitt 2015 Australia	Quantitative: Surveys	1150 parents attending ED	Urgent	Nurse	Specific group	Some comparisons between	Medium

			(decline rate 19.9%)				parents who called and did not call but prior to attending ED	
Service use following triage	Siddiqui 2019 Australia	Quantitative: Routine data analysis & data linkage	12,741 triaged cases linked to 72.577 ED presentations	Urgent	Nurse	General population	n/a	High

The following sections consider the key findings from the three main outcome areas:

1) Patterns of use. This included characteristics of patients using urgent care via telephone based digital triage, (including age, sex and presenting symptoms), and patterns of triage outcomes, including patient demographics or presenting symptoms that are associated with triage outcome urgency.

2) Service use and clinical outcomes following triage, including patients subsequent use of ED, primary care, hospitalisation, and mortality.

3) Caller experience, including the experiences of patients and carers in their use of telephone based digital triage.

2.6.1 Patterns of use:

Nine studies focused on outcomes relating to patterns of triage advice (patient characteristics, and their associations with triage outcome urgency); all of these were analyses of routine datasets(27, 29, 30, 76-81). Key findings are summarised below; detailed findings from studies are shown in Table 4.

2.6.2 Characteristics of callers

Across studies, the highest frequency of calls related to abdominal and respiratory related symptoms: abdominal or digestive symptoms made up 6.8% - 12.2% of calls(27, 76, 79, 80, 93); and respiratory related symptoms made up 11.3%(93) - 11.9%(80) of calls. Six studies reported a larger proportion of calls were about female patients(range: 59%-72%)(27, 30, 76, 79, 80, 93).

Calls about patients in the younger age groups made up a comparatively higher proportions of calls(30, 79); one study reported that 24% of calls were for 0 – 5 year olds(30) whilst another reported that 15% of out of hours calls were about 0-4 year olds(27).

2.6.3 Patient characteristics and triage outcome urgency

Factors associated with triage outcome urgency related to patient age, sex, presenting symptoms and language proficiency of the caller. The direction of these factors on the triage outcome urgency level are described below:

1) Patient age in relation to triage outcome urgency: two studies reported urgency was lower in calls about children(30) (77); of these, one reported a high proportion (47%) of calls about patients aged 0 – 15 were resolved through self-care advice or health information(77). Two studies reported that the triage outcome urgency level increased with age(76, 80).

2) Sex in relation to triage outcome urgency: two studies suggested that women may be more likely to receive lower urgency outcomes in comparison to men; however, neither of these studies took into account patient age or presenting symptoms(30, 78), one suggested this difference could be explained by women seeking care advice earlier, before symptoms become more severe and urgent(78).

3) Presenting symptoms: two studies reported symptoms that were associated with higher urgency triage outcomes(77, 81); one study of these investigated service use in children (aged 0 -15) and reported that calls about respiratory symptoms were more likely to be referred to emergency care as compared to calls about other symptom types in this patient group(77).

4) Language proficiency of the caller: one study of case-control design investigated triage outcome urgency in relation to language proficiency. They defined limited English proficiency (LEP) as patients where an interpretation service was used during triage. They reported that patients with LEP were more likely to receive triage outcomes relating to higher urgencies (ambulance, immediate ED attendance or urgent visit) (49.4% versus 39.0%; $P < 0.0004$)(29); the two groups in this study (those proficient in English and those with LEP) were balanced based on age, sex and co-morbidities(29).

Table 4 Characteristics of patients and triage advice (9 studies that utilised routine data analysis)

***This table is also presented in the published review** (Sexton, V., et al. (2022). "Service use, clinical outcomes and user experience associated with urgent care services that use telephone-based digital triage: a systematic review." BMJ Open **12**(1): e051569, doi:10.1136/ bmjopen-2021-051569**)**

First author Year Country Reference	Sample / data size	Staff conducting digital triage	Participants	Key findings relating caller/patient characteristics and triage advice
Payne **2001** **England**	56,450 calls	Nurse	General population	**Patient/symptom characteristics** • The patient was the caller in 45% of calls; 31% of calls were made by parents calling on behalf of their child. • 24% of calls were about 0-5 year olds. 22% were for 17-29 years, and 22% for 30-39 years. **Triage advice and urgency** •Urgency increased with age: 0-5 year olds were more likely to be categorised as "no urgency", 17-39 years were more likely to be "routine", and over 70s were more likely to be categorised as urgent. •56% of calls were prioritised as "no urgency", 32% were categorised as having some degree of urgency, and 11% were routine; 37% of patients were advised to self-care • Males were more likely to be categorised as urgent; females were more likely to be referred to community services or given information.
Elliot **2015** **Scotland**	1,285,038 calls	Nurse	General population	**Patient/symptom characteristics:** • Abdominal symptoms accounted for the largest proportion of calls (12.2%) followed by dental (6.8%) and rash/skin related symptoms (6.0%).

				• Symptoms differed by age group. Rash/skin symptoms were most frequent in the under 5's, abdominal problems most frequent in 5-74, and respiratory symptoms most frequent in over 75s. • Less affluent users tended to contact the service less often compared to affluent users, exceptions were for throat , genitourinary, eye related symptoms and fever. **Triage advice and urgency:** • Out of hours calls most frequently resulted in: advice to visit an out-of-hours centre (34.1%), followed by a GP home visit (12.2%) or self-care advice being provided (10.2%). Whereas in-hours calls mainly resulted in: advice to contact a dentist (27.6%), a NHS 24 service clinician calling the patient (21.1%) or advice to contact a GP (19.2%).
Zwaanswijk 2015 Netherlands	895 253 patients	Nurse (within General practice cooperative)	General population	**Triage advice and urgency:** • Urgency variation was symptom specific: For Cystitis/Urinary Infections: 93.4% of variation ascribed to differing patient characteristics. For cystitis urgency was significantly lower for females and lower for adult patients; for lacerations and cuts: urgency significantly higher for patients over 5 years old than for younger children • Higher variation in urgency occurred at lowest two urgency levels.
Njeru 2017 USA	587 cases 587 controls	Nurse	Adult callers with and without limited English	**Triage advice and urgency:** • Nurse recommendations for higher urgency care, (ambulance, visit the ED, or schedule an acute appointment) were more frequent for limited English proficiency callers (LEP) callers than non-LEP callers (49.4% versus 39.0%; P < 0.0004), differences remained significant after adjustment for co-morbidities. • The LEP patients were less likely to follow the recommendations given by the nurse, n (%): 339 (60.9%) versus 379 (69.4%) - even after adjusting for sex, co-

			proficiency (LEP)	morbidity, caller type (self or surrogate), duration of call, and recommended action
Jacome 2018 Portugal	148,099 calls	Nurse	General population (Older age groups 65+)	**Patient/symptom characteristics:** • Majority of users were female (63% vs. 37%), most users were younger than 80 years old (60.6% vs. 39.4%). Mean age: 77.3. • Most common symptoms were: pain (18.1%), respiratory tract infections (11.9%), digestive related (8.6%), diabetes mellitus (6.4%) **Triage urgency and advice** Users in the “oldest old” group were more often referred to ED (51% vs. 40% of those in the “65–79 age” group) and less often advised to rely on self-care (11% vs. 15%).
Hsu 2011 England	402,959 calls about older people (In 12-month study period)	Nurse	Older age groups (aged over 65 years)	**Patient/Symptom characteristics** • The age of the callers ranged from 65 to 109 years (mean = 76.78; median = 76; Standard Deviation =7.856; mode = 65). During the study period, the estimated proportion of people aged 65 years and over was approximately 16% of the England and Wales population, but accounted for only 7.2% of service use. • Amongst older adults, service use increased with age, with higher use among women than men **Triage advice and urgency** Overall, the largest advice category was to visit GP, primary care service (PCS) or dentist on the same day: 28%, (n = 112,778), followed by home care 25.4% (n = 102,406) and being advised to see their GP, PCS or dentist, either routinely, 15.2%(n = 61,419) or urgently 14.7% (n = 59,154), being referred to the

				emergency service 6.9% (n = 27,612), ED 5.4%(n = 21,650) and community services 2% (n = 7,931).
Cook 2013 England	358 503 calls	Nurse	children aged 0–15 (<1, 1–3 and 4–15 years))	**Patient and symptom characteristics** • For infants aged <1, highest call rates were found for ‘crying’’ • High call rates were also found for symptoms relating to ‘skin/hair/ nails’ and ‘colds/flu/sickness’ for all age groups; self-care and health information was provided to 59.7% and 51.4% of these cases respectively. **Triage advice and urgency** • 47% calls made on behalf of children aged <1, 48.7% of calls for children 1–3 and 43.9% of calls for children aged 4–15 were managed with no onward referral needed by giving health information and advice •For children aged <1, only 7% of calls were forwarded to A&E, which was markedly higher for children aged 1–3 (12.3%) and for children aged 4–15 (13.5%). However, for GP outcomes (urgent/same day/routine), this was higher for children aged <1 (30%) than for children aged 1–3 (24.5%) and 4–15 (23.5%) •The symptoms which contributed to the highest number of high urgency calls related to ‘respiratory tract’ (n=840, 5.1%, ASR=32.7) and ‘neurological disorders’ (n=51, 8.4%, ASR=12.1)
North 2010 USA	20,230 calls over a 2-year period	Nurse	General population (users with insurance and subscription)	**Patient characteristics (seriousness of symptoms as investigated through hospitalisation rates).** This study compared hospitalisation rates in 3 groups, patients who: 1) were digitally triaged, 2) made a GP visit and 3) attended ED. •Triaged patients are more likely to result in hospitalisation as compared to those visiting a GP; but less likely than those attending ED. •3% (n=547) of

				callers were hospitalised. Hospitalisation rate varied by age: low (2%) for ages 3 – 17 to high (10%) for 65+ •Hospitalisation following triage call occurred quickly: 77% occurred with 48 hours of the call •Those aged 65 years + were 5 times more likely to have problems requiring hospital admission when presenting to the ED compared to callers. •Symptom calls in the 65 years and older age group had hospitalization rates close to 10%, •Findings relating to symptoms: for adult abdominal pain, rates of hospitalisation between callers and ED attendees were similar. •There was a higher proportion of female callers compared to female ED attendees and GP visits (females made up 72% of callers, 61% of GP visits and 56% of ED visits)
North 2010 USA	163,608 calls	Nurse	General population (users)	**Patient/symptom characteristics** • Study compared surrogate (calls made by someone on behalf of the patient) calls to self-calls, made by the patient themselves Adult calls accounted for 105,866 (65%) of the total calls, of these, 14,646 (14%) were made by surrogate; men and the elderly were the two most over-represented groups in surrogate calls • For surrogate calls, the top 5 symptoms were: abdominal pain, vomiting or nausea, other, skin problems, dizziness. In self calls the top symptoms were: abdominal pain, skin problems, chest pain, other, eye or vision problems. •Vomiting or nausea, dizziness or light-headedness, and other were significantly more likely to be reported by surrogate callers. Abdominal pain, skin problems, chest pain, and eye or vision problems were significantly more likely to be

	reported by self-callers •Surrogate calls, as a percent of total calls by age group, increased with the age of the patient •Calls concerning women patients made up 70% (n=74,069) of all adult calls, of which 9% (n=6780) were made by surrogates. Of the 31,797 calls about male patients, 25% (n=7866) were made by surrogates. Overall, males were the subject of 54% of surrogate calls and 26% of self calls. **Triage advice and urgency** • Emergency advice was recommended 28% (n=29,371) of all calls. 38% (n= 5545) of surrogate calls ended with this nurse recommendation compared to 26% (n=23,826) of self calls (OR 1.72; 95% CI 1.66 to 1.79). • Advice urgency increased with age for both surrogates and self calls

2.6.4 Service use and clinical outcomes following triage.

There were two main approaches taken by studies that explored service use and/or clinical outcomes following triage: 1) studies that evaluated the impact of digital triage *implementation,* (where digital triage was recently introduced within a service) on wider healthcare service use and 2) studies that investigated *patient level service use* following triage and patients' adherence with triage advice.

2.6.4.1 Change in service use following digital triage implementation.

Eight studies reported on the impact of digital triage implementations on the change in wider health care service use, such as primary care, ED use, emergency admissions and ambulance use (38, 43, 84, 85, 87, 90, 91, 97). Of these studies, one investigated non-clinician led triage(38) whilst the others investigated clinician led digital triage. The studies used different comparators: rates of service use in patients receiving care as usual (e.g. usual care via GP) in comparison to those who were digitally triaged(87, 91); service use rates prior to and after digital triage implementation(43, 84, 90, 97); comparator regions with and without digital triage implementation(38, 85); and finally a national service use comparator(43).

There were mixed findings in the effect of digital triage implementation on wider service use across studies; these are summarised visually in Figure 3.

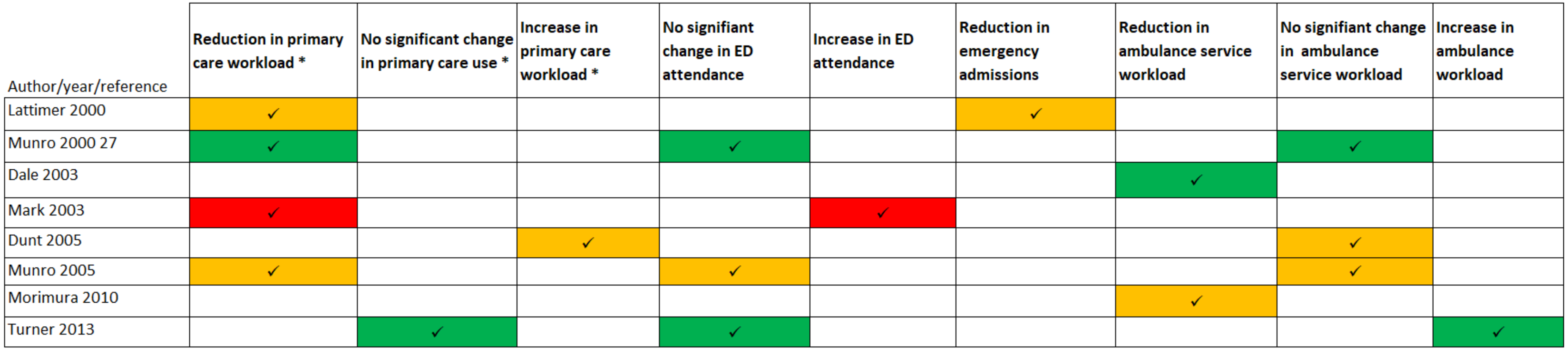
Most studies reported a reduction or no change in wider service use following implementation. There were, however, two exceptions, which both investigated nurse led digital triage: one of these (which was rated as being a lower quality) reported an increase in ED use(97). The other study investigated the implementation of ‘standalone’ digital triage call centres in comparison to national comparator; this study reported some increase in out of hours service use (home visits and GP clinic use); however, it differed to the other studies in its methods, as it utilised household surveys to gather self-reported information regarding service use(43).

Table 5 presents detailed findings from studies.

Figure 3 Visual summary of studies that explored change in service use following implementation of digital triage

***This figure is also presented in the published review** (Sexton, V., et al. (2022). "Service use, clinical outcomes and user experience associated with urgent care services that use telephone-based digital triage: a systematic review." BMJ Open **12**(1): e051569, doi:10.1136/ bmjopen-2021-051569**)**

Change in service use after digital triage implemenation and strength of evidence



Author/year/reference	**Reduction in primary care workload ***	**No significant change in primary care use ***	**Increase in primary care workload ***	**No signifiant change in ED attendance**	**Increase in ED attendance**	**Reduction in emergency admissions**	**Reduction in ambulance service workload**	**No signifiant change in ambulance service workload**	**Increase in ambulance workload**
Lattimer 2000	🟨 ✓					🟨 ✓			
Munro 2000 27	🟩 ✓			🟩 ✓				🟩 ✓	
Dale 2003							🟩 ✓		
Mark 2003	🟥 ✓				🟥 ✓				
Dunt 2005			🟨 ✓					🟨 ✓	
Munro 2005	🟨 ✓			🟨 ✓				🟨 ✓	
Morimura 2010							🟨 ✓		
Turner 2013		🟩 ✓		🟩 ✓					🟩 ✓

*change in one or more: home visits, general practice cooperatives, primary care centres or OOH general practice
Green = studies of high quality
Amber = studies of medium quality
Red = studies of lower quality

Table 5 Change in wider healthcare service use following digital triage implementations (8 studies)

***This table is also presented in the published review** (Sexton, V., et al. (2022). "Service use, clinical outcomes and user experience associated with urgent care services that use telephone-based digital triage: a systematic review." BMJ Open **12**(1): e051569, doi:10.1136/ bmjopen-2021-051569**)**

First author Year Country Reference	Study type	Sample / data size	Staff conducting digital triage	Participants	Comparator	Findings relating to change in wider health care service use (primary care, hospitalisations, ambulance services, ED attendance)
Lattimer **2000** **England**	Cost effectiveness report of controlled trial	>14000 Control group (n = 7308 calls) Intervention group (Nurse telephone consultation): (n=7184 calls)	Nurse (within general practice cooperative)	General population	Usual care (referral to a GP)	***Primary care:*** During intervention period GPs made 428 fewer home visits, generating savings of £3360 (£2578 to £4198) in a year. ***Hospitalisations:*** The cost of providing nurse telephone consultation was £81 237 per annum; cost savings were estimated to be £94 422 due to reduction of other costs for the NHS arising from reduced emergency admissions to hospital.

Munro 2000 England	Routine data analysis	Study corresponds to the 1st year of operation: 68 500 NHS direct calls from the 1.3 million people served.	Nurse	General population	Service use in regions with no NHS direct	***Primary care:*** There was a significant decrease in use of GP cooperatives at sites using digital triage: change in estimated trend from increase of 2.0% per month before to − 0.8% afterwards (estimated relative change − 2.9% (95% confidence interval (CI)− 4.2% to − 1.5%). compared to negligible change in control: from 0.8% a month before to 0.9% afterwards (relative change 0.1%; CI: − 0.9% to 1.1%)) ***Ambulance services:*** Changes in trends were small and non-significant ***ED attendances:*** Changes in trends were small, variable and not significant.
Dale 2003 England	Controlled trial	635 calls digitally triaged by ambulance service; 611 non-triaged calls	Nurse and paramedic	Callers to emergency service for non-emergency concern (aged 2+)	Usual care (ambulance dispatch)	***Ambulance services:*** 52% (n=330) of calls were triaged as not requiring emergency ambulance. Of these: 47% had moderate urgency: care needed within 24 hours; 26% needed a routine appointment; 27% self care sufficient. Overall, 9.8% of ambulances were cancelled in the intervention groups (where this was offered). ***ED attendances:*** In the intervention group: 81% of patients triaged as requiring ambulance call outs attended ED; 63.4% of patients triaged as not requiring ambulance

						attended ED. ***Hospitalisations***: Some inconsistency in triage: 10% of those triaged as not requiring ambulance dispatch subsequently required hospital admission
Mark 2003 England	Mixed methods (routine data analysis + observation, interviews)	Numbers of calls analysed across three years: 5126 (year 1998) 5702 (1999) 4698 (2000)	Nurse	General population	Service use before implementation	***Primary care:*** Two main 'transitions': 1.Inital increase in GP cooperative workload and in-hours calls. Followed by fall in OOH GP co-operative workload by 18%. Use of primary care centres declined following the arrival of NHS Direct; allocation of home visits initially increased then decreased; OOH doctor advice progressively increased. Within older age groups: decline in both use of primary care centres and home visits, but a rise in doctor advice. ***ED attendances:*** Progressive increase in ED attendance
Dunt 2005 Australia	Four controlled trials	Random sampling (350 households per trial site)	Nurse (Two "standalone" call centres)	General population	1. Service use before implementation 2. Implementation of two	***Primary care***: Some types of out of hours care became more frequent in sites using digital triage services ***Ambulance services:*** Overall no change in any site

					telephone triage sites within existing 'embedded services' using paper-based protocols	
Munro 2005 England	Surveys with care providers	571 surveys sent (188/297) responses from GP cooperatives, (35/35) for ambulance services and (200/239) for emergency departments	Nurse	General population	Service use before implementation	***Primary care:*** The 3-year period following digital triage implementation was associated with a reduction in calls to OOH general practice. In the context of an underlying trend of demand rising by about 1% each year, the introduction of digital triage was associated with an immediate 3% fall in demand coupled with a reversal of the trend so that demand began to fall by almost 8% per year ***Ambulance services***: No significant change in emergency ambulance service use. ***ED attendances:*** There was negligible change in use of emergency departments.

Morimura 2010 Japan (Tokyo)	Routine data analysis (+ surveys with patients)	26,138 telephone consultations	Nurse and non-clinical call handler	General population	Service before implementation,	***Ambulance services:*** Number of ambulances used per 1 million was statistically reduced compared with that of the previous year: 46 846 vs. 44 689, p<0.0001. The out of hours ambulance use per 1 million people was also significantly reduced: 31 965 vs. 30 370. *Hospitalisations*: In those who were referred to a hospital by an ambulance (n =3252) 30.8% (1000 cases) were hospitalised. The emergency hospitalisation rate (EHR) decreased annually before the introduction of digital triage service. However, the rate after its introduction was statistically higher 36.5% vs. 37.8%, p<0.0001)(EHR increased following the introduction of the service).
Turner 2013 England	Routine data analysis	400,000 calls in first year of operation analysed.	Non-clinical call handler	General population	Control sites selected to match equivalent geographical areas	***Primary care:*** In one site - statistically significant reduction in urgent care attendances; 3 sites: reduction in calls to former (nurse led) digital triage service. Overall, no change in primary care could be attributed to implementation ***Ambulance services:*** Reduction in ambulance emergency calls in 1 site and an increase in another site; All sites showed increase in emergency ambulance incidents. Overall, no change in emergency service

(999) calls were attributable to implementation

ED attendances: Overall no change could be attributed to implementation

2.6.4.2 Patient level service use and adherence with advice

Six studies reported on patient adherence to triage advice through the evaluation of patients' ED attendance following digital triage(82, 83, 86, 89, 92, 93). Of these, four used routine data and data linkage with sample sizes ranging from: 3312 to 13,019 triage calls(83, 89, 92, 93); two studies were survey based(82, 92).

Of the four studies that evaluated ED use following triage using routine data, three reported 60% - 70% of patients who were advised to attend ED followed the advice they were given(83, 89, 92). One study reported a wider range of 29% – 69%, they also reported higher adherence when ambulance was advised (53-69%) and lowest adherence when patients were recommended to visit ED using their own transport(29%)(93).

One study was survey based (n= 268 callers) and captured self-reported service use; this study reported higher adherence compared to the other studies, reporting adherence on: recommendation to attend ED (96%; 49 of 51 calls), to visit a GP (92%; 133 of 144) and with self-care advice (93%; 64 of 69)(82).

Four studies reported varying proportions of patients who attended ED despite receiving alternative triage advice (a recommendation other than attending ED), three of these used routine data and reported the following percentages: 2.4%(83) and 9%(89, 92), whilst one study was survey based (using self-reporting), this a higher percentage of 22%(86). The latter study also reported that 51 of 1150 parents attended ED as they remained worried after calling the digital triage service(86). Results of studies reporting on patient level service use and adherence with triage advice are presented in Table 6.

Table 6 Studies investigating patient level outcomes: service use, adherence with advice and hospitalisations (6 studies)*

***This table is also presented in the published review** (Sexton, V., et al. (2022). "Service use, clinical outcomes and user experience associated with urgent care services that use telephone-based digital triage: a systematic review." BMJ Open **12**(1): e051569, doi:10.1136/ bmjopen-2021-051569**)**

First author Year Country Reference	Study design	Sample / data size	Staff conducting digital triage	Participants	Comparison groups used in analyses	Key patient level service use findings
Foster 2003 England	Routine data analysis & data linkage	4493 calls, of which 193 were advised to go to ED	Nurse	General population	Three groups: 1) Callers triaged to ED who attended ED 2) Callers triaged to ED, who did not attend 3) Callers who received different triage	***ED Attendance*** 8 % (358 of 4493) of callers were advised to attend ED. Of these, where data was available, 64.2% (124 of 193) followed the advice to visit ED with the same presenting complaint. • 2.4% (99 of 4135) went to ED for the same presenting complaint as their contact following triage despite being given other advice ***Hospitalisations*** 66.9% (83 of 124) of those attending ED after being advised to were sent home without further referral. However, 10 were referred on within the hospital and seven were admitted. 0.3% of callers (15 of 4235) who were not advised to attend A&E and were

					advice who attended ED	subsequently admitted raised concerns about the quality of triage.
Sprivulis 2004 Australia	Routine data analysis & data linkage	13,019 presentations to ED	Nurse	General population	Two groups: 1) ED users called a digital triage service in 24 hours prior to attending ED 2)ED users not digitally triaged	***ED Attendance*** 6.5% (842 of 13019) of patients attending ED had contacted the digital triage service in 24 hours prior to attendance. ***Hospitalisations*** For those triaged to 'immediate/prompt care' and 'non-urgent' care by HD and who presented to the ED (in the latter group, against the triage advice), there was a similar hospital admissions rate and ED triage distribution.
Stewart 2006 England	Routine data analysis & data linkage	3312 calls to NHS Direct North West Coast, and 14,029 patients who attended ED (between the 1st of December	Nurse	Children and young adults aged under 16	Two main matched patient groups: 1) Patients advised, through digital triage, to attend A&E in the last 12 hours (n = 299) 2) Patients given alterative	***ED Attendance*** •88% of those digitally triaged to attend ED did so within 1 hour. • 88% of those advised to take another course of action attended A&E within 4 hours. • Some indication that those triaged presented with higher urgency complaints, based on higher urgency advice within ED triage using “Manchester triage group 5-point system” for digitally triaged patients, compared to self-referrals. •74% of digitally triaged patients were discharged home compared to 56% of those referred by GPs and 64% of those who self referred.

		2002and 28th of February 2003)			triage advice, but who still attended ED (n=163) Additional groups: Those attending ED who were GP referred and self-referred.	• ***Hospitalisations:*** 27% of GP referrals, 10% of the self-referral group and 15% of NHS Direct referrals were admitted. Of those admitted patients referred by NHS Direct 52% were advised to attend A&E, and 48% were given other advice.
Byrne 2007 England	Surveys	268 callers	Nurse	Calls about abdominal pain, cough or sore throat	None	***General Practice use*** Among callers digitally triaged to self-care, 93% (64 of 69) reported that they had followed the advice to look after themselves at home, while five 7% (5 of 69) reported that they had chosen not to do so. Of the five, three said they had decided to go to their GP because, despite the advice of NHS Direct, they thought the condition was sufficiently severe to require such a visit. A further two said that their condition deteriorated after being triaged, so they then decided to contact their GP
Siddiqui 2019 Australia	Routine data analysis &	12,741 triaged cases linked to 72.577 ED	Nurse	General population	n/a	***ED Attendance*** • Compliance with ED attendance advice was between 29-69% • There was higher compliance if ambulance was advised (53-69%) and • lowest compliance when self-transport to ED was recommended (29%). • Appropriateness of attendance to ED for those

	data linkage	presentations				using TTAC was comparable to those who hadn't been triaged by TTAC. • 4% of ED presentations between 2016-2017 had contacted the digital triage service
Turbitt 2015 Australia	Surveys	1150 parents attending ED	Nurse	Parents of children	Some comparisons between parents who called and did not call the digital triage service.	***ED Attendance*** • 20% (230 of 1150) of parents had called the digital triage service ahead of ED attendance for their child's lower urgency concern • 70% of those digitally triaged attended ED because they were advised to attend. • 22% of those digitally triaged attended ED because they were still worried after receiving alternative digital triage advice (not to attend). • Of overall ED users: 16% of respondents had not heard of the digital triage service; 53% were aware of the service, but thought it would not be helpful.

2.6.5 Safety

This section describes potential safety related findings from studies within the review, whilst many of these safety findings were peripheral to the main study aims in the included studies, these highlight potential inaccuracies in digital triage.

Four studies suggested potential triage errors identified by investigating hospital admission rates in patients following triage(83, 89, 91, 92). Most of these related to potential 'under-triage', where the triage advice was considered to be of too low a level of urgency in relation to the clinical need of the patient. However, the evaluation of 'under-triage' was not a central aim of these studies(83, 89, 91, 92).

One study reported similar hospital admission rates between patients who attended ED having been directed to 'immediate or prompt' care and 'non-urgent' care; they reported proportions attending ED within both groups as: immediate or prompt: 38%(n= 261), 95% CI 34–41 vs. non-urgent: 37% (n=56), 95% CI 30–44)(89). Another study reported 15% (n=71) of paediatric patients who attended ED after being triaged were admitted; of these, 37 had been advised to attend ED whilst 34 were given other lower urgency advice(92).

One study reported that 15% (n=15) of patients who were given advice that was lower in urgency than ED attendance, (for example, advised to an urgent or routine GP appointment or given self-care advice), attended ED following triage and were admitted to hospital(83). One study within the emergency setting reported that 9.2% of patients (n=30) triaged as not requiring ambulance dispatch were subsequently admitted to hospital(91).

Finally, one qualitative study described callers feeling that their health concerns were not taken seriously during telephone triage, and perceptions that they were not given the correct advice, for example through being advised to self-care at home for symptoms which later turned out to be very serious requiring care in hospital(50).

2.6.6 Caller experience

Seven studies were focussed on caller experience and satisfaction(28, 32, 48, 50, 94-96). Most of these involved asking patients about their experiences using interviews(28, 94-96) or surveys(32, 48), whilst one used data that was posted to online forums by recent patients who had used the service(50). Three studies reported a high level of satisfaction amongst users(28, 32, 86). Two studies reported higher satisfaction in patients who received higher urgency advice(32, 48). Two studies reported dissatisfaction in relation to the number and relevance of triage questions(28, 32).Three studies reported that callers felt they needed to be assertive in order to receive the care advice that they expected(50, 94, 96). The example below is from a study that explored callers' experience of digital triage based on online forum posts, the quote below shows a user's post to an online forum where they express a need for assertiveness and negotiation:

> "If you need help and advice you can always call the healthcare advice line, if you think they're giving you the 'wrong' advice, tell them, and maybe you'll get better help"(50).

Two studies reported that patients had positive experiences and felt reassured when they felt that the nurses conducting digital triage gave them sufficient time and conducted thorough assessments(95, 96).

In contrast, findings from the study using a different data source (callers who posted to an online forum) reported that they felt scrutinized by the nurses questioning their symptoms and need for care(50).The study described some callers expressing doubts about nurses' advice, competency and credibility(50).

Integrated services enabled a smoother patient care journey and improved patient experience. Conversely one study based described patients' frustrations where care providers were poorly integrated:

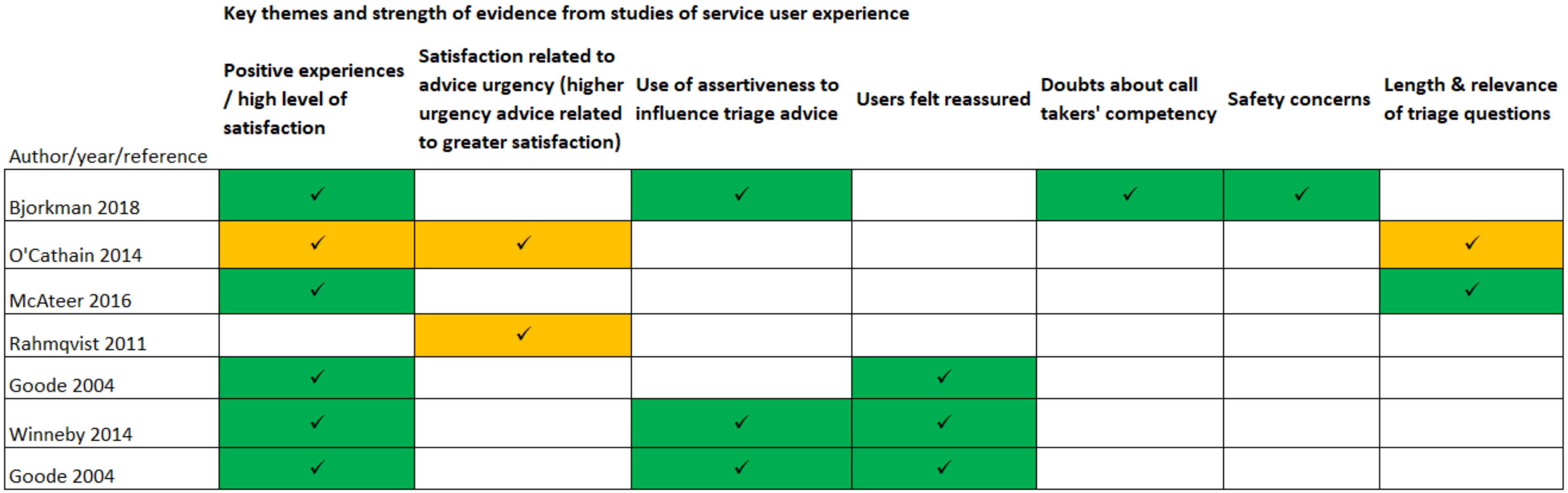
> "They send you to the ER where they yell at you for being stupid enough to listen to them (SHD). SHD is a big problem and seems to be at war with the ER"(50).

Whilst another study, in contrast, reported high satisfaction in 71%, of callers where the service provider was able to book an appointment at a local service on behalf of the patient (32).

See Figure 4 for a visual summary of findings across studies and Table 7 for detailed findings.

Figure 4 Key themes and strength of evidence from studies of caller experience

***This figure is also presented in the published review** (Sexton, V., et al. (2022). "Service use, clinical outcomes and user experience associated with urgent care services that use telephone-based digital triage: a systematic review." BMJ Open **12**(1): e051569, doi:10.1136/ bmjopen-2021-051569**)**



Key themes and strength of evidence from studies of service user experience

Author/year/reference	**Positive experiences / high level of satisfaction**	**Satisfaction related to advice urgency (higher urgency advice related to greater satisfaction)**	**Use of assertiveness to influence triage advice**	**Users felt reassured**	**Doubts about call takers' competency**	**Safety concerns**	**Length & relevance of triage questions**
Bjorkman 2018	🟩 ✓		🟩 ✓		🟩 ✓	🟩 ✓	
O'Cathain 2014	🟧 ✓	🟧 ✓					🟧 ✓
McAteer 2016	🟩 ✓						🟩 ✓
Rahmqvist 2011		🟧 ✓					
Goode 2004	🟩 ✓			🟩 ✓			
Winneby 2014	🟩 ✓		🟩 ✓	🟩 ✓			
Goode 2004	🟩 ✓		🟩 ✓	🟩 ✓			

Green = studies of high quality

Amber = studies of medium quality

Table 7 Findings from studies that investigated user experience and satisfaction.

***This table is also presented in the published review** (Sexton, V., et al. (2022). "Service use, clinical outcomes and user experience associated with urgent care services that use telephone-based digital triage: a systematic review." BMJ Open **12**(1): e051569, doi:10.1136/ bmjopen-2021-051569**)**

Author Year Country **Reference**	**Study type**	**Sample / data size**	**Digital triage user**	**Participants**	**Key themes and example quotes**
Björkman 2018 Sweden	Descriptive research design using information from online forums using six step 'netnographic' method	Data from 3 Swedish online forums were purposively sampled.	Nurse	General population (users)	***General satisfaction/attitudes*** **"***Where we are, the healthcare advice line is great, I'd rather call them than my primary care center"* ***Experience of call taker:*** Patients expressed doubts and mistrust on advice given and credibility of nurses. Feelings that nurses were not well competent/ qualified and relied on google: *"And seriously, are they real nurses who take the calls at SHD? I almost think it sounds like they're googling every question they get."* ***Safety:*** Some concerns related to safety and feeling that advice given was not appropriate, for example: a user posted that they were advised to stay at home for a condition that turned out to be serious, *"When you're advised to take two paracetamols and go to bed. Not go into the ER. When I was feeling really bad, and called them and described my symptoms, that's the exact advice I was given. The situation ended with my husband more or less forcing me into the car and*

					driving me to the hospital. By then, my lips were purple and I was having trouble keeping my balance. Once there, they found that both my lungs were filled with 100 s of small blood clots." ***Assertiveness & negotiation:*** One user posted, *"If you need help and advice you can always call the healthcare advice line, if you think they're giving you the 'wrong' advice, tell them, and maybe you'll get better help"* ***Service working together*:** a user expressed dissatisfaction where the service did not work well together, *"There's no point calling [digital triage service name]. They send you to the ER where they yell at you for being stupid enough to listen to them. [digital triage service name] is a big problem and seems to be at war with the ER"*
O'Cathain 2014 England	Survey	Survey sent to 1200 patients from each of the 4 pilot sites studied, 1769 responded and were included for analysis	Non-clinical call handler	General population (users)	***General satisfaction/attitudes*** Satisfaction levels were good overall (91% very satisfied or satisfied). 73% (1255/1726, 95%confidence interval: 71% to 75%) were very satisfied with the way NHS 111 handled the whole process, 19% (319/1726) were fairly satisfied and 5% (79/1726) were dissatisfied. Two aspects of the service were less acceptable than others: 1) relevance of questions asked and 2) whether the advice given worked in practice. ***Greater satisfaction with higher urgency advice:*** Patients more likely to feel the service was helpful if directed to ambulance service (76%), compared with self-care(64%) visit health centre (55%), other service 54%, contact GP (52%).

					Services working together: Patients more likely to feel the service was helpful if an appointment was arranged for them (71%).
McAteer 2016 Scotland	Other - mixed methods	Age and sex-stratified random sample of 256 adults from each of 14 Scottish GP surgeries, final sample was 1190 based on response rate with 601 of those having used the digital triage service. Purposive	Non-clinical call handler	General public (users and non-users)	***General satisfaction/attitudes:*** • Questionnaire findings: over 80% of those who had used the digital triage service reported being either 'satisfied' or 'very satisfied' - education was the only socioeconomic factor associated with satisfaction (with higher educated participants being less satisfied). Interview findings showed users were broadly satisfied with service. • Most common reasons for dissatisfaction related to initial triage questions, for example, *"I just felt that, she should get me onto a nurse and stop asking me questions, you know, I felt it went on too long"*, and the length of time it took to receive visits and not being kept informed.

		sampling used for interview group with total of 30 being interviewed.			
Rahmqvist 2011 Sweden	Survey	Random sample of 660 callers, made at one site in October 2008	Nurse	General public (users)	***Greater satisfaction with higher urgency advice*** Patients who were recommended to wait and see, were less likely to be satisfied and more likely to make an emergency visit or an on call doctor. Results reported in relation to callers' agreement with advice: analysed using 3 groups: 1) cases: those who disagreed with nurse advice *and* felt they needed higher level of care; 2) controls: those who disagreed with nurse advice or felt they needed higher level of care; 3) other callers. Average global patient satisfaction was significantly lower for nurses who served the cases compared to those who had not served the cases
Goode 2004 England	Interview study	60 interviews	Nurse	General public (users)	***General satisfaction/attitudes*** Results related to feelings that the digital triage service was 'trustworthy', and being able to access care without being a ‘nuisance’. Authors state that some interviewees experienced or predicted deterioration in service quality: "They’ll put a bit too much work on their call centres, they’ll be understaffed, then they’ll start becoming hurried or you’ll lose that friendly ‘take as long as you like’ sort of attitude that I experienced. . . ."

					Experience of call taker: reassurance Users felt reassured and cared for: • "I felt like they cared. I was suffering and I felt like they cared. And that’s what I wanted" • "For me to be able to ring somebody, you know, and when I did feel in pain, but wasn’t sure whether it was normal or not – well I knew that it wasn’t normal, but is it common? And it was nice just to speak to somebody. And, ‘Okay, yeah, do go to your doctors’, you know, ‘you’re not being silly’
Winneby 2014 Sweden	Interview study	8 semi-structured interviews	Nurse	General public (users)	***Experience of call taker: feeling reassured when taken seriously*** The authors describe findings relating to users feeling re-assured on follow up care required, *"When the nurse believed and advised them to turn to the care center on duty, having obtained a mandate to go there, gave them a sense of security".* A quote from a participant: *"Because they [nurses] know more than I do and will refer me if it’s something serious."* ***Assertiveness and negotiation*** *"Being a nurse, I know what to say and what I’ve done at home. Otherwise they will tell you to “drink plenty of fluids” and 'do this and that'. But now I say that “I have drunk a lot” and 'I have medication at home'. It feels as if they [SHD] try to sift out and turn away . . . you don’t call unless it’s necessary."*
Goode 2004 England	Interview study	10 interviews	Nurse	General public (users) interviews	***General satisfaction/attitudes*** • A participant commented on male partner: '"He thought it was great. He was very impressed. And a male nurse spoke to him as well, which I think he was even more impressed that a man would know what he was talking about . . .”

				with men / or that related to men	• The authors describe a male interviewee whose wife called on his behalf “He now described NHS Direct as an excellent and much-needed service, which he would continue to use to meet his need for ‘expert’ guidance on the appropriate response to symptoms." ***Assertiveness and negotiation*** One male participant made a follow up call to NHSDirect regarding his wife, whilst his wife was waiting for a call back from the service: "I simply had one aim at that point, which was to get a doctor out to the house without putting the phone down . . . everything was pretty much arranged in the one call. It was acknowledged that things were bad and that a doctor would be calling tonight . . . I guess I was being pretty direct, like, ‘She is sick and she must be seen.”

2.7 Discussion

This systematic review evaluated the evidence on the impact of urgent care services utilising telephone-based digital triage on wider health care service use, clinical outcomes and user experience. Thirty-one studies were included, these had a wide range of designs, differing settings, populations, and digital triage systems. Overall studies mostly showed no change or a reduction in wider healthcare service use following the implementation of digital triage. The studies reported varying levels of patient adherence to the triage advice they received. Evaluations of clinical outcomes in patients following triage was very limited; however, four studies reported some findings on hospital admission rates, which in some cases suggested potential safety issues relating to under-triage.

Caller satisfaction with telephone based digital triage broadly appeared to be good, but there was evidence of poorer experience and frustration related to the number of triage questions and relevance of triage questioning. In one study patients also expressed feeling that their symptoms weren't taken seriously and that they didn't receive the right care advice for symptoms that turned out to be serious. Studies showed that patients sometimes felt they needed to be assertive during triage when they felt their expectations were not being met; however, this has been reported in telephone-based consultation more widely(99) and is therefore not specific to services that use digital triage.

There was considerable heterogeneity between the studies included in this review, including within the differing study settings and contextual factors, study designs, types of participants, and the 'digital triage' systems in use. This review has highlighted that 'Digital triage' is a complex intervention, and outcomes are likely to be influenced by multiple factors including varying healthcare systems, local service configuration, staff types and level of staff training and the continually changing landscape in the use of digital technologies for example, through additional routes of entry via enabling patients to seek urgent care through self-triage using NHS111 online(100). Due to these wide-ranging factors, these findings need to be interpreted with caution, particularly in terms of applicability of findings internationally, due to the differing health care systems in different countries. It also highlights the need for caution when interpreting the findings from the subsequent studies within the PhD, for example, with regards to contextual differences between the participating service providers. This has been considered in the respective quantitative, qualitative study chapters and the final discussion chapter of the thesis.

Many of the studies that investigated the impact of digital triage implementations on wider healthcare service use reported no impact or change in wider service use. On one hand, in a certain context, this could be seen as a success in terms of workforce mix. For example, if the service being evaluated is a non-clinician -led service which replaced a clinician led service(38); in this case the success could be that a different workforce, who may be easier to recruit and retain, deliver the same standard of care, which does not adversely impact on wider healthcare service use. However, there was only one study investigating service use following non-clinical triage, which reported mixed findings (no change in primary care use or ED attendance, however increased ambulance use). It additionally is challenging to understand the success of an implementation without information regarding cost effectiveness, which was only reported in one older (2000) study(87).

One of the included studies in this review evaluated wider service use following a 'standalone' implementation of digital triage and reported increased GP clinic use(43), this finding was in contrast to other included studies; this may explained by the service being less embedded in the healthcare system, however, it may also be due to a methodological consequence of gathering service use data via household surveys (43), due to use of smaller sample size and potential for recall bias as compared to studies that used routine data.

2.7.1 Strengths and limitations

A strength of this review is that it addresses a key gap in the literature; it is the first systematic review to evaluate the use of telephone based digital triage in the provision of urgent care. The review is also very extensive and includes studies from a 20-year period. During this 20-year period there were changes in how urgent care was delivered including the staff mix and shifts towards non-clinician led service delivery. This review has additionally enabled evaluation of a broad range of service delivery models and covered urgent care delivered in the both the urgent and emergency care settings.

A further strength of this review is that it has taken a comprehensive mixed methods approach therefore included different types of evidence generated using different designs. The MMAT was chosen as it was the best option for assessing the quality of different study types. However one limitation is the applicability of the MMAT criteria for assessing studies of cross-sectional design, which is a known limitation of the tool(101).In cross-sectional study designs there are not always clearly defined groups with an exposure or intervention, which was applicable to some of the included studies in this review

Digital triage is a complex intervention; this review demonstrates the heterogeneity of study designs and outcomes explored. The review suggests that digital triage is likely dependant on contextual factors, including depth of training that call takers have received, the type of staff conducting triage, and how embedded a triage service is within wider urgent and emergency care. This review has summarised findings through narrative synthesis, however, a realist review could have further evaluated outcomes in relation to contexts. Realist reviews are suited to evaluate complex interventions(102) like digital triage. They have been described as enabling configurational, rather than aggregative, evidence synthesis. This allows for results to be organised and interpreted to explain why, how, for whom and to what extent outcomes have occurred(102).

Another limitation of this review is that has been restricted include only studies published in English, which may have led to important evidence being overlooked. This review highlighted the limited evaluation of delivery models using non-clinician led digital triage: only one study evaluated the impact on service use following non-clinician led service implementation and there were no studies of clinical outcomes related to non-clinician triage. Another limitation is the scope of the review, studies exploring broader utilisation of digital triage services, such as those solely evaluating call volumes, call lengths and caller characteristics, as well as study investigating cost effectiveness, and staff focussed outcomes were excluded.

2.7.2 Comparison with other literature

There have been no previous reviews focussed on digital triage in the delivery of urgent care. Previous reviews that evaluated urgent care triage have been broader in scope and included services that are not digitally supported(2, 3). In comparison the scope of this review is narrower, in terms of the intervention considered and the study setting.

A review conducted by Bunn et al. evaluated telephone triage in comparison to usual care(3). They included studies conducted all healthcare settings, including in the general practice, urgent (out of hours) or emergency care setting. Similarly, they reported no significant change in ED visits, routine GP appointments and hospitalisation admissions associated with telephone triage. Other reviews reported a high level of user satisfaction as generally when comparing telephone consultation with other forms of care(3), however lower satisfaction has been described when patients' expectations of care were not met, which aligns with the findings on patient experience identified in this review(99).

This review also highlights the limited investigation of patients' clinical outcomes following digital triage to date. A previous review evaluating telephone triage conducted by Huibers et al. reported limited and inconclusive evidence relating to mortality rates of patients who had been triaged (they reported some studies being underpowered with no mortalities occurring in some studies that investigated this outcome), they additionally reported rates of potential under-triage and subsequent hospital admission to vary, ranging from 0.2% – 5.25%(2).

Although this review excluded studies of broader service utilisation of digital triage services, a previous study highlighted lower than expected use by some ethnic minority groups(103). This review found no studies reporting on patterns of triage outcome urgency, caller experience, service use or clinical outcomes relating to telephone based digital triage in ethnic minority groups; this may be limited by the exclusion of studies were published in other languages.

One of the findings from this review was that patients' adherence with triage advice varied based on study setting and design. One study identified in this review reported high compliance with advice(82), however this is might be an overestimate resulting from response bias in comparison to studies that evaluated adherence using routine service use data. Higher adherence rates in studies using self-reported service use have been observed by two other reviews of telephone triage(104, 105).

2.8 Implications

This review has identified many gaps in the literature, it has highlighted a need for evaluation of patient level service use and clinical outcomes associated with digital triage, which fed into the design of the PhD project. Analyses of patient level datasets (particularly those linked to patients' subsequent service use and clinical outcomes data) will help to better understand which patient groups do and do not adhere to advice and to evaluate the safety of digital triage, particularly concerning under-triage (the underestimation of clinical risk) in certain patient groups.

The lack of comparative studies reported in the review, which may be in part because they are more challenging to conduct, highlights that it is unclear how patient experience and service use outcomes are affected by contextual factors. These include the design of services, the staff type and level of training and supervision, and the type of digital triage system in use. In addition, further evaluations of non-clinician led digital triage may help policy makers and service commissioners to adopt the most efficient and safe digital triage systems.

This review additionally highlights that associations between patient level factors, for example, age, sex, and ethnicity, and the urgency level of advice have not been explored in depth. The granular demographic and symptom data available in routine generated by digital triage tools provides the opportunity to explore these associations and may provide insight into how services are used by different groups and could be used to generate hypotheses within particular patient groups.

Many studies included in this review were conducted when digital triage was first being implemented or shortly after implementation. However, as with any significant change to the model of service delivery, digital triage services require time to become established and performing optimally, this is especially true within services that have been used to working in another way. This review highlights that no studies of longitudinal data have evaluated the extent to which this occurs. Longer term studies will help to explore how the safety and effectiveness of services changes over time.

This review was conducted just after the onset of the Covid-19 pandemic, and no studies of digital triage services had been published showing change in relation to the pandemic at the time of conducting the review. However, telephone based care has been critical during the Covid-19 pandemic and may be more widely adopted in the long term(106); therefore, evaluation of how these services have functioned during and after the pressures of a pandemic is important and there may be literature relating to this published since this review was conducted.

Lastly, this review highlights the limited number of qualitative and mixed methods studies investigating digital triage. Combining findings from routine data with qualitative approaches may help to better understand the experiences and care needs of particular patients groups, which could feed into targeted support for these groups and ultimately improve urgent care service delivery which is central to a well-functioning healthcare system.

2.9 Chapter summary

This chapter has presented the methods and a justification of the methods selected to conduct the review. A large base of evidence evaluating the evidence from studies focussed on patient-centred outcomes relating digital triage in the provision of urgent care has been described. The findings from this review have informed the design of both the qualitative and quantitative studies described in the subsequent chapters 3, 4 and 5. The findings from this review are also integrated into the overall PhD findings in the mixed methods synthesis described in chapter 6.

3 Quantitative study chapter: A routine data analysis exploring the use of clinician led digital triage.

3.1 Chapter overview

This chapter presents the quantitative study, which explored service utilisation and patterns of triage outcomes in urgent care delivered via telephone based digital triage. The focus of this study is on secondary triage in England. This chapter presents the study objectives, justification of methods, methods used, results and finally a discussion of the key findings from this study.

3.2 Study Objectives

This study aimed to address the four following objectives:

1. To describe service utilisation and the characteristics of patients who undergo clinician led secondary triage in urgent care.
2. To investigate factors (such as call, patient, and service level characteristics) associated with the urgency of triage outcomes selected by clinicians.
3. To explore the types of calls that clinicians upgraded and downgraded from the digitally recommended triage urgency.
4. To describe triage outcomes assigned in primary, non-clinician led triage through NHS 111, and to investigate how urgency changed in subsequent secondary clinician led digital triage.

3.3 Justification of method

Consideration was given to the most appropriate method to best address the overarching research aim, which was: to understand how digital triage functions in the provision of urgent care and the related patterns of triage outcomes and patient experience. The key objectives for this study were developed based on the overarching aim for the PhD, to primarily investigate patterns within the use of digital triage in urgent care. A routine data analysis study was selected as it enabled patterns of use and triage outcomes to be explored on a large scale. This enabled the evaluation ‘real world’ service use, rather than within a more controlled setting of a trial which would not be practical or suitable for exploring the research question.

Additionally, the study was designed to be broad and exploratory in nature, with an expected sample size of 200,000+ call records. The use of routine data lends itself to hypothesis generation(107); this was a key benefit specifically selected for the study due to the lack of previous depth studies investigating the granular routine data captured within digital triage systems.

The use of routine data was also selected as it enables a cost-effective approach to analysing data in detail; analysing this scale of data through prospective data collection would be prohibitively expensive and unfeasible in the scope of a PhD project.

A further advantage of using routine data analysis was the inclusion of patient groups who are typically under-served in research, particularly those living in the most deprived groups.

Consideration was given to the data items required in the analysis to address the objectives, A full list of data items were developed and requested; a description of data items is provided in section 3.3.4.

3.3.1 Use of regression modelling

During protocol development, the types of data variables within the requested dataset were considered to select the most appropriate statistical approach needed to address the study aim and to enable a range of factors that may be associated with triage outcome urgency to be explored.

Regression modelling was selected as it enables the investigation of a range factors associated with the outcome variable. Key outcome variables explored in this study related to the urgency of triage outcomes, for example: selection of an urgent triage outcome (care within 6 hours or less) by the clinician; or the clinician's upgrade or downgrade of the digitally recommended triage outcome. The type of outcome variable should be considered when selecting the statistical approach; as these outcome variables are categorical in nature (and specifically binary), rather than continuous, logistic regression modelling was selected.

The factors being explored in relation to triage outcome urgency related to the patient (e.g., their presenting symptom, age group and sex), the service (at which participating service provider the call was triaged) and call related factors (e.g., length of the call, time of day of the call); these make up the independent variables. Regression modelling enabled the investigation of independent (adjusted) associations between each of these variables of interest and the outcome variable (e.g., selection of an 'urgent' triage outcome).

The investigation of *independent* (adjusted) associations was important as some of these variables may be related to each other (for example, certain symptoms may be more common in certain age groups). Without adjusting, some of the relationships between these independent factors may have been confounded and hence may not reflect true associations. For this reason, a regression approach which adjusts for confounding(108) was selected.

An alternative statistical approach could be to use ordinal logistic regression (which would have enabled the analysis of an ordinal dependent variable, which for this study could have been the 7 urgency levels (1. Emergency 2. Immediate care within 1 hour 3. Immediate care within 2 hours 4. Urgent care within 4 – 6 hours 5. Moderately urgent care within 24 hours 6. Routine care 7. Self-care or no urgency); this approach was discussed with the statistician supervisor(GA); however, binary logistic regression selected as it enabled a simpler approach, with results that are easier to interpret and share with a wide-ranging audience.

Use of Mixed effects regression modelling

Consideration was given to clustering within the dataset, specifically the data were clustered by the clinicians, who triaged multiple calls within the dataset. This presented a problem as these data are not independent, thus violating one of the assumptions of a logistic regression model; to overcome this problem mixed effects regression models were used. This model type is standard in medical research and is appropriate when observations are not independent(109).

The study additionally sought to quantify the variation between individual clincians in their use of triage, for example, in their selection of urgent triage outcomes, or call upgrading/downgrading. Reporting crude rates of variation alone (e.g., the range of the percentage of calls upgraded by clinicians) presents two main problems: firstly, some variation may reflect the type of patients that clinicians handle, and secondly variation can be artificially inflated due to chance, which is particularly an issue when there are small numbers of calls are involved. To overcome this problem a random intercept model was used, which can be used to account for chance variation when comparing performance between organisations, geographical areas or individuals; it mitigates the risk of overestimating variation due to the chance variation (109).

The random intercept model is the simplest type of mixed-effects model. In this study, a random intercept for the clinician conducting triage was used, this accounted for the impact of chance on variations in triage outcomes associated with individual clinicians (for example, by chance some clinicians may have triaged a more urgent case mix within the dataset, which may occur more so for clinicians who only triaged a small number of calls).

In this model a term is added, which enables identification of variation between reporting unit (in the case of this study, the term being the individual clinician that conducted triage). This between unit variation is described by a distribution that is assumed to be a normal distribution, which can be described by a standard deviation or variance.

The resulting variance from this cannot be easily interpreted due to the variance being defined on a log-odds scale(109). This study has used an approach that presents the variability, after accounting for chance, on the natural scale of the indicator (e.g. the odds of calls being upgraded by individual clinician). This is more accessible and simpler to interpret(109).

There are different options to describe variation on the natural scale. One option is to estimate percentiles of the fitted underlying distribution in terms of proportions. In this study the 2.5th and 97.5th centiles of the indicator of the fitted distribution on a log-odds scale were calculated before converting back to the native scales (e.g., proportion of calls upgraded by clinician); this enables for direct comparison with the observed scores. The relative difference between these two centiles were then calculated, to describe the 95% midrange of observations. This represents the range we would expect most observations, ignoring extremes, to lie within. The resulting modelled variation represents true variation, whilst simply calculating the 95% mid-range of observed percentages of upgraded calls would result in greater variation that does not take into account the role of chance.

A further advantage of mixed-effect models is that they can be used even when data are sparse.

Use of Poisson regression

To investigate call rates, a Poisson regression was selected as this type of model uses count data (for this study 'count data' included: numbers of calls in the dataset, number of calls by sex, and level of deprivation. Rates were calculated taking into account a local population denominator which is described in section 3.4.4.

3.3.2 Dataset description

A dataset of secondary triage call records spanning an 18-month period (April 2019 - September 2020) were requested from four England based urgent care service providers. These services providers were: Bardoc (http://bardoc.co.uk/), GTD Healthcare (https://www.gtdhealthcare.co.uk/), Practice Plus group (https://practiceplusgroup.com/) and Mastercall (http://www.mastercall.org.uk/).

These services use the same Odyssey digital triage tool in secondary triage. At these services digital triage is conducted by mixed clinician types (predominantly nurses), including general nurses, paediatric nurses, advanced care practitioners, palliative care specialists and paramedics. Table 8 shows the numbers of calls within the full dataset from each of the four participating services.

These services provide out of hours care in different regional areas within England, including regions in the Northwest, Midlands, and the South-East. Table 9 shows the full list of Clinical Commissioning Groups (CCGs) where the participating services provide OOH care. CCGs represent regional areas within England that organised local delivery of health services(110), which operated until July 2022 until being reformed into integrated care systems(111).

Table 8: Number of calls in the dataset from each service

Out of Hours Service name		Number of calls	Percentage of all calls
Bardoc		112,944	39.0
GTD-Healthcare		83,768	28.9
Mastercall		25,128	8.7
Practice Plus Group		67,970	23.5
Total		**289,810**	**100.0**

Table 9: Clinical commissioning groups covered by out of hours service providers.

Service provider	CCG Name
Bardoc	NHS Bury CCG
	NHS Heywood, Middleton and Rochdale CCG
GTD	NHS Chorley and South Ribble CCG
	NHS Oldham CCG
	NHS Tameside and Glossop CCG
	NHS Manchester CCG
	NHS Greater Preston CCG

Mastercall	NHS Stockport CCG
	NHS Trafford CCG
PPG	NHS Coventry and Rugby CCG
	NHS Gloucestershire CCG
	NHS Ipswich and East Suffolk CCG
	NHS North-East Essex CCG
	NHS South Warwickshire CCG
	NHS Warwickshire North CCG
	NHS West Suffolk CCG
	NHS Herefordshire and Worcestershire CCG
	NHS Surrey Heartlands CCG

3.3.3 Data available from service providers and the digital triage tool software versions & services

The dataset spanned 01 April 2019 – 01 October 2020. During this time the digital triage tool software was upgraded (version 2 to version 3) at three of the services. The number of calls within each software version are listed in Table 10 below. The main difference between versions related to default urgency values; in version 2 the default triage urgency level was emergency, which gets adjusted as the call takers answers questions within the tool; the opposite is true in version 3, where the default value was no urgency, depending on the answers completed by the clinician, urgency increases from the default value. This did not impact on the study, as all analyses which investigated associations with urgency were conducted on data from version 3 systems only (triaged calls n = 195,496 across 3 services). Service utilisation analyses (objective 1) included the whole dataset, from all 4 participating services.

Table 10: Number of calls by digital triage tool version

Out of Hours Service name	Date range of calls	Number of calls
Bardoc (v3)	01/04/2019 – 01/10/2020	112,944
GTD-Healthcare (v3)	13/08/2019 – 1/10/2020	74190
GTD-Healthcare (v2)	01/04/2019 – 10/01/2020[1]	9578
Mastercall (v3)	27/01/2020 – 01 10 2020	8362
Mastercall(v2)	01/04/2019 – 26/01/2020	16766
PPG (v2)	01/04/2019 – 01/10/2020	67970

3.3.4 Variables within the dataset

The dataset included:

1. Information about the patient: anonymised patient id, time and date of call, call length, patient age and sex, deprivation decile (based on the Index of Multiple Deprivation(112) which is described further later in section 3.3.7) and presenting

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[1] Overlapping time periods for GTD Healthcare use of v2 and v3 digital triage tool due to use of both versions whilst clinicians being trained on new system

symptom. The dataset contained one entry per call, so any patients who called more than once occurred in the dataset multiple times.

2. Data collected during the digital triage process: questions and answers completed during the triage call, digitally recommended triage outcome, (the triage outcome digitally generated based on the clinican's answers entered into the digital triage tool), the clinician selected triage outcome (final triage outcome selected by the clinician), and a non-identifiable staff member ID representing the clinician that conducted the triage.

   Both digitally recommended triage outcome and clinician selected triage outcome corresponded to one of 7 urgency levels:

   - Emergency
   - Immediate care within 1 hour
   - Immediate care within 2 hours
   - Urgent care within 4 – 6 hours
   - Same day care within 24 hours
   - Routine care
   - Self-care or no urgency, which included cases where the caller was advised to contact a different care service.

3. The preliminary triage outcome generated in primary triage (non-clinician triage by NHS 111 using the Pathways software) prior to referral to the clinician led OOH services. This triage outcome was in the format of a 4 – 5 character code known as a "DxCode" and referred to as a pathways code hereafter.

Within the dataset there were 86 different pathways codes, code meanings are available from: https://www.england.nhs.uk/statistics/statistical-work-areas/nhs-111-minimum-data-set/

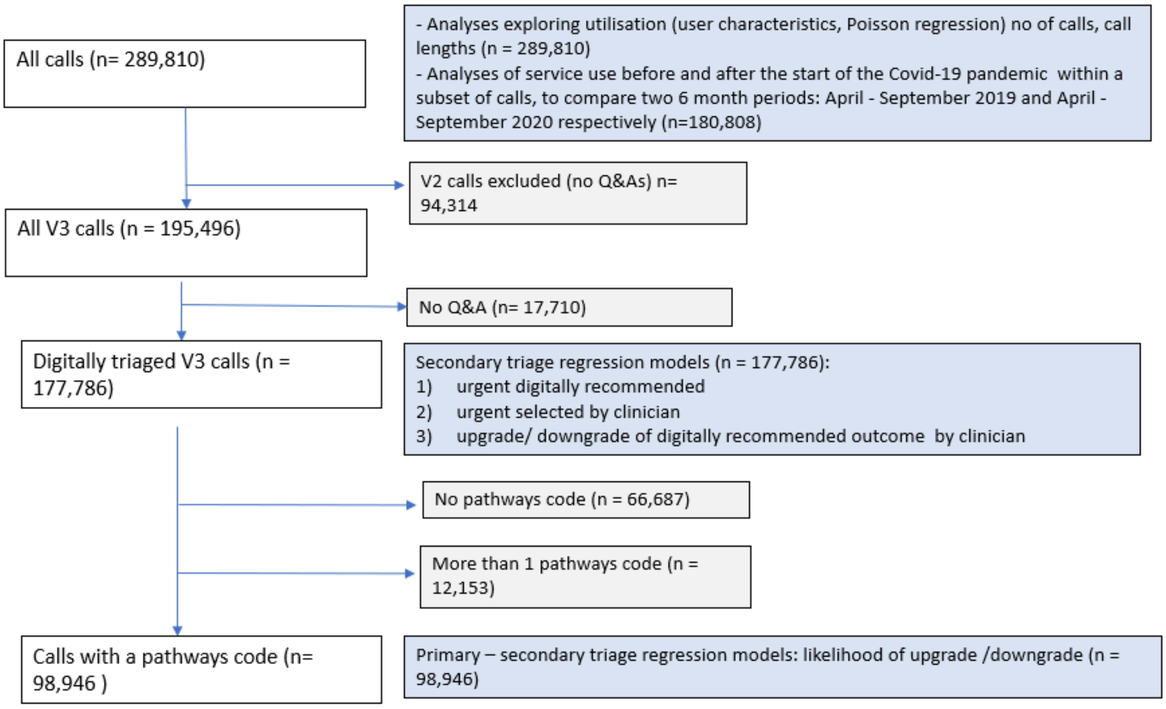
Examples of pathways codes include: Dx05: "Contact a primary care service within 2 hours" (Primary care); Dx321: "Speak to a clinician from our service immediately – Refused Ambulance" (Ambulance).

Pathways codes were only available in the version 3 digital triage tool, used across three of the service providers: GTD Healthcare, Bardoc and Mastercall. Of the total v3 dataset (n= 195,496 calls), a pathways code was available in 63 % of calls and missing in the other 37%.

Calls with no code represented patients that were referred from a provider other than the NHS 111 telephone service, for example: the 119 National Covid Clinical assessment service during its periods of operation (this was a temporary service that was set up in response to the Covid-19 pandemic)(7); through ambulance services via healthcare professional (HCP) telephone lines, laboratories, community services and dental cases via a shortened pathway.

The data included in the various analyses presented in this chapter are outlined in Figure 5.

Figure 5 Flow chart showing missing data and datasets used in analysis. Blue boxes describe the analyses conducted and present the number of calls included in the respective analysis stage.



3.3.5 Comparisons of service utilisation pre- and post-Covid start

in addition to investigating the whole 18-month dataset, a subset of the data (n calls =180,808) was used to investigate service use before and after the start of covid; this is referred to the topmost blue box in Figure 5.

To compare utilisation before and after the start of Covid-19 the same 6-month comparison period across two years (April – September 2019 and April – September 2020) was selected from the 18-month dataset that was available to the project. This allowed call rates to be investigated before and after the start of Covid-19 in a manner that mitigated the impact of seasonal variation on service use. If the study had simply compared the pre and post Covid start by splitting the 18 month time period in two from when the Covid-19 Pandemic was declared (March 2020)(113), this would have introduced bias arising from seasonal variation, as there are higher pressures due to greater demand on healthcare service use seen during the winter(114).

3.3.6 ‘Urgent’ triage outcome as an outcome variable in regression modelling

Two regression models investigated the odds of ‘urgent’ triage outcomes (models 1 and 2 as detailed in section 3.4.5). Urgent was defined as where the triage outcome related to care within 6 hours or less. (This included the 4 of the 7 most urgent levels: 1. Emergency care 2. Immediate care within 1 hour 3. Immediate care within 2 hours 4. Urgent care within 4 – 6 hours 5. Same day care within 24 hours). The cut off urgency level of 6 hours was selected as it represents a reporting standard within England based urgent care(115).

3.3.7 Measure of deprivation

The Index of multiple deprivation (IMD) was selected to measure patient deprivation. This was selected as it enabled a consistent and pre-existing measure that could be used nationally across England. IMD is a comprehensive measure based on indicators of deprivation across seven different domains: income, employment, crime, health, barriers to housing and living environment deprivation(116).

IMD is calculated at the Lower Super Output Area level (LSOA) representing a population of 1500 people (which is typically geographically smaller than postcode level). The IMD decile (1- 10; 1 being the most deprived and 10 being the least deprived) of the LSOA area, that corresponded to the patient postcode was selected for use in the analysis as it is a more specific measure, being based on the individual patient postcode, as compared to being calculated at the practice or service provider level. To protect patient confidentiality, IMD based on patient postcode was derived by Advanced Health and Care; postcodes were not provided in the dataset.

3.4 Methods

3.4.1 Data cleaning and pre-processing

Data were examined to ensure that they fell within the expected categories, for example to check that urgency reflected one of the 7 urgency levels:

- Emergency
- Immediate care within 1 hour
- Immediate care within 2 hours
- Urgent care within 4 – 6 hours
- Moderately urgent care within 24 hours
- Routine care
- Self-care or no urgency

In approximately 3% calls (n=7867) in the overall dataset, there was an unexpected code (“IMM3”); the code meaning was checked with Advanced who confirmed that the code reflected ‘immediate care within 2-hour’. These calls were re-coded in the dataset in the data pre-processing stage.

3.4.2 Symptom categorisation

Different methods of symptom categorisation were considered, for example the use of MeSH terms(117); however due to the wide range of presenting symptoms within the digital triage tool, and for ease of communicating findings with stakeholders (service providers and Advanced health & care ltd) who were familiar with the existing categories within the digital triage software, it was felt that the existing symptom categorisation within the digital triage tool was most appropriate.

3.4.3 Primary triage outcomes: Pathways code descriptions and categorisation

Pathways codes were manually categorised into 7 levels of urgency, to match the categories available within the Odyssey digital triage tool used in secondary triage. Mapping of the pathways codes to the urgency levels within Odyssey enabled urgency levels to be compared and visualized using a sankey diagram. This manual categorisation was reviewed by the clinical (GP) supervisor (JD). The mapping generated is included in Appendix 4.

To investigate how urgency changed between primary and secondary triage, two binary variables were created 1) an upgraded variable, to indicate cases where the triage outcome was more urgent in clinician led secondary triage, compared to the primary triage and 2) a downgraded variable indicating where the urgency of the call was lower urgency in the secondary triage, as compared to primary triage.

3.4.4 Generating a population denominator to evaluate service use.

To evaluate the utilisation (call rates) of services providing secondary triage, a population denominator dataset was created containing the age, sex and level of deprivation of the local population served by the OOH services. This was based on the Clinical commissioning groups where the OOH services operate.

A denominator dataset containing the numbers of the local population (based on the CCG geographical region) for each decile, by sex and age group was generated. This was compared to the corresponding triage call records within each decile by sex and age group in the Poisson regression. Age groups reflected: 0-1 (Infancy - under 24 months), 2-4 (young child), 5 - 15 (child), 16-24 (young adult), 25 - 34, 35 – 44, 45 – 54, 55 – 64, 65 – 74, 75 – 84, and 85 and over.

The denominator data required numbers of the local population (based on the CCG geographical regions) for each decile, by sex and age. However, as there is no direct publicly available information relating to age, sex and deprivation level listed by CCG, linking of information from three publicly available files was required in order to generate the denominator data, as detailed below.

The first stage involved obtaining a list of lower layer super output areas (LSOAs) corresponding to the CCGs covered by the service providers. This was obtained using: https://geoportal.statistics.gov.uk/datasets/lower-layer-super-output-area-2011-to-clinical-commissioning-group-to-local-authority-district-april-2016-lookup-in-england. This stage was needed to identify the numbers of the population in each decile, as conducted in the second stage.

The second stage involved mapping the LSOAs identified in the previous step to its corresponding decile. This was conducted using: https://data-communities.opendata.arcgis.com/datasets/communities::lower-super-output-area-lsoa-imd2019-wgs84/explore?location=52.735079%2C-2.327771%2C7.00

The third stage involved retrieving the numbers of patients by age and sex corresponding to LSOAs covered by CCGs in the areas where the participating service provider operate, this was retrieved using:https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/clinicalcommissioninggroupmidyearpopulationestimates.

These three sources enabled a table to be generated , which included the numbers of males and females by each age group, within each deprivation decile This denominator dataset was used in the Poisson regression, as described in the next section.

3.4.5 Data analyses

3.4.5.1 Descriptive statistics: calls by patient and clinician, summary of triage outcomes

Descriptive statistics were used to summarise the numbers of calls overall in the dataset by patient for the whole 18-month dataset and well as in the time periods before and after the start of Covid-19. Frequencies of triage outcomes in both primary and secondary triage, according to the 7 urgency levels were summarised.

Additionally calls triaged by clinicians were explored, including for example, the mean number of calls triaged by each clinician within the dataset, the mean percentages and interquartile ranges of calls upgraded and downgraded per clinician.

Two Sankey diagrams were created to visually present change in triage outcome urgency. These show the change in outcome urgencies between 1) the digitally recommended triage outcome and 2) the urgency level assigned by the non-clinician in primary triage as compared to the final urgency level selected by the clinician in secondary triage.

3.4.5.2 Service utilisation and patient characteristics

Call rates were modelled using a Poisson regression which incorporated local populations served by the clinical commissioning groups where the OOH services operated as denominators (see Table 9 for CCG list). The Poisson regression was adjusted for age, sex deprivation, and service use before or after the start of the Covid-19 pandemic (April - September 2019 and April - September 2020 respectively); this represents a sub-set of calls (n = 180,808) as indicated on Figure 5.

3.4.5.3 Associations between patient characteristics, urgent triage outcomes and call upgrading/downgrading

Mixed effects logistics regression models were used to investigate the odds of the following binary outcomes:

1. Urgent triage outcome(care within 6 hours or less) being digitally recommended by the digital triage tool (digitally recommended urgency)
2. Urgent triage outcome (care within 6 hours or less) selected by the clinician at the end of secondary triage (clinician selected urgency). This urgency may be different to the digitally recommended urgency where the clinician manually adjusted the digital recommendation, to make it more or less urgent for a given patient.
3. Upgrade and downgrade of digitally recommended triage outcome, which is where the clinician selected a triage outcome that was more urgent or less urgent respectively than the urgency recommended by the digital triage tool. This was based on the 7 urgency levels. An example of an upgraded call is one with a digitally recommended urgency of “Moderately urgent care within 24 hours”, which was subsequently changed to a higher urgency such as “Immediate care within 1 hour” by the clinician.
4. Calls upgraded in secondary triage, where triage outcome selected by clinician was more urgent than that assigned in primary triage.
5. Calls downgraded in secondary triage, where the triage outcome was made less urgent compared to the assigned urgency in primary triage.

All models (1-5) adjusted for the clinician conducting secondary triage as the random effect. Such approaches can be used to quantify the variability between different healthcare providers(109), or in the case of this study, individual clinicians. The variability between clinicians was quantified by calculating the Odds ratio covering the 95% midrange of clinicians (for example, demonstrating the odds of upgrade in those clinicians who upgrade most; at the top of the 95% range compared to those clincians who upgrade least at the 5%).

The following fixed effects were included in the models as categorical variables: patient sex, age group, main presenting symptom as recorded within the digital triage tool, IMD Decile, service provider, day of week and time of day. Models 2 -5 included additional fixed effects: number of calls triaged by clinician within the 18-month dataset (an indicator of the clinician’s triage experience) and call length. The number of calls were included as proxy indicator of the clinicians’ familiarity with the digital triage tool, which may influence clinician’s decision in relation to their odds of upgrading or downgrading calls.

Joint tests were used to calculate p-values showing the significance level for each of these fixed effects variables.

All analyses were conducted using Stata (v17); Sankey diagrams were created using Python.

3.5 Results

The routine dataset included 289,810 calls made about 231,419 individual patients.

3.5.1 Characteristics of calls

Most calls (92%) were made out-of-hours (weekdays outside of 08:00 - 18:00, or weekends and bank holidays at any time). After removing calls that were longer than 2 hours in duration the mean length of the phone call was 10.13 minutes (standard deviation: 7.88, range 0.83 – 118.63), and the median call length was 8.75 minutes. The mean call length increased from 8.56 minutes before the start of Covid-19 (April – September 2019) to 12.32 minutes after the start of Covid-19 (April – September 2020). Calls longer than 2 hours in duration were removed as they are likely to be where the call was not closed by the call taker in error.

3.5.1.1 Time of day

The highest frequency of calls occurred in the evenings between 18:00 – 24:00 on weekdays (excluding bank holidays), whilst on weekends and bank holidays, calls were made more consistently throughout the daytime (Figure 6).

The call rate (number of calls per day) was higher on weekends as compared to weekdays (954 vs 337 calls); the highest rate being on weekend mornings; a breakdown of the total calls and calls per hour is shown in Table 11.

Figure 6 Histogram showing time of secondary triage calls (top graph shows calls on weekdays; bottom graph shows calls on weekends and bank holidays).

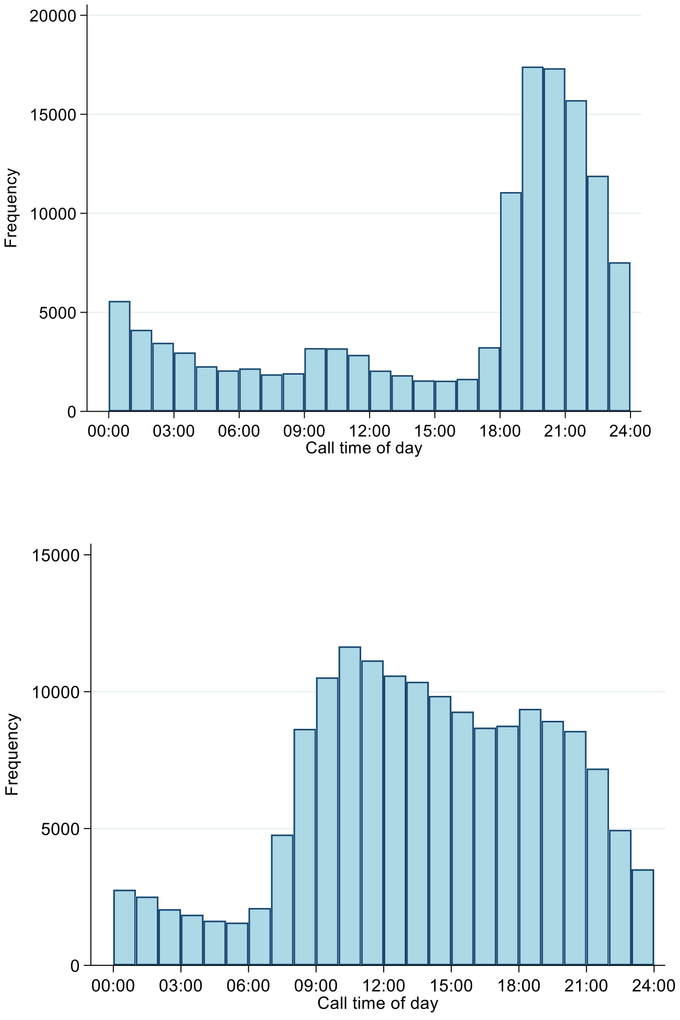


Table 11: Calls per hour by time of day on working days and weekend/bank holidays

	Working day		**Weekends and bank holidays**	
Time of day	**Total calls in dataset**	**Calls per hour**	**Total calls in dataset**	**Calls per hour**
00:00 - 00:59	5576	14.64	2763	16.35
01:00 - 01:59	4120	10.81	2514	14.88
02:00 - 02:59	3464	9.09	2052	12.14
03:00 - 03:59	2976	7.81	1849	10.94
04:00 - 04:59	2280	5.98	1632	9.66
05:00 - 05:59	2073	5.44	1563	9.25
06:00 - 06:59	2170	5.70	2096	12.40
07:00 - 07:59	1872	4.91	4778	28.27
08:00 - 08:59	1928	5.06	8643	51.14
09:00 - 09:59	3198	8.39	10523	62.27
10:00 - 10:59	3184	8.36	11656	68.97
11:00 - 11:59	2854	7.49	11144	65.94
12:00 - 12:59	2064	5.42	10592	62.67
13:00 - 13:59	1829	4.80	10363	61.32
14:00 - 14:59	1566	4.11	9845	58.25
15:00 - 15:59	1552	4.07	9272	54.86
16:00 - 16:59	1644	4.31	8686	51.40
17:00 - 17:59	3246	8.52	8758	51.82
18:00 - 18:59	11074	29.07	9373	55.46
19:00 - 19:59	17413	45.70	8934	52.86
20:00 - 20:59	17326	45.48	8566	50.69
21:00 - 21:59	15715	41.25	7191	42.55
22:00 - 22:59	11899	31.23	4952	29.30
23:00 - 23:59	7531	19.77	3511	20.78
Total calls	**128554**		**161256**	

3.5.2 Characteristics of patients

3.5.2.1 *Age group*

A large proportion of calls related to the youngest age groups, with 19.5% of calls being about infants and children aged 4 years or younger (Table 12). When comparing service use before and after the start of Covid-19 (April – September 2019 and April – September 2020 respectively) frequency of calls was lower overall (n=86125) after the start of Covid-19 compared to before the start of Covid-19 (n=94,683). In most age groups the number of calls decreased after the start of Covid-19, however the use of the services increased in four age groups (16 – 24, 25 – 34, 35 – 44, 45- 54).

Table 12: Calls by patient age group

	All calls (1 April 2019 - 1 October 2020)		**Before Covid (April - Sept 2019)**		**After Covid (April - Sept 2020)**	
Age Group	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**
Infancy - under 24 months	11.9	34,613	11.4	10,855	8.8	7,611
2-4 (young child)	7.6	21,922	7.0	6,598	4.7	4,046
5 - 15 (child)	8.5	24,623	7.9	7,507	7.9	6,830
16-24 (young adult)	10.5	30,300	10.4	9,856	11.9	10,203
25 - 34	14.0	40,418	13.8	13,066	16.0	13,783
35 - 44	9.3	26,853	8.9	8,406	10.7	9,212
45 - 54	8.2	23,864	8.3	7,827	9.5	8,187
55 - 64	7.5	21,606	7.4	7,048	8.5	7,333
65 - 74	7.1	20,600	7.5	7,074	7.4	6,370

75 - 84	8.2	23,755	9.1	8,580	8.0	6,910
85 and over	7.3	21,256	8.3	7,866	6.6	5,640
Total	100.0	289,810	100.0	94,683	100.0	86,125

3.5.2.2 Sex

A higher proportion of calls were about female patients (58.5%, n= 169429) compared to male patients (41.1%, n=120381); this remained similar before and after the start of Covid-19 (Table 13).

Table 13: Calls by patient sex

All calls (1 April 2019 - 1 October 2020)			**Before Covid (April - Sept 2019)**		**After Covid (April - Sept 2020)**	
Sex	Percent	n	Percent	n	Percent	n
Female	58.5	169,429	58.83	55,699	58.9	50,752
Male	41.5	120,381	41.17	38,984	41.1	35,373
Total	100.0	289,810	100	94,683	100.0	86,125

3.5.2.3 Ethnicity

Ethnicity was missing in 74% of triaged calls (215,505 of 289,810 calls). Due to the large amount of missing data, ethnicity was not included in further in analyses. Table 14**Error! Reference source not found.** below shows ethnicity in calls where it was recorded (n = 74,305).

Table 14 Calls by ethnicity.

Ethnicity	**Percentage of calls**	**n (calls)**
White British	80.4	59,767
White Irish	0.4	287
White other	1.5	1,113
Mixed White and Black Caribbean	0.3	194
Mixed White and Black African	0.3	208
Mixed White and Asian	0.4	274
Mixed other	0.7	523
Asian or Asian British Indian	4.5	3,372
Asian or Asian British Pakistani	9.3	6,902
Asian or Asian British Bangladeshi	0.6	456
Other Asian	0.0	17
Black or Black British Caribbean	0.2	154
Black or Black British African	0.6	440
Other Black background	0.2	142
Chinese	0.1	91
Other ethnic groups	0.5	363
Refused to Answer	0.0	2
Total	**100.0**	**74,305**

3.5.2.4 Top presenting symptoms

The top three presenting symptoms across the 18-month period were: 1) cough (8.0% of calls, n=14,234), 2) abdominal (7.9%, n=14012) and, 3) high temperature (5.0%, n=8941);the top 20 presenting symptoms are shown in Table 15. Presenting symptom was not available in 9% of calls (n=17,710).

There was a change in the top three presenting symptom before and after the start of Covid-19. Before the start of Covid-19 the top symptoms related to: 1) abdominal pain 2) pain management and 3) cough, whilst after the start of Covid-19 these were: 1) abdominal pain 2) cough and 3) high temperature (Table 16).

Table 15 Table of main symptom

	Main symptom (category assigned to first question asked)	**Percent**	**n calls**
1	Cough	8.0	14,234
2	Abdominal Pain	7.9	14,012
3	High Temperature	5.0	8,941
4	Rash	4.1	7,357
5	Analgesics	3.2	5,662
6	Back pain	3.0	5,276
7	Earache	3.0	5,260
8	Urinary Symptoms	2.8	5,051
9	Chest Pain	2.8	5,031
10	Breathlessness	2.8	4,924
11	Sore Throat	2.7	4,822
12	Vomiting	2.4	4,330
13	Diarrhoea	2.3	4,011

14	Cold/Flu	2.0	3,490
15	Unwell	1.8	3,253
16	Dizziness	1.7	3,046
17	Headache	1.7	2,965
18	Medication query	1.4	2,524
19	Itching	1.1	2,015
20	Information	1.1	1,980

Table 16 Presenting symptoms before and after Covid-19 start

	Before Covid April - Sept 2019			**After Covid April - Sept 2020**		
	Symptom	Number of calls	% of calls	Symptom	Number of calls	% of calls
1	Abdominal Pain	3,875	8.7	Abdominal Pain	5,302	8.42
2	Pain management	3,707	8.3	Cough	2,935	4.66
3	Cough	2,631	5.9	High Temperature	2,769	4.4
4	High Temperature	1,430	3.2	Rash	2,722	4.32
5	Rash	1,377	3.1	Back pain	2,179	3.46
6	Back pain	1,296	2.9	Chest Pain	2,047	3.25
7	Earache	1,231	2.8	Urinary Symptoms	1,989	3.16
8	Diarrhoea	1,155	2.6	Breathlessness	1,747	2.77
9	Urinary Symptoms	1,155	2.6	Earache	1,636	2.6

10	Chest Pain	1,083	2.4	Covid-19	1,499	2.38
11	Sore Throat	992	2.2	Sore Throat	1,372	2.18
12	Breathlessness	963	2.2	Diarrhoea	1,258	2
13	Vomiting	887	2.0	Vomiting	1,205	1.91
14	Dizziness	825	1.9	Dizziness	1,195	1.9
15	Toothache	795	1.8	Headache	1,157	1.84
16	Medication query	765	1.7	Unwell	1,148	1.82
17	Cold/Flu	748	1.7	Medication query	923	1.47
18	Itching	719	1.6	Stings	867	1.38
19	Headache	691	1.6	Analgesics	766	1.22
20	Unwell	653	1.5	Constipation	760	1.21

3.5.2.5 Top presenting symptoms by sex:

There were differences in presenting symptom between males and females; the top presenting symptom in male patients related to cough whilst for female patients it related to abdominal pain. Another difference was the frequency of calls about urinary symptoms, with this being the fifth most common symptom in female patients compared to the 14th in male patients (Table 17).

Table 17 Patients' symptoms by sex

FEMALE	**n calls**	**%**	**MALE**	**n calls**	**%**

Abdominal Pain	9,289	8.87	Cough	6,745	9.23
Cough	7,489	7.15	Abdominal Pain	4,723	6.46
High Temperature	4,435	4.24	High Temperature	4,506	6.17
Rash	3,894	3.72	Rash	3,463	4.74
Urinary Symptoms	3,667	3.5	Analgesics	2,439	3.34
Back pain	3,322	3.17	Breathlessness	2,206	3.02
Analgesics	3,223	3.08	Chest Pain	2,076	2.84
Earache	3,199	3.05	Earache	2,061	2.82
Sore Throat	2,960	2.83	Back pain	1,954	2.67
Chest Pain	2,955	2.82	Sore Throat	1,862	2.55
Breathlessness	2,718	2.6	Diarrhoea	1,822	2.49
Vomiting	2,573	2.46	Vomiting	1,757	2.4
Diarrhoea	2,189	2.09	Cold/Flu	1,564	2.14
Dizziness	2,010	1.92	Urinary Symptoms	1,384	1.89
Unwell	1,952	1.86	Unwell	1,301	1.78
Headache	1,946	1.86	Dizziness	1,036	1.42
Cold/Flu	1,926	1.84	Headache	1,019	1.39
Medication query	1,537	1.47	Medication query	987	1.35
Itching	1,223	1.17	Information	870	1.19
Asthma symptom	1,190	1.14	Constipation	851	1.16

3.5.3 Call rates

The results of the Poisson regression examining the variation in the rate of calls is shown in Table 18. The overall call rate was 8% lower after the start of Covid-19 (April - September 2020) compared to the previous year (April - September 2019: RR=0.93 (0.92 - 0.94), p<0.001).

Overall, highest call rates were found in the infancy age group (under 24 months) (RR compared to 45 - 54-year-olds 5.32, CI: 5.21 - 5.44) and older adults aged 85+ (RR compared to 45 - 54-year-olds 4.17 CI:4.07 - 4.26p<0.001 for both. The call rate was highest for patients living in the most deprived areas, and the call rate was lower for male patients compared to female patients (RR 0.73; CI0.72-0.74); p<0.001 for all.

Table 18: Characteristics of triaged patients rate ratios from adjusted Poisson regression:

Subgroup		
Age group		**Rate ratio (confidence interval); all p< 0.001 in joint test**
	Under 24 months	5.32 (5.21 - 5.44)
	2-4 (young child)	1.91 (1.87 - 1.96)
	5 - 15 (child)	0.74 (0.72 - 0.75)
	16-24 (young adult)	1.27 (1.24 - 1.30)
	25 - 34	1.31 (1.29 - 1.34)
	35 - 44	Ref
	45 - 54	0.90 (0.88 - 0.92)
	55 - 64	0.94 (0.91 - 0.96)
	65 - 74	1.09 (1.07 - 1.12)
	75 - 84	2.04 (2.00 - 2.09)
	85 and over	4.17 (4.07 - 4.26)
Sex		

	Male	0.73 (0.72 - 0.74)
	Female	Ref
IMD Decile		
	1 (most deprived)	3.15 (3.08 - 3.21)
	2	2.63 (2.57 - 2.69)
	3	2.00 (1.95 - 2.04)
	4	1.36 (1.33 - 1.40)
	5	1.25 (1.22 - 1.28)
	6	Ref
	7	1.06 (1.03 - 1.09)
	8	0.95 (0.92 - 0.97)
	9	0.89 (0.87 - 0.91)
	10 (least deprived)	0.68 (0.67 - 0.70)
Before or after Covid		
	Before (March - Sep 2019)	Ref
	After (March - Sep 2020)	0.93 (0.92 - 0.94)

3.5.4 Clinicians' triage of calls

Calls within the dataset were triaged by 259 different clinicians. The mean number of calls triaged by clinician was 755. The clinicians' use of secondary triage in terms of their 1)generation of digitally recommended urgent outcomes, 2)selection of urgent triage outcomes, 3) upgrading /downgrading from digital recommendation and 4) upgrading/downgrading from primary triage outcome is summarised in Table 19.

Table 19 Summary of clinicians' use of secondary triage (spanning 18-month time period of dataset)

By clinician:	**Mean**	**Median**	**IQR**
Digital triage dataset (n calls = 177,786)			
Number of calls	755	378	60-1144
% Urgent triage outcome digitally recommended	38.5%	39.8%	27.3 – 50.0%
% Urgent triage outcome selected	52.8%	55.3%	37.6% – 70.0%.
% Calls upgraded from digitally recommended outcome	24.0%	22.5%	11.3% - 32.6%
% Calls downgraded from digitally recommended outcome	7.8%	5.3%	1.4% - 11.1%
Dataset containing primary triage urgency code (n calls = 98,946)			
Number of calls	1051	922	486 – 1382
% Calls upgraded	11.0%	10.7%	8.1%- 14.1%
% Calls downgraded	73.6%	74.5%	69.0% - 78.8%

3.5.5 Triage outcome urgency levels

Secondary triage: digitally recommended triage outcomes and subsequent clinician selected urgency.

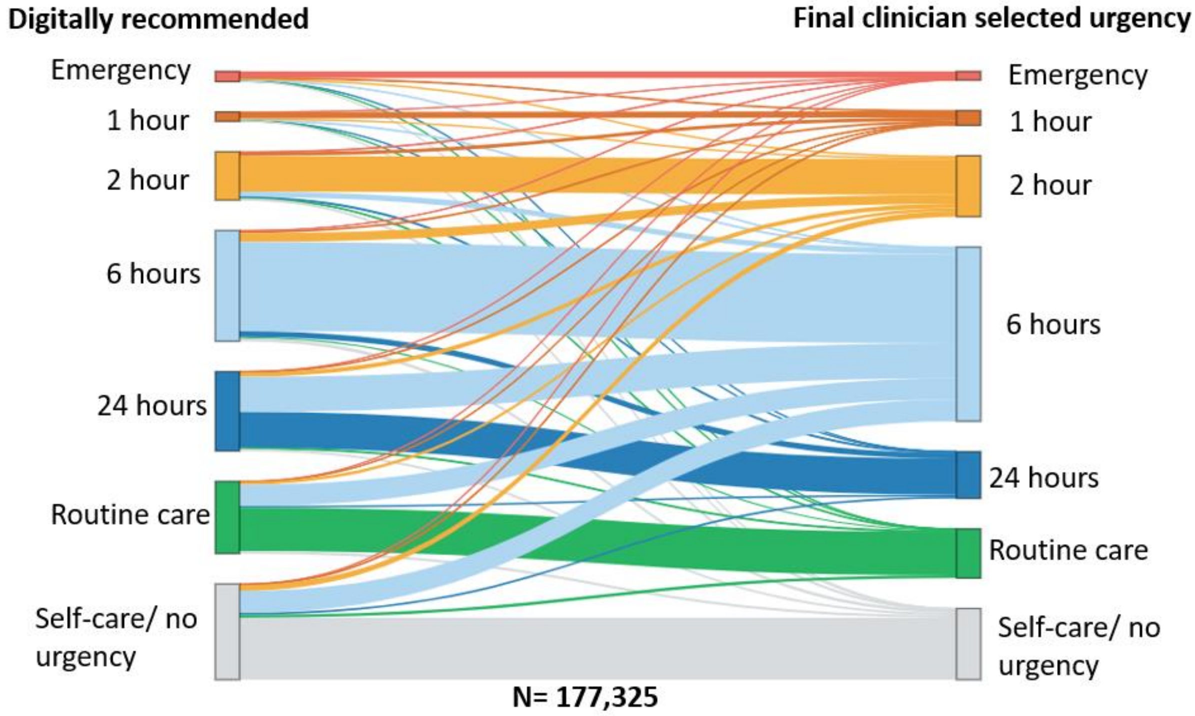
The highest proportion of calls had a digitally recommended triage outcome urgency of "urgent care within 6 hours" (25.97%); in the subsequent clinician selected urgency this remained the most frequent urgency level, with clinicians selecting this urgency level in 40.81% of calls. Overall, the percentages of the lower urgency triage levels were smaller in the clinician selected urgency (indicating upgrading of digitally recommended urgency level by clinicians). See Table 20 for the number of calls and percentages within each urgency level for both digitally recommended urgency and clinician selected urgency.

Table 20 Digitally recommended urgency and clinician selected urgency in secondary triage (all calls – after removing calls with missing Q&A)

Digitally recommended urgency	**Percentage of calls**	**Number of calls**
Emergency	2.4	4,282
Immediate within 1 hour	2.2	3,885
Immediate within 2 hours	11.4	20,166
Urgent care within 6 hours	26.0	46,065
Urgent care within 24 hours	18.7	33,081
Routine care	16.9	30,006
Self-care or no urgency	22.5	39,863
Total	**100.0**	**177,348**
Clinician selected urgency	**Percentage of calls**	**Number of calls**
Emergency	2.1	3,658
Immediate within 1 hour	3.5	6,158
Immediate within 2 hours	14.3	25,434
Urgent care within 6 hours	40.8	72,440
Urgent care within 24 hours	11.0	19,511
Routine care	11.7	20,684
Self-care or no urgency	16.7	29,640
Total	**100.0**	**177,525**

The Sankey visualisation (Figure 7) shows the change in urgency levels between the digitally recommended outcome urgency and the subsequent selected urgency level selected by the clinician. The left-hand side shows the urgency level recommended by the digital triage tool after the clinician has entered the patient's symptoms into the software, and the right-hand side shows the final urgency level selected by the clinician for each call (n = 177,325).

Figure 7 Sankey diagram showing the change in urgency levels between digitally recommended triage outcome urgency and subsequent clinician selected urgency.



3.5.6 Factors associated with urgent secondary triage outcomes.

3.5.6.1 Factors associated with urgent digitally recommended urgent triage outcomes.

The results of the adjusted regression models are shown in Table 21. Compared to female patients, male patients were around 10% less likely to have an ‘urgent’ (care required <=6 hours) triage outcome digitally recommended (0.91 CI: 0.89 - 0.93, p<0.001). The symptoms with highest odds of an urgent outcome being digitally recommended related to breathlessness (1.53 CI: 1.42 - 1.65, p<0.001) and chest pain (1.20 CI: 1.12 – 1.29, p<0.001); reference group: abdominal pain. The odds of a digitally recommended urgent outcome was lower in younger age groups, with the lowest odds in the 5-15 years age group (OR:0.72, CI 0.68-0.75, p<0.001; reference 45-55 years).

There was no association between level of deprivation or participating service providers in the odds of an urgent digitally recommended triage outcomes.

Most substantially, there was variation in digitally recommended urgent outcomes associated with the clinician conducting triage. There was an odds ratio of 25.57 comparing the 95% mid-range of clinicians (the clinicians most likely to generate an urgent triage outcome using digital triage, at the top of the 95% mid-range, had a 26-fold increase in the odds of generating this compared to the clinicians with lowest odds of generating this, at the bottom of the 95% mid-range). See Table 21.

Table 21 Associations relating to urgent (care <=6 hours) digitally recommended triage outcomes and urgent (care <=6 hours) selected by the clinician: results from adjusted mixed effects logistic regression

	Digitally recommended urgent triage outcome (care within 6 hours or less)	Urgent secondary triage outcome selected by clinician (care within 6 hours or less)
	OR (95% CI)*	**OR (95% CI)****
Sex		
Male	0.91 (0.89 - 0.93)	0.94 (0.92 - 0.96)
Female	ref	ref
Top 20 presenting symptoms		
Abdominal pain	ref	ref
Back pain	0.57 (0.53 - 0.60)	0.73 (0.68 - 0.79)
Breathlessness	1.53 (1.42 - 1.65)	1.45 (1.34 - 1.57)
Chest Pain	1.20 (1.12 - 1.29)	1.23 (1.14 - 1.33)
Cold/Flu	0.42 (0.38 - 0.45)	0.46 (0.42 - 0.50)
Cough	0.42 (0.40 - 0.44)	0.66 (0.62 - 0.69)
Diarrhoea	0.61 (0.57 - 0.66)	0.42 (0.39 - 0.45)
Dizziness	0.30 (0.28 - 0.33)	0.54 (0.50 - 0.59)
Earache	0.30 (0.28 - 0.32)	0.64 (0.60 - 0.69)
Headache	0.41 (0.37 - 0.44)	0.60 (0.55 - 0.65)
High Temperature	0.64 (0.61 - 0.68)	0.66 (0.62 - 0.70)
Itching	0.16 (0.15 - 0.19)	0.38 (0.35 - 0.43)
Medication query	0.01 (0.01 - 0.01)	0.63 (0.57 - 0.69)
Rash	0.30 (0.28 - 0.32)	0.42 (0.39 - 0.45)
Sore Throat	0.17 (0.16 - 0.19)	0.56 (0.52 - 0.60)
Unwell	0.55 (0.51 - 0.60)	0.71 (0.65 - 0.78)

Urinary Symptoms	1.04 (0.97 - 1.12)	1.42 (1.31 - 1.54)
Vomiting	0.48 (0.44 - 0.52)	0.48 (0.44 - 0.52)
Pain management	0.47 (0.43 - 0.51)	0.84 (0.77 - 0.93)
Other	0.57 (0.55 - 0.59)	0.64 (0.62 - 0.67)
IMD Decile		
1 - Most deprived	1.02 (0.98 - 1.07)	1.01 (0.96 - 1.06)
2	1.02 (0.97 - 1.07)	1.01 (0.96 - 1.06)
3	1.00 (0.95 - 1.06)	0.98 (0.92 - 1.03)
4	1.00 (0.94 - 1.05)	0.95 (0.90 - 1.01)
5	1.01 (0.95 - 1.07)	1.01 (0.95 - 1.07)
6	ref	ref
7	0.97 (0.91 - 1.03)	0.99 (0.93 - 1.05)
8	0.96 (0.91 - 1.02)	0.99 (0.93 - 1.06)
9	1.00 (0.94 - 1.06)	1.02 (0.95 - 1.09)
10 -Least deprived	1.00 (0.92 - 1.07)	1.05 (0.97 - 1.14)
Age group		
0-1 (Infancy - under 24 months)	0.85 (0.81 - 0.89)	0.92 (0.87 - 0.96)
2-4 (young child)	0.79 (0.75 - 0.84)	0.82 (0.77 - 0.86)
5 - 15 (child)	0.72 (0.68 - 0.75)	0.79 (0.75 - 0.83)
16-24 (young adult)	0.87 (0.83 - 0.91)	0.80 (0.76 - 0.84)
25 - 34	0.93 (0.89 - 0.97)	0.87 (0.83 - 0.91)
35 - 44	0.95 (0.90 - 0.99)	0.94 (0.89 - 0.99)
45-54	ref	ref

55 - 64	1.04 (0.99 - 1.10)	1.04 (0.99 - 1.10)
65 - 74	1.01 (0.96 - 1.07)	1.16 (1.09 - 1.22)
75 - 84	1.01 (0.96 - 1.07)	1.34 (1.27 - 1.42)
85 and over	0.96 (0.91 - 1.02)	1.50 (1.42 - 1.60)
Service		
Service 1	1.08 (0.86 - 1.37)	0.67 (0.50 - 0.90)
Service 2	0.69 (0.49 - 0.98)	0.39 (0.25 - 0.59)
Service 3	ref	ref
Day of week		
Sunday	1.09 (1.04 - 1.13)	1.24 (1.19 - 1.30)
Monday	0.99 (0.94 - 1.04)	0.91 (0.86 - 0.95)
Tuesday	0.97 (0.92 - 1.02)	0.86 (0.81 - 0.90)
Wednesday	ref	ref
Thursday	0.95 (0.91 - 1.00)	0.91 (0.86 - 0.95)
Friday	0.92 (0.87 - 0.96)	0.99 (0.94 - 1.04)
Saturday	0.99 (0.95 - 1.03)	1.37 (1.31 - 1.43)
Call time period		
24:00 - 06:00	0.95 (0.90 - 1.00)	0.69 (0.66 - 0.73)
06:00 - 12:00	0.94 (0.91 - 0.97)	0.82 (0.79 - 0.84)
12:00 - 18:00	ref	ref
18:00- 24:00	1.11 (1.08 - 1.15)	1.01 (0.97 - 1.04)
Clinician conducting triage†	25.57	54.92

† Odds ratio covering 95% mid-range of call handlers (6)

***p<0.001 for all (based on joint tests of categorical variables) except IMD where p=0.2764 and service provider: 0.0399**

****p<0.001 for all (based on joint tests of categorical variables) except IMD where p=0.129**

3.5.6.2 Associations with urgent triage outcomes being selected by the clinician.

Results from the adjusted mixed effects logistic regression (Table 21) showed that male patients had 6% lower odds of the clinician selecting an urgent triage outcome (OR:0.93 CI:0.91 - 0.96) compared to female patients; this was less pronounced as compared to the odds of digitally recommended urgent outcomes for males, suggesting manual adjustment by the clinician (more call upgrading in male patients). The odds of a clinician selecting an urgent triage outcome increased with increasing age of the patient; this was more pronounced compared to the model investigating digitally recommended urgent triage outcome.

The symptoms with highest odds of an urgent triage outcome being selected related to urinary symptoms OR:1.42 (CI:1.31 - 1.54), chest pain OR:1.23 (CI:1.14 - 1.33) and breathlessness OR:1.45 (CI: 1.34 - 1.57) , reference: abdominal pain, as presented in Table 21. Additionally, calls about urinary symptoms had higher odds of an urgent triage outcome being selected by the clinician, as compared to the digital recommendation (clinician selected OR: 1.42 (CI:1.31 - 1.54) vs digitally recommended urgency OR: 1.04 (CI:0.97 - 1.12); reference: abdominal symptoms). There was no evidence of association between level of deprivation and the odds of an urgent outcome being selected.

As compared to odds of urgent digitally recommended outcomes in model 1, there was much greater odds of urgent clinician selected outcomes on a Saturday (Model 2 OR:1.37, CI:1.31 - 1.43 vs Model 1 OR 0.99 CI:0.95 - 1.03; reference: Wednesday, p<0.001).

There was variation by service provider in clinicians’ selection of urgent outcomes (in contrast to no significant variation in digitally recommended triage outcomes between service providers). Most substantially, there was very large variation between clincians in their selection of urgent triage outcomes, with an odds ratio comparing the 95% mid-range of clinicians being 54.9; this variation was higher than in the digitally recommended triage outcome model, in which the OR comparing mid-range of clinicians was 25.17 (Table 21).

3.5.6.3 Clinicians' upgrading and downgrading of digitally recommended triage outcomes in secondary triage.

Most calls, 65.5%, (n= 116,054) were unchanged (neither upgraded nor downgraded by the call taker) from the digitally recommended triage outcome, whilst 27.3% (n=48,397) were upgraded and 7.3% (n=12,874) were downgraded. The degree of upgrade and downgrade can be seen visually in the sankey diagram above (Figure 7).

Factors associated with upgrading of digitally recommended secondary triage outcome urgency.

Results from the adjusted regression models exploring call upgrading and downgrading from the digitally recommended urgency are shown in Table 22. The results show that calls about male patients had 4% higher odds of being upgraded compared to calls about female patients (OR: 1.04, CI: 1.04 - 1.10). The top three symptoms with highest odds of upgrade were: sore throat (OR 2.75, CI:2.54 - 2.97), earache (OR 1.96, CI:1.82 - 2.12), and dizziness (OR 1.86, CI:1.69 - 2.04); Whilst symptoms with highest odds of downgrade were: diarrhoea (OR: 1.50, CI: 1.33 - 1.70) and backpain (OR: 1.15, CI:1.03 - 1.29); reference group of abdominal pain, p < 0.001 for all.

The odds of upgrade increased with increasing patient age, with calls about the youngest age group having lowest odds of upgrade OR: 0.78, CI: 0.73 - 0.83); whilst calls about adults aged over 85 had highest odds of upgrade (OR:1.62, CI:1.53 - 1.72). The opposite pattern was evident in downgraded calls, with the oldest age group having lowest odds of downgrade; reference group: 45 – 54-year-olds, p <0.001 for all.

There was no association between deprivation level and odds of upgrade or downgrade of digitally recommended triage outcome urgency.

Calls had highest odds of upgrade during the weekend days, for example calls made on Saturdays (OR:1.30, CI:1.24 - 1.37), reference group: Wednesday; p<0.001. Shorter calls had highest odds of upgrade, whilst longer calls had greater odds of downgrade, for example calls over 20 minutes long had greatest odds of downgrade (CI:2.02, OR:1.91 - 2.15, p<0.001; reference: 10-15 minutes). There was no association between the number of calls triaged by clinician and the odds of upgrade or downgrade.

However, there was variation between clinicians based in the different participating sites, for example there were much lower odds of upgrade and higher odds of downgrade by clinicians based in service 1, respectively: OR:0.56 (CI: 0.43 - 0.74) and OR 1.81 (CI:1.31 - 2.51); reference: service 3, p<0.001. Most substantially, there was a very large variation between individual clinicians in their upgrading and downgrading of digitally recommended triage outcomes, with an odds ratio comparing the 95% mid-range of clinicians being 36.3 and 64 respectively. See Table 22 below for full results.

Table 22 Clinicians' upgrading and downgrading of digitally recommended triage outcomes

	Upgrading calls **OR (95% CI)***	**Downgrading calls** **OR (95% CI)****
Sex		
Male	1.04 (1.02 - 1.07)	0.95 (0.91 - 0.99)
Female	ref	ref
Top 20 symptoms		
Abdominal pain	ref	ref
Back pain	1.27 (1.18 - 1.38)	1.15 (1.03 - 1.29)
Breathlessness	0.99 (0.91 - 1.08)	1.11 (0.99 - 1.25)
Chest Pain	1.13 (1.04 - 1.23)	1.12 (0.99 - 1.26)
Cold/Flu	1.05 (0.95 - 1.15)	0.90 (0.77 - 1.05)
Cough	1.64 (1.54 - 1.74)	0.75 (0.68 - 0.83)
Diarrhoea	0.74 (0.67 - 0.81)	1.50 (1.33 - 1.70)

Dizziness	1.86 (1.69 - 2.04)	0.46 (0.38 - 0.56)
Earache	1.96 (1.82 - 2.12)	0.44 (0.37 - 0.52)
Headache	1.48 (1.34 - 1.63)	0.71 (0.60 - 0.83)
High Temperature	1.00 (0.93 - 1.08)	0.83 (0.75 - 0.93)
Itching	1.92 (1.72 - 2.13)	0.75 (0.61 - 0.93)
Medication query	5.85 (5.28 - 6.47)	0.25 (0.17 - 0.37)
Rash	1.32 (1.23 - 1.43)	0.73 (0.61 - 0.86)
Sore Throat	2.75 (2.54 - 2.97)	0.91 (0.82 - 1.03)
Unwell	1.35 (1.23 - 1.48)	0.47 (0.40 - 0.56)
Urinary Symptoms	1.06 (0.97 - 1.15)	0.89 (0.77 - 1.04)
Vomiting	1.07 (0.97 - 1.17)	0.44 (0.37 - 0.53)
Pain management	1.74 (1.60 - 1.90)	0.97 (0.86 - 1.11)
Other	1.26 (1.21 - 1.33)	0.92 (0.86 - 0.99)
IMD Decile		
1 – Most Deprived	0.97 (0.92 - 1.03)	1.01 (0.92 - 1.10)
2	0.97 (0.92 - 1.03)	0.99 (0.91 - 1.09)
3	0.98 (0.92 - 1.03)	1.01 (0.92 - 1.11)
4	0.95 (0.89 - 1.01)	1.03 (0.92 - 1.14)
5	1.00 (0.93 - 1.06)	0.96 (0.86 - 1.07)
6	ref	ref
7	0.99 (0.93 - 1.06)	0.95 (0.85 - 1.07)
8	1.02 (0.96 - 1.10)	0.92 (0.82 - 1.03)
9	0.99 (0.92 - 1.06)	0.93 (0.82 - 1.05)
10 – Least Deprived	1.06 (0.97 - 1.15)	0.94 (0.82 - 1.08)
Service		

Service 1	0.56 (0.43 - 0.74)	1.81 (1.31 - 2.51)
Service 2	0.61 (0.40 - 0.92)	1.63 (0.98 - 2.70)
Service 3	ref	ref
Age group		
0-1 (under 24 months)	1.00 (0.94 - 1.06)	0.99 (0.90 - 1.08)
2-4 (young child)	1.00 (0.94 - 1.06)	0.98 (0.89 - 1.09)
5 - 15 (child)	1.06 (1.00 - 1.12)	0.78 (0.70 - 0.86)
16-24 (young adult)	0.86 (0.82 - 0.91)	1.11 (1.02 - 1.21)
25 - 34	0.90 (0.86 - 0.95)	1.04 (0.96 - 1.13)
35 - 44	1.00 (0.95 - 1.05)	1.07 (0.98 - 1.17)
45-54	ref	ref
55 - 64	1.06 (1.00 - 1.12)	0.98 (0.89 - 1.08)
65 - 74	1.25 (1.18 - 1.32)	0.94 (0.86 - 1.04)
75 - 84	1.42 (1.34 - 1.50)	0.88 (0.80 - 0.96)
85 and over	1.62 (1.53 - 1.72)	0.87 (0.78 - 0.96)
Day of week		
Sunday	1.13 (1.08 - 1.19)	0.82 (0.76 - 0.89)
Monday	0.90 (0.85 - 0.95)	0.98 (0.90 - 1.08)
Tuesday	0.86 (0.81 - 0.91)	1.02 (0.93 - 1.12)
Wednesday	ref	ref
Thursday	0.95 (0.90 - 1.01)	1.06 (0.97 - 1.17)
Friday	1.00 (0.94 - 1.06)	0.95 (0.86 - 1.04)
Saturday	1.30 (1.24 - 1.37)	0.79 (0.73 - 0.85)
Call time-period		
24:00 - 06:00	0.75 (0.70 - 0.79)	1.02 (0.92 - 1.13)

06:00 - 12:00	0.89 (0.86 - 0.92)	1.16 (1.10 - 1.23)
12:00 - 18:00	ref	ref
18:00- 24:00	0.96 (0.93 - 1.00)	0.96 (0.91 - 1.02)
Call duration		
0-5 minutes	1.26 (1.20 - 1.32)	0.26 (0.22 - 0.29)
5-10 minutes	1.16 (1.13 - 1.20)	0.63 (0.59 - 0.66)
10-15 minutes	ref	ref
15-20 minutes	0.84 (0.81 - 0.87)	1.44 (1.36 - 1.52)
Over 20 minutes	0.74 (0.71 - 0.77)	2.02 (1.91 - 2.15)
Number of calls triaged by clinician		
Under 200	0.80 (0.55 - 1.18)	0.79 (0.49 - 1.27)
200-1000	1.18 (0.82 - 1.71)	0.77 (0.49 - 1.19)
1000 - 1800	ref	ref
1800- 2500	1.28 (0.73 - 2.23)	0.89 (0.49 - 1.62)
2500+	0.79 (0.44 - 1.40)	1.03 (0.54 - 1.96)
Clinician conducting triage†	36.63	64.04

*p<0.001 for all (based on joint tests of categorical variables) except IMD where p=0.1683 and number of calls triaged by clinician where p=0.070

** p<0.001 for all (based on joint tests of categorical variables) except sex where 0=0.014, IMD where p=0.358, service where p=0.001 and number of calls triaged by clinician where p=0.716

†Odds ratio covering 95% mid-range of call handlers **(109)**

3.5.6.4 Patterns of primary triage outcomes

The majority, 71% (n=70,428) of calls had a preliminary urgency level of immediate care within 1 or 2 hours assigned by the non-clinical operator prior to being transferred to the urgent care provider for secondary triage. The primary triage outcome urgency levels assigned are shown in Table 23.

Table 23 primary triage urgency levels, as mapped to the 7 urgency levels.

Primary triage outcome assigned by non-clinician led service	**Percentage of calls**	**N calls**
Emergency*	0.0	0
Immediate within 1 hour	36.9	36,485
Immediate within 2 hours	34.3	33,943
Urgent within 6 hours	16.0	15,822
Same day within 24 hours	11.4	11,296
Routine care	0.4	358
Self-care or no urgency	1.1	1,042

Total	100.0	98,946

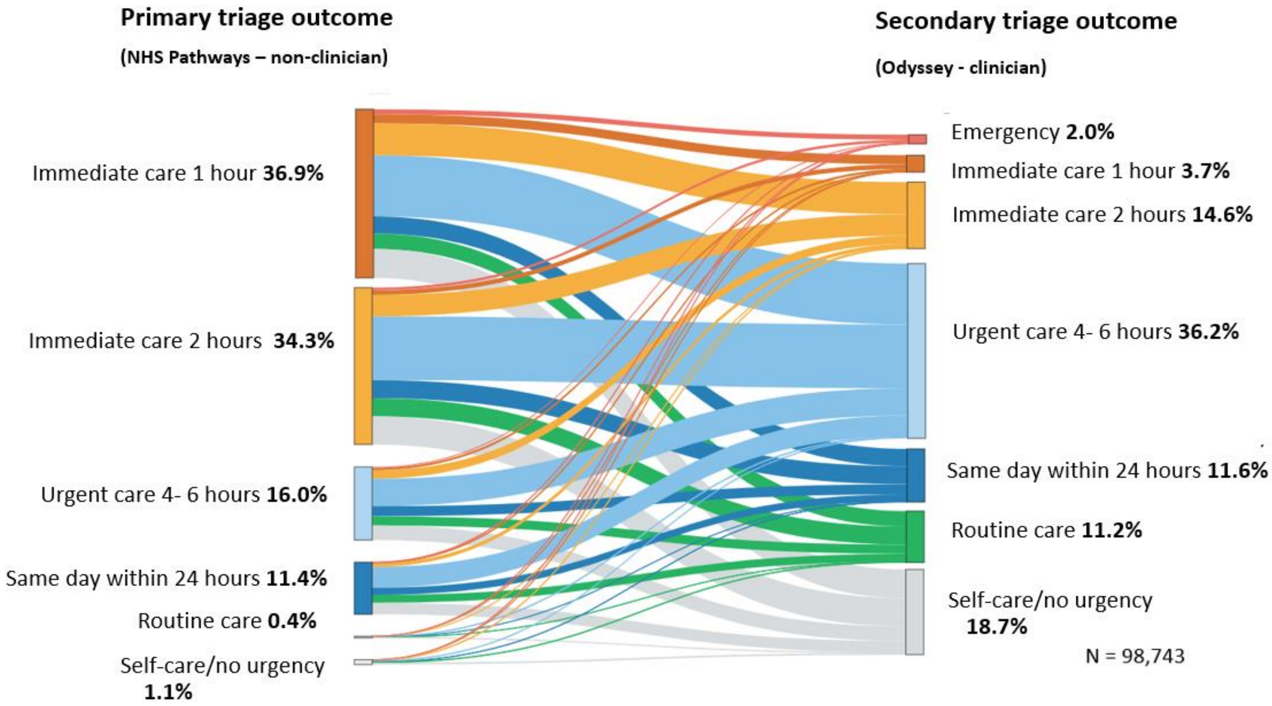
*No calls categorised as emergency are sent for secondary triage, as these would have been transferred directly to the emergency service.

The majority of calls: 73.6% (n=72,845), were downgraded by the clinician from the primary triage outcome urgency by the clinician conducting secondary triage, 11.7% (n= 11,596) were upgraded in urgency and 14.7% (n = 14514) stayed the same urgency level, being neither downgraded nor upgraded.

The Sankey diagram (Figure 8) shows a visual presentation of change in triage outcomes between primary non-clinician led triage by NHS 111 and secondary clinician led triage. The left-hand side indicates the preliminary urgency level assigned in primary triage and the right-hand side indicates final urgency level selected by the clinician.

This visualisation shows the degree of change in upgrading and downgrading of urgency levels, sometimes by several urgency levels. For example, the top two grey bands indicate calls that are downgraded by several levels of urgency to self-care/no urgency from a primary triage urgency level of immediate care within 1 hour or 2 hours.

Figure 8 Sankey diagram to show change in triage outcomes between non-clinician led primary triage (through NHS111 telephone service) and secondary clinician led triage



3.5.6.5 Associations with call upgrading and downgrading from the primary triage urgency level.

Symptoms with highest odds of upgrade from the primary triage urgency level were chest pain (OR: 2.69, CI:2.37 - 3.05), breathlessness (OR: 1.61, CI:1.41 - 1.84), and urinary symptoms (OR: 1.44,CI:1.26 - 1.65); reference group: abdominal pain, p <0.001 for all, as shown in Table 24. However, these represented a relatively small proportion (4.7%, 3.5% and 3.4% respectively) of all calls that were upgraded from the primary triage outcome urgency (Table 25).

Symptoms with highest odds of downgrade were earache (OR 2.15,CI:1.90 - 2.42), and dizziness (OR: 1.49 CI:1.22 – 1.81); reference group: abdominal pain, p <0.001 for all. Again, these represented a relatively small proportion of calls (3.0% and 1.9% respectively) of all calls that were downgraded from the primary triage outcome urgency (Table 26).

When investigating the proportions of calls upgraded and downgraded from the primary triage outcome urgency by presenting symptom, the largest proportion of upgraded and downgraded calls was for calls in the ‘other’ category (which represent calls made about symptoms that were not within the top 20 presenting symptoms undergoing secondary triage), the list of symptoms in the other category, and the numbers of these calls in the dataset is included in Appendix 5.

Highest odds of downgrade were in the young children (2-4 years) age group OR: 1.35,CI:1.25 - 1.46, and in young adults OR: 1.21, CI:1.13 - 1.30; reference age group: 45 – 54-year-olds, p <0.001 for all.

There was variation in the odds of both upgrade and downgrade associated with the participating service; calls triaged at service 3 had greater odds of upgrading and lower odds of downgrading compared to the other two participating services.

Calls had greatest odds of upgrade on Saturdays OR:1.39, CI:1.27 - 1.52, and lower odds of upgrade in the early morning. Shorter calls had greater odds of being upgraded OR:1.30, CI:1.19 - 1.42, p <0.001 for all.

There was no evidence of association in odds of upgrade or downgrade related to patient sex, level of deprivation or the number of calls triaged by clinicians within the dataset.

Most substantially, there was variation between clinicians in their upgrading and downgrading of calls, with an odds ratio comparing the 95% mid-range of clinicians being 5.15 and 4.71 respectively.

Table 24 Results from adjusted mixed effects logistic regression exploring clinicians' upgrading and downgrading of primary triage outcome urgency.

	Upgraded from primary triage **OR (95% CI)***	**Downgraded from primary triage** **OR (95% CI)****
Sex		
Male	0.96 (0.92 - 1.00)	1.02 (0.99 - 1.06)
Female	Ref	ref
Top 20 symptoms		
Abdominal pain	Ref	ref
Back pain	1.30 (1.13 - 1.49)	0.94 (0.85 - 1.04)

Breathlessness	1.61 (1.41 - 1.84)	0.80 (0.72 - 0.88)
Chest Pain	2.69 (2.37 - 3.05)	0.67 (0.61 - 0.74)
Cold/Flu	0.79 (0.66 - 0.96)	1.65 (1.44 - 1.89)
Cough	1.01 (0.90 - 1.13)	1.26 (1.17 - 1.37)
Diarrhoea	0.93 (0.79 - 1.09)	1.33 (1.19 - 1.48)
Dizziness	0.61 (0.50 - 0.76)	1.93 (1.68 - 2.22)
Earache	0.67 (0.57 - 0.79)	2.15 (1.90 - 2.42)
Headache	1.36 (1.15 - 1.61)	0.98 (0.86 - 1.10)
High Temperature	0.95 (0.84 - 1.08)	1.19 (1.10 - 1.30)
Itching	1.05 (0.84 - 1.32)	1.30 (1.10 - 1.55)
Medication query	2.33 (1.96 - 2.78)	0.54 (0.47 - 0.63)
Rash	0.88 (0.78 - 1.00)	1.21 (1.12 - 1.32)
Sore Throat	0.97 (0.83 - 1.14)	1.31 (1.17 - 1.46)
Unwell	1.35 (1.14 - 1.59)	1.02 (0.90 - 1.15)
Urinary Symptoms	1.44 (1.26 - 1.65)	1.07 (0.97 - 1.19)
Vomiting	0.90 (0.77 - 1.04)	1.51 (1.36 - 1.68)
Pain management	1.18 (0.99 - 1.41)	1.08 (0.94 - 1.23)
Other	1.28 (1.18 - 1.39)	0.98 (0.93 - 1.04)
IMD Decile		
1 – Most Deprived	0.92 (0.84 - 1.00)	1.05 (0.98 - 1.12)
2	0.90 (0.82 - 0.99)	1.08 (1.00 - 1.15)
3	0.90 (0.82 - 1.00)	1.05 (0.97 - 1.13)

4	0.96 (0.87 - 1.07)	1.00 (0.93 - 1.09)
5	0.93 (0.83 - 1.04)	1.01 (0.93 - 1.10)
6	Ref	ref
7	1.00 (0.89 - 1.12)	1.00 (0.91 - 1.09)
8	0.89 (0.79 - 0.99)	1.03 (0.94 - 1.12)
9	0.97 (0.86 - 1.10)	0.99 (0.90 - 1.08)
10 – Least Deprived	0.96 (0.84 - 1.11)	1.02 (0.92 - 1.13)
Service		
Service 1	0.64 (0.55 - 0.74)	1.31 (1.15 - 1.49)
Service 2	0.64 (0.50 - 0.83)	1.57 (1.26 - 1.94)
Service 3	ref	ref
Age group		
0-1 (under 24 months)	0.94 (0.86 - 1.04)	1.11 (1.04 - 1.19)
2-4 (young child)	0.75 (0.68 - 0.84)	1.35 (1.25 - 1.46)
5 - 15 (child)	0.81 (0.74 - 0.90)	1.12 (1.04 - 1.21)
16-24 (young adult)	0.80 (0.72 - 0.88)	1.21 (1.13 - 1.30)
25 - 34	0.93 (0.85 - 1.01)	1.07 (1.00 - 1.14)
35 - 44	0.92 (0.84 - 1.02)	1.08 (1.00 - 1.16)
45-54	Ref	ref
55 - 64	0.99 (0.90 - 1.10)	1.00 (0.92 - 1.07)
65 - 74	0.92 (0.83 - 1.02)	1.01 (0.93 - 1.09)
75 - 84	0.84 (0.76 - 0.94)	1.02 (0.95 - 1.10)
85 and over	0.81 (0.73 - 0.91)	1.02 (0.94 - 1.11)

Day of week		
Sunday	1.22 (1.12 - 1.34)	0.85 (0.80 - 0.91)
Monday	1.13 (1.02 - 1.25)	0.91 (0.85 - 0.98)
Tuesday	1.13 (1.01 - 1.25)	0.88 (0.82 - 0.95)
Wednesday	Ref	ref
Thursday	1.03 (0.92 - 1.15)	0.95 (0.88 - 1.02)
Friday	1.18 (1.06 - 1.31)	0.96 (0.89 - 1.03)
Saturday	1.39 (1.27 - 1.52)	0.81 (0.76 - 0.87)
Call time-period		
24:00 - 06:00	0.89 (0.81 - 0.98)	1.05 (0.98 - 1.13)
06:00 - 12:00	1.04 (0.97 - 1.11)	0.97 (0.93 - 1.02)
12:00 - 18:00	Ref	ref
18:00- 24:00	1.01 (0.95 - 1.07)	0.92 (0.88 - 0.96)
Call duration	0.89 (0.81 - 0.98)	
0-5 minutes	1.30 (1.19 - 1.42)	0.80 (0.75 - 0.86)
5-10 minutes	1.14 (1.08 - 1.21)	0.89 (0.86 - 0.93)
10-15 minutes	Ref	ref
15-20 minutes	1.00 (0.94 - 1.07)	0.99 (0.94 - 1.03)
Over 20 minutes	1.08 (1.01 - 1.16)	0.89 (0.85 - 0.94)
Number of calls triaged by clinician		
Under 200	1.07 (0.85 - 1.35)	0.89 (0.73 - 1.09)
200-1000	1.03 (0.85 - 1.25)	0.95 (0.80 - 1.13)
1000 - 1800	Ref	ref
1800- 2500	0.90 (0.70 - 1.16)	1.11 (0.89 - 1.40)

2500+	0.73 (0.55 - 0.96)	1.42 (1.11 - 1.81)
Clinician conducting triage†	5.15	4.71

*p<0.001 for all (based on joint tests of categorical variables) except: Sex where p=0.0636, IMD where p=0.208, call time-period where p=0.0119 and number of calls triaged by clinician where p= 0.0678.

** p<0.001 for all (based on joint tests of categorical variables) except sex where p=0.1366, IMD where p=0.2224, and number of calls triaged by clinician where p=0.0035

†Odds ratio covering 95% mid-range of call handlers **(109)**

Table 25 Proportions of calls upgraded from primary triage outcome urgency by symptom.

Top 20 symptoms	Number of calls	Percent	Odds of upgrade - OR(CI)
Other	5,067	43.7	1.28 (1.18 - 1.39)
Abdominal Pain	827	7.1	ref
Cough	748	6.5	1.01 (0.90 - 1.13)
High Temperature	554	4.8	0.95 (0.84 - 1.08)
Chest Pain	545	4.7	2.69 (2.37 - 3.05)
Rash	486	4.2	0.88 (0.78 - 1.00)
Breathlessness	406	3.5	1.61 (1.41 - 1.84)
Urinary Symptoms	388	3.4	1.44 (1.26 - 1.65)
Back pain	377	3.3	1.30 (1.13 - 1.49)
Vomiting	252	2.2	0.90 (0.77 - 1.04)
Sore Throat	243	2.1	0.97 (0.83 - 1.14)
Diarrhoea	236	2.0	0.93 (0.79 - 1.09)
Pain management	236	2.0	1.18 (0.99 - 1.41)
Medication query	233	2.0	2.33 (1.96 - 2.78)
Unwell	218	1.9	1.35 (1.14 - 1.59)
Headache	216	1.9	1.36 (1.15 - 1.61)
Earache	195	1.7	0.67 (0.57 - 0.79)
Cold/Flu	152	1.3	0.79 (0.66 - 0.96)
Dizziness	114	1.0	0.61 (0.50 - 0.76)
Itching	103	0.9	1.05 (0.84 - 1.32)
Total	**11,596**	**100**	

Table 26 Proportions of calls downgraded from primary triage outcome urgency by symptom.

Top 20 symptoms	Number of calls	Percent	Odds of downgrade OR (95% CI)
Other	28,219	38.74	0.98 (0.93 - 1.04)
Cough	5,783	7.94	1.26 (1.17 - 1.37)
Abdominal Pain	5,770	7.92	ref
High Temperature	4,955	6.8	1.19 (1.10 - 1.30)
Rash	4,315	5.92	1.21 (1.12 - 1.32)
Vomiting	2,651	3.64	1.51 (1.36 - 1.68)
Earache	2,238	3.07	2.15 (1.90 - 2.42)
Urinary Symptoms	2,077	2.85	1.07 (0.97 - 1.19)
Sore Throat	2,047	2.81	1.31 (1.17 - 1.46)
Back pain	2,008	2.76	0.94 (0.85 - 1.04)
Diarrhoea	1,909	2.62	1.33 (1.19 - 1.48)
Breathlessness	1,889	2.59	0.80 (0.72 - 0.88)
Chest Pain	1,546	2.12	0.67 (0.61 - 0.74)
Dizziness	1,411	1.94	1.93 (1.68 - 2.22)
Cold/Flu	1,364	1.87	1.65 (1.44 - 1.89)
Unwell	1,287	1.77	1.02 (0.90 - 1.15)
Headache	1,196	1.64	0.98 (0.86 - 1.10)
Pain management	971	1.33	1.08 (0.94 - 1.23)
Itching	648	0.89	1.30 (1.10 - 1.55)
Medication query	552	0.76	0.54 (0.47 - 0.63)
Total	72,836	100	

3.6 Discussion

This study investigated several associations between key factors relating to the patient, call, service, and the individual clinician conducting triage with level of triage outcome urgency and clincians’ overriding (upgrading and downgrading) of triage outcomes. The key findings, strengths and weaknesses, comparisons to existing literature and implications for service delivery and future research are considered in this section.

3.6.1 Key findings

3.6.1.1 Service utilisation

This study identified patient groups with the highest secondary triage call rates; rates were highest in the youngest (under 24 months) and oldest age groups (over 85 years). Rates were higher in female compared to male patients and were highest in patients living in the most deprived groups.

After the start of Covid-19 the overall call rate decreased by 8%, At the same time, call lengths increased. Increased call lengths are likely due to Covid-19 related changes, including the introduction of screening questions to identify patients who may have Covid-19 at the beginning of the call. These changes are likely a result of how care was delivered in the early stages of the pandemic, which is discussed in more detail in the strengths and weaknesses section of this chapter.

3.6.1.2 Associations with urgent outcomes in secondary triage: digitally recommended and clinician selected triage outcomes

This study highlighted a range of patient, call, and service-level factors associated with 1) clinicians' selection of urgent triage outcomes and with 2) clinicians' overriding of digitally recommended outcome. In both of these, a key finding was substantial variation associated with the individual clinician conducting triage. This suggests that the triage outcome and therefore the care advice given to patients in secondary triage varies based on the individual clinician the patient or carer speaks to. The variation in digitally recommended urgent outcomes (OR:25.57), despite the use of the same digital triage tool, suggests that clinicians may use digital triage in different ways: they may be extracting and interpreting symptom information from patients differently and therefore completing the triage questions differently; some clinicians have much greater odds of generating digitally recommended urgent outcomes than others.

When considering the triage outcome finally selected by the clinician, there is greater variation between clincians (OR:54.92), as compared to the digitally recommended triage outcomes, which is likely to be a result of clinicians using their judgement to accept or change the recommended outcome. This is also reflected in the large variation between clinicians in their call upgrading (OR:36.63) and downgrading (OR:64.04). The results suggest that some clinicians are more likely to upgrade and downgrade calls, whilst others follow the system more closely. Overall, these findings suggest a lack consistency in clinician triage, despite the use of a standard digital triage tool which implies the need for further investigation into why this occurs and a need for training to help improve the consistency of care.

Males were more likely to be upgraded, but females were still more likely to have an urgent outcome (care within 6 hours or less) selected in secondary triage. Calls about chest pain and breathlessness had greater odds of having an urgent outcome being selected. Additionally, certain symptoms had greater odds of upgrade(dizziness, earache) and downgrade(diarrhoea) from the digitally recommended triage outcome, the greater likelihood of upgrade suggests that there may be some under-triage in the digital triage tool for these symptom types and there may be a need to adjust the digital triage content (triage questions, answers and subsequent triage outcomes) for these symptoms.

There were greater odds of both selection of urgent outcomes and upgrading of digitally recommended triage outcomes associated with the time and day of the call. There were greater odds of both the selection of urgent outcomes and call upgrading in calls on Saturdays. This may be due to general practices being typically closed on weekends; therefore, patients may be more likely to be seen within the urgent care service (for example within 6 hours) as they cannot easily see a GP until the Monday. There were lower odds of both selection of urgent outcomes and call upgrading in the early morning period (midnight to 06:00); this may be due to less availability of medical personnel within the out of hours service for patients to be seen or spoken to within the 6-hour timeframe at this time of day. This demonstrates that service availability potentially impacts on and partially explains the variation in clinical decision making and the subsequent triage outcomes selected for patient.

Finally, there was variation in the selection of urgent outcomes, upgrading and downgrading associated with the participating provider service (at which of participating services the call was triaged). The suggests that there are differences in how clinicians use digital triage to guide decision making between the three service providers, which may impact on how likely they are to upgrade and downgrade the digital recommendation). This may be impacted by how the services operate, for example some services may promote a more risk averse attitude to triage.

3.6.1.3 Clinicians' upgrading and downgrading of primary triage outcomes.

The study highlighted that whilst a large proportion of calls 73.6% (n=72,845) were downgraded from the urgency level assigned in primary triage, 11.7% (n= 11,596) were upgraded. Calls with greatest odds of upgrade, related to chest pain and breathlessness, this highlights potential call types where clinical risk is underestimated within primary triage. This may be related to how non-clincians triage these calls, including their use of the pathways tool and the content of the question sets within the pathways digital triage tool. However, this should be considered in the context that these calls about chest pain and breathlessness make up a small proportion of the overall calls that are upgraded from the primary triage outcome urgency. This warrants further investigation into why urgency may be underestimated in certain calls.

3.6.2 Strengths and weaknesses of this study

This research is the first to explore the use of clinician led secondary triage in the context of England's' two step triage model. No previous studies have compared triage outcome urgency levels between primary and secondary triage. It also the first to report on clinicians' variation in their selection of urgent outcomes, and in call upgrading and downgrading, even when a standard digital triage tool is used. The sections below highlight the key strengths and weaknesses of the methodological approach.

3.6.2.1 The use of routine data

A key strength is the use of an exploratory approach to analyse several associations within the patterns of triage outcomes including clincians' overriding of digital recommendations and of primary triage outcomes. The use of routine data also enabled inclusion of typically underserved groups within research including patients living in the most deprived areas. The routine data used in this study covered a wide geographical area with diverse demographics.

However, there was some missing data within the dataset. For example, it was not possible to include ethnicity in the analyses due to large amounts of missing data. Thus, it was not possible to investigate service use, or patterns of triage outcome urgency in relation to ethnicity, which may have led to overlooking important observations in these groups.

Another limitation was not having important data items within the dataset. Due to this limitation, proxys were used for certain variables, for example, clinician's familiarity with digital triage was based on the number of calls triaged per clinician within the dataset within the specific 18-month timeframe. Ideally the research would have considered more detailed information relating to clinician experience overall, such as: numbers of years of clinical experience, type of clinical professional (for example advanced nurse practitioner), experience of a past complaint and number of years of experience in conducting triage.

Another limitation of routine data is uncertain data accuracy(118). One routine data analysis study(27) used audio-recordings to quality check data, however this was not possible due to the large cohort size and the limited scope of the PhD project.

These limitations meant that understanding contextual information (via participating service providers, which was gathered during the planning and interpretation of findings stage) was key to undertaking the analyses and interpreting the findings. Key contextual was presented in the dataset description (Methods) section of this chapter.

Whilst several associations were identified in the study, it is not possible to fully explore reasons and explanations for these associations using routine data alone. Possible explanations for some associations are considered in the qualitative and mixed methods chapters of this thesis.

3.6.2.2 Insight into service use during Covid-19

Whilst investigating the impact of Covid-19 on patterns of service use and triage outcomes was not a primary aim of the study, the timing enabled change since the start of Covid-19 to be explored. The 8% lower call rate after the start of the pandemic can likely be explained by the alternative entry points to urgent care that were introduced in England's response to the pandemic; for example, the national 119 health line which was provided for Covid-19 concerns(25). Patients may also have avoided seeking care(119) so as not be a burden on the healthcare system, and to avoid exposure to Covid-19; this is considered in more detail in the qualitative and mixed methods chapters. The increased call duration may reflect Covid-19 screening questions introduced by urgent care providers at the beginning of triage and may also result from patients discussing concerns relating to Covid-19.

The Covid-19 pandemic may have contributed to the high level of variation between clincians in their selection of triage outcomes and call upgrading/downgrading, as early in the pandemic the protocols used to assess potential covid cases were unsophisticated. This may have led to increased variation in the assessment of patients until health services and healthcare professionals better understood the condition.

3.6.2.3 Degree of change in triage urgency level

Visual representation using Sankey diagrams showed the degree of change in triage urgency levels, both from the primary triage outcome and the digitally recommended secondary triage outcome as compared to the final clinician selected urgency. However, due to the scope of the PhD project the regression models used a simplified binary measure of upgrading and downgrading which does not reflect the degree of change in urgency level. Calls that are upgraded by several levels from the digitally recommended urgency (for example, from self-care to emergency care or care with 1 hour) may indicate areas where the clinical content (questions and answers) within the digital triage tool requires improvement and where clinician training may be necessary. Similarly calls that are upgraded by several levels from the primary triage, may indicate where further attention is required in the Pathways digital triage software and in how non-clinicians are trained for particular call types. Investigating the degree of change in further detail would be the next step for extending this research, as it would likely uncover patterns of upgrading and downgrading, thus providing further insight into improving safety and consistency of urgent care triage.

3.6.2.4 Lack of patient outcomes following triage

The study enabled comparisons between 1)digitally recommended triage outcomes and 2) primary triage outcome selected by non-clinicians as compared to the final urgency level selected by the clinician in secondary triage. These comparisons highlighted change in urgency levels through clinicians' upgrading and downgrading. For example, a large proportion of calls triaged as requiring care within 1 or 2 hours in primary triage were subsequently downgraded by clinicians, sometimes by several levels of urgency. This is an important finding, as it indicates the importance of clinician led secondary triage; the downgrading of calls will have implications on how wider primary and emergency care services are used by patients. However, it is not possible to conclude on which triage level assigned was 'correct' or most appropriate without further investigation of subsequent patient outcomes, for example their ED attendance. The use of linked outcomes data, such as ED attendance and hospitalisation is required to help understand accuracy of triage decisions. This was originally planned in the PhD, however due to delays in accessing data via NHS Digital this was not possible within the PhD timeframe. The intended protocol for the research needed to investigate patient outcomes is provided in the next chapter.

Qualitative research is also important to better understand patients' experiences and attitudes towards the appropriateness of primary and secondary triage outcomes. These are considered in the qualitative study chapter.

3.6.2.5 Evaluation of data from one digital triage system

A key strength is that primary triage was all undertaken using the NHS Pathways digital triage system that is widely used in England and the secondary triage was all undertaken by clinicians using the Odyssey digital triage system. This allowed for rigorous comparison between the two levels of triage by minimising the impact of differing types of digital triage systems. However, a limitation is that the study cannot account for whether the findings would apply to services using different digital triage systems or whether they would apply more generically to all triage systems. Research is needed to compare models of secondary triage, where differing digital triage systems are used, to understand the extent to which the digital triage software being used affects triage outcomes. In addition, comparisons between digitally supported secondary triage and secondary triage conducted without the use of digital triage should be undertaken to explore the impact that digital triage has on variation between clinicians in their selection of urgent triage outcomes and in call upgrading and downgrading.

3.6.3 Comparison to other literature

3.6.3.1 Variation by clinician in their use of digital triage

This study highlights substantial variation between clinicians in their selection of urgent triage outcomes in secondary triage as well as in their upgrading and downgrading of primary triage outcomes. This raises questions about the safety and consistency of care and the wider impact on urgent care workload. Previous studies have not specifically reported on variation in triage outcomes based on clinicians’ use of digital triage in urgent care, however, it has widely reported clinicians’ differing use of clinical decision support in broader healthcare settings(120, 121).

There are likely several factors that contribute into clinicians’ assignment of urgency despite the use of a standard digital triage tool. Variation and the range of factors that feed into clinicians’ referral decision making in primary care more broadly (without the use of digital triage) been investigated, in routine care(122) and out of hours care(123-125) settings. Findings from these studies may help explain the clinician variation found in this study, some key findings are discussed below.

A qualitative study explored general practitioners’ referral of patients to hospital in the out of hours setting. They reported that differences between “low”, “medium” and “high” referrers related to differing beliefs and attitudes of GPs in relation to several dimensions(124). These included the GP’s experience, confidence, their experience of a complaint, and their attitude to risk; the patient, including their symptom presentation, social circumstances and wishes of the patient and their family. Finally they identified service level factors, for example service availability and alternatives to hospital admission, and the time of the call(124). Whilst this study investigated a different type of clinician as compared to this PhD study (general practitioners rather than nurse practitioners) and it did not involve the use of digital triage, it offers some explanations of why there may be variation by nurses in the present study. The present study builds on their finding that service availability plays a role in clinician decision making: the present study found the odds of urgent triage outcomes were greater on Saturdays (when general practices are typically closed) and lower in the early morning periods (when there is likely to be less clinical cover), as well as variation between service providers. The latter may be impacted by service level factors for example, how integrated the service is with other local care providers.

One study reported substantial variation between clinicians’ referral rates to acute hospital care in the out of hours care setting(123), and that there were lower hospital referrals amongst primary care physicians who were attached to a local general practice(123). Another study in the out of hours setting reported that female GPs had higher referral rates than male GPs(125). Whilst this level of information about clinicians was not available for in the dataset used in this PhD study, factors identified in previous studies likely contribute to the variation seen between clinicians and service providers in this PhD study. For example, service providers may vary in how linked or knowledgeable staff are about local out of hours or general practices within the present study.

The present study did not identify an association between the number of calls triaged by clinicians within the dataset (a proxy for clinician's familiarity with the digital triage tool) and the urgency of triage outcome. Other studies have similarly reported no association between GPs' number of contacts and referral rate(123, 125). Further, the variation seen between clinicians may be due to differences in their how likely they are to escalate or de-escalate triage outcome urgency. Differing referral propensity has been described by a previous study that investigated referral to ED and inpatient care by out of hours GPs(123).

3.6.3.2 Change in urgency levels between primary and secondary triage.

Previous studies investigating digital triage urgency levels in the urgent care setting have focussed on a slightly different patient population: those undergoing direct clinician triage (27, 30, 126), whereas the patient population in this study has a lower likelihood of requiring emergency care, as such patients would have been referred to emergency care directly from the initial primary triage in most cases.

Previous research suggested non-clinician triage may increase workload for emergency and urgent care service providers(38, 127, 128). This study similarly found that primary triage is risk averse and therefore it may lead to an unnecessarily high proportion of calls being assessed as requiring urgent care. However, this study additionally raises an important safety finding that some potentially life-threatening calls may have clinical risk underestimated in primary non-clinician led triage. This builds on findings from a study of the NHS111 telephone service, which linked calls triaged by NHS111 with patients' subsequent ED attendance. They reported mis-triage by NHS-111 in some cases, where patients were given low urgency advice by the service, but were subsequently assessed as urgent in ED, a proportion of these patients were later admitted to hospital(40).

3.7 Chapter summary

This chapter has presented the quantitative study findings which included substantial variation between individual clinicians in their selection of triage outcomes even when using a standard digital triage software. Other factors associated with urgency level assigned in triage include time of call, day of week, the patients' symptoms, and the service conducting triage. Lastly this study showed that a large degree of change between primary and secondary urgency levels, including some potential areas where clinical risk may be underestimated by non-clinicians. This indicates the importance of clinician led triage in England's two step triage model.

4 Qualitative study methods

4.1 Chapter overview

This chapter describes the aims, methods and set up of the qualitative interview study. This study involved recruiting patients and carers from two UK based urgent care who utilise clinician led digital triage. The aim was to develop a deeper understanding of patient and carer experiences of these services.

4.2 Development of research question and methods

The research focus and question were developed based on the findings from the systematic review(62) which highlighted very limited in-depth studies of patient experience relating to telephone based digital triage, with many previous studies being survey based and reporting on patient satisfaction. The review highlighted studies reporting that satisfaction was related to urgency of triage recommendation, with patients being given lower urgency advice being less satisfied.

Although many of the studies identified in the systematic review(62) were conducted in England, none specifically focussed on England's two step triage model or made comparisons between differing triage models.

Additionally, the review highlighted the underrepresentation of certain groups in research investigating digital triage, including older age groups and different ethnicities.

To address these research gaps, this study aimed to use qualitative methods to explore the experiences of patients and carers, with a focus on the England's two-step triage model. The study aimed to include patients who received differing clinician-led triage outcome urgency levels, and those with low representation in research (older age groups and ethnic minority groups). Participants were recruited from service providers who used different triage delivery models ('two step triage' and 'direct clinician triage').

4.3 Aim and objectives.

4.3.1 Aim

To understand how patients and carers experience urgent care delivered through clinician led telephone based digital triage, and to make service delivery recommendations to improve the patient care journey.

4.3.2 Research question

What are patient and carers' experiences of urgent care delivered through clinician led telephone based digital triage?

4.3.3 Objectives

1. To explore patient and carers' experiences of urgent care delivered through clinician led telephone based digital triage, including two models of triage delivery (two-step triage vs. direct clinician triage)
2. To explore experiences of the overall patient/carer journey, prior to and following triage.

4.3.4 Justification for use of semi-structured interviews

Semi-structured interviews were selected as they allow in-depth experiences to be captured, as compared to focus groups(143), and because they are complementary to understanding patterns and findings identified in the quantitative study(143).

They were also selected as they were convenient in enabling participants located in different regions (across England and Northern Ireland) to participate. Based on the topic being explored (experiences of triage call and the callers' wider care journey) interviews were expected to have a duration of up to one hour, which would enable participants to discuss their experiences in detail through open ended questions.

4.4 Reflexivity

Time for reflexivity was built into all stages of this study. Reflexivity is an important element of qualitative research; it relates to the researcher making clear their relationship with research participants, to improve the trustworthiness and interpretation of findings by the reader(144). In qualitative research it has been said that “The researcher is the research instrument”(144). A brief reflexive summary of the PhD candidate is presented in box 2.

Box 2

Reflexivity: background of the PhD Candidate

I come from a deductive discipline, having originally studied Biomedical Sciences (BSc). I am first-time qualitative researcher, and new to the topic of digital triage and urgent care prior to the start of the PhD project. I am a British Indian female and have lived in England my whole life.

I have some experiences of using urgent care services (telephone triage via NHS 111, NHS 111 online and face-to-face out of hours care) for myself and have seen the experience of family members in their use. My own experiences of urgent care and those of my family members have been positive. These previous experiences helped to understand and interpret patients’ experiences within the system. However, I have no direct experience of hospital care that many patients discussed during the interviews.

Since the start of the PhD, I have developed an interest in the inclusion of minority and deprived groups in research, however it proved challenging to recruit these groups into the study.

4.5 Use of theory

Theory has been described as “a big idea that organizes many other ideas with a high degree of explanatory power” (145). A theoretical framework is the application of a theory (or theories) in a study that conveys the values of the researcher and provides a lens for how the study will process new knowledge(145). Theoretical frameworks can be used to guide the conduct of a qualitative study but may also be used to interpret findings of a study(145). The latter approach was selected for this study.

As the PhD candidate(VS) was new to qualitative research and the research topic, a predominantly exploratory, inductive approach was taken, without the use of a theoretical framework to guide the design and conduct of the study. The study was not fully inductive however, as it was informed by the systematic review findings. Additionally, VS’s interpretations were discussed with wider team members who have worked on a similar research topic in primary care research, adding deductive input.

The framework selected for interpretating findings was Oben’s conceptual framework of patient experience centred on the humanity of the unique individual patient, where their experience of healthcare services is multidimensional and multi-faceted and on a continuum from health to onset of ill health(146). In reference to the patient experience, Oben states that “it is informed by a complex combination of the patient’s personal life, as well as their own and their family’s experiences within the health-care system at all levels of care”. Oben describes that factors influencing the patient experience include those relating to the person prior to the onset of disease including their physical, psychological, and social dimensions, such as family and community support (146). This framework was selected as it provides a broad and holistic lens through which to evaluate patients’ experiences of triage. Several other theories were considered for use, and are described below, together with the reasons why they were unsuitable for use in this study.

Many studies exploring experiences of technology or digital triage within healthcare services have used Normalisation process theory or Actor Network theory, both are described in more detail below, however these are both more suitable for studies of implementation, and for evaluating the direct users of the digital technology. Therefore these were not suitable as this PhD study evaluates a largely established system, albeit with more recent changes, such as greater use of NHS 111 online which likely relates to the Covid-19 pandemic(24). Additionally, patients are not direct users of the digital triage technology considered in this research; rather the direct user is the clinician.

The actor network theory has been described as providing “a lens through which to view the role of technology in shaping social processes”(147). This approach seeks to explore relationships between different actors which may be human, or inanimate objects. Creswell et al., using the example of the implementation of integrated electronic health records into a health system, recommend the use of this theory in investigating technology implementations within healthcare(147). For this reason, is it not suitable for the present study. However, this theory could be helpful in considering how the system of care changes in response to new access routes e.g., increased use of NHS111 online self-triage resulting from the Covid-19 pandemic, and how this impacts the existing system and network of actors (actors being the patient, clinician, and digital triage tool). Whilst it was expected that the use of NHS 111 online may feature in the data collected, it was not the focus of interviews and therefore this framework was not selected for the study.

Normalisation Process Theory relates to ‘how and why things become, or don’t become, routine and normal components of everyday work’(148). It is appropriate for investigating implementation of technology within services or routine work for example online appointment booking by patients. Normalisation process theory has been used by studies investigating implementation of digital triage in its use by staff(149) (150). However, it is less suitable for investigating patient experiences of digitally supported healthcare services, particularly in urgent care, where typically most patients use these services on a more ‘ad-hoc’ basis.

Another theoretical model considered was Holden et al.’s ‘technology acceptance model’ which can be used to evaluate established technology in healthcare settings(151). However, this model lends itself to study the user who is directly using the technology, which in the present study is not the patient (but rather the call taker), for this reason this model was not selected.

4.6 Patient Public Involvement (PPI)

Patient and public involvement was conducted ahead of the protocol finalisation; this involved discussing the study aims, interview schedule questions and the elements of experience of triage that may be important to patients. This fed into the questions included in the schedule. PPI input was also sought for participant recruitment posters, with members of the PPI group providing suggestions on simplified wording.

4.7 Study setting

This study was based in the urgent care setting, where patients or carers called a telephone based urgent care provider and were digitally triaged. There were two study sites, one in England, one in Northern Ireland, which have different triage delivery models:

1. England based site, where a predominantly ‘Two-step’ triage model is used. At the England based site, most patients accessed clinician led triage via the NHS 111 telephone service, and a small number accessed it via NHS 111 online.
2. Northern Ireland based site, where ‘direct clinician triage’ is used; this is where patients typically call a local out of hours provider, leave their contact details with a receptionist and are called back by a clinician who conducts triage.

At both sites the clinicians conducting triage (typically nurses) use the Advanced ‘Odyssey’ digital triage tool, a full description of this software was provided in the introduction chapter (section 1.7).

4.8 Wider context and impact of covid-19 impact.

Data was collected for this study between July 2021 and February 2022. During this time the Covid-19 pandemic was ongoing, however generalised restrictions including the national ‘lockdown’ had been largely lifted. Prior to the study period, the public were encouraged to use online routes of care advice, rather than telephoning or seeking in person care. After the start of the Covid-19 pandemic, and during this study period, wider primary care had undergone an accelerated shift to remote delivery(24), during which face-to-face GP care was gradually reintroduced, however even by the end of the study recruitment (February 2022) it remained considerably below the pre-pandemic level(24). During this time there were extreme pressures on the NHS(152) and patient satisfaction with NHS care as measured in 2021 was reported to be very low(152, 153).

4.9 Site recruitment

The PhD candidate (VS) recruited sites to participate in the study with the support of supervisor Prof Jeremy Dale. A list of 12-UK based urgent care providers who operate within the NHS and utilise Odyssey for clinician led digital triage was provided by Advanced. These sites operated across England, Wales, and Northern Ireland; each site was contacted by the PhD candidate (VS), with an invitation to participate in the study. The initial invitation letter sent to potential sites is included in Appendix 6.

Prior to obtaining ethical approval, sites who had expressed an interest in participating were provided with a simplified protocol and asked for feedback and any foreseen challenges with the participant recruitment strategy (see **Error! Reference source not found.**). As a result of feedback from the sites, greater flexibility on methods of participant recruitment was incorporated into the study protocol, allowing for users to be contacted by phone, post, and text according to standard practices at the different service providers; more detail is provided in the ‘methods of inviting participants’ section below.

Of the four sites that had agreed to participate, two dropped out, due to pressures on the services relating to the Covid-19 pandemic and/or due to a change of staff. Despite this, the two recruited sites were deemed to be sufficient for the research question to be addressed, given that they used different triage models in their delivery of urgent care, as described in section 4.7 of this chapter. The involvement of these two sites would enable comparisons of patient experience between the ‘two-step’ and ‘direct clinician’ triage models to be investigated.

Ahead of starting recruitment at the two final participating sites, ethical approval was gained, and a site presentation was delivered to both sites by the PhD candidate to ensure that the participating sites were fully informed about the study and understood the sampling and recruitment strategy and wider protocol.

4.10 Participant sampling

The process of sampling is central to qualitative methods, consideration was given to four key stages of sampling(154): sample population, sample size, sampling strategy and sample sourcing, these are outlined below.

4.10.1 Sample population

The study population comprised of patients who had been digitally triaged by a clinician, or carers who had called on behalf of someone else who had been digitally triaged by a clinician using the Odyssey digital triage tool. The population included patients and carers aged over 18, including parents who had accessed care for their children. The full inclusion and exclusion criteria for participants are listed below in this chapter (section 4.11).

4.10.2 Sample size

The study aimed to recruit 25-30 participants, which was based on a previous study of barriers and facilitators in users and non-users of the NHS 24 service in Scotland, and was expected to ensure data saturation(28) where further interviewing does not yield any more findings and “no new information about the focus of the research is revealed”(155). During the process of collecting data through interviews, key elements of the discussion were reviewed to check if anything new came up in the interviews, to ensure that data saturation was reached.

4.10.3 Sampling strategy: purposive quota sampling

A sampling frame was designed based on findings of the systematic review(61), which highlighted that certain groups are underrepresented in their service use and underrepresented in previous research. These under-represented groups included: older age groups and callers with differing ethnicity. Additionally, urgency of triage recommendation was included in the sampling frame. A diverse range of participants within the sampling frame was sought through purposive sampling, to allow for the exploration of a wide range of caller perspectives.

Purposive quota sampling was chosen as it enables participants to be selected in a strategic way, based on differing pre-defined characteristics that are relevant to the research question(156). Within purposive sampling there are different approaches to drawing the sample(156), maximum variation sampling was chosen as it enables a diverse population, with differing characteristics to be selected iteratively, so that a range of experiences relevant to the research question can be explored.

The pre-defined quota included a larger proportion (n=15) of patients who had received low urgency advice, as well as those who received medium or high urgency advice(n=15). This was designed to allow for a larger quota of patients who received low urgency advice, as the systematic review highlighted that they had been reported to be less satisfied with services(32) (48) Recruitment via service providers, who had access to patient demographic information and urgency of triage advice enabled maximum variation sampling based on the following characteristics: patient or carer, those calling on different days of the week, older age groups who have been reported to under use services(12, 27, 79, 89) and those in ethnic minorities, where previous research into patient experience is limited.

4.11 Sampling and recruitment via urgent care providers

Participating sites were instructed to follow a three-stage process to assist with the sampling and recruitment strategy. The three stages included: 1) Selection of service users (recent patients/carers who had called the service) 2) Service user screening 3) Inviting eligible service users. These stages are described in further detail below. For data privacy and confidentiality purposes, sites were instructed to ensure care service staff members who already access patient identifiable data in their day-to day role conducted these stages.

4.11.1 Stage 1 Service user selection

This stage enabled purposive quota sampling based on the following characteristics:

1. Urgency of triage outcome (Low urgency advice: routine GP appointment / self-care. Medium or high urgency care advice (requiring to be seen immediately, within 1 hour, with 2 hours, within 6 hours or within 24 hours.)
2. Caller type: patient or carer
3. Ethnicity of patient
4. Age of the patient
5. The staff member who triaged the participant (to avoid recruiting more than one patient per clinician)
6. Diversity in terms of day of the week

Sites were instructed to select consecutive callers to avoid selection bias(157), where services may preferentially select patients who had positive experiences of care.

Sites were instructed to select recent users based on the above characteristics, who had been triaged by a clinician in the last 1 week; this time-period was chosen to ensure that participants would be able to recall their experiences of telephone triage.

4.11.2 Stage 2 Eligibility screening of service users

Sites were asked to assess eligibility of all users selected following stage 1. All potential participants selected in stage 1 were screened for eligibility by a clinician in accordance with the below eligibility criteria below. Those that met the eligibility criteria were informed about the study by the recruiting site. The participating sites used different methods to inform users: the English site telephoned their recent users to inform them about the study; whilst the Northern Irish site sent information about the study to its recent users by post.

There is further detail on these approaches in the method of inviting patients section (section 4.12).

4.11.2.1 Eligibility criteria for participants

The inclusion criteria specified that users must have been digitally triaged within the past week; a one-week period was selected so that users would be better able to recall their experience of the triage phone call, a longer time-period between the users' triage phone call and their participation in the study interview may have made recall more difficult. The inclusion criteria also specified that patients aged under 18 and patients with particularly sensitive care problems were excluded. The criteria for sensitive care problems were discussed and agreed with the clinical supervisor who is a GP (JD). These exclusions were required to ensure the safety of patients and was in line with study's ethical approval. The inclusion criteria only included users who spoke in English, which was due to the limited resources available in the PhD project meaning that translation costs could not be covered. The full inclusion and exclusion criteria are detailed below.

Inclusion criteria:

All participants (patients or carers) must

- have been triaged or called on behalf of a patient who was triaged by the site in the past week.
- be at least 18 years-old.
- be considered appropriate for inclusion in the study (based on the triage call, participants must not have any sensitive care problem, relating to: end of life, substance/alcohol misuse, suicidal thoughts, abnormal behaviour/thoughts, complex social situation such as domestic violence or where there may be safeguarding issues)
- have spoken English when calling the urgent care provider.

Exclusion Criteria

Participants (patients or carers) were excluded if they were:

- aged under 18.
- had a sensitive care problem (the following were excluded: calls relating to end of life, substance/alcohol misuse, suicidal thoughts, abnormal behaviour/thoughts, complex social situation such as domestic violence or where there may be safeguarding issues)
- unable to read and understand the information sheet and consent form.
- unable to understand verbal explanations in English.
- did not speak English or had special communication needs (e.g., use of translator)

4.11.3 Stage 3: Inviting eligible service users.

Sites were provided with a target number of participants to invite, based on characteristics making up the sampling frame, this was to mitigate for non-responders and those who did not wish to take part. Appropriate targets were also chosen to allow for a pool of interested participants for purposive sampling.

In order to recruit approximately 30 participants for interview, sites were asked to send an initial batch of 50 invitations, which was an estimate based on the response and participation rate from a previous interview study conducted with service users in the out-of-hours care setting(158), with subsequent batches being sent until the required sample was achieved. See an example of a batch in the below table:

Triage advice urgency level	**Service user characteristic**	**Number of service users to select**
Low urgency advice	Males (under 60)	3
	Males (under 60) - ethnic minority	3
	Females (under 60)	3

	Female (under 60) - ethnic minority	3
	Males (over 60)	4
	Males (over 60) - ethnic minority	4
	Females (over 60)	4
	Females (over 60) - ethnic minority	4
Medium or high urgency advice	Males (under 60)	3
	Males (under 60) - ethnic minority	3
	Females (under 60)	3
	Female (under 60) - ethnic minority	3
	Males (over 60)	4
	Males (over 60) - ethnic minority	4
	Females (over 60)	4
	Females (over 60) - ethnic minority	4
	Total invitations sent	**53**

4.12 Method of inviting participants

A range of factors feed into successful recruitment to research, including the researcher's interpersonal skills and methods of communication to potential participants(159). In this study there was regular communication between the PhD candidate (VS) and the recruiting sites. Sites were also given flexibility on how they contacted potential participants based on their usual ways of working. One site preferred to post invitations to their service users, allowing the user to directly contact VS if interested in participating, whist the other site preferred to call their service users about the study and were provided with a telephone script; participants who expressed their interest were then directly contacted by VS about their potential participation.

4.13 Alternative recruitment strategies

Different approaches to recruitment are also important when designing the study(15) and were considered in case of difficulty with recruitment. As an alternative recruitment strategy via advertising a study recruitment poster in participating services' out of hours centres was built into the protocol and sites were provided with this option. However, sites felt this approach was less targeted to patients/ carers who had been digitally triaged and so was not undertaken.

4.14 Proceeding to informed consent and interviews.

Service users (patients/carers) who expressed their interest in participating were provided with study information by VS and were given a minimum of 24 hours to consider the information. A convenient time for informed consent and interview was arranged by VS with each potential participant. At the time of arranging the interview, potential participants were advised to read through the participant information ahead of the interview, if they had not already done so.

4.15 Informed consent and right of withdrawal

Verbal informed consent was taken by VS by telephone or videocall for all participants, before proceeding to the interview. Ahead of taking informed consent, the study aims and voluntary participation were explained to the potential participant. Participants were advised that they could stop the interview even if they had agreed to participate and given consent and that participants could request for their data to be withdrawn from the study until up to two weeks after the interview and decline any further contact for the study (during the two-week period the data was pseudonymised to protect participant's confidentiality). A two-week period was chosen, as after this, the recorded interviews were transcribed and fully anonymised, so it would not be possible to identify the interview data relating to an individual participant.

4.16 Interviews

4.16.1 Interview guide

An interview guide was developed prior to the start of data collection. Interview guides are an outline of planned topics to be discussed, which can be refined throughout the study(143). The interview guide was piloted with a member of the wider research team (CB) in which VS is based. The following areas formed the basis of the interview guide:

1. Experience of accessing urgent care through chosen route, with a focus on the digital triage element.
2. Experience of overall journey, including health outcomes

The guide was adjusted after conducting the first few interviews, to ensure that it was ordered appropriately and covered relevant topics that came up. See Appendix 7 for the interview guide.

4.16.2 Data collection

Ahead of proceeding to the interview, brief voluntary questions were asked over the telephone to obtain the patient's: 1) age group, 2) ethnicity, 3) postcode (deprivation status was derived from this), 4) the telephone advice they received from the out of hours provider (e.g. to visit ED, to book a routine GP appointment, referral to emergency service, self-care advice) 5) approximate time and day of call. The collected answers were used to provide contextual information used in the analysis and to help with tracking participant characteristics for sampling purposes.

Following informed consent and the collection of participant characteristics, data collection proceeded via semi-structured interviews. The interview questions followed the format outlined in the interview guide; prompts were used to guide the participant and to encourage discussion around their experience. Interviews lasted up to 1 hour and calls were securely recorded using MS teams, in line with the study's ethical approval.

4.16.3 Transcription

Audio files of the interviews were securely sent to a professional transcription service (Appen) who have a confidentiality agreement with the University of Warwick. Transcripts were checked against audio files for accuracy.

4.17 Recruitment tracking

Recruitment numbers in the sub-groups were tracked in a sampling grid (based on voluntary questions relating to participant characteristics), VS informed sites of groups which were under-represented to try to boost numbers, this informed their further selection of users thus enabling maximum variation sampling.

4.18 Compliance with UK GDPR

Principles of the UK general data protection regulation (GDPR)(160) were followed in the design and conduct of this study, this included: data minimisation to ensure that only the minimum data required for the purpose of the study was be collected and stored. Identifiable data was only be stored temporarily for the purpose of contacting patients. Data was anonymised as soon as possible, and any identifiable data that was no longer required was destroyed immediately. Informed consent audio files were stored separately and securely on University of Warwick servers. The process of data collection for the purpose of research was explained in the participant information sheet in a fully transparent manner.

4.19 Analysis of interview data

Thematic analysis was selected for analysing interview data as it provides a flexible and accessible method that can be learnt and applied by those new to qualitative research(161). Thematic analysis has been described as theoretically flexible(162), and can be undertaken without being as anchored to a theoretical framework in comparison to other qualitative approaches(163). Thematic analysis was selected as it enables a pragmatic approach to be taken in this exploratory project; it allows findings to be more accessible and understood by different audiences(161), which was felt to be important in this PhD project where results were to be shared with wide ranging stakeholders, of which most did not have academic backgrounds.

A largely inductive approach was used in analysis, with themes being constructed from the information contained within the data in an exploratory manner(161). Colleagues within the research team brought a more deductive perspective via their prior experience in the field.

Thematic analysis has been described by Braun and Clarke to comprise of six main stages(161), which were followed in the analysis conducted for this study. The stages are:

1) familiarization, which involved listening to the interview recordings and reading and re-reading through the interview transcripts. At this stage the researcher becomes familiar with areas of discussion and recurrent ideas, facilitated by note making.

2) Generating initial codes, which are potentially relevant to the research question. Codes are short hand meanings drawn from the entire data; these may be descriptive and mirror the participants language or may be more interpretive, which identify meanings lying beneath the surface of the semantic data(161). Coding was completed by VS using nVivo software; coding was shared with and checked by two other researchers (HA and CB). Coding and subsequent analysis stages were done in parallel with conducting interviews, and an iterative approach to coding and re-coding was used.

3) Searching for themes: Braun and Clarke defined a theme “captures something important about the data in relation to the research question, and represents some level of patterned response or meaning within the data set”’(161, 163). This stage involved generating themes based on areas of similarity of codes.

4) Reviewing potential themes, to ensure they fit the data; this was done together with re-reading the whole dataset.

5) Defining and naming themes, which were refined through discussion with team members

6) Producing the report, based on all of the above stages

All stages were completed iteratively and with support from the wider team (HA and CB supported in all stages; stage 5 included support from JD, with feedback additionally sought from Advanced. Throughout the study, time for reflexivity and continual iterative approach was built in.

4.20 Ethical approval

NHS ethical approval was gained for this study from the Leicester South research ethics committee (REC reference: 21/EM/0093).

4.21 Chapter summary

This chapter has described the methods for the qualitative component within the PhD, this included study set up and recruitment of participating sites, justification of methods: sampling, semi-structured interviews, and thematic analysis. The next chapter presents the analyses and discusses the findings and the strengths and limitations of the study.

5 Qualitative analysis and discussion chapter

5.1 Chapter overview

This chapter presents the results of the interview study, including themes identified from the interview data using thematic analysis, and a discussion of the strengths, weaknesses, and comparisons with other literature.

5.2 Results

A total of 26 interviews were conducted between July 2021 and February 2022, of which one interview was excluded. There were more participants based in England (n=17) as compared to participants in Northern Ireland (n=8). More participants were female (n=17) as compared to male (n=8). Participants age ranged from the 18–25-year age group to 75-84 years age group. Most participants were White British (n=20), other participants were White Irish (n=3), mixed ethnicity(n=2) and black African(n=1).

There were similar numbers of participants who were patients (n=13) and participants who were carers (n=12). Of participants who were carers, most were parents of young children or infants (n=9) and a smaller number (n=3) were calling about a family member in an older age group (65+).

Seven participants described being advised to a routine GP appointment or being given self-care advice; 11 described a GP call back, 1 described a next day GP appointment, 1 described being advised to attend an out of hours centre, 2 were referred to ED, and 3 were referred to the emergency service.

Characteristics of participants are presented in Table 27.

Table 27 Participant characteristics

	Service provider location* **England /NI (NI)**	**Caller Sex**	**Patient or carer**	**Caller age group**	**Patient age**	**Ethnicity**	**Deprivation decile** 1 = most 10 = least deprived	**Participant reported triage advice**
1	England	Female	Patient (some information also captured about separate call about son)	35 - 44	35 - 44	White British	10	Attend ED (self) Self-care, attend ED if condition worsens (son)
2	England	Female	Patient	75 - 84	75 - 84	White British	9	GP call back
3	England	Male	Male patient & female partner (both spoke to triage nurse, and both participated in interview)	65-74	65-74	White British	7	Referral to emergency service

4	England	Male	Male carer	35 - 44	-	White British	1	EXCLUDED from study
5	England	Female	Carer	55-64	75-84	White British	10	Book routine GP appointment
6	England	Female	Patient	18-25	18-25	White British	6	Self-care advice and information (dental services)
7	England	Male	Patient	45-54	45-54	White British	10	Routine GP appointment
8	England	Male	Patient	55-64	55-64	White British	9	Attend ED
9	England	Female	Patient	25-34	25-34	White British	8	GP call back
10	England	Female	Patient	65 - 74	65 - 74	Mixed "other" (Anglo Indian)	8	GP call back
11	England	Female	Carer (parent of baby 10-month-old)	35 - 44	Under 24 months	Mixed (South American)	7	GP call back
12	England	Female	Patient	25 - 34	25 - 34	White British	4	Referral to emergency service

13	England	Female	Carer (parent of 3-year-old child)	25 - 34	2- 5 years	White Irish	9	GP call back
14	NI	Female	Carer (parent of 12-week-old)	25 - 34	Under 24 months	White Irish	5	GP call back
15	England	Female	Carer (parent of 11-month-old - girl)	35 - 44	Under 24 months	Black African	8	GP call back
16	NI	Male	Patient	55 - 64	55 - 64	White British	7	Next day GP appointment
17	NI	Female	Carer (parent of 2.5-year-old boy)	25-34	2- 5 years	White British	9	OOH GP call back
18	NI	Female	Carer (parent of 8-week-old boy)	25 - 34	Under 24 months	White British	Postcode not found in deprivation look up	OOH GP call back
19	NI	Male	Patient	55-64	55-64	White British	Did not know postcode	Referral to emergency service

20	NI	Female	Carer (daughter few days old)	25-34	Under 24 months	White Irish	3	OOH centre visit
21	NI	Female	Carer for mother(aged 79)	45 - 54	75 - 84	White British	7	GP call back
22	England	Male	Called on behalf of wife	65 - 74	65 - 74	White British	10	Routine GP appointment
23	England	Male	Patient	55-64		White British	6	Routine GP appointment
24	England	Female	Carer (Parent)	25 - 34	2--4	White British	1	GP call back (within 2 hours)
25	England	Male	Patient	75-84		White British	6	Routine GP appointment
26	Ireland	Female	Carer (5-year-old daughter)	35-44	2- 5 years	White British	7	Routine GP appointment

Key themes identified in this study included: 1) complexity in the system of care, 2) barriers and facilitators to communication, 3) patient-professional dynamic, and 4) the good/responsible patient. There were additional cross-cutting themes of 'Covid-19 impact' and care continuity. Themes and sub-themes are illustrated in

Figure 9, these themes are not mutually exclusive. Themes are described further below.

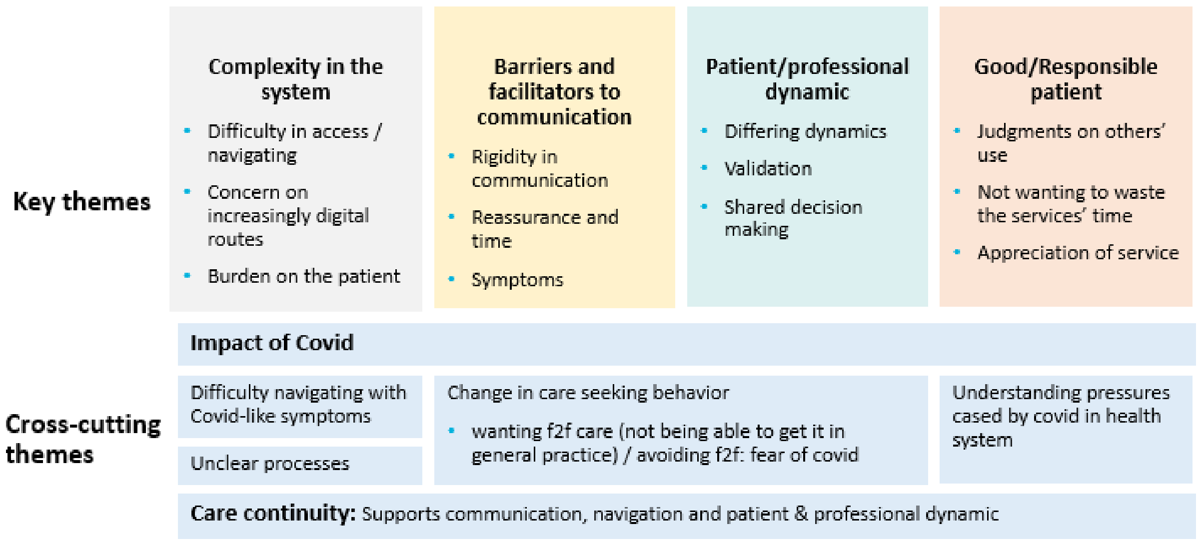


Figure 9 Overview of key themes

5.3 Complexity in the system

5.3.1 Awareness and access

Participants described access via the telephone as being convenient, and that they could speak to somebody immediately on the phone regardless of the time, and without needing to leave home:

> "And so it was great not having to get the baby in the car late at night… and drive 45 minutes away" – *Parent of baby, female (F), aged 25 – 34, White British*

Participants in both England and Northern Ireland described being aware of the England based (NHS 111) and Northern Ireland based (Dalriada urgent care) services respectively, either through their prior experience of using the service or having found the service through a google search.

However, England based patients who were referred from another service (such as general practice or the 999 Emergency telephone service) to the NHS 111 telephone service appeared to be less sure of its role:

> “But I'm not sure what, what reason I would call them for. I know if it's an emergency it's nine … usually, you know, the way my thinking works is, if it's an emergency, 999, or if it's not an emergency you phone the doctors'…But, like, is, is 111 a replacement for the doctor?” –- *Patient, M, England, aged 55 – 64, White British, Routine GP appointment (Participant 23)*

The quote above is from a patient who was referred from their GP to NHS 111; this demonstrates the uncertainty about when to use the service expressed by callers who were referred to the telephone services, rather than those who self-referred (deciding to call the NHS 111 service themselves).

5.3.2 Complexity in two-step triage

England based callers described complexity in navigating triage. They described needing to repeat information about their health problem in two different phone calls (one with the non-clinician and a second with the clinician) before they could speak to an out of hours doctor. Some questioned why it was necessary to do this and expressed their frustration. On occasion users did not understand the differing roles and profession types between the first and second triage calls. The ‘middle phone call’ in the below quote refers to the nurse call back:

> " I'm not gonna lie, it is a bit of a pain repeating the whole, like, the whole thing over and over. So I don’t, it's, I don't know if that middle step is totally necessary from, like, a patient point of view because I'm assuming the 111 caller's [call takers] , I don't know, are they just as qualified to make that call to say, “Oh yeah, a GP needs to speak to you.” So is it totally necessary and efficient for that middle phone call?" - *Mother of young child, F, England, aged 25-34, White British, OOH GP call back (Participant 13)*

Some patients remarked that access has changed over time and noticed that accessing out of hours care has become more impersonal or too centralised, which is a change from the previous less complex system. In the example quote below the patient compares experiences of the current set up with the previous, simpler, and more local organisation of urgent care in England:

> "Before the 111 came into existence, the, if you rang up out of hours and the, of the surgery, they would put you through to an out-of-hours doctor …in your town…You know?...And, and you could actually, sort of, drive down there and sit in a queue. And, and they would look at your eye or whatever it was. And, you know, and it was very, very local. And then suddenly the whole thing become, dunno if it's centralised but it seems like centralised.-- *Patient, M, England, aged 75-84, White British, routine GP appointment (Participant 25)*

Patients noticed that the system has changed and become more complex and impersonal than it was in the past.

5.3.3 Difficulty in navigating

Participants expressed difficulty in accessing their first choice of care, for example through their general practice or recommended post operative care, which led them to seek care via the telephone-based service as a second-best option. Sometimes patients turned to telephone based urgent care services due to difficulty getting an appointment or recent poor experiences at their general practice:

> "I mean, if, if it's easy to get through to someone at the 111, I would rather go there than go, than call my doctor…'cause it's so difficult talking, you know, trying to get …through to the doctor" - *Patient, M, England, aged 55 – 64, White British, Routine GP appointment (Participant 23)*

More widely in general practice settings, participants described difficulty in accessing care via digital routes. Based on their own experiences, they reflected on concerns around increasingly digital access for older patients' in the wider care journey.

> "So I, I then in the end got on to the GP, the surgery, which is all, they have their website now. And you can't, you can't really get through to anybody. You have to

> go through a whole series of loops, you know…to get anybody. God knows what elderly people do if they're not IT literate. How on earth do they get to their GP?" - *Patient, M, England, aged 75-84, White British, routine GP appointment*

Difficulty with digital routes extended to the use of NHS 111 online, which allows patients in England to self-triage using an online tool, and to receive a clinician call back, bypassing the non-clinician triage. Two England based callers who had accessed care via NHS111 online, or had some previous experience of it, acknowledged the two differing routes of access to care (NHS 111 telephone service and NHS 111 online).

These callers expressed a lack of confidence in being able to get timely care when using the NHS 111 online service. Due to experiences of long call back times after using NHS 111 online, they reflected on needing to make a judgement about the seriousness of their symptoms when deciding whether to use the online route. Below is a quote from a patient expressing these concerns in relation to NHS 111 online:

> "Again you can do it online, you know, they've now got that option where you answer the same questions that they ask you…and then it refers you to a nurse but they don't ring you back for about six hours so it's a bit pointless. If you want to speak to them you need to ring them, you know, like, to tell them even if you're not well." *Patient, F, England, aged 25-34, White British, Referred to emergency service* (Participant 12)

This highlights callers' concern regarding digital routes more widely, and the related need for patients/carers themselves to judge how serious their symptoms are in their choice of route to access urgent care.

Callers also had trouble in navigating throughout the care journey. In some cases, this started with unclear messaging whilst awaiting telephone triage. For example, the quote below was from a mother of an infant, who described being directed to the NHS 111 online service, whilst on the NHS 111 queue; this subsequently turned out to be inappropriate based on the patient's age (under 2 years old):

> "I waited for about 20 minutes and then it just kept saying, to try see if I can get NHS online, and when I tried it online ...and I got to the stage and it said, If the

> baby was, if the child was under two, then you must have support. So I went back to calling and waiting again. –- *Mother of infant, England, aged 35 – 44, Black African, OOH GP call back (Participant 15)*

Some patients felt they were referred to the wrong place or given the wrong information, where a service was not able to provide the required care or information that the caller needed, meaning that their expectations for receiving care were not met. The quote below demonstrates where a caller needed to speak to several staff members, being required to speak with the NHS 111 service, followed by a triage nurse and their general practice before being directed to the government website for the request.

> "Because if she's [triage nurse] gave me that wrong information, she's given other people the wrong … you know, when she told me to phone the, phone my doctor, I did have a long conversation with her about why I don't wanna phone my doctor…You know. But she convinced me. She said, "Look, it's the only way you're gonna do it. You've got to call your doctor… And that, but if, if she'd have said to me straightaway, "Oh, you need to go onto government website. You need to go here. You need to go there and answer this question and that question," and that would be…I would have been, you know, well happy with that." –- *Patient, M, England, aged 55 – 64, White British, Routine GP appointment (Participant 23)*

Even patients who felt they did receive the correct care advice in secondary triage, sometimes had trouble navigating care following triage. Patients described experiencing poor integration between services. For example, being referred between the emergency service and the urgent care service or between hospitals following triage. A patient who was referred in secondary triage to the emergency service described receiving a call from the emergency service, who referred her back to NHS 111 for a problem that subsequently required hospital admission:

> And they went, "Oh, actually you don't warrant an ambulance, we're gonna refer you to 111," I said, "I've just come from 111…you know, "I've just come from 111"…They're like, "Oh, we're gonna refer you back there," I was like, "Okay." And, obviously, by this point I was just like, "Oh, whatever," like, you know, like,

> I'm, I'm actually going to go to bed ..." -- *Patient, F, England, aged 25-34, White British, Referred to emergency service* (Participant 12)

The following quote is from a patient who was referred to ED following secondary nurse triage for post-operative bleeding, however the ED was not able to help, due to not having the specialist dressing required for the patient:

> "When I went to A&E, they couldn't help me…So I actually wasted my time... and in the end I went to sleep" *Patient, M, England, aged:55-64, White British, advised to attend ED (Participant 8*)

When the participant was asked what could be improved with the care journey, he commented on the lack of integration in relation to the urgent care service not knowing which resources were available at the ED,

> "Well, in this particular case, they perhaps need some, needed some data on what A&E can and can't deal with. I suspect had I gone to the original hospital... I might have got some care -- *Patient, M, England, aged:55-64, White British, advised to attend ED (Participant 8*)

Patients evidently needed to navigate through a complex process, often in involving several unnecessarily complicated steps and felt that their time was wasted. Much of the time, this complexity was linked to poor information sharing and integration between services.

5.3.4 Gaming the system

Patients expressed their frustration about the time it took to receive a call back or not receiving care advice they believed to be of a high enough urgency. Based on these experiences, some reflected on their knowledge of triage and how to best navigate the system; for example, mentioning certain types of symptoms, would expedite the care received:

> “I know there’s Covid and all this here and things, but it seems as if your appointment is a minor one, they just forget about you. You know, when you mention heart or anything like that, fast AF, that seems to go red, that must be a very serious one, so they’re with you straight away”- *Patient, M, Northern Ireland, aged 55-64, White British, referred to Emergency service (Participant 19)*

5.3.5 Communication barriers and facilitators

5.3.5.1 Rigidity in communication

Whilst users understood the need for triage, they described dissatisfaction in the rigidity of the triage process, describing it as repetitive, and scripted or algorithmic. Patients described simply needing to provide a ‘yes’ or ‘no’ answer during triage and feeling unable to ask questions. This often related to England’s non-clinician led triage, whilst clinician led triage was described as more natural, even when users acknowledged the use of scripted triage questions.

An example of a patient who expressed a lack of human touch during triage by NHS 111:

> “I, I just felt, sort of, I could have been anybody, you know? You know, it wasn’t very personal, you know? It's all very synthetic and … I suppose it's talking to a computer basically …… rather than a human, you know?...There wasn’t a lot of human touch. It was just tap, tap, tap. Know, next question. Tap, tap, tap.“ - *Patient, M, England, aged 75-84, White British, routine GP appointment (Participant 25)*

Below is an example of a patient’s description of more natural communication with the secondary triage nurse:

> I mean, she, she may, she may have a set of questions that she has to ask…But she did it in a friendly manner, that it, it just felt like two people having a conversation. – *Patient, M, England, aged 55 – 64, White British, Routine GP appointment (Participant 23)*

Callers reported finding triage conversations difficult when they were experiencing or calling on behalf of someone experiencing more than one health concern or symptom. In this scenario they felt that they needed to decide on one main symptom, when it was not necessarily clear which one was most important. A participant described this difficulty when talking to the NHS 111 primary triage call handler:

> "So when they ask you questions, when they ask you questions about what you're most worried about, I, I wanted to be able to say what I was all worried about, not just one thing…Well, I'm worried about both, her temperature and her, and her not eating…and her not drinking, and her tonsils." And he said, "Well, I need to know the one main thing for your call." – *Mother of young child, F, England, aged 25-34, White British, OOH GP call back (Participant 24)*

Callers' difficulty when there was more than one symptom was also evident in clinician led triage in some cases. The following quote is from a caller who had experience using digital triage whilst previously working as a health care professional. In the quote below, she refers to the triage nurse:

> "I mean if she followed that one algorithm for the breathing and then one algorithm for the infection in his arm … she might have got to a conclusion, but she seemed to muddle the whole two things up together where they were actually separate." – *Partner of male patient, F, England, aged 65-74, White British, Referred to emergency service (participant 3)*

She also commented on questions that were repeated during the secondary nurse triage,

> "I noticed that I was being asked the same question two or three times, "Have you got chest pains?" "No you haven't got chest pain." You know, we already established that." - *Partner of male patient, F, England, aged 65-74, White British, Referred to emergency service (participant 3)*

The rigidity of the communication was not seen to serve any purpose in helping or supporting the patient.

5.3.5.2 Communication of the problem

Space to communicate symptoms.

Patients felt that unhurried communication helped their explanation of symptoms and enabled them to feel more confident and reassured in self-care at home. Users appreciated two-way communication with the triage nurse, including being listened to and having space to explain their symptoms during 'natural' conversation, which contrasted with the rigidity explored previously. In the example quote below, the patient describes their experience with the triage nurse:

> …And when you're not well, you need someone to sit back and take time to listen…And that's what, that's what she did…She left it, she left the empty spaces that I could freely fill …you know, with relevant or non-relevant information, you know. And I think that's how a nurse should be, you know, or, you know, a nurse or a doctor. They should do that. Because it's not always what you say. It's, it's the information in between that can give clues on what's going on. –- *Patient, M, England, aged 55 – 64, White British, , Routine GP appointment (Participant 23)*

This patient also first described feeling reassured and listened to by the triage nurse and then compared this communication with recent experiences of their GP,

> "I found her absolutely lovely to talk to. She was really friendly...And, you know, she took time to listen to you…You know. I'm, I'm comparing her now to my doctors. They don't wanna talk to you. They … any time I have dealings with my doctors, they, they don't listen to you and, you know, they get you off the phone as soon as possible, type of thing…And you, you're feeling frustrated because you haven't said all you wanted to say." - *Patient, M, England, aged 55 – 64, White British, Routine GP appointment (Participant 23)*

Where consultations felt rushed, which often occurred in care received following triage, patients described difficulty in communicating their symptoms or feeling anxious, particularly when they felt the professional was under pressure and could not allocate enough time to listen or appeared not to take the problem seriously. Not being rushed was the antithesis of the rigidity sometimes experienced.

In the example quote below, the patient describes his experience of the telephone conversation with the out of hours doctor:

> “He's stressed. You know… short answers, sharp questions. "What's been wrong? What's happening now?" Almost like an, an anger management, you know. He obviously had a problem. He was obviously up against it himself, you know?... Well, I just churned out the never-ending symptoms I had, you know….but he didn’t say, "Oh, I'm sorry. We, we'll try and get this sorted out for you this morning." It was almost like another series of questions, you know, on … "Has this happened? What about this?" You know, all that …does, raise your anxiety, doesn’t it?” -- *Patient, M, England, aged 75-84, White British, routine GP appointment (Participant 25)*

In encounters like this, communication failed, and patients were not able to fully express their concern and led to feelings of frustration or worry.

5.3.5.3 Reassurance in communication

Reassuring communication was important to callers. In cases where self-care was suggested, reassurance provided by the clinician helped in the patient’s decision to stay at home, rather than seeking further care which they may have done otherwise. The following quotes are examples of where reassuring communication helped patients to stay at home rather than attending ED:

> But the lady that was on the phone, the nurse that phoned me back ...again, she was ever so thorough, she went through all different things with me to check on him. And she ultimately said, “Look if, if you really feel anxious I would go, just for you to put your mind at ease,” she said, “I think he needs to be monitored. And if any other symptoms arise then, you know go to A&E.” … She said, “I will leave ...” she kind of, left it with me ...to make the decision to go A& E or not. So I think in

> her heart of hearts she probably thought that it wasn't worth, not worth but wasn't in call of an A&E appointment. Which ultimately I didn't go 'cause I thought, "You know what she's right, perhaps it was me being a bit anxious," but she did calm me down a lot. By kind of, reassuring me... that you know, it wasn't as bad as probably I thought it was. - *Patient, F, England, aged 35 - 44, White British, self-care*. Participant 1

Additionally, one caller reflected on other patients seeking reassurance through the service rather than needing to speak to a doctor:

> I would imagine the calls they get that people doesn't actually really need to speak to a doctor. But this whole reassurance I think …that people are looking for as opposed to an actual problem. - *Daughter calling about mother (aged 75+), F, Northern Ireland, aged 45-54, White British, OOH GP call back (Participant 21)*

Patients additionally described feeling reassured when they were given practical advice, especially during the night-time or early morning period when patients/carers described being anxious:

> "So she was very good, she said, "You need to write it down." And then she gave me advice to put her head on a hot water bottle and see if that would help ease her a bit, you know, it's just, like, common sense nearly, but I didn't think of it at the time ..." - *Mother of 5-year-old child, F, NI, aged 35-44, White British, Routine GP appointment -Participant 26*

> "she's very good, very reassuring, and that's what I just needed at that time in the morning" - *Mother of 5-year-old child, F, Northern Ireland, aged 35-44, White British, Routine GP appointment -Participant 26*

Callers described feeling re-assured when they were given an accurate timeframe and when they were kept up to date with delays. The approach to providing this information appeared to vary based on the service; England based callers described being given a call back timeframe, whilst those based in NI service described not being given timeframes. A quote from an England based participant:

> So while I was waiting for the hour, for the doctor to call, they called twice again to say, I'm still on the queue. Which is really comforting ‘cause I was super worried. - *Mother of infant, England, aged 35 – 44, Black African, OOH GP call back (Participant 15)*

Callers who were not given a timeframe reported feeling more anxious. In the example quote below, the caller describes frustration at not being given an expected call back timeframe,

> But like, my husband had come home that evening, my mum had come over to look after our, our other son if we had to go. And it was just constantly, you know, “When are they gonna ring? When are they gonna ring?” You know, and I suppose because it was, because we were worried about his breathing, there was a few times within the hour that my husband said, “Call back and see when we’ll get the phone call.” -- *Mother of infant, Northern Ireland, aged 25-34, White Irish, OOH doctor call back – (Participant 14)*

Patients’ experiences of communication were positive when they felt listened to and reassured and kept informed, in contrast to the poor experiences of rigidity that some described particularly in relation to non-clinician triage.

5.3.5.4 Audio and visual information

Users described communication of symptoms being assisted through audio cues and sharing of photos, which in turn influenced the clinician’s assessment of urgency and the referral advice received by the patient. There appeared to be variation in clinicians’ prompting for audio-and visual information between the two participating services. Northern Ireland based users described the out of hours doctors pro-actively asking the caller to send a photo of the symptoms or asking to hear the patients breathing. For example, one participant described the clinician asking to hear the breathing and coughing of a child, which led to advice to self-care at home, and subsequently the child’s symptoms resolved:

> "And then he said that he wasn't concerned about J coming in at the moment, because he said that his breathing was, it was rapid but it wasn't rapid enough for them to be concerned about bringing him in" – *Mother of young child, M(patient), Northern Ireland, aged 2-5, White British, OOH doctor call back (participant 17)*

One England based caller, the mother of an infant, described the triage nurse and subsequently the out of hours doctor hearing breathing over the telephone (without requesting to hear it). The nurse noticed the child's breathing did not sound right over the telephone, which led to more urgent advice being recommended. Based on hearing the child's breathing, the triage nurse advised that a doctor would call back:

> "She could hear, she could hear her over the phone, she was like, "That's not right." And she said, she would, a doctor would call me ...within 30 minutes…"
> *–- Mother of infant, England, aged 35 – 44, Black African, OOH GP call back (Participant 15)*

In the subsequent call back from the out of hours doctor, the mother felt that the doctor did not take the symptoms seriously, until again, the doctor heard the breathing over the phone:

> And the doctor was almost a bit trying to like just dismiss me. I was telling him it wasn't that, I know something is wrong. She may be sleeping.. but I'm not worried of her being sick, as soon as I put food in her mouth, just rolls back up, she just throws it back up...I'm not worried about that but it's the coughing and laboured breathing I'm worried about. I mean no allergy can caused that, not a food allergy could have caused that, if you get what I mean…So and then while I was talking to him, she coughed and like instantly the doctor was like, "Oh no that's not right. You have to go into the walk-in clinic. -- *Mother of infant, England, aged 35 – 44, Black African, OOH GP call back (participant 15)*

Callers expressed concern about communicating their symptoms, without the use of audio and visual information in remote care more broadly:

> I mean if you were sat face-to-face to you, you know, you can get out, you can explain it to them more, you can show them…Show them your shoulder, you can tell them

> how you feel, but when you're doing it through the phone, I mean, the nurses or whoever it is is ringing you, they're asking you, "Are you white? Are you red? Are you warm?": You know, they're asking you all these different questions – *Patient, M, Northern Ireland, aged 55-64, White British, referred to Emergency service (Participant 19)*
>
> And it's difficult for a doctor at the other end of the phone to, you know, it's like me asking you today how you are because I, I can't see you so I don't actually know…And how do you, how do you address those issues. -- Daughter calling about mother (aged 75+), F, Northern Ireland, aged 45-54, White British, OOH GP call back (Participant 21)

This extended to the use of NHS 111 online triage, where symptom information is entered into the online tool in text form. Users expressed that this did not feel an appropriate way to communicate serious symptoms. In relation to NHS 111 online, one user described that it would be difficult for the urgent care service to gauge the extent of breathlessness being experienced by the patient, in turn having an impact on timeliness of care provided and patient safety:

> Like, don't get me wrong it's the same questions as what they'd want you to, to answer ... but it just, it just, so long to ring you back and I don't know how they can gauge that over the, like, over the internet just by people answering questions 'cause you can't hear them, you can't, you know, you don't know how breathless they are or whatever.- *Patient, F, England, aged 25-34, White British, Referred to emergency service -Participant 12*

The communication was expanded by the addition of audio and visual cues, and sometimes these cues were essential to the interaction.

5.3.6 Patient-professional dynamic

5.3.6.1 Confidence in knowing what is required.

Differing patient-professional dynamics were evident, with some patients describing that they sought authority and reassurance from a professional, to help them make a judgement on the care that was required. They acknowledged their own limited knowledge regarding their health concern and respected the knowledge and expertise of clinicians. This particularly applied to patients who were not sure of what action to take, and in some cases how serious the symptoms were.

The example below is from a patient who describes the importance of discussing different symptoms, and for the nurse or doctor to use their expertise to make a clinical judgement on the problem,

> I'm, like, I'm not a professional. I can't … you know, and it's like many other people out there. You know, we're not professionals. So we don't know what to tell you… And then it's your job as a professional to tie all the, all the words together and say, "Yeah, you're feeling that because you've got this," or, "you've got that," or, "you're unwell," or, or for this reason, that reason or another reason- *Patient, M, England, aged 55 – 64, White British, Routine GP appointment (Participant 23)*

Patients described liking the authority of triage nurses, the quote below is from a patient describing the advice given by the nurse in secondary triage:

> "Look, I'm gonna refer you to the ambulance service, it's, it's that simple." So, like I quite, like, her, kind of, authority as such as, "Look, no, you're going to hospital."…You know? "We're not gonna call a doctor out 'cause that, that would be a bad idea." You know, like, "You've done everything you can, we've done everything we can, simple answer is," you know, which she was right in the end. - *Patient, F, England, aged 25-34, White British, Referred to emergency service (participant 12)*

In contrast, other callers were more confident in their approach. They knew what they wanted and expected. In these cases, patients tended to be more familiar with their health problem, due to previous experiences of it or because the call related to a long-term problem. In these cases, the user took agency and asserted their view on the level of care required. Often this was supported by a family member or partner who was more experienced or confident. For example, a carer described ease of communication due to being familiar with a chronic problem that her mother was experiencing,

> “You know, if you haven’t, if you’ve been fortunate not to, you haven’t needed doctors and not to have been exposed to, you know, hospitals and things you mightn’t have the same … confidence, I suppose, in expressing yourself and knowing what these symptoms might be. I’m not saying I’m medically trained or anything like that, but, you know, my mum has had issues over the years” … - *Daughter calling about mother (aged 75+), F, Northern Ireland, aged 45-54, White British, OOH GP call back (Participant 21)*

Callers often described shared decision-making during triage. A range of factors fed into shared decision making, for example the patient’s level of anxiety about their health concern, fears of exposure to Covid-19 in subsequent in person care and how busy the recommended care providers were.

> And so the, the nurse asked me just what, what the problem was and ...she, she was very helpful and I told her exactly what my pressure was and she, she said that, you know, “If you, if you wanted to come into the hospital you can but it is just chock-a-block…So, so I, I didn't, I didn't bother, I, I said to the nurse and she was very understanding, she said, “Maybe if, if you don’t wish to come in maybe it would be wise as, as long as you just continue to monitor your pressure and that.” So the, the doctor had actually, my GP had arranged for me to come down the next day anyway ... - *Patient, M, Northern Ireland, aged 55-64, White British, GP appointment (Participant 16)*

In some cases, the user asserted the required care, during the triage assessment. This occurred particularly in callers who were confident about their health concern or were more health literate. Family members were often involved in shared decision making, the example quote below is from a partner of a patient who described pushing for the perceived level of care needed (an ambulance via the emergency service). When asked about whether there was anything she liked about the call with the triage nurse, she described the ability to input or influence the triage recommendation,

> “Well yes because we finally got the outcome that I wanted ...for my husband. And I suppose in one way it gave me a choice, at least I could voice my opinion.” - *Partner of male patient, F, England, aged 65-74, White British, Ambulance dispatch (participant 3)*

Patients varied in their approach to triage, this related to their confidence and knowledge of the health problem, those who were more confident asserted and negotiated subsequent care.

5.3.6.2 Validation

Some patients described seeking “validation” of their health concern and relied on the clinician to confirm they were unwell and needed follow-up care. They described a sense of being giving permission to access other services.

For example, in the quote below, the patient described the conversation with the paramedic conducting triage helped to confirm that care was needed, and that he would not be wasting the general practitioner’s time:

> “Well, his advice was to see my GP straightaway and I, you know, as soon as the GP, as soon as I was able to call in the morning I, you know, I did that…And, and I mentioned the call that I’d had with the paramedic. And I think that probably just helped the GP understand that, you know, I needed some help and, and that I was following advice and, and not just, you know, wasting their time.” – *Patient, M, England, aged 45-54, White British, Routine GP appointment (participant 7)*

Another user described feeling that the nurse helped to confirm the need to go into hospital,

> “She, kind of, confirmed my suspicions I thought we should go to hospital” – *Patient, F, England, aged 25-34, White British, Referred to emergency service (participant 12)*

They needed to feel that their use of the health service had been validated by a healthcare professional.

5.3.7 Care continuity

Care continuity supported communication, in that patients did not need to fully explain their problem and circumstances to be understood. Where the patient was able to speak with the same healthcare professional, or where their own GP influenced triage, patients expressed feeling more supported and confident in receiving appropriate care. In the quote below, the patient described that the GP was called by the paramedic who attended the patient’s home, following telephone triage. The wife of the patient described this as helping resolve the health concern:

> So speaking to the GP we were able to resolve that problem…Which was affecting his breathing, that new drug was...affecting his breathing. - *Partner of male patient, F, England, aged 65-74, White British, referral to emergency service (participant 3)*

In some cases, care continuity occurred by chance, where the patient spoke to the same call taker when contacting the telephone service for a second time. The quote below is from patient who was referred to the emergency service in secondary triage and then referred back to NHS 111, having to start the process over again. The patient described that the second time she called the service she spoke to the same nurse, who immediately realised the seriousness of the problem, and helped to escalate the call to the emergency service:

> So, had I been another hour messing about and 111 hadn’t got back to me or they hadn’t have realised that there was a big problem here... and had it had been a different nurse, it could have been a different…So, it’s just, it was thanks to the nurse going, “This is ridiculous, the only other thing I can do is refer to the doctor and I’m

> gonna put it as urgent as I can." - *Patient, F, England, aged 25-34, White British, Referred to emergency service – (*Participant 12)

Care continuity was a cross cutting theme, where patients felt more able to communicate when the triage nurse knew them and the severity of their problem, impacting on the dynamic between the patient and profession to support shared decision making. This in turn helped patients to better navigate complexity and receive the care they felt appropriate.

5.3.8 The good/responsible patient

The theme of good and responsible encompasses patients' expression of their appreciation of the care received and the wider health service, particularly given the pressures resulting from the Covid-19 pandemic. It also relates to their responsible use of these services only when necessary, so as not to burden the system or put others at risk, by taking up precious resources that others may be in more need of.

Patients and carers were keen to share their appreciation of the urgent care service and the wider NHS. Patients additionally expressed their understanding of pressures within the NHS, particularly the additional pressures resulting from the Covid-19 pandemic. This often impacted on their expectations, for example the call back timeframe:

> "I appreciate how hard the, how hard the NHS work, so I wasn't expecting an immediate call." –Patient, F, England, *aged 25-34, White British, GP -call back -* Participant 9
>
> "I would say I think the service is doing the best that they, they can, and ...I'm really grateful that we have that service. -- *Mother of young child, M(patient), Northern Ireland, aged 25-34, White British, OOH doctor call back - Participant 17*

Patients described not wanting to burden the care services or downplaying their symptoms, so as not to take up resources which others might need. They viewed themselves as responsible patients.

> “Yeah, so she rang for an ambulance and then they called me. And, obviously, this is where something went wrong because me being, I was like, “Oh, no, I’m alright, you know, I know you're busy,” 'cause they was saying how busy they were, I was like, you know, “I’ll wait.” -- *Patient, F, England, aged 25-34, White British, Referred to emergency service – (*Participant 12)

In some cases, patients preferred not to burden the healthcare service but were encouraged to seek care by a family member:

> Because my mum, to be fair, is very long suffering and wouldn’t use the services, you know, wouldn’t go to the doctor unless she really had to…She’s just old school and doesn’t feel that it’s …You know, she does feel that the, the medical treatment and NHS and what we have is precious…And you use it when you need it not something that’s just there to be used and abused, if you like…That, that, that’s just her mindset and you have to force her to actually make that phone call. I mean I had, I said look, “I’m, I’m coming up, you’re going to ring Dr C because we need to know what’s going on here.” -- *Daughter calling about mother (aged 75+), F, Northern Ireland, aged 45-54, White British, OOH GP call back (Participant 21)*

Patients expressed their understanding of pressures in the health system in relation to the Covid-19 pandemic, as well as patterns of usual pressures, such as knowing when services are most busy and how this may impact care received:

> “I suppose in a way, I mean, Saturday night, the NHS is actually overwhelmed, you know...usual suspects, I suppose. So, so I suppose it's the worst night. If… I, if I'd have rung up on a, sort of, Wednesday about ten o'clock at …night, be more relaxed, wouldn't they?” -- *Patient, M, England, aged 75-84, White British, routine GP appointment (Participant 25)*

Patients also described taking responsibility based on the healthcare information they had been provided with, to look out for symptoms of progression and act accordingly,

> And once, once you get that opinion from somebody who’s medically trained well then it puts your mind at ease and then you can watch for, you know, things that

> they’re telling you. Like, it was, my mum had a problem with her leg and they were telling us to watch, you know, for the heat in the leg in case it would be a clot, you know… if something had started. You know, they give you, if you’re sensible enough, like, that, you know, they’re going to give you the advice you need to take it to look out for points that if it doesn’t, you know, doesn’t improve and it does start to get worse …you ring them back…You know, there’s, there’s an element, you have to be responsible. - *Daughter calling about mother (aged 75+), F, Northern Ireland, aged 45-54, White British, OOH GP call back (Participant 21)*

Callers expressed their appreciation of services and knowledge of pressures experienced, in some cases these led to patients downplaying their symptoms or being hesitant to use services without the encouragement of a family member or call taker.

5.3.9 Cross-cutting theme: Impact of Covid-19

The impact of Covid-19 cut across the three key themes. In ‘navigating the system’, patients who were calling about covid-like symptoms, for example Asthma related symptoms reported feeling frustration and experiencing delay in seeking care due to needing to complete Covid-19 screening questions.

Additionally, frustration at services’ communication of changes to the process (resulting from Covid-19) of accessing care was evident. Callers described that communication relating to accessing face-to- face care was not clearly explained; users felt that services were not always upfront about their policies. For example, they described that face-to-face care was not available through the out of hours service without a negative Covid-19 test, which was not made clear when first calling the service. Users consequently felt that time was wasted in triage within the out of hours service and that they should have directly gone to the emergency department.

> “... obviously I know they triage them calls, but I always think if the information was made clear ...and if it was communicated to parents or to anybody calling them, that more or less, “Look, there's no point, there's no point,” like, you know,

> not there's no point waiting on a call, but, “We would advise you to go A&E if you have Covid symptoms.” – -- *Mother of infant, Northern Ireland, aged 25-34, White Irish, OOH doctor call back – (Participant 14)*

The impact of Covid-19 also influenced care seeking behaviour, for example, with some users expressing that they were not able to get the face-to-face care from their general practitioner as usual, influenced their desire for face-to-face care.

> “No, I'm not having no more of this.” I said, “I want hands on, if you don’t get the paramedics out here soon, I’ll just take it further. - Partner of male patient, F, England, aged 65-74, White British, routine GP appointment (participant 3)

Patients reflected on weighing up their need for face-to face care following telephone triage and potential risks of exposure to covid:

> I was really I suppose I was doing a risk assessment mentally ... in, in my head, you know, which is the worst, you know, to suffer the blood pressure and maybe take the nurses advice and just stay calm and rest. Or ... or, or go to A&E and risk the, risk maybe being infected by Covid so... I mean for me personally it was a, it was no contest, it, it was ...it was a straight, straight, it was clear-cut, you know. *Patient, M, Northern Ireland, aged 55-64, White British, GP appointment (Participant 16)*

Patients varied in their behaviours and attitudes to seeking care and reflecting on their needs in the context of Covid-19.

5.4 Discussion

5.4.1 Summary of findings

Patients had largely positive experiences of telephone-based care, and many were able to access care via telephone-based services more easily as compared to care via their general practice. Despite this accessible entry point patients often experienced complexity in navigating triage and their subsequent care journey, and they did not always receive the desired level of care.

The burden of seeking appropriate care appears to be on the patient; those with experience of the health system, their own condition and/or support from family members appeared better able to navigate and negotiate the care they felt was required. Patients described needing to make judgements on access routes, based on the seriousness of their symptoms, particularly in relation to the use of NHS111 online.

Whilst callers understood the need for triage, they often described rigidity in communication, highlighting the importance of the call takers' communication skills together with their use of digital triage; this particularly occurred in relation to non-clinical call takers. Overall patients described being able to easily communicate with triage nurses and appreciating reassuring communication and being listened to. Reassuring communication was key to enabling patients to feel confident with self-care at home. Sharing of audio information and photos in communicating symptoms was also helpful and reassuring from the callers' perspective and some described receiving the correct level of care advice as a result of sharing this information.

This study additionally highlights that callers can influence the recommended care advice, through using their knowledge, experience of accessing care, and health literacy. Additionally, callers described other factors feeding into shared decision making of the triage outcome, such as service pressures and fears of exposure to Covid-19.

5.4.2 Interpretation using theoretical framework of patient experience.

This section considers the study findings through the lens of Oben's conceptual framework of patient experience(146), which is centred on the humanity of the unique individual patient, where their experience is multidimensional and multi-faceted and on a continuum from health to the onset of ill health (146). In reference to the patient experience, Oben states that "it is informed by a complex combination of the patient's personal life, as well as their own and their family's experiences within the health-care system at all levels of care". Factors influencing the patient experience include those relating to the person prior to the onset of disease including their physical, psychological, and social dimensions, such as family and community support (146).

There are four elements to Oben's framework, each are considered below in relation to the study findings:

"A Continuum and Unity", Oben describes this as the patient being the same person they were prior to the onset of disease. Whilst interacting with health care services, the patient may be having trouble aside from the direct experience of the care service, such as discomfort from their symptoms, or anxiety in other parts of their life. Within the study findings, patients and carers' anxiety was apparent, including in parents calling about young children. This fits with patients' feeling that reassuring communication was important, in making them feel more confident to self-care at home. Experiences of care were also shaped by patients and carer's life experiences, for example, patients sometimes downplayed their symptoms if they felt that other were more in need of care within their community. Two participants were health care professionals and expressed their understanding of pressures within the service, how digital triage works and their confidence in pushing for the care they felt was correct.

The second element, building on the previous is "the person: The human experience", Oben states, "Our interest in the humanity of our patients naturally leads us to care for the person who is suffering from an illness and seeking help from the health-care system, rather than merely managing a case or disease", within the present study, this can be linked to patients views that communication during triage lacked in human touch, particularly within the non-clinician led triage where the call takers attention may be on navigating digital triage rather than fully listening to the patient and communicating in a reassuring manner.

The third element described by Oben is "The patient: the experience of illness"; this relates to the transition of an individual to becoming a patient, and their experience of illness being distinct and multi-dimensional (psychological, physical, social, and spiritual), which plays into all interactions of care. The data collected in this study indicate patients difficulty in relation to anxiety about symptoms, the support of family members and in some cases physical difficulty, although the latter is not represented within a theme. Oben's framework does not relate to carers' experiences; however, anxiety of carers was also very evident and played into supporting communication and care received by the patient. Considering the needs the patient through this holistic lens, we can understand patients' poorer experiences of the rigid and structured approach to communication which may result from the call takers' use of digital triage. The final element of Oben's framework relates to the experience of health-care services, stating that "The patient experience, in essence, is the human experience of healthcare services", which further builds on the importance of humanity in communication.

A key finding from the qualitative study related to the theme of responsible patient and validation being sought by the patient. In the former (the responsible patient), patients often expressed their concern for others in the use of care services, and for example, in wanting to make sure their symptoms were serious enough to warrant care via the emergency service. The validation theme was closely aligned to the notion of patients seeking permission or direction from someone in authority to legitimize their subsequent use of health care services.

Whilst elements of Oben's framework touched on the theme of the responsible patient, (patients' personality, and their understanding and views which may be shaped by prior experiences during health or illness may lead them to be responsible in their use of healthcare services) this theme also closely aligns with theory proposed by Ziebland et al. based on the 'Goldilocks zone', a metaphor for the struggle that patients face when deciding if they need to consult a healthcare service about a health care problem(164).

Ziebland et al. present contradictory norms in patient behaviour, for example, "The good citizen accepts the doctor's reassurance about the low likelihood of a serious health problem but also listens to their own body and is prepared to challenge advice if the symptom persists or worsens". In the present study contradictory patient behaviours were present, and likely vary based on the individual, their character and circumstances. Whilst some patients were hesitant about seeking care and did not want to be burden on the service, others were more willing to challenge their triage outcome and voice their opinion.

Ziebland et al. also suggest clinicians require time to respond to and contextualise the complexity of the individual patient and the patients' understanding of their symptoms, which may prevent re-consultation. This supports the finding in this research that patients felt better able to manage their care needs at home, when they felt the clinician conducting triage gave them sufficient time.

Ziebland et al. describe this need for the clinician to spend more on understanding the patient as being in contrast to the contemporary focus of standardisation and efficiency. This particularly applies in telephone triage, which could be seen as a system centred on standardisation and efficiency. However, the present study suggests that patients, when given sufficient time by the clinician conducting triage, feel enabled to self-care at home, which demonstrates how these notions may not be exclusive.

5.4.3 Comparisons with other literature

Compared with other research studies, the focus of this study was primarily on clinician led digital triage, including within the context of England's two step triage model, which has not been explored by previous studies.

Many previous studies of the use of digital triage in urgent care delivery explored patient experience through surveys; two explored patient experiences of digital triage in depth using qualitative methods, as identified in the systematic review(62). One of these was a 2004 study of NHSDirect (nurse led triage), conducted early after its implementation, which similarly reported positive patient experiences of reassurance from the service, and improved access to care(95). The study also reported patients using the telephone triage service so as not to be a nuisance to their GP, which was echoed in the theme of the good/responsible patient in this study. However, the present study reflects the current pressures on general practice(95), with patients often choosing urgent care services due to recent poor experiences of or difficulty in getting through to their GP.

The second qualitative study explored experiences of users and non-users of NHS 24, which reported a common area of dissatisfaction being the initial triage questions(28), which was also found in this study. The present study further builds on this by highlighting other areas of frustration, including where there is rigidity in communication. For example, callers expressed difficulty in knowing which symptoms were most important or were not confident in the triage process where there was more than one health concern, which has also been reported in a recent study of patients' experiences of NHS 111 online(165). In the present study, additionally, patients felt they were not able to ask questions and were only asked closed questions, particularly in primary non-clinician triage. A previous study suggests that greater use of open ended questions by triage nurses may promote patient safety through checking patients' understanding of triage recommendations(166).

The present study highlights difficulties faced by patients in navigating the system of care sometimes due to being given the incorrect advice or being unnecessarily referred between care providers, resulting in patients feeling frustrated. A recent study conducted by Pope et al. explored staff perspectives of the NHS 111 online self-triage service and echoes this finding(167). It describes "circular triage journeys and loop backs experienced by patients"(167) in part due poor integration between digital triage systems. An example they provide is that patients may seek care though a digital consultation system used within a general practice, of which many link to NHS 111 online when the general practice is closed. The patient may then complete a self-triage through NHS 111 online which then directs them back to their general practice(167). This additionally aligns with the notion of the burden being on the patient in navigating access to care that has been identified in the present study.

This study highlights the importance of the call takers communication skills in combination with digital triage. It appeared that when patients feel more reassured by the clinician, they are likely to feel more confident in managing their health concern, in some cases enabling them to stay home. The importance of reassurance has been previously reported in urgent(168) and emergency care(169, 170) settings, where fear or anxiety may drive some patients to use services, when they are seeking reassurance rather than needing in person care(169, 170).

Comparing NHS111 telephone and NHS111 online access modalities was not the main focus of this study, however this study highlights patient's reflections on needing to make a judgement on the seriousness of their symptoms when choosing which route of access. This finding supports a recent study which reported patients tend to use NHS111 online for symptoms they judge as less urgent or due to feeling that their problem was not urgent enough(171).

Callers reported that clinicians' use of audio and sharing of photos assisted communication and was reassuring. This is supported by a recent study that investigated implementation of video triage for parents calling a medical helpline about their children; the study reported both call handlers and patients found that video-triage assisted communication, was reassuring and helped with avoiding unnecessary hospital visits(172).

The systematic review conducted in this PhD highlighted an association between higher priority triage advice and patient satisfaction with the service(48): patients whose triage resulted in an ambulance being dispatched were more satisfied than those receiving lower urgency advice (32). The present study shows a more nuanced picture; whilst some callers did express dissatisfaction with routine care advice; many reported positive experiences of feeling supported through reassuring communication and shared decision making to stay at home for self-care.

Shared decision making, in terms of the caller's subsequent care decision including use of another service or self-care was apparent in this study. This is in contrast with a previous Sweden based study which suggested less scope for shared decision making, with only a small number of calls where patients were asked for their opinion on the care advice given(166). This may be due to differing clinician training between countries; it may also reflect the study sample, with the Swedish study using data from patients who specifically disagreed with the advice they were given; whilst the present study, callers described following the advice they were given or that was agreed.

This study suggests that care continuity could play in a crucial role in repeat callers. There were examples of improved experience and picking up a critical emergency case, where callers were able to speak to the same healthcare professional when calling the service more than once. Linked to this finding, a recent study investigating adverse outcomes in patients calling NHS 111 about suspected Covid-19 identified repeat callers to be a predictor of clinical deterioration(173); whilst this is a slightly different patient population it suggests that repeat callers are a high risk group.

Finally, the notion of the "good" or "responsible" patient, including appreciation of service and using the health system responsibly, and downplaying systems has been widely reported in primary and urgent care settings(164, 174).

5.4.4 Strengths and limitations

This is the first study to focus on patients' experiences within England's two step triage delivery model, which allowed some contrasting of the experiences they described during the primary triage assessment with those in the secondary clinician-led triage. The research shows broadly positive experiences of the telephone-based care, however there were several areas of dissatisfaction throughout and following primary and secondary triage. These included difficulties in needing to provide one main health problem in the initial (primary triage) call, rigidity in communication, including the perception of non-clinical call handlers lacking human touch and the rigidity of Yes/No questions. Patients also needed to repeat the triage questions during secondary triage. There was additionally dissatisfaction about the delays between primary and secondary triage and in poor integration of services following triage, for example in patients being referred between care providers.

The design enabled comparative analysis between two-step and direct-triage models. The findings suggest that the latter is clearer for callers to navigate; with callers perceiving two-step triage to be more impersonal and complex. However, this should be interpreted with consideration of the wider primary and urgent care landscapes and the costs of model delivery.

A further strength is that participating sites were asked to select consecutive callers based on a set of characteristics, and therefore there was a lower risk of self-selection bias compared with other approaches such as advertising directly to patients.

Although participating sites were instructed to select a purposive sample based on quotas, the exact quotas were not achieved, with only a few participants in ethnic minority groups and the oldest age groups being recruited, greater recruitment of these groups may have been expected in the England based service (which serves a more diverse population) and may have provided further insight into experiences within these patient groups. Although deprivation was not specified in the quota sample, there were no participants representing the three most deprived deciles of the population, despite these making up a large proportion of patients as identified in the quantitative study.

Poorer recruitment in these groups may be due to response bias, with groups typically under-served by research potentially being less likely to participate. Additionally, the England based site informed VS that ethnicity information is not always available within the triage record. As there were smaller numbers of participants in the most deprived groups and ethnic minority groups, this study has been limited in exploring relationships between these groups and experiences of care.

Another limitation was that the study was limited to two participating sites, due to site recruitment taking place shortly after the onset of Covid-19 pandemic. During this time services were under an extremely high level of pressure due to the pandemic. The two services that did participate additionally had limited time to support user selection and eligibility checks, which needed to be done by a senior clinician. This impacted particularly on recruitment numbers within the Northern Irish service, with more participants needing to be recruited from the England based site. Overall, however, this is not felt to have impacted on the study, as data saturation was reached following 25 interviews, where no further topics were arising from interviews.

Another weakness related to the study being conducted during the Covid-19 pandemic, this was a unique time, in terms of greater pressures and changes in how care was delivered to patients, with shifts away from face-to-face care. Thus, experiences may not reflect usual care outside of a pandemic. However as discussed in the previous section, many findings from this study build on and support others' findings prior to the Covid-19 pandemic.

5.5 Chapter summary

This chapter presented the key themes constructed from the qualitative interview study, these related to navigating the system, communication, patient-professional dynamic, and the good/responsible patient. A key finding was the importance of reassuring communication together with call takers' use of digital triage, this should be central to how services and digital triage software are designed and delivered.

6 Mixed methods integration chapter

6.1 Chapter overview

This chapter starts with the aim of the mixed method integration, it then describes the method that was followed to triangulate the data and the justification for using this approach. It goes on to summarise the integrated findings from the PhD research conducted. The integration is then synthesised, which additionally incorporates stakeholder feedback. Finally, the strengths and limitations of the method and overall synthesis are outlined.

6.2 Aim

The integration aims to synthesise the findings from all elements of PhD research (the systematic review, the quantitative routine data study and the qualitative interview study) in order to answer the overarching PhD project aim: To understand how digital triage functions in the provision of UK based urgent care and the related patterns of service use, triage outcomes, and patient experience; to develop recommendations for research and service delivery improvement.

6.3 Justification for integration approach

Mixed methods integration can enable generation of new insights as "the whole can be greater than the sum of the parts"(175). For this project, findings from all components of the PhD were compared to generate new insights and develop a greater understanding of how digital triage functions. There are different approaches to integrating mixed methods data(176), including three main approaches that have been previously described by O'Cathain et al(177). These approaches include: 1)mixed methods matrix, 2) following a thread, and 3) triangulation. The first two approaches are conducted at the analysis stage whilst triangulation can be used for comparing findings at the interpretation stage(177, 178).

Triangulation was selected as it enables the analysis of quantitative and qualitative components separately, followed by the integration of findings, which was felt to fit in well with the overall convergent study design used in the PhD project. Triangulation is the only method to identify areas of 'silence', where a finding arises in one study but not the other(179); this was considered to be important for this project due the differing focus and nature of the quantitative and qualitative components of the project. Additionally the triangulation method was selected as it enables multiple perspectives to be brought together and enables the researcher to tap into different approaches to investigate a phenomenon(179) and generate insights(177).

The triangulation protocol provides structured steps for conducting integration (as presented in the section below). These steps were felt to be an appropriate way to ensure the numerous findings from the quantitative study were all considered in the integration with the systematic review and qualitative study findings. In contrast, the 'following a thread' technique uses a less structured approach through the use of a visual model to integrate findings(177).

The mixed methods matrix, another alternative approach, is most suitable for when there are comparable cases between the different studies(177), for example where people have responded to a questionnaire item and then this item or topic is discussed in the interviews. Triangulation was selected as the best approach as there was expected to be several areas of incomparable analysis units within the PhD study integration (for example call rates for different types of patients do not have a clear comparable case, beyond the types of patients involved in the interview study).

6.4 Use of triangulation:

Triangulation was conducted following the conduct of the systematic review and individual analyses of the quantitative and qualitative studies using the triangulation protocol. This protocol was initially developed for synthesis of findings from qualitative studies by Farmer et al.(179), however it is relevant and useful for conducting mixed methods integration(177).

The triangulation protocol involves the development of a "convergence coding matrix" representing key findings from each component of the project within a single matrix. The matrix presents areas of agreement, partial agreement, dissonance as well as silence within the findings of each study component(177). Farmer et al. describe a triangulation protocol consisting of six main stages which are followed to generate the matrix(179):

1) Sorting (dataset preparation), in this stage key themes are listed to cover all findings from the studies, these make up the rows of the matrix

2) Coding and assessment of convergence, partial agreement, dissonance and silence across themes and comparing completeness. At this stage, areas of silence are identified.

4) Completeness comparison. At this stage the datasets are compared for similarity and uniqueness to create a unified summary from across the studies for each theme.

5) Researcher comparison, where agreement between researchers in their assessment of the degree of convergence is compared

6) Feedback, which involves sharing of the matrix with the research team for comment and discussion to check accuracy; this stage improves validity of study findings.

These steps were followed in the integration, with two modifications to the process, as described below.

The first small modification related to step 5 (researcher comparison). This researcher comparison stage is considered important when different researchers are responsible for different studies(177, 179). As the PhD candidate completed all elements of the study, this stage was slightly modified in that it was completed primarily through discussion of findings/interpretations with the supervision team. Findings were discussed throughout the

PhD project and during the integration stage for all elements of the project. For example, findings from the quantitative routine data study were initially discussed with Dr Gary Abel (GA), and were subsequently discussed with the whole supervision team; this supported the interpretation of findings. For the interview study, interview transcripts were read by Dr Helen Atherton (HA) and Dr Carol Bryce(CB); and coding and subsequent thematic analysis was also discussed with HA and CB. Finally, discussions with the whole supervision team fed into the development of the convergence comparison matrix presented in this chapter.

The second modification was an additional step to consider and present stakeholder feedback alongside the integrated findings, which served to validate the findings. The process for obtaining stakeholder feedback, the stages followed to conduct the integration and the resulting matrix are described in further detail below.

6.5 Methods

6.5.1 Generating the convergence comparison matrix

The initial sorting stage involved listing key themes from both quantitative and qualitative studies, these key themes correspond to each row; the key theme is described in the second column in Table 28.

Following the sorting stage, the key theme was considered across all PhD elements (the systematic review, and quantitative and qualitative studies) and an assessment was conducted by the PhD candidate to identify areas of similarity, dissonance, and silence. The second column shows the level of agreement across the studies, and notes on the reflection and rationale on level of agreement was recorded in the third column. Finally, a unified summary (fourth column) was generated and a key integrated theme identified (fifth column). The matrix was discussed with the supervision team with feedback incorporated.

6.5.2 Incorporating stakeholder input

The PhD candidate gained internal funding through the Warwick industry and stakeholder forum funding award to run a dissemination workshop where findings from the quantitative routine data study and qualitative interview study were presented to several stakeholders. Attendees included clinical leads from the participating urgent care service providers, and employees from Advanced Health and Care ltd, external UK based researchers, the Nuffield Trust, the Scotland based NHS24 service and members from the PPI group. Polls were conducted to identify areas of most interest to service providers and stakeholders, and two breakout groups were set up to gain input from attendees on their experiences in relation to the research findings and what they would like to see in future for improving service delivery.

In addition to the stakeholder feedback, several meetings to discuss the PhD project findings were held with the individual participating care providers, external researchers, and NHS England, including individuals with responsibility for the NHS111 service in England.

The PhD candidate additionally obtained funding from the Warwick-Monash Alliance to travel to Australia and disseminate findings to an international audience. The PhD findings were presented to research groups within Monash University, this included a presentation of the work at: 1) a seminar given to the Department of Primary Care, 2) a departmental meeting at the Department of Paramedicine and 3) a forum within the school of nursing. The work was additionally presented to Ambulance Victoria, who operate in Melbourne and use Odyssey within their service and a clinical user group based in Australia who also use Odyssey in their provision of urgent care.

Notes and audio recordings of the stakeholder event, dissemination work conducted in Melbourne and individual meetings were considered in the interpretation of the PhD findings (see **Error! Reference source not found.** for selected slides from the stakeholder event). The findings were also considered in relation to the integrated findings during development of the convergence coding matrix. Key suggestions for further development of this research were mapped to the key integrated themes, as shown in Table 29.

6.6 Results

This section combines the findings from the systematic review, quantitative and qualitative studies within the convergence comparison matrix, considers the stakeholder feedback and discusses the integrated themes generated.

A summary of findings from the triangulation process via the convergence comparison matrix is presented in Table 28.

Table 28 Convergence comparison matrix comparing findings from the systematic review, quantitative and qualitative studies.

row	Key quantitative findings/themes	Agreement / partial agreement / dissonance/ silence	Notes on comparisons and agreement/dissonance	Unified summary	Integrated theme
1	**Service use – call rates by patient group/symptoms:** Highest call rates about youngest and oldest age groups Deprived groups had highest call rates (likely due to greater prevalence of urgent conditions in these groups). Urgency of calls in deprived groups was similar compared to less deprived groups.	Partial agreement (Analysis unit not fully comparable)	**Qualitative -** Partial agreement based on types of patients involved in interviews, however this comparison approach has limitations (qualitative sample not intended to be generalisable): Involvement of participants calling about the youngest age groups. Some involvement of calls about the oldest age groups, where calls were typically made by a carer on behalf of the patient. However poor involvement of patients	The qualitative study showed that telephone based urgent care helped meet unmet demands (e.g., where patients have difficulty accessing their GP). Whilst patients living in deprived groups make up the highest proportion of callers / high rates. This suggests that urgent care is likely to be important in meeting unmet care needs (access via GP)in the most deprived groups. There was partial agreement in the patient characteristics; the PhD study	**Complexity** (access and unmet care needs)

	Top three presenting symptoms included cough, abdominal pain and high temperature		who lived in most deprived deciles. **Systematic review** – Agreement in the largest proportions of calls about younger age groups. However, higher call rates relating to older age groups was not found in the systematic review: studies within the review did not report service use (call rates) in relation to population denominators therefore may have underestimated use in older age groups. Partial agreement in the top presenting symptoms. Top presenting symptoms in review included abdominal symptoms; whilst Covid-19 related symptoms (cough and high temperature) were frequent presentations in the	showed there were more patients presenting with Covid-19 related symptoms. PhD study identified older adults as having high call rates compared to the review (Likely due to methodological differences: studies within the review did not report call rates in relation to population denominators)	

			quantitative study due to the study timing / Covid-19 impact.		
2	Call lengths: the longest calls (20 min+) were twice as likely to be downgraded from the digitally recommended outcome urgency (where the call is manually downgraded in urgency level by the clinician, from the digitally recommended urgency level). There were greater odds of call upgrading, and lower odds of call downgrading from the digitally recommended urgency during the	Partial agreement (Analysis unit not fully comparable)	**Qualitative -** Patients expressed feeling more reassured when given the time and space to communicate their symptoms, this involved discussion of the best course of action. In some cases, this enabled patients to stay at home. However, this could have an alternate explanation (calls that are downgraded to self-care/routine care may take longer to conduct due to the clinician providing self-care advice and safety netting advice to follow in case the patient's condition deteriorates) **Systematic review** - silence within the systematic review;	Findings suggest the importance of clinicians' softer skills and taking time to speak to patients, in conjunction with digital triage. Allocating sufficient time when conducting triage may help in call downgrading and enabling patients to self-care at home. Additionally, resource availability (how busy the service is, and therefore how much time a clinician can spend with the patient) likely also influences downgrading. When the service is busier, clincians may be less likely to spend time speaking to the patient, and more likely to upgrade the call.	**Inconsistency in care** (variation in triage outcome and patient experience based on call length, time of calls which may be due to service availability)

	busiest periods (e.g., weekend days)		no studies reported on call length or time of day in relation to upgrading/downgrading		
3	Call lengths increased after the start of Covid-19	Agreement in qualitative study Silence in systematic review	**Qualitative -** Patients described discussing best course of action after the triage call, for example fears of exposure to Covid-19. Sometimes leading them to self-care / stay out of hospital. Patients described additional delays (Covid-19 screening questions / discussions of testing requirements prior to accessing the recommended subsequent face to face care.	(As above) Importance of clinicians' communication skills in conjunction with digital triage; allocating sufficient time when conducting triage, which may have been possible due to lower call rates after the start of Covid-19	**Impact of Covid-19** **Inefficiency** (delays in the process)

			Systematic review - silence; no studies reported digital triage service use in relation to onset of Covid-19		
4	Number of calls to the OOH service providers decreased after the start of Covid-19	Partial agreement in qualitative study (Analysis unit not fully comparable) Silence in systematic review	**Qualitative -** *Differing access routes* -Patients discussed their use/ awareness of alternative routes of access e.g., via NHS 111 online (these were promoted after the start of Covid-19) *The responsible patient* **–** patients did not want to burden the healthcare system particularly during the onset of the Covid-19 pandemic. **Systematic review** - silence; no studies reported digital triage service use in relation to onset of Covid-19	Secondary triage call rates decreased after the start of the Covid-19 pandemic, which may be explained by patients not wanting to burden the health system at this time and using other routes	**Complexity** (access and unmet care needs) **Impact of Covid-19**

5	Comparing primary and secondary triage outcomes: Calls are often upgraded/downgraded by several levels of urgency from primary triage outcome urgency A proportion of patients (2.1%) are referred to emergency care (potentially should have been directly referred to emergency care by NHS 111 service)	Partial agreement (Analysis unit not fully comparable) Silence in systematic review	**Qualitative -** Patients described needing to go through multiple steps to push for the care they felt was needed. In one patient interview, patient described ending up in intensive care on the day of secondary triage (should have been referred directly from 111 to emergency service?). **Systematic review** - silence, no studies have reported on secondary triage outcomes in the context of ‘two-step’ triage.	Suggests that clinician led triage is important as a safety net in two-step triage and that some patients should have been referred directly to the emergency service. Non-clinician triage may miss emergency cases	**Inefficiency in the process** **–Complexity** (patients faced complexity in navigating/needing to push for care)
6	Variation in clincians’ use of digital triage – substantial variation in:	Partial agreement	**Qualitative -** Some patients described having used service previously, and experiencing varying levels of reassurance, quality of communication from different	There is a lack of consistency between clinical call takers in how they triage calls, which may be impacted by how busy the service is. This is supported by some patient experiences.	**Inconsistency in care** (variation in triage outcomes

	1) selection of urgent outcomes (care within 6 hours or less) 2)upgrading/downgrading from digitally recommended triage outcome 3) upgrading/downgrading from pathways triage Variation in above outcomes relating to the service provider which triaged the call	(Analysis unit not fully comparable) Silence in systematic review	call takers. Patients understood different times of the week when services are under pressure, which may impact on care received (within the theme of the responsible patient). Qualitative study highlighted potential differences between service providers e.g., services differed in their prompting to hear patient's breathing (an example of operational difference which may explain variation between service in triage outcomes) Some dissonance: Variation could be explained by factors that influence the triage outcome relating to the patient e.g., knowledge/confidence/family support. However, this does not explain the magnitude in variation.	However, there are other factors at play relating to the patient (e.g., their health literacy, level of support, assertiveness)	associated with individual clinician)

			Some silence: Difficult to capture variation by individual clinician from a patient perspective due to the nature of telephone based urgent care: usually infrequent use of services and lack of primary triage outcome visibility to the patient. **Systematic review -** silence within the review, no studies explored clinician level variation. Varying degrees of adherence to advice reported, which could reflect clinician variation.		
7	Certain calls had greater odds of urgent outcomes being selected/ being	Partial agreement in qualitative study	**Qualitative** - Older age groups had greatest odds of urgent triage outcomes being selected and being upgraded. Clinical		**Inconsistency in care** (variation in

	upgraded / downgraded from digital recommendation / primary triage: Patient characteristics (e.g., age/sex) Based on symptom type Call time: Saturdays/ afternoon periods had greatest odds of upgrade and selection of urgent outcomes	and systematic review (Analysis unit not fully comparable)	complexity of presenting problem in older patients and need for emergency care evident in some interviews. Could not capture symptom specific differences within broad qualitative sample. **Systematic review** - identified that callers with limited English proficiency had triage outcomes with a higher urgency; this was an area of silence in the PhD studies as this information was not captured. Systematic review identified certain symptom types were more likely to result in higher urgency outcomes (e.g., children with respiratory complaints)/ regression models in PhD quantitative study not run by symptom and age group		triage outcomes associated with patient level factors, time of call)
	1. **Key qualitative themes**	**Level of agreement in**			

		quantitative study & SR			
8	*Navigating the system* Choice of access route: burden on the patient e.g., NHS 111 online not suitable for serious problems – care needed when making choice. Difficulty in accessing care through usual route so turning to urgent care.	Silence	**Quantitative -** Whilst silence in quantitative study, row 1 (Deprived groups had highest call rates, which may suggest greater access to care via general practice) and row 4 are relevant(Number of calls to the OOH service providers decreased after the start of Covid-19 – likely due to other access routes 119 service/ NHS 111 online **Systematic review** - silence within the review, studies did not report on patients experiences prior to triage		**Complexity** (access and unmet care needs)
9	Two-step triage (England) vs direct clinician triage	Partial agreement	**Quantitative -** Evidence of large degrees of upgrading and downgrading suggests limitations in the accuracy of	Evidence from qualitative and quantitative analysis suggests that quality and safety of non-clinician	**Complexity**

	Complexity: too many steps / processes too long/ not understanding need for two triage levels	(Analysis unit not fully comparable)	non-clinician triage and highlights the need for secondary triage. Area of silence: direct clinician triage not evaluated in quantitative study. **Systematic review** - silence within the review, studies did not report on patients' experiences of two-step triage; rather they focussed on initial non-clinician triage or direct clinician triage	triage requires improvement and investigation	**Inefficiency** (in relation to large degrees of upgrading/downgrading)
10	Complexity in care journey: Poor integration, being referred to wrong place– or not getting the required care (following triage)	Silence in quantitative study Agreement in systematic review	**Quantitative -** Silence, as patients' subsequent health care use following triage is not captured within the quantitative study. **Systematic review** – agreement, studies reported greater patient satisfaction where services were integrated	Interview study showed experiences of poor integration between urgent and emergency care providers, which aligned with findings in the systematic review; however, this was beyond the scope of the quantitative study	**Complexity** (access and unmet care needs)

			well e.g., where the service conducting triage could book a subsequent appointment on behalf of the patient		
11	Communication: Importance of reassurance and having the space and time to explain symptoms (conversely, rigidity in communication when patients did not feel listened to)	Partial agreement in quantitative study (Analysis unit not fully comparable) Agreement in systematic review	**Quantitative -** Partial agreement in relation to greater downgrading when more time is spent; however, insight from quantitative study is limited. See row 2. **Systematic review** – agreement, studies reported positive experiences of patients having thorough assessments and feeling reassured by call takers.	See row 2	**Inconsistency in care** (variation associated with individual clinician)
12	Patient-professional dynamic (patient's confidence, knowledge, and health literacy; validation; shared decision making)	Silence in quantitative study (Analysis unit not comparable)	**Quantitative -** Silence due to incomparable analysis units, patient-professional dynamic is likely to influence variation of triage outcomes (but does not	See row 6	**Inconsistency in care** (variation associated with individual clinician / patients can

	influences triage outcome	Partial agreement in systematic review	explain extent of variation seen between clincians in their use of digital triage), see row 6. **Systematic review** – partial agreement, studies reported patients feeling that they needed to be assertive to receive the care advice they expected; review additionally reported one study where patients felt scrutinized during triage		influence triage outcome through their confidence and knowledge)
13	The good / responsible patient	Partial agreement in quantitative study (Analysis unit not fully comparable) Silence in systematic review	**Quantitative –** May be reflected in lower service utilisation following onset of Covid See row 4. **Systematic review** - silence within the review; this may be due to survey-based studies not capturing this or studies not reporting on this element of experience; it may be more	Patients described their understanding of pressures, particularly in light of the Covid-19 pandemic; some were hesitant to use the service as a result. The quantitative study showed a decrease in the call rate to the urgent care providers after the start of Covid-19	**Impact of Covid-19**

			pronounced in the PhD study due to the Covid-19 pandemic.		

6.6.1 Stakeholder input

Feedback from the dissemination workshop and meetings was considered in the interpretation and validation of the PhD research findings. These feedback points have been mapped to the integrated themes (Table 29). Further observations and questions which could be considered in developing future research are summarised in the box below, these are considered in greater depth in the following discussion chapter.

Box 2: Stakeholder input: areas of interest / points to consider when doing future research.

1. How are medical records and medications used during digital triage? (both in primary and secondary triage)
2. Considering the study findings (the importance of sufficient time for triage and the level of variation associated with clinicians), there is a need for digital triage standards to be developed including, for example, guidance on appropriate timeframes for clinicians to spend on a call.
3. How can the use of reassuring and empathic communication in urgent care be promoted and used to improve patient care?
4. Inclusion of high-risk patient groups in research, for example, children with disabilities (this is not a potential study but something to consider when doing research).

Table 29 Integrated themes and stakeholder feedback

Key theme elements	Stakeholder observations / areas of interest
Theme 1: Complexity	
• Urgent care is important in meeting unmet care needs in the most deprived groups: The qualitative study showed patients turn to telephone based urgent care as a second-best option, e.g., when they can't access their GP. Whilst patients in the most deprived groups make up the highest proportion of callers / high rates. • Patients who were referred to NHS 111 from another care service were not sure of the role of NHS 111 • Patients described difficulty during triage when there was more than one symptom/health concern. • Evidence from qualitative and quantitative analysis suggests that quality of non-clinician triage requires improvement and investigation; non-clinician triage may cause delays and miss emergency cases.	Findings in line with service provider experiences. Stakeholder expressed the importance of: - Gaining a better understanding of when patients do and don't follow the recommended triage outcome, and the reasons for patients attending ED – e.g., is it because they can't access a GP, rather than them thinking it is an emergency? - Understanding how the use of medical records impacts on digital triage outcomes and patient safety. - Further exploration of high-risk/complex patient groups (abdominal pain) - Promote patient/public education: E.g., for conditions such as fever in children, where self-care is appropriate; expectations: promote understanding of the different routes that are available and the circumstances in which each should be used. - Agreement that service availability impacts on clinical decisions e.g., greater upgrading on Saturdays when there is a

	long wait for general practices to open on Mondays. To address this, more referral pathways required (available services to which patients can be referred to receive timely care).
Theme 2: Inconsistency in care	
- Triage outcome urgency associated with factors including: time of call, length of call, individual clinician conducting triage, and the service conducting triage, symptom. - Patients can also influence triage outcome urgency (e.g., through their health literacy, level of support, assertiveness). - Importance of clinicians' communication skills (including reassurance in communication) in combination with digital triage; allocating sufficient time when conducting triage may help in call downgrading. - Symptom specific risks identified in the quantitative study; however, this was an area of silence in the qualitative study.	Findings in line with service provider experiences. Upgrading of digitally recommended outcomes in sore throat and earache may be explained by patient expectation for antibiotics for these symptom types. Clinician's decision-making during triage is also impacted by their clinical experience and specialty, confidence after an incident, needing to meet targets (e.g., for call lengths / not sending too many patients to emergency services). Decision making is additionally impacted by the clinician's communication skills which affects assessment and management of patient expectations and anxiety. Diverse patient groups e.g., dementia / translation needs, will influence call lengths/triage outcomes. It is important to investigate clinical issues that are known to be difficult to triage. e.g., Abdominal pain is often underestimated and is a risk area. First hand experiences of need for better supervision / support to clinicians working within urgent care triage. This may help improve the service. **Potential areas to develop research:**

	How can reassuring communication be promoted and used within secondary triage; exploring reasons for inconsistency between clinicians; use of bench marking; development of digital triage standards to support clinicians' digital triage use
Theme 3: Inefficiency in two-step triage	
• Upgrading and downgrading of primary triage outcome urgency by several levels highlights importance of re-triage. • The majority of calls (70%+) downgraded; a small proportion are upgraded to emergency care. • Patients felt frustrated at delays and repetition in the process	Findings in line with service provider experiences, no specific observations or areas of interest discussed
Additional theme: Impact of Covid-19	
• Secondary triage call rates decreased after the start of the Covid-19 pandemic, which may be explained by patients not wanting to burden the health system at this time. This may have meant services had more time to allocate to triage calls. • Longer call length reported in quantitative study following covid-19 start; patients described Covid-19 related screening questions and discussing fears of exposure to Covid-19 during triage	Findings in line with service provider experiences, no specific observations or areas of interest discussed

6.6.2 Feedback from NHS England

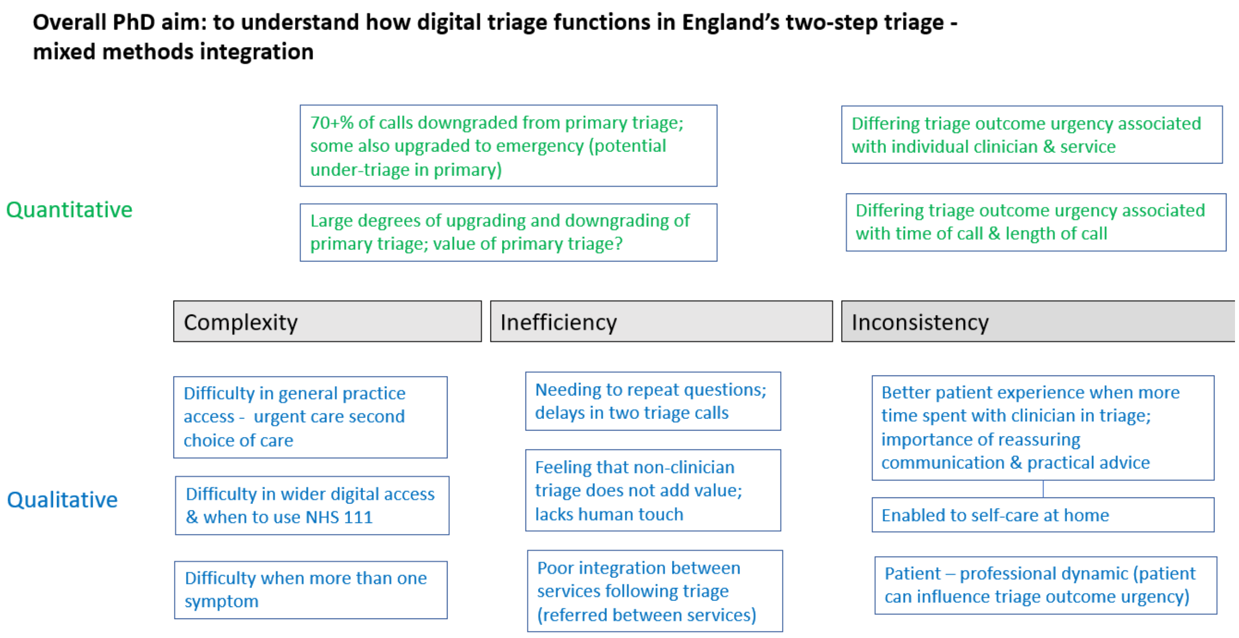
The PhD candidate and supervision team met with individuals from NHS England and NHS Improvement teams in June 2022. The PhD candidate presented key findings from the PhD research, with a focus on the change in triage outcome urgency between primary and secondary triage, which showed a large degree of call urgency downgrading from the urgency level assigned by the NHS 111 telephone service.

NHS England members expressed that the NHS 111 service is designed to be risk averse and felt the findings (approximately 70% of calls being subsequently downgraded in urgency level) were as they would expect. They additionally expressed concern about how the research would be disseminated. Following this feedback, care was taken in the publication of the quantitative study to present the findings of the research in context: the publication clearly states that primary triage is risk averse by design, whilst highlighting limitations of the system. Members of NHS England were invited to the wider stakeholder dissemination workshop which was attended by participating service providers and members of NHS 24 Scotland; however, they declined to attend this. A further meeting was held with a member of NHS England (NHS England Regional Clinical Lead for Integrated Urgent & Emergency Care); findings were well received, including their importance in helping to highlight where urgent care triage can be improved.

6.6.3 Integrated themes

Integrated themes related to 1) complexity within the system of care (both during triage and throughout the care journey), 2) inefficiency in the two-step triage process and 3) inconsistency in care. A summary of the key integrated findings is shown in Figure 10 below and the sub-themes are described in the following section.

Figure 10 PhD research integrated findings.



6.6.4 Complexity

The qualitative study highlighted complexity in the choice of care. When considering the patients' decision to access care via the telephone-based services, the qualitative study showed that patients turn to these services when they are unable to access their first choice of care, for example via their general practice. This suggests that telephone based urgent care plays a vital role in helping patients with unmet care needs navigate the wider healthcare system. Whilst access to care was not explored in the quantitative study, call rates amongst different groups provide some insight. For example, the most deprived patient groups had much higher call rates. When considering greater service use in deprived groups together with the qualitative study findings, this suggests that deprived groups likely have greater unmet needs in the wider care system, and that urgent care provision is particularly important for addressing care needs in this patient population. This is well recognised in the broader literature and is discussed further in the next discussion chapter (comparison to other literature section).

Additionally, patients described not always understanding the need for two levels of triage, finding it unnecessarily complicated.

6.6.5 Inefficiency in two-step triage

Inefficiency in two-step triage was identified as an integrated theme when considering the findings from both the quantitative and qualitative studies. Some patients expressed their frustration with the process; they felt that the primary triage did not add anything and, in some cases, delayed the care that was required.

Meanwhile, the quantitative study highlighted very high levels of change between primary and secondary triage outcomes, which suggests limitations in the accuracy and usefulness of primary triage. The quantitative study also suggests that clinical risk may be underestimated in primary triage in some calls, and therefore may delay emergency or immediate care in some patients. This delay in receiving care was echoed in patients' experiences. However further research investigating patient outcomes following triage is required to better understand this.

6.6.6 Inconsistency in care

The quantitative study showed individual variation between clinicians in their selection of urgent triage outcomes and in how likely they were to upgrade and downgrade calls. This suggests that clincians greatly vary in their clinical decision making, even when using standardised digital triage tool.

The qualitative study corroborated this finding to some extent, with patients describing call takers to be variable in how helpful and reassuring they had been, when they had used telephone-based services on more than one occasion. Partial agreement was selected for this finding, as the focus of the interview study was on the patients' latest experience of secondary telephone triage (with many patients being first time users) and therefore only a few patients mentioned their variable experiences based on their interaction with different clinicians in their previous service use. The qualitative study also indicated that the patient's knowledge, confidence and the support of a partner or family member influenced their interaction with the call taker and influenced the final triage outcome. These factors were not considered in the quantitative study due the lack of patient experience information being available due to the nature of the call record data used. These differing patient factors and behaviours will likely impact on triage outcomes, however, they do not explain the extent of the variation seen between clinicians. The influence of the patient on clinical decision making in relation to existing literature is presented in the next discussion chapter (comparison to other literature section).

The quantitative study indicated certain call types had greater odds of urgent triage outcomes being selected (care within 6 hours or less), including in female patients, older patients, calls made on Saturdays and calls made in the afternoon period of the day. For most of these factors there was silence in the qualitative study, due to the differences in the nature of the data collected, which are discussed further in the strengths and limitations section.

Areas of partial agreement related to patient age and sex, where older patients described having more complex needs and co-morbidities, which likely explains the greater odds of urgent outcomes in this group. Stakeholders discussed that parents of younger children were frequent callers of problems that can be simply resolved through care at home (e.g., calls relating to fever), which supports the lower odds of urgent outcomes in calls about younger patients. Stakeholders additionally felt that awareness of health problems that can be cared for at home should be promoted to raise awareness of when urgent care should and should not be sought.

When considering patient sex, the qualitative study indicated some hesitancy in male patients using health care services more broadly with some male patients describing encouragement from their female partners in seeking care; male patients may be playing down their symptoms, resulting in less urgent outcomes.

Call related factors (e.g., call length and time of day) were associated with upgrading and downgrading of the digitally recommended triage outcome by clincians; for example, longer calls had greatest odds of the digitally recommended urgency level being downgraded by the clinician. The qualitative study showed that patients felt more reassured when they had sufficient time to explain their symptoms and to discuss practical self-care at home. Taken together, these findings may suggest that clinicians who spend more time during triage could help patients to stay at home and care for themselves where appropriate. Longer calls may be more likely possible when the services are not under too much pressure and therefore well-resourced with clincians conducting triage. Therefore, well-resourced urgent care could have an impact on reducing demand on urgent and emergency care services from less patients seeking follow up care. Downgraded may take longer as this likely involves the clinician taking more time to do a thorough assessment, providing advice to the patient and safety netting advice in case the patient's condition worsens.

Finally, in the qualitative study there were differences between clinicians in their level of prompting for audio and visual information; it appeared that clinicians in Northern Ireland based services proactively requested audio and visual symptom information, whilst clinicians in England based services did not. Patients described the use of this type of information as helpful and felt that it informed the advice they were given. This suggests that use of this information may inform urgency level, however this was an area of silence within the quantitative study, as data relating to the use of audio and visual information was not available in the routine call record data. In addition, routine triage data was not available for the Northern Ireland based site and therefore was not included in the quantitative study; therefore, the potential impact of the use of audio and visual information on triage outcomes could not be investigated.

The stakeholder group raised a number of additional factors that may play into variation seen in clinicians' decision making, such as the clinician's experience, and a prior mistake or incident they had been involved in. Stakeholders also highlighted that the availability of medical records and the complexity of the patient and influences the time spent on a call, for example patients with dementia or where an interpreter is required would take longer to triage.

6.6.7 Impact of Covid-19

The impact of Covid-19 was evident in elements of both quantitative and qualitative studies and is a cross-cutting theme. In the qualitative study, the impact of Covid-19 was seen in the theme of the good/responsible patient where patients described their awareness of alternative routes of access e.g., via NHS 111 online and not wanting to burden healthcare services unless it was necessary. This was reflected in the quantitative study with lower call rates following the Covid-19 pandemic, where patients likely used alternative access routes. The qualitative study showed patients' differing concerns relating to the Covid-19 pandemic; for example, wanting to avoid going into hospital due to fears of exposure to Covid-19; this may have impacted on triage outcomes, however, was not explored in the quantitative study.

6.7 Strengths and Limitations

One factor that is both a strength and a limitation relates to areas of silence in this integration. This is a strength as it has enabled several areas for further research to be highlighted through identification of areas of silence(177); these are considered in further detail and presented in the following discussion chapter.

It may also be considered a limitation due to "incompatibility between the units of analysis"(179) identified in some areas of integration, where key findings between the studies could not be compared due to differences in the data available. This relates to differences in the focus, scope, and nature of the data analysed in the different studies. The quantitative study data was more granular and focussed specifically on the digital triage call record, including information such as the patient's demographics, symptom, and the resulting triage outcomes whereas the patient experiences covered the broader journey including patients' decision making on where to access care ahead of telephone triage, and the subsequent care, including their use of follow up services. Additionally, patients have limited visibility of some elements of the digital triage process; for example, patients likely had no visibility of the preliminary triage outcome assigned by the non-clinician during primary triage.

Despite the difference in focus of the studies, the resulting synthesis outlined in this chapter highlights how patient experiences can help to understand how clinicians digitally triage patients, and areas for service improvement. For example, through further training on the importance of patients feeling listened to, encouraging reassuring communication and ensuring that call takers have sufficient time to triage calls may help to improve call takers communication skills.

The different focus of the quantitative routine data study and qualitative interview studies was not designed at the study outset, rather it arose due to the exploratory nature of the quantitative study. The quantitative study explored several associations with the patterns of secondary triage outcomes; a key finding related to the individual clinician conducting triage being the factor that had greatest influence on how likely calls were to be upgraded or downgraded. This key finding relating to the individual clinician was not expected at the outset. At the outset the qualitative study was designed to focus on patient experience rather than healthcare professional perspectives, to fill the evidence gap relating to patients, however this meant there are areas of silence when considering why there was variation between clinicians in their selection of triage outcomes and upgrading/downgrading.

Finally, a further strength is that triangulation method was modified with the addition of a step to consider stakeholder input alongside the integrated findings. Inclusion of a wide range of stakeholders' observations, interpretations and key areas of interest/importance served to validate the findings and highlight contextual factors that should be considered in the interpretation of findings and to consider when designing future research.

6.8 Chapter summary

This chapter has justified and described the triangulation method used to integrate findings from the research in the PhD. Key findings, arising from the integration were presented via a convergence comparison matrix, and stakeholder feedback was fed into the synthesis. Three integrated themes of complexity, inefficiency, and inconsistency within two-step triage were presented. Several areas of silence were identified, which can be considered both a strength and weakness, in part this occurred due to the differing scope and nature of the individual studies. These areas of silence and how they may be explored in further research are presented in the following discussion chapter.

7 Discussion chapter

7.1 Chapter overview

This chapter discusses the overall PhD findings, strengths and limitations of the project, and comparisons of the findings to the wider literature. Finally, recommendations for future research, policy, service delivery and technology providers are presented.

7.2 Summary of PhD findings

The overarching PhD project aim was to understand how digital triage functions in England's two-step delivery of triage in urgent care.

There are three key finding areas that result from this PhD research. Firstly, this research suggests that secondary clinician-led digital triage is important within the two-step model and likely enables the more efficient wider use of urgent and emergency care. Secondly, there are several factors that impact on secondary triage outcome urgency, which may impact on how patients subsequently go onto use these healthcare services. The third finding relates to complexity and inefficiency of two-step triage, which may introduce risk to patients using telephone based urgent care. These three finding areas are discussed in further detail below.

7.2.1 Importance of secondary triage within England's delivery of two-step triage

This PhD research suggests that secondary triage is important in England's delivery of urgent care and may support patient safety and promote the more efficient use of the urgent and emergency care system.

Exploring patterns of change in triage outcomes between primary and secondary triage highlighted that the majority (over 70%) of calls were downgraded in secondary triage from the assigned urgency level in primary triage. For example, in around 20% of calls clinicians selected an urgency level corresponding to routine care or self-care, whilst less than 2% of calls were assigned these lower urgency levels in primary triage. This re-triage may divert patients away from unnecessary use of urgent and emergency care, including attending ED, however further investigation of patients' service use following triage is needed to confirm this, and is discussed further in the implications for research section of this chapter.

7.2.2 Complexity and Inefficiency in two-step triage

Patients experienced complexity in navigating the two-step triage process and subsequent care. This encompassed difficulties in access, including the best choice of access route (for example online self-triage via NHS 111 online vs telephone triage). Patients additionally expressed wider unmet care needs including difficulty in accessing their first choice of care, which was typically general practice.

Complexity also related to some patients not understanding the need for two-step triage and experience of delays and repetition in the process. Delays caused concern and frustration in some patients due to timeliness of care not meeting expectations. Some patients expressed primary triage as lacking human touch and questioned its value. Difficulty navigating the system of care following triage was also evident, for example patients described being referred between urgent and emergency care services or being referred to a care service which was not able to provide the care that the patient felt was necessary.

The large degree of change in urgency levels between primary and secondary triage highlights inefficiencies and an additional layer of complexity for the patient to navigate through. Additionally, a small proportion of patients may be being referred for secondary triage when they require emergency care, suggesting that clinical risk may have been underestimated in the primary triage of these calls. Two-step triage may introduce an unnecessary delay for patients seeking care, which could present a risk to some patients requiring emergency care. Based on these inefficiencies, these findings bring into the question the value of primary non-clinician led.

7.2.3 Factors impacting triage outcome urgency and patient experience.

Several associations with triage outcome patterns were investigated in this research, through exploring clinicians' selection of urgent outcomes (care within 6 hours or less), and their overriding or acceptance of digitally recommended triage outcomes. Factors that impact triage outcome urgency are important as they make up the resulting advice the patient is given and thus will impact how patients go on to use emergency, urgent and routine care following triage. The patterns identified that represent areas of new knowledge are summarised in this section.

A key finding relates to the variation between service providers in their selection of urgent outcomes and in their overriding of digitally recommended triage outcome. This highlights that clincians based in different service providers vary in their decision-making during triage, in whether to upgrade, downgrade or accept the digitally recommended urgency. This may be explained by local ways of working at the service provider for example, (e.g., extent to which clinicians are trained to follow the digital triage guidance or encouraged to use their clinical judgement. Services may differ in the proportions of nursing staff with different experience (e.g., some service providers may have more advanced nurse practitioners or specialty nurses).

Another potential difference in ways of working at service providers was identified through the qualitative study, where patients in the Northern Ireland based service described being prompted by the clinician for audio information (being asked to hear the patient's breathing) whereas this was not the case in the England based service. Patients felt the use of this type of information assisted communication during triage; in some cases, they described that it influenced the clinician's subsequent recommendation of care. However, further research is required to better understand how the use of audio and photo-sharing may support triage and is considered in more detail in the implications section of this chapter.

Another difference between service providers could be the pressure under which they are operating; this may be impacted by the patient population served and the availability of local services where patients can be referred to (e.g., the capacity within local out of hours centres) may all impact on clincians' decision making in their selection of urgent outcomes and in their upgrading and downgrading; if there is good availability within an out of hours centre, they may be more likely to refer the patient to it for an appointment rather than recommending the patient to attend ED.

A further key finding was the very high variation between individual clinicians in how likely they were to select urgent triage outcomes and how likely they were to upgrade or downgrade calls, despite the use of a standard digital triage tool. Several factors may influence a clinician's decision making, which are discussed further in the comparison to other literature of this chapter.

One potential factor that may explain this variation relates to the clinician's communication skills. Patients particularly valued reassuring communication during triage and being given sufficient time to explain their symptoms and concerns and feeling that they were being listened to. The importance of being listened to and experiencing reassuring communication to patients was identified in the systematic review as well as within the qualitative study.

This research also showed that longer calls had greater odds of being downgraded in urgency level, whilst some patients expressed that reassuring communication made them feel more confident to self-care at home. As discussed in the previous chapter the association between the longer call length and greater odds of downgrading may be explained by the clinician needing to spend more time on completing the full triage question set, taking more time to assess the patient, providing care advice and safety netting advice to the patient and checking the patients' understanding of the advice given.

Although no studies in the systematic review reported on triage outcomes in relation to call length, there is some literature supporting the notion that longer consultations may promote patient enablement in the general practice setting; these studies reported increased care quality and patient enablement associated with longer consultation lengths(180-182).

However, when services are under pressure, clinicians may feel the need to curtail calls as quickly as possible, therefore this finding suggests the importance of urgent care services being well staffed so that clincians can spend sufficient time with patients; this may enable patients to self-care at home or arrange a routine care appointment where appropriate, which in turn may help reduce demand on urgent and emergency care providers.

Finally, patients may also influence triage outcome urgency through their approach to triage through their prior experience of seeking healthcare, knowledge of their symptoms, and their communication skills. For example, patients and carers who expressed feeling confident about their care needs were able to influence the level of urgency (e.g., by demanding ambulatory care) assigned during triage and described participating in shared decision making. Family members were often involved in encouraging hesitant patients to access care and supported communication during triage. However, the approach of the patient during triage cannot fully explain the extent of the variation seen between individual clincians in their selection of urgent triage outcomes and their over-ridding of digitally recommended triage outcomes.

7.3 Strengths and Limitations

The strengths and limitations of the individual studies and the synthesis were considered in the respective chapters; this section summarises the strengths and limitations of the overall project design, methods and resulting findings.

7.3.1 Strengths

This research is the first in-depth mixed methods evaluation of two-step triage that operates in England's delivery of urgent care. Previous research has considered direct clinician triage (the single step triage that is typically used internationally) or focussed only on the initial non-clinician triage within the NHS 111 service in England(32, 171) or the NHS24 service in Scotland(165). This PhD research generates new knowledge on two-step triage service delivery, including its risk aversity, with a large proportion of calls (over 70%) being downgraded in urgency following secondary triage. Additionally, there was a large degree of change (both upgrading and downgrading) from the primary triage outcome urgency level following secondary triage which may lead us to question the value of non-clinician triage and highlights the importance of secondary triage within the two-step model.

This research is the first to obtain patient experiences relating to two-step triage. The qualitative study recruited two service providers using different urgent care delivery models, two-step triage and direct clinician triage, in England and Northern Ireland based sites respectively. This additionally enabled the first comparative research between these two models, thus addressing a key gap in the existing literature. The comparative analyses highlighted that patients appear to experience more complexity and delay in two-step triage as compared to the direct triage model used in Northern Ireland. Patients also described a lack of human touch in relation to non-clinician triage within the two-step triage model, which was not expressed by patients in the Northern Irish service.

This PhD project approached the broad question of how digital triage functions in urgent care through an innovative quantitative study designed with the large scale granular digital triage routine dataset in mind, to explore a range of associations. An important and unanticipated finding related to the very large variation associated with individual clinicians in their selection of triage outcomes; with some clinicians having much greater odds of selecting urgent triage outcomes (care with <=6 hours), and some having much greater odds of how likely they are to upgrade or downgrade digital triage recommendations.

The exploratory approach used in the quantitative study has highlighted several important associations and patterns that warrant further research, these are summarised in Table 30. As discussed in chapter 6 (mixed methods integration), the qualitative element of the study has generated additional insights alongside the quantitative study, and questions for further research, for example would longer calls enable patients to better self-care? This is discussed further in section 7.5.2. below.

Finally, a key strength is that findings from the project were presented to several stakeholders, who reported that the findings were in line with their experiences of day-to-day service delivery, this served to validate the study findings. This PhD research has provided evidence supporting some of the difficulties faced within services. For example, stakeholders agreed that the availability of care services where patients can be referred and access care following triage impacts on clinical decision-making. The quantitative study demonstrated that patients calling on a Saturday are more likely to receive urgent triage outcomes. This may be explained by the call being made at a time when general practice is closed. In these cases, the call may be upgraded so that the patient can physically see or speak to an out of hours doctor (within a 6-hour target for example); this would not be possible via an urgent general practice appointment on a Saturday or Sunday when practices are closed.

A further strength is that study findings were widely disseminated to UK based and international audiences. Whilst this PhD research was conducted in England and Northern Ireland; presenting this work to an international audience has highlighted that many challenges presented here are consistent in other countries' urgent care systems.

7.3.2 Limitations

A limitation of the project is that the perspectives and experiences of call takers (both clinicians and non-clinicians) in their use of digital triage has not been investigated. Exploring their perspectives will help to better understand why there is variation between call takers in their interaction with digital triage, including their approach to call upgrading and downgrading and communication with patients.

Another gap within this PhD research is the lack of quantitative comparative evaluation of patterns of triage outcomes between services using 'two-step' triage and 'direct clinician triage'. Whilst the qualitative study evaluated the two differing models of urgent care delivery, the quantitative study considered only two-step triage; this was due to data not being available to share for research due to how the data was hosted within the Northern Ireland based service.

The use of routine data in the quantitative study meant that some relevant information was not available for the analysis. One example is that the complexity of the patient is not captured, for example if the patient was calling about more than one health concern or had an additional long-term condition. The complexity of the patient would likely impact on the triage outcome urgency and may impact on call length and could be one factor explaining the variation between service providers in their odds of selecting urgent secondary triage outcomes. For example, urgent care providers that serve a population with greater healthcare needs may be more likely to upgrade calls.

Some missing relevant information is a limitation of most studies that utilise routine data. Whilst there may be scope to extend this research by collecting information about other symptoms or conditions the patient presented with from the triage question and answer data, this was not undertaken in the PhD project as it is challenging to conduct at scale and is still unlikely to provide a full picture of the complexity of the patient.

Another example of data that was not available is further information about the clinician conducting triage: the type of nurse they were, (e.g., advanced nurse practitioner), and the number of years of clinical experience; these types of factors may have helped to understand the variation seen between clinicians and services in the odds of urgent outcomes being selected, and in upgrading and downgrading of triage outcomes.

Another limitation of the study is that service use and experiences of patient groups who are typically under-served in research, for example minority ethnic groups and those living in the most deprived areas could not be investigated fully in both the quantitative and qualitative elements. The participating service providers confirmed that this demographic was not widely populated on the electronic medical records that they have access to. Thus, in the quantitative study this meant there was missing data about ethnicity, this variable therefore could not be included in the regression modelling. In the qualitative study it proved difficult to recruit patients in different ethnicities, again because service providers were not able to easily invite this group due to them not having access to ethnicity information about their users. It also proved difficult to recruit patients living in the most deprived areas, despite the sampling strategy used and despite that patients in deprived groups make up a high proportion of service users. Approaches on how to include these groups in future research are discussed further in the implications section of this chapter.

In addition, due to resource constraints the qualitative study was restricted to recruiting patients who speak English, and similarly data relating to the use of translation was not available in the quantitative study. The systematic review identified that callers with limited English proficiency had triage outcomes with a higher urgency(62, 183); therefore understanding service use and the patterns of triage outcomes in this group requires focus and future studies that are adequately resourced studies to explore this.

Finally, as presented in Appendix 1, the protocol detailing the planned study to investigate patients' subsequent service use following triage, was excluded from the PhD research due to delays in the NHS Digital data application process. The lengthy and time-consuming nature of the data application process presented a significant challenge in this PhD project and represents a wider challenge to research that evaluates patient outcomes being conducted.

Understanding how patients go on to use ED and inpatient care is important in evaluating the effectiveness of digital triage, as it would provide insight on patients' compliance with advice, as well as the safety of triage, through investigating where digital triage may under- or over- estimate clinical risk. It is therefore a limitation that this part of the planned work could not be incorporated into the PhD thesis.

7.4 Impact of Covid-19 on PhD research

The PhD research coincided with the start of the Covid-19 pandemic declared in March 2020. The systematic review was started in March 2020 just before the pandemic was declared, due to this timing no studies investigating digital triage since the start of the Covid-19 pandemic had been published at the time conducting the systematic review.

The routine dataset spanned March 2019 – September 2020, whilst the qualitative interviews were conducted between July 2021 and February 2022. This timing served both as a strength and a weakness. On one hand, whilst investigating Covid-19 related change was not an aim of the research, elements of its impact were explored in both the qualitative and quantitative studies.

Patient's experiences of urgent care triage were explored and this necessarily included the context of Covid-19. In 2020 patient satisfaction with the NHS was reported to be lower than in the previous year(184) and in 2022 the British social attitudes survey showed that patient satisfaction with health care services was at its lowest level since 1997(185).

Dissatisfaction was reflected in patients experiences in this PhD research, with one area of dissatisfaction relating to frustration in service providers' communication of Covid-19 processes. The pandemic may have influenced other aspects of experience, such as greater delays in receiving care and patients' preference for self-care or remote care following triage. If the study were to be conducted again, it may result in different findings as more time has passed since the start of the pandemic with some parts of care delivery returning to 'normal', with greater availability of face-to-face care via general practice(186).

The impact of the pandemic was additionally incorporated into the quantitative study's first aim: to explore patterns of service use (call rates) in different patient groups. Service use was investigated before and after the start of Covid-19. This was included as it was felt that not considering the impact of Covid-19 at all would have been an omission. However, Covid-19 may have also impacted on other parts of the quantitative findings, including the patterns of triage outcome urgency levels identified. For example, there would likely have been more severe cases of breathlessness after the onset on the pandemic. The research could have been extended to investigate patterns of urgency levels and upgrading/downgrading before and after the start of Covid-19 to better understand patterns both prior to and after the onset of the pandemic, however this was not conducted as it fell outside the scope of the main PhD aims and as such was not feasible to add.

The onset of the Covid-19 pandemic likely impacted the recruitment of service providers to participate in both the quantitative and qualitative project elements, due to high pressures on services related to the pandemic(187). It particularly impacted site recruitment in the qualitative study, which required staff time at the service providers to support selection, screening, and initial invitation of service users. Originally over 10 service providers who operated in both the urgent and emergency care settings were invited to participate in the research, with four being recruited into the quantitative study and two recruited into the qualitative study.

None of the participating services operated in the emergency care setting. This was not felt to impact the study findings, rather the PhD focus was narrowed to focus on the use of digital triage within the urgent care setting. For this reason, urgent care triage conducted within the emergency setting was considered in the systematic review but was not evaluated further in the rest of the PhD project.

7.5 Comparison to other literature

7.5.1 Access: service use and unmet care needs in deprived groups

A key finding from the PhD relates to the importance of telephone based urgent care services in addressing the healthcare needs of patients living in the most deprived areas. This was indicated by the substantially higher call rates amongst patients living in the most deprived areas. Meanwhile patients described turning to the telephone based urgent care due to not being able to access their first choice of care (typically via general practice). Considering these findings together suggests greater unmet care needs in healthcare access in the patients living in the most deprived areas.

This finding builds on extensive literature indicating unmet care needs in the most deprived patient groups as discussed below. The finding aligns with the inverse care law, published in 1971, which states that “the availability of good medical care tends to vary inversely with the need for it in the population served”(188).

Previous studies have suggested that there are unmet care needs in the most deprived patients in the general practice setting, for example, a recent study reported that patients with multimorbidity in areas of greater deprivation received shorter call lengths than their counterparts in less deprived areas(189).

Further, deprived populations have a higher prevalence of patients with acute conditions as well as co-morbidities, for example a 2015 study based in Scotland reported that practices operating in the most deprived areas had 38% more patients with multi-morbidities, as compared to practices operating in the least deprived areas(190). Considering this, we may have expected to see greater odds of urgent outcomes being selected in deprived groups due to the likely increased complexity (co-morbidities) in this patient group. However, this was not found in the quantitative study. Whilst call rates were higher in the most deprived patient groups, there was no difference in odds of urgent triage outcomes, or the upgrading/downgrading of triage outcomes, from both the digitally recommended and primary triage outcomes. This may be because these patients experience the need for care more often but have a similar profile of conditions and urgencies compared to those living in less deprived areas. Alternatively, it may be influenced by how patients living in deprived areas approach triage; these groups may have lower health literacy and difficulty in communication(191).

A recent Danish study conducted by Gamst-Jensen et al. reported that patients with lower socioeconomic status (SES) received less urgent triage advice compared to those with higher SES, with those in lower SES being less likely to be triaged to face-to-face care, and that despite this, they had higher 30-day mortality(41). This slightly contrasts with the findings in the quantitative study, where there was no association between deprivation and triage outcome urgency or upgrading/downgrading. This may be explained by differences between the patient populations served, or differences in how services operate across the two countries. Methodological differences may also play a part; Jensen et al's study used a smaller sample of calls (approximately 6000 callers) and their regression models only adjusted for sex and age, whilst the models used in the PhD study adjusted for a much wider range of factors. Adjustment for presenting symptom is likely to be particularly important in investigating urgency levels, and this was not included in Jensen et al.'s analyses. The different findings may also arise from how deprivation/SES is measured, the PhD study used IMD decile, a robust measure of deprivation whilst Gamst-Jensen used a simpler binary measure of middle/high and low SES, based on education level and household income.

More broadly there is a lack of standardisation in how urgent care triage outcomes are defined, which presents a wider challenge in comparing literature within urgent care triage.

Overall, whilst this PhD suggests the importance of urgent care triage in the most deprived groups, this section highlights that further research into triage outcomes and subsequent clinical outcomes in the most deprived groups is important, particularly due to the known vulnerabilities of this group. This is discussed further in the implications section.

7.5.2 Variation in clinical decision making in triage.

A key finding of the PhD research relates to variation between individual clinicians in their odds of selecting urgent triage outcomes (care within 6 hours or less), and their odds of upgrading and downgrading calls.

Whilst previous studies have not reported on individual variation between clinicians' use of digital triage, they have investigated various factors that influence clinical decision making. For example, studies conducted in the general practice setting have reported the GP's sex(125), the GP's experience, confidence their prior experience of a complaint, their attitude to risk(124), and their level of attachment to local services(123) influences decision making, as does service availability, such as alternatives to hospital referral(124).

An older study (Wachter et al., 1999) additionally demonstrated differences in how nurses (n=15) triaged calls when presented with the same standardised cases relating to respiratory symptoms in a paediatric population(192). In this study nurses were instructed to use standard protocols (not digitally supported) in telephone triage and were specifically informed not to deviate from the protocols. The study found a high level of variability in the dispositions (triage outcomes) reached; the authors reported that even when nurses selected the same protocol, different dispositions were reached. They additionally highlighted that 58% of nurses found protocols restrictive, 50% felt forced to spend time on irrelevant questioning and 42% reported deviating from them(192).

As Wachter et al.'s study presented standardised cases (with no variability associated with case mix), it supports this PhD's finding of variability associated with individual clinicians.

In addition, there are differences in how patients approach the telephone triage in the real-world setting, for example their varying levels of assertiveness and confidence, as demonstrated in the qualitative study. Wachter et al. additionally investigated a much narrower patient group (paediatric respiratory cases) and the participating nurses were instructed to follow protocols, hence their study is likely to have less variation in resulting dispositions, compared to real world triage, as has been explored in this PhD research.

Whilst Wachter et al.'s study reports on the use of protocols rather than digital triage, many of the issues outlined will likely play a role in digital triage. Their study clearly indicates variation between individual nurses in their interpretation of clinical urgency when presented with the same cases.

Other research has highlighted that in some cases variation may be warranted, for example, in cases where GPs 'know' the patient beyond the presenting symptom, for example through access to the patient's medical history through their record may result in appropriate variation in care(193). This type of variation between patients is likely to be helpful in digital triage as found in the qualitative study, for example where patients can influence triage outcome urgency (through shared decision making) or where the patient has spoken to the same clinician when calling the service again; however, this type of warranted variation does not explain the extent of variation seen between individual clinicians in this PhD research.

7.5.3 Influence of the patient on clinical decision making

This PhD research highlighted that differing patient-professional dynamics may influence triage outcome urgency levels, which is supported by previous literature showing that patient health literacy and communication style impacts on the care received(194). An old (1991) study reported that patients' communicative styles influence communication between the patient and GP, reporting that GPs tended to give more information to patients who were worried or anxious(195). They also reported that patients' assertiveness and expressiveness led to more "partnership building" and information giving by the GP(195). The study also indicated that GPs gave more information to more educated and younger patients(195); there was no indication of this in the PhD findings, however this could be an element to explore in future research.

There may be other patient factors not reported within this PhD research that influence patient-clinician interactions, for example a review reported differences in doctor-patient communication related to patient ethnicity, with patients of non-white ethnicity being less expressive and assertive with health care professionals(196). The way in which patients communicate and assert themselves, as demonstrated in these previous studies, will likely impact on triage outcome urgency levels and patients' subsequent service use.

7.5.4 Variation between services in selection of triage outcomes and call upgrading/downgrading.

Variation between service providers could be explained by contextual factors and differences in how services operate. This may include the level (detail and depth) of clinician training and supervision, for example the extent to which clinicians are encouraged to fully complete the digital triage questions (via training and supervision) including in higher urgency calls.

Service providers may differ in the mix of clinician types (for example proportions of advanced nurse practitioners and nurses with specialties). Differences in decision making between different staff types has been demonstrated by an older study of secondary triage in the emergency care setting, which reported nurses were more likely to refer patients to ambulance dispatch as compared to paramedics(197).

Additionally, the service provider's level of integration with or availability of health providers where patients may be referred following triage may impact on how likely clincians within the service are to upgrade and downgrade calls. The PhD systematic review highlighted the importance of integrated follow-on care, and this was also a finding from the qualitative study: patients had poorer experiences following triage when services were not well integrated. Stakeholder input echoed that the availability of linked services within the health service, where patients can be directly referred to and receive care following triage, enables more patients to be directed to appropriate care, and may avoid patients' unnecessary use of emergency services. The importance of availability of follow on care has also been highlighted in a systematic review of secondary triage in the emergency care setting, which reported that the lack of linked alternative service providers may have led to higher referrals to ambulance dispatch to ensure patients received a face-to-face assessment(130).

The PhD qualitative study highlighted differences between services' prompting for audio and visual information which appeared to impact on the subsequent advice given to patients following triage. Patients additionally felt that it supported their communication during triage; the use of visual information in supporting communication, particularly in groups with lower health literacy has been reported previously(194).

7.5.5 Challenges in comparing study findings.

This comparison to other literature section has highlighted that urgent care triage is a complex intervention that is influenced by many different contextual factors, such as integration with other care providers, and therefore comparing studies is challenging. Others have additionally reported the lack of standardisation across various measures such as symptom categorisation and triage outcome levels(198), which makes comparisons across international literature challenging. This project took a broad approach to investigating how digital triage functions, considering the whole population using clinician led triage services, whilst others have reported on population subsets(77, 78, 183) which presents an additional challenge in comparing literature.

7.6 Implications for service delivery, policy, and future research

7.6.1 Areas for further research

Extending this research by exploring degree of upgrade and downgrade

This PhD research has taken a broad approach to evaluating how digital triage functions in urgent care, by seeking to explore use in the overall population using these services, rather than focussing on a particular patient group, condition or symptom type. It has highlighted areas of inefficiency and potential risk, including the potential underestimation of clinical risk in primary triage of certain calls, as well as difficulties expressed by patients in navigating and communication during triage and throughout their care journey. This broad approach enabled several patient, service and call related factors to be explored in relation to triage outcome urgency.

This approach was specifically selected for this PhD as it was felt to be appropriate for the first research evaluating two-step triage in urgent care. The approach had some drawbacks, as discussed in the quantitative study chapter. For example, a simplified approach was used in exploring call upgrading, and downgrading using a binary measure in the adjusted regression models; this did not consider the degree of upgrading or downgrading. The degree of upgrading and downgrading is likely to be important in assessing under- or -over estimation of clinical risk and potential inaccuracies within digitally recommended triage outcomes. The identification call types that are upgraded by several levels of urgency (e.g., from care within 24 hours in primary triage to emergency care in secondary triage) are likely to be of much more clinical significance than those upgraded by a single urgency level.

Future research should develop this work by building in the degree of upgrade or downgrade in evaluating change in urgency levels from both primary triage outcomes and digitally recommended triage outcomes. For example, future research should evaluate: which call types tend to be upgraded or downgraded by several levels of urgency? This may enable more focussed areas of clinical risk and risk aversity within to be identified within the system, which may relate to a given symptom or patient demographic(s).

Exploring primary triage in more depth

This PhD research is focussed on secondary triage within the two-step model used in England. A key finding of the research relates to the questionable value that NHS 111 adds in two-step triage. This is based on the experiences of patients and carers and is also indicated by the patterns of change in urgency levels between primary and secondary triage, where there is a large degree of change in both call upgrading and downgrading. This finding should be interpreted in the context of the population of focus PhD research: patients that have been identified as requiring clinical attention from the NHS 111 service (ie. approximately 50% of calls to the NHS 111 service that are referred to an urgent care provider for secondary triage), rather than the whole population of patients that use the NHS 111 service.

Future research should extend this by exploring patients' experiences and service use following NHS 111 triage of the whole population of callers (to NHS 111), including those referred directly to emergency care, self-care or another service by the NHS 111 who do not undergo secondary triage. This may help to support or challenge the finding relating to the questionable value that non-clinician triage brings more broadly, including in patients who are not referred for secondary triage.

The systematic review identified only one study that used a qualitative approach to exploring experiences of non-clinician led triage (the NHS 24 service in Scotland) in all patients(28), and included both users and non-users. This highlights the need for a wider study of the NHS 111 telephone service exploring patients experiences of depth, in those who have been provided different triage outcomes.

In addition, future research could evaluate: for which types of calls is the primary triage outcome urgency in agreement with the secondary triage outcome urgency? This research could be undertaken using routine data and descriptive analyses, similar to those used in some parts of this PhD project. This may help to highlight call types that can be dealt with by primary triage where secondary triage may not be necessary. The use of patient outcomes data (e.g., ED attendance) will also be helpful in understanding the effectiveness of NHS 111 triage.

Exploring reasons for clinician and service level variation

A key finding of the PhD related to very high variation between clinicians in their selection of urgent outcomes and in their call upgrading and downgrading, despite the use of a standardised digital triage tool. Based on this new knowledge generated in the PhD, future research should seek to understand why this variation occurs. This could be achieved by investigating a research question such as: how do clincians interact with digital triage tools during triage? This could consider how the clincians' interaction with the digital triage tool and the patient impacts on triage outcome urgency, call upgrading and downgrading, call length and patients' subsequent use of emergency, urgent and routine care. This could be achieved using a mixed methods approach (for example, ethnography to observe triage interactions combined with routine data analyses). It is also important to explore experiences and perspectives for example to identify particularly challenging call types for clincians, and their perspectives on barriers and facilitators to conducting triage. This may help to identify differences in how clinicians respond to different call types, and factors that influence how likely they are to upgrade or downgrade.

As digital triage is a complex intervention and its use is impacted by contextual factors, future research should also investigate which service level factors impact on clinicians' upgrading and downgrading of calls. This could be achieved by analyses of routine data together with surveys completed by service providers and call takers. The surveys could include items such as: depth and detail of staff training, staff mix, level of clinical supervision (e.g., the number of supervisory or senior clinicians available for each call taker and the culture of asking for help). It may also include the level of integration (for example whether the urgent care provider can directly book an appointment at a linked out of hours centre, general practices or other health providers, and the service providers approach to the use of prompting for audio and visual information during triage. The potential importance of the latter was highlighted in the qualitative study, where patients felt that the use of audio and visual information supported communication and impacted on the advice they were given.

An additional research question that future research could address is: how can audio and visual information best be used to support clinician-patient communication during triage? This may encompass types of symptoms where the use of photos and the use of audio (e.g., hearing a patient's breathing) is most helpful in supporting triage. This could be explored through a mixed methods approach, for example through analysing triage call recordings to identify the types of symptoms where this information is used to inform triage, and qualitative interviews to explore call takers experience of using this type of information during triage. Additionally, patients subsequent use of healthcare services between service providers that promote use of this information and those that do not (as appeared to be the case in the England based and Northern Ireland based care providers respectively in the PhD qualitative study) could be explored.

Further evaluation of safety and effectiveness in the use of digital triage

To better understand the impact of digital triage on the consistency and safety of care provided to patients, further research should compare urgent care delivered using digital triage with services that are not digitally supported. This will help to ascertain the value that digital triage adds to the delivery of care. It is also important for future research to compare services delivered using different digital triage tools, to improve the generalisability of the research.

This comparative research should be combined with investigating patient health and service use outcomes (such as ED attendance, hospitalisation, and use of general practice) following triage in order to compare safety and patients' compliance with care recommendations within these urgent care delivery models. For example, a research question that could be addressed is: how does the use of digital triage impact on the effectiveness and safety of triage outcomes? This could be evaluated by comparing service use and health outcomes (for example using HES data linkage) in patients that are triaged by services that use digital triage and those that do not use it.

Finally, as presented in Appendix 1 (protocol for investigating patient outcomes following triage) future research is required to better understand the patterns of triage outcome urgency in relation to how patients go onto use emergency care, in-patient and general practice care. This will provide insight into the appropriateness of both primary and secondary triage outcome urgencies, which will help to identify where improvement in two-step triage is necessary.

Inclusion of deprived, ethnic minority and non-English speaking patient groups

Calls from people living in deprived areas made up a high proportion of calls triaged by clinician led triage services in England; and patients accessing telephone-based urgent care services had difficulty with the usual care routes which lead then to seeking help in urgent care. As discussed in the comparison to other literature section of this chapter patients in deprived groups are known to have a greater need for care therefore their greater use of urgent care is to be expected. Future research should seek to better understand the experiences of patients in the living in the most deprived areas. This may help identify how these groups can be better supported. For example, future research could seek to explore communication during triage within patients living in areas with differing deprivation levels, including the types of symptoms and calls where difficulty in communication occurs; this may help identify how communication can be better supported during triage.

Patients living in the three most deprived deciles were not recruited into the qualitative study despite these users making up the large proportions of patients undergoing secondary triage and despite the sampling strategy used (selecting consecutive users with different demographics). As discussed earlier in this chapter, there was no evidence of deprived groups receiving more urgent advice in secondary triage, however this population may be more likely to have co-morbidities and lower health literacy. Thus, ensuring these groups are included in future research is important, particularly in evaluating their health and service use outcomes following triage.

The sampling strategy used in the qualitative study involved the service providers selecting patients based on different demographics, including age and sex. It did not however specify deprivation level. Future research should target recruitment of deprived groups, this can be achieved through different approaches that would require additional resources(199), for example through oversampling by inviting much larger numbers of patients in the most deprived deciles. This would however require additional time for participating service providers to lookup the deprivation decile based on patient postcode. Another approach to reach these groups could be to advertise study recruitment in out of hours centres that serve more deprived populations, having a researcher onsite to promote engagement with potential participants, recruitment via community groups, and offering greater incentives for participation(199).

This PhD research did not consider patients with limited English proficiency, which may include refugees, migrants and first-generation immigrants. These groups likely represent a high-risk patient group in telephone triage(183). There was also very limited involvement ethnic minority groups within the systematic review and the qualitative study of this PhD. Future research should seek to include these groups. This may require a different approach to recruitment, for example recruitment via a researcher onsite to identify and invite participants (due to the lack of this demographic being recorded in medical records), and will likely need additional resource to allow focussed engagement with ethnic group communities(200).

Repeat callers and care continuity.

Due to the limited scope of this project, repeat callers were not analysed. A recent study, conducted early in the Covid-19 pandemic, highlighted that repeat callers to NHS 111 were an under-recognised predictor of clinical deterioration(173). Routine digital triage datasets, as used in this PhD research, provide the opportunity to better understand service use by repeat callers.

The qualitative study highlighted the positive impact of care continuity, which occurred for some callers by chance when they contacted NHS 111 for a second time. Building a level of care continuity into urgent care (regardless of whether digital triage is used or not), for example by routing repeat callers to the same clinical professional may be beneficial for patients. The professionals' prior knowledge of the patient based on the previous call may facilitate communication of the health concern and timely provision of the care required. Further research should investigate care continuity and repeat callers, including their use of urgent care, patterns of triage outcomes, and service use outcomes following triage. In addition, research could be conducted to investigate if the detailed medical record that is captured during digital triage (including triage questions and answers) supports continuity of care, as compared to usual medical records.

Developing research into patterns of triage outcomes

Key recommendations for future research are presented in Table 30 below.

Table 30 Recommendations for future research

	Recommendation	Description
1	**More focussed evaluation into areas of risk identified in the PhD.**	Research should consider the degree of upgrade and downgrade when comparing primary and secondary urgency levels, and when comparing digitally recommended and clinician selected urgency levels; particularly in areas of clinical risk identified in this PhD, for example, calls about chest pain and breathlessness which had greatest odds of upgrade from the primary triage outcome urgency.
	More research into where the system works well	Future research should explore further associations such as identifying in which calls non-clinician and clinician led triage are in agreement; this may help identify which calls can be triaged by non-clinicians alone.
2	**Explore variation between clinicians**	Future research should seek to understand why there is very high variation between clinicians in how likely they are to select urgent outcomes, and how likely they are to upgrade and downgrade calls. Understanding differences may help to improve training and service level factors to better support clinicians in their decision making to help ensure safe and consistent care
3	**Research into patients' use of healthcare services following triage**	Whilst a recent study has investigated patient service use following NHS 111 triage(40); no research has investigated service use in relation to two-step triage; this would enable insight into the effectiveness, and areas for improvement within the two-step model.

4	**Further studies comparing effectiveness (patterns of triage and safety) of two-step and direct clinician triage models.**	Due to clinical staff shortages in several countries, two-step non clinician led models may be of interest to countries who currently use direct clinician triage. Comparative studies may help to better understand the effectiveness and safety of both models of urgent care delivery
5	**Research into how communication can help with self-care**	Research exploring call length, use of audio and visual information and clinician/patient communication in enabling self-care may help to better understand how care can be best delivered to patients for whom self-care is appropriate. This may help to lower unnecessary demand on wider urgent and emergency care services whilst providing appropriate and safe care to patients.
6	**Inclusion of under-served groups**	Research into urgent care triage should include groups under-served in research, including the most deprived groups and ethnic minority groups. (See also row 1 of Table 31)
7	**Development of standardised outcomes**	The development of standardised outcomes (e.g., urgency levels, symptom categorisations and timeframes to investigate service use following triage), will facilitate literature comparison and comparative research into different models of urgent care delivery

7.6.2 Implications for policy, service delivery and technology providers

This study has highlighted potential inefficiency and clinical risk within two-step triage. In terms of inefficiency, 70% of calls were downgraded which raises questions about whether the primary triage is valuable in terms of time and resources required for it to take place, and the inconvenience and potential delay introduced for the patient. Clinical risk in primary triage relates to calls which may have been underestimated in clinical risk, for example the 2% of calls that were upgraded to emergency care following primary triage may represent calls that were unnecessarily delayed by not being directly referred to the emergency service by NHS 111. This occurred in a range of calls about different symptoms, however, calls with greatest odds of upgrading from the primary triage outcome urgency related to breathlessness and chest pain.

Providers of secondary triage should monitor and audit calls that are referred to emergency services in secondary triage and ensure communication with the primary triage provider to increase awareness and to better understand the types of calls that may have been underestimated in clinical risk. This may help to identify where change is required, for example, whether change within the digital triage tool content is required or if further call taker training is required for certain conditions or symptom types.

Whilst limitations of the two-step triage model have been highlighted in this research; this work may be useful to policy makers in countries considering changing their model of urgent care delivery. This research suggests caution is required in the design of two-step triage and highlights the importance of clinician triage in its delivery.

Although there are challenges in recruiting and retaining clinical staff in primary care and health care more broadly(201, 202), and a non-clinician workforce may be more easily recruited, retained and less costly as a workforce, the research presented in this PhD suggests that the output of the work requires a large degree of re-triage by a clinician indicating possible duplication in the process. This duplication of activity may be considerably more costly for the health system. However as discussed in the previous implications for research section, more in depth research of non-clinician triage is required as it may be providing value in patients that it directly refers to emergency care, self-care or other services (where patients do not undergo secondary triage).

This research highlights the importance of clinicians' softer skills, including their ability to listen to and reassure patients, together with their use of digital triage. Reassuring communication should be a central element of call taker training, for both clinicians and non-clinicians. Additionally, digital triage software should be designed with a focus on supporting communication, this could include the use of open-ended questions at the end of triage questions to ask whether patients have understood the recommendation or have concerns. Patients found the use of audio information and photos in communicating their symptoms to be helpful and reassuring (for example where the triage nurse or doctor heard the child's breathing, or the patient was able to share a photo of their symptoms with a doctor following triage). This type of communication could be promoted in training and incorporated within digital triage systems' clinical content in combination with further research to assess its effectiveness.

Policymakers and service providers should consider care continuity within their delivery of urgent care; whilst care continuity may be difficult to implement due to the nature of urgent care, with the most patients only using services on ad ad-hoc and infrequent basis, mechanisms to route repeat callers to the same call taker could be considered by services.

A challenge faced in in this project was difficulty in timely access to Hospital Episodes Statistics (HES) data, this is a wider challenge to researchers seeking to use valuable patient outcomes data and likely means that data is not being optimally used in research leading to missed opportunities. This research has highlighted that digital triage datasets have potential to provide useful insight into patterns of use and health within the population and can help to develop hypotheses for further research for ultimate benefit of service delivery. To date these types of datasets are not easily available to researchers and efforts should be made to enable these types of datasets to be more accessible.

There is a need for policymakers to ensure that data is more easily accessible. Aligned to this, the 2022 Goldacre review(203), which was commissioned by the secretary of state for health and social care highlights that this requires strategic investment to tap into the potential that NHS data holds. Goldacre suggests that this investment is required to ensure NHS data is well curated, and shared in platforms that are secure, perform well, and that promote open working practices. Open working practices may include sharing of code use to curate and analyse data to avoid duplication of work. Some of the recommendations of the Goldacre review fed into the governments ‘Data saves lives’ policy paper from June 2022(185).

Another difficulty identified in the PhD research was the inclusion of ethnic minority groups in the analyses. Ethnicity data is important for understanding patterns of health service use including potential health disparities(204), which could have been explored in this PhD if ethnicity data had been more widely recorded within the medical records. Policymakers and service-providers should promote data completeness to enable high quality and inclusive service evaluation and research into urgent care triage. One approach to improving this may be to ask patients to provide this information, however this may be difficult due to the sensitive nature of this type of personal information. Another way of achieving this could be service providers to use medical records that can be self-reported and updated by the patient directly(204).

Technology providers should consider making use of the data recorded in digital triage to offer software features aimed at promoting and monitoring service quality, for example, regular or real time reports of the level of variation between clinicians in their selection of urgent outcomes and in their call upgrading and downgrading, based on factors including presenting symptom and time of day. This PhD research suggests that reporting on outliers may be particularly important (those clinicians who upgrade and downgrade most and least) as they will likely affect the efficiency and possibly the safety of the service and may be where auditing and training could be targeted. This type of information could be used by service providers to monitor calls and areas of risk more efficiently.

The key recommendations from this PhD research for policy, service delivery and technology providers are summarised in Table 31 below.

Table 31 Recommendations for policy and service delivery

Recommendation	Area	Description

1.**Promotion of data completeness (e.g., ethnicity)**	Policy/ service provision	Policymakers should promote data completeness / service providers should seek to improve their recording of key information such as ethnicity in electronic records to support more complete service evaluations and assist with research
2.**Promoting culture change and data sharing for improving patient safety**	Policy/ service provision / technology providers	Policy makers should prioritise and promote the sharing of data for improvement of patient safety via service evaluation and research. This may help digital triage software to start moving away from 'black box' systems to transparent and continually improving systems
3.**Monitoring and audit of clinician variation and under- / over- triage**	Service delivery	Urgent care providers should monitor and audit clinician variation, including at different times of day, and when there are differing amounts of medical cover available.
4.**Improved communication between primary and secondary triage providers, (relating to the large degree of upgrading and downgrading of**	Service delivery	Improved communication between primary and secondary triage providers in calls that may be under and over-triaged in

calls from the primary triage outcome)		primary triage; however, linkage with patient outcomes (ED attendance and hospitalisation) may help to better understand when under/over triage may be occurring.

7.7 Conclusion

This final chapter has discussed findings from the PhD, which is the first in-depth evaluation of two-step triage in urgent care and has brought new knowledge to the field.

This research is the first to compare primary triage outcomes generated by the NHS 111 service and subsequent secondary triage outcomes. It has highlighted a large proportion of calls (over 70%) are downgraded from the primary triage outcome urgency. Additionally upgrading and downgrading was found to occur across several levels of urgency, which suggests that clinicians play an important role in re-triaging patients in the urgent care system, which leads to questioning the efficiency of the two-step triage in England. Around 12% of calls were upgraded following primary triage, and around 2% of calls were triaged to Emergency care; this suggests that the two-step process may lead to delays emergency care for some patients and thus highlights potential clinical risk in the system. These findings have implications for the efficiency and safety of the urgency care system, considering these findings is important for the future design of urgent care within the NHS. This research may be helpful for countries considering the adoption of a two-step triage model, particularly given the challenges in recruiting and retaining clinical workforce.

This research also the first to report on comparisons between digitally recommended triage outcome urgency and the clinicians' overriding of these outcomes in secondary triage. It has identified a range of factors that are associated with secondary triage outcome urgency including the service at which a patient is triaged, the individual clinician conducting triage and the call length. Longer calls were more likely to be downgraded from the digitally recommended urgency by the clinician, and patients felt reassured when the secondary triage clinician spent more time in the assessment, in some cases patients reported this enabled them to self-care at home. These factors all warrant further research as they will likely impact on how patients go onto use subsequent emergency, urgent and routine care.

The findings also highlighted challenges faced by patients in navigating two-step triage, which extended to their choice of entry route, delays in the process and experiences of poor integration through being referred between services. Patients had an influence (through their level of assertiveness, confidence, and the support of a family member) on triage outcome urgency, however these do not explain the extent of the variation seen between clincians in their use of digital triage.

The exploratory approach used in this PhD to investigate call upgrading and downgrading from the digitally recommended outcome urgency may be useful in identifying where clinical content (triage questions and answers) may need to be changed, for example in calls about symptoms that that are often upgraded or downgraded in urgency; this may additionally be useful in service evaluation or research into different digital triage systems or the use of digital triage in different care settings (e.g. routine or emergency care).

This research has additionally identified several areas for further research, including further comparative studies of different digital triage tools, as well as non-digitally supported triage together with patient service use outcomes following triage.

Recommendations for service delivery included a need for services to audit and monitor higher risk calls, and to improve training to support the delivery of more consistent care.

Lastly, policymakers and service providers should make efforts to improve the availability of the data captured in digital triage systems, as they hold great potential to better understand and improve how services are delivered. Future research should continue to build on and focus on where there is greatest clinical risk and greatest potential to improve patient safety within urgent care triage.

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Appendices

Appendix 1:A protocol for the evaluation of patient service use outcomes following telephone based urgent care triage.

This appendix provides a full study protocol, developed to investigate how patients use further health care services (ED and hospitalisation) following secondary triage, and the factors that may influence their service use. It additionally describes approvals obtained for the study, and the data application process followed to request ED attendance and hospitalisation data from NHS Digital. Due to the lengthy approval and data request process, data was not received in time to be analysed and included within this PhD thesis.

Study aims and research question.

The aim of this follow-on study is to explore patients' service use (ED attendance and hospitalisation) following secondary triage by urgent care providers in England. The secondary aim is to draw comparisons between primary and secondary triage outcomes and the subsequent use of hospital emergency care. The study takes an exploratory approach to generate insight on the safety of telephone based digital triage in England's two-step model of urgent care delivery.

The study aims can be further broken down into three research questions:

1) What proportions of patients attend an emergency department (ED) / are admitted to hospital following primary and secondary triage?
2) Which patient, call and service level factors are associated with patients' subsequent ED attendance and hospitalisation following triage?
3) How do triage outcomes change between primary/secondary triage and the urgency level assigned in the emergency department?

Summary of background and rationale

The introduction chapter highlighted the central role that digital triage plays in urgent care and the healthcare system overall, by supporting the management of patient demand and ensuring patients are referred to appropriate services for care. The introduction chapter also outlined the limited research conducted on patients' health and service use outcomes following digital triage within the urgent care setting.

Whilst the systematic review chapter identified a number of studies that evaluated the impact of telephone based services that use digital triage on wider healthcare, most were conducted following the implementation of a new digital triage service. The review highlighted a need for research in established services using digital triage. Additionally, whilst four studies(83, 89, 91, 92) in the systematic review indicated potential safety findings related to under-triage (where clinical risk was underestimated in triage), exploring safety was not the main aim of any of these studies. Studies have explored appropriateness of triage outcomes in the emergency care setting(129, 130) but none have explored safety and appropriateness of secondary triage within urgent care.

A study investigating patients' ED attendance and hospitalisation following triage by NHS 111 identified potential safety issues(40). This study, conducted by Lewis et al. (2021), analysed over 3 million calls that were triaged in Yorkshire & Humber region between 2013 – 2017. The authors reported that 11% (n=289,748) of patients advised to self-care subsequently attended ED within 48 hours despite the self-care advice given by NHS 111. They additionally reported a large proportion of those patients were assessed as urgent in ED (88%, n=255,931) with some (37%, n=106,207) subsequently being hospitalised.

The planned study will build a detailed picture of patients subsequent service use in the context of England's two-step triage. This is possible through comparing primary and secondary triage outcomes and patients' subsequent service use to better understand how the two-step system functions.

Overall, this planned study will address the gaps in the literature relating to the safety of primary and secondary triage within the English urgent care system. The study has also been designed to build on findings from the PhD quantitative study; for example, to explore the influence of patient and service level factors, as well as the individual clinician conducting triage, on the odds of patients attending ED or being admitted to hospital.

It will additionally build on the quantitative study findings that showed large degrees of change in triage urgency level between primary and secondary triage. This study will enable insight into both primary and secondary triage outcome urgency in relation to patients' subsequent use of emergency department and in-patient care.

Justification for method

As with the quantitative study conducted in the PhD, routine data was selected as it allows a large sample to be analysed to investigate patterns in service use at scale. Mixed effects regression modelling was selected as it enables the investigation of odds of a binary variable, in this case, for example whether or not the patient attended ED following triage. The regression analyses in this protocol mirror the methods used in the PhD quantitative study due to the similar type of data being analysed; justification for the regression modelling approach can be found in chapter 3.

This study additionally uses the NHS hospital episode statistics (HES)(131) data. This type of data was selected as it includes information relating to ED attendance and hospitalisation, which is required to answer the research questions. HES data also particularly suited to this study as it is a national dataset with standardised coding and has been used by other studies to similarly investigate patterns in hospitalisation(132-134) and ED attendances(135) in different population groups.

The Odyssey triage dataset used in the PhD quantitative study will be linked to two HES datasets from NHS Digital: the Admitted patient care (APC)(136) and Emergency Care Dataset (ECDS)(137). Linkage will allow for patient level service use data to be explored in patients who have undergone secondary triage. Previous studies exploring patient's service use following triage have used a similar data linkage approach, including the recent study that explored compliance with triage recommendations from NHS 111(40), and another study that had investigated ED use and hospitalisation in patients who had undergone triage within the emergency setting(129).

Datasets

The Odyssey dataset that has been linked to the HES data includes the following variables:

1. Patient demographics and presenting symptom: anonymised patient id, time and date of call, call length, patient age and sex, deprivation decile (based on Index of Multiple Deprivation) (112), see chapter 3, section 3.3 for description of this deprivation

measure) and presenting symptom. The dataset contained one entry per call, so any patients who called more than once occurred in the dataset multiple times.

2. Triage outcome urgency levels corresponding to a) digitally recommended urgency b) clinician selected urgency level c) preliminary urgency assigned in primary triage (as mapped to urgency levels in Odyssey, described in the previous quantitative study chapter). Triage outcome urgency all correspond to one of 7 levels: Emergency / Immediate care within 1 hour / Immediate care within 2 hours/ Urgent care within 4 – 6 hours / Same day care within 24 hours / Routine care/ self-care or no urgency, which included cases where the caller was advised to contact a different care service.

3. The participating service (GTD healthcare, Bardoc, Mastercall) and anonymised ID of the clinician conducting triage

Two datasets were requested via NHS Digital (APC and ECDS datasets). These datasets have been linked based on the anonymised patient ID in the Odyssey dataset at the individual call record level by NHS Digital.

The APC and ECDS datasets are routinely collected and stored by NHS Digital. They were requested through NHS Digital's Data Application Request Service (DARS) (https://digital.nhs.uk/services/data-access-request-service-dars). Due to the way NHS Digital records data, the datasets were requested based on complete NHS financial years, running from April - March). Data requested for this study correspond to two financial years (April 2019 – March 2020, April 2020 – March 2021); which was selected to correspond to the Odyssey triage cohort analysed in the PhD quantitative study.

The APC data includes information about patients from the Odyssey cohort (who had undergone secondary triage) who were hospitalised at any point during the 18-month study period. The APC covers every episode of care in NHS hospitals in England. The dataset is constructed of consultant led episodes of care and single admissions may be made up of multiple episodes of care. The data additionally includes: the date and method of admission, duration of admission, procedures, and diagnoses during admission.

The ECDS data includes information about patients from the Odyssey cohort (who had undergone secondary triage) who attended ED at any point during the 18-month study period. The dataset contains information such as the arrival and departure time, presenting complaint, the time the patient was seen, diagnoses if any, and the admission decision.

Both datasets contain the anonymised patent ID, so that the data can be linked to the Odyssey triage dataset, to evaluate which patients attended ED and or were hospitalised following triage. Anonymised IDs are being used to avoid the unnecessary use of identifiable data (e.g., NHS number) in line with UK GDPR principles to protect patient confidentiality.

The full list of variables requested are shown in **Error! Reference source not found.**.

NHS Digital data application process and approvals

The NHS Digital DARS (data access request service) application required the submission of the following:

1) An extensive research proposal within the data access request service (DARS) application system

2) Evidence of four approvals: research sponsorship approval, university ethics approval, NHS HRA (non-REC) approval and confidentiality advisory group approval (CAG).

Confidentiality advisory group (CAG) was required for this study as the data linkage process involved some handling of identifiable patient data by Advanced Health and Care ltd and NHS Digital, on behalf of the study. Specifically, this involved Advanced Health and Care sending a list of NHS numbers and date of births corresponding to the patients triaged within the Odyssey dataset. NHS Digital subsequently linked data to NHS Digital's ED attendance and hospitalisation data based on the NHS number and date of births (these identifiable fields were then removed by NHS Digital before sending them to the University of Warwick).

As this process involved the handling of identifiable data for the purpose of data preparation, section 251 approval via the CAG and was obtained for the study. Section 251 is part of the NHS Act 2006; it allows for the common law of confidentiality to be lifted temporarily to allow confidential patient data to be disclosed(138) without the need for informed consent. In the case of this study, this was required for a one-off data linkage involving the transfer of data from Advanced Health and Care and NHS Digital's use of identifiable data to link it to Odyssey anonymised IDs. The CAG approval is in place, as detailed in the ethical approval section below.

3) Evidence of appropriate security and information governance in place. This included the provision of evidence relating to Advanced Health and Care's s security standards, for example, their ISO27001 certification, an international standard for information security management systems(139). It also included confirmation of their data security and protection toolkit (DPST), an organisation level self-assessment measuring performance against the National Data Guardian's data security standards(140), and a letter of approval from their Caldicott guardian.

4) Evidence of data sharing agreements with participating service providers

Prior to the DARS application, the following data-sharing agreements (DSA) were set up: 1) DSA between NHS Digital and Advanced as the cohort provider, 2) DSA between Advanced and each participating urgent care providers permitting data to be analysed in this research, and 3) A data sharing agreement between Advanced and the University of Warwick, to allow the PhD candidate to analyse the anonymised data.

The application process involved close collaboration with Advanced and NHS Digital prior to application submission. A timeline of key milestones is provided in the challenges in study set up section.

Data analysis plan

There will be three key analysis stages to this project as outlined in this section.

Key outcomes

The key outcomes explored in stages 1 and 2 relate to patients' ED attendance and hospitalisation following triage. Previous studies have used different timeframes between the triage call and ED attendance, reporting ED attendance rates from 1 to 48 hours following telephone triage (89, 92, 93). This study will investigate ED attendance within 24 hours, 48 hours, and 7 days, and hospitalisation within 24 hours of the ED attendance. These timeframes have been chosen as they will help to identify the calls where urgent care was required, and to identify if urgent triage outcomes were provided in these calls. A similar approach was taken by Lewis et al. in their study investigating patients' compliance with advice from NHS 111; they investigated ED attendance within 48 hours of the NHS 111 triage phone calls, and hospital admittance within 24 hours of ED attendance. For this study, these outcomes are additionally measured at 24 hours and 7 days to provide a more detailed picture of whether patients do or do not go onto use these services following triage.

Analysis Stage 1: proportions of patients attending ED/being hospitalised.

The first stage will investigate the first research question: what proportions of patients attend an emergency department (ED) / are admitted to hospitalisation following primary and secondary triage in the urgent care setting?

Descriptive statistics will be used to calculate:

1.The proportions of patients who attended ED/were hospitalised for each *primary* triage level (emergency care, care within 1 hour, care within 2 hours, care within 4-6 hours, care within 24 hours, routine primary care appointment, and self-care as mapped within the PhD quantitative study)

2.The proportions of patients who attended ED/were hospitalised for each *secondary* triage level (urgency levels as above).

Analysis stage 2: Associations with ED attendance and hospitalisation following secondary triage in urgent care.

The second stage of the analysis will explore how patient, call and service level factors are associated with 1) ED attendance and 2) hospitalisation.

Two mixed effects regression models will be used to investigate:

1.) The odds of ED attendance (within 24 hours, 48 hours, and 7 days of secondary triage)
2.) The odds of hospitalisation (within 48 hours of ED attendance) in patients who have undergone primary and secondary triage.

The models will include the following fixed effects: patient sex, age group, deprivation, clinician selected urgency level, main presenting symptom, service provider, day of week, time of day, number of calls triaged by clinician in the whole dataset (which is an indicator of the clinician's familiarity with digital triage) and the call length.

In a secondary element of the analysis, these models will be run using digitally recommended triage outcome in place of the clinician selected urgency level fixed effect. This will enable the impact of clincians' overriding (upgrading and downgrading) of triage outcomes on the odds of ED attendance and hospitalisation to be explored.

A random intercept (individual clinician conducting triage) will be used in these models.

Analysis stage 3: Exploring change in triage outcome urgency and subsequent urgency assigned in the emergency department.

Primary and secondary triage outcome urgencies will be compared to the urgency levels assigned in ED, in those patients who present to ED within 24 hours, to identify potential under- or over-triage. From the time of the triage call, the patients' condition may deteriorate, in consideration of this, a timeframe of 24 hours was selected, (as opposed to a longer timeframe, e.g., 7 days, where ED attendance or hospitalisation may more likely reflect the patient’s deterioration rather than mis-triage). This will be described in tabular form and will be visually presented through Sankey diagrams comparing the urgency levels assigned in 1) primary triage and 2) secondary triage and 3) the urgency level assigned during at the ED (The “acuity” variable within the ECDS dataset indicates the urgency level assigned in the ED). Patients assigned with urgent triage outcomes (care within 6 hours or less) who did not attend ED will also be included on the sankey visualisation.

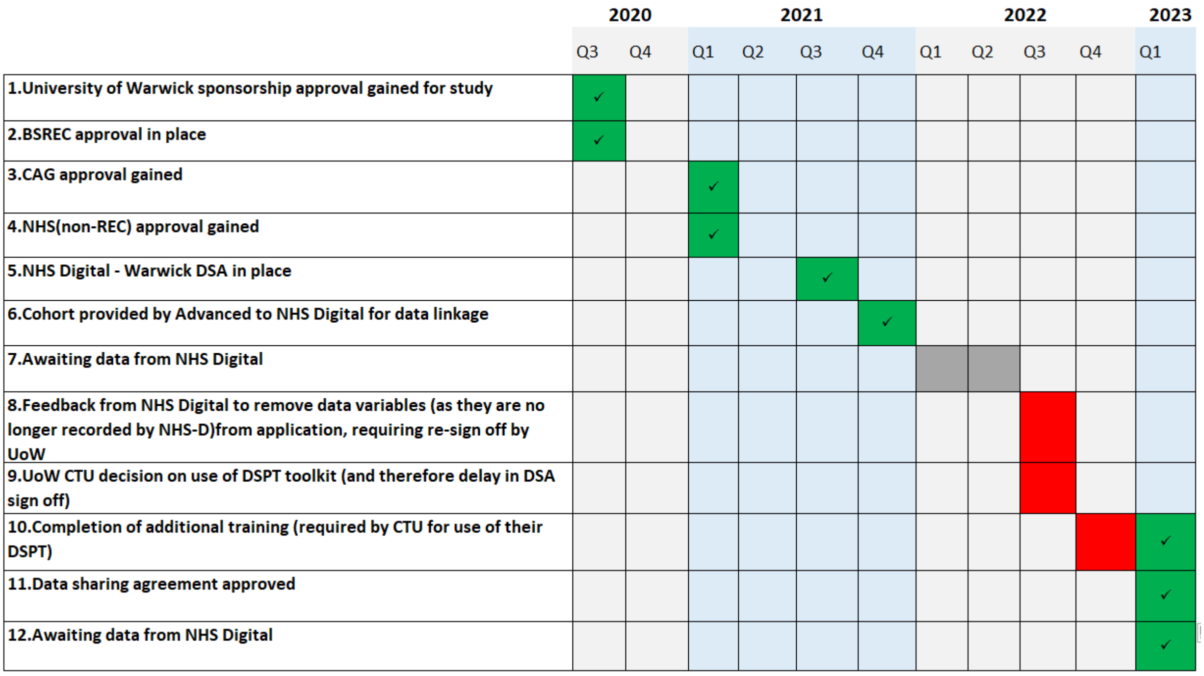
Validity checks: concurrence between reason for call and reason for subsequent service use

A sample of calls will be checked to identify the reason the patient attended ED or was admitted, as compared to the reason their call was made. To do this, problem or symptom (based on diagnosis) from the HES data will be compared to the reason the patient called the urgent care service (the main presenting symptom for the call). This will be checked in 200 calls, and the proportion of calls where there is concurrence will be reported. Similar validity checks have been conducted in in another study of triage in the urgent care setting (27).

Challenges in study set-up

The data application process, via NHS Digital DARS, was started in 2020 and was complex and lengthy for this study. Prerequisites included institutional ethics approval via the Biomedical and Scientific Research Ethics Committee (BSREC), NHS HRA (non-REC) approval and confidentiality advisory group (CAG) approval; these were both in place in 2021. During set up in 2020, the PhD candidate held weekly meetings with Advanced, to gain all required documentation. A timeline of approvals obtained, and unexpected delays (shown in red) is provided in the below figure.

Timeline of approvals and unexpected delays in NHS Digital data application



	2020		2021				2022				2023
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
1.University of Warwick sponsorship approval gained for study	🟩✓										
2.BSREC approval in place	🟩✓										
3.CAG approval gained			🟩✓								
4.NHS(non-REC) approval gained			🟩✓								
5.NHS Digital - Warwick DSA in place					🟩✓						
6.Cohort provided by Advanced to NHS Digital for data linkage						🟩✓					
7.Awaiting data from NHS Digital							▨	▨			
8.Feedback from NHS Digital to remove data variables (as they are no longer recorded by NHS-D)from application, requiring re-sign off by UoW									🟥		
9.UoW CTU decision on use of DSPT toolkit (and therefore delay in DSA sign off)									🟥		
10.Completion of additional training (required by CTU for use of their DSPT)										🟥	🟩✓
11.Data sharing agreement approved											🟩✓
12.Awaiting data from NHS Digital											🟩✓

One unexpected delay related to NHS Digital's requirement for applicants to have a data security and protection toolkit (DSPT) in place. The DPST is an organisation level self-assessment relating to data security. This allows organisations to measure their performance against the National Data Guardian's data security standards(140). These standards relate to three elements: staff (ensuring they are equipped to handle information securely), process (to ensure that organisations prevent data breaches and respond appropriate to incidents), and technology (to ensure it is secure and up to date)(141).

An DSPT is in place at the Clinical Trials Unit at Warwick Medical School however the wider Warwick Medical school does not have one in place. The PhD candidate was informed by the relevant research support team that the CTU's DSPT could be used for this project; they had provided approval for the project in 2021 and had signed off a data sharing agreement for the study. However, following a minor update to the DSA in Q3 2022 (which was requested by NHS Digital to remove some variables from the request as these were no longer recorded by NHS-Digital) an updated version of the DSA requiring re-sign by the University of Warwick(UoW) was prompted. However, on this occasion, UoW were not able to sign the DSA; use of the CTU DSPT had to be negotiated. The PhD candidate and supervision team were informed that the DSPT was intended to be used internally within the CTU. Since this issue occurred, the CTU have agreed for this study to use their DPST, with the condition of the PhD candidate and primary supervisor completing mandatory training that all members of the CTU are required to complete, this includes further training in information security, data protection, research integrity, research codes of practice and reading of CTU standard operating procedures (SOPs). This training has now been completed by the PhD candidate.

The data was received in February 2023, and data cleaning ahead of analyses has been started by the PhD candidate. However due to the lengthy process and unexpected delays, a decision was made by the PhD candidate and supervision team to exclude this linked study from the thesis.

Discussion

This would be the first study to explore patients' subsequent service use outcomes, in England's two step triage model, including variation between clinicians conducting triage and patients' subsequent service use. It will enable patterns of both primary and secondary triage to be explored in relation to how patients go onto use emergency care services.

Limitations of routine data to explore service use following triage include that patients' conditions may worsen or improve over time, meaning that their needs may change. Therefore, triage outcomes provided to patients may be accurate at the time of triage, and the patients' needs may change following the triage phone call; this cannot be fully captured with the use of routine data analysis alone; qualitative approaches alongside routine data analysis would help to inform this.

A further limitation is that patients may attend ED or be hospitalised for a different problem than the problem they had called the urgent care service and been triaged for. For example, a patient may have had a sore throat and been given self-care advice at triage, and a few days later may have had a fall and fractured their ankle, subsequently needing admission and surgery. As data regarding the problem that the patient attends ED and/or is admitted for is available, validation checks are planned to compare the main symptom that the patient called about, to the problem as coded in the ED attendance and hospital admission data. This will help to present the extent to which subsequent service use by patients is due to a health problem that is different to the reason for accessing telephone based urgent care .

Finally, a limitation of HES data, as with all routine data, relates to data quality, this includes errors relating to 'diagnosis'(142), for example how accurate the urgency level recorded in ED is, and 'recording' including for example missing data where it was not added to the system or where the information was coded incorrectly(142).

This chapter has demonstrated the difficulty faced in obtaining data from NHS Digital and highlights the need for simpler access to data for researchers, particularly as this type of data provides excellent opportunity to better understand how well services are operating and to gain insight on the effectiveness and risk within urgent care triage.

Ethics

This study has been approved by the London - Camden & Kings Cross Research Ethics Committee (REC reference: 21/LO/0184) and confidentiality advisory group (CAG) approval for the use of identifiable data without consent is in place.

Protocol summary

This protocol how patients' use of health care services following urgent care triage will be investigated. It has described the data application process and approvals that were required and obtained. The next chapter describes the qualitative component of the project.

List of fields requested from NHS Digital

Admitted patient care (APC) dataset.

ACPEND_N	Augmented Care Period End Date
ACPSTAR_N	Augmented Care Period Start Date
ADMIAGE	Age on Admission
ADMIDATE	Admission Date (Hospital Provider Spell)
ADMIMETH	Method of Admission
ADMISORC	Source of Admission
AEKEY	A&E Record Identifier
BEDYEAR	Bed Days Within the Year
CAUSE_4	Cause Code - 4 Characters
DISDATE	Date of Discharge
DISDEST	Destination on Discharge
DISMETH	Method of Discharge
EPIDUR	Episode Duration
EPIEND	Episode End Date
EPIORDER	Episode Order
EPISTART	Episode Start Date
EPISTAT	Episode Status
ETHNOS	Ethnic Category
IMD04_DECILE	IMD Decile Group
INTDAYS_N	Intensive Care Level Days
MAINSPEF	Main Specialty
MYDOB	Date of Birth - Month and Year
OPERTN_NN	Procedure Code
ORGSUP_N	Number of Organ Systems Supported

PROCODE3	Provider Organisation Code
PROCODET	Provider Code of Treatment
RURURB_IND	Rural / Urban Indicator
SEX	Current Gender of Patient
TRETSPEF	Treatment Specialty

Emergency care dataset (ECDS)

ACCOMMODATION_STATUS	Accommodation status
ACCOMMODATION_STATUS_VALID	Accommodation status valid
ACUITY	Urgency level assigned in ED
ACUITY_VALID_APPROVED	acuity valid approved
ARRIVAL_DATE	Date of arrival
ARRIVAL_MODE	Arrival Mode
ARRIVAL_MODE_VALID_APPROVED	arrival mode valid approved
ARRIVAL_TIME	arrival time
ASSESSMENT_DATE	assessment date
ASSESSMENT_TIME	assessment time
BIRTH_YEAR	birth year
CHIEF_COMPLAINT	chief complaint
CHIEF_COMPLAINT_EXTENDED_CODE	chief complaint extended code
CHIEF_COMPLAINT_VALID_APPROVED	chief complaint valid approved
COMORBIDITIES_NN	comorbidities
COMORBIDITIES_VALID_APPROVED_NN	comorbidities valid approved
CONCLUSION_DATE	conclusion date
CONCLUSION_TIME	conclusion time

DECIDED_TO_ADMIT_DATE	decided to admit date
DECIDED_TO_ADMIT_TIME	decided to admit time
DEPARTMENT_TYPE	department type
DEPARTURE_DATE	departure date
DEPARTURE_TIME	departure time
DIAGNOSIS_CODE_NN	diagnosis code
DIAGNOSIS_QUALIFIER_NN	diagnosis qualifier
DIAGNOSIS_VALID_APPROVED_NN	diagnosis valid approved
DISCHARGE_DESTINATION	discharge destination
DISCHARGE_STATUS	discharge status
DISCHARGE_STATUS_VALID_APPROVED	discharge status valid approved
INJURY_ACTIVITY_TYPE	injury activity type
INJURY_ACTIVITY_TYPE_VALID_APPROVED	injury activity type valid approved
INJURY_DATE	injury date
INJURY_TIME	injury time
INVESTIGATION_CODE_NN	investigation code
INVESTIGATION_DATE_NN	investigation date
INVESTIGATION_TIME_NN	investigation time
INVESTIGATIONS_VALID_APPROVED_NN	investigations valid approved
PREFERRED_SPOKEN_LANGUAGE	preferred spoken language
PREFERRED_SPOKEN_LANGUAGE_VALID	preferred spoken language valid
RURAL_URBAN_INDICATOR	rural urban indicator
SEEN_DATE	seen date
SEEN_TIME	seen time
SEQUENCE_NUMBER_NN	sequence number

STATED_GENDER	stated gender
TREATMENT_CODE_NN	treatment code
TREATMENT_DATE_NN	treatment date
TREATMENT_TIME_NN	treatment time
TREATMENTS_VALID_APPROVED_NN	treatments valid approved
TREATMENTS_VALID_APPROVED_NN **TREATMENTS_VALID_APPROVED**	treatments valid approved treatments valid approved

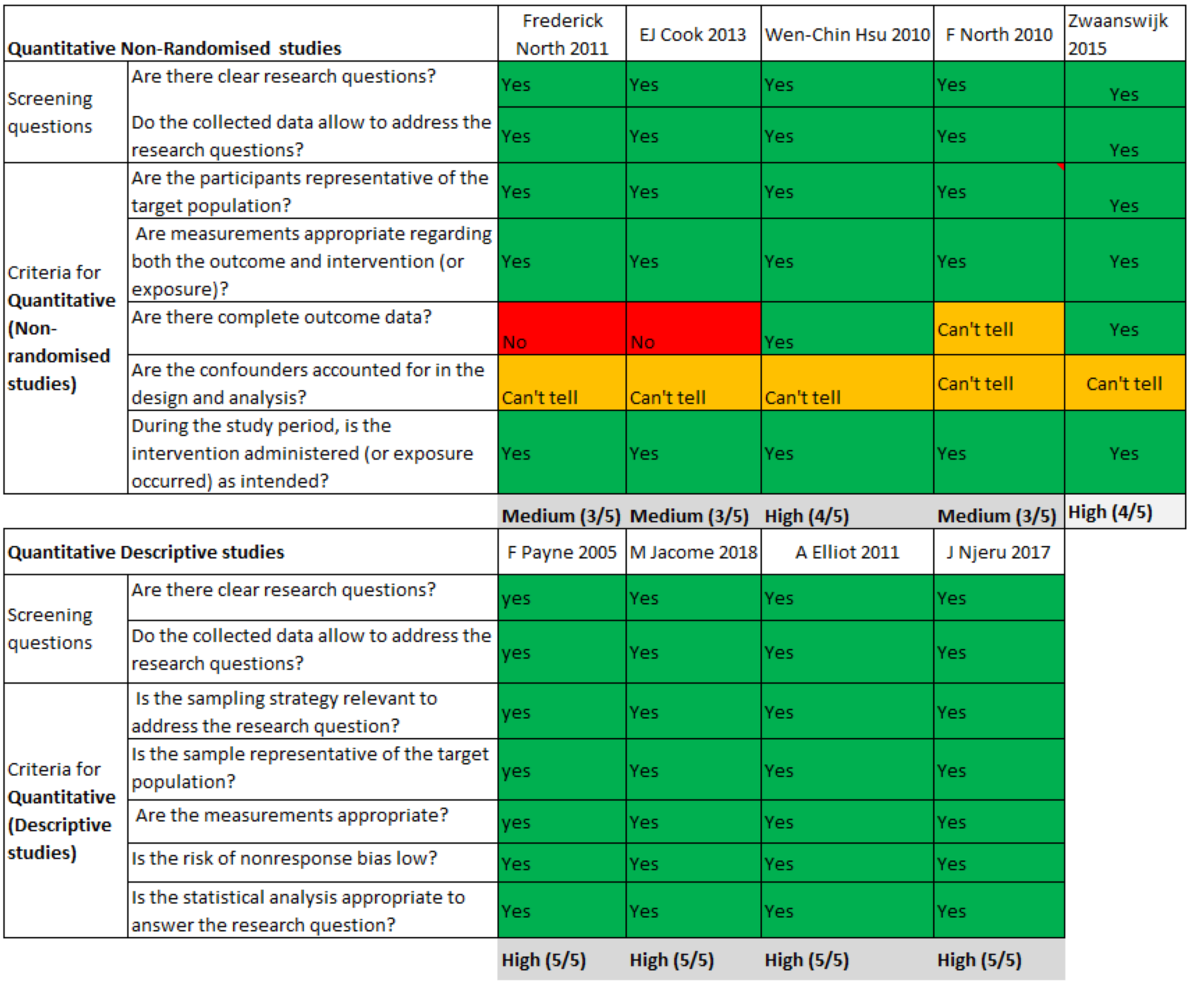
Appendix 2 Systematic Review PRISMA checklist (submitted with manuscript to BMJ open journal)

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	2
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5

Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5 (appendix 2)
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6 (appendix 3)
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	7
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	n/a
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	7

Appendix 3 MMAT results

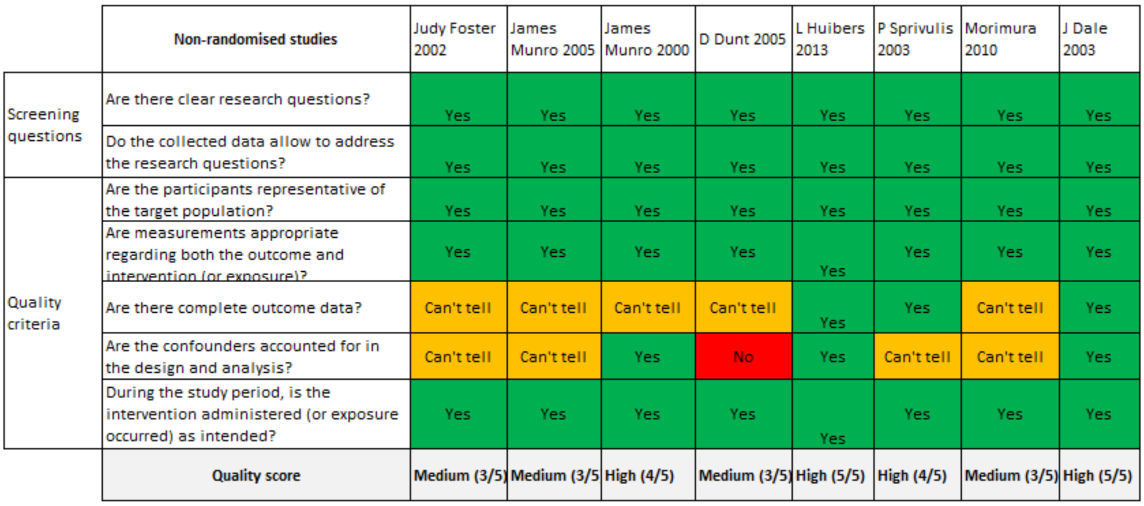
Studies investigating patterns of triage advice urgency.



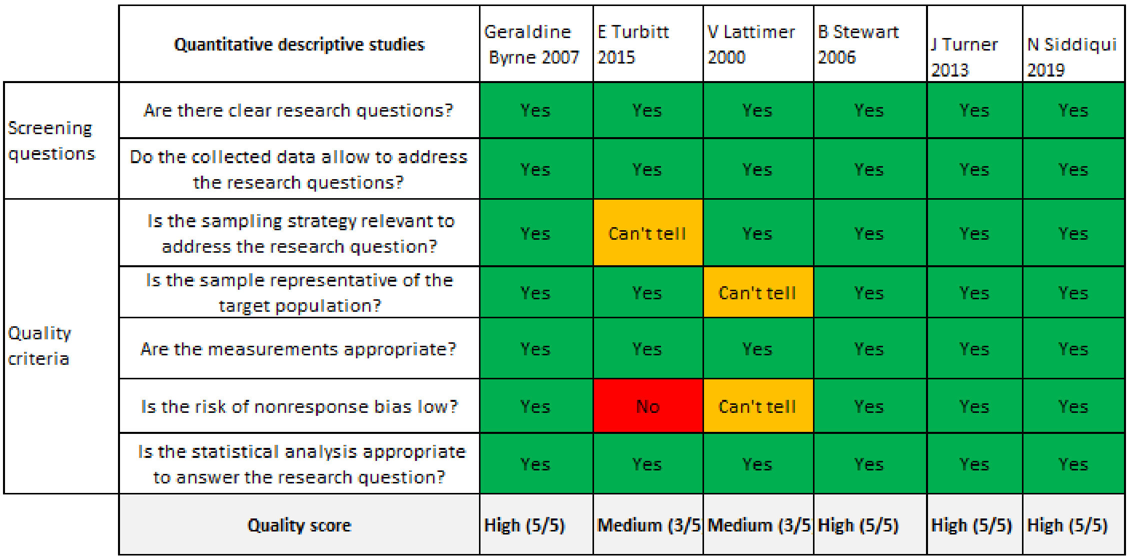
Quantitative Non-Randomised studies		Frederick North 2011	EJ Cook 2013	Wen-Chin Hsu 2010	F North 2010	Zwaanswijk 2015
Screening questions	Are there clear research questions?	Yes	Yes	Yes	Yes	Yes
	Do the collected data allow to address the research questions?	Yes	Yes	Yes	Yes	Yes
Criteria for **Quantitative (Non-randomised studies)**	Are the participants representative of the target population?	Yes	Yes	Yes	Yes	Yes
	Are measurements appropriate regarding both the outcome and intervention (or exposure)?	Yes	Yes	Yes	Yes	Yes
	Are there complete outcome data?	No	No	Yes	Can't tell	Yes
	Are the confounders accounted for in the design and analysis?	Can't tell	Can't tell	Can't tell	Can't tell	Can't tell
	During the study period, is the intervention administered (or exposure occurred) as intended?	Yes	Yes	Yes	Yes	Yes
		Medium (3/5)	**Medium (3/5)**	**High (4/5)**	**Medium (3/5)**	**High (4/5)**

Quantitative Descriptive studies		F Payne 2005	M Jacome 2018	A Elliot 2011	J Njeru 2017
Screening questions	Are there clear research questions?	yes	Yes	Yes	Yes
	Do the collected data allow to address the research questions?	yes	Yes	Yes	Yes
Criteria for **Quantitative (Descriptive studies)**	Is the sampling strategy relevant to address the research question?	yes	Yes	Yes	Yes
	Is the sample representative of the target population?	yes	Yes	Yes	Yes
	Are the measurements appropriate?	yes	Yes	Yes	Yes
	Is the risk of nonresponse bias low?	Yes	Yes	Yes	Yes
	Is the statistical analysis appropriate to answer the research question?	Yes	Yes	Yes	Yes
		High (5/5)	**High (5/5)**	**High (5/5)**	**High (5/5)**

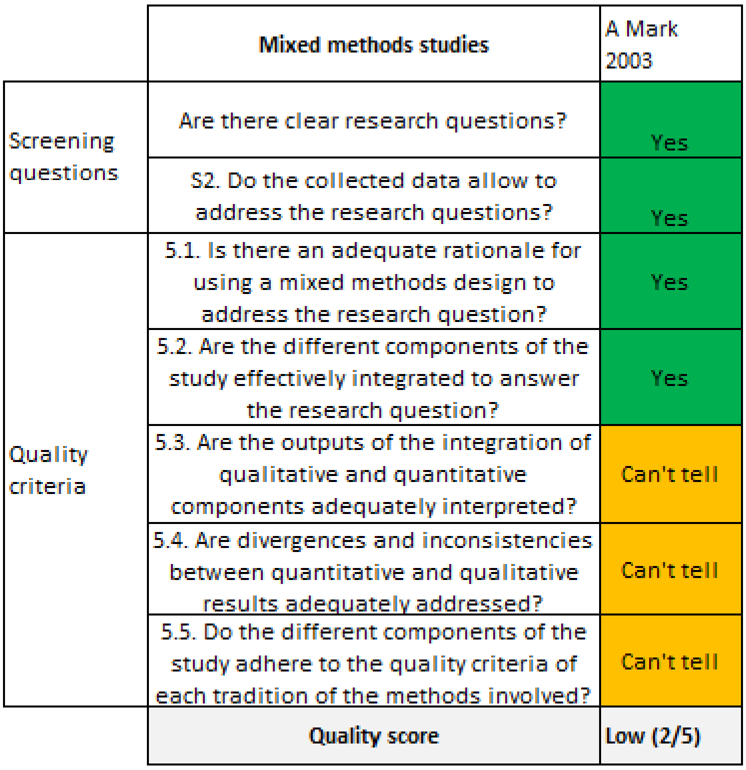
MMAT results - studies investigating service use.



	Non-randomised studies	Judy Foster 2002	James Munro 2005	James Munro 2000	D Dunt 2005	L Huibers 2013	P Sprivulis 2003	Morimura 2010	J Dale 2003
Screening questions	Are there clear research questions?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Do the collected data allow to address the research questions?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quality criteria	Are the participants representative of the target population?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Are measurements appropriate regarding both the outcome and intervention (or exposure)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Are there complete outcome data?	Can't tell	Can't tell	Can't tell	Can't tell	Yes	Yes	Can't tell	Yes
	Are the confounders accounted for in the design and analysis?	Can't tell	Can't tell	Yes	No	Yes	Can't tell	Can't tell	Yes
	During the study period, is the intervention administered (or exposure occurred) as intended?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Quality score	**Medium (3/5)**	**Medium (3/5**	**High (4/5)**	**Medium (3/5)**	**High (5/5)**	**High (4/5)**	**Medium (3/5)**	**High (5/5)**

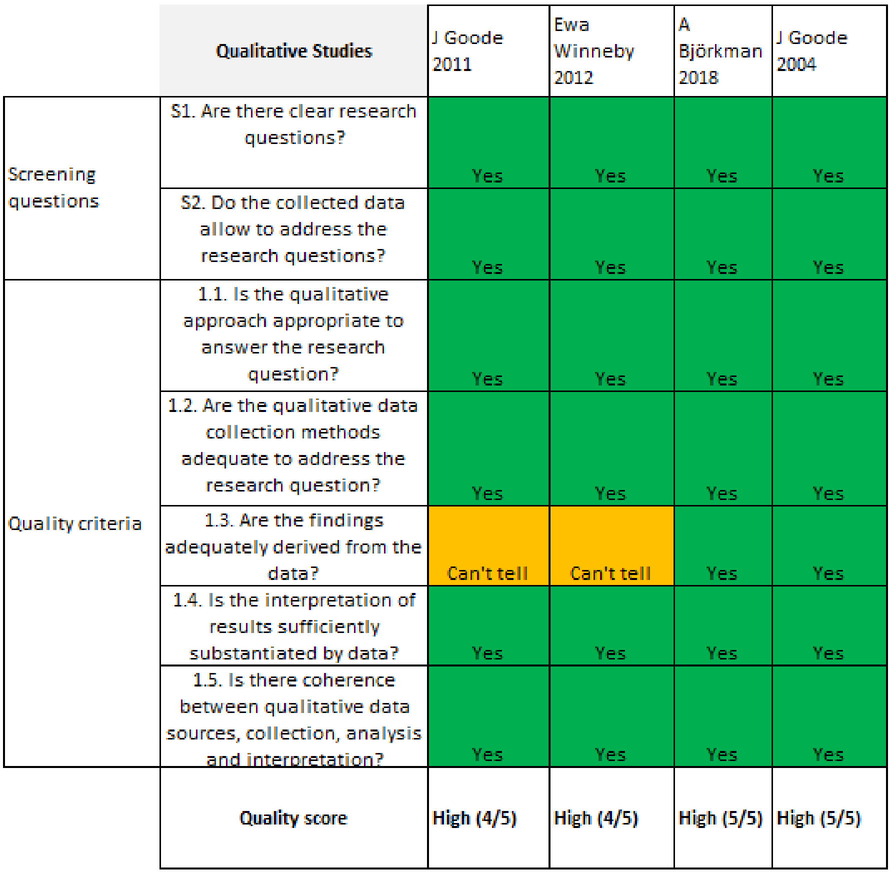


	Quantitative descriptive studies	Geraldine Byrne 2007	E Turbitt 2015	V Lattimer 2000	B Stewart 2006	J Turner 2013	N Siddiqui 2019
Screening questions	Are there clear research questions?	Yes	Yes	Yes	Yes	Yes	Yes
	Do the collected data allow to address the research questions?	Yes	Yes	Yes	Yes	Yes	Yes
Quality criteria	Is the sampling strategy relevant to address the research question?	Yes	Can't tell	Yes	Yes	Yes	Yes
	Is the sample representative of the target population?	Yes	Yes	Can't tell	Yes	Yes	Yes
	Are the measurements appropriate?	Yes	Yes	Yes	Yes	Yes	Yes
	Is the risk of nonresponse bias low?	Yes	No	Can't tell	Yes	Yes	Yes
	Is the statistical analysis appropriate to answer the research question?	Yes	Yes	Yes	Yes	Yes	Yes
	Quality score	**High (5/5)**	**Medium (3/5**	**Medium (3/5**	**High (5/5)**	**High (5/5)**	**High (5/5)**

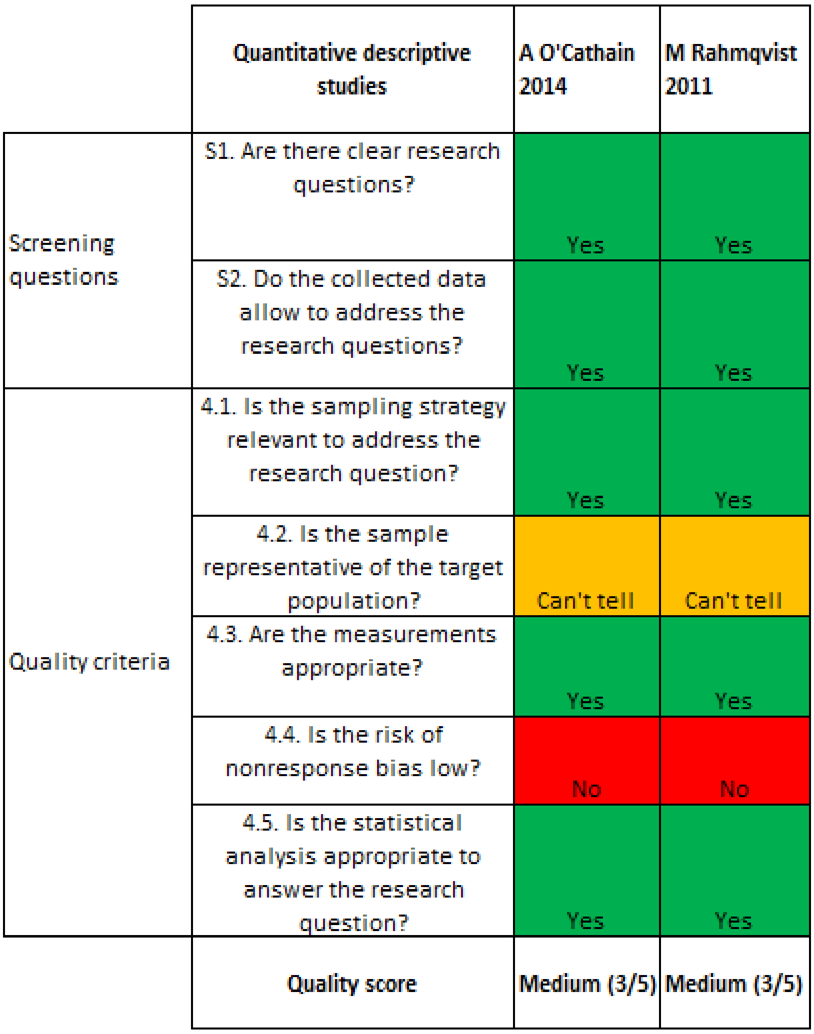


	Mixed methods studies	A Mark 2003
Screening questions	Are there clear research questions?	Yes
	S2. Do the collected data allow to address the research questions?	Yes
Quality criteria	5.1. Is there an adequate rationale for using a mixed methods design to address the research question?	Yes
	5.2. Are the different components of the study effectively integrated to answer the research question?	Yes
	5.3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	Can't tell
	5.4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?	Can't tell
	5.5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?	Can't tell
	Quality score	**Low (2/5)**

MMAT results - studies investigating user experience.



	Qualitative Studies	J Goode 2011	Ewa Winneby 2012	A Björkman 2018	J Goode 2004
Screening questions	S1. Are there clear research questions?	Yes	Yes	Yes	Yes
	S2. Do the collected data allow to address the research questions?	Yes	Yes	Yes	Yes
Quality criteria	1.1. Is the qualitative approach appropriate to answer the research question?	Yes	Yes	Yes	Yes
	1.2. Are the qualitative data collection methods adequate to address the research question?	Yes	Yes	Yes	Yes
	1.3. Are the findings adequately derived from the data?	Can't tell	Can't tell	Yes	Yes
	1.4. Is the interpretation of results sufficiently substantiated by data?	Yes	Yes	Yes	Yes
	1.5. Is there coherence between qualitative data sources, collection, analysis and interpretation?	Yes	Yes	Yes	Yes
	Quality score	**High (4/5)**	**High (4/5)**	**High (5/5)**	**High (5/5)**



	Quantitative descriptive studies	**A O'Cathain 2014**	**M Rahmqvist 2011**
Screening questions	S1. Are there clear research questions?	Yes	Yes
	S2. Do the collected data allow to address the research questions?	Yes	Yes
Quality criteria	4.1. Is the sampling strategy relevant to address the research question?	Yes	Yes
	4.2. Is the sample representative of the target population?	Can't tell	Can't tell
	4.3. Are the measurements appropriate?	Yes	Yes
	4.4. Is the risk of nonresponse bias low?	No	No
	4.5. Is the statistical analysis appropriate to answer the research question?	Yes	Yes
	Quality score	**Medium (3/5)**	**Medium (3/5)**

Mixed methods study	A McAteer 2016
S1. Are there clear research questions?	Yes
S2. Do the collected data allow to address the research questions?	Yes
5.1. Is there an adequate rationale for using a mixed methods design to address the research question?	Yes
5.2. Are the different components of the study effectively integrated to answer the research question?	Yes
5.3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	Yes
5.4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?	Yes
5.5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?	Yes
Quality score	**High (5/5)**

Appendix 4 Dxcodes mapped to Odyssey urgency level in dataset.

*Mapped urgency represents one of the seven secondary triage urgency levels that best aligns with the DxCode meaning

Dx code	**DxCode meaning (within Pathways system)**	**Mapped Odyssey urgency***
Dx02	Attend Emergency Treatment Centre within 1 hour	Care within 1 hour
Dx03	Attend Emergency Treatment Centre within 4 hours	Care within 4- 6 hours
Dx05	To contact a Primary Care Service within 2 hours	Care within 2 hours
Dx06	To contact a Primary Care Service within 6 hours	Care within 4- 6 hours
Dx07	To contact a Primary Care Service within 12 hours	Same day care within 24 hours
Dx08	To contact a Primary Care Service within 24 hours	Same day care within 24 hours
Dx09	For persistent or recurrent symptoms: get in touch with the GP Practice for a Non-Urgent Appointment	Self-care
Dx10	MUST contact own GP Practice for a Non-Urgent appointment	Routine care
Dx106	A Clinician from our Service will call the individual back immediately to assess the problem	Care within 1 hour
Dx108	The call is closed with no further action required	None
Dx11	Speak to a Primary Care Service within 1 hour	Care within 1 hour

Dx110	Community Nurse within 4 hours	Care within 4- 6 hours
Dx1112	COVID risk Clinical Assessment service 1 hour	Care within 1 hour
Dx1113	COVID risk Clinical Assessment service 2 hours	Care within 2 hours
Dx1114	COVID risk Clinical Assessment service 4 hours	Care within 4- 6 hours
Dx1115	COVID risk Clinical Assessment service 6 hours	Care within 4- 6 hours
Dx1116	COVID risk Clinical Assessment service 12 hours	Same day care within 24 hours
Dx1117	COVID risk Clinical Assessment Service next working day	Routine care
Dx115	Contact Own GP Practice next working day for appointment	Routine care
Dx116	Speak to the Primary Care Service within 6 hours for Expected Death	Care within 4- 6 hours
Dx117	Speak to a Primary Care Service within 1 hour for palliative care	Care within 1 hour
Dx118	Attend Emergency Dental Treatment Centre within 4 hours	Care within 4- 6 hours
Dx119	Call-back by Healthcare Professional within 2 hours	Care within 2 hours
Dx12	Speak to a Primary Care Service within 2 hours	Care within 2 hours
Dx120	Call-back by Healthcare Professional within 4 hours	Care within 4- 6 hours
Dx13	Speak to a Primary Care Service within 6 hours	Care within 4- 6 hours
Dx14	Speak to a Primary Care Service within 12 hours	Same day care within 24 hours
Dx15	Speak to a Primary Care Service within 24 hours	Same day care within 24 hours
Dx16	For persistent or recurrent symptoms: get in touch with the GP Practice within 3 working days	Routine care

Dx18	To Contact a Dental Service within 2 hours	Care within 2 hours
Dx19	To Contact a Dental Service within 6 hours	Care within 4- 6 hours
Dx20	To Contact a Dental Service within 12 hours	Same day care within 24 hours
Dx21	To Contact a Dental Service within 24 hours	Same day care within 24 hours
Dx22	To Contact a Dental Practice within 5 working days	Routine care
Dx25	Home Management	Self-care
Dx28	Contact Pharmacist within 24 hours	Self-care
Dx30	Speak to Midwife within 1 hour	Care within 1 hour
Dx31	Contact Genito-Urinary Clinic or other local service	Self-care
Dx32	Speak to a Clinician from our service Immediately	Care within 1 hour
Dx321	Speak to a Clinician from our service Immediately - Refused Ambulance Disposition	Care within 1 hour
Dx322	Speak to a Clinician from our service Immediately - Refused Emergency Treatment Centre Disposition	Care within 1 hour
Dx323	Speak to a Clinician from our service Immediately - Refused Primary Care Service Disposition	Care within 1 hour
Dx324	Speak to a Clinician from our service Immediately - Refused Disposition	Care within 1 hour
Dx325	Speak to a Clinician from our service Immediately - Toxic Ingestion/Inhalation	Care within 1 hour
Dx326	Speak to a Clinician from our service Immediately - Frequent Caller	Care within 1 hour

Dx327	Speak to a Clinician from our service Immediately - Chemical Eye Splash	Care within 1 hour
Dx328	Speak to a Clinician from our service Immediately - Management of dying individual (expected)	Care within 1 hour
Dx329	Speak to a Clinician from our service Immediately - Failed Contraception	Care within 1 hour
Dx330	Speak to a Clinician from our service Immediately - Burn; Chemical	Care within 1 hour
Dx332	Speak to a Clinician from our service Immediately - Management of palliative care	Care within 1 hour
Dx333	Speak to a Clinician from our service Immediately - Ambulance Validation	Care within 1 hour
Dx334	Speak to a Clinician from our service Immediately - Emergency Treatment Centre Within 1 Hour Validation	Care within 1 hour
Dx335	Speak to a Clinician from our service Immediately - Other Disposition Validation	Care within 1 hour
Dx336	Paramedic requesting call-back from Healthcare Professional within 30mins	Care within 1 hour
Dx339	Speak to a Clinician from our service Immediately – COVID 19 Chest Pain Assessment	Care within 1 hour
Dx34	Speak to Clinician from our service within 30 minutes	Care within 1 hour
Dx35	Speak to Clinician from our service within 2 hours	Care within 2 hours
Dx38	Speak to Clinician from our service for home management advice	Care within 1 hour
Dx39	Symptom Management Advice	Self-care
Dx391	COVID Self Care	Self-care

Dx45	Service Location Information	Information/other
Dx46	Refer to health information within 24 hours	Information/other
Dx48	Refer to Another Out of Hours Service Provider	Information/other
Dx49	999 for police	Information/other
Dx50	Speak to Midwife or Labour Suite immediately	Care within 1 hour
Dx60	Contact Optician next routine appointment within 72 hours (3 days from now)	Routine care
Dx74	Refer to Social Services; next working day	Information/other
Dx75	MUST contact own GP Practice within 3 working days	Routine care
Dx76	Call-back by Healthcare Professional within 30 minutes	Care within 1 hour
Dx77	Call-back by Healthcare Professional within 60 minutes	Care within 1 hour
Dx78	Receive report of results or tests from laboratory	Information/other
Dx80	Repeat prescription required within 6 hours	Self-care
Dx81	Contact Own GP Practice next working day for Repeat Prescription	Self-care
Dx82	Medication Enquiry	Self-care
Dx85	Repeat prescription required within 2 hours	Self-care
Dx86	Repeat prescription required within 12 hours	Same day care within 24 hours
Dx87	Repeat prescription required within 24 hours	Self-care
Dx88	Speak to a Dental Service within 2 hours	Care within 2 hours
Dx89	Attend Emergency Treatment Centre within 12 hours	Same day care within 24 hours

Dx92	Refer to Mental Health/Crisis Service within 4 hours	Care within 4- 6 hours
Dx96	Refer to Health Information within 12 hours	Information/other
Dx97	Emergency Contraception required within 2 hours	Self-care
Dx98	Emergency Contraception required within 12 hours	Self-care

Appendix 5 Frequency of calls about 'other' symptoms (Odyssey v3)

Other symptom	Number of calls	Percentage
Abdo pain/pregnant	483	0.67
Abdomen (GI)	17	0.02
Abdominal Injury	56	0.08
Abdominal Swelling	216	0.3
Abrasion	383	0.54
Abscess	913	1.28
Acne problem	12	0.02
Act Daily Living	20	0.03
Alcohol screen	57	0.08
Allergy symptom	1,423	1.99
Altered sensation	596	0.83
Amenorrhoea	155	0.22
Anal problem	575	0.8
Ankle Injury	311	0.43
Ankle pain/problem	481	0.67
Anxiety/Stress	1,290	1.8
Appetite Problem	662	0.92
Arm Pain	436	0.61
Arm pain/problem	417	0.58
Arm site injury	29	0.04
Arm swelling	243	0.34
Assault	82	0.11
Asthma symptom	1,912	2.67
Back Injury	249	0.35
Bereavement	43	0.06
Bite/scratch injury	297	0.41
Bleeding	7	0.01
Bleeding Nose	620	0.87
Blood in Semen	8	0.01
Blood in Urine	1,432	2
Blood/fluid contact	16	0.02
Breast Lump	156	0.22
Breast Problem	401	0.56
Burn (Chemical)	23	0.03
Burn (Scalding)	193	0.27
Burn (Thermal)	117	0.16
COPD	466	0.65
COPD symptom	214	0.3
Cancer therapy asses	7	0.01
Cannabis use	2	0
Cardiovascular risk	645	0.9
Catheter Problem	534	0.75
Chest Injury	180	0.25

Cocaine/crack use	2	0
Cold injury/low temp	520	0.73
Colicky baby	83	0.12
Collapse	93	0.13
Constipation	1,900	2.65
Contracept'n implant	5	0.01
Convulsion/Fit	274	0.38
Coping difficulty	6	0.01
Covid-19	1,503	2.1
Cramp	43	0.06
Croup (symptom)	13	0.02
Crying	743	1.04
Current Medication	10	0.01
Death	225	0.31
Dementia issues	67	0.09
Dental Problem	694	0.97
Diabetes	676	0.94
Domestic abuse	6	0.01
Drug/withdrawal	172	0.24
Ear Discharge	319	0.45
Ear Foreign Body	30	0.04
Ear Injury	55	0.08
Ear Wax	37	0.05
Ebola risk	4	0.01
Eczema	201	0.28
Eczema symptom	206	0.29
Elbow Injury	76	0.11
Elbow Pain/problem	139	0.19
Electrical Burn	7	0.01
Emerg. Contraception	44	0.06
End of life care	198	0.28
Enteral tube problem	56	0.08
Eye Foreign Body	31	0.04
Eye Injury	153	0.21
Eye pain/problem	688	0.96
Eye problem	854	1.19
FB Ingestion	103	0.14
Facial Injury	137	0.19
Facial Pain	420	0.59
Facial Swelling	1,192	1.67
Faecal incontinence	13	0.02
Fall	679	0.95
Fall risk assessment	11	0.02
Fall(s)	1,361	1.9
Finger Injury	475	0.66

Finger Pain	476	0.66
Flushing	10	0.01
Foot Injury	340	0.47
Foot Pain/problem	1,037	1.45
Forearm Injury	96	0.13
GU Foreign Body	35	0.05
GU Injury	78	0.11
GU Symptoms	98	0.14
General Aches	554	0.77
General Condition	135	0.19
General Weakness	283	0.4
Genital Rash	161	0.22
Haemoptysis	256	0.36
Haemorrhoid symptom	205	0.29
Hair Loss	22	0.03
Hand Injury	186	0.26
Hand Pain	304	0.42
Head Injury	1,321	1.85
Head Lice	1	0
Head/Eye	2	0
Healing wound	1,332	1.86
Health Check	2	0
Hearing Loss	209	0.29
Hiccups	34	0.05
Hip Injury	52	0.07
Hip Pain/problem	344	0.48
Illicit Drug Taking	1	0
Immunisation	379	0.53
Indigestion	307	0.43
Information	1,980	2.77
Inguinal Problem	537	0.75
Inhalation Injury	73	0.1
Injury	12	0.02
Jaundice	56	0.08
Jaw Problem	137	0.19
Joint pain/problem	219	0.31
Knee Injury	231	0.32
Knee Pain/problem	827	1.16
Laceration/Cut	394	0.55
Leg Pain	1,712	2.39
Leg Swelling	787	1.1
Limb Injuries	14	0.02
Limping	7	0.01
Lost Consciousness	207	0.29
Low mood	543	0.76

Lower Leg Injury	136	0.19
Lower Leg Pain	462	0.65
Lower leg problem	105	0.15
Medical History	18	0.03
Melaena symptom	60	0.08
Memory Loss	26	0.04
Menstrual Problem	210	0.29
Mouth Problems	1,199	1.68
Mouth injury	25	0.03
Multiple Injuries	6	0.01
Nappy Rash	130	0.18
Nausea	543	0.76
Neck Injury	98	0.14
Neck Pain/Stiff	601	0.84
Neck Swelling	103	0.14
Neonatal Jaundice	15	0.02
Nocturia	898	1.25
Nose Foreign Body	13	0.02
Nose Injury	44	0.06
Overdose/ingestion	132	0.18
Overdose/intoxicated	96	0.13
Pacemaker problem	1	0
Pain	6	0.01
Palliative Care	161	0.22
Palpitations	929	1.3
Pandemic-Phase 6-4	1	0
Panic Attack	243	0.34
Pelvic Pain	539	0.75
Penile Discharge	67	0.09
Penis problem	501	0.7
Personal context	919	1.28
Photophobia	29	0.04
Plaster/cast Problem	13	0.02
Possible drowning	12	0.02
Possible labour	1	0
Possible self harm	54	0.08
Post TOP	13	0.02
Post Vasectomy	4	0.01
Post coil fitting	29	0.04
Post colposcopy	1	0
Post implant fitting	4	0.01
Postnatal	54	0.08
Pregnancy?	472	0.66
Pregnant/Vomiting	271	0.38
Psychological State	712	0.99

Psychosocial Assess	23	0.03
Pubic Lice	2	0
Recent operation	90	0.13
Rectal Bleeding	764	1.07
Red Eye	321	0.45
SARI	190	0.27
Shoulder Injury	130	0.18
Shoulder Pain/prob	517	0.72
Skin bleed/bruising	358	0.5
Skin blisters	276	0.39
Skin/Tissue Problem	1,246	1.74
Skin/tissue lump(s)	780	1.09
Sleeping problem	132	0.18
Smell sense problem	11	0.02
Soft Tiss For. Body	86	0.12
Sport related injury	1	0
Sticky Eye	590	0.82
Stings	1,520	2.12
Stoma problem	78	0.11
Suicidal	232	0.32
Sun/Heat injury	65	0.09
Sunburn	13	0.02
Suprapubic Pain	140	0.2
Swallowing problem	196	0.27
Sweating	57	0.08
Temp management	1	0
Testis Problem	459	0.64
Thigh Injury	35	0.05
Thirst	221	0.31
Throat Foreign Body	39	0.05
Throat problem	353	0.49
Thrush symptom	334	0.47
Tick bite symptom	23	0.03
Tinnitus	63	0.09
Tiredness	205	0.29
Tissue viability	16	0.02
Toe Injury	291	0.41
Toe Pain	452	0.63
Toothache	919	1.28
Traffic Accident	101	0.14
Traffic Collision	23	0.03
Travel	1	0
Tremor	143	0.2
Umbilical Problem	119	0.17
Unconscious	14	0.02

Unusual Behaviour	190	0.27
Unusual Ideas/Talk	114	0.16
Upper Arm Injury	56	0.08
Vaginal Bleed	923	1.29
Vaginal Discharge	210	0.29
Vaginal Problem	363	0.51
Visual Disturbance	213	0.3
Voice/speech problem	45	0.06
Vomiting Blood	396	0.55
Watering eye(s)	26	0.04
Weak/Paralysis	201	0.28
Weak/lethargy	7	0.01
Weight Loss	18	0.03
Worm symptom	75	0.1
Wrist Injury	127	0.18
Wrist Pain/problem	133	0.19
Total	71,582	100

Appendix 6 Draft protocol and feedback requested from potential participating urgent care providers.

Digital Triage Interview Study – DRAFT PROTOCOL

I would like to invite feedback on this part of my PhD research study prior to seeking NHS ethics approval.

This document provides a summary of the study and how your service will be asked to help with selecting and inviting your service users to consider participation. I would be very grateful to receive any feedback on:

1. Any elements that would be useful to your service that you would like incorporated into the interviews
2. If you feel the recruitment process is feasible for your service.

Summary of the study

This research investigates how service users (who may be patients or carers) experience urgent care that is delivered through digital triage. Working with up to six UK service providers, this study will recruit a diverse range of patients and carers, including those who have been shown to be under-represented in their use of these services and in previous research (including older age groups and ethnic minorities).

Around 35 interviews will be conducted with service users, in order to investigate how patient experience compares for those who receive low urgency advice as compared to those receiving higher urgency advice. The study will also investigate user attitudes to these telephone-based services in the context of the COVID-19 pandemic. Understanding user experience will help identify areas that can be improved in service design and delivery, and so improve patients' care journeys and outcomes. A report of the results will be offered to participating services and to participating service users.

What will taking part involve for you as a care provider?

Taking part in this project will require your service to:

- Confirm participation via the Health Research Authority Organisation Information Document

- Select service users to participate in the study, according to particular participant characteristics. Please see the section below for more information on how.
- Send participant packs (containing an invitation, information about the study and a reply slip to the selected service users). Information packs will be provided to you by the PhD student.

How will you be asked to identify service users for invitation?

You will be helped to create a list of 50 – 100 service users between March 2021 – June 2021. The list will be produced by a report that Advanced will provide and will cover service users with a wide range of characteristics.

For example, you may be asked to invite participants with the characteristics as below:

Triage advice urgency level	**Service user characteristic**	**Number of service users to select**
Low urgency advice	Males (under 60)	3
	Males (under 60) - ethnic minority	3
	Females (under 60)	3
	Female (under 60) - ethnic minority	3
	Males (over 60)	4
	Males (over 60) - ethnic minority	4
	Females (over 60)	4
	Females (over 60) - ethnic minority	4
Medium or high urgency advice	Males (under 60)	3
	Males (under 60) - ethnic minority	3
	Females (under 60)	3
	Female (under 60) - ethnic minority	3
	Males (over 60)	4
	Males (over 60) - ethnic minority	4
	Females (over 60)	4
	Females (over 60) - ethnic minority	4
	Total invitations to send	**53**

A senior clinician at your service would be asked to check the service users are eligible to take part based on the eligibility criteria on page 4.

How will you be able be asked to help invite service users?

You will be asked to invite the service users you have screened as eligible to consider participating in the study.

You will be provided with two different types of participant information packs: one for service users selected in the low urgency group and for service users selected in the high urgency group. Each pack will contain:

1. A participant information sheet
2. A consent form
3. A reply slip containing the researcher's details, so that the service user can contact the PhD student directly if they would like to take part. This will contain a reference number indicating the triage advice urgency.

You will be asked to report back the numbers of service users that you have invited in each group, so that I can keep track of the participant response rates. You may be asked to send reminders at 2 weeks, which will be provided to you.

Overall, we would like each service to have recruited between 5 – 10 participants. If participant response rates are low, you may be asked to send another batch of invitations (up to 100 overall).

Eligibility criteria for participants

Sites will be asked to use the following eligibility criteria at the participant selection stage

Inclusion criteria	**Exclusion criteria**
All participants (patients or carers) must • be at least 18 years old • have called the service and been triaged themselves or called on behalf of a patient who was triaged in the past week at the time the invitation is sent • be considered appropriate for inclusion in the study (based on the triage call, participants must not have any sensitive care problem, which relates to: end of life, substance/alcohol misuse, suicidal thoughts, abnormal behaviour/thoughts, complex social situation such as domestic violence or where there may be safeguarding issues) • be able to read and understand the information sheet and consent form • understand verbal explanations about the research • be able to give consent by themselves • not have any special communication needs (e.g., translator)	All participants (patients or carers) must • be at least 18 years old • have called the service and been triaged themselves or called on behalf of a patient who was triaged in the past week at the time the invitation is sent • be considered appropriate for inclusion in the study (based on the triage call, participants must not have any sensitive care problem, which relates to: end of life, substance/alcohol misuse, suicidal thoughts, abnormal behaviour/thoughts, complex social situation such as domestic violence or where there may be safeguarding issues) • have the ability to read and understand the information sheet and consent form • understand verbal explanations about the research • have the ability to give consent by themselves • not have any special communication needs (e.g. translator)

Appendix 7 Interview guide

Ahead of the interview, the PhD student will explain that the interview focuses on the telephone call with the clinician (usually a nurse) at the out of hours service. In England, the patient/carer would have spoken to the out of hours service after speaking to NHS 111; it will be made clear that this interview is about the second person (usually a nurse) that the participant spoke to. For services outside England, NHS 111 will not be mentioned, as the patient would have contacted the service directly. The PhD student will ensure that the participant understands all terms in the questions (for example: “out of hours service”).

The student will remind participants that interviews will be audio-recorded

Questions will include further prompts for enquiry where necessary and these are to support the researcher in covering the key issues.

Part 1: Experience of the telephone triage

1. Could you tell me how you came to speak to the out of hours service [name] on the phone?
    - Prompt (England only): did you call via NHS 111 or call the [name] service directly?
    - If via 111 –
        i. Did you receive call back after speaking with NHS 111?
        ii. Were you immediately transferred from NHS 111 to speak to a clinician?
2. Can you take me through the conversation you had with the person (clinician) answering the call? [England based services: Here I am referring to the second person you spoke to, after you initially spoke to NHS 111?]
3. What was his/her general attitude/manner like?
4. How easy was it for you to talk with the person answering the call?

Prompts: Clarity of questioning; relevance of questions; impression of thoroughness; confidence in clinician, and their interpretation of urgency

5. Was there anything about the conversation with the clinician/nurse you did not like?
6. Was there anything about the conversation with the clinician/nurse you did like?
7. How well did you understand the advice given to you by the clinician/nurse?
8. How did you feel about the health advice given to you?

    - Was it what you expected?

Part 2: Care journey following the telephone call

This section will be followed for all participants, however, only the applicable questions will be asked. For example, participants who followed self-care advice and did not receive any further care will only be asked question 1; questions 2 and 3 would not be applicable.

1. What did you do about your problem after the telephone call?

    - Prompt: did you follow the advice? Reasons for following or not following advice

2. What was your experience of receiving care following the telephone call? (if applicable)

    - Prompt: Appropriate care received / health concern resolved

3. After the phone call, how did you find speaking to a doctor or nurse over teleconference? (only where applicable)

Part 3: Particular barriers or facilitators

1. Did you have any difficulties with telephoning the service?
    - Difficulties with making the telephone call
    - Getting through to someone
2. How does this recent experience compare with past ones, if you have used the service before?
3. Are there any aspects of the process that you think should be improved?
    - What would a good/improved service look like to you?
4. Do you have any other comments you would like to make?

At the end of the interview the student will provide a brief summary and debrief to the participant. The participant will be thanked for taking part in the research.

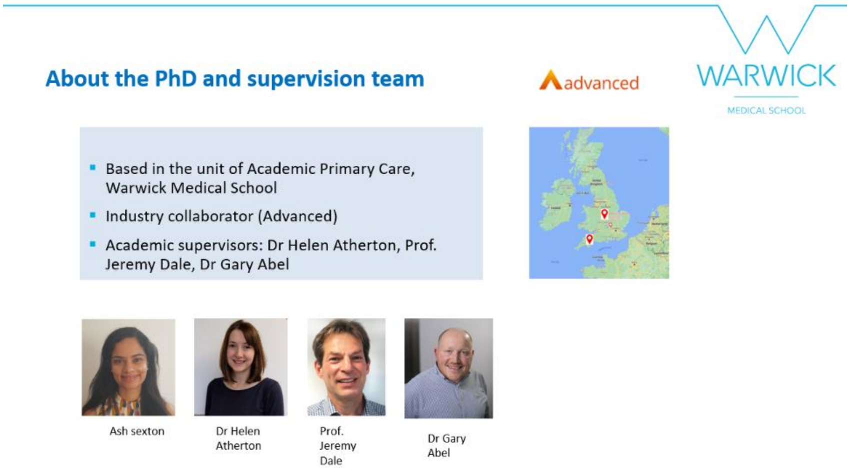
Appendix 8 Selected slides from research dissemination workshop

Digital triage in urgent care: how can research findings drive improvement in service delivery?

Ash Sexton, Doctoral Student (ash.sexton@warwick.ac.uk)

Academic supervisors: Dr Helen Atherton – associate professor, Prof Jeremy Dale – Professor, Dr Gary Abel – associate professor

23 June 2022



About the PhD and supervision team

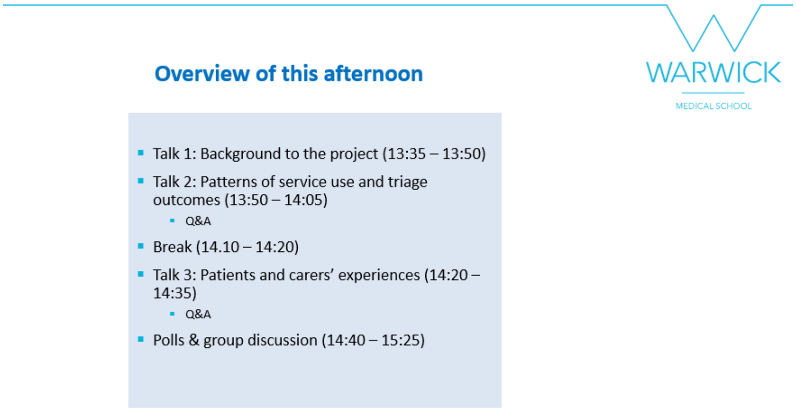
- Based in the unit of Academic Primary Care, Warwick Medical School
- Industry collaborator (Advanced)
- Academic supervisors: Dr Helen Atherton, Prof. Jeremy Dale, Dr Gary Abel

Ash sexton

Dr Helen Atherton

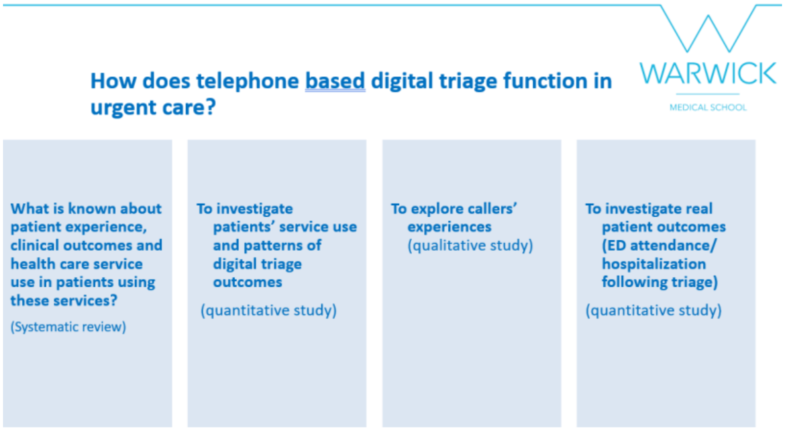
Prof. Jeremy Dale

Dr Gary Abel



Overview of this afternoon

- Talk 1: Background to the project (13:35 – 13:50)
- Talk 2: Patterns of service use and triage outcomes (13:50 – 14:05)
  - Q&A
- Break (14.10 – 14:20)
- Talk 3: Patients and carers' experiences (14:20 – 14:35)
  - Q&A
- Polls & group discussion (14:40 – 15:25)



How does telephone based digital triage function in urgent care?

What is known about patient experience, clinical outcomes and health care service use in patients using these services?

(Systematic review)

To investigate patients' service use and patterns of digital triage outcomes

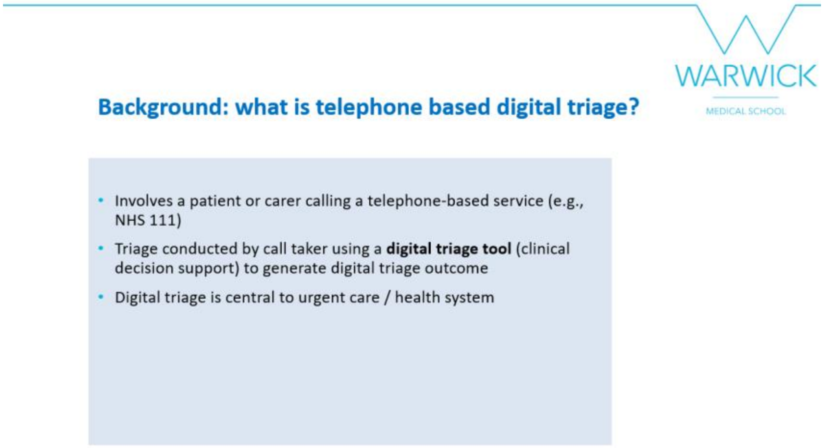
(quantitative study)

To explore callers' experiences

(qualitative study)

To investigate real patient outcomes (ED attendance/ hospitalization following triage)

(quantitative study)



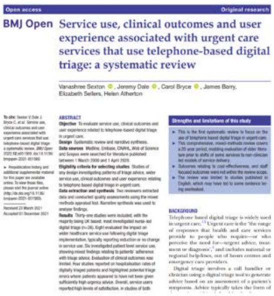
Background: what is telephone based digital triage?

- Involves a patient or carer calling a telephone-based service (e.g., NHS 111)
- Triage conducted by call taker using a **digital triage tool** (clinical decision support) to generate digital triage outcome
- Digital triage is central to urgent care / health system

Systematic review

What is known about patient experience, clinical outcomes and health care service use in patients using these services?

WARWICK
MEDICAL SCHOOL



Open access Original research

BMJ Open Service use, clinical outcomes and user experience associated with urgent care services that use telephone-based digital triage: a systematic review

Vanashree Sexton, Jeremy Dale, Carol Bryce, James Barry, Elizabeth Sellers, Helen Atherton

ABSTRACT

Objective To evaluate service use, clinical outcomes and user experience related to telephone-based digital triage in urgent care.

Design Systematic review and narrative synthesis.

Data sources Medline, Embase, CINAHL, Web of Science and Scopus were searched for literature published between 1 March 2000 and 1 April 2020.

Eligibility criteria for selecting studies Studies of any design investigating patterns of triage advice, wider service use, clinical outcomes and user experience relating to telephone based digital triage in urgent care.

Data extraction and synthesis Two reviewers extracted data and conducted quality assessments using the mixed methods appraisal tool. Narrative synthesis was used to analyse findings.

Results Thirty-one studies were included, with the majority being UK based; most investigated nurse-led digital triage (n=26). Eight evaluated the impact on wider healthcare service use following digital triage implementation, typically reporting reduction or no change in service use. Six investigated patient level service use, showing mixed findings relating to patients' adherence with triage advice. Evaluation of clinical outcomes was limited. Four studies reported on hospitalisation rates of digitally triaged patients and highlighted potential triage errors where patients appeared to have not been given sufficiently high urgency advice. Overall, service users reported high levels of satisfaction, in studies of both

Strengths and limitations of this study

- This is the first systematic review to focus on the use of telephone based digital triage in urgent care.
- This comprehensive, mixed-methods review covers a 20-year period, enabling evaluation of older literature prior to shifts of some services to non-clinician led models of service delivery.
- Outcomes relating to cost-effectiveness, and staff focused outcomes were not within the review scope.
- The review was limited to studies published in English, which may have led to some evidence being overlooked.

BACKGROUND

Telephone based digital triage is widely used in urgent care.[1,2] Urgent care is the 'the range of responses that health and care services provide to people who require—or who perceive the need for—urgent advice, treatment or diagnosis',[3] and includes national or regional helplines, out of hours centres and emergency care providers.

Digital triage involves a call handler or clinician using a digital triage tool to generate advice based on an assessment of a patient's symptoms. Advice typically takes the form of

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An investigation of telephone based digital triage in urgent care

WARWICK
MEDICAL SCHOOL

Study 1 To investigate patients' service use and patterns of digital triage outcomes (quantitative)

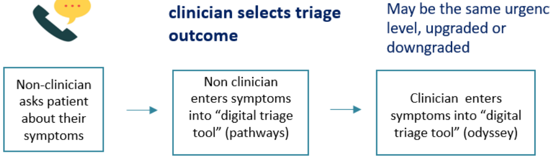
1. How do triage outcomes change between primary NHS111 pathways triage and secondary triage?
2. To describe patients undergoing clinician led triage
3. Which patients are more likely to be given "urgent and emergency" triage outcomes?

Four **England** based urgent care providers, all using the same "Odyssey" digital triage tool

Study 2 To explore callers' experiences (qualitative study)

1 **England** based / 1 **Northern Ireland** based

Comparing triage outcomes between “primary” and “secondary” triage



Primary triage: non-clinician selects triage outcome

Clinician selected triage outcome (re-triage)

May be the same urgency level, upgraded or downgraded

Non-clinician asks patient about their symptoms

Non clinician enters symptoms into “digital triage tool” (pathways)

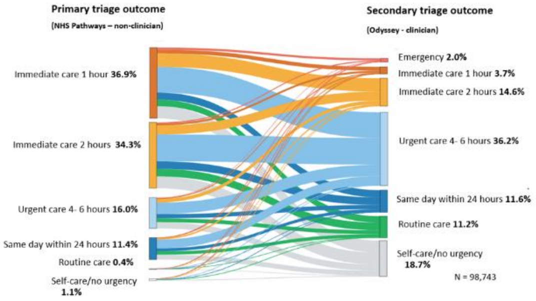
Clinician enters symptoms into “digital triage tool” (odyssey)

1. Emergency
2. Care within 1 hour
3. Care within 2 hour
4. Care within 4 – 6 hours
5. Care within 24 hours
6. Routine care
7. Self-care / no urgency

(Mapped from “Dxcode”)

1. Emergency
2. Care within 1 hour
3. Care within 2 hour
4. Care within 4 – 6 hours
5. Care within 24 hours
6. Routine care
7. Self-care / no urgency

How do triage outcomes change between primary (NHS111) and secondary (clinician led) triage?



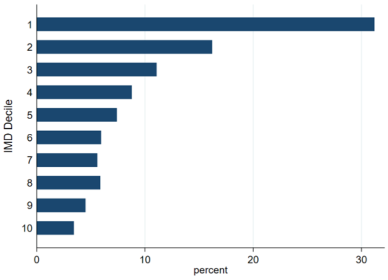
Clinician led triage: Call rates higher in certain patient groups

Call rates highest in:

- Under 24 months: (RR: 5.32) and 85 +: (RR4.17) (ref:35-44)
- Female patients
- Deprived groups (IMD decile)

After the start of Covid-19:

- Overall call rate decreased, but increased in certain age groups (between 16 – 64)
- Call lengths increased (Before covid: 9 min, after start of covid: 12 min)



Talk 2 Summary & any questions?

Comparing primary and secondary triage

- 74% of calls downgraded from triage outcome assigned by NHS 111 pathways
- Symptoms most likely to be upgraded: chest pain and breathlessness
- Variation in upgrading/downgrading associated with clinician

Patterns in Secondary triage

- Certain groups have higher call rates: female patients, deprived groups
- Symptoms most likely to have emergency/urgent outcome: breathlessness & chest pain
- Upgrading/downgrading of digitally recommended triage outcome
  - sore throat & earache most upgraded
  - backpain & diarrhea most downgraded
- Very high variation in how clinicians triage calls

Overview of themes

Navigating the system

- Difficulty in access/ navigating usual care routes
- NHS 111 picked up unmet needs

Communication

- Reassuring communication important
- Rigidity in interaction

Patient/professional dynamic

- The patient's knowledge
- Patients sought validation
- Shared decision making

Good/Responsible patient

- Appreciation of service
- Not wanting to waste the services' time
- Judgments on others' use

Presentation last modified: 07/11/2022

Navigating the system: Inaccessibility of care through usual route

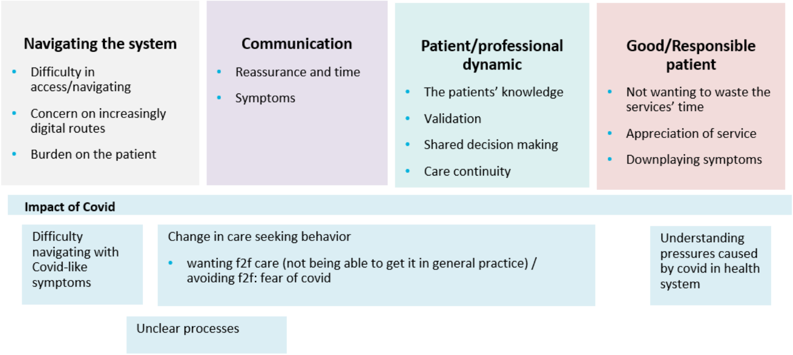
"I've always been, well thankful really for having that 111. Well because you can't, well ***I can't get through to my doctors for love nor money a lot of the time*** *…"*

– Patient (England), F, aged 35 - 44, White

"So I, I, first of all I had an emergency, what's supposed to be a 24-hour emergency number to contact the hospital when the operation was done… which is an NHS hospital. ***And I could get no answer, so I called NHS 111****"*

– Patient (England), M, *aged:55-64*

Cross-cutting theme: Impact of covid



Navigating the system
- Difficulty in access/navigating
- Concern on increasingly digital routes
- Burden on the patient

Communication
- Reassurance and time
- Symptoms

Patient/professional dynamic
- The patients' knowledge
- Validation
- Shared decision making
- Care continuity

Good/Responsible patient
- Not wanting to waste the services' time
- Appreciation of service
- Downplaying symptoms

Impact of Covid

Difficulty navigating with Covid-like symptoms

Change in care seeking behavior
- wanting f2f care (not being able to get it in general practice) / avoiding f2f: fear of covid

Understanding pressures caused by covid in health system

Unclear processes

Discussion session

Summary

Comparing primary & secondary triage

- Most calls (70%) from Pathways are downgraded in secondary triage
- Calls about chest pain / breathlessness most likely to be upgraded

Clinician led triage

- Higher service use in deprived groups & female patients
- Large differences in how clinicians conduct triage and override digital recommendation

Patient experiences
- NHS 111 picks up unmet needs
- Importance of softer skills/reassurance together with digital triage
- Patient knowledge and health literacy influences triage outcomes

1. **What are your experiences as a service provider/stakeholder/patient/researcher?**

2. **Moving forward:**
   - Where would you like to see more research?
   - Which findings might help improve service delivery?