

Exploring Factors Associated with Paramedic
Conveyance Decisions for Patients with Chronic
Obstructive Pulmonary Disease:
A Retrospective Cohort Study.

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Declaration

I, Colin Crookston, hereby declare that this thesis represents my own original research and that I am the sole author, except where otherwise acknowledged. To the best of my knowledge and belief, all sources have been appropriately cited and referenced. AI tools were not used to generate original academic content; Grammarly® was used for spelling, grammar and language refinement, and all suggested changes were critically reviewed.

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I made you a promise. This is for you.

Abstract

Background:

Paramedic non-conveyance is an established and expanding component of pre-hospital care; however, the processes underpinning these decisions remain incompletely understood. Existing research is characterised by heterogeneous patient populations, reliance on measurable risk predictors, and limited linkage to outcomes, resulting in an incomplete account of how decisions are made in practice. This gap is particularly evident in condition-specific analyses, including chronic obstructive pulmonary disease (COPD), where clinical complexity and baseline physiological variability introduce significant uncertainty into decision-making.

Aim:

This study examines the associations among patient demographics, physiological observations, service-level factors, COPD pathway suitability and paramedic conveyance decisions, and examines how hospital admission, length of stay and 30-day mortality vary across physiological risk classifications, pathway-defined groups and observed dispositions.

Methods:

A retrospective cohort study was conducted using routinely collected Scottish Ambulance Service data linked to hospital outcome data. Patients presenting with COPD were identified and analysed with respect to conveyance decisions. Variables included demographics, physiological observations, and service-level factors. Outcomes were examined across physiological risk classifications, pathway-defined groups and observed disposition categories.

Results:

Respiratory rate and heart rate were strongly associated with conveyance decisions, while oxygen saturation showed a directional but statistically non-significant association. Associations between physiological and pathway classifications and subsequent outcomes varied across the cohort. Patients identified as higher risk were more likely to be conveyed, admitted, and to experience adverse outcomes. In contrast,

demographic and service-level factors showed no consistent association with conveyance decisions. However, measurable variables did not fully explain decision-making. Divergence between physiological status and disposition was consistently observed, with both non-conveyance of higher-risk patients and conveyance of lower-risk patients evident in the dataset.

Conclusions:

The findings suggest that recorded physiological variables and pathway criteria do not fully account for observed variation in conveyance decisions. Although this pattern is consistent with influences beyond the measured variables, including clinical and contextual factors, those influences were not directly examined.

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List of Abbreviations

COPD	Chronic Obstructive Pulmonary Disease
CPG	Clinical Practice Guidelines
CRT	Community Respiratory Team
DPIA	Data Protection Impact Assessment
ED	Emergency Department
eDRIS	Electronic Data Research and Innovation Service
ePR	Electronic Patient Record
GP	General Practitioner
HCPC	Health and Care Professions Council
HEI	Higher Education Institutions
JB I	Joanna Briggs Institute
JRCALC	Joint Royal Colleges Ambulance Liaison Committee
LUCS	Lothian Unscheduled Care Service
MPDS	Medical Priority Dispatch System
NASMeD	National Ambulance Service Medical Directors
NHS	National Health Service
NQP	Newly Qualified Paramedic
PHS	Public Health Scotland
SAS	Scottish Ambulance Service
SIMD	Scottish Index of Multiple Deprivation
UCD	Unscheduled Care Data Mart

Chapter 1: Introduction

1.1 Introduction

This chapter introduces the study and sets out its academic and professional context. It outlines the clinical and policy significance of chronic obstructive pulmonary disease (COPD), defines non-conveyance, and explains why paramedic decision-making regarding conveyance is examined.

Non-conveyance is an established and increasingly important aspect of contemporary ambulance practice. In this context, it refers to ambulance clinicians assessing and treating a patient without transporting them to an emergency department. This approach reflects broader health system pressures and policy ambitions to deliver care closer to home, reduce unnecessary hospital admissions, and improve the patient experience (O’Cathain et al., 2018; Turner et al., 2019).

Despite its growing prevalence, the processes underpinning paramedic decision-making remain incompletely understood, particularly for specific clinical conditions such as COPD.

This chapter therefore defines the research problem, identifies a key gap in the existing evidence, and introduces the central research question. COPD is established as a clinically relevant and methodologically appropriate lens for examining paramedic decision-making, which is framed as complex, context-dependent, and shaped by factors beyond protocol adherence.

1.2 Research Context and Rationale

Non-conveyance decision-making has been widely discussed in ambulance research and policy. Previous work consistently shows that these decisions are multifactorial, shaped by clinical presentation, patient context, clinician experience, organisational pressures, and the availability of alternative care pathways (Snooks, 2005; O’Hara et al., 2014; Lederman et al., 2019).

Snooks (2005) highlights that decision-making is shaped by an interplay of protocols, education, experience, patient preferences, and system-level factors. Similarly, O'Hara et al. (2014) describe non-conveyance as a complex, high-stakes process influenced by time pressure, uncertainty, and organisational context. Lederman et al. (2019) further emphasise the limited feedback and support structures available to clinicians, which may shape clinicians' risk perception and decision-making.

These findings remain highly relevant to contemporary paramedic practice. Although non-conveyance is supported as a safe and appropriate alternative to hospital transport for selected patients, conveyance is often perceived as the lower-risk option for professional accountability (O'Hara et al., 2014; Lederman et al., 2019).

This creates a fundamental tension. On the one hand, there is a clear policy direction towards community-based care and the reduction of unnecessary hospital conveyance. On the other hand, clinicians work in environments marked by uncertainty, time pressure, and limited access to follow-up information. In this context, conveyance may be seen as the safer option, even when clinical indicators suggest that alternative management may be appropriate.

Despite the importance of this issue, existing research remains heterogeneous and largely examines non-conveyance as a general phenomenon rather than in specific clinical contexts (Ebben et al., 2017; Blodgett et al., 2021). As a result, understanding of how decision-making operates within specific patient groups, including those with COPD, remains limited.

1.3 Professional Background and Positioning

I am an Advanced Paramedic in Critical Care within the Scottish Ambulance Service, with extensive experience in pre-hospital emergency care, clinical leadership, and patient safety. My career within the National Health Service (NHS) began in pathology, after which I moved into frontline ambulance practice as an Ambulance Technician and later qualified as a paramedic.

Over time, I progressed through a range of clinical and leadership roles, including Paramedic Clinical Team Leader, South-East Scotland Clinical Pathways Lead, and National Patient Safety Manager. These roles provided direct exposure to system-level challenges in unscheduled care, particularly those relating to clinical decision-making, governance, and the safe implementation of alternative care pathways.

In my current role, I manage high-acuity patients across pre-hospital and hospital settings, supported by an honorary contract with NHS Lothian. This position provides a perspective across the continuum of emergency care, from community assessment to hospital-based treatment.

My academic development includes postgraduate study in critical care, advanced clinical practice, leadership, and non-medical prescribing. This blend of clinical experience and academic training informs both the design and the interpretation of this research.

This professional background is directly relevant to the study. It offers insight into the practical realities of non-conveyance decision-making and highlights the tension between clinical judgement, patient safety, and organisational expectations. While this experience enhances contextual understanding, the analysis in this thesis is grounded in structured quantitative methods and population-level data, ensuring that findings are based on systematic evidence rather than on individual perspectives.

1.4 Focus on Chronic Obstructive Pulmonary Disease (COPD)

To examine non-conveyance decision-making in greater depth, this study focuses specifically on chronic obstructive pulmonary disease (COPD). COPD is a chronic, progressive respiratory condition characterised by airflow limitation and impaired ventilation, most commonly caused by long-term exposure to tobacco smoke (World Health Organisation, 2024).

COPD is a major contributor to global morbidity and mortality and a leading cause of emergency healthcare utilisation. In Scotland, it accounts for a substantial share of unscheduled care, including ambulance attendances, emergency department

presentations, and unplanned hospital admissions (Scottish Government, 2017; Scottish Public Health Observatory, 2023).

For ambulance services, COPD poses a particularly complex clinical challenge. Exacerbations vary widely in severity, from mild episodes that may be safely managed in the community to severe, life-threatening events requiring urgent intervention. This variability introduces diagnostic and prognostic uncertainty at the point of care.

Patients with COPD frequently present with multimorbidity, reduced functional reserve, and varying levels of social support. These factors extend beyond physiological assessment and complicate decisions about conveyance or alternative management pathways.

Importantly, COPD has been the focus of targeted service innovation, including condition-specific pathways to support safe non-conveyance and community-based management. Evidence suggests that, for selected patients, community-based management of COPD exacerbations can achieve outcomes comparable to inpatient care, while improving patient experience and reducing system burden (Jeppesen et al., 2012; Ko et al., 2017).

COPD therefore provides both a clinically relevant and methodologically appropriate lens for examining paramedic decision-making in practice.

1.5 Research Gap

Although non-conveyance has been widely studied, the existing evidence base is marked by several important limitations. Systematic and scoping reviews consistently report substantial heterogeneity across the literature, including variation in study design, outcome measures, and patient populations (Ebben et al., 2017; Blodgett et al., 2021).

A key limitation is the absence of condition-specific analysis. Despite its prevalence within ambulance caseloads, COPD is rarely examined as a distinct analytical category.

Instead, most studies aggregate a broad range of clinical presentations, limiting the ability to understand how decision-making operates within specific conditions.

Furthermore, quantitative studies predominantly focus on physiological indicators and measurable outcomes, such as re-contact rates and hospital admissions. While these metrics are important, they provide only a partial account of decision-making processes. In contrast, qualitative evidence indicates that clinical judgement is shaped by a broader range of contextual factors, including uncertainty, organisational pressures, and patient-specific circumstances (O'Hara et al., 2014; Lederman et al., 2019).

This divergence highlights a critical gap in the literature. Evidence directly linking patient characteristics, physiological observations, and downstream outcomes to paramedic disposition decisions within a condition-specific framework is scarce.

1.6 Aim and Research Question

This study examines the associations among patient characteristics, physiological observations, service-level factors, COPD pathway suitability and paramedic conveyance decisions, and examines how subsequent outcomes vary across physiological risk classifications, pathway-defined groups and observed dispositions.

The primary research question is:

Among patients with COPD attended by paramedics, what associations exist between patient demographics, physiological observations, service-level factors, COPD pathway suitability, and conveyance decisions, and how do subsequent outcomes vary across physiological risk classifications, pathway-defined groups, and observed dispositions?

Secondary research questions:

1. Which patient demographic characteristics (age, sex, and socioeconomic deprivation) are associated with conveyance decisions?

2. Which physiological observations are associated with conveyance decisions, and how do outcomes vary by physiological risk classification and disposition?
3. Which service-level factors (including attendance time, distance to hospital, and paramedic characteristics) are associated with conveyance decisions?
4. To what extent do paramedic conveyance decisions align with COPD pathway suitability criteria, and how do hospital admission, length of stay, and 30-day mortality outcomes differ between pathway-defined groups and observed dispositions?

To address these questions, the study adopts a quantitative retrospective cohort design using routinely collected ambulance data linked to outcome data. By examining COPD as a distinct clinical group, the research provides a more detailed understanding of how measurable indicators are associated with conveyance decisions and where quantitative explanations alone are insufficient to account for variation in practice, thereby highlighting areas where clinical judgment may play a role.

The study's primary focus is the examination of factors associated with conveyance decisions. It also examines how hospital admission, length of stay, and 30-day mortality vary across physiological risk classifications, pathway-defined groups, and observed dispositions. These outcomes are included as contextual outcome measures to assess how patient outcomes vary across these categories. These outcomes are not used to assess the appropriateness of individual clinical decisions but to provide contextual insight into the clinical environment in which conveyance decisions occur.

1.7 Significance of the Study

This thesis makes a condition-specific contribution to the evidence base on paramedic decision-making. By focusing on COPD, it addresses a recognised gap in the literature, in which respiratory conditions are often embedded within heterogeneous datasets yet are rarely examined as discrete analytical categories.

By linking pre-hospital clinical data to hospital admission, length of stay and mortality, the study examines how subsequent outcomes vary across physiological risk classifications, pathway-defined groups and observed dispositions.

More broadly, the study advances understanding of how paramedics integrate objective physiological assessment with clinical judgement in real-world practice. In doing so, it contributes to ongoing debates about the role of ambulance clinicians in delivering community-based care and in managing risk outside hospital settings.

1.8 Thesis Overview

The remainder of this thesis is structured as follows:

- Chapter 2 situates the study within the broader healthcare system and policy context, examining organisational structures and the development of COPD pathways.
- Chapter 3 presents a scoping review of the literature to identify what is known about non-conveyance decision-making.
- Chapter 4 outlines the study's methodology.
- Chapter 5 presents the results.
- Chapter 6 discusses the findings in relation to the existing literature.
- Chapter 7 presents the conclusions and their implications.

1.9 Chapter Summary

This chapter has established the rationale for examining paramedic decision-making in the context of chronic obstructive pulmonary disease (COPD). It has highlighted the growing importance of non-conveyance and identified the absence of condition-specific evidence as a key limitation in the current literature.

By framing decision-making as a complex, multidimensional process that encompasses physiological assessment, clinical judgement, and the system context, the chapter provides the conceptual foundation for the subsequent analysis.

The following chapter situates the study within its organisational and policy context and examines how system-level factors shape paramedic practice.

Chapter 2: Health System, Policy Context and Clinical Pathways for COPD

2.1 Introduction

This chapter situates the study within the wider health system and policy environment in which paramedic practice operates. It traces the structural and strategic influences on unscheduled care in Scotland, from national policy direction to frontline clinical decision-making.

In particular, the chapter examines the shift towards community-based care and reduced hospital conveyance, highlighting the tensions this creates for paramedics working in time-critical and uncertain environments. The development and implementation of the COPD pathway are explored as a system-level response to these pressures, providing a structured framework to support alternative management strategies in practice.

By outlining the organisational, professional, and policy context, the chapter demonstrates that paramedic decision-making is not determined solely by clinical presentation. Rather, it arises from the interplay of clinical guidance, service availability, and system expectations. These influences frame the broader context in which the research question is set.

2.2 Health Service Delivery in Scotland

Responsibility for health policy in Scotland is devolved to the Scottish Government and delivered by NHS Scotland.

NHS Scotland comprises 14 territorial Health Boards, seven Special Health Boards, and a national public health body. Collectively, these organisations employ approximately 140,000 staff and are responsible for improving population health and delivering frontline clinical services (NHS Scotland, 2022). Territorial Boards provide local care, while Special Boards provide national and specialist services, including the Scottish Ambulance Service (SAS).

2.3 The Scottish Ambulance Service

The Scottish Ambulance Service (SAS) is a national Special Health Board within NHS Scotland. It provides emergency and unscheduled care across a geographically complex area, serving a population of approximately 5.5 million across urban, rural, and island communities.

SAS employs over 4,300 staff and responds to approximately 1.8 million calls annually, of which around 70% are classified as emergencies. In addition, the service facilitates approximately 150,000 inter-facility and primary care transfers each year (Scottish Ambulance Service, 2015). The scale and diversity of demand are further compounded by Scotland's geography, which includes over 790 islands and necessitates the integration of air transport services and specialist retrieval teams.

Specialist components of the service include the Air Ambulance Service, which undertakes approximately 3,500 taskings annually, and ScotSTAR, which provides retrieval and transfer of critically ill patients, completing around 2,300 transfers each year (Scottish Ambulance Service, 2015).

Within this operational context, structured clinical pathways have been developed to support paramedic decision-making, particularly for conditions that present recurrently as emergencies, such as COPD. These pathways provide a framework for identifying patients suitable for community-based management while maintaining patient safety. They are a key component of contemporary non-conveyance practice.

2.4 Shifting the Balance of Care

Scottish health policy has increasingly emphasised delivering care in community settings rather than in hospitals. This shift is reflected in a series of strategic frameworks, including the Scottish Ambulance Service 2015–2020 strategy (Scottish Ambulance Service, 2015), the National Clinical Strategy (Scottish Government, 2016), and the Realistic Medicine agenda (Scottish Government, 2024).

Collectively, these frameworks promote a model of care characterised by care delivered closer to home, a focus on prevention and anticipatory management, an emphasis on shared decision-making, and support from integrated multidisciplinary teams.

This policy direction is driven by multiple pressures across the health system. Scotland has an ageing population, rising multimorbidity, persistent health inequalities, and increasing demand for services (Mercer et al., 2023). At the same time, workforce constraints, financial pressures, and geographic challenges necessitate the development of more efficient and flexible care models.

In this context, ambulance services are expected not only to respond to emergencies but also to act as gatekeepers within the unscheduled care system. This expectation creates a fundamental tension: paramedics are encouraged to avoid unnecessary hospital conveyance while managing clinical risk in uncertain, time-critical environments.

2.5 Paramedics in the Scottish Ambulance Service

2.5.1 Role and Scope of Practice

Paramedics within the SAS provide frontline assessment and management across a broad spectrum of clinical presentations, from minor illness to life-threatening emergencies. They work in pre-hospital settings, frequently making rapid decisions on diagnosis, treatment, and patient disposition.

A central aspect of the paramedic role is determining the most appropriate outcome for each patient encounter. This may involve transporting to an emergency department, referring to alternative healthcare services, or treating and discharging at the scene.

For clarity, disposition refers to the outcome of the patient encounter, specifically the decision to transport the patient to hospital or to manage the patient through alternative care pathways.

2.5.2 Education and Training

Paramedic education in Scotland has shifted from vocational training models to university-based degree programmes. Historically, paramedics were trained through the Institute of Health Care Development (IHCD) routes, which emphasised practical skills and protocol-driven care but gave limited emphasis to pathophysiology.

Contemporary paramedics complete a three-year pre-registration degree at one of five Higher Education Institutions (HEIs) in Scotland. This educational model integrates clinical reasoning, pathophysiology, and evidence-based practice, reflecting the increasing complexity and scope of paramedic roles.

Following qualification, Newly Qualified Paramedics (NQPs) undertake an 18-month structured programme with the SAS to consolidate clinical competencies in real-world practice.

2.5.3 Regulation

Paramedics are regulated by the Health and Care Professions Council (HCPC), which sets standards for education, training, and professional conduct (HCPC, 2023). Registration requires practitioners to demonstrate fitness to practise, including competence in clinical assessment and decision-making.

The transition from vocational to degree-based training is particularly relevant to this study, as it reflects a broader shift away from protocol-driven care towards professional judgement and autonomous decision-making.

2.6 Paramedic Decision-Making: Conceptual Framework

This section outlines the conceptual framework for interpreting paramedic decision-making in this study. It draws on two complementary perspectives: Collen's *Decision Making in Paramedic Practice* (2016) and the narrative review by Perona, Rahman and O'Meara (2019). Together, these perspectives integrate the professional, ethical, and cognitive dimensions of decision-making.

Collen (2016) conceptualises decision-making as a practice-based process grounded in clinical reasoning, ethics, and professional accountability. He describes the hypothetico–deductive method, in which clinicians generate and test diagnostic hypotheses through structured assessment, and Cognitive Continuum Theory, which frames decision-making as a spectrum between analytical and intuitive modes. Crucially, Collen situates decision-making within organisational and professional contexts, emphasising that decisions must be defensible, documented, and open to scrutiny. Reflective tools such as the *Garden Gate Test*, a heuristic for assessing whether a clinical decision would withstand public scrutiny, reinforce the view that decision quality depends not only on outcomes but also on the transparency and robustness of clinical reasoning.

By contrast, Perona et al. (2019) examine decision-making through the lens of dual-process theory (Kahneman, 2011), distinguishing between Type 1 (rapid, intuitive) and Type 2 (analytical, deliberate) thinking. Their synthesis shows that paramedics move fluidly between these modes in response to time pressure, uncertainty, and familiarity with clinical presentations. Decision-making is therefore non-linear, shaped by pattern recognition, prior experience, and environmental cues.

These perspectives are complementary. For example, during a COPD exacerbation, less experienced clinicians may rely on structured assessments and clinical guidelines, whereas more experienced practitioners may form rapid, pattern-based judgements that are later verified by analytical reasoning. Collen’s framework explains how such decisions are justified and documented, while Perona et al. (2019) explain how they are generated cognitively.

A distinction must be drawn between experience and expertise. Experience denotes the length of practice, whereas expertise reflects the capacity to integrate analytical and intuitive reasoning in uncertain conditions. Collen (2016) associates experience with ethical awareness and accountability, whereas Perona et al. (2019) link expertise to cognitive adaptability. This study adopts an integrated framework to interpret both the appropriateness of decisions and the reasoning processes that underpin them.

Both perspectives emphasise the importance of education, reflection, and feedback. Formal education supports the development of analytical reasoning, while clinical experience refines intuitive judgement. However, intuitive decision-making remains subject to critical reflection and ongoing development.

Context is central to both accounts. Collen (2016) emphasises organisational factors such as governance, documentation, and risk aversion, whereas Perona et al. (2019) focus on cognitive load, environmental complexity, and time pressure. In practice, decisions arise from the interplay of these factors. For example, paramedics may convey low-risk COPD patients due to limited access to alternative services, while non-conveyance decisions may reflect incomplete assessment or cognitive bias. Outcomes alone are therefore insufficient indicators of decision quality.

Within this thesis, this framework provides a lens through which the quantitative findings may be interpreted. While the dataset does not permit direct examination of clinical reasoning processes, it enables exploration of whether observed patterns are consistent with decision-making that extends beyond physiological measurements.

2.7 COPD Best Practice and National Guidance

The *COPD Best Practice Guide* (Scottish Government, 2017) provides a system-level framework to improve COPD care across the patient journey. Although not a formal clinical guideline, it outlines a coordinated, patient-centred approach aligned with national policy priorities.

Two elements of this framework are particularly relevant: improving timely access to services to reduce care delays, and supporting the management of patients at home where appropriate to avoid unnecessary hospital admissions.

These priorities align directly with the broader policy objective of shifting care from hospital to community settings. For ambulance services, this presents both opportunities and challenges, as paramedics must assess whether patients can be safely managed outside hospital.

2.8 SAS Clinical Practice Guidelines for COPD

Clinical care within the SAS is guided by the national Ambulance Clinical Practice Guidelines (CPG), developed by the Joint Royal Colleges Ambulance Liaison Committee (JRCALC) and overseen by the medical directors of UK ambulance services.

These guidelines focus primarily on assessing COPD exacerbations, delivering emergency treatment, and identifying patients who require hospital-based care. However, they also emphasise that paramedics should consider alternative care pathways where appropriate, consistent with the broader policy shift towards non-conveyance.

While the guidelines provide essential clinical structure, they do not prescribe specific pathways for community-based management. This limitation has prompted the development of condition-specific pathways, including the COPD pathway in Edinburgh.

2.9 The SAS COPD Pathway: Development, Application and System Context

At the start of data collection, a COPD pathway was implemented only in Edinburgh; a national pathway was introduced by the SAS in 2022. The Edinburgh pathway therefore served as the operational model for the 2019 study period (Scottish Government, 2017, p.21).

COPD poses a persistent challenge for urgent and unscheduled care because of its high prevalence, recurrent exacerbations, and frequent contact with emergency services. In Scotland, COPD accounts for a substantial share of ambulance call-outs, emergency department attendances, and unplanned hospital admissions (Scottish Public Health Observatory, 2023; NHS Scotland, 2022). Historically, ambulance practice defaulted to hospital conveyance for patients presenting with acute breathlessness, even in non-life-threatening cases (O’Cathain et al., 2018). Although clinically cautious, this approach does not consistently align with patient preferences

or with optimal resource utilisation when safe alternatives are available (Turner et al., 2019).

The COPD pathway was developed to address the gap between clinical need, system pressures, and available care options. It is best understood as a complex, adaptive intervention rather than a discrete service innovation, consistent with complex intervention theory (Craig et al., 2008). Its development was driven by practitioner-identified challenges in frontline practice, in which clinicians recognised that many COPD exacerbations could be managed safely outside hospital but lacked viable referral pathways (Mason et al., 2017).

A multidisciplinary group within SAS, in collaboration with primary care and Community Respiratory Teams (CRT), initiated a pilot in Edinburgh in 2013. The pilot enabled paramedics to refer selected patients directly to community-based services using a structured decision-support tool. Iterative refinement of eligibility criteria, escalation thresholds, and safety-netting processes followed, informed by audit data and clinician feedback within a quality improvement framework (Langley et al., 2009). This process ensured the pathway remained operationally credible while supporting, rather than constraining, clinical judgement. Subsequent national scale-up was facilitated by governance agreements, shared learning, and local adaptation across Health Boards (Healthcare Improvement Scotland, 2021).

In practice, the pathway provides a structured framework for screening and referral. Paramedics assess patients against defined physiological criteria, typically respiratory rate, oxygen saturation, heart rate, and temperature, to determine suitability for non-conveyance. Patients meeting these criteria may be referred to alternative services, such as Community Respiratory Teams, out-of-hours general practice, or other urgent care pathways. Those who do not meet them are generally conveyed to hospital. However, the pathway does not dictate decisions; rather, it structures decision-making. Final disposition depends on the clinician's interpretation of the overall clinical picture, including comorbidity, clinical trajectory, and social context. In this respect, the pathway functions as a decision-support scaffold rather than a deterministic tool.

The pathway is underpinned by an established evidence base. Systematic reviews indicate that, in appropriately selected cases, community- or home-based management of COPD exacerbations yields outcomes comparable to inpatient care, with similar mortality and readmission rates and higher patient satisfaction (Jeppesen et al., 2012; Ko et al., 2017). National guidance, including NICE and *BMJ Best Practice*, informs risk stratification and management approaches (NICE, 2019; *BMJ Best Practice*, 2024). The pathway also reflects broader policy principles, including Realistic Medicine and shared decision-making, which are operationalised through frameworks such as BRAN (Chief Medical Officer Scotland, 2016; Elwyn et al., 2012).

Implementation followed established quality improvement methodology, including the Model for Improvement and Plan–Do–Study–Act cycles (Langley et al., 2009). National expansion aligned with Scotland’s Redesign of Urgent Care programme and incorporated system-level mechanisms, such as Flow Navigation Centres, to facilitate referrals to appropriate community services (Scottish Government, 2021). This integration highlights that the pathway operates not as a standalone intervention but as part of a wider system redesign.

Service-level evaluations indicate that the pathway has reduced unnecessary hospital conveyance, improved the patient experience, and enhanced system flow (Scottish Ambulance Service, 2022; Healthcare Improvement Scotland, 2023). However, significant limitations remain. Evidence is largely drawn from service evaluations rather than controlled studies, and there is persistent variation in implementation, governance, and data quality. Furthermore, outcome measurement remains inconsistent, limiting robust evaluation of safety and equity.

Overall, the COPD pathway illustrates how national policy is translated into frontline practice. It operationalises the shift towards community-based care while maintaining reliance on clinical judgement. At the same time, its implementation exposes the inherent tension in paramedic decision-making: clinicians are expected to reduce conveyance while managing uncertainty, limited follow-up, and variable access to alternative services. Within this context, the pathway does not resolve decision-making

complexity but reshapes it, providing structure without removing the need for professional judgement.

2.9.1 The COPD Pathway in Practice

In practice, the pathway functions as a structured screening and referral tool. Paramedics assess patients against predefined physiological criteria, including respiratory rate, oxygen saturation, heart rate, and temperature.

Patients who meet these criteria are considered potentially suitable for non-conveyance and may be referred to services such as Community Respiratory Teams, out-of-hours general practice, or other urgent care services. Those who do not meet them are typically conveyed to hospital.

Crucially, the pathway (Figure 1) does not replace clinical judgement. Instead, it provides a structured framework within which paramedics make decisions, with final disposition depending on the clinician's interpretation of the overall clinical picture.

Figure 1: COPD Pathway Edinburgh

 South East Division COPD Pathway Edinburgh																		
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Eligibility		Patient excluded from pathway if (✓) any of the grey boxes <table border="1"> <thead> <tr> <th>Yes</th> <th>No</th> </tr> </thead> <tbody> <tr> <td>☐</td> <td>☐</td> </tr> <tr> <td>☐</td> <td>☐</td> </tr> <tr> <td>☐</td> <td>☐</td> </tr> <tr> <td>☐</td> <td>☐</td> </tr> </tbody> </table>	Yes	No	☐	☐	☐	☐	☐	☐	☐	☐						
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CRT Referral Times 0800-1800 Monday to Friday 0900-1600 Saturday to Sunday This is a 90 minute response (including public Holidays)	NHS Lothian Hub (outwith trial hours) as per pre-existing prof 2 prof arrangements (request 10 min call back)	<div>Write Outcome</div> <div> Outcome (Refer to Key) 1. CRT 2. LUCS 3. Acute Facility 4. Referred to GP 5. Refused (Forward to GP) </div>																

Version 1.0 (02/15)

2.9.2 The anatomy of a COPD patient response

The SAS clinical response model, illustrated in Figure 2, outlines the structured process for triaging emergency calls and translating them into an appropriate clinical response. The process begins with an emergency 999 call and is initially guided by two critical screening questions posed by the call handler: whether the patient is breathing and whether the patient is conscious.

If both questions are answered affirmatively, the call is triaged under the Medical Priority Dispatch System (MPDS) within the Category 3 (C3) triage framework (Scottish Ambulance Service, 2024). This system provides an evidence-based, standardised approach to prioritising and managing medical and trauma-related emergency calls.

Figure 2: Simplified visual representation of a 999 call to a disposition



Scottish Ambulance Service (2024)

Illustrative Clinical Scenarios

To contextualise the application of this response model and its interface with the COPD pathway, two hypothetical clinical scenarios are presented. These scenarios are intended to illustrate how physiological thresholds within the COPD pathway may translate into conveyance and non-conveyance decisions in practice, and they do not constitute an empirical analysis.

Scenario Context

A 68-year-old patient with a known diagnosis of COPD, living independently, experiences deterioration in respiratory symptoms after recent treatment by a general practitioner for a chest infection. In response to worsening difficulty in breathing, an emergency 999 call is made to the ambulance service. Following triage via the Medical Priority Dispatch System (MPDS), an ambulance is dispatched.

Scenario Outcome 1: Conveyance to Emergency Department

During the paramedic assessment, conducted in accordance with the SAS Clinical Practice Guidelines, the following physiological observations are recorded:

- Respiratory rate: 44 breaths per minute
- Heart rate: 136 beats per minute
- Blood pressure: 154/98 mmHg
- Temperature: 39.6 °C
- Peripheral oxygen saturation (SpO₂): 79%

The patient presents with clinical features indicative of severe respiratory compromise and possible pneumonia. When assessed against the physiological thresholds and eligibility criteria defined within the COPD pathway (Figure 1), these findings show a significant deviation from parameters considered safe for alternative management. Accordingly, the patient is deemed unsuitable for non-conveyance and community-based treatment and is conveyed to the Emergency Department for urgent assessment and escalation of care.

Extract from Figure 1

Critical Vital Signs	
Respiratory Rate RR > 30	
Respiratory Rate RR < 10	
Heart Rate (BPM) > 110	
Blood Pressure (BP) < 100mm (Hg) systolic	
Temperature > 37.7c	
SpO2 ≥ 88% (on room air or on normal prescribed level of Oxygen)	
Signs and symptoms of Pneumothorax, Pneumonia, CCF, Cardiac Arrhythmia	

Scenario Outcome 2: Potential Non-Conveyance and Alternative Disposition

In an alternative presentation, the paramedic assessment records the following physiological observations:

- Respiratory rate: 20 breaths per minute
- Heart rate: 92 beats per minute
- Blood pressure: 148/91 mmHg
- Temperature: 36.6 °C
- Peripheral oxygen saturation (SpO₂): 93%

The patient presents with a productive cough but no evidence of acute physiological instability. When mapped against the COPD pathway vital-sign criteria (Figure 1), these observations fall within thresholds that suggest potential suitability for community-based management, subject to clinical judgement. In this context, conveyance to the Emergency Department is not considered immediately necessary.

Given the patient's location within the City of Edinburgh, non-conveyance options may include referral to the Community Respiratory Team (CRT) during operational hours, access to local urgent care services out-of-hours, consultation with another healthcare professional, referral back to the patient's general practitioner, or, where the individual has the capacity to do so, a patient-initiated refusal of further intervention.

2.10 Chapter Summary

This chapter has demonstrated that paramedic decision-making is embedded within a complex system shaped by policy direction, service design, and professional expectations.

National strategies promote community-based care and aim to reduce hospital conveyance, while clinical pathways, such as the COPD pathway, provide structured support for achieving these objectives. However, paramedics continue to work in environments characterised by uncertainty, limited information, and variable access to alternative services.

As a result, decision-making cannot be reduced to the simple application of guidelines. Instead, it reflects a dynamic integration of clinical assessment, professional judgement, and system constraints.

The following chapter examines how these issues have been addressed in the existing literature, identifying what is known and, critically, what remains unknown, about paramedic non-conveyance decision-making, particularly in the context of COPD.

Chapter 3: Literature Review

This chapter presents a scoping review of paramedic non-conveyance decision-making in pre-hospital care. Its purpose extends beyond descriptive synthesis to interrogate how decision-making, risk, and clinical judgement are conceptualised across the evidence base and to assess how well existing research captures the complexity of real-world paramedic practice.

Non-conveyance has become a routine and substantial component of ambulance service delivery, consistently accounting for approximately one-third of patient encounters across international systems (Ebben et al., 2019; Paulin et al., 2020; Heinonen et al., 2022). However, this apparent consistency masks significant variation in how non-conveyance is defined, operationalised, and evaluated (Ebben et al., 2017; Blodgett et al., 2021). Across studies, non-conveyance is variously framed as a marker of system efficiency, a clinical decision point, or a potential patient safety risk, indicating a lack of conceptual alignment within the field.

A recurring theme in the literature is the characterisation of non-conveyance as complex, uncertain, and context-dependent, requiring clinicians to integrate physiological assessment with broader interpretive judgement (O'Hara et al., 2014; Lederman et al., 2019; Johansson et al., 2022). Despite this, much quantitative evidence continues to frame decision-making in reductionist terms, privileging measurable physiological indicators while underrepresenting the contextual, cognitive, and organisational dimensions of practice (Ebben et al., 2017; Blodgett et al., 2021).

A critical omission across this body of work is the lack of condition-specific analysis. In particular, COPD, a common and clinically complex condition in pre-hospital care, is rarely treated as a distinct analytical category. This omission is notable given COPD's characteristic features, including fluctuating physiological baselines, recurrent exacerbations, and frequent healthcare utilisation, all of which complicate conventional interpretations of risk and clinical appropriateness (Blodgett et al., 2021; Oosterwold et al., 2018).

This chapter therefore synthesises review-level, quantitative, and qualitative evidence to identify patterns, contradictions, and structural limitations in the literature. In doing so, it not only maps current understanding but also critically evaluates its adequacy, thereby establishing the rationale for a condition-specific examination of non-conveyance decision-making in COPD.

3.1 Scoping Review Methodology

This review was conducted in accordance with the Joanna Briggs Institute (JBI) framework for scoping reviews (Peters et al., 2015; Peters et al., 2020), informed by the foundational approaches of Arksey and O'Malley (2005) and Levac et al. (2010). A scoping methodology was chosen to accommodate the heterogeneity of the evidence base, which spans diverse study designs, populations, and outcome measures.

Unlike systematic reviews, which aim to synthesise findings within tightly defined parameters, scoping reviews map the breadth and nature of the evidence, identify conceptual boundaries, and highlight gaps in knowledge (Levac et al., 2010; Peters et al., 2020). This approach is particularly appropriate for studying non-conveyance, where variability in definitions and methods limits the feasibility of direct comparison or quantitative synthesis.

The methodological focus of this review is therefore not on aggregating outcomes but on examining how non-conveyance decision-making is constructed, measured, and interpreted across the literature.

3.2 Review Question and Scope

This review is guided by the following question:

What is known about the facilitators and barriers to paramedic non-conveyance decision-making, and how do paramedics perceive and assess risk in pre-hospital care?

The Population–Concept–Context (PCC) framework was used to define the review’s scope (Archibald et al., 2016).

COPD was initially identified as a condition of interest within the conceptual framework. However, using COPD-specific search terms alongside non-conveyance concepts yielded no eligible studies. Consequently, the review was expanded to include the broader non-conveyance literature. The absence of COPD-specific evidence is therefore interpreted as a substantive finding rather than a limitation of the search strategy.

Rather than reflecting a methodological constraint, this finding indicates a systematic lack of condition-specific analysis in the literature (Blodgett et al., 2021; Oosterwold et al., 2018). Therefore, removing COPD as a search limiter was necessary to capture the broader evidence base, while the absence itself remains a central finding of the review.

Table 1 defines the population (paramedics), concept (non-conveyance decision-making and risk), and context (pre-hospital care), thereby demonstrating how the review scope was operationalised.

Table 1: PCC Objectives and Review

Objective	Review Question	Population	Concept	Context
To identify the characteristics of facilitators, barriers, and paramedic perspectives on risk in non-conveyance decision-making	What is known about the facilitators and barriers to paramedic non-conveyance decision-making, and how do paramedics perceive and assess risk in pre-hospital care?	Paramedics and patients involved in ambulance service encounters (≥18 years)	Non-conveyance decision-making, risk perception, facilitators and barriers	Pre-hospital emergency care settings

Note on COPD focus			COPD was initially included as a condition-specific focus but removed after no eligible studies were identified; its absence is treated as a key finding of the review	
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3.3 Search Strategy

Searches were conducted in the MEDLINE and CINAHL databases for the period 2014–2024. Search terms combined concepts related to paramedics, ambulance services, pre-hospital care, non-conveyance, decision-making, and risk, and were supported by sensitivity filters developed for paramedic research retrieval (Olaussen et al., 2017).

The inclusion of COPD-specific terms, when combined with non-conveyance concepts, yielded no eligible studies, necessitating an expansion into the broader non-conveyance literature. This finding reflects a wider absence of condition-specific focus rather than a limitation of the search strategy.

A total of 12,766 records were identified. After applying limits and structured screening, 33 studies progressed to title and abstract review, of which 22 met the inclusion criteria.

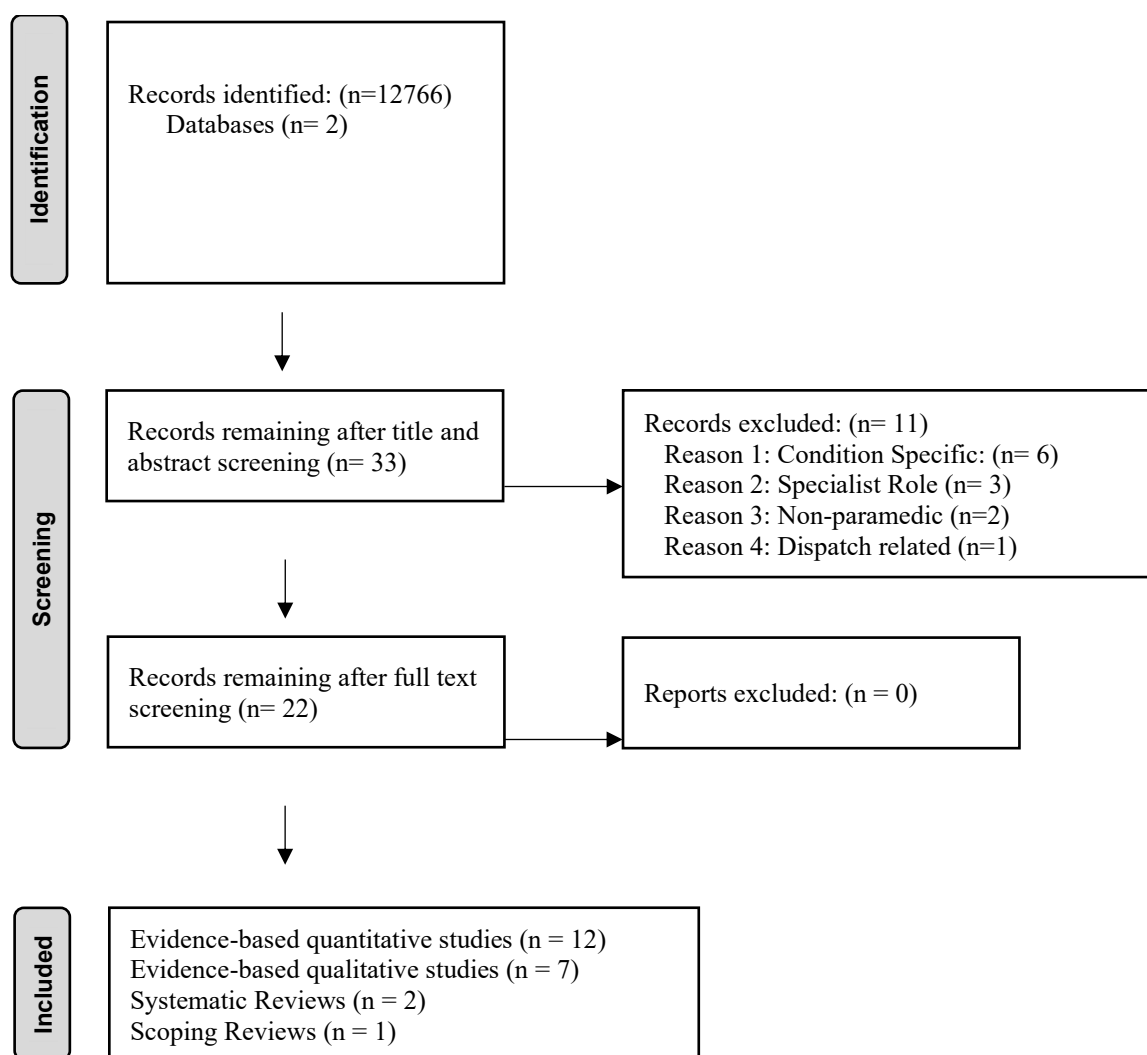
Table 2 summarises the databases searched, the search terms used, the inclusion criteria, and the filters applied, ensuring transparency and reproducibility.

Table 2: Scoping Review Database Search

Search No	Terms	Results
1	(Ambulances or Emergency Medical Technicians or Air Ambulances). sh. or paramedic*.tw. or ems.tw. or emt.tw. or pre-hospital.tw. or pre-hospital. tw. or first responder*.tw. or emergency medical technicians.tw. or emergency services.tw. or Ambulance*.tw. or HEMS.tw. or field triage.tw. (98700)	98700
2	limit 1 to (English language and full text)	12766
3	(non-convey* or non convey*).tw.	79
4	1 and, 2, and 3	33
5	Limit 4 to (COPD, chronic obstructive pulmonary disease, COAD, or chronic obstructive airway disease).tw.	0

Figure 2 illustrates the study selection process, from initial identification (n = 12,766) through screening and eligibility assessment to final inclusion (n = 22), with reasons for exclusion.

Figure 3: PRISMA Flow Chart



Studies were excluded if they focused on condition-specific pathways (e.g. falls or hypoglycaemia), specialist practitioner roles, or non-paramedic populations. This ensured the review remained focused on generalist paramedic decision-making processes.

3.4 Study Selection and Data Extraction

The included studies were peer-reviewed, conducted in pre-hospital settings, and focused on paramedic or equivalent decision-making. Data extracted and managed in Microsoft Excel comprised study design, population characteristics, outcomes, and key findings.

Although scoping methodologies typically involve dual screening, this review was conducted by a single researcher because of the nature of doctoral thesis authorship. Methodological consistency was maintained through predefined inclusion criteria and the iterative refinement of screening decisions (Peters et al., 2020).

3.5 Findings

The included studies were published between 2014 and 2024 and conducted across a range of international healthcare systems, predominantly in Europe, including Sweden, the Netherlands, Finland, and the United Kingdom. Study designs included systematic and scoping reviews, retrospective and prospective cohort studies, and qualitative interview-based research, reflecting the field's methodological diversity.

The final dataset comprised three review-level studies, twelve quantitative studies, and seven qualitative studies. These were analysed iteratively to identify patterns, contradictions, and areas of convergence and divergence.

3.5.1 Systematic and Scoping Review Studies

The review-level literature provides a broad overview of non-conveyance practice across international settings, synthesising evidence from studies conducted predominantly in Europe and other high-income healthcare systems. The included reviews, published between 2017 and 2021, draw on large, heterogeneous datasets spanning observational, quantitative, and qualitative research. Despite differences in scope and methodology, these reviews consistently identify substantial variation in non-conveyance rates, definitions, and outcome measures.

Importantly, review-level evidence shows that non-conveyance is not a uniform clinical category but a context-dependent practice shaped by patient characteristics, organisational structures, and system pressures. However, these syntheses also highlight significant conceptual and methodological limitations, including inconsistent outcome definitions and a lack of condition-specific analyses, particularly for respiratory disease and COPD.

Ebben et al. (2017), synthesising 67 studies, report marked variability in non-conveyance rates (3%–93%), reflecting differences in healthcare systems, case mix, and definitions. Their analysis further reveals substantial inconsistency in outcome measurement, with studies using recontact rates, hospital admissions, or mortality as safety indicators. The absence of validated decision-support tools further limits interpretability.

Oosterwold et al. (2018) extend this analysis by identifying both patient-level and organisational influences on decision-making. While clinical characteristics such as age and comorbidity are relevant, organisational factors, including access to alternative care pathways, training, and medico-legal considerations, shape decision thresholds rather than merely informing risk assessment.

Blodgett et al. (2021) reinforce these limitations, highlighting the continued reliance on proxy outcomes, such as recontact rates. Their critique is especially significant in the context of chronic disease, where repeat service use may reflect disease trajectory rather than clinical error. This raises fundamental questions about how “safety” is conceptualised in the literature.

Across all reviews, non-conveyance is consistently characterised as complex and context-dependent. However, none of the reviews examine COPD or other respiratory conditions as distinct analytical categories; instead, they aggregate heterogeneous populations, thereby obscuring clinically meaningful variation.

Table 3 summarises the included review studies, covering study design, number of papers, key findings, and identified limitations.

Table 3: Systematic and Scoping Reviews (n = 3)

Author	Journal	Population	Context	Concept	Methodology	Outcomes (Numbers/Statistics)	Key Findings	COPD/Respiratory Findings
Ebben et al. (2017) — Netherlands	Scandinavian Journal of Trauma, Resuscitation and Medicine	2,989 records screened; 67 included	Pre-hospital literature (international)	Non-conveyance from patient-safety and professional perspectives	Systematic review (heterogeneous designs)	No meta-analysis; variable non-conveyance rates; high recontact within ~48h	Decision-making is complex; tools/guidance limited; variable study quality	No COPD subgroup; respiratory presentations not stratified; ICD-10 used but not analysed by condition
Oosterwold et al. (2018) — Netherlands	BMJ Open	2,412 records screened; 29 included; 8 exclusively ≥65 years	Pre-hospital literature (elderly focus)	Influencing factors for (non-)conveyance in older adults	Systematic review	No meta-analysis; 16 quantitative, 12 qualitative, 1 mixed-method	Non-medical influences prominent (guidelines, feedback, training, litigation risk)	No COPD subgroup; respiratory multimorbidity discussed implicitly but not quantified
Blodgett et al. (2021) — UK	Scandinavian Journal of Trauma, Resuscitation	16,037 records (incl. 29 grey); 41	Pre-hospital literature (international)	Safety, effectiveness, efficacy of	Scoping review	Meta-analysis not feasible; methodological rigour often limited	Benefits to ED crowding recognised; safety	No respiratory/COPD-specific analysis; recommends

	n and Medicine	included (18 quantitative , 12 qualitative, 11 consensus- based)	, updated in 2020)	non- conveyance			evidence weak; over- reliance on recontact as safety proxy	linked data to follow complete patient journeys
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3.5.2 Quantitative Studies

The quantitative evidence base comprises twelve studies published between 2018 and 2022, conducted predominantly in European ambulance systems, including Sweden, the Netherlands, Finland, and the United Kingdom. These studies primarily use retrospective and prospective cohort designs, utilising routinely collected ambulance and linked healthcare data to examine patterns of conveyance and non-conveyance, associated patient characteristics, and clinical outcomes. Sample sizes vary considerably, ranging from small regional cohorts to large population-based datasets comprising more than 300,000 patient contacts.

Collectively, these studies aim to identify measurable predictors of non-conveyance, with particular emphasis on demographic variables, physiological observations, and system-level factors. However, variation in study design, population characteristics, and outcome measures limits direct comparability. As a result, although quantitative studies provide valuable insight into activity patterns and associated risks, they offer only a partial account of the decision-making processes underpinning non-conveyance.

While non-conveyance rates are broadly stable at about one-third of ambulance contacts (Ebben et al., 2019; Paulin et al., 2020; Heinonen et al., 2022), the underlying clinical characteristics of these populations vary considerably. This variability is most evident in the relationship between physiological status and conveyance decisions.

Multiple studies demonstrate that non-conveyed patients frequently exhibit clinically significant physiological abnormalities. Vloet et al. (2018) report that more than half of non-conveyed patients had at least one abnormal vital sign, and Lederman et al. (2020) report similar findings among higher-acuity patient groups. Rather than representing a deviation from expected practice, these findings suggest that paramedics routinely operate within a context of managed clinical uncertainty, in which physiological abnormality alone does not determine patient disposition.

However, this pattern is not uniform. In contrast, Höglund et al. (2020) identify a cohort characterised by physiological stability and a low immediate risk. These patients are

more often directed towards self-care or alternative care pathways, aligning more closely with traditional conceptions of non-conveyance.

The coexistence of these findings highlights a fundamental issue in the literature. Non-conveyance is not a single clinical category but encompasses multiple, overlapping decision-making processes, ranging from reassurance of low-risk cases to pragmatic management of uncertain or borderline presentations. The assumption that non-conveyance can be characterised by a consistent risk profile is therefore not supported by the available evidence.

System-level influences further complicate interpretation. Paulin et al. (2020) show that non-conveyance is more likely during out-of-hours periods and in areas with longer transport distances. These findings suggest that decisions are negotiated within operational contexts, with clinicians adjusting decision thresholds in response to environmental constraints. In this sense, risk is not fixed but is situationally constructed.

Outcome measurement in quantitative studies is similarly problematic. Follow-up periods vary considerably, from immediate recontact to 30-day mortality. Although Heinonen et al. (2022) report a 1.3% mortality rate and identify increased risk among general respiratory presentations, shorter follow-up intervals used in other studies (Vloet et al., 2018; Ebben et al., 2019) are unlikely to capture delayed deterioration.

This limitation is particularly significant in COPD. Given its episodic and progressive nature, deterioration may occur outside standard follow-up periods, and repeat service contact may reflect expected disease progression rather than a failure of initial decision-making. Reliance on short-term outcome measures therefore risks misrepresenting both risk and safety.

Although early warning scores such as NEWS2 are used in several studies (Paulin et al., 2020), their role remains unclear. They appear to serve as supportive tools within a broader interpretive framework rather than as deterministic guides to decision-making.

The lack of prospective validation in non-conveyance contexts further underscores the disconnect between quantitative measurement and clinical practice.

Collectively, quantitative evidence captures patterns of activity but offers only a partial explanation of decision-making. Although associations between variables are identified, the processes by which clinicians interpret competing signals, assess risk, and act under uncertainty remain poorly understood.

Table 4 summarises study characteristics, populations, non-conveyance rates, key physiological findings, and outcome measures across the included quantitative studies.

Table 4: Quantitative Studies (n = 12)

Author	Journal	Population	Context	Concept	Methodology	Outcomes (Numbers/Statistics)	Key Findings	COPD/Respiratory Findings
Vloet et al. (2018) — Netherlands	Scand J Trauma Resusc Emerg Med	54,797 contacts (2 regions)	Pre-hospital clinical	Conveyed vs non-conveyed comparison	Retrospective	Non-conveyed generally younger; rural skew; >50% had ≥1 abnormal clinical finding	Initial reasons often mental health; abnormal physiology despite non-conveyance	No COPD subgroup; respiratory status not stratified
Ebben et al. (2019) — Netherlands	World J Emerg Med	1-year review of non-conveyed patients	Pre-hospital clinical	Describe non-conveyance patterns	Retrospective observational	Non-conveyance ≈ 33% of contacts; ~50% referred to other professionals; temporal distribution relatively even	Common reasons: collapse, mental health, alcohol; differences among outcomes not examined	No COPD subgroup; no respiratory stratification

Miles et al. (2019) — UK	British Paramedic Journal	143 paramedics ; 6 vignettes each	Pre-hospital educational	Decision accuracy using linked ambulance-ED data	Prospective mixed-method	Accurate conveyance decisions ~69%; rule-in ED 0.90 vs rule-out 0.49	Risk mitigation and patient safety concerns drive conveyance	No COPD focus; respiratory risk not modelled
Forsgårde et al. (2020) — Sweden	BMJ Open	32,085 contacts (3 different years, one region)	Pre-hospital clinical	Retrospective analysis	Longitudinal comparative	Non-conveyance associated with age, symptoms, triage, scene, time/day/season	Multiple patient and system factors influence decisions	No COPD subgroup; respiratory symptoms not separated
Höglund et al. (2020) — Sweden	BMC Emerg Med	23,250 contacts; 2,691 non-conveyed	Pre-hospital clinical	Proportion and characteristics of non-conveyed	Prospective cohort	Non-conveyance lower than national/international rates; ~50% referred to self-care; majority with normal physiology	Supports a low-risk subset among non-conveyed	No COPD subgroup; no respiratory-focused outcomes
Paulin et al. (2020) — Finland	Scand J Trauma Resusc Emerg Med	35,454 contacts; 14,874 non-conveyed (6	Pre-hospital clinical	Conveyed vs non-conveyed factors	Prospective cohort	Non-conveyance more likely evenings/weekends and with longer	Interplay of system design and risk scoring	No COPD subgroup; no respiratory stratification

		months, one region)				distances; NEWS2 influenced conveyance; <1h before shift end not impactful		despite NEWS2 relevance
Lederman et al. (2020) — Sweden	BMJ Open	Population 2.3m; 210,000 contacts; 23,603 non- conveyed	Pre- hospital clinical	Population-based cohort of non-conveyance in Stockholm	Retrospectiv e cohort	Higher non- conveyance at the highest dispatch level; younger predominated; non- specific/mental health symptoms common; abnormal physiology present	Medication patterns differed by age and conveyance	No COPD subgroup; respiratory physiology not reported
Blodgett et al. (2020) — UK	BMC Emerg Med	~4,500 patients screened; ~150 per arm (ED vs GP) analysed	Pre- hospital clinical	Outcome comparison by referral destination	Prospective cohort	GP referral generally safe; older, female, minor incidents more likely referred to GP	Calls for larger, more rigorous trials	No COPD subgroup; respiratory status not separated
Lederman et al. (2021) — Sweden	BMC Emerg Med	Two age- stratified groups; 1	Pre- hospital clinical	Prevalence/characteristi cs and risk factors by age	Retrospectiv e cohort	Older adults at higher risk of adverse events;	Organisation al safety	No COPD subgroup; respiratory

		region; 1 year				multimorbidity prominent	concerns for older patients	multimorbidity implied but not quantified
Heinonen et al. (2022) — Finland	Acta Anaesthesiologica Scand	324,207 contacts; 72,233 non-conveyances (4-year, one region)	Pre-hospital clinical	Describe non-conveyance and mortality	Retrospective cohort	Non-conveyance ≈ 33%; 30-day mortality 1.3%; respiratory illness associated with increased 30-day mortality	DNACPR/care-limitation decisions not integrated in non-conveyance	Respiratory category had the highest mortality signal; COPD not isolated
Johansson et al. (2022) — Sweden	BMC Emerg Med	5-year mixed-methods; 34 variables; 240 records	Pre-hospital clinical	Underlying causes of patient harm among non-conveyed	Mixed-methods (3-phase)	Low adherence to guidelines; protocol deviations noted	Risks in multimorbid older adults; safety measures needed	No COPD-specific analysis; respiratory risk not modelled
Höglund et al. (2022) — Sweden	Scand J Trauma Resusc Emerg Med	Population 295,000; 30,000 contacts (1-year prospective)	Pre-hospital clinical	Outcomes and associations for non-conveyed	Prospective analytical	Within 7 days: 0 ICU; 18 deaths (0.7%); older age linked to hospitalisation/death	Fewer short-term adverse outcomes than prior studies; guideline improvements suggested	No COPD subgroup; age effect may proxy respiratory burden

These findings demonstrate that physiological indicators alone are insufficient to define non-conveyance populations, reinforcing the need for a more integrated conceptual approach.

3.5.3 Qualitative Studies

The qualitative evidence base comprises seven studies published between 2014 and 2024, conducted across a range of European pre-hospital settings, including the United Kingdom, Sweden, Finland, and the Netherlands. These studies employ methodologies such as in-depth interviews, focus groups, observational fieldwork, and patient questionnaires to explore the lived experience of non-conveyance from both clinician and patient perspectives. Sample sizes are typically small and context-specific, reflecting the exploratory and interpretive nature of qualitative research.

In contrast to quantitative studies, which focus on measurable associations, qualitative research offers insight into the cognitive, professional, and organisational dimensions of decision-making. These studies consistently portray non-conveyance as a complex, high-stakes process shaped by uncertainty, risk perception, and contextual constraints. However, despite this depth of insight, no qualitative study explicitly examines COPD or respiratory presentations as a distinct focus, highlighting a significant gap in the literature.

Paramedics describe non-conveyance decisions as high-stakes, marked by limited guidance, variable support, and the potential for adverse outcomes (O'Hara et al., 2014; Lederman et al., 2019; Johansson et al., 2022). Decision-making is shaped not only by clinical findings but also by anticipated risk, professional accountability, and clinical judgement.

The organisational context emerges as a central influence. Limited access to alternative care pathways, a lack of feedback, and inconsistent or unclear guidance heighten uncertainty and foster risk-averse behaviour (Lederman et al., 2019; Johansson et al., 2022). In some cases, deviations from guidelines are linked to patient harm, reinforcing the tension between protocol adherence and adaptive decision-making.

From a patient perspective, studies highlight the importance of communication, reassurance, and safety-netting (Van Doorn et al., 2020; Larsson et al., 2022). However, persistent gaps remain in the explanation of discharge and in patient understanding, suggesting that decision-making extends beyond the clinical encounter to include comprehension and follow-up behaviour.

Notably, COPD-specific experiences are not examined in any qualitative study, despite the likely influence of breathlessness, anxiety, and chronic disease management on decision-making.

Table 5 summarises qualitative study designs, participant characteristics, and key themes related to paramedic decision-making, risk perception, and patient experience.

Table 5: Qualitative Studies (n = 7)

Author	Journal	Population	Context	Concept	Methodology	Outcomes (Salient Results)	Key Findings	COPD/Respiratory Findings
O'Hara et al. (2014) — UK	J Health Serv Res Policy	57 paramedics; 34 shifts; 3 sites (~5m population)	Pre-hospital clinical	Observation, digital diaries, focus groups	Multi-method qualitative	Nine decision types; seven systems/risk factors identified	Risk aversion; demand/performance pressure; limited feedback; access to options	No COPD focus; respiratory safety not addressed
Lederman et al. (2019) — Sweden	BMJ Open	11 ambulance clinicians (region: ~200k contacts; 25k non-conveyed/year)	Pre-hospital interviews	In-depth, open-ended interviews	Phenomenological	Complex decisions with limited organisational support	Clinicians bear responsibility amid inadequate education/guidelines/feedback	No COPD focus; respiratory scenarios not explored
Van Doorn et al. (2020) — Netherlands	International Emergency Nursing	15 patients + 7 relatives; 3 months	Pre-hospital interviews	Experiences of non-conveyed patients	Qualitative	Phases: fear, reassurance, confirmation (relatives),	Interpersonal skills crucial; psychosocial consequences; shared decision-making	No COPD subgroup; breathlessness-related anxiety not explored

						shame (patients)		
Larsson et al. (2022) — Sweden	BMC Emerg Med	162 questionnaires (87 patients; 75 significant others)	Pre-hospital questionnaire	Satisfaction with ambulance service among non-conveyed	Cross-sectional	High satisfaction overall; ~20% dissatisfied with discharge advice	Communication and expectations need strengthening	No COPD focus; respiratory discharge advice not tailored
Lederman et al. (2023) — Sweden	BMC Emerg Med	9 in-depth interviews; 12 months	Pre-hospital interviews	Lived experience of non-conveyance	Phenomenological	Themes: being unwell, vulnerable, active in decision-making, safe afterwards, missing answers	Calls for clinical capability and organisational support	No COPD subgroup; respiratory risk not discussed
Granlund et al. (2024) — Sweden	BMC Nursing	14 nurses; 30 incidents	Pre-hospital interviews	Factors influencing care encounters in non-	Qualitative	Confidence, information sharing, communication, organisational	Implications for guidelines; further patient-relative research needed	No COPD focus; respiratory assessment not specified

				conveyance		aspects; collaboration required		
Skaffari et al. (2024) — Finland	BMC Emerg Med	1017 surveys; 247 responses; 13 months	Pre-hospital questionnaire	Experience s by age, gender, time	Patient- experience survey	High satisfaction with interpersonal care; needs: pain management, clearer explanations	No demographic effect on experience in conclusions	No COPD subgroup; respiratory symptom management not addressed

These findings position decision-making as a negotiated, contextually situated process rather than a purely clinical judgement.

3.5.4 Integrated Findings

When considered collectively, the quantitative, qualitative, and review-level evidence reveal a fragmented yet convergent understanding of non-conveyance decision-making. Despite substantial variation in study design, populations, and outcome measures, three consistent themes emerge across the literature: the heterogeneity of non-conveyance populations, the inconsistent conceptualisation of risk, and the influence of organisational context on clinical decision-making.

These patterns indicate that non-conveyance cannot be adequately explained by isolated variables or purely physiological measures. Instead, decision-making arises from the interplay of clinical, cognitive, and system-level factors. The lack of condition-specific analysis, particularly for COPD, further limits the applicability of existing evidence and reinforces the need for more focused, contextually grounded research.

When synthesised, the evidence reveals three interrelated patterns. First, non-conveyance is common yet inherently heterogeneous, spanning a wide spectrum of clinical presentations and decision-making contexts (Ebben et al., 2019; Paulin et al., 2020; Heinonen et al., 2022). Second, risk is conceptualised inconsistently, with quantitative studies treating it as a measurable property and qualitative studies framing it as interpretive and context-dependent (Vloet et al., 2018; O'Hara et al., 2014; Lederman et al., 2019). Third, organisational context is a structural determinant, shaping both decision-making processes and which decisions are deemed acceptable (Oosterwold et al., 2018; Paulin et al., 2020; Johansson et al., 2022).

Taken together, these findings demonstrate that non-conveyance cannot be understood through isolated variables but must be conceptualised as the outcome of dynamic interactions among clinical, cognitive, and organisational factors. They further highlight the need for analytical approaches that can model interactions among physiological, contextual, and system-level variables, rather than treating these factors in isolation.

3.6 Critical Synthesis of the Evidence Base

The literature reveals a series of interrelated limitations that constrain its explanatory power. Outcome measures are conceptually weak and poorly aligned with clinical reality. Recontact and utilisation metrics are widely used yet fail to capture expected patterns of chronic disease, particularly in COPD (Blodgett et al., 2021; Ebben et al., 2017). This ambiguity complicates the interpretation of safety.

More fundamentally, the literature largely operates within a reductionist model of risk, privileging physiological indicators while underrepresenting interpretive judgement (Vloet et al., 2018). In practice, risk is constructed through the interplay of patient factors, clinical experience, and system constraints (Lederman et al., 2019; Johansson et al., 2022).

The systematic absence of COPD as an analytical category constitutes a critical structural gap. By aggregating heterogeneous populations, the literature obscures condition-specific dynamics and limits clinical applicability (Oosterwold et al., 2018; Blodgett et al., 2021). As a result, the evidence base offers only a partial account of non-conveyance decision-making: it shows that non-conveyance can be safe but does not explain how safe decisions are made in practice.

Paramedic decision-making is therefore best conceptualised as a multidimensional, adaptive process that integrates physiological assessment, clinical reasoning, patient context, and organisational constraints. Within this framework, variation reflects adaptive responses to complexity rather than a deviation from protocol.

This review supports a conceptualisation of decision-making as a dynamic model comprising four interacting domains: physiological assessment, clinical interpretation, patient context, and organisational environment. Decision-making emerges from the interaction of these domains rather than from any single determinant, and risk is constructed through this interaction rather than measured directly.

These limitations are therefore not merely empirical but conceptual. By attempting to reduce risk to measurable physiological variables, the literature fails to account for the

inherently interpretive and anticipatory nature of risk in clinical practice. As a result, existing models of non-conveyance risk are not only incomplete but also misaligned with the realities of paramedic decision-making.

Closely related to this is the literature's implicit treatment of risk as a quantifiable, physiologically determined construct. Quantitative studies predominantly frame decision-making around vital-sign abnormalities and triage scores, implying that non-conveyance can be understood through objective thresholds. However, qualitative evidence consistently shows that paramedic risk perception extends beyond physiological assessment to include diagnostic uncertainty, patient context, social support, system pressures, and anticipated access to follow-up care. This divergence highlights a fundamental conceptual tension: while quantitative studies model risk as measurable and static, real-world clinical decision-making is dynamic, context-dependent, and shaped by professional judgement. The current evidence base does not fully reconcile these perspectives, limiting its explanatory power.

These findings directly inform the rationale for the present study. By linking ambulance and outcome data to examine a defined cohort of patients with COPD, this research addresses the lack of condition-specific evidence and explores associations between physiological observations, demographic characteristics, and system-level factors with conveyance decisions in real-world paramedic practice. In doing so, it provides a more focused, contextually grounded understanding of non-conveyance and highlights the continued need for complementary qualitative research to elucidate the clinical reasoning underpinning these decisions.

Building on these limitations, paramedic decision-making in COPD is conceptualised as a multidimensional and dynamic process rather than a linear application of physiological thresholds. Decision-making integrates four interacting domains: physiological assessment, clinical interpretation, patient context, and system influence. Physiological observations provide an initial signal of acuity and inform eligibility for structured pathways; however, these data require interpretation within a broader clinical context. Paramedics integrate objective findings with experiential knowledge, pattern recognition, and ongoing clinical assessment. This interpretive

process is further shaped by patient-specific factors, including comorbidity, functional status, social support, and patient preference.

In parallel, decisions are made within an organisational context, where access to alternative services, time of day, resource availability, and perceived professional accountability exert additional influence on clinical judgement. These domains do not operate in isolation but interact dynamically, with paramedics shifting between analytical and intuitive modes of reasoning. Within this model, clinical pathways function not as deterministic rules but as decision-support scaffolds, providing structured boundaries within which professional judgement is exercised.

This conceptualisation aligns with this study's findings and offers a framework for interpreting variation in conveyance decisions as adaptive responses to complexity rather than as deviations from protocol.

The literature therefore offers only a partial account of non-conveyance, describing patterns of practice without fully explaining how decisions are made in clinically complex conditions such as COPD. In particular, the absence of condition-specific analysis limits the applicability of existing findings to respiratory care, where physiological instability, recurrent exacerbations, and individual baseline variation challenge standard risk measures.

This identified gap justifies the present study. The following chapter therefore outlines the methodological approach used to examine paramedic decision-making in COPD, including the study design, data sources, and analytical framework.

This study sits at the intersection of these limitations. It directly addresses the absence of condition-specific analysis by examining COPD as a discrete clinical population, and it challenges the reductionist conceptualisation of risk by integrating physiological measures with contextual and outcome-based interpretation. In doing so, it moves beyond descriptive accounts of non-conveyance towards an explanatory model grounded in real-world paramedic decision-making.

In summary, non-conveyance decision-making is complex and context-dependent, and cannot be reduced to physiological thresholds. The literature is fragmented, inconsistently conceptualised, and limited by the absence of condition-specific analyses. The lack of COPD-focused evidence represents a significant gap. This study addresses this gap by examining COPD as a distinct clinical population and exploring how physiological, demographic, and contextual factors influence paramedic decision-making.

This provides the foundation for the empirical analysis in the following chapter, which examines how these factors operate in practice among a COPD population. It also evaluates the extent to which paramedic conveyance decisions align with established COPD pathway criteria, recognising that deviations from protocol may reflect adaptive clinical judgement rather than error.

Chapter 4: Methodology

This chapter outlines the methodological approach used to investigate paramedic decision-making regarding patient conveyance for individuals with COPD. It details the study design, data sources, cohort selection, variables, and analytical framework, ensuring clear alignment with the research questions.

A retrospective cohort design was used to examine real-world clinical decisions using routinely collected, linked data. This approach enables analysis of practice as it occurs in operational settings, capturing the complexity and variability inherent in pre-hospital care.

The chapter also addresses key considerations regarding data quality, ethics, and governance, alongside the statistical methods used to explore associations among patient characteristics, physiological observations, and outcomes. Recognising the limitations of routinely collected data, the methodology is framed as a pragmatic approach to understanding decision-making at the population level, rather than to evaluating individual clinical judgements.

4.1 Quantitative approach and research paradigm

Cohort, cross-sectional, and case-control designs are collectively categorised as observational studies. These designs are often the most feasible approach for investigating particular phenomena, especially in aetiological research, where randomised controlled trials (RCTs) may be unethical or impractical, or where the condition of interest is rare. Cohort studies are commonly used to examine incidence, causation, and prognosis; by measuring events sequentially over time, they provide the temporal ordering necessary to support causal inference. In contrast, cross-sectional studies are primarily used to estimate prevalence and, although relatively quick and economical to conduct, do not permit causal inference. Case-control studies involve retrospective comparisons between groups and aim to identify potential predictors of outcome. This design is particularly suited to the investigation of rare diseases or outcomes and is often used to generate hypotheses that can subsequently be tested in

prospective cohort or experimental studies (Mann, 2003; Creswell, 2015a; Creswell, 2015b).

Retrospective cohort studies utilise data collected for purposes other than the current research question and are therefore conducted post hoc. Although the temporal span of such studies may extend over many years, the duration of the research is largely determined by the time required to access, collate, and analyse the existing data. An illustrative example is provided by Marwick et al. (2014), who conducted a cohort study using anonymously linked routine outcome data from a prospectively identified group of adult hospital in-patients with sepsis. Using logistic regression modelling, the authors examined associations between mortality and demographic characteristics and clinical variables, including blood culture results and six severity classification systems. This approach enabled the identification of a preferred severity score for predicting mortality risk within this patient population.

In the context of the present study, a prospective design was neither feasible nor methodologically appropriate. Data collection coincided with the onset and progression of a global pandemic, an unprecedented disruption to contemporary paramedic practice that precluded prospective investigation and fundamentally altered the clinical context. To capture typical seasonal variation in COPD presentations, a 12-month retrospective cohort design was therefore adopted, and random sampling was considered inappropriate. Importantly, the cohort comprised COPD cases occurring before the SARS-CoV-2 outbreak, as coronavirus disease 2019 (COVID-19) was not the focus of this study.

As the pandemic unfolded, interpretation of the findings occurred alongside the broader global recovery from SARS-CoV-2. It is acknowledged that paramedic perspectives and clinical decision-making in relation to COPD management may have evolved as a consequence of the pandemic, representing an area for further investigation in contemporary practice. However, by examining pre-pandemic COPD cases, this study sought to minimise confounding influences arising from altered service delivery models, heightened clinical uncertainty, and pandemic-specific operational pressures.

Retrospective study designs typically incur lower costs because the requisite data have already been collected. A key methodological advantage is the reduced risk of observer bias, since the outcomes of interest were not known at the time of data collection and were not the primary purpose for which the data were generated. Nevertheless, this approach is not without limitations. Because the data were collected for other purposes, it cannot be assumed that all variables of interest were consistently or comprehensively captured, and the potential for missing or incomplete data must be acknowledged.

This methodological and philosophical position underpins the study design outlined below.

4.2 Study Design and Overview

This study used a retrospective cohort design to examine conveyance and non-conveyance decisions for adult patients with COPD attended by the SAS in the City of Edinburgh in 2019. Routinely collected electronic patient record (ePR) data were linked to outcome data from the Unscheduled Care Data Mart (UCD), enabling analysis of patient disposition and subsequent clinical outcomes.

The methodological approach was informed by the conceptual framework developed in Chapters 2 and 3, which positions paramedic decision-making as a multidimensional process arising from the interaction of physiological assessment, clinical interpretation, patient context, and organisational factors. Consistent with this framework, the study was designed to examine associations among measurable patient characteristics, physiological observations, service-level influences, and disposition decisions in real-world practice.

The primary outcome was conveyance to the Emergency Department (ED), the central decision point under investigation. Secondary outcomes included hospital admission, length of stay, and 30-day mortality, providing insight into patient outcomes after the initial pre-hospital decision. Outcomes were compared across physiological risk

classifications, pathway-defined groups and observed dispositions, while conveyance to the ED remained the primary outcome.

Associations between demographic characteristics, physiological observations, service-level factors, and patient outcomes were analysed at the population level. The study therefore moves beyond a purely descriptive account of conveyance, providing a structured analysis of how observable factors relate to decision-making in practice, including the extent to which decisions align with or diverge from established clinical pathway criteria.

4.3 Data Sources and Cohort Identification

Data were obtained from the SAS ePR system and linked to outcome data from the UCD, enabling analysis of initial clinical assessments and subsequent patient outcomes across unscheduled care services.

Inclusion and exclusion criteria were applied to define a final COPD cohort suitable for comparative analysis of conveyed and non-conveyed patients. This process supports answering the research questions by demonstrating data completeness and cohort integrity.

The UCD is a collaboration between Public Health Scotland (PHS), NHS 24, and the SAS (Public Health Scotland, 2024). It links data from NHS 24, SAS, out-of-hours primary care, Emergency Departments, acute services, mental health services, and death records, enabling the construction of a comprehensive patient journey for records with a valid Community Health Index (CHI) number. This linkage provides system-level visibility of patient pathways, for example, from initial contact via NHS 24 through ambulance response to Emergency Department attendance and subsequent hospital admission.

Linking ambulance service records with outcome data was intended to enhance the dataset's richness and analytical value. The ambulance and outcome datasets were merged into a single dataset, anonymised at source by the SAS data analyst, and then

assessed for data quality within a secure NHS OneDrive environment. Following confirmation of data quality and completeness, the dataset was deemed suitable for further analysis. Data quality considerations are discussed later in this chapter. An initial dataset of approximately 4,000 clinical records was anticipated; however, the final cohort size was determined only after data extraction and cleaning.

Following consultation with an SAS data analyst, a Business Intelligence Requirements Specification Document (RSD) was developed to formally define and authorise the analytical work for this study. The RSD specified the study cohort, variables of interest, and analytical outputs, thereby enabling the extraction and preparation of the dataset in line with organisational governance procedures.

During this process, it was confirmed that all patient-identifiable data could be fully redacted before extraction and analysis. As a result, access to the National Safe Haven environment was not required, as the dataset could be effectively anonymised at source. The governance requirements of the National Safe Haven are considered later in this chapter.

The completed RSD is provided in Appendix 3. Table 6 summarises the requested variables and those ultimately available, and explains the rationale for including or excluding each variable, based on data availability, relevance to the research questions, and governance constraints.

Table 6: Data variables available

Variable	Reason for variable	Rationale for inclusion/ exclusion for analysis
Incident number	Cross check for analyst in linking data.	Excluded Not required for analysis and maintains patient confidentiality
Call method	Cross check that call was made via 999	Included Key variable for 999 inclusion and non-999 exclusion criteria
Incident	Cross check for date range. Provides time of day.	Included Key variable for date inclusion criteria and analysis of time of day

Dispatch code/ description	Cross check for 06 Breathing Problem dispatch code	Included Breathing problem inclusion and non-breathing problem exclusion criteria
Chief complaint code/ description	Cross check for 06 Breathing Problem from Paramedic ePR	Included Breathing problem inclusion and non-breathing problem exclusion criteria in the event of difference from dispatch code
Call colour	Call priority categorisation	Excluded Analysis of MPDS not under review.
Call stopped reason	Description of final disposition of patient	Included Key variable in the analysis of patient disposition
Attendance flag	Cross check that ambulance attended	Included Key variable in the analysis that patient was assessed on-scene
Crew count	Denotes the number of clinicians on scene	Excluded Superfluous information
Paramedic count	Denotes paramedic status of any of the attending clinicians	Included Key variable in the analysis that patient was assessed by a Paramedic
Conveyed flag	Cross check for conveyance/ non-conveyance	Included Key variable coupled with disposition
Incident postcode Receiving hospital	Proximity to receiving hospital from scene	Included Key variable for possible decision related to distance to hospital
Observations: AVPU Blood pressure GCS Pulse Respiratory rate SPO₂ Temperature	Description of key observations required for pathway suitability	Included Key variables in the COPD pathway inclusion/ exclusion criteria
Additional comments	Clinical narrative provided by the	Included

	responding Paramedic	Key variable was that the Paramedic believes the patient diagnosis was that of COPD and rational for disposition decision
Data linkage	Cross check that ePR and UCD linked	Included Key variable that linked data was available
Multiple patients	System checks for multiple patients at scene	Excluded Superfluous information
Continuous urgent care pathway Position in pathway	Record of that patients most recent interactions with healthcare	Excluded Further explanation provided after table
Patient age	Cross check age criteria met	Included Key variable to review patient age
Patient gender	Description of gender of patient	Included Key variable to review patient gender
Patient SIMD	Description of patient SIMD code	Included Key variable to review patient SIMD
Patient SPARRA risk score/ description	Description of SPARRA risk score	Excluded Further explanation provided after table
Patient mortality (30 days)	Description of patient's mortality 30 days on from encounter	Included Key variable to review patient mortality
Acute record count Acute admission Acute discharge Acute subsequent diagnosis code/ description (1-5 entries)	ICD-10 code(s) Diagnosis codes	Included Key variable to review patient COPD diagnosis, if patient was admitted and for how long
Job title Joined Length of service Paramedics start date Paramedic length of service	Description of job role and length of service	Included Key variable that patient was reviewed by a paramedic, their length of service as a paramedic Date of Paramedic start denotes how they would have been trained and qualified

The linked dataset, derived from the SAS ePR system and the UCD, enabled examination of three principal analytical domains aligned with the study objectives.

First, comprehensive demographic and clinical outcome data were available for all patients with COPD attended by paramedics. These data included physiological observations, clinical assessments, and recorded patient dispositions, covering both conveyance to hospital and non-conveyance outcomes. The inclusion of disposition status was particularly important, as it is a core component of risk stratification within the COPD pathway screening tool and central to understanding paramedic decision-making in the pre-hospital setting.

Second, linkage with the UCD provided definitive diagnostic information for patients referred to the ED. This included International Classification of Diseases, Tenth Revision (ICD-10) diagnostic coding, which is not recorded in the SAS ePR. The UCD also provided downstream outcome data, including hospital admission status, length of inpatient stay, and 30-day mortality, enabling mapping of subsequent stages of the patient care pathway and evaluation of short-term clinical outcomes following pre-hospital assessment and management.

Third, workforce-level data were available at the crew level, enabling analysis of attending clinicians' characteristics. These variables included whether a registered paramedic attended the incident, years of professional experience, and educational and qualification background. Analysis of these variables allowed exploration of whether clinician attributes were associated with variation in decision-making, particularly regarding conveyance and non-conveyance decisions for patients presenting with acute COPD exacerbations.

To improve clarity, the process of data linkage and cohort identification is summarised as follows:

1. Electronic patient record data for ambulance attendances were extracted for the defined study period (2019) within the City of Edinburgh.

2. Cases were screened to identify patients with COPD, based on the recorded clinical impression in the ambulance dataset.
3. Eligible cases were linked to outcome data in the Unscheduled Care Data Mart, enabling identification of subsequent healthcare utilisation, including attendance at the Emergency Department, hospital admission, and mortality.
4. The linked dataset was anonymised at source before analysis.
5. Inclusion and exclusion criteria were applied to determine the final analytical cohort.

This process enabled the construction of a linked dataset encompassing pre-hospital assessment, disposition decision, and downstream patient outcomes for the defined cohort.

4.3.1 Additional data considerations

The ICD-10 is a globally standardised system developed by the WHO for the systematic recording, analysis, interpretation, and comparison of morbidity and mortality data across healthcare systems. ICD-10 was the diagnostic classification system in use in the United Kingdom during the 2019 study period and is widely used in health services research to ensure consistency and comparability of diagnostic coding. Although ICD-10 has since been superseded by the Eleventh Revision (ICD-11), its use in this study was appropriate given its contemporaneous application during data collection (WHO, 2024). All diagnostic classifications and outcome measures derived from secondary care data were therefore based on ICD-10 conventions.

The UCD is a nationally coordinated dataset developed through collaboration among Public Health Scotland (PHS), NHS 24, and SAS. It integrates routinely collected data from multiple unscheduled and emergency care services, including NHS 24, SAS, out-of-hours primary care, EDs, acute hospital services, mental health services, and statutory death records. For individuals with a valid Community Health Index (CHI) number, the linked data enable reconstruction of the Continuous Unscheduled Care Pathway (CUP), mapping patient trajectories across unscheduled care services.

The availability of CUP data enables longitudinal examination of patient flows through emergency and urgent care systems, for example from initial telephone contact with NHS 24, through ambulance attendance, ED care, and subsequent acute hospital admission. In this study, CUP data were accessed via SAS analytical processes, which summarised patient interactions using sequential pathway codes (e.g. N–S–P–E–A). However, these sequences lacked clinical and temporal detail, such as acuity at each stage or the rationale for transitions between services. Consequently, while descriptive of system interactions, CUP variables could not meaningfully inform the specific research questions and were therefore excluded from the final analytical dataset.

Scottish Patients at Risk of Readmission and Admission (SPARRA) is a risk stratification tool developed by Public Health Scotland to estimate an individual's probability of emergency hospital admission over a 12-month period. SPARRA uses routinely collected healthcare data to generate a predictive risk score that supports population-level planning and targeted interventions. During the study period, SPARRA scores were available for approximately 80% of the Scottish population.

In the present study, SPARRA data were available for only a small subset of patients. Although scores ranged from 1% to 99%, they were accompanied by limited contextual information, typically categorised as “long-term condition.” The low availability and limited granularity of SPARRA data substantially reduced their analytical utility. Consequently, despite their potential relevance, SPARRA variables were excluded from the final analysis.

The National Early Warning Score 2 (NEWS2) (Royal College of Physicians, 2017) was also considered for inclusion as a measure of physiological risk stratification. During the study period, NEWS2 was being implemented incrementally within SAS, replacing the original NEWS system. Although NEWS2 is widely recognised across NHS Scotland as a standardised measure of patient acuity, with adaptations for chronic respiratory disease, it was not consistently recorded in the study cohort due to its phased implementation. As a result, NEWS2 could not be reliably incorporated into the analysis. Nevertheless, its clinical relevance highlights its potential value for inclusion

in future research on risk stratification and decision-making in patients with acute COPD exacerbations.

4.4 Inclusion criteria

The study population comprised adult patients attended by the Scottish Ambulance Service (SAS) whose records met the following inclusion criteria:

1. Cases were identified through linkage of Community Health Index (CHI) numbers across SAS electronic patient care records and the Unscheduled Care Data Mart (UCD). Eligible cases occurred between 00:00 on 1 January 2019 and 23:59 on 31 December 2019 and met the minimum dataset requirements (Appendix 3).
2. The patient was assessed in person by a registered paramedic employed by the Scottish Ambulance Service.
3. Patients were aged 18 years or older at the time of the emergency call.
4. The index contact was initiated via the emergency 999 service.
5. Chronic obstructive pulmonary disease (COPD) was recorded as the primary clinical reason for attendance.
6. The incident occurred within predefined geographical boundaries corresponding to postcode districts EH1 through EH17 and EH99.

4.5 Study Outcomes and Variables

Study outcomes and variables were defined a priori and aligned with the research questions and the conceptual framework underpinning this study. In line with the framework developed in Chapter 3, variables were selected to capture measurable components of physiological risk, patient characteristics, and system-level factors. Consistent with the multidimensional model of paramedic decision-making described in Chapters 2 and 3, variables were organised into four domains: patient demographics, physiological observations, service-level factors, and clinical outcomes.

Primary outcome: conveyance to the Emergency Department (ED) (yes/no)

This outcome is the central decision under investigation and serves as the primary measure of paramedic disposition.

Secondary clinical outcomes: hospital admission, length of stay and 30-day mortality.

Explanatory variables: demographics, physiological observations and service-level factors.

Classification variable: COPD pathway suitability.

Derived analytical groups: the four pathway-suitability/disposition combinations.

These outcomes were selected to provide a broader assessment of patient trajectory following the initial pre-hospital decision, enabling evaluation of associations between conveyance decisions and short-term clinical outcomes. These secondary outcomes address RQ2 when compared across physiological risk classifications and dispositions, and RQ4 when compared across pathway-defined groups and observed dispositions.

Predictor variables

Patient demographics

- Age
- Sex
- Scottish Index of Multiple Deprivation (SIMD)

These variables were included to assess whether demographic characteristics are associated with conveyance decisions.

Physiological observations

- Respiratory rate
- Heart rate

- Blood pressure
- Peripheral oxygen saturation (SpO₂)
- Temperature

These variables reflect routinely recorded clinical observations used in pre-hospital assessment and align with the COPD pathway criteria. They provide an objective measure of physiological status at the time of paramedic assessment.

Service-level factors

- Time of attendance (in-hours vs out-of-hours)
- Distance to hospital, estimated using postcode-based geographic mapping from the incident location to the nearest Emergency Department
- Paramedic experience, defined as years since initial qualification

These variables were included to examine how organisational and operational contexts influence decision-making, recognising that conveyance decisions occur within a system shaped by resource availability, access to alternative care pathways, and clinician characteristics.

Relationship to the COPD pathway

The selected physiological variables align directly with the criteria used in the COPD pathway to support decision-making. This enabled classification of cases as pathway-suitable or pathway-unsuitable for non-conveyance, providing a structured framework for assessing alignment between observed clinical parameters and the actual disposition decisions.

By integrating these domains, the analytical framework reflects the conceptual position that conveyance decisions arise from the interaction of physiological assessment, patient context, and service-level influences, rather than from isolated variables.

4.5.1 Narrative Data and Evidence of Pathway Use

Analysis of the narrative free-text fields and direct evidence of COPD pathway use was considered during study development but was not included in the final analysis.

Although narrative entries and clinician-recorded rationales were available in the dataset, there was no consistent or standardised documentation indicating whether the COPD pathway had been explicitly consulted or applied during decision-making.

References to pathway use were infrequent, variable in format, and often absent altogether, making reliable identification of pathway utilisation impossible.

Furthermore, the recorded rationales for conveyance and non-conveyance decisions were highly heterogeneous, ranging from brief single-word statements to more detailed free-text descriptions, with substantial variation in terminology, clinical detail, and completeness. Given the retrospective nature of the study and the absence of a validated coding framework for these data, meaningful and reproducible analysis could not be undertaken without introducing a high degree of subjectivity and interpretive bias. Consequently, the study focused on objectively recorded variables and examined pathway alignment by comparing documented physiological observations and patient disposition with pathway criteria, rather than attempting to infer pathway use or clinician reasoning from inconsistent narrative documentation.

4.6 Research Questions

This study was designed to address a clearly defined set of primary and secondary research questions (section 1.6, p. 15), informed by the conceptual framework developed in Chapters 2 and 3.

The literature indicates that paramedic decision-making in non-conveyance is complex, context-dependent, and not determined solely by physiological thresholds. Instead, decisions arise from the interplay of clinical assessment, professional judgment, patient context, and organisational factors. The questions examine the associations between demographic, physiological and service-level variables and conveyance decisions; variation in outcomes across physiological risk classifications and dispositions; and the alignment of conveyance decisions with COPD pathway

suitability, including variation in admission, length of stay and 30-day mortality across pathway-defined groups and observed dispositions

Positioning of data quality within the study design

The completeness and quality of routinely collected SAS data were assessed as part of the methodological process to ensure the dataset was suitable for comparative analysis. This assessment is treated as a methodological consideration within the study design rather than as a substantive research question.

4.7 Data Management and Processing

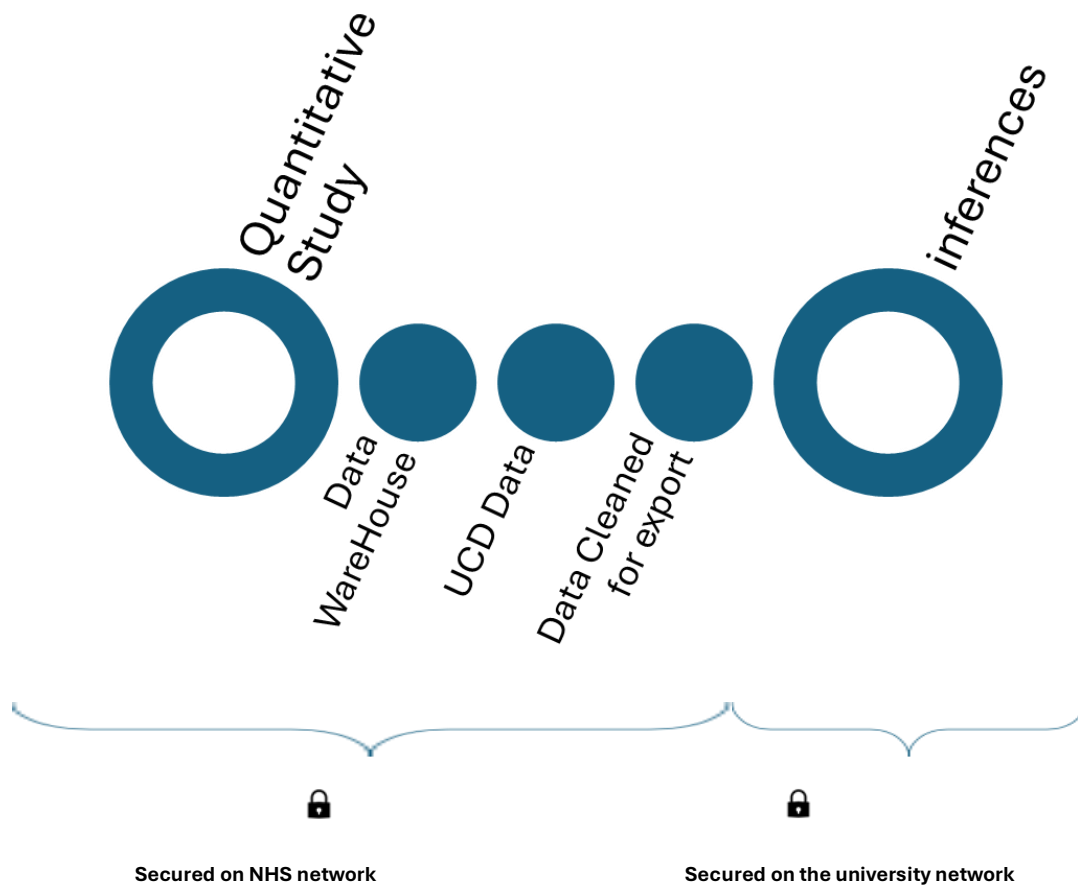
Data extraction and management were carried out in Microsoft Excel within the NHS secure network. After linkage by the SAS data analyst, the anonymised dataset remained securely stored on the NHS network and was assessed for completeness before statistical analysis on the University secure network.

4.8 Data Analysis

For RQ2, individual physiological observations were compared with conveyance decisions, and outcomes were examined across physiological risk classifications and disposition categories. For RQ4, pathway suitability was cross-classified with observed disposition, and hospital admission, length of stay and 30-day mortality were compared across the resulting pathway-disposition groups.

Descriptive statistics summarised patient demographics, physiological observations, and disposition outcomes. Comparative analyses were conducted using Pearson's chi-squared tests for categorical variables and two-way analysis of variance (ANOVA) for comparisons of group means, where the statistical assumptions were met. Levene's test was used to assess the homogeneity of variances. Data extraction, cleaning and descriptive management were undertaken in Microsoft Excel. Inferential statistical analyses were conducted in IBM SPSS Statistics on the university's secure network, following consultation with a faculty statistician. Figure 4 outlines the analytical framework

Figure 4: Diagrammatic visualisation of study



Statistical analyses were conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cohort studies, with particular emphasis on clear variable definitions, justification of analytical methods, and transparent assessment of statistical assumptions (von Elm et al., 2007).

After data extraction, variables were categorised as categorical or continuous according to their measurement scale and distributional characteristics. Descriptive statistics summarised baseline patient, service-level, and workforce characteristics. Categorical variables were reported as frequencies and percentages, while continuous variables were summarised using means and standard deviations where distributional assumptions were met, or medians and interquartile ranges where appropriate.

In consultation with a statistician from the University of Stirling, inferential statistical tests were selected a priori according to the data structure and study objectives. All

analyses were two-sided, and significance was set at $p < 0.05$. Estimates of association are presented with measures of precision to aid interpretation.

Associations between categorical variables were examined using Pearson's chi-square test of independence, which tests the null hypothesis of no association between two categorical variables by comparing observed and expected frequencies. Where cell counts were small, results were interpreted with appropriate caution.

Comparisons of continuous outcome measures across multiple independent groups were conducted using two-way analysis of variance (ANOVA). This approach enabled examination of the main effects of two independent variables and any interaction effects on the continuous dependent variable. Prior to conducting ANOVA, the assumptions of independence, approximate normality of residuals, and homogeneity of variance were assessed.

Homogeneity of variance was formally evaluated using Levene's test, which tests the null hypothesis that group variances are equal. A p-value below 0.05 was taken to indicate a violation of this assumption. Where assumptions were not met, findings were interpreted conservatively, with emphasis on the consistency of observed patterns rather than statistical significance alone. Analyses were conducted on complete cases, and the extent of missing data was assessed descriptively. Given the retrospective design and reliance on routinely collected healthcare data, no imputation of missing values was performed.

By integrating patient-level clinical data, service-level operational variables, and workforce characteristics, this analytical approach enabled an examination of patterns in clinical disposition and subsequent outcomes among patients with COPD. The following section synthesises these findings to illustrate potential care trajectories following paramedic assessment in the Scottish Ambulance Service.

4.8.1 Analytical Framework and Operationalisation of Disposition

Quantitative physiological observations recorded during paramedic assessment—namely level of consciousness (Alert, Voice, Pain, Unresponsive [AVPU]), systolic and

diastolic blood pressure, Glasgow Coma Scale (GCS), heart rate, respiratory rate, peripheral oxygen saturation (SpO₂), and body temperature—were compared with predefined thresholds in the chronic obstructive pulmonary disease (COPD) pathway to assess physiological suitability for non-conveyance.

Based on this comparison, each case was categorised according to the relationship between pathway-defined physiological suitability and the observed disposition decision. This produced a four-category analytical classification framework:

- **Conveyed – pathway unsuitable:** Patients whose conditions exceed the pathway criteria and are transported to the ED by ambulance.
- **Conveyed – pathway suitable:** Patients who meet the pathway criteria for non-conveyance but are nonetheless transported to the ED by ambulance.
- **Non-conveyed – pathway unsuitable:** Patients whose conditions exceed the pathway criteria but are managed in the community rather than transported to the ED by ambulance.
- **Non-conveyed – pathway suitable:** Patients who meet the pathway criteria and are appropriately managed in the community without transport to the ED by ambulance.

To reemphasise, the terminology used for these classifications is as follows. Attending paramedics interpret *conveyed* to mean that a patient is transported by ambulance to an ED, while *non-conveyed* refers to patients who are not transported to an ED by ambulance.

The terms *pathway suitable* and *pathway unsuitable* apply to patients assessed against the pathway criteria. Patients are classified as *pathway suitable* when appropriate for community-level care, and as *pathway unsuitable* when they require care beyond this level. These classifications are illustrated in Section 2.9.2 through the clinical scenarios presented.

To avoid the repeated use of lengthy labels for the remainder of this thesis (for example, “conveyed – patient does not meet the pathway criteria and therefore unsuitable for community-level care”), the terminology has been abbreviated as outlined above.

This classification served as the primary analytical framework for examining alignment between pathway suitability and observed disposition and for comparing hospital admission, length of stay and 30-day mortality across pathway-disposition groups.

Within this framework, disposition (conveyed vs non-conveyed) was treated as the primary outcome variable, while pathway classification and physiological measures were treated as explanatory variables. This structure enabled both descriptive and inferential analyses of associations between patient presentation and observed outcomes.

Disposition was further operationalised to capture variation within outcome categories. Conveyed cases were stratified by urgency (emergency versus non-emergency conveyance) and by the presence or absence of a documented clinical rationale in the ePR. Non-conveyed cases were categorised by documented management pathway, including discharge at scene, referral to out-of-hours primary care, referral to alternative healthcare providers, patient-initiated refusal of care, and referral to the Community Respiratory Team via the COPD pathway.

Free-text fields in the ePR were coded to assess whether a clinical rationale for disposition was documented. This variable was operationalised as a binary indicator (documented vs not documented) and incorporated into the categorical analysis of disposition, particularly when pathway classification and observed outcomes were discordant.

4.8.2 Analytical Modelling of Patient-Level Associations

To examine associations between patient characteristics and disposition outcomes, comparative analyses were conducted across key demographic and clinical variables. These variables comprised age (measured in years), sex (as recorded in the ePR), and socioeconomic status, operationalised using the SIMD.

SIMD was derived from postcode-linked data zones and categorised into quintiles, ranging from 1 (most deprived) to 5 (least deprived). As an area-level composite measure, SIMD covers multiple domains, including income, employment, education, health, crime, housing, and access to services.

Disposition outcomes were analysed in relation to these variables to assess against physiological risk classification and disposition for RQ2, and across pathway-defined/disposition groups for RQ4.

In addition, analyses examined associations between disposition and downstream clinical outcomes. These outcomes included hospital admission after conveyance (binary outcome), length of hospital stay (measured in days; continuous outcome), and all-cause mortality within 30 days of the index event (binary outcome).

These variables were incorporated into the analytical framework to assess the association between initial pre-hospital disposition and short-term patient outcomes. This approach enabled examination of outcome patterns in relation to both pathway classification and observed disposition decisions.

4.8.3 Analytical Modelling of Service-Level and Workforce Factors

Disposition outcomes were further examined in relation to service-level and workforce variables to assess the extent to which operational context was associated with observed clinical decision-making. The variables included time of attendance (categorised as in-hours or out-of-hours), estimated distance to the receiving hospital (derived from postcode-based geographic mapping of the incident location), and paramedic characteristics, including qualification pathway and length of service.

Length of service, defined as years since initial paramedic qualification, served as a proxy for professional experience. Qualification pathway was included to reflect differences in educational preparation associated with the transition from vocational training models to higher-education-based paramedic programmes.

These variables were incorporated into the analytical framework to assess whether organisational context and clinician characteristics were associated with variation in disposition outcomes, alongside the analysis of patients recorded clinical presentations.

While these variables enable analysis of associations at the population level, the dataset does not capture the cognitive processes underpinning individual clinical decisions. Accordingly, the analysis is limited to observable patterns of association rather than to direct measurement of clinical reasoning.

4.9 Summary of the main ethical issues

Individual informed consent was not obtained for this study, in line with the Caldicott principles governing the use of patient information. Using patient data without individual consent may raise ethical concerns about autonomy, informed consent, and respect for human dignity. However, given the study's retrospective nature, direct patient involvement was not required, and the principle of autonomy did not apply in the conventional prospective sense.

The study adhered to the ethical principle of justice, as no interventions were undertaken and no individuals or groups were subjected to differential treatment. The dataset was derived from routine clinical practice, and no selection bias was introduced through sampling. The ethical justification for the study was grounded in the principle of proportionality, whereby the anticipated public benefit outweighed the minimal risk associated with secondary analysis of anonymised data. The findings have the potential to reduce unnecessary hospital admissions and improve the safe use of alternative care pathways.

Confidentiality was given full consideration throughout the research process. The Scottish Ambulance Service granted Caldicott Guardian approval following ethical review by the University of Stirling. The relevant Caldicott principles were consistently upheld, and all handling of patient information complied with the General Data Protection Regulation (GDPR). The study also adhered to the European Commission's

principles for researchers (UKRIO, 2009) and to the professional standards set by the Health and Care Professions Council (HCPC).

Data were collected and managed in accordance with the Caldicott principles. Access to patient-identifiable information was restricted to a designated Scottish Ambulance Service analyst, who was responsible for data extraction and anonymisation. All identifiable information was removed before the dataset was released, and no person-identifiable data were available to the researcher at any stage.

Electronic data were initially stored on secure Scottish Ambulance Service servers until the data-cleaning process was complete. Cleaned and anonymised data were then stored in Microsoft Office 365 SharePoint, which provides multi-factor authentication, encryption, and secure access controls. The dataset was then transferred to a secure University of Stirling network environment for analysis.

Only data directly relevant to the study objectives were accessed and analysed, in accordance with the Caldicott principles and the NHS Code of Confidentiality. Access to the anonymised dataset was restricted to the researcher, academic supervisors, and the faculty statistician.

The study imposed no burden on patients, as data collection was retrospective and non-interventional. However, the potential emotional impact of reviewing clinical cases, particularly when evidence of suboptimal care may be identified, was recognised. To address this, a governance process was established under which any significant concerns regarding clinical practice would be escalated to the Lead Consultant Paramedic. This process was formally agreed at the point of ethical approval (Appendix 2).

A Scottish Ambulance Service Data Protection Impact Assessment (DPIA) was completed as part of the organisational approval process, outlining data handling and security arrangements. At no point were patient identifiers, such as name, date of birth, address, or contact details, accessible to the researcher.

Ethical approval was obtained from the University of Stirling Nursing, Midwifery and Allied Health Professions Research Ethics Committee. Subsequent research and development approval was granted by the Scottish Ambulance Service, followed by Caldicott approval. Approval from an NHS Research Ethics Committee (REC) was not required, as the study involved secondary analysis of anonymised data. Similarly, Public Benefit and Privacy Panel (PBPP) approval was not required, as the study was a single-centre project using Unscheduled Care Data Mart data within existing governance frameworks.

All relevant ethical approval documentation is included in Appendix 2.

4.10 Study Limitations

This study has several methodological limitations that should be considered when interpreting the findings.

First, the retrospective observational design limits the ability to establish causal relationships. The analyses identify statistical associations between patient characteristics, physiological observations, service-level factors, and disposition outcomes, but do not provide direct evidence of the causal mechanisms underlying individual clinical decisions. Accordingly, the findings should be interpreted as population-level associations rather than definitive explanations of decision-making behaviour.

Second, the study relies on routinely collected ambulance service data, which were not originally gathered for research purposes. Although these data enable analysis of real-world clinical practice at scale, they are inherently constrained by variability in completeness, accuracy, and clinical documentation. In particular, the dataset captures observable clinical variables and recorded outcomes but does not systematically capture the reasoning processes underpinning paramedic decisions. Consequently, interpretation of decision-making is necessarily inferential and based on observable proxies rather than direct measurement of cognitive or contextual factors.

Third, the lack of fully linked ED data limits the ability to examine the complete patient care trajectory. Although linkage with the UCD provided information on hospital admission, length of stay, and mortality, detailed ED clinical data, such as diagnostic reasoning, treatment decisions, and discharge pathways, were unavailable. This restricts the depth of outcome evaluation and limits interpretation of downstream clinical appropriateness following conveyance or non-conveyance decisions.

Fourth, several potentially relevant variables could not be included in the analysis due to data availability constraints. These included structured physiological risk scores such as NEWS2, which was inconsistently recorded during the study period, and SPARRA risk scores, which were available only for a limited subset of patients. Similarly, CUP variables lacked sufficient contextual and temporal detail to support meaningful analysis and were therefore excluded. The omission of these variables may limit the explanatory power of the analysis.

Fifth, the study is geographically and contextually specific. The cohort comprised patients attended by SAS paramedics in a defined urban setting (the City of Edinburgh) and reflects practice within a specific organisational and service context, including local implementation of the COPD pathway. As a result, the generalisability of the findings to other regions, healthcare systems, or models of care may be limited.

An important limitation of the study was the inability to reliably assess COPD pathway utilisation and referral activity from free-text clinical documentation. Although narrative records may contain clinically important contextual information, documentation was often incomplete, inconsistent in detail, and not recorded in a standardised manner. As a result, it was not possible to determine with confidence whether pathway tools had been used, whether referrals had been completed, or the extent to which these factors influenced decision-making. Future research incorporating prospective data collection or standardised recording of pathway utilisation may help address this limitation.

Finally, the analytical framework focuses on observable associations between variables and disposition outcomes and does not capture broader contextual influences, such as clinician experience beyond measurable proxies, organisational

pressures, or patient preferences. Although these factors are acknowledged in the conceptual framework, they are not directly measured in the dataset and therefore cannot be empirically evaluated in this study.

A further limitation is that the analysis is primarily based on univariate associations. Consequently, observed relationships may be confounded by variables not modelled simultaneously. For example, an observed association between one variable and disposition may, in part, reflect the influence of age, disease severity, or another unmeasured factor.

Collectively, these limitations do not invalidate the findings but define the boundaries within which they should be interpreted. This study provides a robust analysis of observable patterns in pre-hospital decision-making for COPD, using routinely collected data, while recognising that a more comprehensive understanding of clinical reasoning and contextual decision-making would require complementary qualitative or mixed-methods approaches.

4.11 Impact of COVID-19

The conceptualisation of risk in relation to non-conveyance is extensive and exceeds the feasible scope of a Clinical Doctorate. Consequently, the research focus was deliberately narrowed to COPD to develop an in-depth understanding of this patient group and to generate findings that can inform clinical decision-making, particularly regarding patient and clinician safety.

Notably, there is limited evidence on patients conveyed to the ED and subsequently discharged without specialist intervention or documented follow-up. Although the proposed study sought to interpret outcomes in this cohort, the emergence of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic resulted in significant delays in obtaining the linked datasets required to address this question.

On 23 March 2020, the UK Prime Minister announced a national “stay at home” directive. At the time, consultations were underway with NHS Lothian’s Research and Development Department and NHS Scotland’s Information Services Division (now

incorporated within Public Health Scotland) to secure ethical approval for access to ED data and its linkage with SAS datasets. However, as the UK entered lockdown, professional priorities shifted rapidly, necessitating immediate redeployment to support the national emergency response.

As PHS served as the data custodian for the required datasets, the Scottish Government directed the organisation to prioritise the collation and reporting of SARS-CoV-2 data. These priorities led to delays and extended timescales for accessing non-pandemic datasets, which ultimately rendered the proposed ED linkage incompatible with the time-limited requirements of the doctorate. Consequently, the linked ED dataset could not be obtained.

To mitigate this limitation, SAS data were linked to available outcome measures in the absence of detailed ED data, enabling a comparative analysis of conveyed and non-conveyed patients within a clearly defined COPD cohort. Despite this constraint, the revised analytical approach remains methodologically robust and offers a useful framework for future research. In particular, it lays a foundation for addressing the original research aims using SAS–ED linked data in subsequent post-doctoral work.

Further consideration of the implications of data access, governance, and methodological constraints is presented in Chapter 6.

4.12 Chapter Summary

While routinely collected data enable the analysis of real-world clinical practice at scale, they also introduce important limitations. In particular, reliance on single time-point physiological observations and variable clinical documentation constrains the ability to fully reconstruct the decision-making process. However, these limitations are not incidental but intrinsic to the operational context under study and therefore form part of the phenomenon under investigation. As such, the findings should be interpreted as reflecting both clinical decision-making and the systems in which those decisions are recorded.

This chapter has outlined the methodological framework for examining conveyance and non-conveyance decisions among patients with COPD in routine clinical practice. By utilising linked routinely collected data, the study captures real-world decision-making while acknowledging the inherent limitations of these datasets.

The following chapter presents the findings of this analysis. It describes the study cohort and examines associations between paramedic disposition decisions and physiological observations, patient characteristics, and service-level factors.

Chapter 5: Results

5.1 Introduction

This chapter presents the study findings, examining conveyance and non-conveyance decisions among patients with COPD attended by the SAS. Overall, conveyance decisions were strongly associated with physiological observations and COPD pathway classification, whereas no statistically significant associations were observed for demographic or service-level factors. Results are presented at the population level using descriptive and inferential statistics, with interpretation reserved for Chapter 6.

Within the study framework, paramedic decision-making is understood as a multidimensional process shaped by the interplay of physiological assessment, clinical interpretation, patient context, and organisational factors. Accordingly, findings are organised into four analytical domains: patient demographics, physiological observations, service-level factors, and alignment with COPD pathway criteria. Although introduced in Chapter 2 as a system-level intervention and conceptualised in Chapter 3 as part of the decision-making environment, the COPD pathway in this analysis serves as a key interface between structured guidance and clinical judgement.

The primary focus of this study is to examine factors associated with paramedic conveyance decisions. Hospital admission, length of stay, and 30-day mortality are included only to provide contextual insight into how patient outcomes vary across physiological risk classifications, pathway-defined groups, and observed dispositions. These outcomes are not analysed as measures of decision quality and should not be interpreted as indicators of the appropriateness of individual clinical decisions.

The chapter opens with an overview of data completeness and cohort characteristics, establishing the dataset's suitability for comparative analysis. Findings are then presented sequentially across each analytical domain and synthesised to examine how these factors relate to decision-making in practice. Throughout, emphasis is placed on identifying patterns of association rather than attributing causation, recognising that observed variables serve as proxies for complex clinical reasoning.

Results are presented in relation to the study's research questions to ensure clear alignment between the analysis and the study objectives.

- Research Question 1 (RQ1): Examines the association between patient demographic characteristics (age, sex, and socioeconomic deprivation) and decisions on conveyance.
- Research Question 2 (RQ2): Examines which physiological observations are associated with conveyance decisions, and how do outcomes vary according to physiological risk classification and disposition.
- Research Question 3 (RQ3): Examines the association between service-level factors (including attendance time, distance to hospital, and paramedic characteristics) and conveyance decisions.
- Research Question 4 (RQ4): Examines the extent to which conveyance decisions align with COPD pathway suitability criteria and how hospital admission, length of stay and 30-day mortality vary between pathway-defined groups and observed dispositions.

This structure reflects the analytical framework outlined in Chapter 4 and supports transparent interpretation of how the individual components of the analysis contribute to addressing the overall research question.

5.2 Data Quality and Dataset Overview

An assessment of data quality was conducted to determine the dataset's suitability for comparative analysis of conveyance and non-conveyance decisions. The assessment focused on the completeness, consistency, and clinical relevance of routinely collected SAS ePR data linked to UCD outcome data.

A total of 3,954 cases were initially identified from the SAS dataset (Figure 5). After applying the inclusion and exclusion criteria sequentially and manually verifying the primary COPD diagnosis, a final analytical cohort of 333 cases was established (8.4% of the initial records).

Overall, the dataset demonstrated sufficient completeness across the core variables required for analysis, including patient demographics, physiological observations, and disposition outcomes. Physiological measurements were available for most cases, reflecting routine clinical practice and enabling comparisons between conveyed and non-conveyed groups. When data were missing, this was generally limited to isolated variables rather than systematic gaps across records.

The use of routinely collected clinical data introduces inherent limitations.

Documentation quality varied across cases, particularly in clinical narratives and in the recording of decision rationale. In addition, physiological observations are single time-point measurements and do not capture dynamic clinical change during the patient encounter. These factors constrain the ability to fully interpret the clinical reasoning underpinning individual decisions.

Despite these limitations, the dataset is considered suitable for population-level analysis of associations among patient characteristics, physiological observations, service-level factors, and conveyance decisions. The data's completeness and structure support robust comparative analysis, while recognising that the observed variables serve as proxies for more complex, context-dependent decision-making processes.

Figure 5: Manual review of cases for inclusion

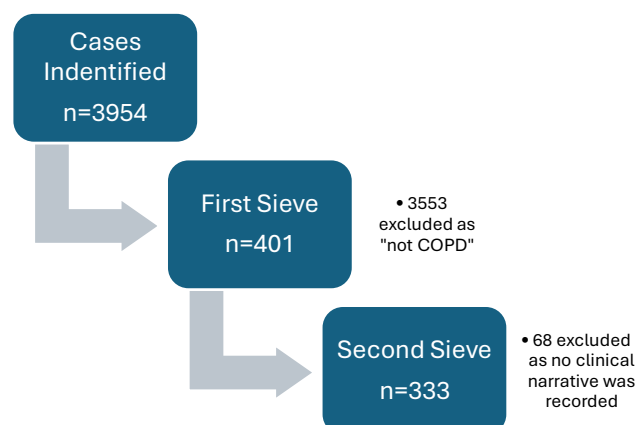


Figure 5 illustrates the manual case-selection process used to identify records for inclusion in the final analytical cohort.

5.3 Patient Demographics and Conveyance Decisions (RQ1)

This section addresses RQ1: *Which patient demographic characteristics (age, sex, and socioeconomic deprivation) are associated with conveyance decisions?*

Overall, demographic characteristics did not show a consistent or independent association with conveyance decisions in this COPD cohort.

Age-related variation was observed, with higher conveyance rates in older patient groups. This pattern aligns with established associations between advancing age, increased comorbidity, and perceived clinical risk. However, the relationship was not uniform across outcomes and did not show a stable or predictive effect when considered in isolation.

Sex showed minimal variation in disposition, with no meaningful difference observed between male and female patients in rates of conveyance or non-conveyance. This suggests that sex did not act as a determining factor in decision-making within this population.

Socioeconomic deprivation, measured using SIMD, showed distributional differences across the cohort. Patients from more deprived areas were over-represented in the dataset; however, no consistent gradient was observed in relation to conveyance decisions. Although local variation was present, it did not translate into a clear or systematic association with disposition.

Taken collectively, these findings indicate that demographic characteristics alone do not adequately explain paramedic conveyance decisions in COPD. Rather than acting as primary drivers, they appear to serve as contextual factors within a broader decision-making process.

5.3.1 Disposition by Gender

Disposition by sex is presented in Table 7. Among the 333 patients in the cohort, comparable proportions of male and female patients were conveyed to the ED.

Table 7: Disposition by Gender (n=333)

	Female	Male	Total
Conveyed	102	97	199
COPD Pathway unsuitable	(51%)	(49%)	(100%)
Conveyed COPD Pathway suitable	34	22	56
	(61%)	(39%)	(100%)
Non-conveyed	11	18	29
COPD Pathway unsuitable	(38%)	(62%)	(100%)
Non-conveyed COPD Pathway suitable	25	24	49
	(51%)	(49%)	(100%)

Statistical analysis using Pearson's chi-square test for RQ1 found no statistically significant association between sex and conveyance decision ($\chi^2(3) = 4.05$, $p = 0.256$). The proportion of patients conveyed was similar across the two groups, and non-conveyance rates showed no meaningful variation.

These findings indicate that sex was not associated with disposition in this cohort.

5.3.2 Disposition by Age

Age was analysed descriptively and in relation to conveyance decisions. The mean age of conveyed patients is presented in Table 8. However, a two-way analysis of variance (ANOVA) for RQ1 found no statistically significant association between age and conveyance decision ($F(3,329) = 1.002$, $p = 0.392$).

Table 8:Disposition by age (Years)

	Mean (95% CI)	Standard Deviation	Median (IQR)	Range (Youngest to Oldest)
Conveyed – COPD Pathway unsuitable	69.39 (67.80-70.97)	11.35	69 (54-84)	39 – 99
Conveyed – COPD Pathway suitable	68.98 (65.82-72.14)	11.80	71 (54-88)	45 - 95
Not conveyed – COPD Pathway unsuitable	72.28 (69.01-75.54)	8.58	74 (64.5-83.5)	51 - 88
Not conveyed – COPD Pathway suitable	67.88 (65.11-70.65)	9.64	70 (52.5-87.5)	49 - 86

Further stratification by age group (Table 8) did not show a consistent gradient or threshold effect with respect to conveyance. Although older patients appeared more likely to be conveyed, this pattern was not statistically significant.

These findings provide no evidence that age alone is associated with conveyance decisions in this cohort.

5.3.3 Socioeconomic Deprivation (SIMD)

Dispositions by socioeconomic deprivation were analysed using SIMD quintiles and are presented in Figures 6–8. Conveyance rates were broadly consistent across all quintiles, with no clear pattern indicating a higher or lower likelihood of conveyance in more or less deprived groups.

Figure 6: Comparison of Disposition by SIMD

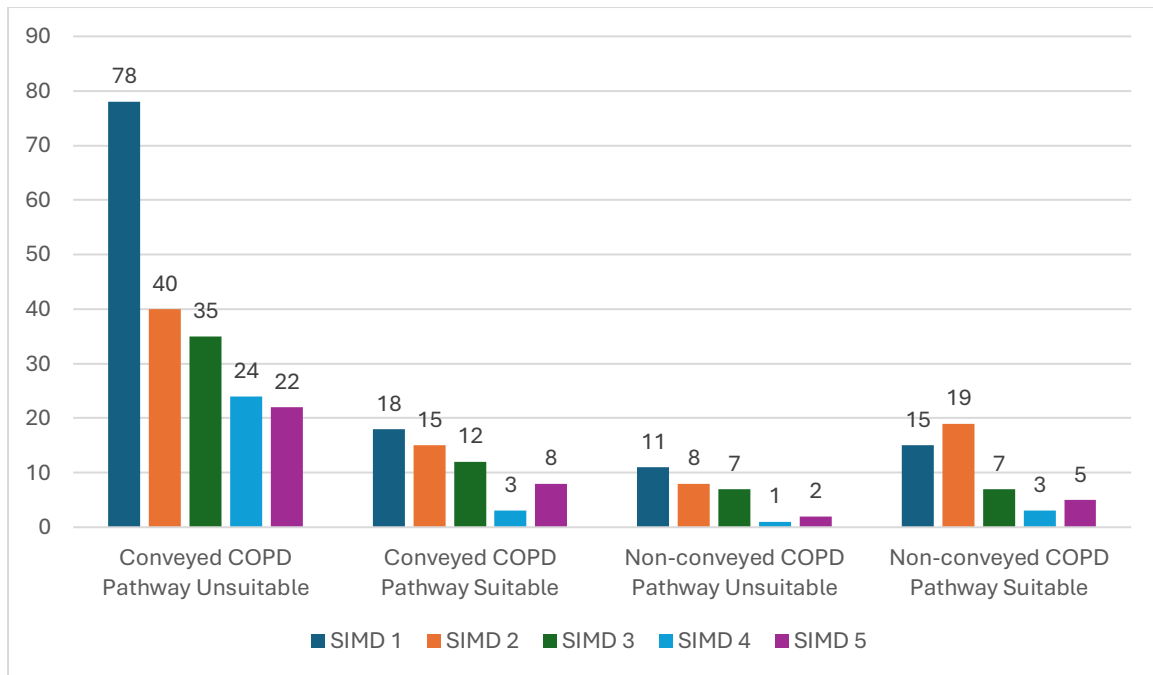


Figure 7: Comparison of % Disposition by SIMD

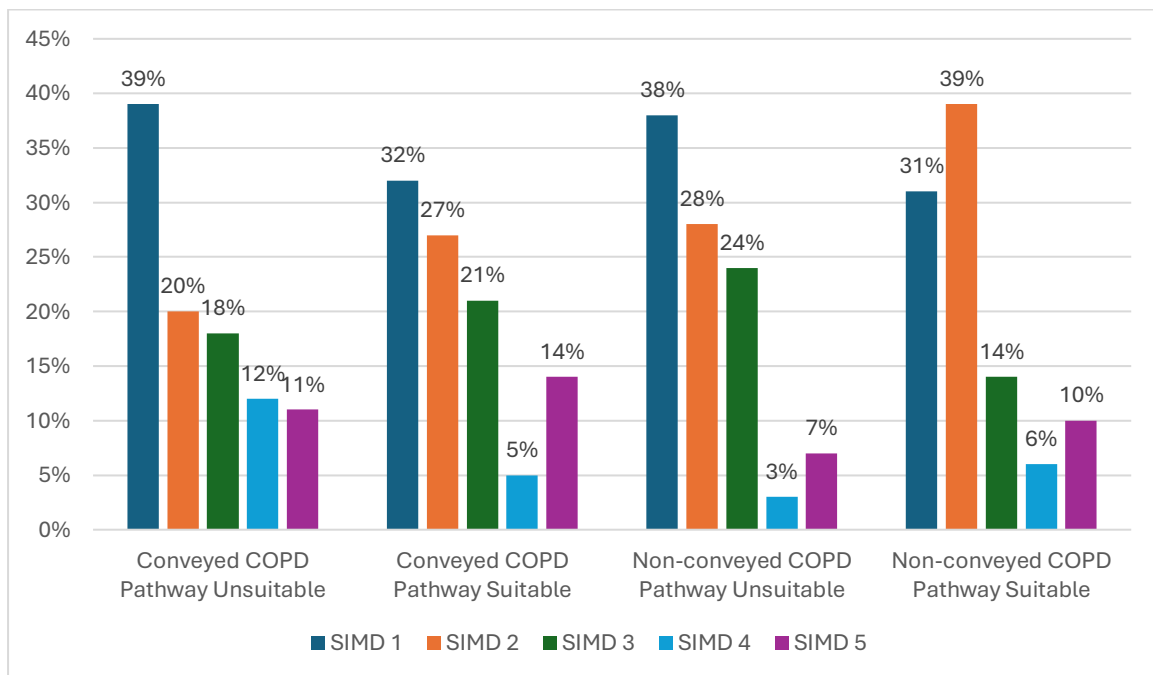
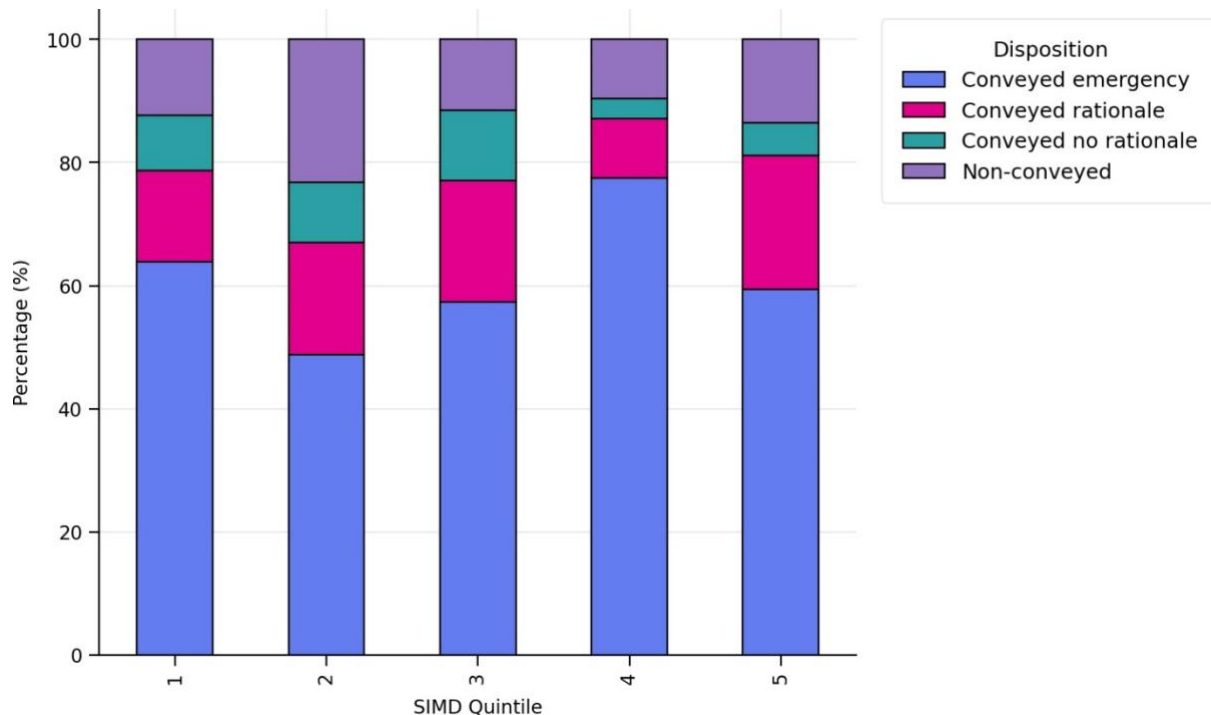


Figure 8: Proportion distribution of patient disposition by SIMD



To further examine the relationship between socioeconomic deprivation and disposition, Figure 8 presents the proportional distribution of disposition categories across SIMD quintiles.

Pearson's chi-square analysis for RQ1 found no statistically significant association between SIMD and conveyance decision ($\chi^2(12) = 13.51$, $p = 0.333$). A comparative analysis of proportions across quintiles showed minimal variation, consistent with the absence of a systematic pattern.

These findings provide no evidence that socioeconomic deprivation, as measured by SIMD, is associated with paramedic disposition decisions in this cohort.

5.3.4 Summary of Demographic Findings

Across all demographic variables analysed for RQ1, no statistically significant associations with conveyance decisions were observed. Although minor descriptive differences were observed, particularly by age, these did not reach statistical significance and were inconsistent across analyses.

Taken together, these findings indicate that patient demographic characteristics were not associated with conveyance decisions in this cohort. Within the conceptual framework underpinning this study, this suggests that decision-making is not primarily driven by patient-level demographic factors but is more likely to reflect clinical assessment and other contextual influences.

The absence of associations across demographic variables also indicates a degree of consistency in decision-making across patient groups, suggesting that variation in conveyance decisions is more likely to stem from differences in clinical presentation and contextual factors than from demographic characteristics.

Overall, these findings demonstrate that demographic variables have limited explanatory power for RQ1 at the population level.

5.4 Physiological Observations, Risk Classification, Disposition and Outcomes (RQ2)

This section addresses RQ2: *Which physiological observations are associated with conveyance decisions, and how do outcomes vary according to physiological risk classification and disposition?*

Physiological observations were associated with conveyance decisions to varying degrees in this cohort. Respiratory rate and heart rate showed the strongest and most consistent associations with conveyance, whereas oxygen saturation showed a directional but statistically non-significant relationship. Blood pressure was not associated with conveyance, and temperature showed a statistically significant but less stable relationship, influenced by small subgroup sizes.

Although abnormal physiological observations were generally associated with a higher likelihood of conveyance, these relationships were not absolute. Some patients with abnormal observations were not conveyed, while others with observations within normal ranges were conveyed. This variability indicates that physiological assessment is an important but non-deterministic component of clinical decision-making.

Overall, these findings suggest that physiological observations provide a structured basis for risk assessment but do not fully account for observed conveyance patterns, indicating the influence of additional clinical and contextual factors.

Table 9: Disposition by physiological variable

Variable	All (333 Patients)	Conveyed (255 Patients)	Non-conveyed (78 Patients)
Respiratory Rate (RR)			
RR<10	2 (100%)	1 (50%)	1 (50%)
Normal	172 (100%)	110 (64%)	62 (36%)
RR >30	159 (100%)	144 (91%)	15 (9%)
Heart Rate (HR)			
Normal	235 (100%)	159 (68%)	76 (32%)
HR >110	98 (100%)	96 (98%)	2 (2%)
Systolic Blood Pressure (BP)			
BP <100 (Low)	11 (100%)	10 (91%)	1 (9%)
BP >100 (Acceptable)	322 (100%)	245 (76%)	77 (24%)
Temperature			
T <34.6 (Low)	39 (100%)	28 (72%)	11 (28%)
Normal	260 (100%)	194 (75%)	66 (25%)
T >37.7 (High)	34 (100%)	33 (97%)	1 (3%)
Blood Oxygen (SPO2 %)			
SPO2 <88%	41 (100%)	35 (85%)	6 (15%)
SPO2 >88% (Accept)	292 (100%)	220 (75%)	72 (25%)

5.4.1 Respiratory Rate

Respiratory rate showed a clear and statistically significant association with conveyance decisions (Table 9). Patients presenting with tachypnoea (respiratory rate >30 breaths per minute) were substantially more likely to be conveyed to the ED than those with normal respiratory rates.

Pearson's chi-square analysis confirmed a significant association between respiratory rate and conveyance decision ($\chi^2(1) = 33.5$, $p < 0.001$), with tachypnoea observed predominantly among conveyed patients.

These findings indicate that respiratory rate is a strong predictor of conveyance and represents a key indicator of respiratory compromise in this cohort.

5.4.2 Heart Rate

Heart rate was also strongly associated with conveyance decisions. Patients presenting with tachycardia (heart rate >110 beats per minute) were markedly more likely to be conveyed than those with heart rates within the normal range.

This association was confirmed by Pearson's chi-square analysis ($\chi^2(1) = 35.3$, $p < 0.001$), with tachycardia occurring almost exclusively in conveyed patients.

These findings demonstrate that heart rate contributes significantly to clinical risk assessment and conveyance decision-making, alongside respiratory parameters.

5.4.3 Blood Pressure

Blood pressure abnormalities were uncommon in the cohort, with hypotension (systolic blood pressure <100 mmHg) observed in only a small number of patients.

Statistical analysis found no significant association between blood pressure and conveyance decision ($\chi^2(1) = 1.30$, $p = 0.25$). The low prevalence of hypotension limited its impact on population-level patterns.

While hypotension remains clinically important at the individual level, these findings provide no evidence of an association between blood pressure and conveyance decisions in this cohort.

5.4.4 Oxygen Saturation (SpO₂)

Oxygen saturation was analysed using a threshold of SpO₂ <88% to define hypoxia. Patients presenting with hypoxia were more likely to be conveyed than those with acceptable oxygen saturation.

However, this association was not statistically significant ($\chi^2(1) = 2.01$, $p = 0.16$).

Although a higher proportion of hypoxic patients were conveyed, the difference was insufficient to demonstrate a reliable association at the population level.

These findings suggest that, although oxygen saturation is clinically important, it does not independently determine conveyance decisions in this cohort.

5.4.5 Temperature

Temperature abnormalities, including hypothermia and hyperthermia, were observed throughout the cohort.

Statistical analysis identified a significant association between temperature and conveyance decision ($\chi^2(2) = 9.08$, $p = 0.011$). This result was primarily driven by the high proportion of patients with elevated temperature who were conveyed.

However, some temperature categories contained small numbers of patients, limiting the stability of this finding. Therefore, the observed association should be interpreted cautiously.

These findings suggest that temperature may influence conveyance decisions in specific cases but is not a primary determinant at the population level.

5.4.6 Summary of Physiological Findings

Across all analyses of RQ2, physiological observations showed variable associations with conveyance decisions.

Respiratory and heart rates showed strong, statistically significant associations with conveyance, with patients presenting with tachypnoea or tachycardia significantly more likely to be conveyed. In contrast, blood pressure and oxygen saturation were not significantly associated with conveyance decisions at the population level, despite their recognised clinical importance.

Temperature showed a statistically significant association with conveyance; however, this finding was affected by small subgroup sizes and should be interpreted cautiously.

Severe physiological abnormalities, such as marked tachypnoea and tachycardia, were strongly associated with conveyance. Nevertheless, these associations were not absolute, and variation in disposition decisions indicates that physiological thresholds are not applied deterministically in practice.

Taken together, these findings indicate that although physiological observations are a critical component of clinical assessment, they are interpreted within a broader decision-making framework. Conveyance decisions appear to reflect the selective weighting of physiological indicators alongside other clinical and contextual factors, rather than reliance on isolated physiological thresholds.

5.5 Service-Level Factors and Decision-Making (RQ3)

This section addresses RQ3: *Which service-level factors, including attendance time, distance to hospital, and paramedic characteristics, are associated with conveyance decisions?*

Across the service-level variables examined, no statistically significant associations with conveyance decisions were observed. These findings do not exclude a wider contextual contribution, but that contribution could not be determined from the available data.

Time of attendance showed some variation, with differences between in-hours and out-of-hours presentations. However, these differences were modest and did not indicate a systematic shift in decision-making practice.

Distance to hospital varied across conveyed cases, but this did not translate into a consistent pattern of non-conveyance or altered decision thresholds. While longer transport distances may influence operational considerations, they were not shown to independently determine disposition in this cohort.

Paramedic characteristics, including qualifications and experience, showed limited variation in recorded outcomes. No clear relationship was observed between

practitioner background and conveyance decisions, suggesting that decision-making was broadly consistent across workforce groups.

Taken together, these findings suggest that service-level variables influence the context in which decisions are made but do not have a direct or predictable effect on conveyance outcomes. Rather than determining disposition, they appear to shape the operational environment in which clinical judgement is exercised.

5.5.1 Time of Attendance

Disposition decisions were analysed in relation to time of attendance (in-hours versus out-of-hours), as presented in Table 10.

Table 10: Comparison of in-hours compared to out-of-hours

	In-Hours	Out-of-hours	Total
Conveyed COPD Pathway unsuitable	114 (57%)	85 (43%)	199 (100%)
Conveyed COPD Pathway suitable	31 (55%)	25 (45%)	56 (100%)
Non-conveyed COPD Pathway unsuitable	16 (55%)	13 (45%)	29 (100%)
Non-conveyed COPD Pathway suitable	30 (61%)	19 (39%)	49 (100%)

Descriptive analysis indicated comparable conveyance across in-hours and out-of-hours attendance periods. Pearson's chi-square analysis for RQ3 found no statistically significant association between time of attendance and conveyance decision ($\chi^2(1) = 0.62$, $p = 0.43$).

These findings provide no evidence of an association between time of attendance and paramedic disposition decisions in this cohort, despite potential variation in access to alternative care pathways during out-of-hours periods.

5.5.2 Distance to Hospital

The distance from scene to hospital was analysed for conveyed patients, as presented in Table 11. Mean transport distance did not differ substantially between disposition groups.

Table 11: Conveyed patients' distance to hospital

	Mean	Standard Deviation	Median (IQR)	Range (Miles)
Conveyed – COPD Pathway unsuitable	5.29	3.01	5.25 (0-10.68)	0.5 – 14.6
Conveyed – COPD Pathway suitable	5.70	2.93	5.25 (1.66-8.84)	0.7 – 14.6

Two-way analysis of variance (ANOVA) for RQ3 found no statistically significant association between distance to hospital and conveyance decision ($F(1,331) = 1.84$, $p = 0.18$).

These findings provide no evidence that geographical proximity to hospital is associated with conveyance decisions in this cohort.

5.5.3 Paramedic Qualification

Disposition was analysed in relation to paramedic qualification, comparing clinicians trained through higher education programmes with those trained via vocational pathways, as shown in Table 12.

Table 12: Comparison of disposition by qualification type of paramedic

	HEI Qualification	Vocational Qualification	Total
Conveyed COPD Pathway unsuitable	58 (29%)	141 (71%)	199 (100%)
Conveyed COPD Pathway suitable	13 (23%)	43 (77%)	56 (100%)
Non-conveyed COPD Pathway unsuitable	11 (38%)	18 (62%)	29 (100%)
Non-conveyed COPD Pathway suitable	13 (27%)	26 (53%)	49 (100%)

Pearson's chi-square analysis for RQ3 found no statistically significant association between paramedic qualification and conveyance decision ($\chi^2(1) = 0.27$, $p = 0.60$).

Conveyance rates were similar across the two groups.

These findings provide no evidence that the paramedic educational pathway is associated with disposition decisions at the population level, indicating consistency in decision-making across training backgrounds.

5.5.4 Paramedic Experience

Paramedic experience, measured by length of service, was analysed in relation to conveyance decisions, as shown in Table 13.

Table 13: Comparison of conveyed pathway suitable against conveyed pathway unsuitable, with length of service as a paramedic

	Mean	Standard Deviation	Median (IQR)	Range (Years)
Conveyed – COPD Pathway unsuitable	13.04	7.95	12.7 (1.7-23.7)	0.3 - 40.0
Conveyed – COPD Pathway suitable	13.70	8.73	12.0 (1.0-23.0)	0.8 - 39.5
Non-conveyed – COPD Pathway unsuitable	11.64	7.45	7.7 (0-19.7)	1.7 – 29.9
Non-conveyed – COPD Pathway suitable	12.88	7.40	11.6 (0.6-22.6)	0.7 – 29.2

Two-way analysis of variance (ANOVA) for RQ3 found no statistically significant association between paramedic experience and conveyance decision ($F(1,331) = 0.91$, $p = 0.34$).

These findings provide no evidence that length of clinical experience is associated with disposition decisions in this cohort, suggesting that decision-making patterns are broadly consistent across experience levels.

5.5.5 Summary of Service-Level Findings

Across all service-level variables analysed for RQ3, no statistically significant associations with conveyance decisions were observed. Time of attendance, distance to hospital, paramedic qualification, and paramedic experience were not associated with variation in disposition outcomes in this cohort.

Taken together, these findings indicate that organisational and operational factors do not significantly influence conveyance decisions at the population level. Despite expected variation in service availability, workforce characteristics, and geographic context, decision-making patterns remained consistent across these domains.

Within the conceptual framework of this study, these results suggest that service-level factors play a limited role in explaining variation in conveyance decisions compared with physiological indicators of clinical risk. The absence of statistically significant associations further indicates that decision-making is not strongly influenced by clinician characteristics or system pressures, as captured in this dataset.

These findings support the interpretation that variation in conveyance decisions is more likely to reflect differences in clinical assessment and judgement than organisational context alone.

Overall, service-level variables offer limited explanatory power for conveyance decisions, indicating that RQ3 is not supported by strong associations at the population level.

5.6 Pathway Alignment, Disposition and Outcomes (RQ4)

This section addresses RQ4: *To what extent do paramedic conveyance decisions align with COPD pathway suitability criteria, and how do hospital admission, length of stay, and 30-day mortality outcomes vary between pathway-defined groups and observed dispositions?*

Paramedic conveyance decisions did not consistently align with COPD pathway criteria, and there was substantial divergence between pathway suitability and actual disposition.

Patients classified as suitable for pathway-based non-conveyance were frequently conveyed to hospital. Conversely, a smaller but clinically significant number of patients classified as unsuitable for the pathway were not conveyed. These findings indicate that pathway criteria were not applied as strict decision rules.

Further analysis of post-conveyance outcomes showed that pathway alignment did not consistently predict admission, length of stay, or 30-day mortality. Patients deemed suitable were not consistently low-risk, and those deemed unsuitable did not uniformly experience adverse outcomes.

This pattern suggests that the pathway criteria alone do not fully account for disposition decisions. The observed divergence suggests that pathway-defined physiological thresholds do not fully account for disposition decisions in this dataset.

Overall, the observed divergence between pathway classification and conveyance decisions suggests that the findings are consistent with the possibility that factors not captured in the dataset contributed to disposition decisions. Variation in decision-making may reflect adaptive responses to complexity rather than a deviation from standardised practice.

5.6.1 Pathway Suitability and Conveyance Decisions

Disposition by pathway status is presented in Tables 14–16. Patients classified as pathway-unsuitable were substantially more likely to be conveyed to the Emergency Department than those classified as pathway-suitable, indicating clear alignment between physiological risk classification and conveyance decisions.

Table 14: General disposition categories

Disposition	Total
Conveyed – COPD Pathway unsuitable	199 (60%)
Conveyed – COPD Pathway suitable	56 (17%)
Non-conveyed – COPD Pathway unsuitable	29 (9%)
Non-conveyed – COPD Pathway suitable	49 (15%)
Total	333 (100%)

Table 15: Conveyed patients to the ED

	Conveyed as Emergency	Conveyed with documented rationale	Conveyed without documented rationale	Total
COPD pathway suitable	5 (9%)	31 (55%)	20 (36%)	56 (100%)
COPD pathway unsuitable	47 (24%)	87 (44%)	65 (33%)	199 (100%)

Statistical analysis of Table 15 using Pearson's chi-square test found that pathway-unsuitable patients were more likely to be conveyed as emergencies (24% vs 9%), whereas pathway-suitable patients were more likely to have a documented rationale for conveyance (55% vs 44%) and slightly less likely to be conveyed without a documented rationale (36% vs 33%).

Overall, this pattern indicates that pathway classification is associated with both the urgency and the documentation of conveyance decisions ($\chi^2(2) = 6.03$, $p = 0.049$).

Table 16: Non-conveyed patients to the ED

	Discharged on scene	Referred to OOH GP	Referred to other	Patient refusal	Referred to CRT - COPD pathway	Total
COPD Pathway suitable	15 (31%)	5 (10%)	11 (22%)	4 (8%)	14 (29%)	49 (100%)
COPD Pathway unsuitable	2 (7%)	5 (17%)	3 (10%)	5 (17%)	14 (48%)	29 (100%)

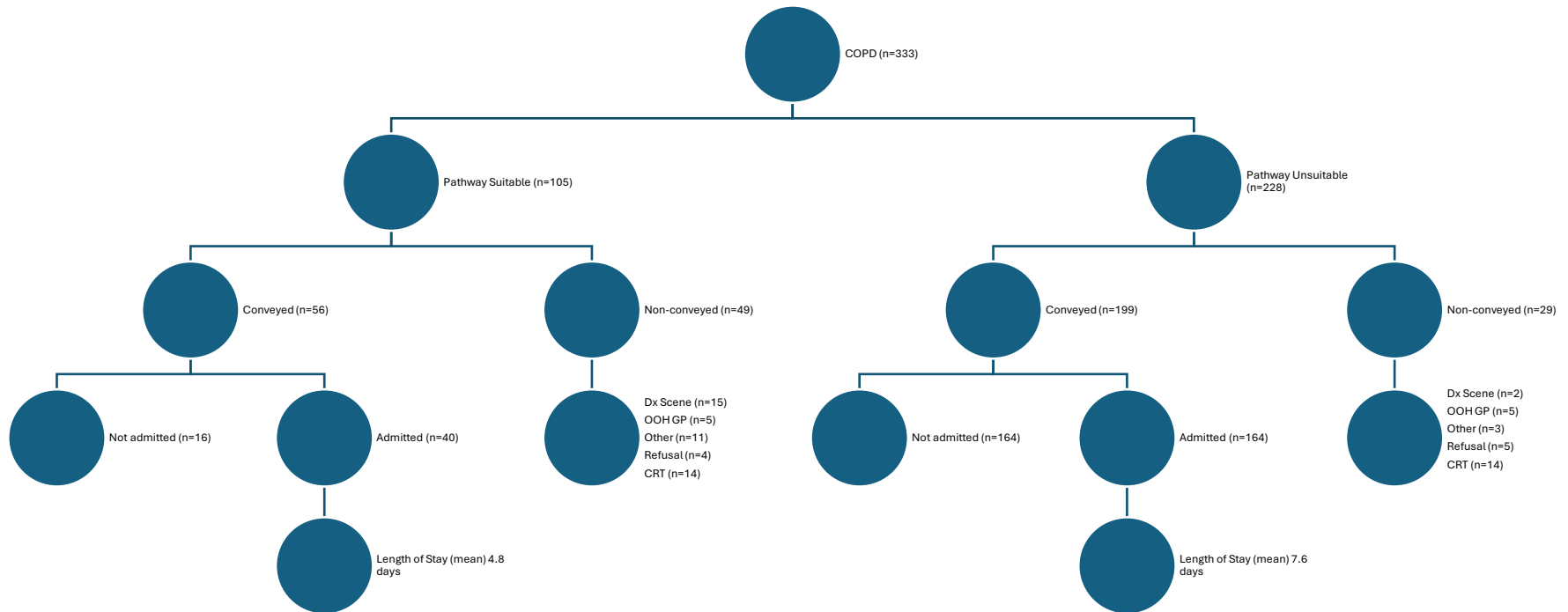
Despite this strong association, and in relation to RQ4, divergence from pathway criteria was observed in both directions. A substantial proportion of patients classified as pathway-suitable for non-conveyance were nonetheless conveyed, while a smaller number of pathway-unsuitable patients were managed in the community.

These findings indicate that although pathway classification is strongly associated with conveyance decisions, it does not fully determine them. This suggests that paramedics apply pathway criteria within a broader clinical context rather than as prescriptive rules.

Although narrative data were available, no consistent or explicit record of COPD pathway utilisation was found in the clinical documentation. The recorded rationales were brief and heterogeneous, and therefore not amenable to systematic or thematic analysis.

Figure 9 provides a visual representation of patient pathways, illustrating the journeys of all 333 cases and linking them to the patient vignette presented in section 2.9.2.

Figure 9: Actual patient journeys (n=333)



5.6.2 Hospital Admission Following Conveyance

Hospital admission following conveyance was analysed by pathway status (Table 17). Patients classified as pathway-unsuitable had higher rates of hospital admission than those classified as pathway-suitable.

Table 17: Comparison of conveyed disposition against admission

	Not Admitted	Admitted	Total
Conveyed COPD Pathway unsuitable	35 (18%)	164 (82%)	199 (100%)
Conveyed COPD Pathway suitable	16 (29%)	40 (71%)	56 (100%)

Statistical analysis of RQ4 revealed a statistically significant association between pathway classification and hospital admission ($\chi^2(3) = 7.21$, $p = 0.041$).

These findings indicate an association between pathway classification and downstream clinical outcomes in this dataset. However, the study was not designed to assess pathway effectiveness or the suitability of pathway criteria as a risk-stratification tool.

However, some pathway-suitable patients required hospital admission after conveyance. This suggests that physiological stability at initial assessment does not fully predict subsequent clinical trajectory and highlights the limitations of relying solely on threshold-based classification.

5.6.3 Length of Hospital Stay

Length of hospital stay (LOS) was analysed by pathway status, as shown in Table 18. Patients classified as pathway-unsuitable had a longer mean LOS than those classified as pathway-suitable.

Table 18: Comparison of length of stay (in days) for conveyed pathway suitable against pathway unsuitable.

	Mean	Standard Deviation	Median (IQR)	Range (Days)
Conveyed – COPD Pathway unsuitable	7.6	9.46	5 (0-12)	0 - 70
Conveyed – COPD Pathway suitable	4.8	4.21	3 (0-8.5)	0 - 16

For RQ4, Levene’s test indicated unequal variances ($p = 0.032$), and an adjusted t-test showed a statistically significant difference between groups ($p < 0.05$). These findings suggest that higher physiological risk at initial assessment is associated with greater healthcare utilisation.

Despite this overall pattern, variability was observed within both groups. Some pathway-suitable patients had prolonged admissions, indicating that the initial physiological classification does not fully capture the complexity of clinical trajectories and disease progression.

5.6.4 Thirty-Day Mortality

Thirty-day mortality was analysed by pathway classification, as shown in Table 19. Mortality was low across the cohort, but there was a clear association with pathway status.

Table 19: Comparison of 30-day mortality

	Mortality at 30 days No	Mortality at 30 days Yes	Total
Conveyed COPD Pathway unsuitable	178 (89%)	21 (11%)	199 (100%)
Conveyed COPD Pathway suitable	55 (98%)	1 (2%)	56 (100%)
Non-conveyed COPD Pathway unsuitable	25 (86%)	4 (14%)	29 (100%)
Non-conveyed COPD Pathway suitable	49 (100%)	0 (0%)	49 (100%)

All but one of the recorded deaths occurred among patients classified as pathway-unsuitable. Notably, no deaths were observed among pathway-suitable patients managed in the community. Given the progressive nature of COPD and the small number of events, no inferential statistical testing was conducted beyond descriptive reporting.

These findings suggest that pathway criteria are associated with identifying patients who may be approaching the end of their disease trajectory or who are at increased risk of adverse outcomes. They also indicate that no deaths were observed among pathway-suitable patients managed in the community within this cohort. These observations should be interpreted cautiously and do not establish the safety of non-conveyance.

5.6.5 Interpretation of Pathway Alignment

Across all outcomes analysed, pathway classification showed consistent associations with conveyance decisions and subsequent clinical outcomes.

Patients classified as pathway-unsuitable were significantly more likely to be transported to hospital, admitted, to have longer hospital stays, and to die within 30 days.

These findings suggest that pathway criteria are associated with physiological risk and clinical acuity across the population.

However, clinically significant divergence from pathway thresholds was also observed. A substantial proportion of pathway-suitable patients were conveyed, whereas a smaller but important group of pathway-unsuitable patients was managed in the community. This pattern indicates that physiological thresholds alone do not fully explain the observed disposition decisions.

5.6.6 Summary of Pathway Findings

Analysis of pathway alignment indicates a strong but non-deterministic relationship between physiological risk classification and paramedic decision-making.

Pathway classification was significantly associated with conveyance decisions, hospital admission, length of stay, and 30-day mortality, supporting its role as a structured approach to risk stratification. However, consistent divergence from pathway thresholds indicates that clinical decision-making extends beyond the application of physiological criteria alone. This divergence suggests that pathway criteria were not applied as prescriptive rules in all cases.

Taken together, these findings suggest that clinical pathways function as decision-support tools rather than deterministic rules. Within the study's conceptual framework, the observed variation may reflect influences beyond the recorded physiological and pathway variables. However, the available data cannot establish the reasons for this variation, including whether it arose from clinical reasoning, patient-level factors, organisational context, or differences in practice. These findings are consistent with the broader literature and show that paramedic decision-making in COPD is dynamic and context-dependent, shaped by the integration of multiple domains rather than determined by protocol alone.

Overall, although COPD pathway criteria are strongly associated with conveyance decisions and clinical outcomes, they do not fully determine disposition, highlighting

that factors beyond the recorded variables may contribute to decision-making and establishing RQ4 as a key component of understanding that process.

5.7 Integrated Summary of Findings

This chapter has examined the relationships between patient demographics, physiological observations, service-level factors, and pathway alignment in relation to paramedic conveyance decisions for patients presenting with acute exacerbations of COPD. Taken together, the findings demonstrate a clear pattern in which physiological indicators of clinical risk form the primary structured basis for decision-making, whereas demographic and service-level factors offer limited explanatory value for variation in patient disposition.

At the patient level, no statistically significant associations were found between conveyance decisions and demographic variables, including age, sex, and socioeconomic deprivation. These findings indicate that, at the population level, patient demographics were not associated with decision-making, suggesting that paramedic disposition is not systematically structured by social or demographic characteristics within this cohort.

In contrast, physiological observations showed variable associations with conveyance decisions. Respiratory and heart rates showed strong, statistically significant associations, with higher values linked to a greater likelihood of conveyance. Other physiological variables showed weaker or non-significant relationships. These findings indicate that clinical assessment of physiological status is central to paramedic decision-making and support its role as the primary mechanism for evaluating clinical risk in practice, while also highlighting that not all physiological indicators contribute equally to disposition decisions.

Analysis of service-level factors, including attendance time, distance to hospital, paramedic qualifications, and experience, found no statistically significant associations with conveyance decisions. These findings provide no evidence that organisational or workforce characteristics were associated with disposition outcomes

at the population level in this cohort, despite their prominence in the literature as potential influences on clinical decision-making.

The examination of pathway alignment offers a critical synthesis of these findings. Pathway classification, derived from physiological observations, showed strong, statistically significant associations with conveyance decisions and downstream clinical outcomes, including hospital admission, length of hospital stay, and 30-day mortality. Patients classified as pathway-unsuitable were significantly more likely to be conveyed and admitted and may experience adverse outcomes, suggesting that pathway-defined physiological thresholds are associated with markers of clinical risk.

However, clinically meaningful divergence from pathway criteria was consistently observed. A substantial proportion of patients classified as pathway-suitable were conveyed to the Emergency Department, while a smaller but important group of pathway-unsuitable patients were managed in the community. This bidirectional variation demonstrates that pathway criteria do not deterministically govern paramedic decision-making but are interpreted and applied within a broader clinical context.

Outcome analysis further supports this interpretation. Although adverse outcomes were concentrated among pathway-unsuitable patients, no deaths were observed among non-conveyed pathway-suitable patients. This pattern indicates that pathway-suitable patients managed in the community had fewer adverse outcomes in this dataset; however, the study was not designed to determine whether these outcomes were attributable to the disposition decision itself.

Taken together, these findings demonstrate that paramedic decision-making in COPD is primarily structured by physiological risk assessment but is not reducible to applying pathway thresholds alone. Instead, the observed decision-making patterns are consistent with the integration of multiple domains, including physiological assessment, clinical interpretation, patient context, and organisational environment, as outlined in the conceptual framework developed in Chapter 3.

Within this framework, physiological observations serve as the primary signal for decision-making, while pathway criteria provide a structured approach to risk stratification. However, the findings are consistent with the possibility that factors beyond protocol-based guidance influence clinical decisions, even though these factors cannot be directly examined in the dataset. Pathways therefore function as decision-support tools rather than prescriptive algorithms, providing structure without eliminating the need for interpretive reasoning.

These findings advance understanding of paramedic decision-making by showing that variation in conveyance decisions was not explained by the demographic or service-level factors examined in this study and may reflect influences not captured in this dataset. The observed patterns may be interpreted through a multidimensional model not as adherence to or deviation from protocol, but as the outcome of a dynamic interplay between structured clinical guidance and professional reasoning.

This integrated interpretation directly addresses the primary research question, showing that although specific physiological observations are strongly associated with conveyance decisions, they do not fully determine them. The findings are consistent with paramedic decision-making in COPD being multidimensional and interpretive, with clinical pathways providing support without replacing professional judgment.

It is important to note that these findings describe associations rather than decision-making processes. Although divergence among physiological status, pathway alignment, and disposition was observed, the dataset does not include direct measures of clinician reasoning. Consequently, the results should be interpreted as identifying patterns consistent with influences beyond the recorded variables, rather than demonstrating how decisions were made. These findings provide the basis for the discussion in Chapter 6, which examines the implications of this dynamic decision-making model for clinical practice, pathway design, and the evaluation of non-conveyance safety in pre-hospital care.

Chapter 6: Discussion

6.1 Introduction

This chapter is structured to address each component of the research question.

- Section 6.2 examines the role and limitations of routinely collected data in informing decision-making
- Section 6.3 examines the association between patient demographics and conveyance decisions
- Section 6.4 analyses the role of physiological observations in risk stratification and outcomes
- Section 6.5 evaluates the impact of service-level factors
- Section 6.6 examines pathway alignment and the nature of deviations in practice
- Section 6.7 integrates these findings to address the primary research question through the lens of clinical judgement

This chapter interprets the study's findings in relation to the research questions and the existing evidence base. The analysis examines how patient demographics, physiological observations, and service-level factors relate to conveyance decisions in COPD, and what these relationships reveal about the role of clinical judgement in paramedic practice.

Across the analysed domains, no single variable fully accounted for the observed disposition. The resulting patterns are consistent with, but do not directly demonstrate, the influence of contextual factors and interpretive judgment. This chapter therefore moves beyond describing associations to examine how these findings advance understanding of decision-making as a complex, context-dependent process in pre-hospital care.

6.2 Data Quality and the Limits of Quantitative Explanation

The findings demonstrate that routinely collected data can identify associations among physiological variables, conveyance decisions, and clinical outcomes; however, its ability to explain decision-making is inherently limited. This limitation is evident in the divergence between measurable indicators and actual disposition decisions. Cases in which physiologically abnormal patients were not conveyed and physiologically stable patients were conveyed indicate that recorded variables do not fully account for the observed variation in disposition decisions. This finding aligns closely with the scoping review, which identified a persistent mismatch between quantitative risk measures and the interpretive nature of clinical decision-making. Quantitative studies consistently frame risk in terms of physiological indicators and outcome measures such as recontact or mortality (Ebben et al., 2017; Blodgett et al., 2021), yet they neglect the reasoning processes underpinning decisions. In contrast, qualitative evidence highlights the role of uncertainty, contextual factors, and professional judgment in shaping disposition decisions (O'Hara et al., 2014; Lederman et al., 2019).

The present study reproduces this tension using a condition-specific dataset. Although physiological measures are clearly associated with both decision-making and outcomes, they do not fully account for the observed variation. Accordingly, these findings support the view that routinely collected data provide necessary but incomplete insight into decision-making and must be interpreted alongside frameworks that recognise the role of judgement and context, consistent with the wider literature.

6.3 Patient Demographics and Conveyance Decisions (RQ1)

The findings demonstrate that demographic variables were not consistently associated with conveyance decisions and did not independently explain disposition in this COPD cohort. This contrasts with findings from the scoping review, which frequently identifies demographic factors, such as age, as predictors of non-conveyance. Quantitative studies suggest that older patients are more likely to experience adverse outcomes and therefore may be conveyed more often (Oosterwold et al., 2018; Heinonen et al., 2022).

However, the review also highlights substantial heterogeneity and inconsistency in these associations (Ebben et al., 2017; Blodgett et al., 2021).

The present findings support this latter interpretation. Although older patients were more frequently conveyed, this pattern did not show a stable or independent effect and is more plausibly explained by underlying clinical complexity rather than age itself acting as a decision driver. Furthermore, the absence of meaningful associations with sex and socioeconomic deprivation reflects limitations identified in the wider literature, where demographic variables are often used as proxies for risk without clear explanatory mechanisms (Oosterwold et al., 2018). Taken together, these findings extend the scoping review by demonstrating that, within a condition-specific context such as COPD, demographic factors are secondary to clinical assessment and do not serve as primary determinants of decision-making.

6.4 Physiological Observations, Risk, and Outcomes (RQ2)

Respiratory and heart rates showed the strongest associations with conveyance decisions in this cohort, whereas associations with subsequent outcomes varied by physiological and pathway classification. This aligns with quantitative evidence from the scoping review, which indicates that abnormal physiological observations are associated with a higher likelihood of conveyance and adverse outcomes (Vloet et al., 2018; Lederman et al., 2020; Heinonen et al., 2022). These findings support the validity of physiological assessment as a central component of risk stratification in pre-hospital care.

However, the present study also reproduces a key limitation identified in the literature. Despite strong associations between physiological measures and outcomes, decision-making does not map directly onto physiological thresholds. Similar patterns are reported in the review, with a substantial proportion of non-conveyed patients presenting with abnormal vital signs (Vloet et al., 2018; Lederman et al., 2020). This reflects the broader critique that quantitative risk models are inherently reductionist (Blodgett et al., 2021). While they capture associations between measurable variables

and outcomes, they do not account for the interpretive processes clinicians use to assess and act on risk.

Therefore, the findings support the interpretation that physiological observations provide a structured framework for assessment but do not fully account for the observed variation in disposition decisions (O'Hara et al., 2014; Lederman et al., 2019). This is particularly relevant in COPD, where baseline variability and clinical complexity further limit the utility of fixed thresholds.

6.5 Service-Level Factors and Decision-Making (RQ3)

The findings demonstrate that service-level factors show inconsistent, context-dependent associations with conveyance decisions and do not independently determine disposition. This partially contrasts with findings from the scoping review, which report that system-level influences, such as time of day, access to services, and transport distance, are associated with variation in non-conveyance (Paulin et al., 2020; Forsgårde et al., 2020). However, these studies also show considerable variability and a lack of consistent effects across contexts (Ebben et al., 2017).

The present findings support this latter interpretation. Although variation was observed, no stable or predictive relationships were identified, suggesting that the service-level factors examined were not statistically associated with conveyance in this cohort. Their broader contextual contribution could not be determined from the available data. Qualitative evidence in the review supports this interpretation, highlighting how organisational context, including access to alternative care pathways, perceived accountability, and operational constraints, shapes clinicians' judgment (Lederman et al., 2019; Johansson et al., 2022). Taken together, these findings support a model in which service-level factors act as contextual modifiers rather than primary drivers of decision-making.

6.6 Pathway Alignment and Clinical Judgement (RQ4)

The findings demonstrate that conveyance decisions did not consistently align with COPD pathway criteria, revealing substantial divergence between pathway-defined

suitability and actual disposition. This directly addresses a key limitation identified in the scoping review, namely the lack of validated decision-support tools that reliably predict safe non-conveyance (Ebben et al., 2017; Blodgett et al., 2021). Across the literature, pathways and guidelines are described as supporting decision-making, yet their application in practice remains variable and insufficiently understood.

The present study provides empirical evidence of this variability within a condition-specific population. Patients classified as suitable for non-conveyance were frequently conveyed, whereas some classified as unsuitable were not conveyed. Importantly, pathway alignment did not consistently predict outcomes, challenging assumptions in the quantitative literature that structured tools map directly onto clinical risk. This finding is strongly supported by qualitative evidence, which shows that clinicians use guidelines and pathways as reference points rather than as prescriptive rules (O'Hara et al., 2014; Lederman et al., 2019). Decision-making is mediated by clinical judgement, which incorporates factors not captured by formal criteria.

The findings indicate that pathway classification was associated with, but did not fully determine, disposition decisions in this dataset, consistent with complex intervention theory (Craig et al., 2008) rather than a deterministic algorithm. These findings provide condition-specific evidence of the relationship between pathway classification and disposition decisions in a COPD cohort in real-world paramedic practice. They should not be taken as evidence of the specific reasoning processes used by individual clinicians. Rather, they show that pathway criteria and recorded physiological observations did not fully account for observed disposition decisions. This residual variation suggests that recorded study variables did not fully account for observed disposition decisions, which may include patient preference, comorbidity, social circumstances, clinician experience, or professional judgment.

6.7 Integration: Clinical Judgement and Decision-Making

Across all domains, the findings align with and extend the central themes identified in the scoping review. The literature consistently characterises non-conveyance as heterogeneous, context-dependent, and resistant to reductionist modeling (Ebben et al., 2017; Blodgett et al., 2021; O'Hara et al., 2014). The present study reinforces these

conclusions by showing that no single domain independently explains decision-making in a COPD population. Instead, the recorded quantitative variables did not fully explain the observed disposition decisions. This aligns with the convergence of quantitative and qualitative evidence identified in the scoping review and addresses its key limitation, namely the absence of condition-specific analysis. By treating COPD as a discrete clinical category, this study offers a more detailed account of how these processes operate in practice, demonstrating that variation in disposition decisions is observable within the dataset, but the reasons for that variation cannot be determined from the available data. In doing so, the thesis moves beyond description by proposing an interpretive framework through which the observed population-level patterns may be understood.

It is important to clarify the inferential limits of this study for clinical decision-making. The analysis presented does not directly observe paramedic cognitive processes or real-time reasoning. Instead, it examines associations between observable variables (for example, physiological observations, demographics, and service-level factors) and patient disposition. Consequently, interpretations of clinical judgment are necessarily indirect. Divergence between measurable physiological risk and disposition is interpreted as consistent with the influence of clinical judgment; however, this should not be taken as a direct measure of decision-making processes. Rather, the findings identify patterns in the data that are consistent with disposition decisions being influenced by factors beyond those measured in the dataset. This distinction is critical. The study does not claim to explain how decisions are made at the level of individual cognition, but instead contributes to understanding how decision-making is expressed at the population level through observable patterns of practice. Further qualitative or mixed-methods research would be required to directly examine the reasoning processes underpinning these decisions.

6.8 Contribution to Research and Development in the Scottish Ambulance Service

This study makes a novel contribution to research and development within the SAS by providing one of the first condition-specific examinations of paramedic conveyance decision-making in patients with COPD, using linked ambulance and outcome data. While existing ambulance research has largely examined non-conveyance as a heterogeneous phenomenon across diverse patient groups, this study demonstrates the value of focusing on a specific clinical population to achieve a more nuanced understanding of decision-making, risk, and patient outcomes. By linking pre-hospital assessment data with subsequent healthcare outcomes, the study advances understanding of how COPD patients move through the urgent and unscheduled care system and provides new evidence on the relationships between physiological observations, conveyance decisions, hospital admission, length of stay, and mortality. These findings address an important evidence gap within both the ambulance literature and the organisational knowledge base of SAS.

The study further contributes to organisational learning by highlighting the strengths and limitations of routinely collected ambulance service data for clinical research and service evaluation. In doing so, it demonstrates both the opportunities and challenges of using linked datasets to evaluate patient pathways and outcomes. The findings reveal that measurable variables such as respiratory rate, heart rate, and oxygen saturation are associated with conveyance decisions and subsequent outcomes; however, they also show that these factors alone are insufficient to explain the complexity of decision-making observed in practice. This has important implications for future pathway evaluation, governance arrangements, and service improvement activity within SAS, suggesting that outcome measurement and quality assurance processes should recognise the contribution of professional judgement alongside protocol adherence.

A particularly important contribution of this study is the insight it offers into how the COPD pathway operates in routine clinical practice. Although pathway suitability was linked to patient outcomes, substantial variation was observed between pathway

criteria and final disposition decisions. Rather than indicating simple concordance or discordance with pathway criteria, these findings demonstrate variation between pathway classification and final disposition decisions. The reasons for this variation cannot be determined from the available data. The observed variation is consistent with interpreting the pathway as a decision-support framework rather than as a deterministic algorithm. Further research would be required to determine how pathway design and professional judgment interact in practice.

From a research and development perspective, the study also provides a methodological foundation for future ambulance service research. The processes developed for cohort identification, data linkage, pathway evaluation, and outcome analysis offer a framework that could be applied to other clinical pathways and patient groups within SAS. Furthermore, the study identifies areas for future development, including enhanced documentation of clinical reasoning, improved capture of referral activity, and greater integration of routinely collected data across the patient journey. Collectively, these contributions extend beyond the study's immediate findings and support the ongoing development of an evidence-informed culture of evaluation, innovation, and service improvement within the Scottish Ambulance Service.

6.9 Chapter Summary

This chapter has interpreted the study findings in relation to both the existing evidence and the study's conceptual framework.

Physiological observations were strongly associated with conveyance decisions and outcomes, confirming their role in risk assessment. By contrast, demographic and service-level variables had limited explanatory power. However, measurable factors alone did not fully account for decision-making, as divergence between risk indicators and disposition underscored the role of clinical interpretation.

Clinical pathways were associated with decision-making patterns. Their application may involve clinical judgement, although this was not directly measured in the present study. This interpretation aligns with the decision-making frameworks outlined in

Chapter 2. From Collen's (2016) perspective, decision-making is a practice-based process grounded in clinical reasoning, professional accountability, and the structured evaluation of patient information. Simultaneously, dual-process models of cognition (Kahneman, 2011; Perona et al., 2019) suggest that clinicians shift between analytical and intuitive modes of reasoning, depending on the demands of the situation. Within this combined framework, clinical pathways provide an analytical structure, while clinical judgement reflects both the interpretation of physiological signals and the application of experience-based reasoning.

Overall, decision-making regarding conveyance in COPD reflects the integration of structured assessment and interpretive reasoning. This reinforces the view that pathways function as decision-support tools rather than prescriptive algorithms. In practice, paramedics synthesise physiological observations with broader clinical and contextual factors, drawing on both analytical evaluation and intuitive judgement. This provides the foundation for the conclusions and implications presented in the following chapter.

Chapter 7: Conclusions and Implications

7.1 Introduction

This chapter summarises the study's conclusions and outlines its contributions to knowledge, practice, and future research. It synthesises the findings in relation to the research questions and situates them within the wider evidence base identified in the scoping review. This study did not directly measure clinical reasoning or decision-making processes. Instead, it examined relationships among recorded patient characteristics, physiological observations, service-level factors, and disposition outcomes. Conclusions about clinical judgement should therefore be interpreted as explanatory inferences from observed patterns rather than as direct observations of clinicians' reasoning.

Across all domains, the findings demonstrate that conveyance decision-making in COPD cannot be explained by isolated variables or by reductionist risk models. Instead, the observed patterns are consistent with decisions being associated with factors beyond structured clinical assessment, although those factors were not directly measured. This chapter therefore moves beyond summary to articulate the study's contribution to paramedic research, clinical practice, and system design.

7.2 Summary of Key Findings

The findings of this study can be summarised in relation to the four research questions.

Demographic factors (RQ1)

Demographic characteristics, including age, sex, and socioeconomic deprivation, did not show consistent or independent associations with conveyance decisions. Although older patients were more often conveyed, this pattern reflected underlying clinical complexity rather than age itself being a determinant of disposition. These findings align with the heterogeneity identified in the scoping review (Ebben et al., 2017; Oosterwold et al., 2018) and suggest that demographic variables act as contextual rather than causal factors.

Physiological observations and outcomes (RQ2)

Respiratory and heart rates showed the strongest associations with conveyance decisions, whereas oxygen saturation showed a directional but statistically non-significant association. Associations with subsequent outcomes varied across physiological and pathway classifications. Pathway classification was associated with markers of clinical acuity and subsequent outcomes in this cohort, but the study was not designed to evaluate pathway effectiveness. These findings align with the quantitative literature (Vloet et al., 2018; Heinonen et al., 2022). However, the relationship between physiological status and disposition was not absolute. Divergence between physiological presentation and conveyance decision was consistently observed, indicating that physiological data alone do not determine decision-making.

Service-level factors (RQ3)

Service-level variables, including time of attendance, distance to hospital, and paramedic characteristics, showed inconsistent, context-dependent associations with conveyance. These findings partially contrast with the literature (Paulin et al., 2020) but align with broader evidence indicating variability and limited explanatory power among system-level factors (Ebben et al., 2017). Overall, service-level factors shaped the context in which decisions were made but did not independently determine outcomes.

Pathway alignment and outcomes (RQ4)

Conveyance decisions showed substantial but incomplete alignment with pathway suitability. Hospital admission and length of stay differed across pathway-defined groups for which these outcomes were available, while mortality was concentrated in pathway-unsuitable groups. These comparisons describe associations between pathway classification and observed disposition and do not establish the causal effect or appropriateness of individual decisions. This finding aligns with limitations identified in the scoping review regarding the validity of decision-support tools (Blodgett et al., 2021). Taken together, the findings are consistent with the COPD pathway functioning

as a decision-support framework rather than a deterministic tool, although the role of clinical judgement in individual cases was not directly examined.

7.3 Contribution to Knowledge

This study provides condition-specific evidence on paramedic decision-making regarding conveyance for patients with COPD, addressing a recognised gap in the literature. Rather than offering a definitive model of decision-making, the findings support a multidimensional interpretation of practice, in which physiological assessment, patient context, and system-level factors interact to shape disposition decisions. The study contributes by demonstrating how routinely collected data can be used to explore associations among patient characteristics, clinical observations, and outcomes in a defined clinical population. In doing so, it provides empirical evidence consistent with existing theoretical accounts of decision-making as complex, context-dependent, and interpretive.

Importantly, the study does not claim to explain cognitive decision-making processes directly. Instead, it offers a population-level perspective on how decision-making is expressed through patterns of conveyance and non-conveyance, highlighting areas where measurable risk and disposition do not align. These findings provide a foundation for further research, particularly qualitative and mixed-methods approaches, to examine clinical reasoning in practice more directly.

7.3.1 Addressing the Absence of COPD-Specific Evidence

The scoping review found no COPD-specific analysis in the non-conveyance literature. Existing studies aggregate heterogeneous patient populations, limiting clinical applicability. This study addresses that gap by examining COPD as a discrete clinical population, providing condition-specific evidence linking pre-hospital assessment, conveyance decisions, and patient outcomes. In doing so, it extends the literature beyond generalised descriptions of non-conveyance and demonstrates how decision-making operates within a clinically complex, high-risk group.

7.3.2 Demonstrating the Explanatory Limits of Measurable Variables

The findings show that although physiological observations are strongly associated with outcomes, they do not fully explain conveyance decisions. This provides quantitative support for a key critique identified in the scoping review, namely that the dominant risk model, based on measurable physiological indicators, is inherently incomplete (Blodgett et al., 2021). By demonstrating divergence among physiological status, pathway criteria, and disposition, this study shows that the findings are consistent with previous literature suggesting that risk may extend beyond measurable physiological indicators alone. The study also shows that quantitative variables explain important variation in conveyance decision-making but are insufficient to provide a complete explanation. The observed divergence between physiological risk indicators, pathway criteria, and actual disposition decisions provides empirical evidence for the limits of reductionist models of paramedic decision-making.

7.3.3 A Conceptual Framework for Interpreting Observed Conveyance Patterns

The study integrates its empirical findings with the existing literature to propose a conceptual framework for interpreting the observed findings. Within this framework, observed disposition patterns are interpreted through four potentially interacting domains: physiological assessment, clinical interpretation, patient context, and organisational environment.

Physiological observations and clinical pathways provide structured inputs to this process, offering a framework for risk recognition and stratification. However, decisions are not determined by these elements in isolation. Rather, the framework offers one interpretation of how physiological data, patient context, and organisational factors may relate to observed disposition patterns. This model directly addresses a key gap in the literature. While previous research consistently characterises non-conveyance decision-making as complex and context-dependent, it offers limited empirical explanation of how this complexity is operationalised in practice. By demonstrating how structured clinical inputs are integrated through interpretive reasoning, the present

study offers a theoretically grounded framework for interpreting observed variation in decision-making.

7.4 Strengths and Limitations of the Study

This study has several important strengths that enhance its originality and value within the existing evidence base on paramedic decision-making and non-conveyance. First, it adopts a condition-specific approach, focusing exclusively on patients presenting with acute exacerbations of COPD. This directly addresses a recognised gap in the literature, where non-conveyance has largely been examined using heterogeneous patient populations. By isolating COPD as a discrete analytical category, the study provides a more clinically grounded understanding of decision-making in a complex and high-risk group.

A second key strength is the use of linked routinely collected data, combining pre-hospital electronic patient records with downstream healthcare outcomes. This design enables examination of both decision-making and subsequent patient trajectories, including hospital admission, length of stay, and 30-day mortality. In doing so, the study moves beyond descriptive analyses of conveyance to provide insight into the relationship between pre-hospital decisions and patient outcomes.

The study is further strengthened by integrating a conceptual framework that combines practice-based and cognitive models of decision-making. By drawing on Collen's (2016) account of professional reasoning and dual-process theories of cognition (Kahneman, 2011; Perona et al., 2019), the analysis interprets quantitative findings within a broader theoretical context. This supports a more comprehensive understanding of decision-making as a structured yet interpretive process, rather than reducing it to measurable variables alone.

Despite these strengths, several limitations must be acknowledged. As a retrospective cohort study, the analysis relies on routinely collected data, not originally recorded for research purposes. This introduces the risk of missing or incomplete data and limits control over variable definition and measurement. In particular, physiological observations were analysed at a single time point, which does not fully capture the

dynamic nature of clinical assessment or the patient trajectory. A key limitation of this study is that it was not possible to incorporate the clinical narrative underpinning paramedic decision-making. The dataset was derived from routinely collected structured variables, which, while enabling population-level analysis, do not capture the interpretive reasoning processes through which clinical decisions are made. As a result, the complex, context-dependent nature of decision-making, including clinician judgement, patient interaction, and situational factors, cannot be fully represented in this analysis. This limitation reflects a broader constraint of quantitative approaches, which can identify patterns of association but are not designed to capture the narrative and cognitive dimensions of clinical practice.

The study is also limited by its reliance on measurable variables. Although physiological observations, demographic characteristics, and service-level factors were systematically analysed, it was not possible to capture other important influences on decision-making, including patient preferences, social context, clinicians' perceptions of risk, and access to alternative care pathways. These factors are likely to play a significant role in practice and may account for some of the observed variation in conveyance decisions.

In addition, the study is geographically and temporally specific, focusing on a single urban cohort in the City of Edinburgh during a defined pre-pandemic period. While this strengthens internal consistency, it may limit the generalisability of the findings to other settings, particularly those with different service configurations or varying levels of pathway availability.

Finally, statistical analysis was conducted at the population level, and the findings should not be interpreted as evaluating the appropriateness of individual clinical decisions. Associations identified in the dataset describe patterns of practice rather than causal relationships. As such, the study provides insight into how decision-making operates collectively but cannot determine the correctness of individual cases.

Overall, these limitations highlight the complexity of studying clinical decision-making using quantitative methods alone and underscore the need for complementary

qualitative research to further explore the reasoning processes underpinning paramedic practice.

In addition, several limitations inherent to the study design should be acknowledged. As a retrospective observational study, the analysis is subject to potential unmeasured confounding, and causal relationships cannot be inferred. The use of routinely collected data means that variables were limited to those available within existing datasets, and some potentially relevant factors (e.g. clinician reasoning, patient preference, and social context) were not captured.

Selection bias may also be present, as inclusion depended on accurate recording of COPD within the clinical dataset. Furthermore, the study is based on a single geographical area (City of Edinburgh), which may limit generalisability to other settings with different service configurations or patient populations.

Finally, although outcomes such as admission and mortality provide important indicators of patient trajectory, they do not fully capture the appropriateness of individual clinical decisions. These limitations reinforce the need to interpret findings as associations within a defined context, rather than definitive explanations of clinical decision-making.

7.5 Future Directions and Next Steps

This study lays the groundwork for a programme of further work to deepen understanding of paramedic decision-making in COPD. The findings highlight both the explanatory value and the limitations of quantitative approaches, indicating the need for a more integrated methodological and theoretical approach to studying decision-making in practice.

Securing external research funding will be a key next step in developing this work into a sustained programme focused on understanding paramedic decision-making in COPD and non-conveyance more broadly. Building directly on this study's findings, future funding applications will support a linked programme of research that integrates

quantitative outcome analysis with detailed qualitative investigation of clinical reasoning in practice. The intention is not simply to extend the current analysis, but to address its identified limitations by examining how paramedics interpret physiological information, negotiate uncertainty, and construct defensible decisions in real-world contexts.

The next phase of this programme will involve developing complementary qualitative research to explore the interpretive processes identified in this study. While the current analysis shows that physiological observations structure decision-making without determining it, it does not capture how paramedics interpret these signals in real time. Future work will therefore focus on how clinicians synthesise physiological data with contextual information, how risk is constructed and negotiated in practice, and how decisions are made under conditions of uncertainty. This will be undertaken through in-depth qualitative methods, including interviews, observational approaches, and case-based analyses, to access the cognitive and contextual dimensions of decision-making that are not represented in routine data. Building on this, further empirical work is planned to extend the current analysis beyond the single-site cohort examined in this study. This will involve replication at a national level to assess the transferability of findings across diverse service contexts, including rural, urban, and mixed populations. Such work will enable comparisons across organisational environments, levels of pathway maturity, and access to alternative care pathways, providing greater insight into how system factors interact with clinical judgement to shape decision-making.

A further strand of development will involve methodological extension towards mixed-methods and integrative analytical approaches. While the present study demonstrates the value of population-level quantitative analysis, it also highlights its limitations in capturing the complexity of decision-making. Future work will therefore aim to link quantitative outcome data with qualitative accounts of clinical reasoning, with the aim of developing a more complete, empirically grounded model of decision-making that reflects both measurable patterns and interpretive processes.

The findings of this study also inform the ongoing development of clinical pathways. Pathway classification was associated with markers of clinical acuity and subsequent

outcomes in this cohort, but it did not serve as a deterministic decision rule. Future work will focus on how pathways can best support, rather than constrain, clinical judgement. This includes refining pathway criteria, improving integration with community-based services, and developing training approaches that explicitly address decision-making under uncertainty. In parallel, there is an opportunity to develop structured feedback mechanisms that link paramedic decision-making to patient outcomes. Providing clinicians with meaningful feedback on the consequences of their decisions can support reflective practice, enhance clinical reasoning, and strengthen governance processes within ambulance services. This represents an important area for service-level development, directly informed by the findings of this study.

More broadly, this programme of work supports a conceptual shift in how non-conveyance is understood and evaluated. Future research and policy development will need to move beyond models that prioritise isolated physiological indicators or protocol adherence, towards frameworks that recognise decision-making as a multidimensional, context-dependent process. Developing such frameworks is a central aim of the next phase of this work.

Collectively, these next steps outline a coherent research programme that moves beyond descriptive analysis towards a theoretically informed, empirically grounded understanding of paramedic decision-making. This programme will integrate quantitative and qualitative methods to better capture the complexity of clinical practice and to inform the development of safer, more effective models of non-conveyance care.

7.6 Implications for Paramedic Practice

The findings of this study have several important implications for frontline paramedic practice. First, they reinforce the central role of physiological assessment in identifying clinical risk, supporting the continued emphasis on structured clinical evaluation in pre-hospital care. However, the observed divergence between physiological status and conveyance decisions highlights the limits of relying solely on predetermined thresholds. In practice, paramedics must interpret physiological findings within the

broader clinical context, incorporating factors such as comorbidity, illness trajectory, and social circumstances into their decision-making.

Second, the findings clarify the role of clinical pathways in practice. The COPD pathway should not be seen as a rule-based tool that dictates disposition, but rather as a structured framework that supports clinical reasoning. Its effective use therefore depends on integrating clinical judgement with pathway guidance, rather than on adherence to predefined criteria in isolation.

Third, the study highlights the importance of reflective and defensible decision-making. Given the variability in disposition decisions, decision quality cannot be assessed solely by outcomes but must also account for the reasoning processes underpinning clinical judgement. This reinforces the need for approaches to practice, training, and governance that support transparent, well-reasoned decision-making in complex and uncertain clinical environments.

7.7 Implications for Governance and Service Design

At the system level, these findings challenge the assumption that non-conveyance decision-making can be effectively standardised through protocols or decision-support tools alone. The observed variability in pathway application and clinical decision-making indicates that governance frameworks must recognise and support the role of clinical judgement, rather than seeking to reduce variation by increasing standardisation. This has important implications for service design and evaluation. Pathway development should prioritise flexibility and support interpretation, ensuring that structured guidance facilitates rather than constrains clinical reasoning. Similarly, audit and performance frameworks must move beyond binary outcome measures, incorporating approaches that reflect the complexity of decision-making processes rather than relying solely on endpoints such as conveyance or non-conveyance.

These findings also highlight the limitations of routinely collected data within current governance systems. While such data are valuable for identifying patterns of association, they do not capture the reasoning behind clinical decisions. As a result, key dimensions of practice remain invisible in existing datasets. Improving the

documentation and integration of narrative elements, such as decision rationale and contextual factors, could enhance both service evaluation and patient safety, enabling a more complete understanding of how decisions are made in practice.

7.8 Final Conclusions

This study suggests that paramedic conveyance decisions in COPD may be understood as a structured yet interpretive process. Physiological observations and clinical pathways provide important frameworks for assessing clinical risk, but the measured variables did not fully account for the observed variation in conveyance decisions. The findings are consistent with decisions being influenced by factors beyond structured physiological assessment, although these influences were not directly measured. The reasons for the observed variation therefore cannot be determined from the available data, and the findings should not be interpreted as establishing either appropriate adaptation or error in individual cases. By providing condition-specific evidence and proposing a conceptual framework for interpreting population-level patterns, this thesis contributes to a more nuanced understanding of paramedic conveyance decisions and establishes a foundation for further research.

7.9 Personal Reflection and Learning

The completion of this thesis has been both a professional and a personal development process, extending beyond the acquisition of academic knowledge to reshape my understanding of clinical practice, decision-making, and evidence.

At the outset, my perspective on paramedic decision-making was grounded primarily in clinical experience, in which decisions are made rapidly amid uncertainty and then evaluated retrospectively against patient outcomes. Through this research, I have developed a more critical understanding of the limitations of outcome-based reasoning and the challenges of assessing decision quality in complex clinical environments.

Engaging with the literature highlighted how non-conveyance is conceptualised using measurable indicators, often without sufficient attention to the interpretive processes underpinning clinical decisions. This prompted a shift in my thinking, from viewing

decision-making as a function of clinical indicators to recognising it as a multidimensional process shaped by context, experience, and organisational factors.

Working with routinely collected data further reinforced these insights. While quantitative analysis provides valuable population-level insights, it became increasingly clear that such data cannot fully capture the reasoning, uncertainty, and judgement inherent in individual clinical decisions. This has shaped how I interpret both my own findings and the wider evidence base, emphasising the need for caution when attributing causality or assessing decision quality based solely on measurable outcomes.

Professionally, this work has deepened my appreciation of the role of clinical judgement in paramedic practice. Rather than automatically interpreting variation as inconsistency, I now recognise that it may reflect responses to clinical complexity, although the reasons for individual decisions require direct examination. This perspective aligns more closely with real-world practice and has implications for how decision-making is supported, evaluated, and governed within ambulance services.

On a personal level, completing this thesis has required persistence, adaptability, and reflection, particularly when navigating challenges within and beyond the research process. It has reinforced the importance of resilience and the value of critical self-reflection for professional development.

Overall, this research has not only deepened my academic understanding but also reshaped my clinical perspective. It has highlighted the importance of integrating evidence with judgement and of recognising the limitations of each. This balance will continue to inform my practice, both as a clinician and in future academic work.

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Appendix 1: List of scoping review articles screened and excluded

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Appendix 2: Ethical approvals



University of Stirling
Cottrell 3B1
Stirling
FK9 4LA

12/08/2022

Dear Colin

Ethics Application Form : A mixed methods sequential explanatory study into the facilitators, barriers, and professional views of risk in Paramedic clinical decision making. (Part 1 and Part 2) 7471

Thank you for your submission of the above ethics application.

The ethical approaches of this project have been approved and you can now proceed with your project.

Please note that should any of your proposal change, a further amendment submission will be necessary.

If you have any further queries, please do not hesitate to contact the Panel by email to ethics@stir.ac.uk

Yours sincerely,

NHS, Invasive or Clinical Research



Research, Development and Innovation Office
 Scottish Ambulance Service
 National Headquarters
 Gyle Square
 1 South Gyle Crescent
 Edinburgh
 EH12 9EB
 Contact: sas.rdi@nhs.scot

30 September 2022
 Colin Crookston
 University of Stirling
 Faculty of Health Sciences and Sport
 Pathfoot Building
 Stirling
 FK9 4LA

Dear *Colin*

SAS RD&I ID: SASRD-2022-005	REC/HRA No: N/A
Title of Project: A mixed methods sequential explanatory study into the facilitators, barriers, and professional views of risk in Paramedic clinical	
Protocol: 20220617_Protocol_V1	IRAS/Sponsor reference: 314679/ UoS NICR ref 2022 7471 6637
Participant Information Sheet: N/A	Consent Form: N/A
Approved locations for this project: N/A	

Having considered the above documentation I am pleased to provide this letter as R&D organisational management approval for the above study on behalf of the Scottish Ambulance Service (SAS). You may proceed with your study subject to the conditions below:

1. Substantial amendments to the protocol will require approval from the Research Ethics Committee which favoured your original protocol and, where applicable, regulatory bodies such as the MHRA. Substantial amendments will also require proportionate approval from SAS R&D.

SAS R&D must be informed of other changes to the study where it relates to the protocol, funding, recruitment, personnel or resource requirement of the Scottish Ambulance Service. Any other substantial or material changes effecting the Scottish Ambulance Service should also be reported.

2. Data Controllers and Processors have a legal obligation to hold a register of all its information assets (for example: data as it relates to personal information and/or special categories of personal data held in paper or electronic format for the purpose of research). This letter of approval requires that you, where you/your organisation are a potential information asset owner, will register any information assets associated with this study with

SAS RESEARCH, DEVELOPMENT AND INNOVATION OFFICE	AUTHOR: ADAM LLOYD (SAS)
R&D APPROVAL LETTER VERSION 3.0	08/JUN/2022



your employing organisation (or other body where the data is being held) in accordance with the Data Protection Act 2018.

3. You are required to provide the following study activity dates:

- date study is open to recruitment
- date of first and last participant recruitment
- date of first and last SAS participant recruitment (note: these dates may be the same for a single site study or where SAS are the first/last site of recruitment)
- date of study closer

4. We ask you to provide SAS R&D with 30 days advanced notice of your intention to submit your findings for publication (this includes academic publications, reports or other forums) – this is to allow the organisation to prepare for any questions that may arise following dissemination of your study.

Where relevant the localised and completed Organisation Information Document is appended to the email with this letter of approval which outlines the capacity and capability of SAS to deliver this study.

We look forward to supporting your study activity. Should you require any further information please contact sas.rdi@nhs.scot and quote your SAS RD&I ID as noted in the table above.

We wish you every success.

On behalf of

Dr Gareth Clegg. Chair – Research, Development and Innovation Group

Dr Adam Lloyd. Vice Chair – Research, Development and Innovation Group

Signed

Date

P.P. Jennifer Brown 30/09/2022



SAS RESEARCH, DEVELOPMENT AND INNOVATION OFFICE	AUTHOR: ADAM LLOYD (SAS)
R&D APPROVAL LETTER VERSION 3.0	08/JUN/2022





**Scottish
Ambulance
Service**
University National NHS Board



Chair Tom Steele
Chief Executive Pauline Howie OBE

Wednesday 11th January 2023

To Whom it May Concern,

As Caldicott Guardian for SAS I have considered Mr Crookston's request and confirm that I have granted Caldicott approval for mechanisms for accessing SAS data in support of his Doctorate.

Yours sincerely,

Dr Jim Ward
Medical Director
Scottish Ambulance Service

Scottish Ambulance Service, National Headquarters, Gyle Square, 1 South Gyle Crescent, Edinburgh EH12 9EB
Telephone: 0131 314 0000 Email: sas.execpa@nhs.scot

www.scottishambulance.com





Chair Tom Steele
Chief Executive Pauline Howie OBE

15th November 2022.

To Whom it may concern,

Clinical Doctorate Research Ethics Application

I am writing to confirm that I will be the designated initial contact for any Ambulance Clinician issues that arise from Mr Colin Crookstons research work.

Any consistent or repeated individual clinicians acts or omissions causing patient harm are relayed directly to the Lead Consultant Paramedic, along with the Ambulance service Datix completion.

Regards,

David Bywater
Lead Consultant Paramedic



Scottish Ambulance Service, National Headquarters, Gyle Square, 1 South Gyle Crescent, Edinburgh EH12 9EB
www.scottishambulance.com

Appendix 3: SAS-UCD data request



Business Intelligence Requirements Specification Document (RSD)



"Requirements analysis is critical to the success or failure of any systems or software project. The requirements should Specific, Measurable, Achievable, Realistic, and Timely (SMART), and defined to a level of detail sufficient for system design without repeated refinement."

Document Information

Project name:	Clinical Doctorate Study
Date of Request:	20/11/2022
Date Required:	28/02/2023
Author:	Andy Kent (andrew.kent@nhs.scot)
Developer:	Andy Kent (andrew.kent@nhs.scot)
Requestor:	Colin Crookston (ColinJamesAndrewKerr.Crookston@nhs.scot)
Document reference:	Requirements Specification Document (Clinical Doctorate Study).docx
Version:	v1.00 01/02/2023 Initial version v1.01 14/03/2023 updated with length of service data from GRS

Approval

Date	Name
23/12/2022	Adam Lloyd (adam.lloyd2@nhs.scot)

Definition Summary

Background:	<p>The proposed research aims to improve the understanding of paramedics' facilitators, barriers, and professional views of risk when they do not convey patients directly to an Emergency Department. In addition, the proposal will look to give insight into any progression of the findings of Snooks et al. (2004), whereby paramedics felt they were not adequately educated and supported, fearing sanctions, dismissal, or patient harm.</p> <p>This research will focus on non-life-threatening clinical decision-making in an ambulance service setting using mixed-method research to answer the research questions. Specifically, this research will look at anonymized data about patients with chronic obstructive pulmonary disease (COPD) who are either conveyed to an emergency department or referred to another part of the health service by a paramedic. This approach will be undertaken to understand this patient group's demographics, physiology, and wishes whilst understanding the paramedic's clinical risk and decision-making process. The researcher selects the focus on COPD as respiratory disease accounts for a significant proportion of the Ambulance Service's workload.</p>
Main Goal:	To provide a data extract from the SAS Data Warehouse linked to the Unscheduled Care DataMart which meets the criteria for the study. There is also the requirement for an element of manual data modelling and investigations into available data within the SAS GRS system.
Desired Outcomes:	[[to be completed by Colin]]
Constraints and Assumptions:	<p>Assumptions</p> <p>Data will be extracted and modelled accurately based on the requirements set out within this document. As the data is taken from multiple sources.</p> <p>Constraints</p> <p>Proximity to hospital – data not held by SAS. This however can be constructed using R between the Lat/Long points of the incident and the conveying hospital. This would be a direct distance between the two points</p> <p>Crew member Paramedic status – This would be based on the crew title held within SAS. The output from these fields would simply the title of the staff member in attendance</p> <p>Constraints that require GRS investigation</p> <p>The variables below are not readily available within data used in reporting and clinical outcomes. They may be</p>

	<p>available direct through GRS, the system used to hold staff data. As part of this study, this source of information will be investigated to see if they can be included.</p> <p>Paramedic length of service – there is a challenge with this criterion. It is possible to infer the length of service by the number of years the staff member has been registered on our system as a 'Paramedic'. But this wouldn't capture previous Paramedic jobs out with SAS, so may not reflect actual length of service. Equally, Allan noted that various senior paramedics have their roles titles changed on the system when they progress to specialist roles (e.g Advanced Practitioner). So searching for 'Paramedic' may not yield the intended results if some other job title has attended that incident.</p> <p>Paramedic qualification – there might be a challenge with automating the collection of this field insofar as it will be HR that likely hold this data, rather than the data warehouse. The data warehouse appears to just show 'Paramedic' and not their qualification. This might be more bespoke via HR so not easily retrievable to merge into an CSV file with a fairly large number of incidents.</p>
Impact Analysis:	<p>Medium/High – an R project will be built in order to extract and model data across multiple sources. Most of these sources have been used before however those that have not (sequence of events) will require investigation to ensure that they are fit for purpose.</p>

References

Other Documentation:



Affected Users

Name	Team	Impact
Andy Kent	Business Intelligence	Time and resource impact of creating this bespoke data set must be recognized at a business level. This will impact on other competing priorities such as the Integrated Clinical Hub and OHCA

Required Data

The data required for this project will come from multiple sources;

Definitions:

Principal inclusion criteria:

1. CHI matched NHS Ambulance case record/UCD for patients from 1st January 2019 through to the 31st December 2019 meeting minimum data required
 2. Assessed by an Ambulance Service Paramedic
 3. 18 years of age and older
 4. Contact originated via the emergency 999 service
 5. COPD is the principal reason for attendance *
- * This translates into incidents that are coded as chief complaint '06' for Breathing Problems
6. Cases are within location boundary EH1 through to EH17, and EH99 only.

```
df_master <- subset(df_master,
  df_master$incident_dt >= "2019-01-01"
  & df_master$incident_dt < "2020-01-01"
  & df_master$call_type %in% "Emergency"
  & df_master$call_method %in% "999 Call"
  & df_master$chief_complaint_code %in% "06"
  & {
    df_master$incident_postcode %in% "EH1"
    | df_master$incident_postcode %in% "EH2"
    | df_master$incident_postcode %in% "EH3"
    | df_master$incident_postcode %in% "EH4"
    | df_master$incident_postcode %in% "EH5"
    | df_master$incident_postcode %in% "EH6"
    | df_master$incident_postcode %in% "EH7"
    | df_master$incident_postcode %in% "EH8"
    | df_master$incident_postcode %in% "EH9"
    | df_master$incident_postcode %in% "EH10"
    | df_master$incident_postcode %in% "EH11"
    | df_master$incident_postcode %in% "EH12"
    | df_master$incident_postcode %in% "EH13"
    | df_master$incident_postcode %in% "EH14"
    | df_master$incident_postcode %in% "EH15"
    | df_master$incident_postcode %in% "EH16"
    | df_master$incident_postcode %in% "EH17"
    | df_master$incident_postcode %in% "EH99"
  }
  & df_master$attendance_flag %in% "Yes"
  & df_master$paramedic_count > 0
  & df_master$multiple_patients %in% "No"
  & df_master$data_linkage %in% "Linked"
  & df_master$patient_age > 17
)
```

Requested Variables:

Variable	Matched to Requested Variable	Source	Format	Notes
incident_number		Incident Level/C3	Character	
incident_dt	Day of the week Month of the year Time of day	Incident Level/C3	Datetime	
call_method	Method of call	Incident Level/C3	Character	
call_type	Time of day	Incident Level/C3	Character	
despatch_code	Despatch code	Incident Level/C3	Character	
despatch_description		Incident Level/C3	Character	
chief_complaint_code	Chief complaint	Incident Level/C3	Character	
chief_complaint_description		Incident Level/C3	Character	
call_colour	Call category	Incident Level/C3	Character	
call_stopped_reason	Call stopped reason	Incident Level/C3	Character	
	Clear reason			Not clear what this variable represents
attendance_flag		Manual	Character	
crew_count		Manual	Numeric	
paramedic_count	Crew member 1 Paramedic status Crew member 2 Paramedic status	Manual	Numeric	
conveyed_flag		Manual	Character	
incident_postcode	Proximity to hospital	Incident Level/C3	Character	Constructed as a straight line distance between the latitude/longitude of the incident and the receiving hospital
receiving_hospital		Resource Level	Character	
distance_to_receiving_hospital		Manual	Numeric	
f_observation_dt	Multiple observations are taken by multiple crews. The first and last observations have therefore been supplied; Pulse rate Respiratory rate BP systolic SPO2 Temperature AVPU GCS total	TerraPace	Datetime	
f_avpu		TerraPace	Character	
f_blood_pressure		TerraPace	Character	
f_gcs		TerraPace	Numeric	
f_pulse		TerraPace	Numeric	
f_respiratory_rate		TerraPace	Numeric	
f_spo2		TerraPace	Numeric	
f_temperature		TerraPace	Numeric	
l_observation_dt		TerraPace	Datetime	
l_avpu		TerraPace	Character	
l_blood_pressure		TerraPace	Character	
l_gcs		TerraPace	Numeric	
l_pulse		TerraPace	Numeric	
l_respiratory_rate		TerraPace	Numeric	
l_spo2		TerraPace	Numeric	
l_temperature		TerraPace	Numeric	
additional_comments		TerraPace	Character	

data_linkage		Manual	Character	
multiple_patients		Manual	Character	
cup_pathway	Continuous urgent care pathway	Unscheduled Care DataMart	Character	
position_in_pathway		Unscheduled Care DataMart	Numeric	
patient_age	Age	Unscheduled Care DataMart	Numeric	
patient_gender	Gender	Unscheduled Care DataMart	Character	
patient_simd	SIMD	Unscheduled Care DataMart	Character	Assumption made that the SIMD of the patient was being requested
patient_sparra_risk_score	SPARRA Score	Unscheduled Care DataMart	Numeric	
patient_sparra_cohort_description		Unscheduled Care DataMart	Character	
patient_mortality_30_days	30-day mortality	Unscheduled Care DataMart	Character	
acute_record_count	ICD 10 code(s) & Diagnosis code(s)	Unscheduled Care DataMart	Character	Diagnosis codes can be captured for the full length of stay while a patient is admitted. The codes supplied here are diagnosis codes immediately following contact with SAS (either as a direct admission or first through A&E)
acute_admission_dt		Unscheduled Care DataMart	Character	
acute_discharge_dt		Unscheduled Care DataMart	Character	
acute_subsequent_diagnosis_1_code		Unscheduled Care DataMart	Character	
acute_subsequent_diagnosis_1_description		Unscheduled Care DataMart	Character	
acute_subsequent_diagnosis_2_code		Unscheduled Care DataMart	Character	
acute_subsequent_diagnosis_2_description		Unscheduled Care DataMart	Character	
acute_subsequent_diagnosis_3_code		Unscheduled Care DataMart	Character	
acute_subsequent_diagnosis_3_description		Unscheduled Care DataMart	Character	
acute_subsequent_diagnosis_4_code		Unscheduled Care DataMart	Character	
acute_subsequent_diagnosis_4_description		Unscheduled Care DataMart	Character	
acute_subsequent_diagnosis_5_code		Unscheduled Care DataMart	Character	
acute_subsequent_diagnosis_5_description		Unscheduled Care DataMart	Character	
acute_subsequent_diagnosis_6_code		Unscheduled Care DataMart	Character	
acute_subsequent_diagnosis_6_description		Unscheduled Care DataMart	Character	
	SMR01 (Inpatient activity)			Not clear what this variable represents
extract_dt		Manual	Datetime	

Variable	Matched to Requested Variable	Source	Format	Notes
incident_number		Incident Level/C3	Character	
incident_dt		Incident Level/C3	Datetime	
job_title		Incident Level/C3	Character	
joined_d		GRS	Datetime	
length_of_service		GRS	Decimal	Value represents years
paramedic_start_d	Paramedic length of service as a Paramedic	GRS	Datetime	
paramedic_length_of_service		GRS	Decimal	Value represents years
	Paramedic qualification	GRS		Under investigation to understand if this can be provided

Notes

Appendix 4: Data quality matrix

Category	Dimension	Definition	Bronze	Silver	Gold	Platinum
Data Documentation	Documentation Completeness	Proportion of metadata (as in the current metadata specification) which is available in the expected format	This element will be calculated automatically based on the level of metadata available on the Gateway, and values set for each category			
	Availability of additional documentation and support	Available dataset documentation in addition to the data dictionary	Past journal articles demonstrate that knowledge of the data exists	Comprehensive README describing extracting and use of data, Dataset FACS available, Visual data model provided	As Silver, plus dataset publication was supported with a journal article explaining the dataset in detail, or dataset training materials	As Gold, plus support personnel available to answer questions
	Data Model	Availability of clear, documented data model	Known and accepted data model but some key field un-coded or free text	Key fields codified using a local standard	Key fields codified using a national or international standard	Data Model conforms to a national standard and key fields codified using a national / international standard
	Data Dictionary	Provided documented data dictionary and terminologies	Data definitions available	Definitions compiled into local data dictionary which is available online	Dictionary relates to national definitions	Dictionary is based on international standards and includes mapping
	Provenance	Clear description of source and history of the dataset, providing a "transparent data pipeline"	Source of the dataset is documented	Source of the dataset and any transformations, rules and exclusions documented	All original data items listed, all transformations, rules and exclusion listed and impact of these	Ability to view earlier versions, including versions before any transformations have been applied data (in line with deidentification and information governance approval) and review the impact of each stage of data cleaning
Technical Quality	Data Quality Management Process	The level of maturity of the data quality management processes	A documented data management plan covering collection, auditing, and management is available for the dataset	Evidence that the data management plan has been implemented is available		Externally verified compliance with the data management plan, e.g. by International Organization for Standardisation (ISO), Care Quality Commission (CQC), Information Commissioner's Office (ICO) or other body
	Data Management Association (DAMA) Quality Dimensions	Technical data quality dimensions: Completeness, Uniqueness, Accuracy, Validity, Timeliness and Consistency	These elements will be calculated with data profiling tools, and the category breakdown evaluated following further data collection			
Coverage	Pathway coverage	Representation of multi-disciplinary healthcare data	Contains data from a single speciality or area	Contains data from multiple specialities or services within a single tier of care	Contains multimodal data or data that is linked across two tiers (e.g. primary and secondary care)	Contains data across more than two tiers
	Length of follow up	Average timeframe in which a patient appears in a dataset (follow up period)	Between 1 - 6 months	Between 6 - 12 months	Between 1 - 10 years	More than 10 years
Access & Provision	Allowable uses	Allowable dataset usages as per the licensing agreement, following ethical and information governance approval	Available for specific academic research uses only	Available for academic and non-profit (e.g. charity, public sector) uses only	Available for limited commercial uses (e.g. relating to a specific domain), in addition to academic and other non-commercial uses	Available for wider commercial uses (in line with ethical and information governance approval), and addition to academic and other non-commercial uses
	Time Lag	Lag between the data being collected and added to the dataset	Approximately 1 year	Approximately 1 month	Approximately 1 week	Effectively real-time data
	Timeliness	Average data access request timeframe	Less than 6 months	Less than 3 months	Less than 1 month	Less than 2 weeks
Value & Interest	Linkages	Ability to link with other datasets	Identifiers to demonstrate ability to link to other datasets	Available linkages outlined and/or list of previously successfully linked provided	List of restrictions on the type of linkages detailed. List of previously successful dataset performed, with navigable links to linked datasets via a Digital Object Identifier (DOI) or Uniform Resource Locator (URL)	Existing linkage with reusable or downstream approvals
	Data Enrichments	Data sources enriched with annotations, image labels, phenomes, derivations, Natural Language Processing (NLP) derived data labels	The data include additional derived fields, or enriched data.	The data include additional derived fields, or enriched data used by other available data sources.	The derived fields or enriched data were generated from, or used by, a peer reviewed algorithm.	The data includes derived fields or enriched data from a national report.

Reproduced from Gordon et al. (2021) p. 7.

Appendix 5: Publication For British Paramedic Journal.

Cover Letter

Dear Editors,

Please find enclosed our manuscript, which we respectfully submit for consideration for publication in the *British Paramedic Journal*:

“What is known about the facilitators and barriers to paramedic non-conveyance decision-making, and how do paramedics perceive and assess risk in pre-hospital care?”

Non-conveyance has become a routine and increasingly significant component of contemporary paramedic practice; however, it remains an area characterised by professional uncertainty, variable organisational support, and limited condition-specific evidence. This scoping review systematically maps the international literature on factors influencing paramedic non-conveyance decision-making, with a particular focus on perceptions of risk, organisational context, and professional judgement.

Using Joanna Briggs Institute methodology and reported in accordance with PRISMA-ScR guidance, the review synthesises evidence from systematic reviews, quantitative studies, and qualitative research across multiple ambulance service systems. A key finding is the near absence of condition-specific analyses of chronic respiratory disease, particularly chronic obstructive pulmonary disease (COPD), despite its high prevalence and associated clinical risk within ambulance caseloads. By explicitly identifying this gap, the review provides a clear rationale for pathway-aware, condition-focused research and contributes to ongoing debates regarding safe and defensible non-conveyance practice.

I believe this manuscript aligns closely with the *British Paramedic Journal*'s mission to support evidence-informed paramedic practice, professional development, and

scholarly debate. The findings are directly relevant to UK paramedic clinicians, educators, service leaders, and policymakers, particularly in relation to clinical decision-making, documentation, risk assessment, and professional autonomy.

This manuscript is original, has been developed from a doctoral thesis, and is not under consideration by any other journal. There are no conflicts of interest to declare.

Thank you for considering this manuscript. We would be pleased to respond to any reviewer comments and hope the paper will be of value to the journal's readership.

Yours sincerely,

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Proposed Title

Paramedic Non-Conveyance Decision-Making: A Critical Integrative Review of Risk, Clinical Judgement and the Absence of COPD-Specific Evidence

Colin J.A.K. Crookston

Abstract

Background

Non-conveyance has become an established and growing component of contemporary ambulance service delivery, accounting for approximately one-third of patient encounters across many healthcare systems. Despite its growing operational importance and policy emphasis on reducing unnecessary hospital attendance and supporting care closer to home, the processes underpinning paramedic conveyance and non-conveyance decision-making remain poorly understood.

Aim

To critically examine contemporary evidence on paramedic non-conveyance decision-making and identify implications for understanding risk, clinical judgement, and the lack of chronic obstructive pulmonary disease (COPD)-specific evidence in pre-hospital care.

Methods

A scoping review was conducted using the Joanna Briggs Institute methodology. MEDLINE and CINAHL databases were searched for studies published between 2014 and 2024 that examined paramedic non-conveyance decision-making. Twenty-two studies met the inclusion criteria, comprising review-level, quantitative and qualitative evidence.

Results

Three principal themes emerged. First, non-conveyance populations were highly heterogeneous, limiting meaningful comparisons across studies. Second, quantitative research predominantly conceptualised risk in terms of physiological variables and outcome measures, whereas qualitative studies described risk as contextual, interpretive and negotiated. Third, organisational influences, including pathway availability, professional accountability and healthcare system pressures, significantly shaped decision-making. No study examined COPD as a distinct analytical category, despite its prevalence in unscheduled care services.

Conclusion

Current evidence offers only a partial explanation of paramedic decision-making. Physiological observations remain important but do not fully explain conveyance decisions. Drawing on the theoretical perspectives of Kahneman, Collen and Perona, non-conveyance is better understood as a multidimensional process encompassing clinical reasoning, cognitive judgement, organisational influences and patient context. The absence of COPD-specific evidence represents a significant gap requiring further investigation.

Keywords: non-conveyance; paramedic; COPD; decision-making; risk; ambulance services; clinical judgement

Introduction

Non-conveyance has become a substantial and increasingly important component of ambulance service activity internationally. Contemporary ambulance services no longer function solely as transport organisations but are increasingly expected to assess, treat, refer and discharge patients in community settings. International evidence indicates that approximately one-third of ambulance contacts result in non-conveyance, reflecting broader healthcare policy ambitions to reduce unnecessary

emergency department attendance and to support care closer to home (Ebben et al., 2019; Paulin et al., 2020; Heinonen et al., 2022).

This transformation has fundamentally altered the professional responsibilities of paramedics. Clinicians are now routinely required to determine whether patients require conveyance to hospital or whether care can be delivered safely via alternative pathways. These decisions are often made under conditions of uncertainty, incomplete information and time pressure, and require simultaneous consideration of patient safety, diagnostic uncertainty, patient preference, organisational expectations and healthcare resource allocation (O'Hara et al., 2014; Lederman et al., 2019).

Existing evidence suggests that non-conveyance decision-making is multifactorial and highly context-dependent. Quantitative studies have predominantly focused on measurable variables such as age, physiological observations, triage categories, mortality and recontact rates. In these studies, risk is generally conceptualised as an objective construct, measurable through clinical indicators and outcome data. In contrast, qualitative studies portray decision-making as an interpretive process involving clinical judgement, contextual understanding, professional experience and organisational influences (Lederman et al., 2019; O'Hara et al., 2014).

Review-level evidence further highlights substantial heterogeneity across the literature. Ebben et al. (2017) identified significant international variation in non-conveyance rates and limited standardisation of non-conveyance processes. Similarly, Oosterwold et al. (2018) and Blodgett et al. (2021) reported that conveyance decisions are shaped by a combination of patient characteristics, clinician factors and organisational context. These findings suggest that non-conveyance cannot be adequately understood by physiological indicators alone and instead reflects a complex interaction among clinical, professional and system-level variables.

A notable limitation in the literature is the absence of condition-specific analyses. Existing studies predominantly aggregate heterogeneous patient populations and rarely examine individual diseases as distinct analytical categories. This omission is particularly important for chronic obstructive pulmonary disease (COPD), a common

cause of ambulance attendance, characterised by recurrent exacerbations, multimorbidity, fluctuating illness trajectories and chronic physiological abnormalities.

COPD occupies a prominent position within Scottish healthcare policy. The Scottish Government identifies COPD as one of the most significant contributors to unscheduled healthcare utilisation in Scotland and reports that the condition accounts for approximately 122,000 emergency bed days annually. COPD is also associated with substantial healthcare expenditure, prolonged hospital admissions and increasing service demand, driven by an ageing population and the growing prevalence of chronic respiratory disease (Scottish Government, 2017).

The Scottish Government further predicts that, if current models of care remain unchanged, admissions for respiratory disease and COPD will continue to rise significantly over the coming decades. Exacerbations of COPD are associated with progressive deterioration in quality of life, worsening psychosocial wellbeing, increased healthcare utilisation and accelerated disease progression (Scottish Government, 2017).

Consequently, the Scottish Government's *COPD Best Practice Guide* places considerable emphasis on avoiding admissions, integrated respiratory services and delivering care closer to home where clinically appropriate. The guidance advocates streamlined patient pathways, multidisciplinary management and alternative approaches to emergency care that reduce unnecessary hospital attendance while maintaining patient safety (Scottish Government, 2017).

COPD remains central to contemporary Scottish healthcare policy. Scotland's *Respiratory Care Action Plan 2021–2026* designates respiratory disease as a national priority and emphasises the need for improved prevention, diagnosis, management, self-management support, integrated care pathways and workforce development (Scottish Government, 2021). Furthermore, the Scottish Public Health Observatory identifies COPD as a significant long-term condition, requiring greater emphasis on community-based care, self-management and coordinated service delivery across healthcare sectors (Scottish Public Health Observatory, 2025).

These policy developments are particularly relevant to ambulance services, as many of their objectives, including admission avoidance, integrated care and management closer to home, require paramedics to make increasingly complex conveyance decisions. However, despite this substantial policy emphasis, no identifiable body of COPD-specific non-conveyance literature currently exists. The review identified no eligible studies examining paramedic conveyance or non-conveyance decision-making specifically within COPD populations. This discrepancy between healthcare policy development and the generation of empirical evidence represents a significant gap in current knowledge (Scottish Government, 2017; Scottish Government, 2021).

The absence of COPD-specific evidence raises important conceptual questions about current understandings of risk. Patients living with COPD frequently exhibit physiological abnormalities, including chronic hypoxaemia, reduced exercise tolerance and altered respiratory function, that differ substantially from population norms. Consequently, physiological observations alone may not reliably distinguish between stable chronic disease and acute deterioration. This challenges reductionist approaches to risk assessment and highlights the potential importance of professional judgement, contextual understanding and clinical reasoning in conveyance decision-making (Scottish Government, 2017).

The aim of this review is therefore not merely to summarise contemporary evidence on non-conveyance, but to critically examine how risk, clinical judgement and decision-making are conceptualised across the literature. Particular attention is paid to the absence of COPD-specific evidence and its implications for contemporary paramedic practice, healthcare policy and future research.

Methods

Design

A scoping review methodology was adopted in accordance with the Joanna Briggs Institute (JBI) framework for evidence synthesis (Peters et al., 2020). The review was further informed by the methodological approaches proposed by Arksey and O'Malley (2005) and refined by Levac et al. (2010).

Scoping review methodology was considered appropriate given the heterogeneous evidence base and the exploratory objective of examining how non-conveyance decision-making, risk and clinical judgement have been conceptualised in the literature. Unlike systematic reviews, which typically focus on narrowly defined intervention questions, scoping reviews facilitate the examination of broad and complex fields of inquiry and help identify conceptual gaps in knowledge.

Review Question

The review was guided by the following research question:

What is known about the facilitators and barriers to paramedic non-conveyance decision-making, and how do paramedics perceive and assess risk in pre-hospital care?

A secondary objective was to identify and assess the extent of COPD-specific evidence within the non-conveyance literature.

Population–Concept–Context Framework

The review scope was defined using the Population–Concept–Context (PCC) framework.

Population

Paramedics and ambulance clinicians involved in patient assessment and in decision-making on disposition.

Concept

Non-conveyance decision-making, conveyance decisions, risk assessment, clinical judgement, facilitators and barriers.

Context

Pre-hospital emergency and urgent care settings.

Search Strategy

The MEDLINE and CINAHL databases were searched for studies published between January 2014 and December 2024.

Search terms included combinations of:

- paramedic*
- ambulance service*
- emergency medical services
- pre-hospital care
- non-convey*
- conveyance
- decision-making
- risk
- clinical judgement

To explore condition-specific evidence, additional search terms included:

- COPD
- chronic obstructive pulmonary disease
- chronic obstructive airway disease
- respiratory disease

Search terms were combined using Boolean operators as appropriate. Reference lists of included studies were also reviewed to identify additional relevant literature.

When COPD-related terminology was combined with non-conveyance concepts, no eligible studies were identified. Consequently, the search strategy was broadened to include the wider non-conveyance literature. Importantly, the absence of COPD-specific evidence was treated as a substantive finding rather than a limitation of the review process.

Inclusion Criteria

Studies were included if they:

- involved paramedics or ambulance clinicians;
- examined conveyance or non-conveyance decision-making;
- were conducted within pre-hospital care settings;
- addressed risk assessment, clinical judgement, facilitators or barriers to patient disposition;
- were published in peer-reviewed journals;
- were written in English.

Exclusion Criteria

Studies were excluded if they:

- focused exclusively on emergency dispatch systems;
- involved non-paramedic healthcare professionals only;
- examined specialist practitioner roles without relevance to routine ambulance practice;
- did not address patient disposition decision-making.

Study Selection

Titles and abstracts were screened against the eligibility criteria. Potentially relevant articles then underwent full-text review. Included studies comprised review-level, quantitative and qualitative evidence, enabling exploration of both measurable outcomes and experiential perspectives.

Data Extraction

Data extraction included:

- author and publication year;
- country of origin;
- study design;

- healthcare setting;
- participant characteristics;
- outcome measures;
- principal findings;
- references to respiratory disease or COPD;
- conceptualisations of risk and decision-making.

Data Synthesis

A narrative thematic synthesis was conducted. Studies were initially grouped by methodological approach and then analysed for recurring themes and conceptual patterns.

The interpretation of the findings was informed by three complementary theoretical frameworks:

1. **Kahneman's Dual-Process Theory** conceptualises decision-making as the interaction between intuitive (System 1) and analytical (System 2) reasoning (Kahneman, 2011).
2. **Collen's Framework of Paramedic Decision-Making** emphasises professional accountability, clinical reasoning and defensible decision-making (Collen, 2016).
3. **Perona et al.'s Model of Cognitive Processing**, which applies dual-process theory to paramedic judgement and decision-making (Perona et al., 2019).

These frameworks informed the interpretation of the findings but were not used as predefined analytical categories.

Study Selection

Twenty-two studies met the inclusion criteria following database searches, screening and full-text review. The final evidence base comprised:

- Three review-level studies (Table 1)
- Twelve quantitative studies (Table 2)

- Seven qualitative studies (Table 3)

The studies were conducted predominantly in Sweden, Finland, the Netherlands and the United Kingdom, and published between 2014 and 2024. Collectively, they examined non-conveyance rates, patient characteristics, safety outcomes, clinicians' experiences and organisational influences on decision-making.

A notable finding emerged during study selection. Although COPD-specific search terms were included in the original search strategy, no eligible studies examining conveyance or non-conveyance decision-making in COPD populations were identified. This absence was treated as a substantive finding rather than a methodological limitation.

Overview of Included Studies

Table 1 – 3 attached in Appendix 1

Theme 1: Non-Conveyance Represents a Heterogeneous Clinical Population

A consistent finding across review-level and quantitative studies was considerable heterogeneity among patients categorised as non-conveyed.

International reviews reported non-conveyance rates ranging from 3% to 93%, highlighting substantial variation in definitions, healthcare systems and operational practices (Ebben et al., 2017; Blodgett et al., 2021). This variation complicates efforts to identify universal predictors of safe non-conveyance.

Quantitative evidence shows that non-conveyed patients frequently present with a wide range of clinical features. Vloet et al. (2018) reported that more than half of non-conveyed patients had at least one abnormal physiological finding. Similarly, Lederman et al. (2020) found that physiological abnormalities were common among patients who were ultimately not transported to hospital. These findings challenge the assumption that physiological abnormality necessarily predicts conveyance.

Conversely, several studies identified low-risk groups within non-conveyed populations. Höglund et al. (2020) reported substantial numbers of patients with relatively stable physiological findings who were managed with self-care advice or referred to alternative services. Collectively, these findings indicate that non-conveyance is not a single clinical phenomenon. Instead, it appears to represent a spectrum of patients with differing clinical characteristics, risk levels and healthcare needs.

Theme 2: Contrasting Conceptualisations of Risk

One of the most striking findings concerned differing understandings of risk across the literature.

Quantitative Conceptualisation of Risk

Quantitative studies primarily conceptualise risk through measurable indicators such as vital sign abnormalities, National Early Warning Scores (NEWS), hospital admission, emergency department attendance, recontact rates, and mortality. Within this literature, risk is generally treated as an objective, quantifiable construct identified using predefined clinical variables and patient outcomes. Studies examining mortality and recontact rates often use these measures to assess the appropriateness and safety of conveyance decisions. For example, Heinonen et al. (2022) reported increased mortality among certain groups of non-conveyed patients, raising concerns about patient safety following non-conveyance. Similarly, Johansson et al. (2022) identified incidents of patient harm associated with non-conveyance decisions, supporting ongoing efforts to identify objective predictors of adverse outcomes. Collectively, these studies reflect a predominantly positivist understanding of clinical risk, in which risk is viewed as a measurable phenomenon that can be assessed through physiological indicators and subsequent patient outcomes.

Qualitative Conceptualisation of Risk

In contrast, qualitative studies offered a markedly different account of risk. Rather than viewing risk as a purely physiological construct, clinicians described it as contextual,

dynamic and often characterised by uncertainty. Paramedics reported considering a wide range of factors when making conveyance decisions, including the patient's clinical presentation, previous healthcare history, social circumstances, family support, personal preferences, availability of follow-up services and professional accountability. Lederman et al. (2019) described decision-making as balancing uncertainty against the information available at the time of assessment, while O'Hara et al. (2014) found that clinicians continually negotiated competing demands relating to patient safety, patient autonomy and organisational expectations. Collectively, these studies suggest that risk is not simply measured by objective clinical indicators but is actively interpreted through professional judgement and contextual understanding.

Theme 3: Organisational Context Shapes Decision-Making

Organisational influences were consistently evident across quantitative and qualitative review-level evidence. Factors reported to influence decision-making included the availability of alternative care pathways, access to specialist clinical advice, local guidelines and protocols, training and education, professional accountability, fear of complaints, litigation concerns and service demand pressures. Several studies suggested that conveyance was often perceived as the safer professional option in the face of uncertainty. Oosterwold et al. (2018) reported that clinicians often defaulted to conveyance in the absence of robust alternative pathways, while Lederman et al. (2019) found that concerns about accountability significantly influenced decision-making behaviour. These findings indicate that conveyance decisions cannot be understood solely as patient-level phenomena. Rather, decision-making appears to be strongly shaped by organisational environments that define acceptable levels of clinical risk, influence professional behaviour and determine which alternatives are clinically and operationally available to ambulance clinicians.

Theme 4: The Absence of COPD-Specific Evidence

The most significant finding from this review was the complete absence of COPD-specific evidence. Despite COPD's prominence in Scottish health policy and unscheduled care planning, no study examined COPD as a distinct analytical category. This finding is particularly notable given COPD's policy significance in Scotland. The Scottish Government identifies COPD as a major contributor to emergency healthcare utilisation and emphasises admission avoidance, integrated respiratory care and enhanced community management as strategic priorities (Scottish Government, 2017).

Similarly, Scotland's Respiratory Care Action Plan identifies COPD as a priority long-term condition, requiring improved community care pathways and reduced avoidable hospital utilisation (Scottish Government, 2021). The Scottish Public Health Observatory likewise highlights COPD as an important chronic disease, requiring strengthened community management strategies and enhanced integration across primary, community and urgent care services (Scottish Public Health Observatory, 2025). Yet despite these policy priorities, no eligible COPD-specific non-conveyance studies were identified. This gap has significant implications.

COPD differs from many acute presentations because patients often live with:

- Chronic hypoxaemia.
- Baseline physiological abnormalities.
- Significant multimorbidity.
- Recurrent exacerbations.
- Complex illness trajectories.

Consequently, physiological observations may require more interpretation than in other patient groups. The absence of COPD-specific evidence therefore limits understanding of how paramedics assess risk, interpret abnormal physiology, and make conveyance decisions in this clinically complex population.

Table 4. Summary of Key Themes

Theme	Principal Findings	Implications
Heterogeneous populations	Non-conveyed patients vary widely in physiology, risk and presentation	Universal predictors remain difficult to identify
Contrasting understandings of risk	Quantitative studies measure risk; qualitative studies interpret risk	Risk may be multidimensional
Organisational influences	Pathways, accountability and service pressures shape decisions	Decisions occur within systems, not isolation
COPD evidence gap	No COPD-specific studies identified	Significant knowledge deficit
Policy-practice disconnect	COPD is a policy priority but absent from evidence base	Research required to inform practice

Table 5. Mapping Findings Against Theoretical Frameworks

Framework	Core Concept	Relationship to Findings
Kahneman (2011)	System 1 and System 2 reasoning	Explains interaction between intuitive and analytical judgement
Collen (2016)	Professional accountability and defensible decision-making	Explains influence of professional responsibility and governance
Perona et al. (2019)	Paramedic cognitive processing	Explains dynamic movement between intuition and analysis
Current Review	Multidimensional decision-making	Integrates patient, clinician and organisational influences

Preliminary Synthesis

The findings suggest that non-conveyance decision-making cannot be adequately explained by physiological indicators alone. Quantitative studies identify important relationships between measurable variables and patient outcomes, yet qualitative evidence consistently shows that clinicians interpret these findings within broader clinical, social and organisational contexts.

Furthermore, the complete absence of COPD-specific evidence appears increasingly significant when considered alongside Scottish policy priorities. While COPD is widely recognised as a condition for which admission avoidance and enhanced community management are required (Scottish Government, 2017; Scottish Government, 2021), little is known about how paramedics assess and manage risk in this patient population.

These observations provide the foundation for the discussion, in which the findings are interpreted using the complementary theoretical frameworks of Kahneman (2011), Collen (2016) and Perona et al. (2019).

Discussion

This review critically examined contemporary evidence on paramedic non-conveyance decision-making and explored how risk, judgement and clinical reasoning are conceptualised in the literature. Four principal findings emerged. First, non-conveyance populations are highly heterogeneous. Second, quantitative and qualitative studies conceptualise risk in fundamentally different ways. Third, organisational influences play a significant role in shaping disposition decisions. Fourth, and perhaps most notably, no COPD-specific non-conveyance studies were identified, despite COPD being recognised as a major priority within Scottish healthcare policy (Scottish Government, 2017; Scottish Government, 2021).

Collectively, these findings suggest that current explanations of non-conveyance decision-making remain incomplete. While physiological observations undoubtedly inform decision-making, they do not fully account for the complexity and variability observed across clinical practice.

Beyond Physiological Reductionism

A recurring assumption in quantitative non-conveyance research is that risk can be understood through objective physiological measures. Studies frequently utilise vital signs, recontact rates, mortality and emergency department attendance as surrogate

indicators of decision quality or patient safety (Vloet et al., 2018; Paulin et al., 2020; Heinonen et al., 2022). While these approaches provide valuable information on outcomes, they offer only a partial account of decision-making.

Several quantitative studies identified abnormal physiological observations among patients who were ultimately not conveyed (Vloet et al., 2018; Lederman et al., 2020). If physiological abnormalities alone determined clinical risk, these patients would be expected to require consistent hospital conveyance. The persistence of safe non-conveyance despite physiological abnormality suggests that clinicians routinely interpret findings rather than apply simple threshold-based decisions. This observation aligns with broader critiques of reductionist models of clinical reasoning. Clinical decision-making rarely occurs in a purely objective manner, as physiological observations must be interpreted within the context of the patient's history, baseline function, symptom trajectory and anticipated future risk (Collen, 2016). Consequently, the review findings suggest that physiological observations should be regarded as important inputs into decision-making rather than as determinants of it.

Understanding Findings Through Kahneman's Dual-Process Theory

Kahneman's (2011) theory of dual-process reasoning provides a useful cognitive framework for interpreting the evidence reviewed. According to Kahneman, decision-making involves the interaction of two complementary systems of thought:

System 1

- Rapid
- Intuitive
- Pattern-recognition based
- Largely automatic

System 2

- Analytical

- Deliberative
- Structured
- Cognitively effortful

Within the reviewed literature, quantitative studies largely reflect System 2 reasoning. Risk is conceptualised in terms of measurable variables, and decisions are assumed to arise from the analytical processing of clinical information. By contrast, qualitative studies present a much richer picture. Paramedics consistently describe drawing on experience, contextual awareness, prior encounters and pattern recognition when making conveyance decisions (Lederman et al., 2019; O'Hara et al., 2014). These descriptions closely align with Kahneman's System 1 processes.

Importantly, Kahneman does not present these systems as competing alternatives. Rather, effective decision-making arises from the interplay between intuitive and analytical reasoning. Clinicians form initial impressions rapidly, then refine, validate or reject them through more deliberate assessment. This explanation offers important insight into why physiological predictors only partially explain conveyance decisions. Many aspects of clinical judgement operate through cognitive processes that are difficult to measure in routine datasets. The review therefore supports the proposition that non-conveyance decisions arise from integrating intuitive and analytical reasoning.

Collen and the Professional Accountability of Decision-Making

While Kahneman offers a cognitive explanation of decision-making, Collen (2016) provides a professional and ethical perspective. Collen argues that paramedic decision-making extends beyond technical assessment to include professional accountability, ethical reasoning and defensible judgement. Within this framework, the quality of a decision is determined not solely by outcome but by the robustness of the reasoning process underpinning it. The findings of this review strongly support this perspective.

Qualitative studies repeatedly identified concerns relating to:

- Professional accountability.
- Fear of adverse outcomes.
- Litigation.
- Complaints.
- Organisational scrutiny.

Such factors shape how clinicians perceive and manage uncertainty (Lederman et al., 2019; Oosterwold et al., 2018). From Collen's perspective, clinicians do not merely ask whether a patient can remain at home. They must also consider whether the reasoning behind that decision can be justified and defended if adverse outcomes subsequently occur. This interpretation further explains why conveyance is often viewed as the professionally safer option in the face of uncertainty. Hospital conveyance may reduce the burden of accountability, even if it does not necessarily reduce objective patient risk. The evidence therefore suggests that non-conveyance decisions occur within broader professional contexts characterised by responsibility, governance and accountability.

Perona and the Cognitive Continuum of Paramedic Practice

Perona, Rahman and O'Meara (2019) extended dual-process concepts to paramedic practice. Their narrative review argues that paramedic decision-making is best understood as a movement along a cognitive continuum. Clinicians shift between intuitive and analytical reasoning depending on:

- Clinical complexity.
- Familiarity with presentations.
- Environmental pressures.
- Time constraints.
- Available information.

The current review provides strong support for this interpretation. For example, experienced clinicians frequently described recognising familiar patterns of illness

during formal assessment. Decisions were not driven by intuition or analysis alone, but by the continuous interaction between the two approaches. Perona's framework therefore helps reconcile apparent tensions between quantitative and qualitative studies. Quantitative studies capture the measurable outputs of decision-making, while qualitative studies capture the interpretive processes through which those outputs are generated. Together, they describe different dimensions of the same phenomenon.

Organisational Context and Risk Negotiation

A further important finding concerns the influence of organisational context on non-conveyance decision-making. Across the reviewed studies, clinicians consistently reported that decisions were shaped by factors beyond the individual patient, including the availability of alternative care pathways, access to clinical support, service accessibility, governance structures, workforce pressures and demand management priorities. These findings suggest that risk is not solely an inherent characteristic of the patient but is negotiated within organisational environments that determine which management options are realistically available. For example, a patient who may be safely managed within the community in one healthcare setting may require hospital conveyance in another where appropriate referral pathways or follow-up services are unavailable. This observation challenges simplistic interpretations of non-conveyance as an exclusively clinical process. Instead, conveyance decisions appear to emerge from the interplay of clinical assessment, organisational capability, professional accountability and available resources. Understanding non-conveyance therefore requires consideration of both individual-level and system-level factors, recognising that clinical judgements are made within organisational contexts that shape perceptions of risk and influence disposition decisions.

COPD as a Challenge to Conventional Risk Models

The absence of COPD-specific evidence may point to a broader limitation in existing non-conveyance research. Most studies implicitly assume that physiological

abnormality reflects escalating clinical risk. However, this assumption is problematic in the context of chronic respiratory disease.

Patients with COPD frequently live with:

- Chronic hypoxaemia.
- Abnormal respiratory rates.
- Reduced exercise tolerance.
- Persistent breathlessness.
- Significant multimorbidity.

Consequently, observations that may indicate deterioration in one patient may reflect normal baseline function in another. The Scottish Government's *COPD Best Practice Guide* emphasises admission avoidance, integrated respiratory pathways and management closer to home where appropriate (Scottish Government, 2017). Similarly, Scotland's Respiratory Care Action Plan promotes community-based care and improved management of long-term respiratory conditions (Scottish Government, 2021). These policy objectives assume that healthcare professionals can identify which patients require hospital attendance and which can be managed safely outside acute care settings. However, the complete absence of COPD-specific non-conveyance evidence means that little is known about how paramedics conduct this risk assessment in practice. Consequently, COPD represents both a significant evidence gap and an important opportunity for future research.

Towards a Multidimensional Model of Paramedic Decision-Making

The findings of this review support a multidimensional model of decision-making comprising four interacting domains.

Physiological Assessment

Objective observations provide important information on current physiological status.

Clinical Interpretation

Clinicians interpret observations through experience, expertise and evolving clinical reasoning.

Patient Context

Comorbidity, baseline function, social support, health literacy and patient preferences modify the interpretation of clinical findings.

Organisational Environment

Pathways, governance systems, accountability structures and resource availability shape decision-making options.

Implications for Practice

The findings of this review have several important implications for paramedic practice. First, educational programmes should extend beyond developing technical assessment skills to include explicit training in clinical reasoning, decision-making and the management of uncertainty. Second, healthcare organisations should recognise that conveyance decisions are often made in complex, uncertain environments and provide governance structures that support, rather than discourage, appropriate non-conveyance decisions. Third, the design and implementation of alternative care pathways should acknowledge the interplay between clinical assessment and organisational context, recognising that the availability of services and support mechanisms can directly influence decision-making. Finally, clinicians should be encouraged to view risk assessment as an interpretive, multifaceted process informed by clinical findings, patient circumstances, professional judgement and contextual factors, rather than as a purely numerical exercise based solely on physiological measurements.

Implications for Research

The most significant implication of this review is the complete absence of COPD-specific evidence in the non-conveyance literature. Given the prevalence of COPD in ambulance service caseloads and its prominence in Scottish healthcare policy, future research should examine how paramedics make conveyance decisions for patients with COPD, how physiological observations are interpreted in the context of chronic respiratory disease, and which risk assessment strategies are used when managing acute exacerbations. Further investigation is also needed to examine the relationship between physiological findings and actual disposition decisions, as well as patient outcomes after non-conveyance in respiratory populations. Addressing these areas would help close an important gap between healthcare policy and the available evidence base, providing a stronger foundation for safe, evidence-informed admission avoidance and community-based management strategies for patients with COPD.

Conclusion

Paramedic non-conveyance decision-making is complex, adaptive and context-dependent. Although quantitative studies identify important associations between physiological observations and patient outcomes, these findings provide only a partial explanation of clinical practice. Qualitative evidence consistently shows that clinicians interpret and negotiate risk by integrating experience, contextual understanding, organisational influences and professional judgement.

Drawing on the complementary perspectives of Kahneman (2011), Collen (2016) and Perona et al. (2019), conveyance decisions appear to arise from interactions between intuitive and analytical reasoning rather than from the application of physiological thresholds alone.

The complete absence of COPD-specific evidence is particularly significant given the condition's prominence in Scottish healthcare policy and its contribution to unscheduled care utilisation. COPD challenges conventional risk models because

physiological abnormalities may reflect chronic baseline status rather than acute clinical deterioration.

Consequently, COPD presents an important opportunity to advance understanding of decision-making in pre-hospital care. Future research should move beyond heterogeneous non-conveyance populations and examine how paramedics assess and manage risk in specific long-term conditions. Such work would help bridge the gap between policy ambitions to avoid admission and the evidence needed to support safe, defensible and patient-centred clinical decisions.

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Table 1: Systematic and Scoping Reviews (n = 3)

Author	Journal	Population	Context	Concept	Methodology	Outcomes (Numbers/Statistics)	Key Findings	COPD/Respiratory Findings
Ebben et al. (2017) — Netherlands	Scandinavian Journal of Trauma, Resuscitation and Medicine	2,989 records screened; 67 included	Pre-hospital literature (international)	Non-conveyance from patient-safety and professional perspectives	Systematic review (heterogeneous designs)	No meta-analysis; variable non-conveyance rates; high recontact within ~48h	Decision-making is complex; tools/guidance limited; variable study quality	No COPD subgroup; respiratory presentations not stratified; ICD-10 used but not analysed by condition
Oosterwold et al. (2018) — Netherlands	BMJ Open	2,412 records screened; 29 included; 8 exclusively ≥65 years	Pre-hospital literature (elderly focus)	Influencing factors for (non-)conveyance in older adults	Systematic review	No meta-analysis; 16 quantitative, 12 qualitative, 1 mixed-method	Non-medical influences prominent (guidelines, feedback, training, litigation risk)	No COPD subgroup; respiratory multimorbidity discussed implicitly but not quantified
Blodgett et al. (2021) — UK	Scandinavian Journal of Trauma, Resuscitation and Medicine	16,037 records (incl. 29 grey); 41 included (18	Pre-hospital literature (international , updated in 2020)	Safety, effectiveness , efficacy of non-conveyance	Scoping review	Meta-analysis not feasible; methodological rigour often limited	Benefits to ED crowding recognised; safety evidence	No respiratory/COPD-specific analysis; recommends linked data to

	n and Medicine	quantitative , 12 qualitative, 11 consensus- based)					weak; over- reliance on recontact as safety proxy	follow complete patient journeys
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Table 2: Quantitative Studies (n = 12)

Author	Journal	Population	Context	Concept	Methodology	Outcomes (Numbers/Statistics)	Key Findings	COPD/Respiratory Findings
Vloet et al. (2018) — Netherlands	Scand J Trauma Resusc Emerg Med	54,797 contacts (2 regions)	Pre-hospital clinical	Conveyed vs non-conveyed comparison	Retrospective	Non-conveyed generally younger; rural skew; >50% had ≥ 1 abnormal clinical finding	Initial reasons often mental health; abnormal physiology despite non-conveyance	No COPD subgroup; respiratory status not stratified
Ebben et al. (2019) — Netherlands	World J Emerg Med	1-year review of non-conveyed patients	Pre-hospital clinical	Describe non-conveyance patterns	Retrospective observational	Non-conveyance $\approx$ 33% of contacts; $\sim$ 50% referred to other professionals; temporal distribution relatively even	Common reasons: collapse, mental health, alcohol; differences among outcomes not examined	No COPD subgroup; no respiratory stratification

Miles et al. (2019) — UK	British Paramedic Journal	143 paramedics ; 6 vignettes each	Pre-hospital educational	Decision accuracy using linked ambulance-ED data	Prospective mixed-method	Accurate conveyance decisions ~69%; rule-in ED 0.90 vs rule-out 0.49	Risk mitigation and patient safety concerns drive conveyance	No COPD focus; respiratory risk not modelled
Forsgårde et al. (2020) — Sweden	BMJ Open	32,085 contacts (3 different years, one region)	Pre-hospital clinical	Retrospective analysis	Longitudinal comparative	Non-conveyance associated with age, symptoms, triage, scene, time/day/season	Multiple patient and system factors influence decisions	No COPD subgroup; respiratory symptoms not separated
Höglund et al. (2020) — Sweden	BMC Emerg Med	23,250 contacts; 2,691 non-conveyed	Pre-hospital clinical	Proportion and characteristics of non-conveyed	Prospective cohort	Non-conveyance lower than national/international rates; ~50% referred to self-care; majority with normal physiology	Supports a low-risk subset among non-conveyed	No COPD subgroup; no respiratory-focused outcomes
Paulin et al. (2020) — Finland	Scand J Trauma Resusc Emerg Med	35,454 contacts; 14,874 non-conveyed (6	Pre-hospital clinical	Conveyed vs non-conveyed factors	Prospective cohort	Non-conveyance more likely evenings/weekends and with longer	Interplay of system design and risk scoring	No COPD subgroup; no respiratory stratification

		months, one region)				distances; NEWS2 influenced conveyance; <1h before shift end not impactful		despite NEWS2 relevance
Lederman et al. (2020) — Sweden	BMJ Open	Population 2.3m; 210,000 contacts; 23,603 non- conveyed	Pre- hospital clinical	Population-based cohort of non-conveyance in Stockholm	Retrospectiv e cohort	Higher non- conveyance at the highest dispatch level; younger predominated; non- specific/mental health symptoms common; abnormal physiology present	Medication patterns differed by age and conveyance	No COPD subgroup; respiratory physiology not reported
Blodgett et al. (2020) — UK	BMC Emerg Med	~4,500 patients screened; ~150 per arm (ED vs GP) analysed	Pre- hospital clinical	Outcome comparison by referral destination	Prospective cohort	GP referral generally safe; older, female, minor incidents more likely referred to GP	Calls for larger, more rigorous trials	No COPD subgroup; respiratory status not separated
Lederman et al. (2021) — Sweden	BMC Emerg Med	Two age- stratified groups; 1	Pre- hospital clinical	Prevalence/characteristi cs and risk factors by age	Retrospectiv e cohort	Older adults at higher risk of adverse events;	Organisation al safety	No COPD subgroup; respiratory

		region; 1 year				multimorbidity prominent	concerns for older patients	multimorbidity implied but not quantified
Heinonen et al. (2022) — Finland	Acta Anaesthesiologica Scand	324,207 contacts; 72,233 non-conveyances (4-year, one region)	Pre-hospital clinical	Describe non-conveyance and mortality	Retrospective cohort	Non-conveyance ≈ 33%; 30-day mortality 1.3%; respiratory illness associated with increased 30-day mortality	DNACPR/care-limitation decisions not integrated in non-conveyance	Respiratory category had the highest mortality signal; COPD not isolated
Johansson et al. (2022) — Sweden	BMC Emerg Med	5-year mixed-methods; 34 variables; 240 records	Pre-hospital clinical	Underlying causes of patient harm among non-conveyed	Mixed-methods (3-phase)	Low adherence to guidelines; protocol deviations noted	Risks in multimorbid older adults; safety measures needed	No COPD-specific analysis; respiratory risk not modelled
Höglund et al. (2022) — Sweden	Scand J Trauma Resusc Emerg Med	Population 295,000; 30,000 contacts (1-year prospective)	Pre-hospital clinical	Outcomes and associations for non-conveyed	Prospective analytical	Within 7 days: 0 ICU; 18 deaths (0.7%); older age linked to hospitalisation/death	Fewer short-term adverse outcomes than prior studies; guideline improvements suggested	No COPD subgroup; age effect may proxy respiratory burden

Table 3: Qualitative Studies (n = 7)

Author	Journal	Population	Context	Concept	Methodology	Outcomes (Salient Results)	Key Findings	COPD/Respiratory Findings
O'Hara et al. (2014) — UK	J Health Serv Res Policy	57 paramedics; 34 shifts; 3 sites (~5m population)	Pre-hospital clinical	Observation, digital diaries, focus groups	Multi-method qualitative	Nine decision types; seven systems/risk factors identified	Risk aversion; demand/performance pressure; limited feedback; access to options	No COPD focus; respiratory safety not addressed
Lederman et al. (2019) — Sweden	BMJ Open	11 ambulance clinicians (region: ~200k contacts; 25k non-conveyed/year)	Pre-hospital interviews	In-depth, open-ended interviews	Phenomenological	Complex decisions with limited organisational support	Clinicians bear responsibility amid inadequate education/guidelines/feedback	No COPD focus; respiratory scenarios not explored
Van Doorn et al. (2020) — Netherlands	International Emergency Nursing	15 patients + 7 relatives; 3 months	Pre-hospital interviews	Experiences of non-conveyed patients	Qualitative	Phases: fear, reassurance, confirmation (relatives), shame (patients)	Interpersonal skills crucial; psychosocial consequences; shared decision-making	No COPD subgroup; breathlessness-related anxiety not explored

Larsson et al. (2022) — Sweden	BMC Emerg Med	162 questionnaires (87 patients; 75 significant others)	Pre-hospital questionnaire	Satisfaction with ambulance service among non-conveyance	Cross-sectional	High satisfaction overall; ~20% dissatisfied with discharge advice	Communication and expectations need strengthening	No COPD focus; respiratory discharge advice not tailored
Lederman et al. (2023) — Sweden	BMC Emerg Med	9 in-depth interviews; 12 months	Pre-hospital interviews	Lived experience of non-conveyance	Phenomenological	Themes: being unwell, vulnerable, active in decision-making, safe afterwards, missing answers	Calls for clinical capability and organisational support	No COPD subgroup; respiratory risk not discussed
Granlund et al. (2024) — Sweden	BMC Nursing	14 nurses; 30 incidents	Pre-hospital interviews	Factors influencing care encounters in non-conveyance	Qualitative	Confidence, information sharing, communication, organisational aspects;	Implications for guidelines; further patient-relative research needed	No COPD focus; respiratory assessment not specified

						collaboration required		
Skaffari et al. (2024) — Finland	BMC Emerg Med	1017 surveys; 247 responses; 13 months	Pre-hospital questionnai re	Experience s by age, gender, time	Patient- experience survey	High satisfaction with interpersonal care; needs: pain management, clearer explanations	No demographic effect on experience in conclusions	No COPD subgroup; respiratory symptom management not addressed