NIHR | National Institute for Health and Care Research

Journals Library

Check for updates

Health and Social Care Delivery Research

Volume 13 • Issue 6 • February 2025

ISSN 2755-0079

Clinical and cost-effectiveness of paramedics working in general practice: a mixed-methods realist evaluation

Matthew Booker, Sarah Voss, Nicky Harris, William Hollingworth, Nouf Jeynes, Hazel Taylor, Kirsty Garfield, Helen Baxter, Jonathan Benger, Andy Gibson, Trudy Goodenough, Justin Jagosh, Kim Kirby, Cathy Liddiard, Alyesha Proctor, Sarah Purdy, Behnaz Schofield, Hannah Stott, Grace Scrimgeour and Nicola Walsh

DOI 10.3310/GTJJ3104

NIHR | National Institute for Health and Care Research

Health and Social Care Delivery Research

Check for updates

Extended Research Article

Clinical and cost-effectiveness of paramedics working in general practice: a mixed-methods realist evaluation

Matthew Booker,[1‡] Sarah Voss,[2*‡] Nicky Harris,[2†] William Hollingworth,[3] Nouf Jeynes,[3] Hazel Taylor,[4] Kirsty Garfield,[3] Helen Baxter,[5] Jonathan Benger,[2] Andy Gibson,[2] Trudy Goodenough,[2] Justin Jagosh,[2] Kim Kirby,[2] Cathy Liddiard,[2] Alyesha Proctor,[2] Sarah Purdy,[6] Behnaz Schofield,[2] Hannah Stott,[2] Grace Scrimgeour[1] and Nicola Walsh[2]

[1]Centre for Academic Primary Care, Bristol Medical School (Population Health Sciences), University of Bristol, Bristol, UK
[2]Centre for Health and Clinical Research, University of the West of England (Bristol), Bristol, UK
[3]Health Economics Bristol (HEB), Bristol Medical School, University of Bristol, Bristol, UK
[4]Research Design Service (RDS) South West Bristol Office, The Education and Research Centre, Level 3, University Hospitals Bristol NHS Foundation Trust, Bristol, UK
[5]ARC West, Bristol, UK
[6]Population Health Sciences, Bristol Medical School, University of Bristol, Bristol, UK

*Corresponding author sarah.voss@uwe.ac.uk

‡Joint first author
†In memoriam

Disclaimer: This report contains transcripts of interviews conducted in the course of the research, or similar, and contains language which may offend some readers.

Published February 2025
DOI: 10.3310/GTJJ3104

This report should be referenced as follows:

Booker M, Voss S, Harris N, Hollingworth W, Jeynes N, Taylor H, *et al*. Clinical and cost-effectiveness of paramedics working in general practice: a mixed-methods realist evaluation. *Health Soc Care Deliv Res* 2025;**13**(6). https://doi.org/10.3310/GTJJ3104

Health and Social Care Delivery Research

ISSN 2755-0079 (Online)

A list of Journals Library editors can be found on the NIHR Journals Library website

Health and Social Care Delivery Research (HSDR) was launched in 2013 and is indexed by Europe PMC, DOAJ, INAHTA, Ulrichsweb™ (ProQuest LLC, Ann Arbor, MI, USA), NCBI Bookshelf, Scopus and MEDLINE.

This journal is a member of and subscribes to the principles of the Committee on Publication Ethics (COPE) (www.publicationethics.org/).

Editorial contact: journals.library@nihr.ac.uk

This journal was previously published as *Health Services and Delivery Research* (Volumes 1–9); ISSN 2050-4349 (print), ISSN 2050-4357 (online)

The full HSDR archive is freely available to view online at www.journalslibrary.nihr.ac.uk/hsdr.

Criteria for inclusion in the *Health and Social Care Delivery Research* journal

Manuscripts are published in *Health and Social Care Delivery Research* (HSDR) if (1) they have resulted from work for the HSDR programme, and (2) they are of a sufficiently high scientific quality as assessed by the reviewers and editors.

HSDR programme

The HSDR programme funds research to produce evidence to impact on the quality, accessibility and organisation of health and social care services. This includes evaluations of how the NHS and social care might improve delivery of services.

For more information about the HSDR programme please visit the website at https://www.nihr.ac.uk/explore-nihr/funding-programmes/health-and-social-care-delivery-research.htm

This article

The research reported in this issue of the journal was funded by the HSDR programme or one of its preceding programmes as award number NIHR132736. The contractual start date was in June 2021. The draft manuscript began editorial review in July 2023 and was accepted for publication in May 2024. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HSDR editors and production house have tried to ensure the accuracy of the authors' manuscript and would like to thank the reviewers for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this article.

Published by the NIHR Journals Library (www.journalslibrary.nihr.ac.uk), produced by Newgen Digitalworks Pvt Ltd, Chennai, India (www.newgen.co).

Abstract

Background: General practice services are under pressure due increased demand. Alongside substantial national recruitment challenges, there exists a shortage of general practitioners to meet current need. Resultingly, allied healthcare professionals, including paramedics, are being utilised in general practice.

Aim: To determine the models of paramedics in general practice settings; the mechanisms that underpin effective paramedics in general practice; and the impact of paramedics in general practice on safety, costs and clinical and patient-reported outcomes and experience.

Design: A mixed-methods realist evaluation comprised a rapid realist review followed by an evaluation of paramedics in general practice in general practice case study sites. Patient and public involvement and input was integral, ensuring validity from a patient and carer perspective.

Setting: General practices in England.

Participants: A total of 34 general practices participated as case study sites, of which 25 were 'paramedics in general practice' sites. Data from qualitative realist interviews (n = 69), quantitative questionnaires (n = 489) and electronic records (n = 22,509 consultations) were collected.

Interventions: Paramedics in general practice models were classified according to: (1) level of integration of the paramedic to the general practice team; and (2) complexity of patients seen by paramedics.

Main outcome measures: Qualitative interviews investigated initial programme theories with staff and patient participants. Patient participant questionnaires utilised validated measures: the Patient-Reported Experiences and Outcomes of Safety in Primary Care (safety); EuroQol-5 Dimensions, five-level version (health-related quality of life); Primary Care Outcomes Questionnaire; the Modular Resource Use Measure (health and care resource utilisation). Electronic health records provided data on primary care use.

Review methods: A rapid realist review of the published and grey literature, supplemented with direct enquiry with system leaders and key stakeholders.

Results: The rapid realist review highlighted significant variation in paramedics' roles in general practice. Qualitative interviews identified domains related to access, safety, workforce reconfiguration, infrastructure, patient experience, and outcomes. Lower Patient-Reported Experiences and Outcomes of Safety in Primary Care practice activation scores were found at paramedics in general practice sites (perceived less engaged in promoting safety), in particular those with medium and low levels of paramedics in general practice integration and complexity. There was a small statistically significant difference in the Primary Care Outcomes Questionnaire 'Confidence in Health Plan' by paramedics in general practice complexity, such that confidence had deteriorated slightly more in the high-complexity group compared to non-paramedics in general practice. Paramedics in general practice sites had lower scores at initial visit and 30 days for the Primary Care Outcomes Questionnaire 'Confidence in Health Provision'. We found little evidence that paramedics in general practice care led to substantial spillover effects via increased reconsultations, prescriptions, secondary care referrals or unplanned hospital admission costs.

Limitations: The study faced challenges in recruitment. Self-selected participating sites may not be representative of all general practitioners in England, and categorising paramedics in general practice models for analysis was more complex than anticipated. The comparison of costs and outcomes between paramedics in general practice and non-paramedics in general practice sites was based on an observational study design.

Conclusions: Paramedics in general practice care improves access to general practice. Safety and acceptability require resources for induction, supervision, training and education. Paramedics in general practice integration affects staff satisfaction and role longevity. Paramedics in general practice allows paramedics to develop and evolve.

Future work: Larger studies utilising different study designs with longer follow-up are needed to fully understand the impact of paramedics in general practice on clinical outcomes and episode of care costs.

Study registration: This study is registered as ISRCTN56909665 https://doi.org/10.1186/ISRCTN56909665.

Funding: This award was funded by the National Institute for Health and Care Research (NIHR) Health and Social Care Delivery Research programme (NIHR award ref: NIHR132736) and is published in full in *Health and Social Care Delivery Research*; Vol. 13, No. 6. See the NIHR Funding and Awards website for further award information.

Contents

List of tables

List of figures

List of supplementary material

Report Supplementary Material 1 Rapid realist review

Report Supplementary Material 2 Case studies. Qualitative interviews. Topic guides

Report Supplementary Material 3 Case studies. Qualitative interviews. Participant information sheets

Report Supplementary Material 4 Case studies. Qualitative interview data analysis. Initial coding framework

Report Supplementary Material 5 Case study practices recruited according to Clinical Research Network and geographical spread of sites.

Report Supplementary Material 6 Case studies. Prospective cohort study. Methods and data analysis

Report Supplementary Material 7 Case studies. Prospective cohort study. Patient-Reported Experiences and Outcomes of Safety in Primary Care free text analysis

Report Supplementary Material 8 Case studies. Prospective cohort study. Sensitivity analyses

Report Supplementary Material 9 Case studies. Retrospective study. Standard operating procedure for data extraction

Report Supplementary Material 10 Case Studies. Retrospective study. Index consultations

Report Supplementary Material 11 Case Studies. Retrospective study. Sensitivity analyses

Report Supplementary Material 12 Case Studies. Retrospective study. Post hoc analyses

Report Supplementary Material 13 Patient and public involvement. Public contributor log

Report Supplementary Material 14 Knowledge mobilisation

Supplementary material can be found on the NIHR Journals Library report page (https://doi.org/10.3310/GTJJ3104).

Supplementary material has been provided by the authors to support the report and any files provided at submission will have been seen by peer reviewers, but not extensively reviewed. Any supplementary material provided at a later stage in the process may not have been peer reviewed.

List of abbreviations

A&E	accident and emergency
AHP	allied health professional
ANP	advanced nurse practitioner
ARRS	Additional Roles Reimbursement Scheme
CIIQ	Caregiver Indirect and Informal Care Cost Assessment Questionnaire
CMOC	context–mechanism–outcome configuration
CPRD	Clinical Practice Research Datalink
CRN	Clinical Research Network
EDI	equality, diversity and inclusion
EHR	electronic health record
EQ-5D	EuroQol-5 Dimensions
EQ-5D-5L	EuroQol-5 Dimensions, five-level version
EQ-VAS	EuroQol visual analogue scale
GLM	generalised linear model
GP	general practitioner
GPFV	General Practice Forward View
HCP	healthcare professional
HRQoL	health-related quality of life
IMD	Index of Multiple Deprivation
iNMB	incremental net monetary benefit
IPT	initial programme theory
ModRUM	Modular Resource Use Measure
NIHR	National Institute for Health and Care Research
NMP	non-medical prescribing
PCN	Primary Care Network
PCOQ	Primary Care Outcomes Questionnaire
PGP	paramedics in general practice
PPIE	patient and public involvement and engagement
PREOS-PC	Patient-Reported Experiences and Outcomes of Safety in Primary Care
QALY	quality-adjusted life-year
QoL	quality of life
VAS	visual analogue scale
WTE	whole-time equivalent

Plain language summary

There is a shortage of doctors to meet demand in general practice. Other healthcare professionals, including paramedics, are being employed. Little is known about how best to utilise paramedic skills in this setting. We wanted to understand whether and how paramedics meet the needs of patients, practices and the wider National Health Service, as the general practice surgery is different to the emergency ambulance service role. We used 'realist evaluation' methods to look at different models of paramedics in general practice (we call this 'paramedic working in general practice'). Realist evaluation asks what works, for who, and in what circumstances. This approach is well suited to the different ways paramedic working in general practice operates across the country. We reviewed relevant existing documents, research and reports, and spoke to leaders and experts about paramedic working in general practice. We then recruited 34 'case study' GP practices in England, both with paramedics and without. We collected 2 questionnaires, 30 days apart, from 489 patients who had seen a paramedic or a general practice. These questionnaires helped us compare people's health outcomes, safety concerns, and what services or resources they used (such as hospital appointments and medicines). We interviewed 69 people, including patients, general practitioners, paramedics and other practice staff. We also analysed consultation records from over 22,000 appointments. We combined (integrated) all of these results together to develop and test our theories about paramedic working in general practice. We concluded that paramedic care could help improve access to general practice services without substantial costs or savings for the National Health Service, and we found no important differences in outcomes for patients. However, it is important that patients are supported to understand the paramedic working in general practice role. We found that appropriate initial training and ongoing supervision are important for paramedic working in general practice to be safe and effective. Additional research, using different study designs, is important to better understand the impact of paramedic care on National Health Service costs and patient outcomes.

Scientific summary

Background

General practitioner (GP) services in England are facing significant pressure due to increased healthcare demand. GP consultations have been rising by up to 15% annually, costing the NHS £9B, with a shortage of GPs to meet the rising demand. To address this, there has been a shift towards utilising allied healthcare professionals (AHPs), such as paramedics, to support front-line service delivery in general practice. The NHS England General Practice Forward View and the NHS Long Term Plan have both emphasised the importance of developing the multidisciplinary, integrated workforce and increasing the number of AHPs and support staff in primary care. Paramedics have been identified as a professional group that can contribute significantly to general practice, particularly in managing minor illnesses, conducting home visits, and providing urgent consultations. Health policy and related primary care initiatives in England – including the Additional Roles Reimbursement Scheme – recognise that the generalist skill set of paramedics may be well suited to a GP setting. Legislation for paramedic prescribing was recently enacted, furthering the role this professional group may play in primary care. Consequently, there has been a threefold rise in the number of paramedics working in GP services in the last 5 years.

However, there is a lack of research on the safety, clinical effectiveness, and cost-effectiveness of paramedics working in general practice. Previous studies have focused on the extended skills needed by paramedics and have made assumptions about their impact on reducing GP workload and costs without empirical evidence. General practice services are configured around a diverse array of local contexts, challenges and specific needs, meaning the paramedic skill set is utilised differently across the country. There is very limited evidence of how different models might suit different needs.

Aim

The aim of the study was to determine the clinical and cost-effectiveness of paramedics working in general practice settings ('paramedics in general practice'; PGP).

Research questions

We set out to answer the following seven research questions:

RQ1. What different models of PGP are in operation in England?
RQ2. What are the crucial mechanisms that underpin effective PGP?
RQ3. How does PGP care impact on patient clinical outcomes (e.g. unplanned hospital admissions, prescriptions, referrals, tests and investigations)?
RQ4. How does PGP care impact on patient-reported outcomes [e.g. concern, confidence in health plan, ability to manage symptoms, health-related quality of life (HRQoL)] compared to non-PGP care?
RQ5. Does PGP result in patient-reported safe management?
RQ6. What are the direct costs/savings associated with PGP care, and does it provide good value for money?
RQ7. Does PGP lead to improved experience, how and for which patients?

Methods

We drew upon the epistemology of realist evaluation to explore how the different mechanisms of a range of PGP models were related to outcomes (clinical and economic) and different practice contexts. A mixed-methods approach combined quantitative and qualitative data to gather comprehensive insights into the deployment of PGP models in different contexts, and to iteratively develop and test theories underpinning their successful operation (or otherwise).

The patient and public involvement and engagement group was integral to all stages of the study from writing the ethics applications, refining research instruments, designing patient material to interpretation and synthesis of quantitative and qualitative data, ensuring validity from a participant and carer perspective.

We began by conducting a rapid realist review, including searches of empirical and grey literature, interviews with system leaders (*n* = 8), and a stakeholder prioritisation event (*n* = 22 participants, 14 professionals and 8 patient representatives). Data were analysed using a realist technique called 'appraisal journaling', which involved summarising and reflecting on key causal insights. We developed initial candidate programme theories that we would go on to refine in the evaluation stage.

To conduct the evaluation, a case study approach was utilised, and a total of 34 general practice sites were recruited (*n* = 25 with paramedics and *n* = 9 without). These sites were located in England to maintain consistency in the policy environment. Sites were selected based on practice demographics, such as size, urbanity, and deprivation index, ensuring representation of different service models across England. Practices provided comprehensive detail on their PGP operating model, including details of practitioner competencies (including prescribing ability), patient eligibility for PGP care and practice workforce composition. Data were collected to explore various aspects of PGP care, including its impact on patient outcomes, patient-reported experiences, safety, costs, value for money, patient experience and the workload of GPs and other general practice staff. The quantitative element included both a prospective and a retrospective cohort component.

Qualitative realist interviews (*n* = 69) were conducted with patient participants (*n* = 20), paramedics (*n* = 13), GPs (*n* = 12), practice managers (*n* = 13) and other members of the practice team (*n* = 11) using semistructured interview guides. Quantitative data were collected through prospective patient questionnaires completed by patients immediately after a consultation with a paramedic (at PGP practices) or GP (at non-PGP practices) and 30 days later (*n* = 489 completed questionnaire pairs). These assessed patient experiences and outcomes using validated measures, including: the Patient-Reported Experiences and Outcomes of Safety in Primary Care questionnaire (safety; Oxford University Innovation Ltd, Oxford, UK); EuroQol-5 Dimensions, five-level version (HRQoL; EuroQol Research Foundation, Rotterdam, The Netherlands); Primary Care Outcomes Questionnaire (PCOQ) (health outcomes; University of Bristol, Bristol, UK) and the Modular Resource Use Measure (ModRUM) (health and care resource utilisation). Additionally, a bespoke search was conducted on the electronic health records system (*n* = 10 practices) to undertake a retrospective analysis of the subsequent resource implications of consulting with a paramedic or GP at the start of a care episode. This analysis looked at coded data arising from 22,509 index consultations.

Data analysis involved coding and thematic analysis of qualitative interviews, while quantitative data were analysed using the relevant statistical methods. Multilevel models were used to analyse the primary outcome. Economic analyses were based on published unit costs, where available, or derived from base principles. Sensitivity analyses were also conducted. The research team met regularly to discuss emerging findings, refine theories and ensure alignment between qualitative and quantitative data.

Sites were classified based on the integration level of paramedics within the general practice team and the complexity of patients seen in the PGP service. These classifications aided in organising and comparing findings across sites. Overall, the study aimed to provide valuable insights into the effectiveness of PGP care by examining its impact on various outcomes and considering different contextual factors.

Findings

Realist review

There was significant variation in the ways paramedics worked and became embedded in general practice settings across England. Key issues identified included: the lack of clarity among paramedic staff and general practice about the meaning of the term 'advanced practice'; the challenge of transitioning from ambulance roles to general practice; the need for training and development opportunities for paramedics to acquire the necessary skills for primary care (e.g.

managing multimorbidity and chronic diseases). Access to training was not only important for paramedics' professional development but also played a role in attracting and retaining them in the role. The review also explored patient perceptions and acceptability of the paramedic role in general practice. Overall, patients appeared to be satisfied with the role, but there were instances of confusion regarding who was delivering care (particularly home visits). Patients often associated paramedics with emergency care and had limited understanding of the paramedic skill set and scope of practice in general practice. Clear communication and education were identified as important factors in improving patient perceptions and acceptability of the role. There were variations in paramedic employment models in general practice. Rotational models, where paramedics work in both primary care and emergency services, were seen as beneficial for skill development and staff retention. However, the logistics of implementing rotational models were noted as complex and time-consuming, and there were concerns about maintaining relationships and competencies across different settings.

Qualitative interviews

The analysis was conducted at three levels (patient, practice and wider system/NHS). Within these levels, six principal domains of theorising emerged from the data:

1. *Access to services* PGP provides a new model of care delivery that supports better access to (particularly same-day) general practice services. Being seen more quickly, especially for urgent problems, can improve acceptability for patients.
2. *Safety* Patient acceptance of better access is contingent upon assurances that care is safe, supervised and well supported. The professional background and emergency skills experience of paramedics were seen as a positive in terms of acute care safety. However, time is needed to develop trusting relationships, both between clinicians (paramedics, GPs and other healthcare professionals in the practice) and between paramedics and patients.
3. *Practice workforce* Reconfiguring the workforce to operationalise PGP disrupts service delivery, at least initially. There are specific considerations (and differing levels of training, experience and skills required) for the range of activities in primary care, ranging from simple acute single conditions through to complex frailty management and home visiting.
4. *Infrastructure* Additional resources are required to support PGP, including for comprehensive induction and ongoing supervision. Delivering appropriate training and clinical governance also require resource and may impact GP (and other practice team) workload.
5. *Experience* Patients expressed a desire to be taken seriously, to have their concerns respected, to be given adequate time, and to feel confident that they were in safe hands. While patients had traditionally expected to see a GP, most adjusted their previous expectations about paramedics being primarily emergency clinicians and accepted their broader role within general practice. Patients feel that seeing someone who is not their GP is an acceptable alternative to GP care if they feel they have been listened to, respected and understood.
6. *Outcomes* Patients value a good experience of care but need assurances that PGP care can result in good clinical outcomes that address their medical and psychosocial needs. Patients feel that seeing someone who is not their GP is an acceptable alternative to GP care when the outcome results in what they need (including, where applicable, prescriptions, referrals or tests).

Prospective cohort component

Overall, there were no important differences in the primary outcome between PGP and non-PGP practices. Practice activation scores (degree to which practice is perceived as focusing on safety) were slightly lower in PGP practices, in particular those with medium and low levels of PGP integration and complexity. There was a small statistically significant difference in the PCOQ 'Confidence in Health Plan' domain by PGP complexity, such that confidence had deteriorated slightly more in the high-complexity group compared to non-PGP [−0.10, 95% confidence interval (CI): −0.17 to −0.04]. 'More communication problems between you and healthcare staff' at index visit were reported at PGP sites, especially those with a medium level of integration, and more problems with diagnosis and harm to physical health at day 30 at sites with a low level of integration. PGP sites had lower quality of life (QoL) scores at initial visit and 30 days for the PCOQ 'Confidence in Health Provision' domain. The study found that participants at PGP sites had lower QoL scores at the post-index visit compared to non-PGP sites. However, both groups showed an overall improvement in QoL by the 30-day follow-up, with a higher improvement reported by participants at PGP sites. There was no significant

difference in post-index visit scores for the EuroQol visual analogue scale (EuroQol Research Foundation, Rotterdam, The Netherlands) between PGP and non-PGP participants. In terms of resource use and costs, primary care costs were similar between PGP and non-PGP sites, but secondary care costs were slightly higher at PGP sites. In total, NHS costs were just under £22 more for paramedic-led care (95% CI −£141.89 to £184.87). There was no important difference in quality-adjusted life-years (QALYs) between PGP and non-PGP sites. Differences between different models of PGP care (low/medium/high integration, and low-/medium-/high-complexity patients) were also marginal and unlikely to be clinically significant.

Retrospective cohort component

The retrospective cohort component showed that paramedic-led care had relatively little association with the patterns of subsequent patient care, with the possible exception of increased rates of prescribing. In analyses adjusting for differences in appointment, patient and practice characteristics, we found that paramedic-led care has the potential to reduce the cost of NHS care by approximately £20 per 30-day episode of care (mean −£23, 95% CI −£40 to −£5). After adjustment for appointment, patient and practice characteristics, there was no convincing evidence that the level of PGP integration within a GP practice was associated with substantial differences in the costs of care episodes. Costs of care episodes tended to be lowest in PGPs classified as working with high-complexity patients, although these differences were no longer evident after adjustment for appointment, patient and practice characteristics. The initial differences were largely driven by higher referral and testing rates in PGPs working with low-complexity patients, which may merit further exploration.

Limitations

The study was conducted during the response to and recovery from the COVID-19 pandemic, and during times of atypical pressure on general practice service (including the group A *Streptococcus* outbreak). Recruitment of both sites and individual participants was hampered, requiring amendments to our original plans and an uneven distribution of participants across sites and models. The case study design included sites that were by definition self-selecting, which may have decided to take part due to a desire to demonstrate the perceived effectiveness of PGP. These may not be representative of general practices in England. Additionally, despite attempts to recruit from practices with diverse characteristics, the final sample did not represent the full diversity of practice populations. Due to the range of PGP models, it was more complex to discretely categorise these for analysis than envisaged.

Conclusions

Paramedic working in general practice care can improve access to general practice (particularly same-day care). There is the potential for PGPs to take on a large volume of primary care workload without substantial spillover effects on other NHS colleagues and services. Acceptance of PGP models is based on an understanding of the primary care paramedic role, and confidence that mechanisms are in place to support it. PGP models exhibit substantial variation, and there is no single optimal model. Safety is achieved through a combination of comprehensive induction, ongoing supervision, appropriate postgraduate training and continuing primary care-focused education – all of which require substantial resource. The degree of PGP integration has less of an obvious impact on individual patient-level outcomes, and may be more associated with staff satisfaction, professional identity and role longevity. It may take time to adapt to the clinical context of primary care when transitioning from other areas of practice, and some evolution over time is likely when first operationalising PGP. Rotational working may mitigate some of the potential system-wide impacts on the emergency care workforce, but can require more investment from general practice to sustain. Nevertheless, PGP provides opportunities for the paramedic profession to develop and evolve.

Study registration

This study is registered as ISRCTN56909665 https://doi.org/10.1186/ISRCTN56909665.

Funding

This award was funded by the National Institute for Health and Care Research (NIHR) Health and Social Care Delivery Research programme (NIHR award ref: NIHR132736) and is published in full in *Health and Social Care Delivery Research*; Vol. 13, No. 6. See the NIHR Funding and Awards website for further award information.

Chapter 1 Introduction

Background

General practitioner (GP) services are under sustained pressure due to a growing and ageing population and increasing health-care demand.[1,2] GP consultations are rising by up to 15% annually, and more than 340 million consultations now take place in England annually,[3] costing the NHS £9B.[4] There is a desire for general practice to increase urgent care provision to reduce pressure on emergency departments and the wider system.[5] Alongside increasing workload, GP services face significant workforce challenges. Despite government ambitions to increase the overall number of GPs, there has been a reduction in the past decade.[6] There is a shortage of GPs to meet rising demand; nearly 450 practices have closed in the last 5 years due to recruitment and funding challenges, affecting over a million patients.[7]

General practice is increasingly turning to other staff to address medical shortages. The NHS England General Practice Forward View (GPFV) proposed greater development of the multidisciplinary, integrated workforce, capitalising upon the value that allied healthcare professionals (AHPs) can bring to support front-line service delivery.[5] Following this, the NHS Long Term Plan announced funding for 20,000 more AHPs and support staff over the next 5 years, with the intention that more patient care should be delivered by non-GPs.[8] The GPFV specifically highlights the skills of paramedics, suggesting that general practice should make greater use of this professional group. To support this, legislation for paramedic prescribing was enacted in April 2018. Examples of perceived benefit include the management of minor illness, home visits and the provision of same-day 'urgent' consultations. There is also a growing interest in rotational models of workforce development; paramedics move between different clinical settings in the ambulance service and general practice. These models are designed to address both the career aspirations of paramedics and workforce issues.[9] Various initiatives involving paramedics in general practice (PGP) are being developed, yet there is a lack of research to guide implementation. Providing evidence on the safety and effectiveness of this model of service delivery is therefore of paramount importance.

Our research team carried out a comprehensive review of the literature in 2019.[10] The available evidence at that time advocated for paramedics working in primary care but failed to provide sufficient detail regarding their clinical contribution.[11] A small qualitative study carried out by one of our co-applicant team explored patients' views of paramedics carrying out home visits for older people. This found that views are generally positive but dependent on the reason for the visit.[12] To date, there has been no systematic review on the safety or the clinical or cost-effectiveness of PGP, and the evidence base is weak. Much of the literature focuses on which extended skills may be needed by paramedics to work autonomously or safely in general practice and other community settings.[13–16] This research is largely descriptive and there are many assumptions, such as paramedics reducing GP workload and costs, which have not been tested empirically.

While not investigating paramedics specifically, a recent systematic review examined economic evaluations of nurses, pharmacists and other AHPs working as substitutes for GPs. The authors emphasise the importance of measuring consultation length and accurately recording patients' subsequent healthcare use to improve the quality of future economic evaluations. Based on currently available evidence, they concluded that there is limited economic evidence for role substitution in general practice and that more evaluations are needed.[17]

Prior to embarking on this research, we completed a national scoping survey of 165 general practices and paramedics.[10] Findings indicate that the tasks paramedics are undertaking are mostly same-day home visits (92%), followed by same-day clinics (75%), routine home visits (61%) and telephone triage (43%). One-third of respondents also reported that paramedics carry out prebooked clinics and same-day telephone appointments. There was significant variation in the types of condition and patient groups that paramedics are employed to see. This ranged from seeing all patients to focusing on acute presentations, older patients or housebound patients. The most common exclusions were infants, pregnant women and patients with mental health needs. Many models integrating paramedics into GP practices have developed in response to local circumstances. This variation in paramedic roles in general practice was supported by

a more recent survey by Eaton *et al*.[18] The current study aimed to capture these innovations and understand how they may inform national policies and guidelines.

This study also examined the potential unintended consequences of deploying PGP. Prior scoping work undertaken by our team included qualitative interviews with staff.[10] Analysis of these data suggested that a number of counter theories may exist alongside the drivers for this workforce initiative. For example, a perceived strength of paramedics is that they have been trained to see undifferentiated patients; on the other hand, some practices exclude specific patient groups from seeing a paramedic. An additional argument in support of paramedics is that they will 'free up GP time'; however, in some cases the amount of training, supervision and support that is required may negate this advantage in the short term. A further assumption is that paramedics cost less to employ; however, they may need substantially more time than GPs to assess and treat patients and may make different and potentially more expensive management decisions. We analysed data in the context of these complex and potentially contradictory circumstances using realist evaluation so the findings will inform decisions on the future organisation and delivery of services.

It is currently difficult to reliably estimate the total number of paramedics employed in general practice; workforce data sets do not capture staff employed in certain ways, for example by secondment or on rotations. However, the policy directive is very clear; in 2019 the NHS Long Term Plan announced funding for 20,000 more AHPs and clinical support staff over the next 5 years, with the intention that more patient care should be delivered by non-GPs. In addition, general practice workforce data indicate that the number of paramedics working in general practice has more than trebled over the last 5 years [from 345 whole-time equivalents (WTEs) in September 2018 to 1067 in September 2023],[6] and an update to the GP contract in February 2020 meant that community paramedics were introduced to the 'Additional Roles Reimbursement Scheme' (ARRS) from April 2021. We are therefore confident that this issue will continue to be an area of growing importance for patients, carers and the future of the NHS. We aimed to identify the most efficient ways of deploying paramedics in GP services to address the needs of the NHS and inform the planning and commissioning of future healthcare delivery.

Theoretical framework

Realist evaluation is a theory-driven approach to understanding complex interventions in complex environments.[19] It draws on both constructivist (theory building) and positivist (theory testing) paradigms to offer causal explanations about generative forces that underpin intended and unintended outcomes in a process termed 'retroduction'. Realist evaluation seeks to understand what works, for whom, in what circumstances, how and why.[20] The approach is methodologically robust and systematic and facilitates a clear understanding of the interactions between context and mechanisms that influence the outcomes of interventions. Realist evaluation has been adopted for this study due to the variation in the provision of PGP, and the need to explain how key components (e.g. types of patient seen or mode of consultation) may work in a variety of ways in different contexts (practice sociodemographics). Realist methodology allows the development and testing of theories related to the causal impact of contextual factors, such as funding structure, on PGP-related outcomes; therefore, outputs will be highly relevant to policy and implementation.

Aim

To evaluate the role of PGP and provide evidence about different service delivery models to determine their ability to:

- achieve good clinical outcomes for patients
- provide safe patient care
- improve patient experience
- relieve GP workload pressure
- influence the workload of other general practice staff
- make efficient use of healthcare resources.

Objectives

Rapid realist review and stakeholder event

Conduct a rapid realist review to synthesise currently available information, classify models and produce a set of realist programme theories about how different models work and with which resources in different situations. The programme theories were validated and refined through a series of stakeholder events.

Realist evaluation and case studies

Test the programme theories using case studies of general practices in England. We collected qualitative data from patients, carers and health professionals to understand the barriers to and facilitators of PGP and the impact it has on access to general practice. We analysed the implications of differing models of PGP compared to no PGP on healthcare resource utilisation, costs and patient-reported outcomes and safety outcomes to assess clinical and cost-effectiveness.

Research questions

1. What different models of PGP are in operation in England?
2. What are the crucial mechanisms that underpin effective PGP in different contexts?
3. How does PGP care impact on patient clinical outcomes (e.g. unplanned hospital admissions, prescriptions, referrals, tests and investigations)?
4. How does PGP care impact on patient-reported outcomes [e.g. concern, confidence in health plan, ability to manage symptoms, health-related quality of life (HRQoL)] compared to non-PGP care?
5. Does PGP result in patient-reported safe management?
6. What are the direct costs/savings associated with PGP care and does it provide good value for money?
7. Does PGP lead to improved patient experience; how and for which patients?

Report structure

This report begins by describing the methods and findings from the rapid realist review that formed the first element of the study (see *Chapter 2*). This includes the presentation of 'provisional programme theories' that were identified from the literature and supplementary data. It is followed with an account of the methods that were used to collect data from the case study sites (see *Chapter 3*). Data from the qualitative interviews with participants at the case study sites are then described and discussed and 'interim programme theories' are presented (see *Chapter 4*). Findings from the quantitative elements of the study are then presented. Firstly, analysis of prospectively collected data (patient questionnaires) is described (see *Chapter 5*), followed by the analysis of retrospective data from the electronic health records (EHRs) of participating sites (see *Chapter 6*). The findings from the rapid realist review, the qualitative interviews and the quantitative components of the study are integrated and reported (see *Chapter 7*). Patient and public involvement and engagement (PPIE) activity and knowledge mobilisation is reported (see *Chapter 8*). The report ends with a discussion and final conclusion (see *Chapter 9*).

Chapter 2 Rapid realist review

Introduction

Realist methodology provided a suitable approach for understanding the complexity of the paramedic role in general practice, and its associated outcomes. The realist approach was used to ask: 'What it is about models of paramedic working in general practice that works, for whom, in what circumstances and how?' Realist methodology answers these questions by developing theories to illustrate how an intervention can lead to a variety of intended and unintended outcomes. These theories clarify how active mechanisms are affected by the context in which they are introduced, and these relationships provide causal explanations for observed outcomes, illustrated as context–mechanism–outcome configurations (CMOCs).[21] Mechanisms can be separated into resources (provided by the intervention) and reasoning (the ways in which this changes the response of stakeholders).[22]

To ensure our findings accurately reflect the dynamic nature of the NHS workforce, we chose to undertake a rapid realist review. In addition to using data gathered from existing literature, we also conducted interviews with key stakeholders.[23] This review was conducted in line with RAMESES publication standards.[24]

Aim

To investigate the diverse models of paramedics working in UK general practice and identify the factors that contribute to the success or challenges of their role.

Ethical approval

Ethical approval was obtained from the University of the West of England (Bristol) Faculty of Health and Applied Sciences Research Ethics committee (ref no: HAS.21.07.175) for the system leader interviews and stakeholder event. All participants provided informed consent to take part in the study.

Methods

The review encompassed an extensive search of empirical and grey literature, including social media and video sources. Additionally, we conducted interviews with system leaders involved with the implementation of PGP and organised a stakeholder event involving key stakeholders and public contributors to clarify areas of priority and identify any gaps in theory development. A team of public contributors actively participated in shaping and contributing to the review, providing valuable insights during the planning, data collection and analysis stages.

The realist approach permitted the inclusion of empirical and non-empirical literature including grey literature sources, reflecting the most up-to-date information describing different models of paramedics' work.[25] For full details of empirical and non-empirical literature searches please, see *Report Supplementary Material 1*.

Results

Empirical and grey literature

The empirical literature search returned *n* = 3001 papers. Duplicates (*n* = 766) were removed. Records for *n* = 2235 papers were screened on title and abstract, and *n* = 105 papers were included after initial screening. Consensus on exclusion for 55% of the records that were dual screened was 100%. During the second phase of screening *n* = 73 were excluded, leaving *n* = 32 papers for analysis (*Figure 1* and see *Report Supplementary Material 1*). There were *n* = 12 papers in the subgroup of excluded papers termed 'transferable findings'. One particularly insightful article[11] which reviewed 205 papers on the role of PGP was searched to identify any additional sources.

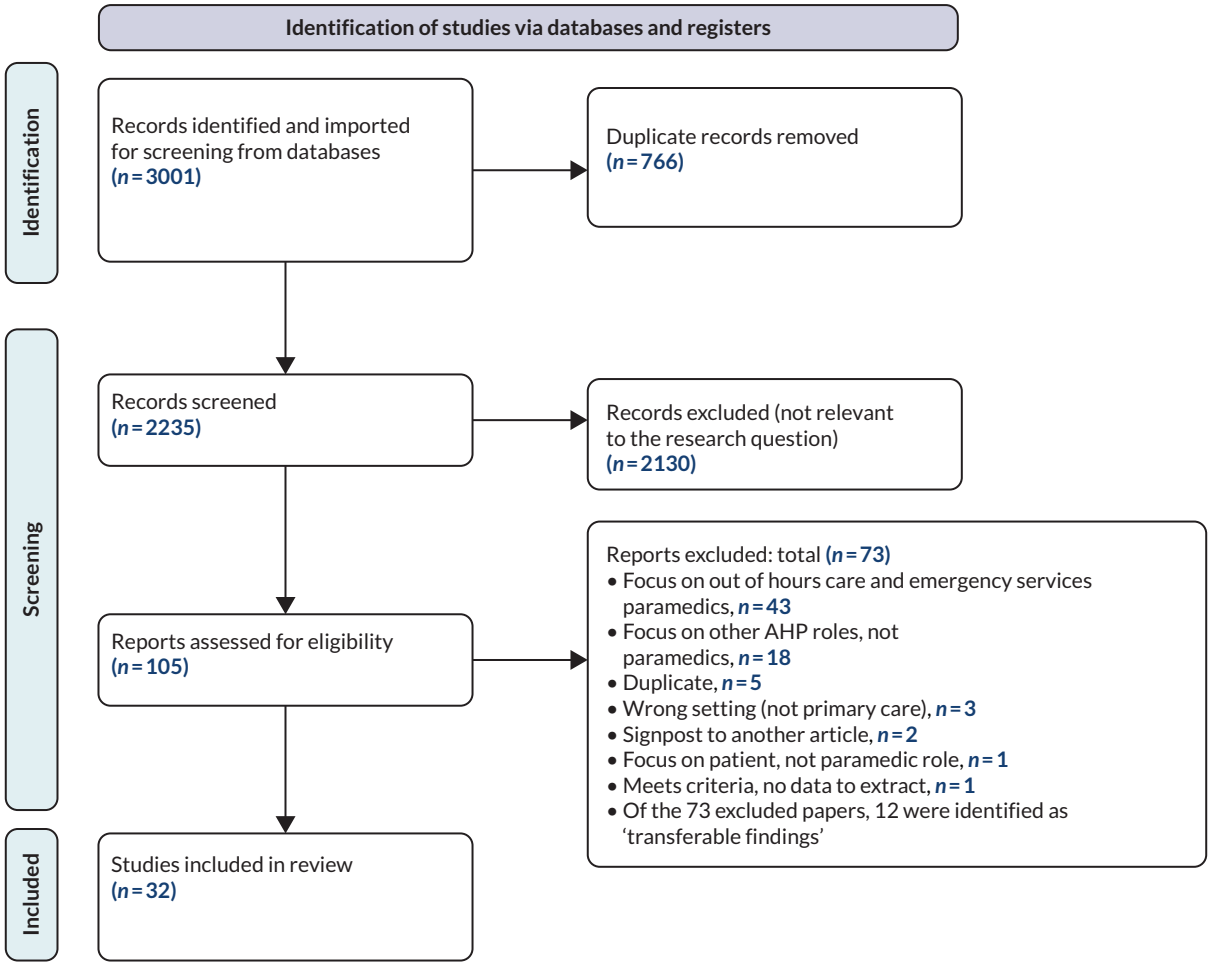

FIGURE 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses diagram. From: Page *et al.*[26] For more information, visit: www.prisma-statement.org/.

System leader interviews

Seven semistructured interviews were conducted with eight participants (one interview included two participants). Interviews lasted between 32 and 59 minutes, and the mean interview length was 39 minutes.

Stakeholder event

The stakeholder was 2 hours long and was attended by 22 participants, made up of 14 professionals (including paramedics working in general practice, GPs and professionals with leadership roles in the delivery of urgent and primary care) and 8 public contributors.

Synthesis

The synthesis encompassed four theory areas, as illustrated in *Table 1*. (For the data sources which contributed to the development of these areas, see *Report Supplementary Material 1*.) Findings indicated there was considerable variation among the models of implementation of the paramedic role: paramedics were working under different employment models and in new or more mature and embedded roles, and there was wide variation in their qualifications and the types of patients and conditions seen. These concepts were evident across the four theory areas. Each theory area is discussed below with key literature references or stakeholder quotes, followed by provisional CMOCs.

TABLE 1 Summary of provisional theory areas

Heading	Provisional theory area
Primary care staff understanding of the role of the paramedic in general practice	1. Understanding 'advanced paramedic practice' 2. Ensuring the 'right fit' for home visits
Paramedic embedding process, and access to training and development opportunities	3. Education and training at induction 4. Ongoing supervision and training of paramedics working in general practice
Patient understanding and acceptability of the paramedic role in general practice	5. Patient perceptions of paramedic role
Variation in paramedic employment models	6. Benefits of rotational models for paramedics working in primary care

Primary care staff understanding of the paramedic role in general practice

Paramedics are attractive to general practice because of their professional culture of innovating and problem-solving, and there is an expectation that they can provide autonomous generalist care.[27] There was a lack of clarity among both paramedic and general practice staff about the meaning of the term 'advanced practice' (level 7) in general practice,[28] 'which generates huge amounts of challenges because people say "I'm an advanced paramedic" and they've got no level seven study at all' (system leader, interview 3). However, paramedic skill sets were developed to meet the requirements of urgent and emergency contexts; the misperception of the role by staff in general practice led to difficulties matching paramedic skill sets to the patient population.

> *Primary care don't get it. They think that paramedics can work in the same way that nurses can, [but] they're not trained to do minor illnesses, to manage frailty . . . there's litigation cases, across the country, for unsafe practice . . . they [GPs] are not understanding what a paramedic can bring.*
>
> *System leader, interview 4*

Provisional context–mechanism–outcome configuration 1: understanding advanced paramedic practice and ensuring 'right fit'

Context:

> *Lack of consistency in the understanding of the term 'advanced practitioner' by paramedics and general practice staff.*

Mechanism:

> *Paramedics are asked to see patients (resource) whose problems may be outside their skill set, and they are unprepared to deal with the clinical challenges they see (response).*

Outcome:

> *For paramedic: uncertainty about role, remit and capabilities.*
>
> *For patient: suboptimal care.*
>
> *For practice: risk of unsafe practice, medical error, and litigation.*

Paramedics required support when transitioning from urgent to primary care as they developed more complex and autonomous clinical reasoning skills, in contrast to a reliance on protocol-driven decision-making in the ambulance service.[29]

> *When employing junior paramedics in a primary care setting it is important for both parties to understand and appreciate that exposure to the complexity and intensity of primary care should be undertaken gradually . . .*[30]

There was consensus that when entering general practice, paramedics needed to clarify the scope of their role, in terms of the types of patients and conditions they can manage.

> *[T]here's probably a bell curve distribution of practice for paramedics . . . Some are providing excellent care that is in line with advanced-level clinicians within primary care, most are providing safe care with support and supervision from GPs, but I imagine there will be a section of the paramedics out there that are providing care that is probably unknowingly out of their scope or might not be safe . . .*
>
> *Paramedic, stakeholder event*

Paramedics' capacity to conduct home visits provided a beneficial extension of general practice services to patients' homes.[31] This model suited GPs and paramedics, because home visits were considered time-consuming, and paramedics were considered experts in community care.[32] Reducing the GP role in home visits was thought to free up time and increase GP appointment capacity in practice,[33] although supervising home visits for less experienced paramedics to ensure safe provision of care by staff unfamiliar with the management of frailty or complex comorbidity did generate a workload burden for GPs (GP, stakeholder event[10]). Concern was also expressed that altering role boundaries may lead to GPs losing home visiting skills (GP, stakeholder event), or compromising continuity of care.

Provisional context–mechanism–outcome configuration 2: ensuring paramedic 'right fit' for home visits

Context:

> *Home visits are time-consuming for GPs, but many patients requiring home visits may have complex multimorbidity or conditions which may be beyond the skill set of inexperienced paramedics or those with lower qualifications.*

Mechanism:

> *Provision of remote support and supervision from the GP (resource) supports safe practice and provides the paramedic, GP and patient with reassurance (response) about standards of care provided.*

Outcome:

> *For patient: timely home visit.*
>
> *For paramedic: supervision while gaining experience and developing skills.*
>
> *For GP: saving time. Initially any time saved by not doing visits may be consumed by supervision but requirements should reduce over time.*

Paramedic home visiting improved timely access to care for patients by increasing the capacity for morning appointments (NHS England, Beacon Medical case study),[34] creating potential benefits for patient outcomes, patient satisfaction and reduced conveyance to hospital.

> *Utilising specialist paramedics to undertake home visits earlier in the day will smooth the flow of primary care home visiting activity which typically occurs around lunchtime when GPs finish morning surgery.*[34]

Paramedic embedding process, including access to training, supervision and development opportunities

The transition from working in ambulance roles to working safely and autonomously in general practice was more successful when paramedics had access to training and development opportunities from the outset. This was because

specific skills required for general practice roles were beyond the scope of ambulance paramedics' core capabilities, such as 'the routine management of multimorbidity and chronic disease, a shift towards preventative care, and a mastery of more nebulous concepts as "continuity" and "the therapeutic consultation"'.[28]

Access to training was also a key driver in attracting paramedics to the role, and in retaining them by ensuring their role was challenging and varied.

> *More training, prescribing for example, because they are also given protected time to do that learning . . . what we have seen is paramedics starting to go back to ambulance trusts because after a while, if the practice don't utilise them to their maximum potential, they get bored.*
>
> *System leader, interview 5*

Requirements for PGP to attain 'advanced practice' qualifications via Health Education England accreditation were becoming accepted as a standard, though academically demanding, part of paramedic development in general practice (social media, 2021).

General practice highlighted the need for development of specific paramedic skills, such as interpretation of blood tests which would support paramedic knowledge around prescribing.[30,35] Yet it was also acknowledged that paramedics brought new skills to general practice, for example in triage, minor injury treatment, catheter management and emergency care, which reduced pressure on duty doctors and other primary care staff.[36,37]

Provisional context–mechanism–outcome configuration 3: education and training mechanisms at paramedic induction into general practice

Context:

> *Paramedic formal training typically does not include routine management of many medical conditions, or managing multimorbidity or chronic illness, but PGP may need to diagnose and treat patients experiencing these conditions.*

Mechanism:

> *Providing the time, resources and support for paramedics to undertake training allows paramedics to gain critical pathophysiological knowledge to treat patients in general practice (resource) which develops paramedic clinical skills and confidence to manage these patients autonomously (response).*

Outcome:

> *For patient: improved safety and standards of care.*
>
> *For paramedic: improved clinical decision-making; reduced need for intensive, time-consuming supervision.*
>
> *For practice: improved retention of paramedics in primary care.*

There was wide variation in the degree to which paramedics could practice autonomously and confidently (e.g. conducting advanced clinical decision-making and using skills such as prescribing) within a general practice patient population. This affected the scope of paramedic workload and the workload of other general practice staff. For example, some paramedics were 'consulting with GPs on almost a case-by-case daily basis, to use them as consultants and prescribers' (paramedic, stakeholder event), whereas other paramedics were 'leading on frailty . . . will help run the emergency clinic, they'll have their own consulting room and actually go through the patients on the emergency list in the morning alongside the GP' (education provider, stakeholder event).

Quality supervision was considered key to successful and safe implementation of the role;[35] however, the addition of supervisory tasks added to the workload of GPs and other staff responsible for this role, and matching the skill sets of supervisors to paramedics was a challenge.

> *[F]or a lot of the PCNs [Primary Care Networks], [supervision] is also an issue, because they don't know how best to support the roles. You can't have this brand new, huge new workforce, and expect the GPs to do all the supervision because that just adds to their workload and they're not necessarily the right people to be doing it either . . .*
>
> *System leader, interview 6*

Provisional context–mechanism–outcome configuration 4: routine supervision of the paramedic role

Context:

> *Paramedics entering general practice roles have a variety of skill sets and experience which affect their ability to work autonomously.*

Mechanism:

> *Routine supervision of paramedics by appropriate practice staff, especially at the outset of the role, offers the opportunity to have enhanced discussions about patient care (resource), which will help to inform practice staff about paramedic scope, and will clarify appropriate ways for the paramedic to manage patient care (response).*

Outcome:

> *For patients: improved patient outcomes and safety.*
>
> *For paramedics: improved staff satisfaction.*
>
> *For practice: increased GP supervision workload while embedding the role.*
>
> *Over time, the paramedics' general practice skill set and ability to work autonomously should develop, and the supervisory burden may reduce.*

Patient acceptability and understanding of the role

Patients generally appeared to be satisfied with the paramedic role in primary care. A small-scale survey of *n* = 80 patients who were treated by a general practice paramedic reported being happy (73%) or very happy (18%) with their experience.[38] While GP home visits typically occurred after morning surgery, introducing paramedics enabled patients to receive home visits earlier in the day.[39]

However, a qualitative study with six patients reported a lack of patient clarity about who was conducting the home visit: 'At all times, the participants were expecting a GP. Despite being told that they were seeing a PP [paramedic practitioner], participants repeatedly said "thank you doctor" at the end of the consultation'.[40] This confusion about the role may have implications for patients who primarily associate paramedics with urgent responses to serious conditions.

> *Patients held preconceived ideas about the role of ambulance service staff, and that the arrival of an ECP [emergency care practitioner] meant they were sufficiently unwell to require hospitalisation.*[40]

Provisional context–mechanism–outcome configuration 5: patient perceptions of the general practice paramedic role

Context:

> *Patients and the public have a traditional view of the paramedic being solely involved in emergency care.*

Mechanism:

> *Patients have opportunities to see paramedics in non-emergency roles during home visits and booked appointments (resource), and opportunities to discuss questions about the nature of this role with reception staff (resource), leading to a revised view of the role of paramedics (response) and increased clarity and confidence about their role in general practice (response).*

Outcome:

> *For patients: timely, effective clinical care; increasing exposure to paramedic-led care normalises the role for patients.*
>
> *For paramedics: increasing levels of patient acceptability.*
>
> *For practice: GPs have more time to attend to more complex patients, and the practice deals with fewer patient concerns about 'not seeing a GP'.*

Patients showed some concern that paramedics' skills were not equivalent to a GP's skill, but this was less of a problem if they felt their symptoms fitted within their perception of the paramedic scope or if it was not an ongoing condition. 'I would prefer to be seen by a GP obviously, but it depends on the reason, if I had anything that a paramedic could deal with, then that would be absolutely fine'.[12] However, patients had limited understanding of what the paramedic skill set and scope involved. Two participants in the stakeholder event stated that they would prefer to see a paramedic for certain conditions because 'they have more experience in crisis management . . . they are less judgemental' (public contributor 1).

Many patients were supportive of the need to lessen the load on GP staff by utilising the paramedic workforce: 'I would be quite happy to see the PP [paramedic practitioner] than waiting longer to see the GP, as I see it, it's obviously a way of reducing the pressure on the surgeries which I can understand'.[12]

Variations in paramedic employment models in general practice

Paramedics were employed in general practice under a variety of employment models depending on location, cost or general practice requirements, which had implications for how the role operated in different settings.

> *[A]cross the country we have rotational models and we have substantively employed models . . . Primary care quite like that [substantive] model because . . . they own that person and they're part of that family and they can help and support and develop them.*
>
> *System leader, interview 3*

Rotational models involved paramedics working in primary care at regular intervals while retaining their role in emergency services. Paramedics in these roles were likely employed by ambulance trusts or primary care networks (PCNs).

> *Paramedics on a rotational model worked really well in some parts of the country . . . they are looking at it as a sustainable business model, whereas in other parts they've looked at it purely as a staff retention model. So, they haven't made money out of it but they've retained staff.*
>
> *System leader, interview 3*

The variety of roles associated with a rotational employment model was thought to be beneficial for the development of clinical skills and autonomy and for paramedic staff retention,[41] which was advantageous to both general practice and ambulance services.[42]

Provisional context–mechanism–outcome configuration 6: benefits of rotational models of paramedic working

Context:

> *Paramedics working in traditional ambulance roles defer to guidelines to determine whether a patient should be admitted to hospital or not, and transfer care to other clinicians to make decisions around ongoing management. Decision-making and risk management is a more binary and immediate process, unlike longer-term management options in primary care.*

Mechanism:

> *Rotational employment which includes work in the home visit setting provides exposure to a wider array of presentations in the primary care patient population compared to attendance for emergencies (resource). Supervision by GPs (resource) allows paramedics to develop clinical autonomy and an awareness of longer-term management options that are alternatives to hospital admission (response).*

Outcome:

> *For patient: care can be personalised rather than protocol-driven, potentially reducing hospital admission.*
>
> *For paramedic: improved decision-making and confidence to suggest patient management options that do not include hospital transfer, knowledge that can be applied to general practice visits or emergency ambulance attendances.*
>
> *For practice and health service more widely: broader skill set and responsibilities improve staff retention.*

There was agreement in the literature and interviews that rotational models were essential to avoid losing paramedics from ambulance roles: 'these posts should be rotational . . . because the ambulance trusts are haemorrhaging' (system leader, interview 5). Yet despite the introduction of rotational roles, there were not enough paramedics to meet demand in all areas of the system (system leader, interview 6).

> *Right now I have no idea whether moving more paramedics into primary care, or taking all of the paramedics out of primary care and putting them back on the DCA [double crewed ambulance] is the right route . . . how do you get deployment right in a system that is in meltdown?*
>
> *System leader, interview 7*

The logistics of employing paramedics via the rotational model appeared administratively more complex and time-consuming[33] than substantive employment and were a source of risk for general practice:

> *[T]here's the contractual stuff around that [the rotational model], which kind of puts people off . . . the practice managers, suddenly getting a one hundred and sixty page, national contract to have a member of staff, that's quite scary and they're not used to it . . .*
>
> *System leader, interview 6*

Paramedics reported the experience of working across general practice and ambulance roles brought both benefits and challenges. Being employed in general practice for shorter periods of time inhibited the development of relationships between paramedics and general practice staff and made it harder to learn local systems and protocols.[33] Maintaining competencies and training across two settings was complex for paramedics, which had implications for retention (social media, 2021). There were potential risks for general practices if they invested in the development and accreditation of rotating paramedic staff who then moved on to a different organisation offering a higher band or salary. However, paramedics who maintained both roles were reported to benefit from clinical development, support and improved shift patterns of general practice while also retaining the sense of a paramedic identity from working in urgent care (system leader interviews 1, 2, 3 and 5).

Discussion

This realist synthesis explored the role of the paramedic in UK general practice. Although the role of the paramedic in UK general practice has been introduced over a period of 20 years, it is still developing and there is a lack of clarity, for general practices, paramedics and patients, about what the role involves. This may lead to paramedics inadvertently working outside of their scope or requiring extensive supervision when transitioning into the role to ensure safe practice. Appropriate levels of support and professional development were important to help paramedics switch from ambulance to general practice settings, embed their role in practices and ensure paramedic satisfaction. Patients were generally accepting of the role, though they expressed uncertainty about who they were being seen by and whether the paramedic skill set was appropriate to general practice. The variable models of work and employment for paramedics had implications for how these roles were maintained across ambulance and general practice settings, and how the role worked for practices, paramedics and patients.

When employing a paramedic in general practice, role clarity has been highlighted as a key area of importance.[43–45] This research provided insights into the range of skill sets among paramedics entering general practice; not all PGP are advanced paramedics. Historically, the wide variety of terms used to describe the role might have contributed to the lack of clarity in general practice and public understanding of the paramedic skill set. More recently the College of Paramedics has differentiated the terms 'specialist paramedic' and 'advanced paramedic' to refer to practitioners working at postgraduate diploma or a Masters level, respectively.[44] Health Education England commissioned the College of Paramedics to detail the core clinical skills and presentations that an advanced paramedic is expected to manage.[43] Implementation guidance tends to put the onus on the paramedic to share their level of competence with general practice, but our review demonstrated that this may be challenging for paramedics working in a new setting with a new patient population, as they may have limited awareness of the range of clinical situations they may encounter.

Expectations and perceptions of the role may differ between general practice staff and paramedics, resulting in dissatisfaction for both groups. Expectations need to be accurate to enable effective collaboration and to ensure appropriate supervision, and to match paramedics to appropriate patient groups. Working closely with general practice teams to test the boundaries of paramedic scope of practice across an array of presentations may be key to embedding the role successfully. As the roadmap to paramedic practice[46] becomes more embedded, and as paramedic and other first-contact practitioner roles become more established in primary care, it is likely that general practice teams will become more aware of the distinctions between different paramedic skill sets and what this means for collaborative working and patient safety. However, in this interim period, practice staff may require additional support to ensure appropriate understanding of paramedic skills and how to utilise these to ensure safe care and optimal practice.

Appropriate supervision of paramedics as they develop and become embedded in general practice was considered fundamental to the success of the role. The need for quality supervision is becoming more widely recognised; paramedics are advised to be guided by a named physician, particularly when completing certain advanced practice modules.[44] However, the supervision workload on GPs or other advanced practice staff is difficult to quantify. It is important to understand how the GP role is evolving, considering their ongoing responsibility for patient care, supervision of multiple AHP roles, and the high workload for GPs in the NHS. It might be that outsourcing paramedic supervision to educational institutions could relieve some of this burden on GPs and other practice staff.

Rotational models of employment may appear to be a solution to the challenge of ensuring the paramedic workforce is not permanently displaced from ambulance trusts to primary care, and for achieving the role variation and professional development that is required to retain paramedic staff in post. However, the longer-term consequences of rotational working require further attention. For example, it is not clear how different shift patterns across primary and secondary services impact on paramedic integration into general practice teams and whether this in turn may influence role satisfaction, professional development or patient outcomes.[33] Communication and collaboration with colleagues are considered benchmarks of multidisciplinary working which improve patient care,[43] and inconsistent or temporary working patterns are likely to disrupt these processes. Practices may also be unclear about the benefits or challenges associated with employing paramedics directly or outsourcing this responsibility to PCNs or ambulance trusts. Each of these models will affect the practice administrative burden (e.g. training, employment processes, covering absence,

indemnity issues and costs) in different ways. Understanding these models is vital to explain what makes the role successful in different contexts.

Strengths and limitations

This rapid realist synthesis was conducted by a multidisciplinary research team, including researchers, academics, GPs, ambulance paramedics and paramedics working in general practice, and utilised public consultation at all stages. It considered a variety of data, including empirical literature, interviews and social media sources, and included a wide range of stakeholder perspectives. Realist methods encompass subjective reasoning to draw causal links between claims, which allows researchers to theorise more deeply as to how mechanisms of PGP are influenced by different contexts to create varied outcomes. In this review any subjective reasoning was discussed within the research team to understand the issues from a variety of perspectives and to ensure the most plausible theory was selected. It should be noted that while these theoretical claims are derived from data, they were not lifted verbatim from single sources, but rather synthesised from a variety of sources to develop theories. In accordance with realist methodology, data were not appraised or weighted based on hierarchies of methodology or source, but selected based on the relevance, rigour and richness of detail to address the research question. It was examined consistently for content to understand the point being communicated and what this might reveal about how the paramedic role works in general practice. As such, the theories put forward should be treated cautiously at this stage; however, they will be tested empirically in the next stage of work.

Conclusion

We found significant variation in the ways in which paramedics are working and becoming embedded in general practice settings across England. Furthermore, variation in paramedic skill sets and development requirements when entering general practice mean it is often difficult to determine how paramedics fit best into the workforce, and which patients and conditions they should manage. The understanding of the role by general practice staff does not always reflect what can be safely and efficiently delivered; equally, paramedics moving into general practice experience a sudden shift in expectations around their role, which may prove undesirable for some. Lack of clarity regarding the paramedic role may be compounded by variation in role titles and the novelty of the role in general practice; this is likely to improve as paramedics become embedded and normalised into teams over time. Rotational models of employment may bring practical benefits to paramedics and patients but appear to be more complicated for general practice to operationalise and may counter the advantages afforded by embedding paramedics into practice teams in the longer term.

Chapter 3 Case study methods and findings

Overview

We used case studies to conduct a mixed-methods, realist evaluation of PGP to identify which models of deployment work for whom, under what circumstances, how, and with what resource implications. Quantitative and qualitative data were collected: the qualitative data focused on the generative mechanisms, and the quantitative data on context and outcomes. Programme theories were generated and tested through an iterative process of construction, exploration and refinement in relation to the data collected. These theories built on the provisional CMOCs formed during the realist review (see *Chapter 2*) to produce interim CMOCs which are reported in *Chapter 4*. The CMOCs explain how PGP works in different circumstances, by considering: patient clinical outcomes and experience; staff experience; resource use; expenditure and savings; and the wider impact on the general practice workforce. These were then synthesised with the quantitative findings to address the research questions in *Chapter 7*.

Ethical approval

Research ethics approval was granted by:

- Yorkshire and The Humber – Bradford Leeds Research Ethics Committee (dated 30 December 2022, ref. 21/YH/0275)
- Health Research Authority Integrated Research Application System (dated 30 December 2022, ref. 279049)

Approval was ratified by University of the West of England (Bristol) Faculty of Health and Applied Sciences Ethics Committee dated 22 January 2023, ref. HAS.22.01.053.

Case study research questions

- How does PGP care impact on patient clinical outcomes (e.g. unplanned hospital admissions, prescriptions, referrals, tests and investigations)?
- How does PGP care impact on patient-reported outcomes (e.g. concern, confidence in health plan, ability to manage symptoms, HRQoL) compared to non-PGP care?
- Does PGP result in patient-reported safe management?
- What are the direct costs/savings associated with PGP care and does it provide good value for money?
- Does PGP lead to improved patient experience; how and for which patients?
- How and why does PGP affect the workload of GPs and other general practice staff?

Case study selection and recruitment

The case studies were geographically contained within England due to variation in the organisation and delivery of general practice services across the UK. This allowed us to focus on a single policy environment, keeping the range of contexts appropriate for the scope of the project. We planned to recruit a total of 24 general practice case study sites. Of the 24 sites, we anticipated that 6 sites would have no PGP and a further 18 would cover 3 service models which were to be defined but likely to be based on the types of consultation undertaken by paramedics – for example, home visits only, clinic-based same-day/urgent care only, or fully embedded in routine practice. We worked with Clinical Research Networks (CRNs) across England to identify and approach suitable sites. Sites were selected according to our sampling frame which included components of practice demographics such as size, urbanity and deprivation index to ensure variation in the types of practices selected for case studies, which were also representative of service models in England (identified in the rapid realist review) and had a geographical spread.

Of these, up to 12 sites would be 'detailed' case study sites where additional data would be collected (detail below):

Planned site enrolment: PGP n = 18 (9 of which detailed).
Non-PGP n = 6 (83 of which detailed).

Overview of data collected

Qualitative interview data (detailed sites only)

Semistructured realist interviews were conducted with patient participants [or their adult carers (individuals) who accompanied the patient participant at their appointment], paramedics, general practice staff and service managers.

Interview topic guides (see *Report Supplementary Material 2*) were based on the initial programme theories (IPTs) developed in the rapid realist review (see *Chapter 2*) and were developed with input from the research team and participants from the study's PPIE group. They were designed to elicit information about how PGP and non-PGP models work, for whom and under which circumstances. The focus was to understand the mechanisms through which PGP, in various contexts, results in intended and unintended outcomes.

Initially 12–15 interviews were planned at each of the 12 detailed case study sites (9 with PGP and 3 with no PGP). Of these, it was planned to complete between four and six patient participant/carer interviews, two with GPs, one or two with paramedics in PGP sites, two with practice nurses, one with a member of the reception staff, one with a practice manager, and one with a local commissioner. This would have given a total of 180 interviews.

The initial qualitative interview sample was determined following careful consideration of the potential qualitative information power[47] available from realist interviews. One of the benefits of the realist approach is that it does not seek thematic saturation, and interviews can be scaled or focused around quite specific areas as theories evolve. The sample size (and composition) was refined by detailed review of feedback from realist evaluation experts, the NIHR HS&DR panel who funded this evaluation, and the Study Steering Committee.

During the early stages of interview data collection, it was apparent that some members of the practice staff at PGP sites had little experience of working with the paramedics at the practice. This applied particularly to the practice nurses and some members of the reception teams. Thus, it was decided to limit interviews to paramedics, GPs, practice managers and reception/admin staff, unless indicated otherwise by the practice staff themselves. In addition, at practices without paramedics, a decision was made not to interview patients because the topic guide was not relevant for patients who did not have the direct experience of seeing a paramedic within primary care. This reduced the planned sample to a range of 81–121 interviews across 12 detailed case study sites (9 PGP and 3 GP).

Prospective patient questionnaires (all sites)

Participant experience and outcome of the consultation was assessed using the Primary Care Outcomes Questionnaire (PCOQ; University of Bristol, Bristol, UK),[48] the Patient-Reported Experiences and Outcomes of Safety in Primary Care (PREOS-PC; Oxford University Innovation Ltd, Oxford, UK)[49,51] compact version,[50] and the EuroQol-5 Dimensions, five-level version (EQ-5D-5L™) questionnaire (EuroQol Research Foundation, Rotterdam, The Netherlands).[51] We also used a customised resource use questionnaire, based on the Modular Resource Use Measure (ModRUM) Core Module[52,54] WPAI:GH V2.0[53] and the Caregiver Indirect and Informal Care Cost Assessment Questionnaire (CIIQ).[54] Questionnaires were administered by post, by telephone or via a secure online server (secure data transfer), depending on participant preference. Further details on the measures can be found in *Chapters 5* and *6*.

We aimed to obtain complete data (index visit and 30-day follow-up) from 23 adult participants at each of the planned 24 case study sites to provide a total sample of 552 participants across the 24 sites. Further details on sample size calculation can be found in *Chapter 5*. Participants were eligible if they had attended an appointment with a paramedic (PGP sites) or GP (non-PGP sites) and were aged 16 years or over.

Recruitment of case study sites proceeded as planned but at several sites participant recruitment was slow, and it became clear that without recruiting additional sites, the total sample of 552 participants necessary for the analysis would not be attained within the study recruitment period.

Thus, in consultation with the Study Management Group and Study Steering Committee, it was decided to recruit up to an additional 12 case study sites to achieve the target sample size (see *Appendix 1*). Additional sites that had already

registered their interest in participating in the study were approached and recruited in accordance with our sampling frame. *Figure 2* shows the case study sites recruitment flow diagram.

Retrospective health record data (detailed sites only)

We planned to extract data from the GP EHR at each of the nine detailed case study practices for patients eligible for PGP over a period of 1 year (to capture seasonal variations in demand). We extracted information on all general practice

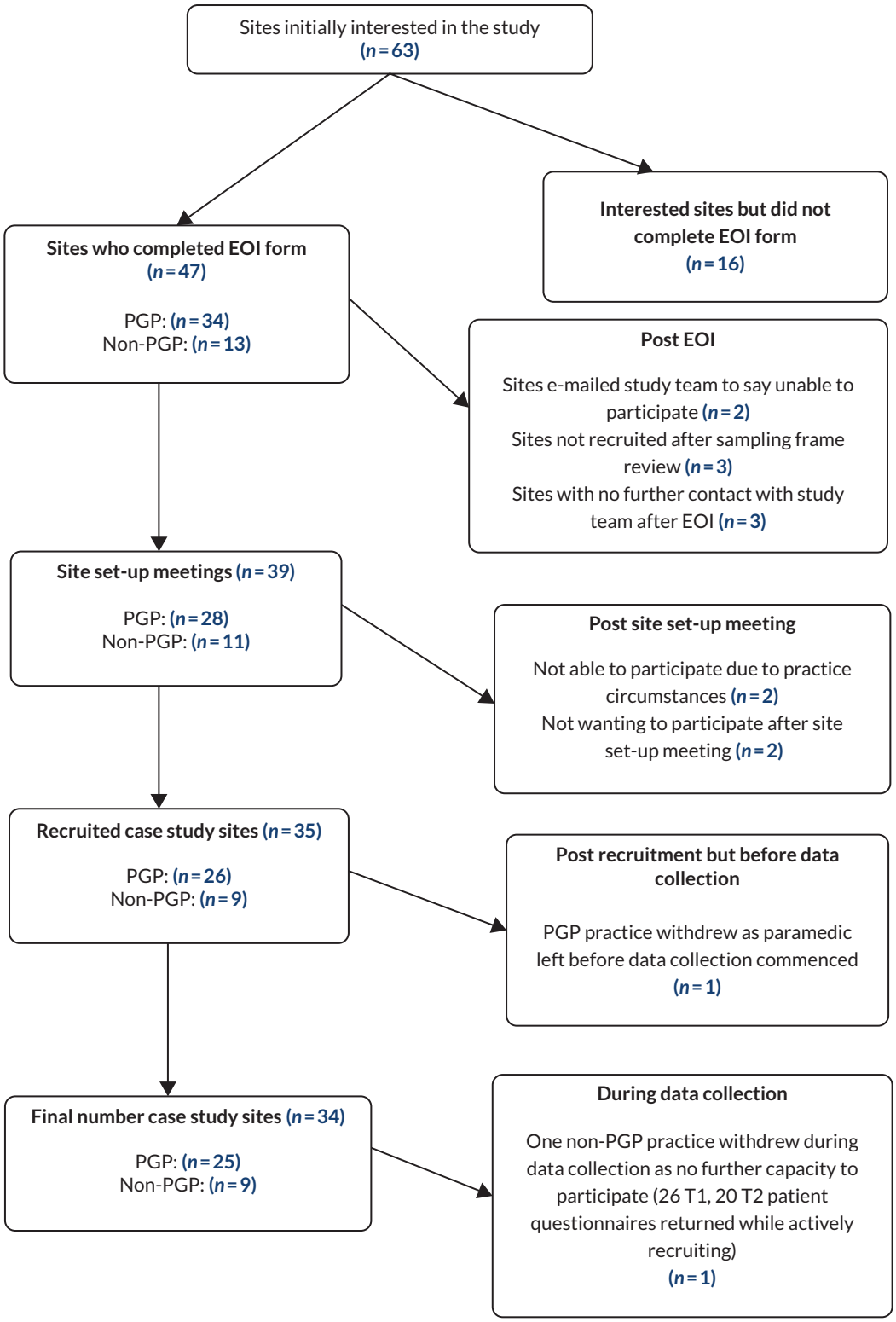

FIGURE 2 Case study sites recruitment flow diagram. EOI, expression of interest.

contacts (including consultation length), tests, medications and referrals during a 30-day period after the initial index appointment (care episode). A 30-day interval was selected to provide sufficient time to evaluate outcomes directly related to the care received at the index appointment (see *Chapter 6* for further detail).

Searches were developed and tested for both EMIS Web (EMIS Health, Leeds, UK; formerly Egton Medical Information Systems) and SystmOne (The Phoenix Partnership Ltd, Leeds, UK) platforms (see *Chapter 6* for further detail). To provide sufficient data for all aspects of the planned statistical analysis of the anonymised patient-level data, we invited additional non-detailed case study sites to undertake the data extraction in addition to their original research activities (see *Appendix 1*, Amendment 5 for more detail).

Procedure

Interview procedure

Patient participants indicated willingness to participate when completing prospective questionnaires (detailed below) or by contacting the study team directly using contact details displayed on posters or the flyers at the surgery. Potential participants were contacted by a member of the study team and provided with the participant information sheet (see *Report Supplementary Material 3*) electronically or by post. Informed consent was obtained before each interview took place, and a copy of the consent form was returned to the participant for their records. Interviews were offered to participants by telephone, by video call or face to face, and were recorded and transcribed verbatim.

General practice staff at case study sites were contacted via the primary site contact to see if they would be willing to take part in the study interview. Interested practice staff were sent a staff participant interview information sheet (see *Report Supplementary Material 3*) by post or electronically as preferred by the participant. Informed consent was obtained before the interview and confirmed before digital recording of the interview began. Interviews were offered by telephone or video call and were recorded and transcribed verbatim.

As a 'thank you' for the time spent on the interview, each patient and staff interviewee was offered a £10 voucher for their participation.

Interview data analysis

Interview analysis took place between July 2023 and March 2024. Interviews were read by all qualitative team members and coded primarily by NH using NVivo version 1.6 (NVivo – Lumivero; QSR International, Warrington, UK) and Microsoft Word 365 (Microsoft Corporation, Redmond, WA, USA). Coding followed realist principles, including multiple readings to focus on general themes emerging from the dialogue, to glean new theories, and test and refine specific CMOCs identified earlier in the research process.[22,55] The initial coding framework is included in *Report Supplementary Material 4*. Twenty per cent of interviews were second-coded by other team members (TG, GS, HS), with good agreement over key findings. These were discussed with reference to developing CMOCs and structuring of theory areas to ensure consistency of interpretation, with discrepancies shared as part of the analytical process.

The use of NVivo allowed demonstration of clear links between the interview data and codes, and these linked to memos (on NVivo and Word) to provide transparent documentation of theory refinement as the study progressed.[22,56] Once each interview was coded, the key findings and the provisional CMOCs were copied to a Word document along with the other interviews from the same site, enabling a collective view of the perspectives of a range of participants from each site. These were combined with the 'pen portraits' of each site that had been developed during the study set-up phase, the full document becoming a Site Summary. Site Summaries were classified and coded against key theory areas. The use of site classifications supported matrix comparisons of findings across sites, linked to interview evidence.

Monthly meetings with the qualitative team (SV, MB, CL, TG, GS, BS, HS, JJ) discussed themes and theory development as the interview process continued. These ensured regular review of emerging findings, with tailoring or adjustment of the interview schedules as required.

Coding was initially modelled on three main areas: the individual experience, the day-to-day activity of general practice, and the broader implications of paramedic activity for the practice and NHS. These were mapped using visual interactive software (Miro Board, https://miro.com) accessible to the qualitative analysis team, allowing visualisation of the links between various elements. The individual section focused on the acceptability of the paramedic role to patients, paramedics themselves, GPs and other staff. The practice activity considered the various functions that healthcare providers need to deliver to patients from the point of contact with the surgery, including: reception and care navigation processes; differing healthcare roles, such as triage, providing home visits, clinic assessments or prescriptions; and various clinical situations, such as patients with minor illnesses, complex needs, frailty, mental health, palliative care needs, or the specific health requirements of population groups, such as women or children. The broader implications included essential infrastructure, such as clinical supervision and training, teamwork and communications, and employment and funding arrangements.

Theory development was supported by meeting with the project PPIE group to discuss early findings, with a meeting in December 2022 to share and explore theories about the acceptability of the role. In addition, meetings took place in February, April and May 2023 involving members of the qualitative and quantitative analytical teams together to discuss theories as they evolved and ensure that data analysis remained focused on the key research questions. Qualitative findings allowed refinement of case classifications to guide the search for quantifiable evidence that could support or refute theories, while shared understanding of the potential and limitations of the quantitative data enabled the qualitative team to understand which theories might become informed by quantitative evidence.

Once the qualitative data set had been fully read and coded in April, the qualitative team met to organise the CMOCs, exploring a variety of frameworks to make best use of the findings to address the research question and deliver relevant guidance for practitioners, commissioners, and service users; these are presented in *Chapter 4*.

Questionnaire procedure

Practices were instructed that all eligible participants aged 16 years or over who had seen a paramedic (PGP case study sites) or GP (non-PGP case study sites) for a full consultation should be given a study pack and invited to take part in the study. The clinical consultation could be face to face in the surgery or at home, or by telephone or video link.

Each paper study pack contained the index questionnaire booklet with the consent form included, participant information sheet, study privacy notice, and reply-paid envelope. An electronic link was provided to give participants access to all the study documents online. Also included in the detailed case study site study pack was brief information about the qualitative interviews. Study team contact details were included so that participants could request further information or express interest in taking part in a study interview.

Participants were provided with a copy of their consent form to keep for their records; copies of completed consent forms then were stored securely with study documentation at the University of the West of England.

Participants were allocated a study ID; personal identifiable information was minimised to include only data required for the study, including contact details as necessary for participants who asked for support to complete the questionnaire by telephone and the administration of the follow-up questionnaire booklet (30 days after the participant's index appointment).

As a thank you for the time spent completing both questionnaire booklets, we offered each participant a £10 voucher. This was sent to each participant once we received their completed second questionnaire booklet.

We requested that at or within 24 hours of the index (initial) consultation, participants were either handed or posted the paper study pack or sent the electronic link. Participants could complete the pack on paper and return it by post using a reply-paid envelope, online (via a secure database), or by telephone with a member of the research staff according to their preference.

Reception and administrative staff at case study sites were provided with information to support their role in the study and the identification of eligible participants. If reception team staff were concerned about whether it was appropriate

to provide the initial study information to participants, the local site lead (a clinician, the study champion) was available to provide any support required. If participants required more information about any aspect of the study at any time, they were able to ask for further information by contacting the study team.

It was initially planned that eligible participants would be identified and approached by the practice reception or administrative staff teams and provided with written and verbal information about the study at the time of their initial appointment. During the early stages of the prospective patient data collection, it became clear from feedback received from the case study sites that pressures on reception and administrative staff were such that in some practices, the recruitment process as agreed with the sites at the site set-up meeting were not working. Thus, in consultation with practices and the Study Management Group, it was agreed that patient participants could also be handed the study pack or sent an electronic link to the study pack by the clinicians at the time of their appointment. To reduce the risk of selection bias, clinicians were instructed to provide study packs to all eligible patient participants whom they saw for a full consultation or episode of care.

The index questionnaire booklet assessed participant experience and outcome of the paramedic or GP consultation using the PCOQ,[48] PREOS-PC[49] (compact version)[50] and the EQ-5D-5L.[51] Thirty days after the participant's index consultation, participants were sent (by post or via electronic link) a follow-up questionnaire booklet. The follow-up questionnaires assessed participant experience and outcome of the paramedic or GP consultation using the PCOQ, PREOS-PC (compact version) and the EQ-5D-5L. In addition, the follow-up questionnaire booklet included a customised resource use questionnaire, based on the ModRUM Core Module[52] online platform or by post, to assess the use of NHS and social services, time off work/usual activities and informal care.

Questionnaire data management

Study data were collected and managed using REDCap electronic data capture tools hosted at the University of Bristol. REDCap (Research Electronic Data Capture) is a secure, web-based software platform designed to support data capture for research studies, providing (1) an intuitive interface for validated data capture; (2) audit trails for tracking data manipulation and export procedures; (3) automated export procedures for seamless data downloads to common statistical packages and (4) procedures for data integration and interoperability with external sources.[57,58]

Initial survey packs given to patients offered the options to complete online (via a QR code or link), by post using a prepaid return envelope, or by telephone by calling or e-mailing the study team. Follow-up packs were sent by the study team to the participant according to their indicated preference.

Online responses

Each site was allocated a unique QR code and online link. Participants using either would be directed to the consent form, participant information sheet, and privacy notice via the REDCap database. Once consented, they would be directed through the three baseline surveys.

New participant records were also recorded weekly on a Microsoft Excel® (Microsoft Corporation, Redmond, WA, USA) study tracker to facilitate other study tasks (reporting, Central Portfolio Management System uploads, tracking of when follow-ups were due).

Thirty days after baseline was recorded on REDCap, the study team e-mailed a link to the follow-up survey to the participant. If not received back, a follow-up e-mail was sent 1 week later. Due to staff capacity, not all participants received a follow-up e-mail after 1 week.

Postal responses

Paper surveys were received in the office and a member of the research team transferred all the data to REDCap and the contact details to the Excel study tracker. Thirty days after baseline was completed, a postal survey was sent to the participant with a return envelope, or if requested, a link to complete the survey online was e-mailed. Where postal replies were not received back after 2 weeks, a text message or e-mail was sent to remind the participant about the study. Again, due to staff capacity these follow-ups were not sent to all participants.

Telephone

On three occasions, participants requested to take part via the telephone. In these instances, a suitable time was arranged, and a member of the study team took verbal consent, read the surveys out and recorded the answers into a paper survey pack. The data were then entered into REDCap and contact details added onto the Excel study tracker. Follow-up surveys were completed using the method requested by the participant.

Data checking

To ensure the links given to each site were going to patients from that site, participants were asked to provide the name of their surgery in the survey pack to facilitate cross-checking. Records were checked before analysis to ensure data had been allocated to the correct site.

At the end of data collection, 20% of the postal surveys (baseline and follow-up) were checked by a member of the study team who had not been responsible for data entry. Surveys were selected at random, but ensuring there was a spread across all sites. Error rates were negligible.

Site enrolment

In total, 34 sites were enrolled into the study: 25 PGP and 9 non-PGP. Details of recruited sites according to English NIHR CRN can be found in *Report Supplementary Material 5*, along with the map showing the geographical spread of sites across England.

Site classification

Sites were classified according to the model of PGP that was provided. The decision about which factors to use for site classification was challenging. It was evident from previous work,[10] the rapid realist review described in *Chapter 2* and discussion among the study team and with stakeholders that the considerable variation in PGP services is linked to several inter-relating factors. Some of these relate to the 'form' in which the service is set up. For example, the employment model may vary according to whether paramedic staff are employed directly by a practice or are accessed through a PCN. Other factors that influence the form of the service are the skills and qualifications of the paramedic, supervision arrangements, the extent of interaction between paramedic staff and the wider team, and where they are physically located within buildings. All these factors are to some extent interdependent, and they also influence the 'function' that the paramedic staff fulfil. Function can be used to indicate the types of patient, condition or appointment modality that the paramedic is allocated. As part of the research process, a number of 'domains of variation' were identified and the extent to which these could be used to classify models was explored [see *Chapter 7*, *What different models of paramedics in general practice are in operation in England? (RQ1)* for further detail]. To capture the most important areas of variation, we opted to use 'integration' and 'patient complexity' to group models for the analysis. The classification of sites was undertaken by core study team members (MB, SV, NH, TG, BS, CL, GS) who had a close overview of site data and other evidence on which to base these decisions. A series of face-to-face meetings, online meetings and written correspondence between these individuals were undertaken and each site was discussed in detail. Where necessary, further direct enquiry with sites was used to clarify details that enabled sites falling between two categories to be classified definitively. Site classification was undertaken between 12 December 2022 and 20 January 2023; at this point in the study, the initial coding and analysis of qualitative data was complete and quantitative data analysis had not yet commenced.

Each site was classified in two ways:

1. level of integration of the paramedic with the general practice team
2. complexity of patients seen in the PGP service.

Integration

Using data from the rapid realist review and additional data gathered from direct enquiry with each site, three integration models were determined: high, medium and low.

Integration refers to the level to which the paramedic is integrated into the general practice team and routinely works alongside other team members. The level of integration was based on the 'form' of the PGP service and clinical integration (e.g. supervision), rather than paramedic subjective reports.

High integration

In this model, paramedics were working at a single practice or up to two surgeries in the same group. They were clinically integrated within the team, with practice staff providing their day-to-day supervision (e.g. Rose: one paramedic at two surgeries; Dahlia: one paramedic at one surgery).

Medium integration

In this model, paramedics were working across or between three or more surgeries/buildings, or the site employed multiple paramedics working across more than two and up to five sites with more than one team supporting their supervision arrangements and caseload management (e.g. Nettle: five paramedics working regularly across four surgeries in the same practice; Camellia: two paramedics working across five surgeries).

Low integration

In this model, paramedics worked across several sites (or different settings in the case of rotational schemes) and operated in a satellite approach, working at the case study site for a limited number of sessions each week (< 25% of WTE at that site) (e.g. Violet: one paramedic working across seven surgeries; Privet: two paramedics, each working at the site for 1 day a week and in other settings for the rest of the time).

Complexity

Using data from the rapid realist review and additional data gathered from direct enquiry with each site, three complexity models were determined: high, medium and low.

Complexity refers to the type of patient that the paramedics consult with. The level of complexity is to some extent determined by the skills and qualifications of the paramedic, but not definitively. For example, at some sites, paramedics with prescribing qualifications were limited to seeing same-day minor illness, while at other sites, paramedics without additional qualifications but with practical experience and/or a specialist interest in certain conditions were seeing the frail and multimorbid population. Complexity was based on the 'function' of the PGP service, and multiple data sources were used to arrive at the classification.

High complexity

Paramedics take responsibility for a medical episode, are largely autonomous and in some cases are seen by other staff as operating 'in the same way the GP does'. They may work with patients receiving palliative care, those with complex diabetes, asthma or frailty, or those with safeguarding concerns. The paramedics are often able to prescribe and there are few or no exclusions on the patients they are allocated (e.g. Fern: paramedic prescribes and completes care home rounds independently; Orchid: paramedic completes home visits, same-day clinics and hospital discharges. They prescribe, have no exclusions and are seen as a primary care clinician by the GP).

Medium complexity

Sites in this model employ paramedics with a mixed scope of practice. In some cases, they may have one paramedic who sees high-complexity patients and one who sees low-complexity patients, or the caseload for their paramedics might be mostly same-day urgent care but with some additional specialisation, such as mental health or dementia reviews (e.g. Tulip: paramedics have a mixed caseload but do not do home visits or other tasks seen as highly complex; Thyme: paramedic is a prescriber and sees a range of presentations but self-excludes those that they do not feel confident to manage).

Low complexity

In this model, paramedics are limited to telephone, triage, seeing minor illness or doing straightforward routine home visiting (e.g. Dahlia: paramedic has limited scope and mainly performs triage, does some home visits for acute needs; Saffron: only same-day urgent care and telephone triage).

Case study site characteristics

The 25 PGP sites enrolled into the study were each classified as low, medium or high, according to integration and complexity. They were also classified according to: (1) proportion of paramedics to GPs (low: ≤ 15%; medium: 15.1–24.9% and high: ≤ 25%) and maturity of the PGP service (low: < 12 months; medium: 12–35 months and high: ≥ 36 months). All 34 sites were described according to demographic characteristics. *Appendix 2* summarises each site.

Summary of changes to the protocol

Version 1 (20 September 2021)

Initial protocol

Version 2 (1 December 2021)

Updates applied following Research Ethics Committee review

Version 3 (1 February 2022)

Addition of participant 'thank you voucher' information in protocol sections: 7.3.1 and 7.3.2 (Ethics Amendment 01).

Version 4 (27 September 2022)

Addition of general practice staff and commissioner interview participants 'thank you' voucher information in sections: 7.3.1 and 7.3.2 (Ethics Amendment 04).

Version 5 (21 November 2022)

The changes were as follows: an additional 12 additional case study sites were invited to participate, to give a maximum of 36 case study sites; 8 additional study sites using EMIS were invited to conduct the anonymised data extraction. The study collection period was extended from 31 December 2022 until 28 February 2023. Further details on changes to the protocol can be found in *Appendix 1*.

Chapter 4 Qualitative results

Overview

Qualitative data were obtained from 11/25 PGP sites and 3/9 non-PGP sites. In PGP sites, interviews were conducted with patients and their carers, and with a variety of staff members; for interview topic guides, see *Report Supplementary Material 2*. In total, 64 interviews took place from practice sites with paramedics, with a mean duration of 34 minutes each. In addition, five interviews took place with staff from practices that did not employ paramedics. Details are shown in *Table 2*.

Within sites, paramedics were employed in various ways and funded at different levels. The sites are described in *Table 3*.

Summary of findings

This realist evaluation sought to explain the underlying mechanisms and contextual factors that influence the outcomes of PGP. Six domains were identified and considered in relation to what aspects of the role work, for whom, under what circumstances, and why.

1. *Access to services* How PGP affects the accessibility of healthcare services. It examines factors, such as reduced waiting times and increased availability of appointments.
2. *Safety* How PGP influences patient safety. For example, enhancing safety through improved access or risking safety through providing non-GP care.
3. *Effects on the workforce* How PGP affects the general practice team and the day-to-day delivery of care. It considers case mix, workload and interprofessional dynamics.
4. *Infrastructure* The additional support required by provider organisations to support and sustain a PGP workforce, including: induction, supervision, training and governance.
5. *Experience* How PGP influences the experience of patients and the workforce. For patients: satisfaction, perceived quality of care, communication and trust; for staff: job satisfaction, impacts on service provision and the wider NHS.
6. *Outcomes* The overall impact of PGP on health outcomes for patients, including hospital admissions, investigations, prescriptions and referrals.

The analysis was conducted on three levels (patient, staff/practice, and the wider NHS) within each of the six domains. Respondents are coded as patient (Pt), paramedic (PGP), practice manager (PM), GP, or advanced nurse practitioner (ANP).

The analysis of data according to these domains is described below and summarised using preliminary IPTs and interim context–mechanism–outcome statements which will be integrated with quantitative findings and *Chapter 7*.

Domain 1: access to services

One of the primary challenges in primary care is access, particularly to same-day appointments. One of the main drivers for the introduction of paramedics is to expand capacity and reduce the demand on GPs; the goal is to ensure that patients receive timely care and that primary care providers can effectively manage their workload.

The acceptability of a PGP service is contingent on several factors. Patients need to feel that their needs are met and that care is appropriate. Practitioners must be willing to embrace new models of care delivery and work collaboratively

TABLE 2 Participant interviews by site

Site	Patient	GP	Practice manager	Paramedic (PGP)	Other clinical staff (i.e. ANPs)	Other non-clinical staff (reception)	Site total	Average duration (minutes)
Interview participants – PGP sites								
Rose	2		1	1	1		5	37
Lavender	2	1	1	1	1		6	32
Tulip	4	1	1	1	1		8	32
Iris	2	1	1	1		1	6	32
Bluebell	2	1	1	1		1	6	32
Orchid	1	1	1	1		1	5	25
Dahlia	2	1	1	1		1	6	27
Marigold		1	1	3		1	6	41
Violet	1	1	1	1		1	5	27
Privet	2	1	1	1		1	6	31
Quince	2		1	1		1	5	29
Total	20	9	11	13	3	8	64	
Duration (avg. minutes)	20	29	32	56	31	18		31
Interview participants – non-PGP sites								
Primrose		1	1				2	30
Sunflower		1	1				2	18.5
Reed		1					1	16
Total		3	2				5	
Duration		21	24.5					23

TABLE 3 Scope of paramedic activity in general practice sites

Practice sites	Paramedic roles							Exclusions				Comments
	Minor illness	Phone triage	Urgent appts	Home visits	Palliative care	Prescribing[a]	Other	Babies/ children	Mental health	Gynae or maternity	Chronic/ palliative care	
Rose	X	X	X	X	X	X	Mental health, learning disability, frailty	X under 2 years	X	X	X	Scope defined by paramedic, not practice
Lavender	X	X	X	X			Share nursing home reviews, 6-month reviews and mental health/dementia reviews. GP perceives most value from triaging patients and home visits				X	Scope defined by paramedic, not practice
Tulip	X	X	X			X		X				Scope defined by paramedic, not practice
Iris	X		X			X		X under 2 years	X	X		
Bluebell	X	X	X	X			Safeguarding lead, veterans lead. PGP does same-day home visits, GP does weekly care home	X under 6 months			X	Paramedic works with 'lower level' patients, ANP next level up and GP with complex patients
Orchid	X		X	X		X	Hospital discharges follow-up					Broad remit, no specific exclusions but discrepancies between interviewees – paramedic and practice manager said no gynae, but receptionist said he saw children and gynae, but no palliative care. GP says he does do some palliative care
Dahlia	X	X	X	X			Practice emergency protocol and equipment.	X			X	Tricky issues re home visits, and judging best person to see 'acute on chronic' issues, as she doesn't do palliative care or prescribe

continued

TABLE 3 Scope of paramedic activity in general practice sites (*continued*)

Practice sites	Paramedic roles							Exclusions				Comments
	Minor illness	Phone triage	Urgent appts	Home visits	Palliative care	Prescribing[a]	Other	Babies/ children	Mental health	Gynae or maternity	Chronic/ palliative care	
Marigold	X	X	X	X		X	Frailty reviews	X		X	X	Home visiting and frailty service organised by the PCN, not the practice. Much of the acute demand in the surgery is done by ANPs
Violet	X		X	X		(Tr[a])						
Privet	X	X	X	X		(Tr[a])						
Quince	X	X	X	X		(Tr[a])		X		X	X	Paramedic says he does see mental health patients, practice manager says he doesn't, and receptionist says they do everything, doesn't mention the 'under 1s' or palliative care or mental health
Total	11	8	11	9	1	5		7	2	4	6	
Total (% of practices)	100	73	100	82	9	45		64	18	36	55	

a Tr, in training for prescribing certification.

with other healthcare providers. Effective communication, clear roles and responsibilities, and robust training programmes are crucial to ensuring patient and practitioner acceptance.

Initial programme theory 1: preliminary theory on 'access'

IF employing a paramedic as part of the practice team means that there are more appointments available for patients, THEN patients will find it acceptable to see the paramedic instead of the GP BECAUSE they know that they will at least be seen quickly.

This is supported from a variety of perspectives:

> *[G]enerally our patients are very happy to see a paramedic because they are being offered an appointment on the day. And for most of our patients that's kind of their main requirement . . .*
>
> *Privet, PM*

In sites without PGP, the decision not to employ a paramedic was explained by the lack of perceived problems with access for patients.

> *[I]f patients are wanting an appointment with us they can have one. So those kind of motivators, what we think is the reason why people take on paramedics, we don't have that.*
>
> *Primrose, PM (non-PGP)*

In addition to benefitting patients, improving access supported working conditions for staff:

> *[T]hat's 19 additional appointments that we never had before, and that's 38 in a week . . . that's a big chunk of additional appointments since he [paramedic] started with us in January.*
>
> *Quince, PM*

Some interviewees identified concerns about changes to general practice services, mainly with respect to potential disruption of existing relationships and continuity of care, if paramedics become a barrier to seeing a GP:

> *I would hate to think that in due course that we would be distant from seeing a GP, and the normal route if you like would be a filtering out . . . I would hate to think this is the thin end of the wedge. And that seeing a paramedic is what is going to be happening in two years' time.*
>
> *Iris, Pt1*

Initial programme theory 1b: preliminary theory on 'access' (RIVAL)

IF patients are routinely directed to see paramedics before their GPs, THEN they will find the introduction of paramedics unacceptable BECAUSE they perceive this as a barrier to access to GPs.

Based on evidence gathered during the rapid realist review and qualitative data gathered from interviews with participants from case study sites, an interim CMOC on patient access to services was developed.

Interim context–mechanism–outcome configuration 1: patient access to services

Context:

> *General practice is a major gateway into NHS health care for patients. Demand on primary care services is increasing, while the number of GPs is falling and recruiting new GPs is difficult.*

Mechanism:

> *Employment of paramedics provides additional appointment capacity, facilitating rapid access for patients to a primary care healthcare professional (new resource), which creates a sense of reassurance for patients (response) that they will receive necessary support when they ask for it.*

Outcome:

> *For patients, speedy access to health care for reassurance, treatment or onward referral, and the psychological benefits of knowing that you will be seen helps patients to view the paramedic service favourably, so patients find it acceptable to see a paramedic rather than a GP. For the practice, the availability of additional appointment capacity eases pressure on practice staff and allows delegation of tasks, allowing better use of their specialist skills. For the NHS generally, fewer GPs and more paramedics maintains patient access capacity while limiting workforce costs.*

This interim CMOC will be further developed in line with findings from the quantitative analysis reported in *Chapters 5 and 6* and the integration of data is reported in *Chapter 7*.

Domain 2: safety

Patient safety is fundamental for maximising positive outcomes while minimising adverse events. The NHS defines quality in health care based on effectiveness, patient experience and patient safety.[59] Adequate staffing, with appropriately trained personnel, is a crucial component of patient safety. Therefore, it is important to carefully consider the safety implications of deploying paramedics to improve access to general practice.

Initial programme theory 2: preliminary theory on patient safety

IF paramedics are employed by the practice team to see patients who would previously have been seen by a GP, THEN assurances about safe standards of care will be needed BECAUSE the role is new and unfamiliar, patients may feel vulnerable about taking unquantified risks about their health, and staff have a moral duty to protect patients from harm.

Many patients felt that paramedics were a safe pair of hands and improved access, as illustrated below:

> *[I]t's good to at least be seen at some point . . . I just wanna know if it's like critical or what, what to do next. I just need professional medical advice . . .*
>
> *Quince, Pt1*

The early detection of potentially dangerous diagnoses or situations is a key priority for patients. However, some patients were concerned about potential safety risks associated with being seen by a paramedic instead of a GP.

> *[I]f I feel that my condition is serious, then I will insist that I see a GP . . . The paramedics are alright within their limits, of course . . . Some of them feel no I can do this, and I can do that, but basically it's beyond them . . . safety has got to be the top thing.*
>
> *Tulip, Pt2*

Safety in acute care and emergencies

General practitioners and other practice staff value the expertise and skills of paramedics when it comes to managing emergency situations.

> *. . . anything that comes through the door that is a bit 'chest pain'-y, or a bit 'having fits'; really quite a poorly person . . . We don't have to get involved, which is quite nice. It goes straight to them [paramedics] and they are brilliant at that.*
>
> *Lavender, ANP*

Timely identification of patients with a serious condition is a key element of safe practice. The delivery of clear 'worsening advice' is important for community medicine. Paramedics are well-placed to deliver this aspect of care:

> *[B]eing a paramedic, I think being used to giving that worsening advice is fundamental really when doing telephone triage in primary care . . . over the phone talking to somebody, you can hear if someone's not well.*
>
> *Tulip, PGP*

Patients attending their GP surgery for same-day care are different from those who have called an emergency ambulance. Paramedics need to adjust their view of what constitutes a patient-defined 'urgent' need.

> *[N]ow I'm quite happy, seeing things and going, 'This can wait a couple of hours, I'll just call you later, once I've spoken to someone'. That was probably one of the hardest transitions I've had, is not seeing an emergency in every patient that I've seen.*
>
> *Privet, PGP*

Initial programme theory 3: preliminary theory on safety (acute care)

IF paramedics use their assessment skills and experience from their ambulance service training, THEN safety for patients with acute conditions will improve BECAUSE they can reliably identify those patients who are unwell, manage them with confidence, or deliver worsening advice to ensure early review.

Safe delivery of care

Several moderating factors were identified regarding the safe delivery of care: trust, the scope of practice and knowing your limits, communication and developing constructive working relationships. These factors play a crucial role in ensuring patient safety and require time, effort, and commitment from healthcare professionals (HCPs).

Trust

Building trust among HCPs, including paramedics, GPs, and other practice staff, was essential for effective collaboration and communication. Trust enabled open discussions, encouraged the sharing of information, and fostered a culture of safety.

> *I think it's based on trust as well. If you get to know certain GPs and they know that you're clinically competent then they're happy . . . part of the paramedics working in general practice is gaining trust and just building up relationships with different healthcare professionals, but GPs in particular.*
>
> *Marigold, PGP3*

Developing trust was more challenging if employment arrangements, such as rotational appointments, meant that there were fewer opportunities to develop relationships. This became a distraction from other duties and potentially reduced patient safety.

> *I think if we had a rotation it would take us time to get used to [paramedic] again, and that would again take more of our energy from seeing other patients.*
>
> *Dahlia, GP*

Initial programme theory 4: preliminary theory on rotational schemes

IF paramedics work on a rotational scheme or work across multiple sites THEN it will be more difficult for those practices to support them to work safely and effectively BECAUSE the lack of regular contact between the practice staff and the paramedic will reduce the awareness and confidence of GPs in the paramedic's roles and responsibilities.

Role understanding

Understanding the scope of practice was crucial for all HCPs involved in the delivery of care. This included paramedics recognising their own limits and knowing when to seek additional support or involve a GP. Adhering to professional boundaries and acknowledging the expertise of other team members contributed to safe care and avoided potential risks associated with exceeding one's capabilities.

> *[O]ne of the first things that really struck me about general practice, is the more you learn, the more you realise you don't really know a lot. So, the more I've learnt, actually, the more cautious it's made me, as a clinician.*
>
> *Lavender, PGP*

Communication

Effective communication and constructive working relationships were vital for safe care delivery. Clear and open communication between paramedics, GPs, and other staff members promoted shared understanding, facilitated the exchange of critical information, and helped prevent errors or misunderstandings. It was important to establish effective channels for communication and ensure that information is conveyed accurately and promptly. Constructive working relationships involved cultivating a supportive and respectful work environment where all team members felt comfortable expressing concerns, seeking advice, and collaborating effectively.

Initial programme theory 5: preliminary theory on trust, communication and teamwork

IF GPs and newly appointed paramedics have an adequate amount of time to build a relationship, develop communication pathways and gain clarity on scope of role THEN efficient teamwork and clear boundaries of practice evolve BECAUSE clinicians acquire mutual trust and respect.

Safety in chronic conditions

Chromic conditions are increasingly being managed in primary care rather than in secondary care. With multiple staff caring for a single patient, robust systems were needed to ensure that those with long-term conditions received the necessary monitoring, interventions and support.

> *[T]here's always been a debate about whether we need to try and split acute and chronic care in primary care, so all of the on-the-day stuff is done by one group and all of the chronic disease management is done by another, because what tends to happen is the acute care is prioritised over chronic care . . . all the routine chronic disease management roles get cancelled, because everyone is trying to manage with the on-the-day demand.*
>
> *Privet, GP*

Initial programme theory 6: preliminary theory on separation of acute and chronic care

IF pressures on the acute general practice workload are overwhelming the needs of those with complex or chronic care, THEN separating acute from chronic care provision should improve patient safety and outcomes BECAUSE patients with chronic conditions will get protected time and attention that they require for proactive preventative care and to develop long-term therapeutic relationships with their HCP.

However, if acute presentations are managed separately from chronic disease management, it may disrupt the continuity of care and the establishment of long-term therapeutic relationships between clinicians and patients, with unforeseen consequences for the quality and safety of patient care.

> *[A] problem that we're creating, medics, is that we need to make sure that we can operate in an environment where continuity is preserved when it is important. That's kind of the more complex stuff that requires continuity, and should definitely go to the GP . . . I suppose one of the questions about that is, that sort of 18-year continuity I have with people, has that built up by seeing them for the minor stuff as well? Would you lose that . . .*
>
> *Bluebell, GP*

Initial programme theory 7: preliminary theory on continuity of care

IF pressures on the acute general practice workload are overwhelming the needs of those with complex or chronic care, THEN separating acute from chronic care provision could harm patient safety and outcomes BECAUSE many patients with chronic or complex conditions may present with subtle signs of change, the significance of which may not be recognised and correctly managed by those who have not had the opportunity to develop trust, familiarity and continuity of care with the patients.

In some circumstances, increasing the numbers of different staff who encounter patients could improve patient safety by providing an additional perspective on patient management.

> *Workload I think yes it [employing a paramedic] has helped, but also because sometimes the allied health professionals with a fresh pair of eyes see things a bit differently, or also they are quite thorough.*
>
> *Reed, GP*

Initial programme theory 8: preliminary theory on additional clinical opinion

IF pressures on general practice mean that there is insufficient time and access for complex patients, THEN having additional support from paramedics can improve patient safety BECAUSE they can provide another informed clinical perspective on acute exacerbations of chronic illness that may help to optimise patient management.

Interim context–mechanism–outcome configuration 2: safety with improved access

Context:

> *Safe practice is a priority for patients, staff and the wider NHS. Rapid access can reduce delays for patients who need medical advice and support, but rapid access to health care should not be detrimental to safe care.*

Mechanism:

> *Paramedics can enhance patient safety by providing timely patient appointments, building on their experience of emergency management, rapid assessment and recognition of the ill patient (new resources). Other practice staff can enhance patient safety by providing support, guidance, and a constructive working environment while paramedics adapt to general practice. Close working relationships and mutual learning can support members of the practice to trust each other's clinical skills, abilities and judgement (response), and provide reassurance for patients about safe standards of care.*

Outcome:

> *Patients are seen sooner as a result of paramedics improving access, and safe standards of practice are maintained which improves the confidence of both patients and staff. For the NHS generally, safety implications of dividing the workload into acute care and chronic/complex care need further consideration.*

This interim CMOC will be further tested and developed in line with findings from the quantitative analysis reported in *Chapters 5 and 6* and the integration of data is reported in *Chapter 7*.

Domain 3: practice workforce

Initial programme theory 9: preliminary theory on workforce

IF many acute presentations are relatively straightforward to manage, THEN a paramedic could be the more sensible person to see them BECAUSE GPs are an expensive and rare resource, and their expertise is not required for all patients.

The importance of efficient use of resources was described by this GP:

> *[M]y argument is, okay, do you really need a GP who has been working for 15, 20 years, who has got huge experience, seeing a patient who has got an infected ingrown toenail or has got pharyngitis?*
>
> *Violet, GP*

Historically, general practice services have been led, and primarily delivered, by GPs. Additional staff, such as nurses have been present for many decades, but patients are still becoming accustomed to new and emerging roles, perceiving a hierarchy of expertise.

> *[I]n terms of skill sets I would go to the pharmacy, then paramedic, then GP and then consultant at the hospital.*
>
> *Iris, Pt1*

As the workforce evolves, practices are having to reconsider roles and responsibilities of different staff.

> *[W]e try to have a model where doctors diagnose and manage complexity, medication titration is done by the pharmacists, the nurses and the healthcare assistants monitor and the paramedics I guess are doing the acute on-the-day stuff.*
>
> *Privet, GP*

Paramedics fulfilled a variety of tasks, including: seeing patients who request same-day appointment, telephone triage, home visits, or reviewing patients in care homes or with learning disabilities. There was wide variation (both within and between sites) in additional skills and qualifications, such as the ability to prescribe (see *Table 3*).

There was a desire to make effective use of the available skill sets to meet the need of patients in the practice.

> *We've always said we don't employ paramedics because we can't get doctors, it's because the scope should be different, in terms of they can do something different . . . the more complex stuff that requires continuity should definitely go to the GP and that's why you have nurse practitioners, paramedics, nurses etc.*
>
> *Bluebell, GP*

To effectively implement this, each practice must adapt to their staff's specific skill sets. Paramedics' scope of practice is influenced by their prior training and experience, organisational policies, ongoing training, and individual interests. The scope may evolve and be determined by the paramedics themselves. Practices required systems to assign patients to suitable clinicians and adjust them as circumstances change. However, due to the diverse skills, capabilities, interests, and appointment availability, this was challenging.

> *Paramedics, as with any profession [this implies] they have the same competencies and skill sets and how good they are. As I said, one of ours is excellent and I'd probably happily train her up to do more and more and more whereas one of them I just think is a bit of a lost cause, and the other sits somewhere in the middle . . . But yes I think one of the paramedics could go on and do almost anything and one of them probably couldn't, so it's hugely variable.*
>
> *Marigold, GP*

Same-day care

The variable skills, interests and capabilities of paramedics made it difficult to generalise about how the paramedic role works best in general practice. All the general practices that employed paramedics used them to support same-day care, and this was generally felt to be an appropriate use of their skills by the other practice staff and the paramedics themselves. However, the boundaries between acute care and management of chronic disease could be blurred, leading to challenges with patient allocation.

> *[Y]ou can really see the knock-on effect on the duty doctor when one of them [paramedics] isn't there . . . it's taking that sort of more acute urgent stuff off that day-to-day workload of the GP . . . that potentially then can free up the GP for other bits and bobs . . . the more complex chronic disease stuff.*
>
> *Tulip, ANP*

Although delegating same-day workload can reduce demand on GPs, it also affects the case mix they see.

> *So, we triage in, maybe too effectively, in some ways, because then we get hideously complicated people with 18 comorbidities and 55 things gone wrong, and you've got 10 minutes . . . it does leave all the harder patients for us, but still the same amount of time.*
>
> *Lavender, GP*

Initial programme theory 10: preliminary theory on reducing same-day demand on general practitioners

IF pressures on general practice mean that there is insufficient time and access for complex patients, THEN having additional support from paramedics can improve patient safety BECAUSE they can provide another informed clinical perspective on acute exacerbations of chronic illness that may help to optimise patient management.

Initial programme theory 11: preliminary theory on reducing same-day demand on general practitioners (RIVAL)

IF all the patients with straightforward conditions are seen by paramedics rather than GPs, THEN the GP workload will change, potentially becoming heavier BECAUSE complex patients are more challenging.

Home visits

Overall, staff from 9 of the 11 PGP practices reported that paramedics did at least some home visits, but the proportion and nature of these varied widely.

Home visits involve considerable time and travel, absenting the GP from the surgery. Paramedics may be well placed to assist, particularly given their ambulance experience of working in the community.

> *If the duty doctor of the day had to do a home visit, then they could be out for quite a long period of time. So, they're [i.e. paramedics] brilliant at doing that sort of thing.*
>
> *Lavender, GP*

Deciding to send a paramedic to do home visits is more difficult when there are grey areas about patient need, as described in this example.

> *She [paramedic] does lots of home visits, which is good for the 'old person off legs', or the person with breathing difficulties. But not necessarily so helpful with things like palliative care, I think that's a big step for her to learn how to do palliative care . . . I guess it's when you get the acute on chronic, and you get a 'off legs when they are palliative care', if you see what I mean? . . . Does she go or does she not go, and is it useful to send her out? And then you might have to go out anyway . . . It would have been quicker if I had just gone to start with, but you don't know that at the start, because she hasn't been to assess it. So, nobody knows.*
>
> *Dahlia, GP*

Initial programme theory 12: preliminary theory on home visiting and time management

IF paramedics provide a home visiting service for the general practice, THEN time management could improve as patients may get more prompt visits, and the GP may have much more flexibility to deal with other work demands BECAUSE home visits are very time-consuming, and paramedics are already familiar with seeing and assessing patients in their own homes.

Initial programme theory 13: preliminary theory on home visiting and clinical skills

IF most of the patients who require home visits are frail or have complex needs, THEN they may not be suitable for home visiting by paramedics BECAUSE the paramedic skill set is about managing same-day problems, so the impact on the GP workload for complex patient management will not reduce.

Clinical triage

Patients must be directed to a member of the team who is able to meet their needs safely and efficiently. A failure to triage patients effectively resulted in potential duplication of effort for staff, safety risks if practitioners are working beyond their limits, confusion for patients, and increased resource use.

> *As a paramedic in a real-life situation you are making snap judgements quickly on the basis your clinical knowledge under high pressure. It's these kinds of things where paramedics may come into their own, it's that assessment thing.*
>
> *Primrose, PM*

In many cases, practices relied on receptionists or care navigators to make decisions about patient appointments despite their lack of clinical training. However, some practices used paramedics extensively to support clinical triage service. This decision-making could be demanding for staff.

> *[S]ince the pandemic, I've moved almost exclusively to a telephone triage role. So, in the mornings, I work with another paramedic practitioner and the duty doctor and we deal with all the triage calls, and that could be the full range of ages. Everything from a baby presenting with a rash, right through to a 90-year-old with a question about end-of-life care and everything in between. So, mental health, minor illness presentations . . .*
>
> *Lavender, PGP*

However, it was clear that practices needed to try different approaches to the challenges of patient allocation, as described below:

> *We keep trying different models, we keep trying to do things differently to see if anyway it helps. I mean some of our patients really don't like this triage, because for years, they've been used to phoning up and making an appointment with a doctor. You could argue you're double handling the patient, because they phone through to reception, then the doctor has to call them back, and then potentially they might then bring them in. So, you could argue you're generating more work, but I think we personally feel it is the only way that we can manage and prioritise patients that really do need to be seen face to face, or really do need appointments and it's not for things that actually could wait.*
>
> *Dahlia, PM*

Preliminary theory on clinical triage

IF patients who request an appointment are clinically triaged by paramedics, THEN they will be seen by an appropriate clinician BECAUSE the paramedics will have an understanding of the patient's problem and their colleagues' skills and can work efficiently to reduce duplication of time and effort by both patient and general practice staff.

Prescribing

In five of the sites, some paramedics had obtained non-medical prescribing (NMP) qualifications, which enabled them to independently generate prescriptions for patients without escalating to the GP. Many paramedics entering general practice were keen to complete the NMP course, and practices with multiple paramedics in their teams often had a mixture of prescribing arrangements. Paramedics who were undertaking NMP training sometimes identified an appropriate medication and dosage for patients they had seen, seeking light-touch confirmation from the supervising GP who then issued the prescription. In practices where there were no qualified non-medical prescribers, all prescriptions were generated by GPs. This added a dynamic element to the prescribing patterns within the practices. This variety of prescribing patterns made it difficult to evaluate the impact of paramedics on observable prescribing patterns.

Paramedics with NMP qualifications were seen as a valuable resource by practice staff to streamline the patient experience and reduce duplication of effort and GP time.

> *[W]hen he [paramedic] sees a patient, he's now able to prescribe most medications quite competently, but he's audited once a month from a GP perspective to make sure that he is prescribing safely. It just means that the patient journey is much streamlined . . . it saves GP time as well, and it actually is a better experience I think for the patient.*
>
> *Orchid, PM*

There were some caveats and concerns about the relevance and safety of paramedic prescribing practices.

> *They do 'prescribing' but none of ours are actually non-medical prescribers. They generate that prescription, and then that prescription is actually signed by a GP . . . I think there are implications. I think the role would be really enhanced with having that prescribing knowledge, because most minor ills do require prescribing . . . they are not that up to date on the latest antibiotics for [urinary tract infections]. I often see they are prescribing trimethoprim when probably they should be prescribing nitrofurantoin. So, yeah I think it would be a really big bonus if they all come out with that course . . . because they wouldn't need to have such a long face-to-face meeting at the end of each surgery. So, it would help, it would save GP time.*
>
> *Lavender, ANP*

Initial programme theory 14: preliminary theory on prescribing

IF paramedics are trained to prescribe THEN treatment for patients will be streamlined and workload reduced for GPs, BECAUSE paramedics can see a patient and 'complete the task' in a time-efficient manner, independently.

Adapting to change

The introduction of new roles and redistribution of work in response to the demand for rapid-access appointments, home visits, and prescriptions requires changes in teamworking, collaboration, delegation, and adapting to new ways

of working. While many practices recognised the need for these changes in the absence of sufficient GP recruitment, it was evident that implementing such changes can be challenging.

> *I think the [paramedic] roles are a great addition, but I think for primary care, the most important thing is having that realisation that you need to give a lot of time initially to recoup it later. If you train people properly, you can offload your work. However, it's not just about offloading work, [but instead] thinking about the consequences of that and how can you design your primary care system, [so] that you are not just killing your GPs by giving them complex work without altering the sessions and the day, which is much more complicated and difficult to do.*
>
> *Violet, GP*

In some cases, adapting to the change included psychological adjustments which proved too challenging, and the introduction of paramedic roles was less successful.

> *[I]t didn't really work, partly because one of the doctors in our practice I think was fairly newly qualified and felt quite threatened by non-doctors doing what was traditionally seen as a doctor's role.*
>
> *Privet, GP*

Initial programme theory 15: preliminary theory on adapting to change

IF practices are struggling with workload demands but can adopt an open and flexible approach to new models of care, THEN accepting new HCPs and clinical roles is more likely to be successful BECAUSE the GPs will have the reassurance and confidence to delegate care to other HCPs within safe and practical limits.

> *[I]t enables us to have more appointments, but the trade-off is that the vast majority of, not just paramedics but a lot of ARRS roles, they don't do all the background work that a GP has to do . . . So yes they [paramedics] absolutely add value in respect of they help them with our access but I do think there is still quite a lot of work that then comes back to the GPs that they're just not able to do.*
>
> *Marigold, PM*

Broader impacts of workforce changes

Paramedics in general practice have long-term consequences that impact the broader NHS, particularly in terms of recruitment and retention of GPs, the impact on ambulance services, and the future shape of general practice. Ongoing issues around managing patient demand and sustaining the GP workforce are not likely to be resolved quickly, and potential solutions were welcomed.

> *Obviously, there are a few things that they can't do, or that they leave to us GPs. So, if someone said to me, 'Would you like another GP or a paramedic?' I would probably say, 'I'd like a new GP', because they can then do everything, as it were. But if someone said, 'You can have another paramedic, instead of anyone else, other than a GP', then I would definitely jump at the chance to have another paramedic. They are really good.*
>
> *Lavender, GP*

However, there was a risk that moving paramedics into general practice would compromise the ambulance service workforce, another part of the NHS facing significant workload challenges. While the introduction of new roles into general practice is part of current NHS policy and funded through the ARRS scheme, repercussions from this were noted in many practices.

> *[O]ur clinical director quite rightly says if we recruit six paramedics between the six practices, that's six fewer at the ambulance service.*
>
> *Primrose, PM*

Interim context–mechanism–outcome configuration 3: workforce adaptation

Context:

> *The introduction of new staff into an existing workforce disrupts previous patterns of service delivery.*

Mechanism:

> *Consideration of the range of skills and efficient use of skill set, the provision of a diverse range of services appropriate to patient need, and a positive mindset that will adapt to change (resources) can facilitate reconfiguration to develop new working patterns within the team (response).*

Outcome:

> *Reshaped workload maximises efficient use of skills while ensuring safe delivery of care.*

Domain 4: infrastructure

Workforce reconfiguration required adjustments to working practices to support staff in new roles and to inform the public of change. This infrastructure includes the provision of information for patients to explain new roles; arrangements to support, develop and accommodate new staff; and the requisite managerial and governance support. Staff needed to review how they worked together and adjust to new dynamics between individuals, routes of communication, and functioning as a team.

Initial programme theory 16: preliminary theory on infrastructure

IF the workforce is to be reconfigured in order to meet the challenges of safe, rapid access to general practice by introducing new groups of professional staff, THEN practices will need to adapt existing models of care and include resources for clinical and managerial support BECAUSE this will improve staff retention, safe and efficient practice, and confidence in new ways of working.

Information for patients and staff

Clear and comprehensive information for patients about new roles in general practice was needed. This included explaining the responsibilities, capabilities, and qualifications of paramedics and other non-GP staff members. If a practice employed staff from a variety of professional disciplines (GPs, paramedics, ANPs, physiotherapists, mental health specialists, pharmacists and others), patients benefited because there was a mixture of skills available to them. Effective communication about these roles helps manage patient expectations, addresses potential concerns, and ensures that patients feel comfortable and informed about the changes in their healthcare team.

> *I don't actually know like what a paramedic qualification is like compared to what a GP is trained in . . . It would be good for it to be shared what the different, like what a paramedic's role might be in a GP surgery compared to a GP and when you might expect to see a paramedic so that you kind of know what to expect.*
>
> *Violet, Pt1*

In addition to providing information for patients, the reshaped workforce needs relevant information about new roles to ensure that staff can work effectively as a team and have the necessary support to work together efficiently.

Induction and supervision for new staff

Paramedics needed appropriate training, mentorship and supervision to ensure they had the necessary skills, knowledge, and confidence to fulfil their roles effectively. Although paramedics were seen to be a good fit for general practice, there are significant differences between working in general practice and for an emergency care service. Many paramedics commented on the steep learning curve when transitioning into primary care and needed support adjusting to new clinical challenges and working with less familiar team structures. It was a highly variable process, depending on the needs of individuals, local circumstances, and relevant policy.

> *We've got quite a good general onboarding process . . . I think the main feedback from them was literally, oh my God, this learning curve is absolutely huge, because they've come from the ambulances and how they work is completely different.*
>
> *Lavender, PM*

> *[I]t were like looking up Mount Everest when I started here . . . at the beginning they didn't know what they were going to do with me. I didn't really know what I was supposed to be doing really in respects to who I see, and when I see . . . as a paramedic you can adapt to anything, so that's the good thing. But I think if anybody was thinking to come into paramedic practice, the thing for me would be – the practice have to be supportive, they have to be.*
>
> *Orchid, PGP*

Comprehensive induction programmes were needed, regardless of whether the paramedics were employed by the practice, PCN or in a rotational role. Co-ordination between the PCN and individual practices would ensure a consistent and effective induction process, including sharing best practice, standardising training and induction materials, and aligning expectations across different practice sites. There was a need for regular communication and collaboration between the PCN and practices to address challenges and complexities in the induction process, particularly for paramedics working across multiple sites.

> *[W]e were doing year rotations . . . it just felt like a lot of effort to then start the process again with somebody new . . . basically having to start again with people who are only in, every other week, essentially . . . we didn't know what they could do and what they couldn't do really.*
>
> *Rose, PM*

Initial programme theory 17: preliminary theory on content of induction programmes

IF paramedics move into general practice from backgrounds in emergency care, THEN they will require appropriate induction to the role BECAUSE they need to learn new ways of thinking and working in general practice, and other practice staff need to become familiar with the role and responsibilities that the paramedics will take on.

Induction and supervision: impact on practices

A comprehensive and tailored induction programme was important. Regular review of the scope of the paramedic role and the time allocated for delivering care helped ensure that workload expectations were realistic and aligned with the paramedics' capabilities. Adapting and flexing the practical arrangements to suit the demands and expectations of both paramedics and the practice was important for successful integration and job satisfaction.

There was no uniform way to do this, nor consistent expectation of the duration of an induction process for new staff. Practice managers reflected that it was important to include existing members of staff (such as receptionists) closely in induction programmes to facilitate this process for paramedics.

> *Well, we are working very closely with the paramedics, working really closely looking at their skill set, what they are comfortable with.*
>
> *Iris, PM*

> *We blocked half her appointments. So, she had 30-minute appointment times in a day rather than the 15 minutes, so she was less under pressure.*
>
> *Tulip, PGP*

Initial programme theory 18: overarching theory on flexibility in induction programmes

If paramedics enter general practice with a variety of backgrounds and training, THEN they will need flexible induction programmes with plenty of time and support BECAUSE each paramedic brings individual skills, interests and experience and will need to adjust to new working practices at their own rate.

Supervision

Ongoing supervision helped ensure that clinical practice was delivered to a safe standard and support was provided by experienced colleagues. Supervision was discussed by staff in all PGP sites.

> *[I have] daily supervision, daily case-based discussions and then regular monthly supervision meetings as well.*
>
> *Lavender, PGP*

> *I think if I'm honest, I think that the doctors thought they [paramedics] might be more help straight away . . . I think you always underestimate the time and commitment for anybody coming, that requires training and support takes.*
>
> *Dahlia, PM*

Induction and supervision required investment from other staff, which incurs hidden costs. Providing induction and supervision for new staff became even more complicated when paramedics were involved with multiple practices.

> *[T]he whole thing though relies on a supervisor to sign you off. Now, there's no funding for the supervision whatsoever, that very much just falls upon the practice.*
>
> *Bluebell, PGP*

> *We're a big practice don't get me wrong, and we felt it was right to have someone covering all those roles because all in all if you add all those roles together they are seeing more than the 12–14 patients a GP would see in a clinic, and they all need supervision more or less.*
>
> *Marigold, GP*

Initial programme theory 19: preliminary theory on induction and general practitioner workload

If paramedics join a general practice and take on the simpler cases, and GP time is needed to train them to take on the workload THEN GPs' time will be squeezed and they will become overloaded BECAUSE paramedics will leave the GPs with complex cases, and induction and supervision demands, which consume even more time.

Integration and teamwork

Workspaces and activity play a significant role in facilitating teamwork and integration. These include physical workspace arrangements, equipment availability, and efficient workflows that support collaboration and communication among team members. Psychological aspects also come into play as new relationships evolve within the team. Building trust, mutual respect, and effective communication channels is essential for establishing positive working relationships among team members. Successful integration was beneficial for all team members. Embedding paramedics effectively into the team could lead to improved work satisfaction, because team members felt supported, valued, and empowered in their respective roles.

> *[I]n terms of feeling integrated into the team and stuff like that, if you don't know where your room's going to be each day then it's potentially quite unsettling.*
>
> *Tulip, ANP*

> *[T]hey're really integrated, so, they are always at our practice meetings, so, on Mondays, they're always there. . . . they're just like the GPs, just like the nurses and the reception team . . .*
>
> *Lavender, GP*

Under some circumstances, there was less integration of paramedics.

> *[T]hey are very much a part of the practice, but their role isn't part of the running of the practice I would say . . . because they are employed by the PCN. And I think the fact that each of them is only here for one day a week, it means that weeks flash by since we last saw them.*
>
> *Privet, PM*

Although practical aspects such as office space, joint meetings and informal opportunities for personal interactions are important, a more fundamental understanding of roles and responsibilities also contributes to the processes of teamwork and embedding staff.

> *[I]t's building that relationship isn't it, and I think that requires us to approach it as paramedics and look at the GPs and say, well, we're asking them to let us make decisions about their patients, and they might feel quite strongly about that.*
>
> *Lavender, PGP*

> *We directly employ [our paramedics]. PCN-employed staff really miss out on the benefit of having their own team. Your workplace is like your second family, you spend enough time at your work . . .*
>
> *Orchid, GP*

Initial programme theory 20: preliminary theory on integration and teamwork

IF paramedics are to join general practices, THEN they will require physical accommodation (office space) and opportunities to attend meetings and integrate with the team BECAUSE this will foster an atmosphere of trust among colleagues and lead to better integration with the wider team, and safer practice more generally.

Impact of variable funding models, managerial structures and governance

Paramedics have been supported to join general practice through national funding from the ARRS scheme. This has been distributed through PCNs, with many paramedics employed either via one or more PCNs, or on a rotational model with ambulance services. In addition, some practices employ their paramedics directly, using their own terms and conditions. This variety of employment models results in a mixed picture of pay, banding, management and governance. In many cases, arrangements were unsatisfactory from the perspective of either the employer or the employee, and a variety of 'coping mechanisms or work-arounds' were used.

> *If you simply want someone to go and visit a patient and come back. Yes, the PCN can employ it. If you want a person to thrive and enjoy the job and take it to their absolute maximum potential, I will always employ that person and give them the best we can.*
>
> *Orchid, GP*

> *I think the difficulty that we found with her being employed by us . . . what team is she in, so is she part of the emergency team, is she part of the nursing team, is she part of the non-medical clinicians team? . . . So, quite a lot of sort of stuff I don't think had occurred to us before we actually employed her.*
>
> *Dahlia, GP*

There are important elements of managerial policy and governance that need to work efficiently to enable maximum benefit for both the workforce and the employing organisation. In many cases, the contractual arrangements and oversight of paramedics employed by the PCN and paid via ARRS funding created challenges in the workplace that had practical consequences for the delivery of the paramedic role.

> *[T]hey'd be arranging annual leave with the PCN and the MESSAGE doesn't always come through . . . and when they're poorly they might ring into their manager but they won't necessarily think to ring us.*
>
> *Sunflower, PM*

Initial programme theory 21: preliminary theory on employment models and governance

IF paramedics are employed, funded and managed by organisations outside the general practice, THEN they may not identify with the practice team with resulting negative impacts on efficient communication and delivery of care BECAUSE the employment issues accentuate difficulties integrating efficiently and effectively with the general practice team.

Paramedic training and professional development

An important element of infrastructure is staff development. Concerns were expressed by some staff in general practice about the extent to which available training opportunities were appropriate for the needs of general practice, and the specific needs of paramedics entering general practice. Many felt that personal attributes of paramedics themselves were at least as important as accredited training but acknowledged that some form of assessed training standard was necessary in order to protect and reassure patients and the practice about the standards of quality and safety of care provided.

> *[U]ltimately it comes down to one thing, their attitude towards helping other people. I don't really care if they have Master's, and I mean it as glibly as it sounds.*
>
> *Orchid, GP*

Despite these concerns about the limitations of current training models involving academic accreditation, there was recognition of the value of standardised levels of care.

> *I think it's important to have standardisation, it doesn't necessarily mean that having a Master's degree or being a graduate makes you a better paramedic, but I think there has to be a standard, there has to be adequate training. I think it helps certainly to have clinical examination diagnostic skills because that's what helps you to become more autonomous . . .*
>
> *Marigold, PGP 1*

Initial programme theory 22: preliminary theory on paramedic training

IF there is no investment or plan for paramedic training that addresses the needs of those working in general practice THEN it will be difficult to meet the needs of the practice, the patients, or the NHS more broadly BECAUSE working in general practice is different for paramedics, and they need appropriate support to contribute to the role effectively and safely.

Bringing these together leads to a provisional overarching theory about workforce change and the necessary infrastructure to support this process:

Interim context–mechanism–outcome configuration 4: reconfiguration of infrastructure

Context:

> *The introduction of new staff into an existing workforce disrupts previous patterns of service delivery.*

Mechanism:

> *Consideration of the range of skills and efficient use of skill set, the provision of a diverse range of services appropriate to patient need, and a positive mindset that will adapt to change (resources) can facilitate reconfiguration to develop new working patterns within the team (response). This requires an investment of time and resources to provide delivery of induction programmes for new staff, ongoing supervision, clarity around managerial lines of communication, disciplinary and governance issues, and consideration of wider systems effects (resources) to support new staff in post and help existing staff and systems to adjust to new working arrangements (response).*

Outcome:

> *Reshaped workload maximises efficient use of skills and can lead to improved staff retention while ensuring safe delivery of care. Costs of infrastructure (time and money) have not been quantified but should be addressed when assessing cost-effectiveness outcomes of the introduction of paramedics into general practice.*

Domains 5 and 6: patient and professional experience and clinical outcomes

Providing a good patient experience is a fundamental goal in health care and an integral component of healthcare quality. Patient experience encompasses respectful and responsive approaches to individual patient preferences, needs, and values. This includes effective communication, clear access to information, and timely access to healthcare support.

A good patient experience is positively associated with self-rated and objectively measured health outcomes, adherence to medication, preventative care and self-care, and a reduction in resource use and adverse events.[60] When patients have a good experience of care, they are more likely to actively participate in their own health care, follow treatment plans, and have better overall health outcomes.

Initial programme theories 23 and 24: preliminary theories on experience of receiving or providing care

IF paramedics working in general practice improve the patient experience by supporting quick access to healthcare advice THEN patients will have an improved experience of care BECAUSE it reduces the time during which they

feel anxious and vulnerable, replacing it with feelings of safety and reassurance, and improves motivation to follow healthcare advice.

IF staff working in general practice enjoy the experience of work THEN staff will be more productive and efficient BECAUSE communication, collaboration and teamwork will support a positive feedback loop encouraging staff motivation, retention and development.

Patients expressed a desire to be taken seriously, to have their concerns respected, to be given adequate time, and to feel confident that they were in safe hands. While in the past patients had traditionally expected to see a GP, most adjusted their previous expectations about paramedics being primarily emergency clinicians and accepted their broader role within primary care. Some sites had employed paramedics for many years, while for others this was a new service development. Even if the practice had employed a paramedic for some time, rotational models of employment, part-time working patterns and staff turnover meant that many patients did not see the same clinician twice, leading to concerns about continuity of care. Some patients reported having no choice about seeing a paramedic, while others were happy to see them as timely access to a HCP opinion was the overriding concern.

Patient acceptability of seeing a paramedic

In many cases, the patient experience was determined largely by the personal characteristics of the paramedic who attended them. Patients valued professionalism, honesty, efficiency and friendliness.

> *She was friendly, like seemed to have time for us, sort of gave him a full check over and just seemed to know what she was talking about . . . She was helpful, she seemed to kind of care, gave [son] a full check over and gave good advice.*
>
> *Violet, Pt1*

> *They were clearly listening and noting . . . I felt they were really engaging with me.*
>
> *Lavender, Pt2*

From the patients' perspectives, seeing a paramedic was often a pleasant experience. This was also related to the booking structures of paramedic clinics:

> *When I see a GP I am aware of that pressure . . . it feels like clock watching.*
>
> *Tulip, Pt3*

> *I've had a lot of patients that said, I'll come and see you in future, because you listen to me . . . so obviously I have a bit longer, so I can listen to them a bit more, and help.*
>
> *Quince, PGP*

The communication skills of paramedics were valued as part of the patient experience:

> *I think the approachability is different. It's on a different level. Paramedics notoriously, or whichever way you want to look at it, are good at walking into anybody's house no matter where they are and changing, they're like chameleons for communication. You know exactly, you have to, you know your audience basically.*
>
> *Iris, PGP*

Manging patient expectations

Patient experience was influenced by some degree of misunderstanding by the public about what a paramedic does, and who they were seeing, which led to some resistance from patients about accepting a paramedic appointment as an alternative to seeing a GP.

> *[W]ould I see a paramedic again? Yes, I would see a paramedic again, at the end of the day, I don't have any choice . . . I don't have any choice, because my surgery tells me I need to see a paramedic before I see a doctor . . . it gives you, it's not a lot of choice, it's a loss of control and actually, I'm the customer, I'm the patient, I'm, I think for some people, it possibly could be a frustrating experience.*
>
> *Rose, Pt1*

Some clinical circumstances influenced the acceptability of seeing a paramedic, the most common being diagnostic uncertainty, internal examinations, or psychological or mental health concerns. Other barriers included a public lack of confidence in paramedic abilities, and concerns about disrupting existing opportunities to develop relationships between patients and their doctors. These extended into longer-term concerns about the implications of the introduction of paramedics to general practice.

> *I wouldn't like the paramedic service, or the paramedic aspect of the practice, to develop to such an extent that I was developing a relationship with a paramedic rather than with my GP . . . they always try and ensure that you see your GP so there is that developing relationship over time. I wouldn't like paramedics to be in the way of that.*
>
> *Tulip, Pt4*

This concern was countered by reflections from professionals about how to readjust patient expectations and provide reassurance about PGP:

> *I just think that they [patients] should know who they've seen but also know that it doesn't have to be a doctor. You can have brilliant advice and care from someone who's not a doctor . . . I think that message needs to get out there.*
>
> *Iris, GP*

Interim context–mechanism–outcome configuration 5.1: patient acceptability of seeing a paramedic

Context:

> *Patients in primary care do not just have acute problems; they also have medical, psychological and social histories, and unmet needs, concerns and expectations. There is little time in a standard GP appointment to cover all the background detail, though this is offset by the value of continuity of care with a member of staff who already knows the patient and their circumstances.*

Mechanism:

> *Longer appointment times for paramedics, good communication skills, access to patient notes, and being calm under pressure (resources) ensure that the paramedic can become well informed and sensitive to the particular situation and needs of the patient and can deal more effectively with their concerns, providing reassurance (response).*

Outcome:

> *Patient feels that seeing someone who is not their GP is an acceptable alternative to GP care because they feel they have been listened to, respected and understood, and will be happy to see the paramedic again, developing a trusting relationship over time. Ultimately this will lead to familiarity and acceptance of referral to a paramedic in general practice.*

Interim context–mechanism–outcome configuration 5.2: patient acceptability of seeing a paramedic (RIVAL)

Context:

> *Patients have preconceived ideas about the role of a GP and do not understand the role and capabilities of a paramedic within the general practice team.*

Mechanism:

> *Patients may doubt the capability or appropriateness of seeing a paramedic for certain conditions, or feel that seeing a paramedic will impair continuity of care.*

Outcome:

> *Patients dissatisfied with seeing a paramedic as their expectations of general practice care are not being met.*

Staff experiences and expectations

The experience of staff can affect how care is delivered, which will in turn affect experiences for patients. Positive experiences for staff can also enhance staff retention, productivity, teamwork and safety.

In many cases, personal preferences directed the decisions of paramedics to move into general practice.

> *I joined here because I wanted to be an advanced practitioner, run my own clinic, I really enjoy seeing my own load of patients and having my own like workload.*
>
> *Rose, PGP*

> *I don't want to work on an ambulance three days a week, through the night, carrying people up and down stairs. I'm nearly 50, I don't want to do that any more.*
>
> *Iris, PGP*

However, some adjustment is required to adapt to working in general practice.

> *You lose the drama element. Anybody that works on an ambulance loves a bit of drama otherwise they wouldn't work on the ambulance . . . [general practice is] relentless because it never stops until the end of the day, it's not mundane, that's a really horrible way of describing it, but it's not all bells and whistles and sirens, if that makes sense.*
>
> *Iris, PGP*

The improved job satisfaction and enjoyment in the role was also reflected by other staff, with recognition that the character of the paramedic made a difference to the success of the role and experience within the practice as a whole.

> *[T]hey're just an integral part of the team now . . . they make life so much easier, they make the job much more enjoyable and more bearable to be honest. So, yes, they are more than just the eyes and ears, they are everything really.*
>
> *Lavender, GP*

Interim context–mechanism–outcome configuration 5.3: staff experience

Context:

> *Paramedics and other healthcare staff find that what they need from their work roles changes over time as their careers evolve and life circumstances change.*

Mechanism:

> *The introduction of paramedics into general practice settings allows paramedics to develop new roles, with rewards including continuity of care and a sense of job satisfaction, and can support unsustainable workloads for GPs.*

Outcome:

> *Improved work–life balance for staff, leading to improved motivation and staff retention within the NHS workforce. A more resilient workforce could deliver an improved patient experience and enhance the quality of patient care.*

Bringing these together leads to a provisional theory about how improving access to general practice support by incorporating paramedics into general practice teams can affect the experience and outcomes of care.

Interim context–mechanism–outcome configuration 5.4: paramedic contribution

Context:

> *Patients value a good experience of care, but also need to be reassured of good clinical outcomes. The NHS is a resource-limited service with a moral imperative to provide value for money, efficient use of time and resources, and high standards of clinical care to the population.*

Mechanism:

> *Paramedics working in general practice can provide timely access, key clinical skills, time, and communication skills (resources) but these come with unknown risks to patient safety, clinical or practice efficiency, and cost-effectiveness of health care. If successful, the introduction of paramedics can facilitate more efficient use of existing skill sets within existing resources.*

Outcome:

> *Improved access and quality of general practice services in the NHS.*

Summary

Improving access to appointments in general practice is a key priority for patients, staff and the wider NHS. The findings from this qualitative study support the theory that paramedics improve access, particularly to same-day care, and that this is largely acceptable for patients and for staff. Patient concerns about safety are primarily due to problems with access; therefore, paramedics are viewed as contributing to safe care.

It is essential that new paramedics, or new PGP services, have a sufficient 'bedding-in' period. Paramedics need to complete bespoke induction and relevant training. Longer appointment slots and regular supervision are important during this process. Furthermore, the bedding-in period is important for the paramedic to become integrated with the team. During this time, effective communication and collaboration between the paramedic and all other members of the team can result in trusting relationships and a shared understanding of the paramedic's skills and capabilities. This leads to efficient teamworking and improved job satisfaction. The skills, capabilities and added value of the paramedic need to be clearly and consistently communicated to patients to manage expectations and to enhance acceptability and confidence in the role.

This chapter highlights challenges and benefits related to the role of PGP, derived from qualitative data. The theory domains, and supporting evidence, are reviewed alongside findings from the quantitative analysis in *Chapter 7* of this report.

Chapter 5 Prospective cohort study examining patient safety, outcomes and costs following paramedic-led and general practitioner-led episodes of care

Aims and research questions

This element of the project looked at the role of PGP in achieving good clinical outcomes, providing safe patient care, and improving patient experience. The prospective study, therefore, is aimed at answering the following research questions:

1. How does PGP care impact on patient-reported outcomes (e.g. concern, confidence in health plan, ability to manage symptoms, HRQoL) compared to non-PGP care?
2. Does PGP care result in patient-reported safe management?
3. What are the direct costs/savings associated with PGP care and does it provide good value for money?
4. Does PGP care lead to improved patient experience; how and for which patients?

Methods

Detail on the PCOQ and PREOS-PC can be found in the *Report Supplementary Material 6*, together with the data sources for the practice variables.

Study design

An observational prospective cohort study was conducted comparing paramedic-led care episodes with GP-led episodes of care. As discussed in *Chapter 3* (see *Overview of data collected* and *Procedure*), two categorisations have been used to reflect different care configurations to PGP care models; these were based on paramedic integration (low, medium and high) and patient complexity (low, medium and high). Paramedic integration and patient complexity are defined in detail in *Site classification*.

Outcome variables

Data were collected from participants using self-completed questionnaires completed within 24 hours following the index visit with a paramedic (at PGP practices) or GP (at non-PGP practices) and 30 days later. Index visit responses were not considered to be baseline measures as they could have been influenced by an immediate effect of the care (i.e. PGP or GP) received. The 30-day follow-up questionnaires were administered by post or electronically according to patient preference. To improve accessibility, the option of completing questionnaires with telephone support was also offered.

Clinical outcome variables

Patient- (or carer-) reported experience, safety and outcome of the consultation was assessed using the PCOQ[48] and the PREOS-PC,[50] compact version.

Detail on the PCOQ and PREOS-PC can be found in the *Report Supplementary* Material 6, together with the data sources for the practice variables.

Health economic outcome variables

The primary 'outcome' variables explored in the economic analysis were quality-adjusted life-years (QALYs) and total cost of health care over the 30-day care episode, which was compared between PGP and non-PGP sites, and two further analyses that compared paramedic integration levels and patient complexity levels.

Quality of life

Health-related quality of life was measured using the EQ-5D-5L.[51] The EQ-5D-5L descriptive system comprises five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Participants' EQ-5D-5L profiles were mapped to the EuroQol-5 Dimensions, three-level version valuation set using the mapping function developed by the Decision Support Unit, which was recommended by the National Institute for Health and Care Excellence at the time of analysis.[61] This was implemented using the *eq5dmap* command in Stata®[62] (StataCorp LP, College Station, TX, USA) to estimate utility scores which are anchored at 0 (dead) and 1 (full health). The EQ-5D-5L mapping function requires information on age and gender. Where age was missing, simple imputation was applied where the median age of all participants was used to impute utility scores. Where gender was missing or not reported as male or female, utility scores were estimated for males and females using the mapping function and the mean of the utility scores was imputed. QALYs were estimated over the 30-day time horizon using the area-under-the-curve method based on responses at the index visit and 30 days later.[63]

Healthcare utilisation and costs

The following healthcare resource use items were obtained from the follow-up questionnaire at 30 days using an adapted version of ModRUM.[52] ModRUM is a brief, generic, standardised, self-report resource use measure.

- Primary and community care utilisation:
  - face-to-face appointments with GPs and/or other HCPs including nurses and paramedics at a GP surgery, health centre or walk-in centre
  - telephone or online appointments, referred to as virtual appointments, with GPs and/or other HCPs including nurses and paramedics, or with NHS healthcare services (e.g. NHS 111)
  - home visits by GPs and/or other HCPs.

- Secondary care utilisation:
  - accident and emergency (A&E) department visits
  - face-to-face and virtual outpatient appointments
  - day case admissions
  - inpatient (overnight) admissions (including number and duration of each admission).

- Prescribed medications in primary care.

Unit costs and their sources are listed in *Table 4*. All costs were valued in GBP (£) at 2022 prices. Where costs were not available at the time of analysis, costs from earlier years were inflated to 2022 prices using the NHS Cost Inflation Index (pay and prices).[64]

Primary care unit costs were sourced from the Unit Costs of Health and Social Care.[64] Unit costs for paramedic-led consultations in any setting and GP- and nurse-led home visits were not available. Therefore, unit costs for a GP-led and practice nurse-led (assuming a typical salary equivalent to Band 6) surgery consultation were used as the basis for estimating these costs (see *Appendix 3* for details). We identified a sample of 10 England-based job adverts for paramedics working in primary care to identify the most appropriate NHS pay band for paramedic salaries.

TABLE 4 Primary and secondary care unit costs

Resource item	Unit cost (£)	Details of cost derivation
A&E visit	304.90	Weighted average of AE tab excluding patients dead on arrival (code VB99Z)[65]
Outpatient appointment		
Face-to-face	191.54	Weighted average face-to-face of CL and NCL tabs, excluding paediatrics. Included first and follow-up appointments[65]
Virtual[a]	153.79	As above but including non-face-to-face appointments only
Hospital day case admission	1198.03	Weighted average of DC tab excluding paediatrics[65]
Hospital inpatient (per night)	516.14	The average cost of an inpatient stay, excluding paediatric care, was estimated using the weighted average of EL, NEL, NES tabs.[65] The cost per night was estimated by dividing the average cost of an inpatient stay (£3019.42) by the average length of stay for people aged 20 and over (5.85 nights)
GP		
Surgery	21 (47)[b]	9.22 minutes consultation excluding overheads and qualification costs
Virtual[a]	12 (28)[b]	Virtual consultation assumed to last 5.40 minutes[65]
Home visits	54 (119)[b]	
Nurse		
Surgery	6 (12)[b]	Assumed Band 6 nurse: (£36,415) excluding overheads and qualification costs. Surgery consultation assumed to last 9.72 minutes and 5.69 minutes for virtual consultations[65]
Virtual[a]	4 (7)[b]	
Home visits	16 (31)[b]	
Paramedics		
Surgery	14 (27)[b]	Excluding overheads and qualification costs
Virtual[a]	8 (16)[b]	
Home visits	35 (69)[b]	
Other HCP		
Surgery	10 (20)[b]	Average unit cost of paramedic and nurse unit costs if patients were from PGP sites, otherwise a nurse unit cost was used
Virtual[a]	6 (12)[b]	
Home visits	26 (50)[b]	
Prescribed medications	Varies by medication	A weighted average by medication using the average prescription cost from the cost per quantity column, in the presentations tab[66]
Time off work and informal care (per hour)	16.30	Median hourly earnings excluding overtime

CL, consultant-led; DC, day cases; EI, elective inpatient; NCL, non-consultant-led; NEL, non-elective long stay; NES, non-elective short stay.
a Virtual refers to telephone and online consultations.
b Unit costs including overheads and qualification costs.

Given the lack of information on annuitised paramedic qualification costs, we inflated the training costs of nurses by one-third to reflect the extra year of advanced postgraduate training that many paramedics working in primary care will have undertaken. We further assumed that overheads (practice and capital expenses) were proportional to paramedic salaries. Paramedics were assumed to have similar working hours per annum to practice nurses, but to spend a similar proportion of their working day on direct patient care as GPs. We used evidence comparing consultation durations of experienced GPs and GP registrars and assumed that paramedics might typically operate like GP registrars, spending approximately 36% longer than experienced GPs in a consultation.[67] We used published evidence to estimate the duration of nurse-led surgery consultation and GP- and nurse-led telephone consultations. We used the most recent estimates of the ratio of costs of a GP home visit to a GP surgery visit to estimate the cost of GP-, nurse- and paramedic-led home visits.[68]

In the adapted version of ModRUM, separate questions were not asked for nurse and paramedic appointments; they were grouped under 'other HCPs'. Therefore, at non-PGP sites, the unit cost of a nurse was used to estimate the cost of appointments with other HCPs, whereas at PGP sites the average unit cost of nurses and paramedics was used.[65] Primary and secondary care unit costs are listed in *Table 4*.

Unit costs for secondary care were estimated from the National Schedule of NHS Costs.[65] Prescribed medications were costed using the Prescription Cost Analysis 2020 and inflated to 2022 prices as the 2022 version was not available at the time of analysis.[66] Each prescription was valued using the net ingredient cost per prescription item (see *Table 4*). Participants were asked the name and number of times (referred to as 'prescription frequency' hereinafter) each prescribed medication was picked up or received in the last month. As eight participants provided responses to prescription frequency that were deemed infeasible (e.g. 40), all instances where prescription frequency was more than two were reviewed for plausibility and replaced with a plausible response if required. If participants did not report prescription frequency, or it was deemed infeasible, it was assumed that one prescription would be collected during the 30-day follow-up period.

Productivity and informal care

To measure workplace productivity, participants were asked whether they were in employment, and if yes, they were asked how much time off work (hours) they had taken over the last 7 days – referred to as 'absenteeism' hereinafter. Participants were also asked how much health conditions affected their ability to do their usual activities on a scale of 0 (no effect) to 10 (completely prevented). An adapted version of the CIIQ was used to capture informal care.[54] Participants were asked how many hours over the last 7 days they received help from friends/relatives with household tasks, personal care, or practical or emotional support that they would not have needed if they were in good health. The proxy goods method was used to value time off work.[54] Time off work and informal care were valued using median hourly earnings obtained from the Annual Survey of Hours and Earnings.[69] Productivity and informal care costs were extrapolated to reflect a 30-day period.

Sample size

The study aimed to recruit 1104 participants to obtain follow-up data from 552 (50%), based on a sample size calculation for change in PCOQ score (the primary outcome) between index visit and day 30. The aim was to have complete data on 138 participants in each of the PGP classifications (e.g. low integration) and non-PGP practices by having six practices in each PGP classification with an average of 23 subjects with complete data in each practice. This would achieve 90% power to detect a difference between the group means of 0.5 of a standard deviation (SD).[70] This assumed an estimated intracluster correlation coefficient of 0.02 and a coefficient of variation of cluster sizes of 0.65 with a significance level of 0.050 with a two-sided test. To achieve 138 complete data sets per PGP model, assuming a conservative 50% follow-up rate, we aimed to recruit 276 participants (46 per practice) in each of the PGP models.

Analysis

Descriptive statistics are reported on participant characteristics for each of the three comparisons (PGP vs. non-PGP; PGP integration; PGP patient complexity), with statistical tests used to identify participant differences, namely Fisher's exact tests, Mann–Whitney *U*-tests and Kruskal–Wallis tests. Practice characteristics have also been tabulated. A similar descriptive approach has been used for the outcome variables.

Multilevel models are fitted to take account of patient and practice characteristics for the primary outcome change in PCOQ at day 30 compared to index visit,[71] with GP practice fitted as a random effect. As the PREOS-PC was found to be highly negatively skewed, the analytical approach depended on the domain.

As part of a sensitivity analysis, the multilevel models were refitted firstly without adjusting for index visit score, and secondly without adjusting for the number of attendances.

A post hoc analysis was carried out for the PCOQ domain 'confidence in provision' at index visit and at 30 days,

Further detail on the statistical analysis can be found in the *Report Supplementary Material 6*.

Economic analyses

A cost–consequence and a cost–utility analysis were undertaken to compare PGP care models. Further details can be found in the *Report Supplementary Material 6*. Briefly, unadjusted and adjusted models were fitted and presented for each PGP care comparison with an appropriate regression technique used for cost data.[72] As described in the *Report Supplementary Material 6*, methods, sensitivity analyses were undertaken to account for methodological uncertainty or assumptions made during the study and analysis.

Results

Overview

A total of 721 participants were recruited from 34 practices, of whom 715 were eligible and completed the index visit questionnaire (*Figure 3*). Of these, 489 (68%) participants from 33 practices completed the 30-day questionnaire, 89% of the intended sample size, of whom 341 were at PGP practices and 148 were at non-PGP practices. The number of participants contributing 30-day follow-up data from the practices ranged from 1 to 59; 453 (93%) were white and 350 (72%) were female.

Patient-Reported Experiences and Outcomes of Safety in Primary Care: free text analysis

The PREOS-PC included two questions with free-text responses. The questions asked participants about what things their GP surgery does well to make sure health care is provided safely and what changes they might suggest. The free-text responses were analysed thematically. Four themes were identified as important aspects of safe health care at PGP sites: access (across the patient journey), continuity of care, checking with the GP, and being listened to were reported. Three of these themes – access, continuity of care, and being listened to – were also reported as related to safety at GP sites. For a full account of the analysis and findings, see *Report Supplementary Material 7*.

Paramedics in general practice versus no paramedics in general practice: main findings

Paramedics in general practice sites were larger than non-PGP sites (median size 14,671 vs. 9331 participants), had a higher age-standardised mortality rate (median 1057 vs. 981 per 100,000 population) and had a lower percentage of participants recorded as of non-white ethnicity (median 3.9% vs. 7.1%) (*Table 5*). Participants at PGP sites were younger (median age 60 vs. 65 years). The gender and ethnicity distributions were similar at the PGP and non-PGP sites. PCOQ domain scores at index visit were similar in three out of four domains, but a difference was observed in the 'Confidence in Health Provision' domain, with lower scores (i.e. less confidence) observed in the PGP group (median 4.0 vs. 4.6; see *Table 5*). Practice activation scores at index visit (i.e. degree to which practices were perceived to be engaged in promoting safety) were found to be lower in the PGP sites (median 75 vs. 92). Within the items concerning specific safety problems, there were more 'Communication problems between you and the healthcare staff' reported in the PGP

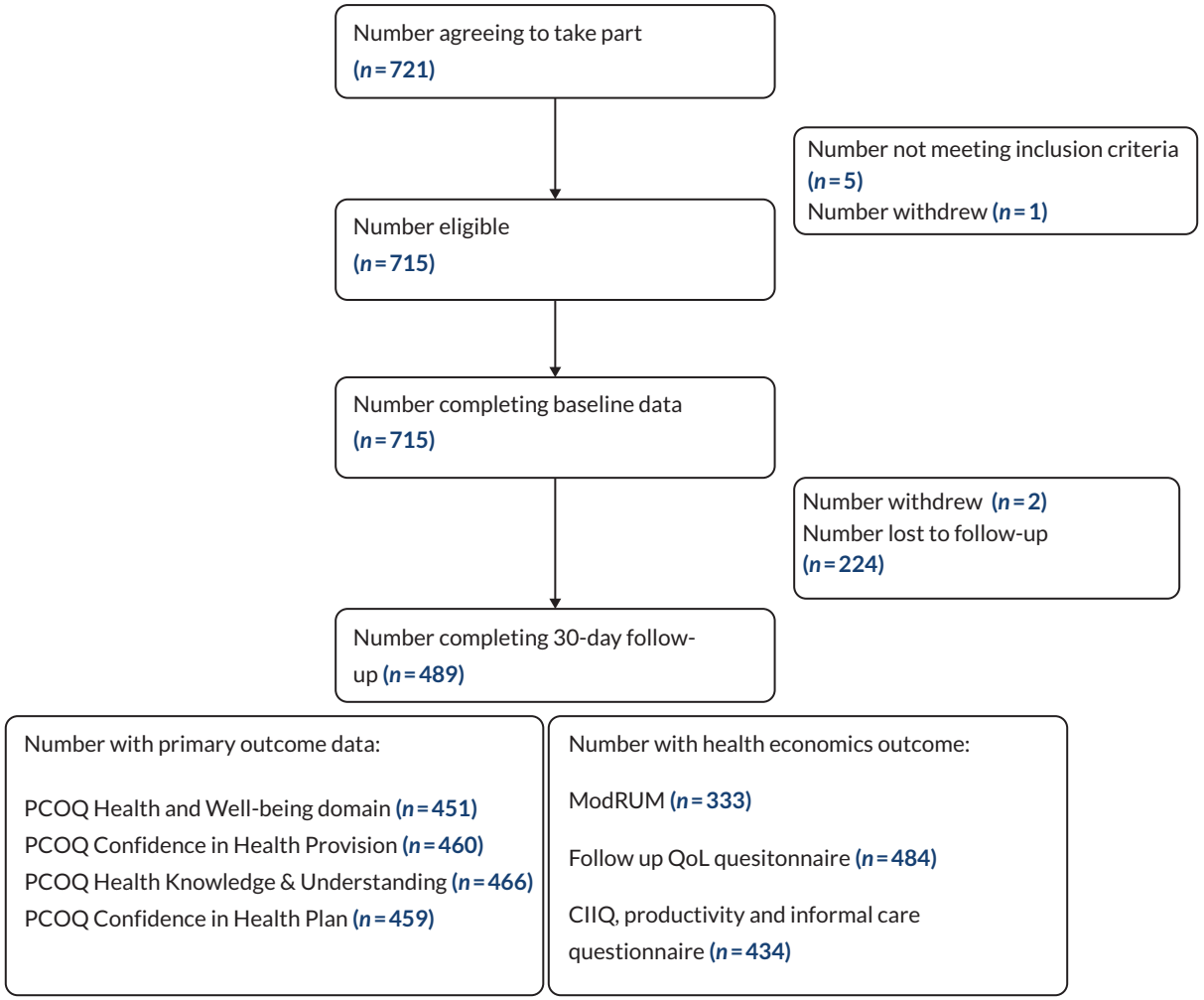

FIGURE 3 Flow diagram for prospective data. QoL, quality of life.

group at index visit (14% vs. 6.6%). A statistically significant difference was found in the PREOS-PC visual analogue scale (VAS) rating. Although the PREOS-PC VAS score medians and interquartile ranges are the same, there is an imbalance of participant numbers between the two groups, with more participants reporting 'outlying' low scores in the PGP group (*Figure 4*).

Unadjusted analysis showed the changes in PCOQ scores between 30 days and index visit to be close to zero for all domains, and these changes did not differ between the PGP and non-PGP practices (*Table 6*). At day 30, the PGP group had lower scores for the practice activation domain (median 75 vs. 94). The proportions reporting specific safety problems were similar in the PGP and non-PGP practices, although a statistically significant difference was found in the number reporting problems with blood and laboratory tests (5.3% vs. 1.4% for PGP vs. non-PGP). There were also statistically significant differences for the PREOS-PC harm severity and VAS score, with lower scores reported in the PGP group (*Figures 5* and *6*).

Results from the adjusted multilevel analyses (*Table 7*) revealed no statistically significant differences between PGP and non-PGP sites, in the change in PCOQ scores. A statistically significant difference was found in the PREOS-PC practice activation scores at day 30, which were found to be lower in the PGP sites, with an adjusted difference in mean score in PGP sites compared to non-PGP sites of −4.4 [95% confidence interval (CI) −6.8 to −2.0], indicating patients at PGP sites felt the practices were less engaged in promoting safety.

TABLE 5 Index visit characteristics and participant-reported outcomes for those who completed 30-day follow-up: PGP vs. non-PGP sites

	PGP	Non-PGP	
No. of sites	25	8	
No. of participants completing follow-up data	341	148	
No of participants from each site (range)	1–59	5–40	
No. of participants with complete index visit data and PCOQ data	288 (84%)	134 (91%)	
Site characteristics			
Practice size, median (range)	14,671 (3965–44,964)	9331 (4710–31,860)	
IMD decile, median (range)	7 (1–10)	8 (6–10)	
Urban sites, *n* (%)	21 (84%)	6 (75%)	
Age-standardised mortality rate, median (range)	1057 (761–1315)	981 (802–1065)	
Ethnicity. % non-white, median (range)	3.9 (1.1–27.5)	7.1 (1.4–49.1)	
Patient characteristics			***p*-value[a]**
Age (years), median (IQR)	*N* = 337 60 (46–71)	*N* = 146 65 (51–74)	0.040
Male, *n* (%)	*N* = 337 94 (28%)	*N* = 146 38 (26%)	0.739
Ethnicity, *n* (%)	*N* = 329	*N* = 148	0.117
White	316 (96%)	137 (93%)	
Mixed	1 (0.3%)	1 (0.7%)	
Asian	9 (2.7%)	4 (2.7%)	
Black	2 (0.6%)	2 (1.4%)	
Other	1 (0.3%)	4 (2.7%)	
Mode of appointment, *n* (%)	*N* = 338	*N* = 146	0.550
Face to face at home	16 (4.7%)	5 (3.4%)	
Face to face at surgery	246 (73%)	112 (77%)	
Telephone/video call	75 (22%)	29 (20%)	
E-consult by text/e-mail	1 (0.3%)	0	
Number of GP surgery appointments in past month, median (IQR)	*N* = 301 2 (1–3)	*N* = 130 2 (1–3)	0.373
Number of prescribed medications in past month, median (IQR)	*N* = 316 2 (0–4)	*N* = 136 2 (1–4)	0.856
Participant-reported outcomes after index visit			
PCOQ domains, median (IQR)			
Health and well-being	*N* = 324 4.4 (3.3–4.5)	*N* = 143 4.1 (3.5–4.4)	0.496
Confidence in health provision	*N* = 325 4.0 (3.7–4.8)	*N* = 145 4.6 (4.0–5.0)	< 0.001

continued

TABLE 5 Index visit characteristics and participant-reported outcomes for those who completed 30-day follow-up: PGP vs. non-PGP sites (*continued*)

	PGP	Non-PGP	
Health knowledge and understanding	*N* = 326 4.8 (4.0–5.0)	*N* = 146 4.8 (4.0–5.0)	0.673
Confidence in health plan	*N* = 324 4.3 (4.0–4.7)	*N* = 145 4.3(3.8–4.8)	0.744
PREOS-PC domains, median (IQR)			
Practice activation	*N* = 294 75 (56–94)	*N* = 137 92 (75–100)	< 0.001
Patient activation	*N* = 199 25 (0–50)	*N* = 81 38 (0–63)	0.566
Patient harm severity	*N* = 299 100 (100–100)	*N* = 132 100 (100–100)	0.127
Patient harm burden	*N* = 297 100(100–100)	*N* = 132 100 (100–100)	0.088
PREOS-PC VAS	*N* = 291 100 (90–100)	*N* = 136 100 (90–100)	0.003
Types of safety problems at index visit, N (%)			
Diagnosis	20 (5.9%)	9 (6.1%)	1.00
Medication prescribed	26 (7.6%)	11 (7.4%)	1.00
Other treatments prescribed	8 (2.4%)	4 (2.7%)	0.76
Vaccines prescribed	8 (2.4%)	4 (2.7%)	0.76
Blood and lab tests	16 (4.7%)	7 (4.7%)	1.00
Diagnosis and follow-up tests	10 (2.9%)	6 (4.1%)	0.58
Appointments	19 (5.6%)	6 (4.1%)	0.66
Health records	15 (4.4%)	4 (2.7%)	0.454
Communication problems between you and healthcare staff	*N* = 299 41 (14%)	*N* = 137 9 (6.6%)	0.035
Communication problems among healthcare staff	*N* = 298 32 (11%)	*N* = 137 10 (7.3%)	0.298
Communication problems between healthcare staff and other HCPs	*N* = 297 34 (11.5%)	*N* = 136 16 (11.8%)	1.000
PREOS-PC Items, N (%)			
Question 5.1, harm to physical health	*N* = 301	*N* = 133	0.374
Not at all	261 (87%)	123 (92%)	
Yes, some	17 (5.7%)	6 (4.5%)	
Yes, a lot	2 (0.7%)	0	
Yes, extreme	2 (0.7%)	0	
I don't know (yet)	19 (6.3%)	4 (3.0%)	

IMD, Index of Multiple Deprivation; IQR, interquartile range.
a Using Mann–Whitney *U*-tests for continuous outcomes and Fisher's exact test for categorical outcomes.

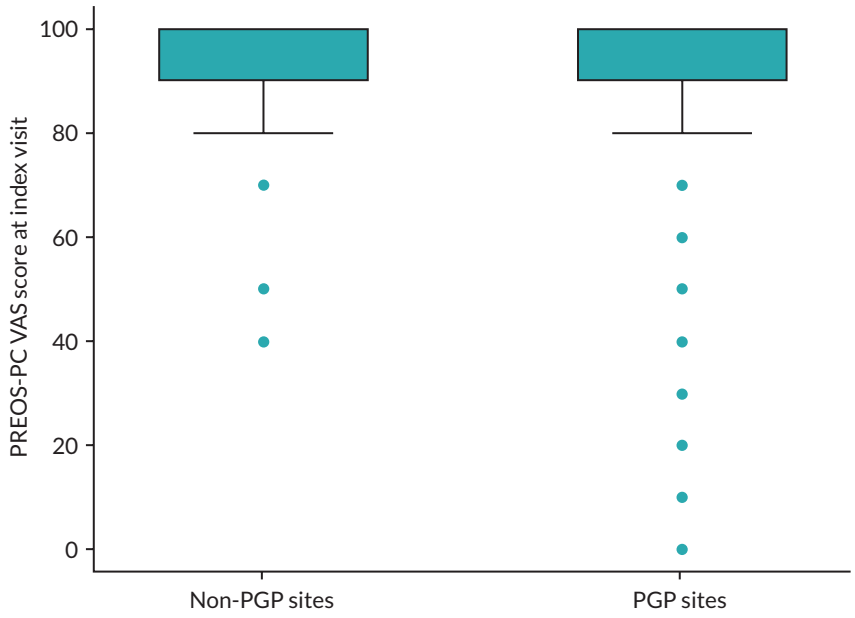

FIGURE 4 Box plot of index visit PREOS-PC VAS score for PGP vs. non-PGP sites.

TABLE 6 Thirty-day unadjusted follow-up data: PGP vs. non-PGP

	PGP	Non-PGP	*p*-value[a]
Change in PCOQ (30 day – index visit), median (IQR)			
Health and well-being	*N* = 313 0.1 (−0.1 to 0.5)	*N* = 138 0.3 (−0.1 to 0.6)	0.209
Confidence in health provision	*N* = 318 0.0 (−0.3 to 0.2)	*N* = 142 0.0 (−0.3 to 0.0)	0.102
Health knowledge and understanding	*N* = 323 0.0 (0.0–0.3)	*N* = 143 0.0 (0.0–0.3)	0.787
Confidence in health plan	*N* = 317 0.0 (−0.3 to 0.3)	*N* = 142 0.0 (−0.2 to 0.3)	0.252
PREOS-PC at day 30, median (IQR)			
Practice activation	*N* = 317 75 (56–94)	*N* = 137 94 (75–100)	< 0.001
Patient activation	*N* = 226 38 (0–63)	*N* = 72 38 (19–63)	0.311
Patient harm severity	*N* = 320 100 (100–100)	*N* = 135 100 (100–100)	0.034
Patient harm burden	*N* = 320 100 (100–100)	*N* = 135 100 (100–100)	0.454
PREOS-PC VAS	*N* = 315 100 (80–100)	*N* = 137 100 (90–100)	0.0312
Types of safety problems, n (%)			
Diagnosis	29 (8.5%)	6 (4.1%)	0.088
Medication prescribed	35 (10%)	11 (7.4%)	0.400

continued

TABLE 6 Thirty-day unadjusted follow-up data: PGP vs. non-PGP (*continued*)

	PGP	Non-PGP	*p*-value[a]
Other treatments prescribed	11 (3.2%)	3 (2.0%)	0.568
Vaccines prescribed	6 (1.8%)	1 (0.7%)	0.681
Blood and lab tests	18 (5.3%)	2 (1.4%)	0.047
Diagnosis and follow-up tests	17 (5.0%)	3 (2.0%)	0.212
Appointments	29 (8.5%)	5 (3.4%)	0.051
Health records	13 (3.8%)	1 (0.7%)	0.074
Communication problems between you and healthcare staff	*N* = 319 46 (14%)	*N* = 135 14 (10%)	0.290
Communication problems among healthcare staff	*N* = 315 26 (8.3%)	*N* = 133 8 (6.0%)	0.558
Communication problems between healthcare staff and other HCPs	*N* = 319 36 (11%)	*N* = 133 12 (9.0%)	0.615
PREOS-PC items, n (%)			
Question 5.1, harm to physical health	*N* = 332	*N* = 136	0.265
Not at all	281 (87%)	126 (93%)	
Yes, some	23 (7.1%)	4 (2.9%)	
Yes, a lot	2 (0.6%)	0	
Yes, extreme	4 (1.2%)	0	
I don't know (yet)	12 (3.7%)	6 (4.4%)	

a Using Mann–Whitney *U*-tests for continuous outcomes and Fisher's exact test for categorical outcomes.

Quality of life

Mean EQ-5D-5L utility scores were significantly lower at post-index visit (mean difference 0.047, 95% CI 0.003 to 0.091) for participants at PGP sites than non-PGP sites (*Table 8*); both PGP and non-PGP groups reported an overall improvement in quality of life (QoL) by 30-day follow-up; however, this was higher in participants at PGP sites (0.024 vs. 0.012). Similar patterns of lower scores at post-index visit and improvement in both groups by 30-day follow-up were also observed in EuroQol visual analogue scale (EQ-VAS; EuroQol Research Foundation, Rotterdam, The Netherlands) scores. There was no significant difference in post-index visit EQ-VAS scores between PGP and non-PGP sites. Mean unadjusted QALYs were very similar for PGP and non-PGP groups. When all covariates were adjusted for (*Table 9*), there was no difference in mean QALYs between PGP and non-PGP groups (0.000, 95% CI −0.001 to 0.002).

Resource use and costs

Mean healthcare resource use and costs are presented in *Figure 7* and *Table 10*. In participants with complete data, mean primary care cost (GP, other HCPs and prescriptions) was similar between PGP and non-PGP groups (£56.63 vs. £57.447); lower costs of GP appointments for participants at PGP sites were almost counterbalanced by the higher costs of other HCP appointments. However, mean secondary care costs were slightly higher at PGP sites (£288.79 vs. £258.11). In the PGP group, nine (3.14%) participants had an overnight stay during the 30-day follow-up period, compared to two (1.61%) participants in the non-PGP group. Likewise, more participants (*n* = 7, 2.44%) reported day case admissions in PGP sites compared to only four (3.23%) participants from the non-PGP sites. In PGP sites, 29 (10.10%) participants reported at least one A&E visit over the same period compared to 10 (8.06%) participants from non-PGP sites. On average, total NHS costs were higher in PGP sites (£345.41 vs. £315.55). In the multivariable regressions (see *Table 9*), paramedic-led care was not associated with a statistically significant change in overall NHS costs in any model. Overall adjusted mean NHS costs were £21.49 more for paramedic-led care (95% CI −£141.89 to £184.87).

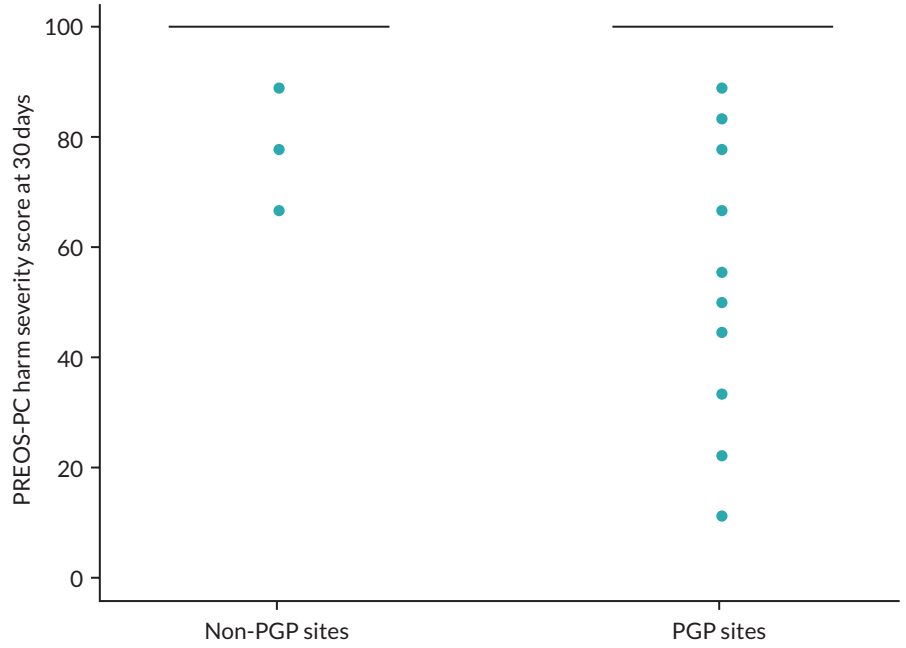

FIGURE 5 Box plot of 30-day follow-up PREOS-PC patient harm severity score for PGP vs. non-PGP sites.

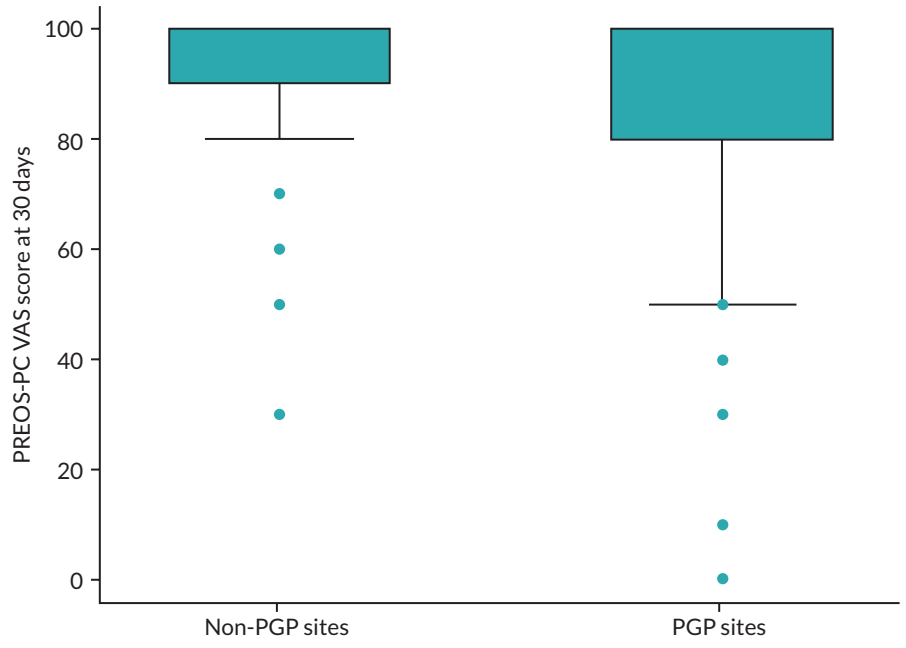

FIGURE 6 Box plot of 30-day follow-up PREOS-PC VAS score for PGP vs. non-PGP sites.

TABLE 7 Results from multilevel modelling showing adjusted[a] difference in means (95% CIs) for PGP vs. non-PGP sites

	PGP vs. non-PGP	*p*-value
Change in PCOQ (30 days – index visit)		
Health and well-being *n* = 433	−0.020 (−0.12 to 0.08)	0.698
Confidence in health provision *n* = 41	−0.050 (−0.15 to 0.05)	0.310
Health knowledge and understanding *n* = 447	0.057 (−0.04 to 0.16)	0.267
Confidence in health plan *n* = 440	−0.059 (−0.13 to 0.01)	0.076
PREOS-PC at day 30		
Practice activation *n* = 389	−4.4 (−6.8 to −2.0)	< 0.001
PREOS-PC VAS[b] < 90 vs. 90 +, *n* = 386	1.29 (0.68 to 2.43)	0.436
PREOS-PC VAS[c] < 100 vs. 100 +, *n* = 386	1.37 (0.74 to 2.55)	0.314

a Adjusting for the patient-level factors: index visit score, age (continuous), sex, ethnicity (white or not white) and the number of attendances (0–1, 2–3, 4 +, unknown), and for the practice-level factors: age-standardised mortality rate (continuous), % non-white (continuous), urban vs. rural, practice size (small, medium, large) and deprivation decile (1–3, 4–7, 8–10), with site fitted as a random effect.
b Adjusted odds ratio for a VAS < 90 vs. 90 + obtained from a multilevel logistic regression model.
c Adjusted odds ratio for having a VAS < 100 vs. a score of 100 obtained from a multilevel logistic regression model, as part of the sensitivity analysis.

Productivity and informal care

Among participants who completed productivity and informal care questions, 36% were employed at non-PGP sites compared to 42% at PGP sites (*Table 11*). Additionally, non-PGP participants reported a higher rate of absenteeism, averaging 2.08 hours (SD 7.01 hours) over the last 7 days compared to 1.33 hours (SD 5.61 hours) in participants from PGP sites. They also received slightly more informal care hours, with an average of 6.05 hours over the same period compared to 5.71 hours by participants from PGP sites. PGP participants rated the impact of their health conditions on their usual activities as slightly higher with an average score of 3.00 (SD 3.22) compared to 2.61 (SD 3.14) reported by participants at non-PGP sites.

Cost–consequence and cost–utility analysis

Over the 30-day episode, PGP care resulted in higher mean NHS costs compared to non-PGP care; this was mainly driven by higher secondary care costs in this group (*Table 12*). Total societal costs, on the other hand, were very similar between PGP and non-PGP care models when NHS, informal care and lost productivity costs were considered. These estimates came with a high degree of uncertainty. There was little evidence that paramedic-led care was associated with a clinically or economically important difference in the costs or outcomes of care compared to GP-led care (*Table 13*). At willingness-to-pay thresholds for a QALY of £20,000 and £30,000 respectively, the incremental net monetary benefit (iNMB) of PGP was −11.61 (95% CI −186.34 to 163.13) and −5.53 (95% CI −182.26 to 171.19).

Paramedics in general practice versus no paramedics in general practice: sensitivity analysis

When overheads and qualification costs are included in GP, nurse and paramedic unit costs, and at willingness-to-pay thresholds for a QALY of £20,000 and £30,000 respectively, the iNMB of PGP was £3.76 (95% CI −£173.89 to £181.41) and was £9.84 (95% CI −£169.08 to £189.48).

Paramedics in general practice: integration findings

The 30-day questionnaires were completed by 205 participants from 13 high-integration practices, 88 participants from 6 medium-integration practices, and 48 participants from 6 low-integration practices. Sites with a medium level of PGP integration were larger than the other sites (median practice size 32,002) (*Table 14*). Sites with a high and medium level of paramedic integration were in lower index of multiple deprivation (IMD) deciles (more deprived), and the age-standardised mortality rate was greatest in sites with a high level of paramedic integration. The median participant

TABLE 8 EuroQol visual analogue scale and EQ-5D-5L utility scores and QALYs, PGP vs. non-PGP sites

		EQ-VAS					EQ-5D-5L utility scores					
		Post index visit		Follow-up			Post index visit		Follow-up		QALYs	
	N	Mean	SD	Mean	SD	*N*	Mean	SD	Mean	SD	Mean	SD
PGP	335	68.01	(20.75)	71.60	(20.25)	332	0.716	(0.241)	0.740	(0.252)	0.060	(0.019)
Non-PGP	146	70.60	(19.78)	75.14	(17.51)	145	0.763	(0.184)	0.775	(0.209)	0.063	(0.015)

TABLE 9 Multilevel regressions of QALYs and total costs of 30-day care episode on practice type (PGP/non-PGP), adjusting for patient and appointment characteristics

	Coefficient (95% CI)[a]	Coefficient (95% CI)[b]	Coefficient (95% CI)[c]
QALYs	0.000 (−0.001 to 0.001)	0.000 (−0.001 to 0.001)	0.000 (−0.001 to 0.002)
Costs (£)	26.97 (−145.46 to 199.39)	33.59 (−131.34 to 198.53)	11.89 (−160.90 to 184.10)

a From multilevel generalised linear model (GLM) (log link, Gamma family) regressions of total cost with fixed effect for PGP (Y/N) and random effect for site number. For QALYs, multilevel mixed-effects linear regression was used with the same covariates as in GLM and post-index visit utility score.
b From multilevel GLM (log link, Gamma family) regressions of total cost with fixed effects for PGP (Y/N) and appointment modality [three levels: surgery (ref.), virtual, home visits] and random effect for site number. For QALYs, multilevel mixed-effects linear regression was used with the same covariates as in GLM and post-index visit utility score.
c From multilevel GLM (log link, Gamma family) regressions of total cost with fixed effects for PGP (Y/N), appointment modality [three levels: surgery (ref.), virtual, home visits], age, gender (male/female) and patient-reported ethnicity; and random effect for site number. For QALYs, multilevel mixed-effects linear regression was used with the same covariates as in GLM and post-index visit utility score.

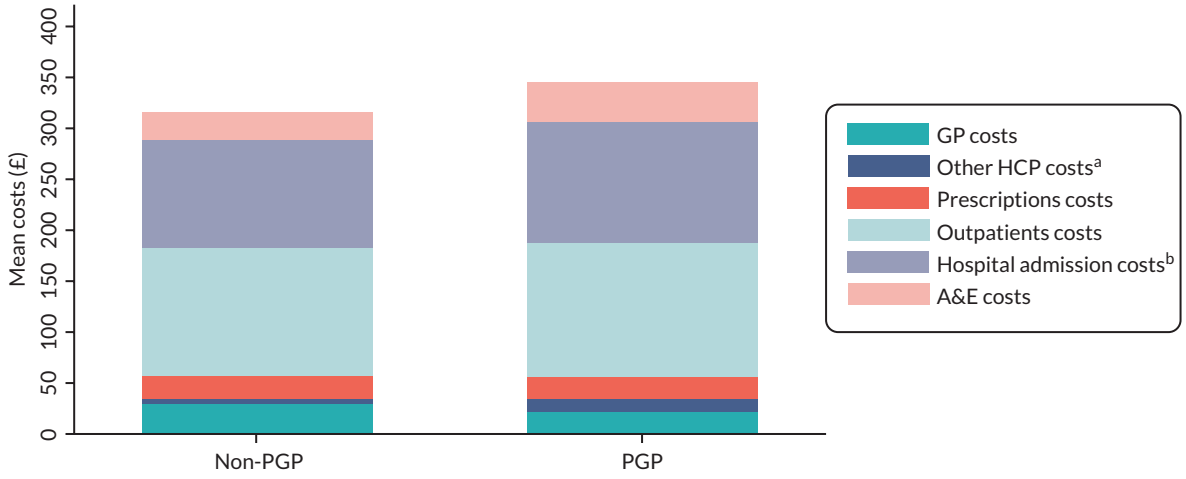

FIGURE 7 Mean total NHS healthcare costs (£): PGP and non-PGP sites. a, HCP includes paramedic, nurse and other non-GP contacts. b, Hospital admissions cost includes day cases and overnight stays.

TABLE 10 Mean resource use and costs: pooled PGP sites vs. non-PGP sites

	PGP (*N* = 287)[a]			Non-PGP (*N* = 124)[a]		
	Mean resource use	Mean cost (£)	SD	Mean resource use	Mean cost (£)	SD
Primary healthcare resource use						
GP	1.25	22.30	(27.63)	1.73	29.76	(24.22)
Other HCP[b]	1.10	12.03	(17.56)	0.67	4.15	(6.02)
Prescriptions	2.61	22.30	(42.66)	2.57	23.54	(42.21)
Secondary healthcare resource use						
Outpatients	0.73	130.94	(217.75)	0.69	125.82	(206.69)
A&E	0.13	38.78	(152.56)	0.09	27.05	(95.33)
Admissions[c]	0.19	119.07	(662.61)	0.16	105.24	(742.79)
Total NHS costs		345.41	(806.28)		315.55	(838.43)

a Based on cases with complete NHS resource use data.
b Includes nurses, paramedics and other non-GP contacts.
c Includes day cases and overnight stays.

TABLE 11 Productivity and informal care: PGP vs. non-PGP sites

	PGP				Non-PGP			
	N[a]	Mean	Costs (£)[b]	SD	*N*[a]	Mean	Costs (£)[b]	SD
Productivity								
Employed	299	42.14%			129	35.66%		
Absent (last 7 days)	299	1.33	92.64	(392.03)	129	2.08	145.40	(501.56)
Informal care								
Hours (last 7 days)	289	5.71	398.96	(1393.66)	122	6.05	422.58	(1335.23)
Measure of usual activities (1–10)[c]	304	3.00		(3.22)	130	2.61		(3.14)

a Available cases by productivity and informal care category.
b Costs were extrapolated to reflect a 30-day period.
c 0 (no effect) and 10 (completely prevented).

TABLE 12 Cost–consequences analysis: PGP vs. non-PGP

		PGP			Non-PGP		
		N[a]	Mean	SD	*N*[a]	Mean	SD
Outcomes	Change in PCOQ: health and well-being	313	0.17	(0.56)	138	0.23	(0.61)
	Change in PCOQ: confidence in health provision	318	−0.06	(0.60)	142	−0.13	(0.50)
	Change in PCOQ: health knowledge and understanding	323	0.08	(0.64)	143	0.04	(0.58)
	Change in PCOQ: confidence in health plan	317	−0.01	(0.53)	142	0.04	(0.44)
	QALY	332	0.060	(0.019)	145	0.063	(0.015)
Costs (£)	Primary healthcare costs	289	56.96	(60.79)	127	57.64	(52.06)
	Secondary healthcare costs	313	292.65	(773.17)	132	273.09	(869.22)
	NHS costs	287	345.41	(806.28)	124	315.55	(838.43)
	Informal care costs	289	398.96	(1393.66)	122	422.58	(1335.23)
	Lost productivity costs	307	90.22	(387.15)	131	143.18	(498.01)
	Societal costs[b]	260	822.47	(1812.64)	107	823.28	(1866.64)

a Available cases by row.
b Includes NHS, informal care and lost productivity costs.

TABLE 13 Costs, QALYs and iNMB of PGP vs. non-PGP based on available data of all covariates (*N* = 382)

	PGP (*n* = 265)		Non-PGP (*n* = 117)	
	Mean	SD	Mean	SD
QALYs	0.061	(0.018)	0.063	(0.015)
Total NHS costs	354.09	(834.48)	312.98	(855.15)
iNMB at £20,000 per QALY[a]	−£11.61 (95% CI −£186.34 to £163.13)			
iNMB at £30,000 per QALY[a]	−£5.53 (95% CI −£182.26 to £171.19)			

a Available cases by row.

age was greatest at sites with a low level of paramedic integration and lowest at sites with a medium level of paramedic integration (67 years vs. 58 years). Paramedics at low integration sites were doing fewer appointments by telephone or video (8.5%) than those at high integration sites (26%).

After the index visit, the PCOQ 'confidence in health provision' scores were lower (i.e. less confidence) for all three levels of PGP integration compared to non-PGP sites (median 4.0 vs. 4.6) (see *Table 14*). Similarly, practice activation scores were lower for all three levels of PGP integration (median 81 in high-integration sites, 75 in medium-/low-integration sites and 92 in non-PGP sites). In the sites with a medium level of PGP integration, more 'Communication problems between you and the healthcare staff' were reported (21% vs. 6.6% in non-PGP sites).

Unadjusted analyses showed no differences between the levels of PGP integration in the change in PCOQ scores (*Table 15*). At day 30, the practice activation scores were lowest in the sites with a medium level of paramedic integration and highest in non-PGP sites (median 68 vs. 94). Statistically significant differences were seen in the PREOS-PC patient harm severity and VAS scores. With regard to the specific PREOS-PC items, participants at sites with a low level of paramedic integration reported more problems with diagnosis (17% compared to 7% at medium- and high-integration sites and 4% at no PGP sites) and fewer reported no harm to physical health (74% compared to 89% or more in the other categories).

TABLE 14 Index visit characteristics and participant-reported outcomes for those who completed 30-day follow-up by level of paramedic integration

	High	Medium	Low	Non-PGP	
No. of sites	13	6	6	8	
No. of participants completing follow-up data	205	88	48	148	
No. of participants from each site (range)	1–59	3–37	3–14	5–40	
No. of participants with complete index visit data and PCOQ data	173 (84%)	73 (83%)	42 (88%)	134 (91%)	
Site characteristics					
Practice size, median (range)	13,207 (8233–24,042)	32,002 (8261–44,964)	13,744 (3965–37,871)	9331 (4710–31,860)	
IMD decile, median (range)	6 (2–10)	5 (1–10)	9 (2–10)	8 (6–10)	
Urban sites, *n* (%)	12 (92%)	5 (83%)	4 (67%)	6 (75%)	
Age-standardised mortality rate Median (range)	1087 (846–1315)	992 (761–1160)	997 (780–1123)	981 (802–1065)	
Ethnicity. % of non-white, median (range)	4.2 (1.5–27.5)	2.7 (1.5–11.4)	4.0 (1.1–21.3)	7.1 (1.4–49.1)	
Patient characteristics					***p*-value[a]**
Age (years), median (IQR)	*N* = 202 60 (45–69)	*N* = 88 58 (45–72)	*N* = 47 67 (55–74)	*N* = 146 65 (51–74)	0.024
Male, *n* (%)	*N* = 203 54 (27%)	*N* = 88 23 (26%)	*N* = 46 17 (37%)	*N* = 146 38 (26%)	0.500
Ethnicity, *n* (%)	*N* = 199	*N* = 84	*N* = 46	*N* = 148	
White	193 (97%)	81 (96%)	42 (91%)	137 (93%)	0.140
Mixed	1 (0.5%)	0	0	1 (0.7%)	
Asian	4 (2.0%)	1 (1.2%)	4 (8.7%)	4 (2.7%)	

TABLE 14 Index visit characteristics and participant-reported outcomes for those who completed 30 day follow-up by level of paramedic integration (*continued*)

	High	Medium	Low	Non-PGP	
Black	1 (0.5%)	1 (1.2%)	0	2 (1.4%)	
Other	0	1 (1.2%)	0	4 (2.7%)	
Mode of appointment, *n* (%)	*N* = 203	*N* = 88	*N* = 47	*N* = 146	
Face to face at home	12 (5.9%)	1 (1.1%)	3 (6.4%)	5 (3.4%)	0.039 for face-to-face vs. not; 0.007 for high vs. low
Face to face at surgery	137 (67%)	69 (78%)	40 (85%)	112 (77%)	
Telephone/video call	53 (26%)	18 (20%)	4 (8.5%)	29 (20%)	
E-consult by text/e-mail	1 (0.5%)	0	0	0	
Number of GP surgery appointments in past month, median (IQR)	*N* = 180 2 (1–4)	*N* = 77 2 (1–3)	*N* = 44 2 (1–3)	*N* = 130 2 (1–3)	0.801
Number of prescribed medications in past month, median (IQR)	*N* = 192 2 (1–4)	*N* = 79 2 (1–4)	*N* = 45 1 (0–3)	*N* = 136 2 (1–4)	0.512
Participant-reported outcomes after index visit					
PCOQ domains, median (IQR)					
Health and well-being	*N* = 197 4.0 (3.4–4.5)	*N* = 81 3.9 (3.0–4.4)	*N* = 46 4.1 (3.3–44)	*N* = 143 4.1 (3.5–4.4)	0.244
Confidence in health provision	*N* = 196 4.0 (3.7–4.8)	*N* = 81 4.0 (3.5–4.8)	*N* = 48 4.0 (3.5–4.7)	*N* = 145 4.6 (4–5)	< 0.001; < 0.001, for high, med, low vs. non-PGP
Health knowledge and understanding	*N* = 197 4.8 (4.0–5.0)	*N* = 81 4.8 (4.0–5.0)	*N* = 48 4.5 (4.3–5.0)	*N* = 146 4.8 (4.0–5.0)	0.384
Confidence in health plan	*N* = 196 4.3 (4.0–4.7)	*N* = 80 4.3 (3.8–4.7)	*N* = 48 4.5 (4.0–4.7)	*N* = 145 4.3 (3.8–4.8)	0.462
PREOS-PC domains, median (IQR) at index visit					
Practice activation	*N* = 174 81 (63–100)	*N* = 73 75 (56–94)	*N* = 47 75 (56–94)	*N* = 137 92 (75–100)	< 0.001; < 0.001 for high, med, low vs. non-PGP
Patient activation	*N* = 121 25 (0–50)	*N* = 52 25 (0–63)	*N* = 26 31 (0–50)	*N* = 81 38 (0–63)	0.952
Patient harm severity	*N* = 180 100 (100–100)	*N* = 75 100 (100–100)	*N* = 44 100 (100–100)	*N* = 132 100 (100–100)	0.035; *p* = 0.007 for med vs. non-PGP
Patient harm burden	*N* = 180 100 (100–100)	*N* = 75 100 (100–100)	*N* = 42 100 (100–100)	*N* = 132 100 (100–100)	0.256
PREOS-PC VAS	*N* = 177 100 (90–100)	*N* = 69 100 (90–100)	*N* = 45 100 (80–100)	*N* = 136 100 (90–100)	0.0282; 0.005 for high vs. non-PGP
Types of safety problems, n (%)					
Diagnosis	10 (4.9%)	8 (9.1%)	2 (4.2%)	9 (6.1%)	0.539
Medication prescribed	14 (6.8%)	9 (10.2%)	3 (6.3%)	11 (7.4%)	0.757
Other treatments prescribed	4 (2.0%)	4 (4.6%)	0	4 (2.7%)	0.422
Vaccines prescribed	5 (2.4%)	2 (2.3%)	1 (2.1%)	4 (2.7%)	1.000

continued

TABLE 14 Index visit characteristics and participant-reported outcomes for those who completed 30 day follow-up by level of paramedic integration (*continued*)

	High	Medium	Low	Non-PGP	
Blood and lab tests	6 (2.9%)	8 (9.1%)	2 (4.2%)	7 (4.7%)	0.156
Diagnosis and follow-up tests	6 (2.9%)	4 (4.6%)	0	6 (4.1%)	0.514
Appointments	11 (5.4%)	7 (8.0%)	1 (2.1%)	6 (4.1%)	0.485
Health records	8 (3.9%)	4 (4.6%)	3 (6.3%)	4 (2.7%)	0.630
Communication problems between you and healthcare staff	*N* = 181 21 (12%)	*N* = 73 15 (21%)	*N* = 45 5 (11%)	*N* = 137 9 (6.6%)	0.031; 0.005 for med vs. non-PGP
Communication problems among healthcare staff	*N* = 182 16 (8.8%)	*N* = 71 9 (13%)	*N* = 45 7 (16%)	*N* = 137 10 (7.3%)	0.291
Communication problems between healthcare staff and other HCPs	*N* = 181 19 (11%)	*N* = 72 11 (15%)	*N* = 44 4 (9.1%)	*N* = 136 16 (11.8%)	0.696
PREOS-PC items, n (%)					
Question 5.1, harm to physical health	*N* = 180	*N* = 76	*N* = 45	*N* = 133	0.209
Not at all	159 (88%)	64 (84%)	38 (84%)	123 (92%)	
Yes, some	10 (5.6%)	6 (7.9%)	1 (2.2%)	6 (4.5%)	
Yes, a lot	1 (0.6%)	1 (1.3%)	0	0	
Yes, extreme	0	1 (1.3%)	1 (2.2%)	0	
I don't know (yet)	10 (5.6%)	4 (5.3%)	5 (11%)	4 (3.0%)	

a Using Kruskal–Wallis tests for continuous outcomes and Fisher's exact test for categorical outcomes. Where significant differences were found, Bonferroni corrected *p*-values ($p = 0.05/6 = 0.0083$ defined statistical significance) from Mann–Whitney *U*-tests/Fisher's exact tests explored which categories differed.

TABLE 15 Thirty-day unadjusted follow-up data by level of paramedic integration

	High	Medium	Low	Non-PGP	*p*-value[a]
Change in PCOQ (30 day – index visit), n =, median (IQR)					
Health and well-being	*N* = 189 0.1 (−0.1 to 0.5)	*N* = 78 0.1 (−0.3 to 0.6)	*N* = 46 0.1 (0–0.5)	*N* = 138 0.3 (−0.1 to 0.6)	0.626
Confidence in health provision	*N* = 191 0.0 (−0.2 to 0.2)	*N* = 79 0.0 (−0.3 to 0.3)	*N* = 48 0.0 (−0.5 to 0.3)	*N* = 142 0.0 (−0.3 to 0.0)	0.345
Health knowledge and understanding	*N* = 195 0 (0.0–0.3)	*N* = 80 0.0 (−0.3 to 0.5)	*N* = 48 0.0 (0.0–0.3)	*N* = 143 0.0 (0.0–0.3)	0.958
Confidence in health plan	*N* = 191 0.0 (−0.3 to 0.3)	*N* = 78 0.0 (−0.3 to 0.3)	*N* = 48 0.0 (−0.3 to 0.3)	*N* = 142 0.0 (−0.2 to 0.3)	0.572

TABLE 15 Thirty-day unadjusted follow-up data by level of paramedic integration (*continued*)

	High	Medium	Low	Non-PGP	*p*-value[a]
PREOS-PC at day 30, median (IQR)					
Practice activation	*N* = 192 75 (65–100)	*N* = 82 68 (44–94)	*N* = 43 75 (50–94)	*N* = 137 94 (75–100)	< 0.001; < 0.001 for high, med and low vs. non-PGP; 0.0049 for high vs. med
Patient activation	*N* = 131 38 (13–63)	*N* = 64 25 (0–50)	*N* = 31 50 (0–75)	*N* = 72 38 (19–63)	0.331
Patient harm severity	*N* = 191 100 (100–100)	*N* = 83 100 (100–100)	*N* = 46 100 (100–100)	*N* = 135 100 (100–100)	0.029; 0.005 for low vs. non-PGP
Patient harm burden	*N* = 193 100 (100–100)	*N* = 83 100 (100–100)	*N* = 44 100 (100–100)	*N* = 135 100 (100–100)	0.832
PREOS-PC VAS	*N* = 191 100 (90–100)	*N* = 79 90 (80–100)	*N* = 45 90 (80–100)	*N* = 137 100 (90–100)	0.029
Types of safety problems, n (%)					
Diagnosis	15 (7.3%)	6 (6.8%)	8 (17%)	6 (4.1%)	0.047; 0.007 for low vs. non-PGP
Medication prescribed	21 (10%)	11 (13%)	3 (6.3%)	11 (7.4%)	0.519
Other treatments prescribed	10 (4.9%)	1 (1.1%)	0	3 (2.0%)	0.202
Vaccines prescribed	6 (2.9%)	0	0	1 (0.7%)	0.236
Blood and lab tests	12 (5.9%)	4 (4.6%)	2 (4.2%)	2 (1.4%)	0.163
Diagnosis and follow-up tests	9 (4.4%)	4 (4.6%)	4 (8.3%)	3 (2.0%)	0.223
Appointments	17 (8.3%)	8 (9.1%)	4 (8.3%)	5 (3.4%)	0.179
Health records	10 (4.9%)	1 (1.1%)	2 (4.2%)	1 (0.7%)	0.057
Communication problems between you and healthcare staff	*N* = 191 25 (13%)	*N* = 82 14 (17%)	*N* = 46 7 (15%)	*N* = 135 14 (10%)	0.511
Communication problems among healthcare staff	*N* = 190 15 (7.9%)	*N* = 81 8 (9.9%)	*N* = 44 3 (6.8%)	*N* = 133 8 (6.0%)	0.769
Communication problems between healthcare staff and other HCPs	*N* = 191 20 (10%)	*N* = 83 11 (13%)	*N* = 45 5 (11%)	*N* = 133 12 (9%)	0.774
PREOS-PC items, n (%)					
Question 5.1, harm to physical health	*N* = 192	*N* = 83	*N* = 47	*N* = 136	0.033; 0.002 for low vs. non-PGP
Not at all	170 (89%)	76 (92%)	35 (74%)	126 (93%)	
Yes, some	13 (6.8%)	3 (3.6%)	7 (15%)	4 (2.9%)	
Yes, a lot	0	1 (1.2%)	1 (2.1%)	0	
Yes, extreme	2 (1.0%)	1 (1.2%)	1 (2.1%)	0	
I don't know (yet)	7 (3.7%)	2 (2.4%)	3 (6.4)	6 (4.4%)	

a Using Kruskal–Wallis tests for continuous outcomes and Fisher's exact test for categorical outcomes. Where significant differences were found, Bonferroni corrected *p*-values ($p = 0.05/6 = 0.0083$ defined statistical significance) from Mann–Whitney *U*-tests/Fisher's exact tests explored which categories differed.

Results from the multilevel modelling (*Table 16*) revealed no statistically significant differences in the change in PCOQ scores by PGP integration. After adjusting for covariates, a statistically significant difference was found in the PREOS-PC practice activation scores at day 30, which was found to be lowest in the PGP sites with medium and low levels of PGP integration. The adjusted difference in the mean score for sites with medium PGP integration compared to non-PGP sites was −7.3 (95% CI −14.4 to −0.1) and for sites with low PGP integration compared to non-PGP was −8.0 (95% CI −12.6 to −3.4).

Quality of life

On average, the mean EQ-5D-5L utility score was slightly lower at post-index visit at low integration sites (*Table 17*). Irrespective of integration level, participants' EQ-5D-5L and EQ-VAS scores indicate an improvement in HRQoL at 30-day follow-up. There were no significant differences in post-index utility scores and EQ-VAS between low, medium and high integrations. Mean unadjusted QALYs were similar across all integration levels. In the adjusted models (*Table 18*), there was no difference between low and medium levels of integration when compared to high levels of integration.

Resource use and costs

Mean unadjusted total NHS costs per 30-day care episode were similar between low- and medium-integration sites (£422.30 and £424.08, respectively; *Figure 8* and *Table 19*), but more than high-integration practices (£294.75). Low-integration sites had higher mean primary care costs (£69.63, SD £97.37) compared to £54.42 (SD £47.52) and £54.97 (SD £54.03) at medium- and high-integration sites, respectively. Mean secondary care costs were highest in medium and lowest in high-integration practices (high: £262.64, SD £570.53; medium: £347.03, SD £1136.71; low: £325.09, SD £754.53). Large SDs indicate high variability, particularly in the medium-integration group, with a small number of participants incurring large costs.

TABLE 16 Results from multilevel modelling showing adjusted[a] difference in means (95% CIs): level of paramedic integration vs. non-PGP

	High	Medium	Low	*p*-value
Change in PCOQ (30 days − index visit)				
Health and well-being, *n* = 433	−0.005 (−0.11 to 0.10)	0.09 (−0.10 to 0.29)	−0.11 (−0.25 to 0.03)	0.300
Confidence in health provision, *n* = 441	−0.03 (−0.12 to 0.06)	−0.09 (−0.29 to 0.10)	−0.11 (−0.26 to 0.05)	0.559
Health knowledge and understanding, *n* = 447	0.07 (−0.03 to 0.17)	0.13 (−0.10 to 0.36)	−0.01 (−0.18 to 0.16)	0.427
Confidence in health plan, *n* = 440	−0.05 (−0.11 to 0.02)	−0.04 (−0.16 to 0.07)	−0.12 (−0.20 to −0.03)	0.074
PREOS-PC at day 30				
Practice activation, *n* = 389	−3.3 (−5.7 to −0.8)	−7.3 (−14.4 to −0.1)	−8.0 (−12.6 to −3.4)	< 0.001; < 0.001 for low vs. non-PGP
PREOS-PC VAS[b] < 90 vs. 90 +, *n* = 386	0.97 (0.47 to 2.00)	1.68 (0.64 to 4.39)	2.51 (0.89 to 7.08)	0.135
PREOS-PC VAS[c] < 100 vs. 100 +, *n* = 386	1.25 (0.64 to 2.45)	1.42 (0.46 to 4.38)	1.89 (0.65 to 5.48)	0.598

a Adjusting for the patient-level factors: index visit score, age (continuous), sex, ethnicity (white or not white) and the number of attendances (0–1, 2–3, 4 +, unknown) and for the practice-level factors: age-standardised mortality rate (continuous), % non-white (continuous), urban vs. rural, practice size (small, medium, large) and deprivation decile (1–3, 4–7, 8–10), with site fitted as a random effect.
b Adjusted odds ratio for a VAS < 90 vs. 90 + obtained from a multilevel logistic regression model.
c Adjusted odds ratio for having a VAS < 100 vs. a score of 100 obtained from a multilevel logistic regression model, as part of the sensitivity analysis.

TABLE 17 EuroQol visual analogue scale and EQ-5D-5L utility scores and QALYs, by PGP integration and complexity levels

		EQ-VAS					EQ-5D-5L utility scores					
		Post-index visit		Follow-up			Post-index visit		Follow-up		QALYs	
Integration	*N*	Mean	SD	Mean	SD	*N*	Mean	SD	Mean	SD	Mean	SD
High	202	68.33	(19.71)	72.42	(20.44)	200	0.719	(0.227)	0.745	(0.238)	0.060	0.018
Medium	85	68.05	(20.26)	69.28	(20.36)	86	0.718	(0.221)	0.737	(0.250)	0.059	0.018
Low	48	66.63	(25.76)	72.27	(19.31)	46	0.698	(0.326)	0.721	(0.311)	0.058	0.025
		EQ-VAS					EQ-5D-5L utility scores					
		Post-index visit		Follow-up			Post-index visit		Follow-up		QALYs	
Complexity	*N*	Mean	SD	Mean	SD	*N*	Mean	SD	Mean	SD	Mean	SD
Low	152	68.47	(22.37)	72.20	(20.22)	149	0.720	(0.252)	0.745	(0.253)	0.060	(0.020)
Medium	95	63.82	(20.69)	68.14	(20.94)	95	0.696	(0.254)	0.697	(0.265)	0.057	(0.020)
High	88	71.74	(16.98)	74.31	(19.23)	88	0.731	(0.204)	0.777	(0.231)	0.062	(0.017)

TABLE 18 Multilevel regressions of QALYs and total costs (£) on practice integration and complexity adjusting for appointment and patient characteristics

Variable	Mean difference in cost (95% CI)[a]	Mean difference in cost (95% CI)[b]	Mean difference in cost (95% CI)[c]
By integration			
QALY	*N* = 477	*N* = 473	*N* = 454
Low	−0.000 (−0.002 to 0.002)	−0.000 (−0.002 to 0.002)	−0.000 (−0.002 to 0.002)
Medium	−0.000 (−0.002 to 0.002)	−0.000 (−0.002 to 0.001)	−0.000 (−0.002 to 0.001)
High (ref.)			
Costs	*N* = 404	*N* = 404	*N* = 388
Low	166.68 (−89.09 to 422.45)	144.46 (−99.48 to 388.39)	138.93 (−104.95 to 382.82)
Medium	118.86 (−131.04 to 368.75)	111.74 (−153.37 to 376.85)	174.17 (−89.88 to 438.23)
High (ref.)			
By complexity			
QALY	*N* = 477	*N* = 473	*N* = 454
Medium	−0.001 (−0.003 to 0.001)	−0.001 (−0.003 to 0.001)	−0.001 (−0.002 to 0.001)
High	0.001 (−0.001 to 0.003)	0.001 (−0.001 to 0.003)	0.001 (−0.001 to 0.003)
Low (ref.)			
Costs	*N* = 404	*N* = 404	*N* = 388
Medium	−2015 (−300.34 to 260.05)	−0.95 (−292.33 to 290.42)	−73.73 (−416.72 to 269.25)
High	−182.88 (−325.93 to 44.35)	−163.22 (−390.20 to 63.75)	−196.28 (−429.68 to 37.11)
Low (ref.)			

a From multilevel generalised linear model (GLM) (log link, Gamma family) regressions of total cost with fixed effect for complexity (low/medium/high) and random effect for site number. For QALYs, multilevel mixed-effects linear regression was used with the same covariates as in GLM and post-index visit utility score.
b From multilevel GLM (log link, Gamma family) regressions of total cost with fixed effects for complexity (low/medium/high) and appointment modality [three levels: surgery (ref.), virtual, home visits] and random effect for site number. For QALYs, multilevel mixed-effects linear regression was used with the same covariates as in GLM and post-index visit utility score.
c From multilevel GLM (log link, Gamma family) regressions of total cost with fixed effects for complexity (low/medium/high) and appointment modality [three levels: surgery (ref.), virtual, home visits], age, gender, ethnicity, and random effect for site number. For QALYs, multilevel mixed-effects linear regression was used with the same covariates as in GLM and post-index visit utility score.

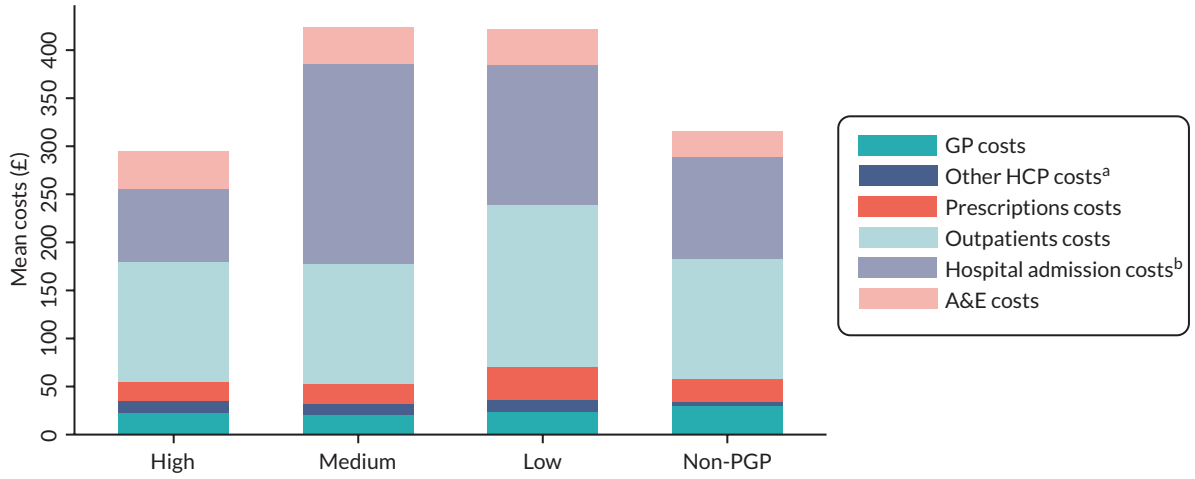

FIGURE 8 Total NHS healthcare costs (£) by integration levels. a, HCP includes paramedic, nurse, and other non-GP contacts. b, Hospital admissions cost includes day cases and overnight stay costs.

TABLE 19 Mean resource use and costs by integration and complexity levels

	Low (*N* = 41)[a]			Medium (*N* = 72)[a]			High (*N* = 174)[a]		
	Mean resource use	**Mean costs (£)**	**SD**	**Mean resource use**	**Mean costs (£)**	**SD**	**Mean resource use**	**Mean costs (£)**	**SD**
By integration levels									
Primary healthcare resource use									
GP visits	1.22	23.63	(32.49)	1.18	20.54	(21.63)	1.28	22.71	(28.71)
Other HCP[b]	1.17	12.88	(18.24)	0.97	11.11	(15.12)	1.13	12.22	(18.41)
Prescriptions	2.44	33.65	(83.22)	2.61	21.28	(37.67)	2.66	20.04	(28.07)
Secondary healthcare resource use									
Outpatients	0.95	168.39	(266.34)	0.69	125.15	(160.25)	0.69	124.51	(225.96)
A&E	0.12	37.18	(101.01)	0.13	38.11	(113.71)	0.13	39.43	(175.53)
Admissions[c]	0.22	146.56	(536.67)	0.40	207.89	(1125.02)	0.09	75.84	(363.68)
Total NHS costs		422.30	(858.09)		424.08	(1196.44)		294.75	(557.15)

	Low (*N* = 130)[a]			Medium (*N* = 81)[a]			High (*N* = 76)[a]		
	Mean resource use	**Mean costs (£)**	**SD**		**Mean resource use**	**Mean costs (£)**	**SD**		**Mean resource use**
By complexity levels									
Primary healthcare resource use									
GP appts	1.29	23.19	(25.90)	GP appts	1.29	23.19	(25.90)	GP appts	1.29
Other HCP[b]	1.13	11.65	(16.87)	Other HCP[b]	1.13	11.65	(16.87)	Other HCP[b]	1.13
Prescriptions	2.40	23.79	(54.89)	Prescriptions	2.40	23.79	(54.89)	Prescriptions	2.40
Secondary healthcare resource use									
Outpatients	0.85	152.22	(231.45)	Outpatients	0.85	152.22	(231.45)	Outpatients	0.85
A&E	0.08	23.45	(81.56)	A&E	0.08	23.45	(81.56)	A&E	0.08
Admissions[c]	0.12	105.49	(431.10)	Admissions[c]	0.12	105.49	(431.10)	Admissions[c]	0.12

a Available cases by resource use costs category.
b Includes nurses, paramedics and other non-GP contacts.
c Includes day cases and overnight stays.

In the multivariable regression models (see *Table 18*), integration level was not associated with a significant difference in total NHS costs. In the fully adjusted model (last column), when compared to high-integration practices, NHS total costs were £138.93 more for low-integration practices (95% CI −£104.95 to £382.82) and £174.17 more for medium-integration practices (95% CI −£89.88 to £438.23); however, there was a considerable uncertainty around these figures and the differences were not significant.

Productivity and informal care

Participants from low-integration practices were least likely to be employed (30%; *Table 20*). Participants from low- and medium-integration sites had a similar absenteeism rate (≈2 hours) which contrasts with the low absenteeism rate (< 1 hour) reported by participants at high-integration sites. Participants from high-integration practices received more informal care than participants from medium- and low-integration practices (an average of 7.02 hours vs. 3.39 hours and 4.31 hours, respectively). It is important to note the high uncertainty in these estimates when considering the SD of informal care costs. Irrespective of integration levels, participants reported an equal impact of their conditions on their usual daily activity: low (3.07), medium (3.00) and high (2.98). There is high uncertainty in the estimates of productivity and informal care costs.

Cost–consequence analysis

Although NHS (see *Table 18*) and broader costs (see *Table 20*) varied by the level of PGP integration, the CIs and SDs are large. This provides no strong evidence that societal costs differed between PGP integration models. Findings for QALYs (see *Table 18*) also indicate no association between PGP integration model and QoL over the 30-day episode. However, when compared to participants at practices that did not use paramedics, there is some evidence that participants at PGP practices who saw a paramedic had lower confidence in health provision and practice activation immediately after their consultation with the paramedic (see *Table 14*). There was also some evidence that participants who consulted paramedics at practices of all integration levels reported lower practice activation scores at 30-day follow-up than participants at practices that did not use paramedics (see *Table 16*).

Paramedics in general practice: patient complexity findings

The 30-day follow-up was completed by 155 participants from 9 low-complexity practices, 97 participants from 8 medium-complexity practices and 89 participants from 8 high-complexity practices (*Table 21*). Sites with paramedics working with medium- and high-complexity patients were larger than the non-PGP and low-complexity sites. The median patient age in the low-complexity sites was slightly younger than for the non-PGP sites (59 vs. 65 years). Paramedics at medium- and high-complexity sites had fewer face-to-face appointments (71% and 73%) compared to paramedics at low-complexity sites and non-PGP sites (84% and 80%).

After the index visit, the PCOQ 'confidence in health provision' scores were lower (i.e. less confidence) for all three levels of PGP patient complexity compared to non-PGP sites (median 4 vs. 4.6) (see *Table 21*). Similarly, practice activation scores were lower for all three levels of PGP patient complexity (median 81 for low complexity, 75 for medium and high complexity, 92 for non-PGP). Differences were also observed with the PREOS-PC patient harm severity and VAS scores, with lower VAS scores in the medium-complexity group (median 90 vs. 100 in other categories). No differences were observed for the individual items on the PREOS-PC looking at types of safety problems.

No differences in the change in PCOQ scores were found between the levels of PGP complexity in the unadjusted analysis (*Table 22*). For the PREOS-PC at day 30, the practice activation scores were lowest in the sites with a medium level of paramedic complexity and highest in non-PGP sites (median 69 in medium complexity, 81 in low and high complexity and 94 in non-PGP). This trend was also seen with the PREOS-PC VAS safety score (median 90 in medium and high complexity and 100 in other categories).

After adjusting for covariates (*Table 23*), a statistically significant difference was seen in the PCOQ domain for change in 'confidence in health plan', such that a slightly smaller change was observed in the high-complexity PGP sites compared to the non-PGP sites. The adjusted difference in the mean change in high-complexity sites compared to non-PGP sites was small (−0.10, 95% CI −0.17 to −0.04), suggesting that confidence in health provision had deteriorated slightly more

TABLE 20 Productivity and informal care by integration and complexity

	Low				Medium				High			
	N[a]	Mean	Costs[b] (£)	SD	*N*[a]	Mean	Costs[b] (£)	SD	*N*[a]	Mean	Costs[b] (£)	SD
By integration levels												
Productivity												
% employed	44	29.55%			77	44.16%			178	44.38%		
Absent (last 7 days)	44	2.05	142.89	(487.01)	77	2.07	144.70	(489.58)	178	0.83	57.69	(308.51)
Informal care												
Hours (last 7 days)	39	4.31	300.92	(612.40)	75	3.39	236.58	(721.14)	175	7.02	490.40	(1699.95)
Measure of usual activities (1–10)[c]	43	3.07		(3.50)	76	3.00		(3.20)	185	2.98		(3.17)
By complexity levels												
Productivity												
% employed	132	44.70%			88	36.36%			79	44.30%		
Absenteeism in the last 7 days	132	2.06	144.21	(493.07)	88	0.67	46.84	(278.77)	79	0.82	57.48	(289.92)
Informal care												
Hours in the last 7 days	127	3.48	243.12	(749.54)	85	10.06	703.09	(1989.35)	77	4.58	320.25	(1380.00)
Measure of usual activities (1–10)[c]	139	3.01		(3.19)	86	3.30		(3.33)	79	2.65		(3.14)

a Available cases by productivity and informal care category.
b Costs were extrapolated to reflect a 30-day period.
c 0 (no effect) and 10 (completely prevented).

TABLE 21 Index visit characteristics and participant-reported outcomes for those who completed 30-day follow-up by patient complexity

	Low	Medium	High	Non-PGP	
No. of sites	9	8	8	8	
No. of eligible participants completing index visit data	229	136	123	228	
No. of participants completing follow-up data	155 (68%)	97 (71%)	89 (72%)	148 (65%)	
No of participants per site (range)	1–59	2–24	3–33	5–40	
No. of participants with complete index visit data and PCOQ data	130 (84%)	79 (81%)	79 (89%)	134 (91%)	
Site characteristics					
Practice size, median (range)	9094 (3965–37,871)	17,897 (13,080–36,169)	15,002 (9957–44,964)	9331 (4710–31,860)	
IMD decile, median (range)	8 (2–9)	6 (3–9)	8 (1–10)	8 (6–10)	
Urban sites, *N* (%)	7 (78%)	8 (100%)	6 (75%)	6 (75%)	
Age-standardised mortality rate, median (range)	1057 (780–1220)	1051 (846–1123)	1015 (761–1315)	981 (802–1065)	
Ethnicity. % of non-white, median (range)	2.8 (1.1–10.2)	3.6 (1.7–27.5)	4.1 (2.3–21.3)	7.1 (1.4–49.1)	
Patient characteristics					***p*-value**[a]
Age, median (IQR)	*N* = 153 59 (42–70)	*N* = 95 62 (49–73)	*N* = 89 62 (49–69)	*N* = 146 65 (51–74)	0.0441; 0.007 for low vs. non-PGP
Male, *n* (%)	*N* = 153 50 (33%)	*N* = 96 19 (20%)	*N* = 88 25 (28%)	*N* = 146 38 (26%)	0.162
Ethnicity, n (%)	*N = 146*	*N = 94*	*N = 89*	*N = 148*	
White	140 (95%)	9 1 (97%)	85 (96%)	137 (93%)	0.494
Mixed	0	1 (1.1%)	0	1 (0.7%)	
Asian	5 (3.4%)	1 (1.1%)	3 (3.4%)	4 (2.7%)	
Black	0	1 (1.1%)	1 (1.1%)	2 (1.4%)	
Other	1 (0.7%)	0	0	4 (2.7%)	
Mode of appointment, n (%)	*N = 154*	*N = 96*	*N = 88*	*N = 146*	*0.037*
Face-to-face at home	4 (2.6%)	9 (9%)	3 (3.4%)	5 (3.4%)	
Face-to-face at surgery	126 (82%)	59 (61%)	61 (69%)	112 (77%)	
Telephone/video call	24 (16%)	27 (28%)	24 (27%)	29 (20%)	
E-consult by text/e-mail	0	1 (1%)	0	0	
Number of GP surgery appointments in the past month, median (IQR)	*N* = 136 2 (1–4)	*N* = 87 2 (0–3)	*N* = 78 2 (1–3)	*N* = 130 2 (1–3)	0.678
Number of prescribed medications in the past month, median (IQR)	*N* = 143 2 (0–3)	*N* = 92 2 (1–4)	*N* = 81 2 (0–3)	*N* = 136 2 (1–4)	0.313

TABLE 21 Index visit characteristics and participant-reported outcomes for those who completed 30-day follow-up by patient complexity (*continued*)

	Low	Medium	High	Non-PGP	
Participant-reported outcomes at index visit					
PCOQ at index visit, median (IQR)					
Health and well-being	*N* = 149 4.0 (3.3–4.5)	*N* = 90 3.9 (3.2–4.3)	*N* = 85 4.3 (3.5–4.6)	*N* = 143 4.1 (3.5–4.4)	0.141
Confidence in health provision	*N* = 149 4.0 (3.7–4.8)	*N* = 91 4.0 (3.5–4.8)	*N* = 85 4.0 (3.5–4.8)	*N* = 145 4.6 (4.0–5.0)	0.002; < 0.001 for low, med, high vs. non-PGP
Health knowledge and understanding	*N* = 151 4.5 (4.0–5.0)	*N* = 90 4.8 (4.0–5.0)	*N* = 85 4.8 (4.3–5.0)	*N* = 146 4.8 (4.0–5.0)	0.349
Confidence in health plan	*N* = 149 4.3 (3.8–4.7)	*N* = 90 4.3 (4–4.7)	*N* = 85 4.5 (4.0–4.8)	*N* = 145 4.3 (3.8–4.8)	0.103
PREOS-PC at index visit domains, median (IQR)					
Practice activation	*N* = 135 81 (63–94)	*N* = 81 75 (50–94)	*N* = 78 75 (56–100)	*N* = 137 92 (75–100)	< 0.001; < 0.001, for low, med, high vs. non-PGP
Patient activation	*N* = 94 25 (0–50)	*N* = 64 38 (0–56)	*N* = 41 25 (0–50)	*N* = 81 38 (0–63)	0.824
Patient harm severity	*N* = 139 100 (100–100)	*N* = 83 100 (100–100)	*N* = 77 100 (100–100)	*N* = 132 100 (100–100)	0.007; 0.003 for med vs. non-PGP
Patient harm burden	*N* = 139 100 (100–100)	*N* = 82 100 (100–100)	*N* = 76 100 (100–100)	*N* = 132 100 (100–100)	0.169
PREOS-PC VAS	*N* = 136 100 (90–100)	*N* = 78 90 (80–100)	*N* = 77 100 (90–100)	*N* = 136 100 (90–100)	0.001; < 0.001, 0.0075 for med, high vs. non-PGP
Types of safety problems, n (%)					
Diagnosis	8 (5.2%)	9 (9.3%)	3 (3.4%)	9 (6.1%)	0.397
Medication prescribed	11 (7.1%)	12 (12%)	3 (3.4%)	11 (7.4%)	0.146
Other treatments prescribed	4 (2.6%)	2 (2.1%)	2 (2.3%)	4 (2.7%)	1.000
Vaccines prescribed	4 (2.6%)	4 (4.1%)	0	4 (2.7%)	0.324
Blood and lab tests	7 (4.5%)	7 (7.2%)	2 (2.3%)	7 (4.7%)	0.491
Diagnosis and follow-up tests	5 (3.2%)	2 (2.1%)	3 (3.4%)	6 (4.1%)	0.878
Appointments	9 (5.8%)	6 (6.2%)	4 (4.5%)	6 (4.1%)	0.851
Health records	7 (4.5%)	6 (6.2%)	2 (2.3%)	4 (2.7%)	0.475
Communication problems between you and healthcare staff	*N* = 139 21 (15%)	*N* = 81 13 (16%)	*N* = 79 7 (8.9%)	*N* = 137 9 (6.6%)	0.059
Communication problems among healthcare staff	*N* = 136 15 (11%)	*N* = 82 8 (9.8%)	*N* = 80 9 (11%)	*N* = 137 10 (7.3%)	0.694
Communication problems between healthcare staff and other HCPs	*N* = 136 18 (13%)	*N* = 82 11 (13%)	*N* = 79 5 (6.3%)	*N* = 137 16 (11.8%)	0.414

continued

TABLE 21 Index visit characteristics and participant-reported outcomes for those who completed 30-day follow-up by patient complexity (*continued*)

	Low	Medium	High	Non-PGP	
PREOS-PC items, n (%)					
Question 5.1, harm to physical health	*N* = 139	*N* = 83	*N* = 79	*N* = 133	0.115
Not at all	124 (89%)	69 (83%)	68 (86%)	123 (92%)	
Yes, some	5 (3.6%)	9 (11%)	3 (3.8%)	6 (4.5%)	
Yes, a lot	1 (0.7%)	1 (1.2%)	0	0	
Yes, extreme	0	1 (1.2%)	1 (1.3%)	0	
I don't know (yet)	9 (6.5%)	3 (3.6%)	7 (8.9%)	4 (3.0%)	

a Using Kruskal–Wallis tests for continuous outcomes and Fisher's exact test for categorical outcomes. Where significant differences were found, Bonferroni corrected *p*-values ($p = 0.05/6 = 0.0083$ defined statistical significance) from Mann–Whitney *U*-tests/Fisher's exact tests explored which categories differed.

TABLE 22 Thirty-day unadjusted follow-up data by level of patient complexity

	Low	Medium	High	Non-PGP	*p*-value[a]
Change in PCOQ (30 day – index visit), n =, median (IQR)					
Health and well-being	*N* = 142 0.1 (−0.1 to 0.5)	*N* = 87 0.1 (−0.2 to 0.4)	*N* = 84 0.1 (−0.1 to 0.5)	*N* = 138 0.3 (−0.1 to 0.6)	0.413
Confidence in health provision	*N* = 147 0.0 (−0.2 to 0.2)	*N* = 88 0.0 (−0.3 to 0.3)	*N* = 83 0.0 (−0.3 to 0.2)	*N* = 142 0.0 (−0.3 to 0)	0.288
Health knowledge and understanding	*N* = 150 0.0 (0.0–0.5)	*N* = 89 0.0 (0.0–0.5)	*N* = 84 0.0 (−0.3 to 0.3)	*N* = 143 0.0 (0.0–0.3)	0.257
Confidence in health plan	*N* = 148 0.0 (−0.3 to 0.3)	*N* = 86 0.0 (−0.5 to 0.5)	*N* = 83 0.0 (−0.3 to 0.2)	*N* = 142 0.0 (−0.2 to 0.3)	0.189
PREOS-PC at day 30, median (IQR)					
Practice activation	*N* = 142 81 (56–100)	*N* = 91 69 (44–88)	*N* = 84 81 (69–97)	*N* = 137 94 (75–100)	< 0.001; < 0.001 < 0.001, 0.006, 0.004, 0.002 for low, med, high vs. non-PGP, low vs. med, med vs. high
Patient activation	*N* = 101 38 (13–63)	*N* = 72 38 (0–50)	*N* = 53 38 (0–63)	*N* = 72 38 (19–63)	0.656
Patient harm severity	*N* = 145 100 (100–100)	*N* = 92 100 (100–100)	*N* = 83 100 (100–100)	*N* = 135 100 (100–100)	0.095
Patient harm burden	*N* = 144 100 (100–100)	*N* = 94 100 (100–100)	*N* = 82 100 (100–100)	*N* = 135 100 (100–100)	0.680
PREOS-PC VAS	*N* = 143 100 (90–100)	*N* = 87 90 (80–100)	*N* = 85 90 (90–100)	*N* = 137 100 (90–100)	0.016; 0.0032 for med vs. non-PGP
Types of safety problems, n (%)					
Diagnosis	13 (8.4%)	8 (8.3%)	8 (9.0%)	6 (4.1%)	0.322
Medication prescribed	14 (9.0%)	15 (15%)	6 (6.7%)	11 (7.4%)	0.162
Other treatments prescribed	7 (4.5%)	2 (2.1%)	2 (2.3%)	3 (2.0%)	0.591

TABLE 22 Thirty-day unadjusted follow-up data by level of patient complexity (*continued*)

	Low	Medium	High	Non-PGP	*p*-value[a]
Vaccines prescribed	3 (1.9%)	1 (1.0%)	2 (2.3%)	1 (0.7%)	0.802
Blood and lab tests	9 (5.8%)	6 (6.2%)	3 (3.4%)	2 (1.4%)	0.127
Diagnosis and follow-up tests	9 (5.8%)	5 (5.2%)	3 (3.4%)	3 (2.0%)	0.365
Appointments	16 (10%)	8 (8.3%)	5 (5.6%)	5 (3.4%)	0.096
Health records	8 (5.2%)	3 (3.1%)	2 (2.3%)	1 (0.7%)	0.117
Communication problems between you and healthcare staff	*N* = 145 26 (18%)	*N* = 90 10 (11%)	*N* = 84 10 (12%)	*N* = 135 14 (10%)	0.269
Communication problems among healthcare staff	*N* = 142 13 (9.2%)	*N* = 89 8 (9.0%)	*N* = 84 5 (6.0%)	*N* = 133 8 (6.0%)	0.692
Communication problems between healthcare staff and other HCPs	*N* = 141 15 (11%)	*N* = 94 14 (15%)	*N* = 84 7 (8.3%)	*N* = 133 12 (9%)	0.491
PREOS-PC items, n (%)					
Question 5.1, harm to physical health	*N* = 144	*N* = 93	*N* = 85	*N* = 136	0.140
Not at all	129 (90%)	80 (86%)	72 (85%)	126 (93%)	
Yes, some	6 (4.2%)	9 (9.7%)	8 (9.4%)	4 (2.9%)	
Yes, a lot	0	1 (1.1%)	1 (1.2%)	0	
Yes, extreme	3 (2.1%)	1 (1.1%)	0	0	
I don't know (yet)	6 (4.2%)	2 (2.2%)	4 (4.7%)	6 (4.4%)	

a Using Kruskal–Wallis tests for continuous outcomes and Fisher's exact test for categorical outcomes. Where significant differences were found, Bonferroni corrected *p*-values ($p = 0.05/6 = 0.0083$ defined statistical significance) from Mann–Whitney *U*-tests/Fisher's exact tests explored which categories differed.

in this group compared to the non-PGP group (i.e. a slightly poorer outcome in the high-complexity sites). A statistically significant difference was also found with the PREOS-PC practice activation score at day 30, with lower scores in sites with a low and medium level of paramedic complexity. The adjusted difference in the mean practice activation score in low-complexity sites was −5.9 (95% CI −8.9 to −2.9), and in medium-complexity sites was −4.9 (95% CI −9.2 to −0.6) compared to non-PGP sites.

Quality of life

Participants showed improvement at follow-up as indicated by EQ-VAS. Mean EQ-5D-5L utility scores remained similar from post-index visit to follow-up at medium-complexity sites but increased on average by 0.025 at low-complexity sites and 0.046 at high-complexity sites (see *Table 17*). There were no significant differences in post-index utility scores and EQ-VAS scores between low-, medium- and high-complexity groups. Differences in unadjusted QALYs by complexity level were small. When patient- and appointment-level characteristics were accounted for in the adjusted analysis, there was no substantial difference in QALYs between levels of patient complexity (see *Table 18*).

Resource use and costs

Total NHS costs per episode were highest among participants at medium-complexity practices: £436.55 (SD £1160.60) compared to £339.79 (SD £652.35) and £257.90 (SD £541.70) among participants at low- and high-complexity practices, respectively (*Figure 9*). The mean cost of primary care visits ranged between £55 and £58 across participant complexity levels (see *Table 19*). The average secondary care costs were highest in medium-complexity practices, but there was one participant at a medium-complexity practice who had an expensive inpatient admission, due to a long

TABLE 23 Results from multilevel modelling showing adjusted[a] difference in means (95% CIs): level of paramedic complexity vs. non-PGP

	Low	Medium	High	*p*-value
Change in PCOQ (30 days – index visit)				
Health and well-being, *n* = 433	−0.02 (−0.13 to 0.10)	−0.05 (−0.25 to 0.15)	−0.018 (−0.14 to 0.10)	0.973
Confidence in health provision, *n* = 441	−0.03 (−0.14 to 0.08)	−0.08 (−0.26 to 0.10)	−0.07 (−0.20 to 0.05)	0.666
Health knowledge and understanding, *n* = 447	0.06 (−0.05 to 0.17)	0.17 (−0.05 to 0.39)	0.02 (−0.10 to 0.14)	0.479
Confidence in health plan, *n* = 440	−0.03 (−0.09 to 0.03)	−0.08 (−0.17 to 0.004)	−0.10 (−0.17 to −0.04)	0.014; 0.002 for high vs. non-PGP
PREOS-PC at day 30				
Practice activation, *n* = 389	−5.9 (−8.9 to −2.9)	−4.9 (−9.2 to −0.6)	−1.7 (−5.3 to 1.9)	< 0.001; < 0.001 for low vs. non-PGP
PREOS-PC VAS[b] *n* = 386 < 90 vs. 90 +	1.02 (0.47 to 2.18)	1.81 (0.84 to 3.90)	1.53 (0.90 to 2.60)	0.137
PREOS-PC VAS[c] < 100 vs. 100 +, *n* = 386	1.37 (0.68 to 2.77)	1.10 (0.51 to 2.34)	1.47 (0.77 to 2.79)	0.606

a Adjusting for the patient-level factors: index visit score, age (continuous), sex, ethnicity (white or not white) and the number of attendances (0–1, 2–3, 4 +, unknown), and for the practice-level factors: age-standardised mortality rate (continuous), % non-white (continuous), urban vs. rural, practice size (small, medium, large) and deprivation decile (1–3, 4–7, 8–10), with site fitted as a random effect.
b Adjusted odds ratio for a VAS < 90 vs. 90 + obtained from a multilevel logistic regression model.
c Adjusted odds ratio for having a VAS < 100 vs. a score of 100 obtained from a multilevel logistic regression model, as part of the sensitivity analysis.

length of stay (13 nights). In the multivariable regressions (see *Table 18*), complexity level was not associated with a significant change in total NHS costs over the follow-up period in any of the models. However, the CIs are wide, reflecting high uncertainty around the estimates.

Productivity and informal care

Participants at low-complexity practices reported the highest amount of absenteeism (> 2 hours) compared to < 1 hour in medium- and low-complexity practices (see *Table 20*). Participants at medium-complexity practices received the highest amount of informal care (> 10 hours). Participants from practices of all complexity levels reported a similar rating for the impact of their health conditions on performing daily activities.

Cost–consequence analysis

Although NHS (see *Table 18*) and broader costs (see *Table 20*) varied by the level of patient complexity, the CIs and SDs are large. This provides no strong evidence that societal costs differed between PGP patient complexity models. Findings for QALYs (see *Table 18*) also indicate no association between PGP patient complexity model and QoL over the 30-day episode. However, when compared to patients at practices that did not use PGPs, there is some evidence that patients at PGP practices who saw a paramedic had lower confidence in health provision and practice activation immediately after their consultation with the paramedic (see *Table 21*). There was also some evidence that patients who consulted paramedics at high-complexity practices had greater deterioration in confidence in the health plan at 30-day follow-up than patients at practices that did not use paramedics (see *Table 23*). Patients who consulted paramedics at practices of all complexity levels tended to report lower practice activation scores at 30-day follow-up than patients at practices that did not use paramedics (see *Table 23*).

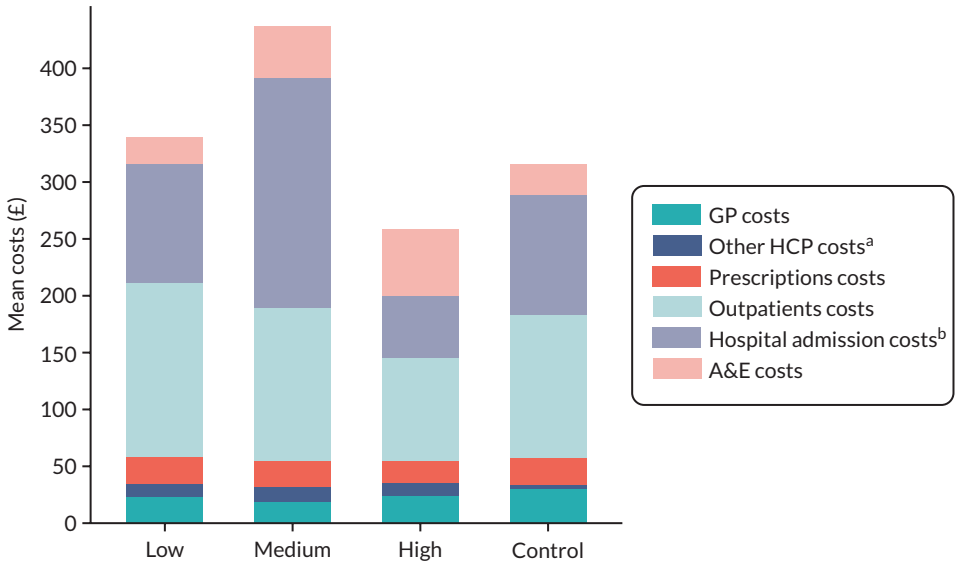

FIGURE 9 Total NHS healthcare costs (£) by patient complexity level. a, HCP includes paramedic, nurse and other non-GP contacts. b, Hospital admissions cost includes day cases and overnight stay costs.

Sensitivity and post hoc analyses

Similar results were observed when the multilevel models were rerun, without adjusting for the index visit PCOQ score in the change in PCOQ score analysis, and the index visit PREOS-PC score in the PREOS-PC analysis (see *Report Supplementary Material 8*). For the PCOQ, as with the analysis adjusting for index visit scores, the only statistically significant difference was with confidence in health plan by complexity, with the adjusted difference in the mean change in high-complexity sites compared to non-PGP sites remaining small (−0.13, 95% CI −0.18 to −0.09). As expected, the effect sizes for the PREOS-PC at day 30 were larger when the index visit PREOS-PC score was not adjusted for, suggesting that some of the variation seen in day 30 scores is due to variation in index visit scores. For PREOS-PC practice activation, the adjusted difference in the mean score for PGP sites compared to non-PGP sites was −10.4 (95% CI −15.5 to −5.2). The only differences in results observed was that for practices in the low-integration groups, the adjusted PREOS-PC practice activation scores were lower than for any of the other groups, with an adjusted difference in mean scores for low-integration compared to non-PGP sites of −17.4 (95% CI −25.7 to −9.1), in comparison to −9.8 (95% CI −19.7 to 0.02) for medium-integration compared to non-PGP sites and −8.8 (95% CI −14.0 to −3.6) for high-integration sites. Also, the adjusted odds of having a VAS score of < 90 was greatest for practices in the medium- (odds ratio 2.32, 95% CI 1.20 to 4.47) and high-complexity groups (odds ratio 1.70, 95% CI 1.10 to 2.61).

The coefficients from the multilevel models not adjusting for the number of attendances (see *Report Supplementary Material 8*) were very similar to those obtained in the primary analysis. However, the *p*-values changed slightly and just reached statistical significance for the PCOQ domain change in 'confidence in health plan' for PGP versus no PGP and PGP integration. However, the differences in means compared to non-PGP were small and are unlikely to be of clinical significance, as with the primary analysis by PGP complexity.

Post hoc analysis of the PCOQ domain 'confidence in health provision' at index visit revealed (after fitting multilevel models and adjusting for covariates) that scores were lower in the PGP practices (see *Appendix 4*), with an adjusted difference in mean scores of −0.33 (95% CI −0.53 to −0.14). Lower confidence in provision was observed in the high- (adjusted difference in mean scores of −0.34, 95% CI −0.52 to −0.15) and low-integration sites (adjusted difference in mean scores of −0.39, 95% CI −0.75 to −0.02) compared to non-PGP practices, and at all levels of complexity (adjusted difference in mean scores of −0.35, 95% CI −0.56 to −0.13 for low complexity; −0.40, 95% CI −0.69 to −0.11 for medium complexity and −0.30, 95% CI −0.51 to −0.08 for high complexity compared to non-PGP). This was also the case for 'confidence in health provision' at 30 days, with lower scores in the PGP practices with an adjusted difference in mean scores of −0.32 (95% CI −0.49 to −0.15), indicating that poorer scores are maintained to 30 days.

Economic sensitivity analyses

Sensitivity analyses were conducted to examine the robustness of our findings to the exclusion of outliers and multiple imputation of missing data (see *Report Supplementary Material 8*). Follow-up data were missing in up to 39% of cases (see *Appendix 5*). Exploratory analysis indicated that the odds of missing data were significantly reduced in females and with increasing age.

The primary analysis model was repeated for the PGP versus non-PGP sites after the exclusion of identified outliers; that is, if overall NHS costs were above 95th percentile. In total, 20 participants were excluded (PGP = 16 participants). The PGP care model resulted in a reduction in total costs by just under £35 when compared to the non-PGP care model (95% CI −£94.88 to £25.52) over a 30-day care episode compared to the increase in costs from the complete case analysis. Although this changed the estimate of the incremental cost of paramedic-led care compared to non-paramedic-led care from somewhat more expensive in our primary analysis to somewhat less expensive in the sensitivity analysis, all the CIs include the possibility that paramedic-led care had no association with NHS costs (see *Report Supplementary Material 8*). This sensitivity analysis demonstrates that our NHS cost findings are sensitive to a small number of high-cost patients. Multiple imputation of missing data had very little impact on the estimates of incremental cost or QALYs or the respective CIs.

For a discussion of the findings, the limitations and implications for future practice, please see *Chapter 9*.

Chapter 6 Retrospective study using general practitioner electronic medical record data to explore the process and costs of paramedic-led and general practitioner-led primary care

Aims and research questions

The aim of this substudy was to evaluate the role of PGP and to provide evidence about different service delivery models to determine their ability to make efficient use of healthcare resources.

Specifically, this substudy aimed to explore the following research questions

1. How does PGP care impact on patient clinical outcomes (e.g. reconsultations, unplanned hospital admissions, prescriptions, referrals, tests and investigations)?
2. What are the direct costs/savings associated with PGP care and does it provide good value for money?

Methods

Study design

We conducted a cohort study comparing:

1. Paramedic-led care episodes at practices that employed paramedics with GP-led episodes of care at practices that did not employ paramedics. For brevity, these comparisons are labelled as **PGP versus non-PGP**.
2. Paramedic-led care episodes at practices that employed paramedics categorised by the level of paramedic integration into the practice (low/medium/high). For brevity, these comparisons are labelled as **PGP integration**.
3. Paramedic-led care episodes at practices that employed paramedics categorised by the level of patient complexity that the paramedics were assigned (low/medium/high). For brevity, these comparisons are labelled as **PGP patient complexity**.

Paramedic integration and patient complexity are defined in detail in *Site classification*. The study used data retrospectively extracted from the GP EHR. Ethical approval for this element of the project is described in *Overview*.

Setting

We aimed to recruit up to 12 GP sites providing NHS care in England (including sites that did and did not have PGP in operation and sites with different models of PGP). These 'detailed' case study sites are a subset of the case study sites described in *Chapter 3*. We planned to recruit sites according to the taxonomy of PGP care developed during the rapid realist review using a sampling frame aiming to ensure variation (e.g. in patient demographics, practice size, urbanity and deprivation) in the types of practices selected as case study sites.

We had anticipated extracting data from practices using each of the two main primary healthcare records platforms in use in England: EMIS Web and SystmOne. With the support of a clinical systems specialist, we developed and piloted the search strategy initially for the EMIS platform. Due to the differing native database architecture of the two platforms, we encountered challenges unifying the data extracts across the EMIS Web and SystmOne platforms, resulting in some subtle (but potentially significant) differences in how episodes of care would have been identified and extracted. A pragmatic decision was made to direct resources to developing one search protocol only, and as the EMIS Web strategy was the most advanced we elected to proceed with this (having satisfied ourselves there were no

material, systematic differences between study practices using EMIS Web and SystmOne platforms). In the event, eight PGP sites and two non-PGP sites provided EMIS Web EHR data.

We planned to extract data from the GP EHR at each of the 10 detailed case study practices covering a period of 1 year (1 July 2021 to 30 June 2022) to capture seasonal variations in care requirements. Due to practical challenges with data extraction, one of the non-PGP practices only provided data for 9 months (1 July 2021 to 31 March 2022).

Participants

In preparation for this project, we designed and piloted data queries suitable for extracting the data required for our analysis, using EMIS Web systems. Piloting involved comparing samples of the data extract with the data held on the EHR to check for concordance. We created a standard operating procedure document to guide practices in extracting data (see *Report Supplementary Material 9*). In order to minimise the size of the data extract, the database query at PGP sites only extracted data on patients who had had any clinical event recorded by a paramedic in the practice during the year. At non-PGP sites the database query extracted data on all patients with any clinical event recorded by any healthcare practitioner during the year.

All patients of any age registered at any of the 10 practices during the year were potentially eligible. Practices use EMIS to record consultations in various settings including surgery, remote (e.g. telephone) and home visits. Consultations are also categorised by type (e.g. new, first, review, none recorded). We defined an index consultation for an individual patient to be the first consultation during the 12-month study period in any setting and of any type with a practice-based paramedic (at a PGP site) or a GP (at a non-PGP site). Therefore, a patient only had one index consultation included in the data set. We excluded patients who did not have any such consultations during the year. We excluded events recorded in the EHR which: (1) occurred before the index consultation; (2) were recorded by an administrator or reflected an administrative event (e.g. referral letter) rather than a consultation; or (3) indicated that the patient did not attend a planned appointment. A single consultation usually has multiple clinical codes recorded in EMIS, reflecting, for example, patient history, symptoms and diagnoses. Any referrals and medications are also recorded for each patient. Each code has a date and time stamp when entered onto the system. However, there is no simple way of differentiating multiple codes entered during a single consultation from multiple codes entered during two consultations in close succession. Therefore, we defined a single consultation for a patient to include all clinical codes entered within 30 minutes of the first code on that day. If more clinical codes were entered later in the day, they were categorised as further consultations.

In the primary economic analysis, we defined the period from the date of the index consultation until 30 days later as the episode of care. This was selected as a period of time which would most likely capture the majority of repeat consultations, medications and referrals directly influenced by the index consultation.

Outcome variables

The primary 'outcome' variable explored in the economic analysis was the total cost of care during the 30-day episode. The following items of healthcare resource are recorded in EMIS and were used in the estimation of costs:

1. consultations by setting (e.g. GP surgery, home visit) and HCP (e.g. GP, paramedic or nurse)
2. prescriptions
3. blood tests
4. referrals [for specialist care, AHPs (e.g. physiotherapist) or imaging]
5. A&E visits
6. unplanned hospital admissions.

Blood tests, A&E visits and unplanned hospital admissions were identified using a predefined list of SNOMED CT codes (see *Appendix 6*). Our analysis is limited to entries coded in the primary care medical record and therefore will under-record hospital and other care that is not recorded consistently in the GP EHR.

The health care itemised above was valued in monetary terms (GBP, £) using data for the cost year 2021–2. The costs of primary care consultations by setting and healthcare provider were based on the Unit Costs of Health and Social Care.[64]

However, the cost of paramedic-led consultations in any setting and GP- and nurse-led home visits are not available from this source. Therefore, we used the unit costs for a GP-led and practice nurse-led surgery consultation as the basis for estimating these costs. Data extracted from EMIS include prescription costs. For blood tests, specialist, AHP care and imaging referrals, A&E visits and unplanned hospital admissions, we estimated costs using the most appropriate figures included in the National Schedule of NHS Costs[68] (see *Appendix 3* and *Chapter 5* for details).

The costs of each item of health care used during the 30-day episode were summed to estimate the total cost per episode of care. A small number of patients whose index appointment occurred in the last month of the study period did not have sufficient follow-up time to estimate 30-day episode costs. These patients were excluded from the analysis of 30-day episode costs.

The clinical outcomes reported are: percentage of patients who saw a paramedic; mean number of paramedic consultations per patient per year; paramedic 'dose'; length of time the paramedics had worked at the practice; and the percentage of patients who reconsulted with a GP within 7 days of the index appointment. The percentage of patients seen by a paramedic was calculated from the paramedic data collected in the study and using information on practice list size obtained from 'Public Health Profiles "Fingertips" data for General Practice' (Office for Health Improvement and Disparities) for the denominator.[73] Data on all paramedic consultations (rather than the index consultation) with the practice list size were used to calculate the mean number of paramedic consultations per patient per year. (Number of WTE paramedics)/(number of WTE GPs) was used as a measure of paramedic dose.

Other variables

The primary 'predictor' variables were HCP (i.e. PGP or non-PGP) and PGP model (i.e. integration level and patient complexity). EMIS records the HCP type associated with each consultation. We grouped these practitioner types into three categories for analysis: PGP, GP, and other HCP (e.g. nurse, healthcare assistant). The level of PGP integration (low/medium/high) and PGP patient complexity (low/medium/high) were prespecified as described in *Site classification*.

Multivariable regression analyses included consultation-level variables, patient-level variables, and practice-level variables in order to minimise potential bias in comparisons. The consultation-level variables extracted from EMIS were consultation type (new; first; review; none recorded) and consultation setting (GP surgery; remote; home visit). The patient-level variables extracted from EMIS were age and gender. The practice-level variables were size [small (< 10,000 patients); medium (10,000–30,000 patients); large (> 30,000 patients)], socioeconomic deprivation [high (IMD deciles 1–3); medium (IMD deciles 4–7); low (IMD deciles 8–10)], age-standardised mortality per 100,000 population, and percentage non-white ethnicity, obtained from the 'Public Health Profiles "Fingertips" data for General Practice'.[73] Age-standardised mortality rates were taken from the 2021 Office for National Statistics data and are standardised to the 2013 European Standard Population, expressed per 100,000 population, and are based on mid-2020 population estimates.[74]

Data source

EMIS Web is a major primary care clinical system used by GPs in England.[75] Data from EMIS have been used widely in research, both as part of aggregated systematised routine data sets (e.g. via the Clinical Practice Research Datalink 'Aurum' data set) and as a result of local, practice-level customised searches.[76] Among other things, GP staff use it to record clinical events (e.g. diagnoses, procedures, test results), administrative events (e.g. text messages, letters, comments), medications and referrals associated with consultations and patient encounters. Search strategy files were imported and run at practice level by site-based collaborators (clinicians or administrators) using the 'population report' function. Data extracts from each GP practice were transferred to university servers for data preparation and analysis. To supplement the data extracts, we asked each practice to return a proforma detailing which practitioner group(s) undertook which consultation types, what the booked/scheduled default appointment duration was, and whether this differed between HCP groups.

Study size

As the purpose of our analyses was to explore the costs and outcomes of different models of paramedic-led care as part of a realist evaluation, we did not predefine any hypotheses or calculate sample size targets. In recruiting up to 12 GP practices, we aimed to cover a range of PGP and non-PGP practices including different models of PGP working.

Statistical and economic analyses

All statistical analyses were conducted in Stata version 14.0 and economic analyses were conducted in Stata version 17.0.

We described the temporal patterns of GP- and paramedic-led care and for each of the three comparisons (PGP vs. non-PGP; PGP integration; PGP patient complexity) we report practice characteristics, patient characteristics, and index consultation characteristics to highlight any imbalance.

The statistical analysis reports the following outcomes for each of the three comparisons: percentage of patients who saw a paramedic; mean number of paramedic consultations per patient per year; paramedic dose; length of time the paramedics had worked at the practice; and the percentage of patients who reconsulted with a GP within 7 days of the index appointment.

The cost analysis was conducted from the NHS perspective including primary care costs and any secondary care costs (e.g. referrals, A&E visits and unplanned admissions) that were recorded in the primary care record. We costed 30-day care episodes and therefore discounting of long-term costs was not appropriate.

For each of the three comparisons we report mean resource use and mean cost per episode grouped into five categories: (1) index day consultation(s); (2) additional consultations; (3) prescriptions; (4) referrals and testing and (5) unplanned hospitalisations. Total mean costs per episode, unadjusted for differences in practice, patient and index consultation characteristics, are presented. As there was evidence of imbalance both between (PGP vs. non-PGP) and within (PGP models of care) in the setting of index consultations, we also graphed mean episode costs stratified by setting (GP surgery; remote; home visit).

For each of the three comparisons, we used generalised linear model (GLM) regression techniques appropriate for non-negative and potentially skewed cost data. The data are hierarchical as patients are clustered within practices, therefore we used multilevel mixed-effects GLM (Stata command *meglm*) with the primary indicator variable [i.e. PGP (yes/no) or PGP integration (low/medium/high) or PGP patient complexity (low/medium/high)] and covariates described below entered as fixed effects and GP practice entered as a random intercept.

Covariates included index consultation type and setting; patient age and gender; and practice socioeconomic deprivation, age-standardised mortality and percentage non-white ethnicity. To aid interpretation, the continuous variables (age, mortality rate, percentage ethnicity) were centred on the mean before inclusion. We present four models: first, including GP site as a random effect; second, adding index consultation covariates; third, adding patient-level covariates; and finally, adding practice-level covariates.

Sensitivity analyses

We prespecified two sensitivity analyses:

1. Expanding the definition of the episode of care to include events up to 60 and 90 days after the index consultation. We then reran the multivariable analyses comparing the costs of paramedic-led versus non-paramedic-led care.
2. Varying the assumptions underpinning the estimate of PGP consultation costs. The primary analysis made conservative assumptions excluding the qualification and overhead costs of GP and paramedic care (resulting in a lower estimated difference in cost between a GP and a PGP consultation). In sensitivity analysis we included qualification and overhead costs which resulted in a higher estimated difference in cost between a GP and a PGP consultation. We then reran the multivariable analyses comparing the costs of paramedic-led versus non-paramedic-led care.

Post hoc analyses

Our initial analyses indicated that paramedic-led care might be associated with higher prescribing and prescription costs in the subsequent 30 days. Therefore, we decided to explore this further by comparing the number of medications prescribed within 30 days of PGP or GP index consultations. Prescriptions following PGP consultations were further subdivided into those at practices with independent PGP prescribers and those at practices where PGPs either could not prescribe or were in training (and prescriptions required GP sign-off). These analyses were limited to consultations in the clinic and stratified by appointment type (first/new or review) in order to compare like with like.

Results

Overview of the data set

A total of 482,492 clinical event codes were extracted from the EMIS EHR at the 10 GP practices (*Figure 10*). Of these, 237,735 codes were excluded as they were entered by an administrator, related to administrative events rather than consultations, or indicated that a patient did not attend a consultation. A further 81,944 codes were excluded because the patient had no paramedic-led (at PGP sites) or GP-led (at non-PGP sites) consultation during the year or they occurred before the index PGP or GP consultation. Finally, 90,384 codes were excluded as they represented multiple additional codes recorded at a single consultation.

This left 22,509 codes representing index consultations (11,991 paramedic-led at PGP sites and 10,518 GP-led at non-PGP sites) which were the basis for our analyses. In addition, there were 11,973 (7334 in the PGP sites and 4639 in the non-PGP sites) further consultations within the 30-day episodes of care defined in our primary analysis. There were also 2254 (1246 in the PGP sites and 1008 in the non-PGP sites) referrals for imaging, medical specialist or AHP care and 67,987 (46,213 in the PGP sites and 21,694 in the non-PGP sites) prescriptions recorded during these 30-day care episodes (see *Appendix 7*, *Figures 13* and *14*)

The temporal patterns of paramedic- and GP-led consultations were similar, although a slightly higher proportion of GP-led consultations occurred at the weekend or on Wednesdays (see *Report Supplementary Material 10*). During the

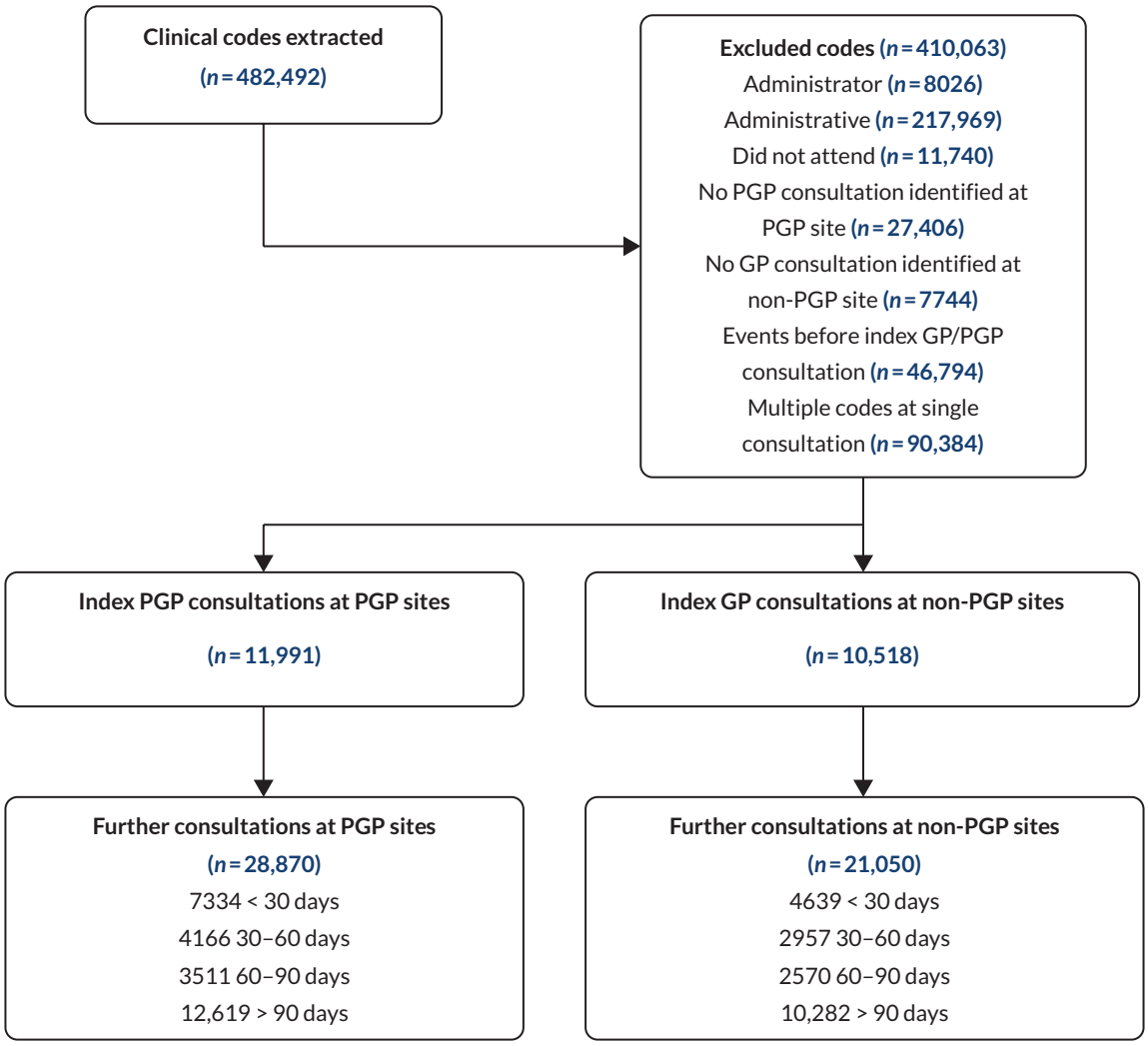

FIGURE 10 Flow chart of clinical codes used to identify index and further consultations.

day, both paramedic- and GP-led consultations had bimodal distributions peaking at approximately 09.00 and at 15.00 (see *Report Supplementary Material 10*). A slightly higher proportion of GP-led consultations were recorded as taking place outside of normal practice hours.

Almost all configurations of PGP integration and PGP patient complexity were represented (*Table 24*), but in all cases this was by no more than one practice. For some permutations, particularly those with low PGP integration where paramedics tended to work across several practices, there were relatively few (< 1000) index consultations represented.

Paramedics in general practice versus non-paramedics in general practice: main findings

Patient age and gender distributions were similar between the eight PGP and two non-PGP sites (*Table 25*). All practices were located in urban areas and the median deprivation in both PGP and non-PGP sites was eight (i.e. low deprivation). Larger differences were evident in practice size and age-standardised mortality; PGP sites tended to be larger (median practice size 17,052 vs. 12,716) and had higher age-standardised mortality rates (median 1041 vs. 916). The largest difference was observed in ethnicity: the two non-PGP sites had the largest proportions of patients recorded as of non-white ethnicity (median 30%) compared to the PGP sites (median 2.5%).

The non-PGP site that only provided 9 months of data resulted in the distribution of index consultation dates in non-PGP practices being skewed towards the start of the year. A higher proportion of paramedic-led index consultations were conducted in the surgery or home (30% and 4%, respectively) compared to GP-led index consultations (24% and 1%, respectively). However, the majority of both paramedic-led and GP-led consultations were conducted remotely. The type of appointment was not recorded in a higher proportion of GP-led index consultations (20% vs. 9% of paramedic-led index consultations).

At the PGP practices, 7.6% of patients had seen a paramedic, and the mean number of paramedic appointments per patient per year was 0.13. The median paramedic dose (no. WTE paramedics/no. WTE GPs) across the eight practices was 0.16, and 50% of the practices had had a paramedic for < 12 months. Among patients who saw a paramedic, 9.8% reconsulted with a GP within 7 days of the index appointment, compared with 14% with a GP index appointment reconsulting at the non-PGP practices (see *Table 25*).

Median scheduled appointment durations were the same between PGP and non-PGP practices for home visits (30 minutes) and routine prebooked appointments (15 minutes). Median scheduled consultation durations were slightly longer in PGP services for urgent/same-day appointments (15 minutes vs. 12.5 minutes in non-PGP sites) and telephone appointments (12.5 minutes vs. 10 minutes).

Although the mean cost of index day consultations was lower in paramedic-led care, the unadjusted difference (£12.21 vs. £15.92; *Table 26*) was small because paramedic-led consultations were more likely to occur in more expensive settings (i.e. the surgery or home visits). The utilisation and costs of subsequent care within the 30-day episode were relatively similar with the exception of prescriptions. On average, 4.02 medications (£30.63) were prescribed in the 30 days after paramedic-led consultations compared to 2.14 medications (£16.79) after GP-led consultations. There was little evidence that additional consultations were substantially higher after paramedic-led consultations (mean number of GP, PGP and other consultations within 30 days = 0.63, £8.61) than after GP-led consultations (0.45, £6.62).

TABLE 24 Paramedics in general practice models by integration and complexity of patients

	Complexity of patients seen					
	Low		Medium		High	
Integration	Practices	Index consultations	Practices	Index consultations	Practices	Index consultations
High	1	284	1	3660	1	1345
Medium	1	1406	1	4274	0	0
Low	1	604	1	188	1	230

TABLE 25 Characteristics and clinical outcomes at PGP and non-PGP sites

	PGP	Non-PGP
No. of sites	8	2
No. of patients/index visits	11,991	10,518
No. of paramedic appointments	21,143	
Site characteristics		
Practice size, median (IQR)	17,052 (11,582–27,377)	12,716 (11,192–14,240)
IMD decile, median (IQR)	8 (4–10)	8 (6–10)
Urban sites, *n* (%)	8 (100%)	2 (100%)
Age-standardised mortality rate, median (IQR)	1041 (914–1127)	916 (802–1030)
Ethnicity, % of non-white, median (IQR)	2.5 (2.1–4.9)	30 (11–49)
Patient characteristics		
Age, median (IQR)	46 (22–67)	44 (24–61)
Patients aged < 1 year, *n* (%)	88 (0.7%)	78 (0.7%)
Patients aged < 5 years, *n* (%)	1141 (9.5%)	678 (6.5%)
Patients aged < 16 years, *n* (%)	2356 (20%)	1835 (17%)
Patients aged ≥ 65 years, *n* (%)	3362 (28%)	2185 (21%)
Male, *n* (%)	4756 (40%)	4383 (42%)
Index visit characteristics		
Appointment July–September 2021, *n* (%)	2455 (20%)	4607 (44%)
Appointment October–December 2021, *n* (%)	3374 (28%)	3122 (30%)
Appointment January–March 2022, *n* (%)	3216 (27%)	2147 (20%)
Appointment April–June 2022, *n* (%)	2946 (25%)	642 (6%)
Appointment type		
First, *n* (%)	7359 (61%)	5601 (53%)
New, *n* (%)	1821 (15%)	1331 (13%)
Review, *n* (%)	1678 (14%)	1498 (14%)
None recorded, *n* (%)	1133 (9%)	2088 (20%)
Appointment setting		
Clinic, *n* (%)	3644 (30%)	2502 (24%)
Remote, *n* (%)	7925 (66%)	7891 (75%)
Home, *n* (%)	422 (4%)	125 (1%)
Outcomes		
Patients who saw a paramedic, *n* (%)	11,991/158,152 (7.6%)	
Mean (SD) number of paramedic consultations per patient per year	0.13 (0.71)	
Paramedic dose (no. WTE paramedics)/(no. WTE GPs), median (IQR)	0.16 (0.04–0.24)	

continued

TABLE 25 Characteristics and clinical outcomes at PGP and non-PGP sites (*continued*)

	PGP	Non-PGP
Paramedic dose (no. WTE paramedics 100)/(no. WTE GPs), n (%)		
≤ 0.15	4 (50%)	
0.151–0.249	2 (25%)	
≥ 0.250	2 (25%)	
Length of time paramedics worked at practice, n (%)		
< 12 months	4 (50%)	
12–35 months	1 (13%)	
36 + months	3 (38%)	
Patients reconsulting with GP within 7 days of index consultation, *n* (%)	1170/11,991 (9.8%)	1523/10,518 (14%)

TABLE 26 Resource use and costs within 30 days of index consultation: unadjusted comparison of pooled paramedic- and GP-led index consultations

	PGP index consultations[a] (*n* = 11,048)		Non-PGP index consultations[a] (*n* = 9931)	
Resource	**Units per episode**	**Cost (£)**	**Units per episode**	**Cost (£)**
Index day consultations				
Clinic	0.39		0.28	
Remote	0.68		0.76	
Home	0.04		0.01	
Total		12.21		15.92
Additional consultations				
GP	0.37		0.39	
PGP	0.22		0	
Other	0.04		0.06	
Total		8.61		6.62
Prescriptions	4.02	30.63	2.14	16.79
Referrals and testing[b]	0.08	15.44	0.09	18.73
Unplanned hospitalisations[c]	< 0.01	1.93	< 0.01	1.92
Total cost		69.87		60.21

a Including only those with sufficient 30-day follow-up.
b Referrals to a specialist; diagnostic imaging and blood tests.
c Unplanned admissions and A&E visits.

In unadjusted analyses, the costs of paramedic-led episodes of care were slightly higher than those of GP-led care (£69.87 vs. £60.21). In analyses stratified by the setting of the index consultation (*Figure 11*), we observed that the lower index visit cost of paramedic-led care was offset by higher prescription costs in all settings, most clearly evident within home visits.

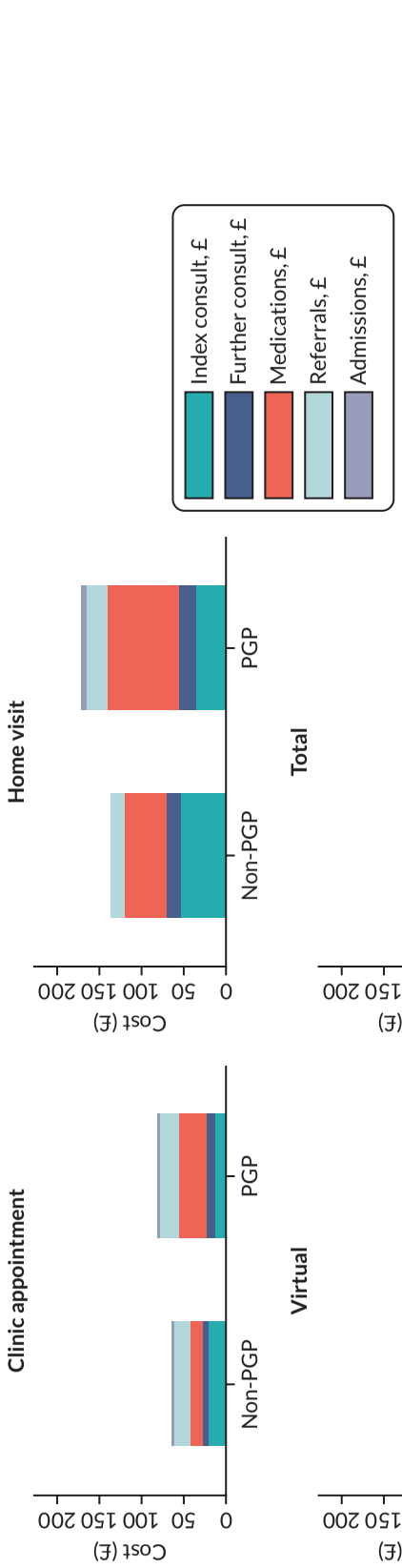

FIGURE 11 Thirty-day episode costs (PGP vs. non-PGP), stratified by index visit type.

In multivariable regression analyses, index consultations in the home setting and for patient review led to more expensive episodes of care than consultations in other settings and of other types (*Table 27*). Increasing patient age and male gender were both associated with increased costs of care episodes. These findings were consistent across the regression models adjusting for appointment, patient and practice characteristics. High practice-level deprivation and age-standardised mortality rates were associated with higher cost per care episode. The finding, from unadjusted comparisons, that paramedic-led index consultations may have been associated with slightly more expensive episodes of care despite the lower initial cost of PGP consultations was not robust to the inclusion of appointment, patient and particularly practice characteristics in the model. Once these were added to the model (final column *Table 27*), paramedic-led episodes of care were less expensive (mean −£23, 95% CI −£40 to −£5) than GP-led episodes of care.

TABLE 27 Multivariable regression of total cost of 30-day care episode on practice type (PGP/non-PGP), adjusting for patient and practice-level characteristics

Variable	Mean difference in cost (95% CI)[a]	Mean difference in cost (95% CI)[b]	Mean difference in cost (95% CI)[c]	Mean difference in cost (95% CI)[d]
Paramedic-led index consult	£17 (−£5 to £40)	£8 (−£7 to £25)	£4 (−£12 to £19)	−£23 (−£40 to −£5)
Index consult type: first (ref.)				
New		£10 (£7 to £13)	£7 (£4 to £10)	£7 (£3 to £10)
Review		£23 (£17 to £30)	£15 (£10 to £20)	£15 (£11 to £19)
None recorded		£9 (−£6 to £24)	£5 (−£10 to £19)	£4 (−£10 to £19)
Index consult setting: clinic (ref.)				
Remote		−£9 (−£15 to −£3)	−£8 (−£15 to −£1)	−£8 (−£15 to −£1)
Home		£78 (£58 to £98)	£49 (£27 to £70)	£48 (£29 to £68)
Patient age[e] (per 10 years)			£8 (£6 to £10)	£8 (£6 to £10)
Male			£7 (£3 to £11)	£7 (£3 to £11)
Practice deprivation category				
Low				−£20 (−£38 to −£2)
Medium				−£37 (−£56 to −£19)
High (ref.)				
Practice mortality rate[e] (per 100 point)				£9 (£6 to £13)
Practice % non-white ethnicity[e] (per 5%)				−£1 (−£3 to £2)

a From multivariable multilevel GLM (log link, Gamma family) regression of total costs with fixed effect for PGP practice (Y/N) and random effect for general practice site.
b From multivariable multilevel GLM (log link, Gamma family) regression of total costs with fixed effects for PGP practice (Y/N), index appointment type, and setting and random effect for general practice site.
c From multivariable multilevel GLM (log link, Gamma family) regression of total costs with fixed effects for PGP practice (Y/N), index appointment type, setting, age and gender; and random effect for general practice site.
d From multivariable multilevel GLM (log link, Gamma family) regression of total costs with fixed effects for PGP practice (Y/N), index appointment type, setting, age, gender, practice deprivation category, mortality rate and ethnicity; and random effect for general practice site.
e Continuous variables centred on the mean.

Note
Details of model fit: model 1: Akaike information criterion (AIC) 215,465, convergence after 10 iterations; model 2: AIC 213,640, convergence after 12 iterations; model 3: AIC 213,628, convergence after 10 iterations.

Paramedics in general practice/non-paramedics in general practice: sensitivity and post hoc analyses

Sensitivity analysis extending the analysis to 60- and 90-day periods following the index consultation and applying assumptions that increased the differential between the cost of a GP visit and a PGP visit demonstrated a similar pattern of findings to the primary analysis (see *Report Supplementary Material 11*). Minimally adjusted models suggested that paramedic-led care might be more expensive than GP-led care. However, once practice-level covariates were added to the full regression model, paramedic-led care was less expensive, albeit with CIs that in some cases approached or included zero.

The number of prescriptions after paramedic-led consultations was higher than after GP-led consultations for patients presenting with first/new symptoms (see *Report Supplementary Material 12*) and for patients presenting for review of existing conditions (see *Report Supplementary Material 12*). However, there was no clear pattern when comparing paramedics who were independent prescribers with those who did not prescribe or who were in training and required GP sign-off for prescriptions.

Paramedics in general practice: integration findings

Patient age and gender distributions were similar across the eight PGP sites stratified by level of PGP integration (*Table 28*). However, there were disparities observed in practice characteristics. For example, the two practices where PGPs were classified as operating with medium integration were located in more socially deprived areas than those

TABLE 28 Characteristics and clinical outcomes of the different PGP models: PGP integration

	Low integration	Medium integration	High integration	Non-PGP
No. of sites	3	2	3	2
No. of patients/index visits	1022	5680	5289	10,518
No. of paramedic appointments	1261	10,584	9298	
Site characteristics				
Practice size, median (range)	19,432 (14,671–37,871)	19,486 (8261–30,711)	13,207 (9957–24,042)	12,716 (11,192–14,240)
IMD decile, median (range)	8 (4–10)	3 (2–3)	9 (8–10)	8 (6–10)
Urban sites, *n* (%)	3 (100%)	2 (100%)	3 (100%)	2 (100%)
Age-standardised mortality rate median (range)	1121 (937–1123)	1045 (960–1131)	891 (846–1220)	916 (802–1030)
Ethnicity, % of non-white, median (range)	5.5 (2.4–21.3)	1.6 (1.5–1.7)	2.5 (2.4–4.2)	30 (11–49)
Patient characteristics				
Age, median (IQR)	46 (14–74)	45 (21–68)	46 (24–66)	44 (24–61)
Patients aged < 1 year, *n* (%)	3 (0.3%)	16 (0.3%)	69 (1.3%)	78 (0.7%)
Patients aged < 5 years, *n* (%)	118 (11.6%)	556 (9.8%)	467 (8.8%)	678 (6.5%)
Patients aged < 16 years, *n* (%)	262 (26%)	1159 (20%)	935 (18%)	1835 (17%)
Patients aged ≥ 65 years, *n* (%)	327 (32%)	1634 (29%)	1401 (26%)	2185 (21%)
Male, *n* (%)	415 (41%)	2287 (40%)	2054 (39%)	4383 (42%)
Index visit characteristics				
Appointment July–September 2021, *n* (%)	137 (13%)	1141 (20%)	1177 (22%)	4607 (44%)
Appointment October–December 2021, *n* (%)	152 (15%)	1689 (30%)	1533 (29%)	3122 (30%)

continued

TABLE 28 Characteristics and clinical outcomes of the different PGP models: PGP integration (*continued*)

	Low integration	Medium integration	High integration	Non-PGP
Appointment January–March 2022, *n* (%)	360 (35%)	1489 (26%)	1367 (26%)	2147 (20%)
Appointment April–June 2022, *n* (%)	373 (37%)	1361 (24%)	1212 (23%)	642 (6%)
Appointment type				
First, *n* (%)	573 (56%)	3497 (62%)	3289 (62%)	5601 (53%)
New, *n* (%)	152 (15%)	900 (16%)	769 (15%)	1331 (13%)
Review, *n* (%)	84 (8%)	1089 (19%)	505 (10%)	1498 (14%)
None recorded, *n* (%)	213 (21%)	194 (3%)	726 (14%)	2088 (20%)
Appointment setting				
Clinic, *n* (%)	325 (32%)	2764 (49%)	555 (10%)	2502 (24%)
Remote, *n* (%)	530 (52%)	2712 (48%)	4683 (89%)	7891 (75%)
Home, *n* (%)	167 (16%)	204 (4%)	51 (1%)	125 (1%)
Outcomes				
Patients who saw a paramedic, n (%)				
Overall	1022/71,974 (1.4%)	5680/38,972 (15%)	5289/47,206 (11%)	
Range by site[a]	(1.0–1.6%)	(14–17%)	(2.2–15%)	
Number of paramedic consultations per patient per year, mean (SD)				
Overall	0.02 (0.18)	0.27 (1.18)	0.20 (0.69)	
Range by site[a]	(0.01–0.03)	(0.26–0.28)	(0.03–0.27)	
Paramedic dose (no. WTE paramedics)/(no. WTE GPs)				
Median (range)	0.06 (0.01–0.1)	0.28 (0.23–0.33)	0.22 (0.03–0.25)	
Paramedic dose (no. WTE paramedics)/(no. WTE GPs), *N* (%) Range by site[a]				
≤ 0.15	3 (100%)	0	1 (33%)	
0.151–0.249	0	1 (50%)	1 (33%)	
≥ 0.250	0	1 (50%)	1 (33%)	
Length of time paramedics worked at practice, n (%)				
< 12 months	2 (67%)	0	2 (67%)	
12–35 months	1 (33%)	0	0	
36 + months	0	2 (100%)	1 (33%)	
Patients reconsulting with GP within 7 days of index consultation, n (%)				
Overall	58/1022 (5.7%)	512/5680 (9.0%)	600/5289 (11%)	1523/10,518 (14%)
Range by site[a]	(3.0–12%)	(5.3–10%)	(11–13%)	(12–17%)

a The range refers to the minimum and maximum percentage for the sites in the category.

classified as high integration or low integration. We also observed large differences in appointment characteristics among models of PGP integration, most obviously in appointment setting. Sixteen per cent of paramedic-led index consultations in low-integration sites were home visits, compared to 4% in medium-integration sites and 1% in high-integration sites. Eighty-nine per cent of paramedic-led consultations in high-integration sites were remote appointments; this was much higher than the equivalent figures at medium- (48%) and low- (52%) integration sites.

Fewer patients saw a paramedic at the low-integration sites compared to the medium- and high-integration sites (1.4% compared to 15% and 11%), with a mean number of paramedic consultations per patient per year of 0.018 compared to 0.27 and 0.20 at the medium- and high-integration sites (see *Table 28*). The ratio of WTE paramedics to WTE GPs was much smaller at the low-integration sites (0.06 compared to 0.28 and 0.22 at the medium- and high-integration sites). At the low-integration sites, 5.7% of patients reconsulted with a GP within 7 days of the index consultation compared with 9.0% and 11% in the medium- and high-integration sites.

The cost of the index consultation was highest in the low-integration PGP practices (*Table 29*; see *Appendix 8*, *Figure 15*) because these consultations were more likely to take place in the most expensive setting (i.e. home visits). Differences in index consultation setting may also contribute to the differences evident in prescriptions and prescription costs, which were highest in low-integration (5.12 prescriptions, £37.93) and medium-integration (4.49 prescriptions, £34.89) practices, where most index consultations were in the surgery or home visits, compared to high-integration practices (3.32 prescriptions, £24.72) where most index consultations were remote. This was reflected in the unadjusted total episode costs, which were highest following index appointments in low- (£77.52) and medium- (£83.67) compared to high-integration practices (£53.64).

TABLE 29 Resource use and costs within 30 days of index consultation: unadjusted comparison of all PGP index consultations by PGP integration

	Low integration[a] (*n* = 902)		Medium integration[a] (*n* = 5255)		High integration[a] (*n* = 4891)	
Resource	**Units per episode**	**Cost (£)**	**Units per episode**	**Cost (£)**	**Units per episode**	**Cost (£)**
Index consultation						
Clinic	0.33		0.56		0.22	
Remote	0.53		0.49		0.90	
Home	0.17		0.04		0.01	
Total		14.84		13.08		10.77
Additional consultations						
GP	0.26		0.35		0.41	
PGP	0.08		0.23		0.24	
Other	0.20		0.05		0.00	
Total		7.97		8.59		8.75
Prescriptions	5.12	37.93	4.49	34.89	3.32	24.72
Referrals and testing[b]	0.12	16.27	0.12	22.62	0.04	7.57
Unplanned hospitalisations[c]	0.00	0	< 0.01	2.56	< 0.01	1.62
Total cost		77.52		83.67		53.64

a Including only those with sufficient 30-day follow-up.
b Referrals to a specialist; diagnostic imaging and blood tests.
c Unplanned admissions and A&E visits.

After adjustment in multivariable regression analyses (*Table 30*) for appointment and patient and practice characteristics, the differences in episode costs tended to be smaller and were not clearly statistically significant. There was little evidence that the costs of paramedic-led care were associated with the level of PGP integration.

Paramedics in general practice: patient complexity findings

Patient age was clearly associated with patient complexity (*Table 31*). The median patient age was 15 years older in practices where PGPs saw high-complexity patients (53 years) than in those where they saw low-complexity patients (38 years). There were also evident differences in appointment setting and type. Compared to 'low-complexity' appointments, a higher proportion of 'high-complexity' appointments were home visits (10% vs. 2%) and a lower proportion were GP surgery visits (33% vs. 51%). Practices that employed paramedics to provide care for low-complexity patients were located in more deprived areas (median IMD 4 vs. 10) and had higher mortality rates (median mortality rate per 100,000 population 1131 vs. 914) than practices that employed paramedics to provide care for high-complexity patients.

A higher proportion of patients saw a paramedic at the medium-complexity practices (11%, compared to 6.4% and 3.9% at the high- and low-complexity practices), with a mean number of paramedic consultations per patient at the medium-complexity practices of 0.21 compared to 0.11 and 0.053 (see *Table 31*). The paramedic dose was greatest at the medium-complexity practices and smallest at the low-complexity practices (median 0.23 vs. 0.06). The percentage of patients reconsulting with the GP within 7 days of the index appointment was similar at the medium- and high-complexity practices (10% and 12%), and slightly lower at the low-complexity practices (6.1%).

In unadjusted cost comparisons (*Table 32*), the costs of primary care consultations were highest after consultations in high PGP patient complexity practices. However, this was more than counterbalanced by higher referral and testing costs compared to medium and low PGP patient complexity practices (mean cost per patient £36 vs. £12 vs. £4, respectively). Therefore, the unadjusted total episode costs were highest in the low PGP patient complexity practices (£90 vs. £67 for medium complexity vs. £58 for high complexity). This pattern was also observed when consultations were stratified by index consultation type (see *Appendix 8*, *Figure 16*). In multivariable analyses adjusting for appointment, patient, and practice characteristics (*Table 33*), the difference in total episode costs between these practice types was smaller and CIs included £0. Overall, despite the large differences in patient characteristics and some evidence of differences in referrals and testing costs, there was limited evidence that the complexity of patients seen by the PGP led to substantial differences in the total cost per episode of care.

For a discussion of the findings, the limitations and implications for future practice, please see *Chapter 9*.

TABLE 30 Multivariable regression of total cost of 30-day care episode on PGP integration, adjusting for patient and practice-level characteristics

Variable	Mean difference in cost (95% CI)[a]	Mean difference in cost (95% CI)[b]	Mean difference in cost (95% CI)[c]	Mean difference in cost (95% CI)[d]
Integration				
Low	£27 (−£24 to £77)	£6 (−£21 to £33)	£6 (−£11 to £22)	£2 (−£11 to £16)
Medium	£31 (£3 to £61)	£25 (−£5 to £56)	£30 (−£5 to £66)	£21 (£1 to £40)
High (ref.)				

a From multivariable multilevel GLM (log link, Gamma family) regression of total costs with fixed effect for PGP integration (low/medium/high) and random effect for general practice site.
b From multivariable multilevel GLM (log link, Gamma family) regression of total costs with fixed effects for PGP integration (low/medium/high), index appointment type and setting; and random effect for general practice site.
c From multivariable multilevel GLM (log link, Gamma family) regression of total costs with fixed effects for PGP integration (low/medium/high), index appointment type, setting, age and gender; and random effect for general practice site.
d From multivariable multilevel GLM (log link, Gamma family) regression of total costs with fixed effects for PGP integration (low/medium/high), index appointment type, setting, age, gender, practice deprivation category (omitted collinear), mortality rate and ethnicity; and random effect for general practice site.

Note
Details of model fit: model 1: Akaike information criterion (AIC) 216,150; model 2: AIC 215,468; model 3: AIC 213,638; model 4: AIC 213,633.

TABLE 31 Characteristics and outcomes of different PGP models: patient complexity

	Low complexity	Medium complexity	High complexity	Non-PGP
No. of sites	3	3	2	2
No. of patients/index visits	2294	8122	1575	10,518
No. of paramedic appointments	3144	15,214	2785	
Site characteristics				
Practice size, median (range)	13,207 (8261–37,871)	24,042 (19,432–30,711)	12,314 (9957–14,671)	12,716 (11,192–14,240)
IMD decile, median (range)	4 (2–8)	8 (3–9)	10 (10–10)	8 (6–10)
Urban sites, *n* (%)	3 (100%)	3 (100%)	2 (100%)	2 (100%)
Age-standardised mortality rate, median (range)	1131 (1121–1220)	960 (846–1123)	914 (891–937)	916 (802–1030)
Ethnicity, % of non-white, median (range)	4.2 (1.5–5.5)	2.4 (1.7–2.4)	11.9 (2.5–21)	30 (11–49)
Patient characteristics/index visit				
Age (years), median (IQR)	38 (17–60)	46 (21–68)	53 (35–73)	44 (24–61)
Patients aged < 1 year, *n* (%)	10 (0.4%)	78 (1%)	0	78 (0.7%)
Patients aged < 5 years, *n* (%)	228 (9.9%)	853 (11%)	60 (3.8%)	678 (6.5%)
Patients aged < 16 years, *n* (%)	547 (24%)	1663 (20%)	146 (9.3%)	1835 (17%)
Patients aged > 65 years, *n* (%)	449 (20%)	2369 (29%)	544 (35%)	2185 (21%)
Male, *n* (%)	925 (40%)	3176 (39%)	655 (42%)	4383 (42%)
Index visit characteristics				
Appointment July–September 2021, *n* (%)	160 (7%)	1727 (21%)	568 (36%)	4607 (44%)
Appointment October–December 2021, *n* (%)	479 (21%)	2360 (29%)	535 (34%)	3122 (30%)
Appointment January–March 2022, *n* (%)	734 (32%)	2233 (27%)	249 (16%)	2147 (20%)
Appointment April–June 2022, *n* (%)	921 (40%)	1802 (22%)	223 (14%)	642 (6%)
Appointment type				
First, *n* (%)	1325 (58%)	5186 (64%)	848 (54%)	5601 (53%)
New, *n* (%)	447 (19%)	1218 (15%)	156 (10%)	1331 (13%)
Review, *n* (%)	249 (11%)	1351 (17%)	78 (5%)	1498 (14%)
None recorded, *n* (%)	273 (12%)	367 (5%)	493 (31%)	2088 (20%)
Appointment setting				
Clinic, *n* (%)	1177 (51%)	1948 (24%)	519 (33%)	2502 (24%)
Remote, *n* (%)	1071 (47%)	5952 (73%)	902 (57%)	7891 (75%)
Home, *n* (%)	46 (2%)	222 (3%)	154 (10%)	125 (1%)

continued

TABLE 31 Characteristics and outcomes of different PGP models: patient complexity (*continued*)

	Low complexity	Medium complexity	High complexity	Non-PGP
Outcomes				
Patients who saw a paramedic, n (%)				
Overall	2294/59,339 (3.9%)	8122/74,185 (11%)	1575/24,628 (6.4%)	
Range by site[a]	(1.6–17%)	(1.0–15%)	(1.6–14%)	
Number of paramedic consultations per patient per year, mean (SD)				
Overall	0.053 (0.311)	0.21 (0.95)	0.11 (0.56)	
Range by site[a]	(0.017–0.26)	(0.011–0.28)	(0.028–0.24)	
Paramedic dose (no. WTE paramedics)/(no. WTE GPs)				
Median, range	0.06 (0.03–0.33)	0.23 (0.01–0.25)	0.16 (0.10–0.22)	
Paramedic dose (no. WTE paramedics)/(no. WTE GPs), n (%)				
≤ 0.15	2 (67%)	1 (33%)	1 (50%)	
0.151–0.249	0	1 (33%)	1 (50%)	
≥ 0.250	1 (33%)	1 (33%)	0	
Length of time paramedics worked at practice, n (%)				
< 12 months	2 (67%)	2 (67%)	0	
12–35 months	0	0	1 (50%)	
36 + months	1 (33%)	1 (33%)	1 (50%)	
Patients reconsulting with GP within 7 days of index consultation, n (%)				
Overall	139/2294 (6.1%)	847/8122 (10%)	184/1575 (12%)	1523/10,518 (14%)
Range by site[a]	(4.6–13%)	(10–12%)	(3.0–13%)	(12–17%)

a The percentages were also calculated at each individual site. The range refers to the minimum and maximum percentage for the sites in the category.

TABLE 32 Resource use and costs within 30 days of index consultation: unadjusted comparison of all PGP index consultations by PGP patient complexity

	Low complexity[a] (*n* = 1969)		Medium complexity[a] (*n* = 7572)		High complexity[a] (*n* = 1507)	
Resource	**Units per episode**	**Cost (£)**	**Units per episode**	**Cost (£)**	**Units per episode**	**Cost (£)**
Index consultation						
Clinic	0.55		0.35		0.37	
Remote	0.47		0.75		0.59	
Home	0.02		0.03		0.10	
Total		12.26		11.96		13.45

TABLE 32 Resource use and costs within 30 days of index consultation: unadjusted comparison of all PGP index consultations by PGP patient complexity (*continued*)

	Low complexity[a] (*n* = 1969)		Medium complexity[a] (*n* = 7572)		High complexity[a] (*n* = 1507)	
Resource	**Units per episode**	**Cost (£)**	**Units per episode**	**Cost (£)**	**Units per episode**	**Cost (£)**
Additional consultations						
GP	0.19		0.41		0.44	
PGP	0.16		0.23		0.30	
Other	0.18		0.01		0.04	
Total		6.30		8.67		11.30
Prescriptions	3.63	27.54	4.15	31.81	3.91	28.77
Referrals and testing[b]	0.20	36.38	0.06	12.20	0.04	4.38
Unplanned hospitalisations[c]	< 0.01	6.84	< 0.01	1.00	< 0.01	0
Total cost		89.58		67.12		57.94

a Including only those with sufficient 30-day follow-up.
b Referrals to a specialist; diagnostic imaging and blood tests.
c Unplanned admissions and A&E visits.

TABLE 33 Multivariable regression of total cost of 30-day care episode on PGP complexity, adjusting for patient- and practice-level characteristics

Variable	Mean difference in cost (95% CI)[a]	Mean difference in cost (95% CI)[b]	Mean difference in cost (95% CI)[c]	Mean difference in cost (95% CI)[d]
Complexity				
Low (ref.)	£6 (−£42 to £54)	−£2 (−£36 to £31)	−£14 (−£44 to £15)	−£5 (−£34 to £25)
Medium	−£1 (−£60 to £59)	−£17 (−£53 to £19)	−£28 (−£60 to £3)	−£13 (−£53 to £26)
High				

a From multivariable multilevel GLM (log link, Gamma family) regression of total costs with fixed effect for PGP complexity (low/medium/high) and random effect for general practice site.
b From multivariable multilevel GLM (log link, Gamma family) regression of total costs with fixed effects for PGP complexity (low/medium/high), index appointment type and setting; and random effect for general practice site.
c From multivariable multilevel GLM (log link, Gamma family) regression of total costs with fixed effects for PGP complexity (low/medium/high), index appointment type, setting, age and gender; and random effect for general practice site.
d From multivariable multilevel GLM (log link, Gamma family) regression of total costs with fixed effects for PGP complexity (low/medium/high), index appointment type, setting, age, gender, practice deprivation category (omitted due to converge issues), mortality rate and ethnicity; and random effect for general practice site.

Note
Details of model fit: model 1: Akaike information criterion (AIC) 216,153; model 2: AIC 215,468; model 3: AIC 213,637; model 4: AIC 213,636.

Chapter 7 Data integration

Overview

This study set out to answer seven related research questions, to determine the clinical and cost-effectiveness of PGP and provide recommendations and guidance based on empirical evidence. Answering these questions drew upon a case study design that explored the attitudes and experiences of paramedics themselves, GPs, other professionals involved in service delivery, patients and their representatives. Methods included data collection and analysis designed to be both theory generating and theory testing, sometimes simultaneously and often iteratively. The study brought together perspectives from system leaders and the wider corpus literature and juxtaposed this with individual patient-level data (self-reported and clinical) from a range of different ways of 'doing' PGP.

The integration of these qualitative and quantitative data represents the final tier of theorising, giving nuance and balance to our final programme theories. Inevitably, not all areas of theory are supported (or countered) by each component of the qualitative and quantitative data collected as part of the case studies, nor reflected in the literature that formed the basis of the evidence synthesis.

Data integration and realist methodology

While realist methodology has established ontological and epistemological foundations and is focused on understanding the hidden reality of complex problems, it does not stipulate specific methods of investigation to establish an irrefutable evidence base to answer a research question. The evidence for our recommendations comes from combining different methods of data collection, theorising explanatory reasoning, and building on the combined knowledge, skills, attitudes and insights of the research team. The strength of the evidence is based on the realist concepts of relevance, rigour and richness. Relevance refers to the modes of enquiry, data outputs, topics and theory areas and how these relate to the research question. Rigour relates to the methods used to demonstrate the evidence, so that the findings are viewed as trustworthy and reliable. Richness of the data adds insights to our understanding by using techniques, such as qualitative realist interviews to glean, test and refine theories to gain a truer, deeper understanding of the reality that we see.[77] As such, our findings are contestable, subject to the time, setting and context of this current study, and further research to explore, challenge or refute our theorising is always welcome.

By integrating data to understand the reality of how a new intervention (such as PGP) brings about the outcomes that we see, we gather insights into the reality of how and when to introduce, support, develop and nurture this evolution in general practice. This deeper understanding of the detailed nuances about how paramedics work in general practice allows readers to make informed decisions about how to implement this workforce development most effectively in their own settings and for their own patient and practice contexts, and how to understand changes that may occur as models evolve over time.

In this study, data integration was embedded throughout, from the early stages of shared training about realist research to ensure a collective understanding of the aims of this project. There were multiple meetings to agree the details of data collection methods; proactive sharing of data management plans for qualitative, statistical and health economic evaluation; regular discussions between qualitative and quantitative teams to explore theory development and share preliminary findings in an iterative fashion; and regular meetings with our PPIE supporters to ensure the relevance of our work to patients and general practice.

What different models of paramedics in general practice are in operation in England? (RQ1)

Throughout this project, it has been clear that identifying and characterising the features that constitute a discrete 'PGP model' was always going to be challenging. The line between how the *services* are structured and how the *individual clinicians* operate is indistinct and variable, and sometimes one is a direct function of the other.

In earlier components of this study, there emerged a strong sense from both the literature and system leader interviews that rotational models of working (paramedics spending time both in primary care and the ambulance service) were likely to hold promise. We theorised (summarised by Provisional CMOC 6) that rotational working was likely to be a model favoured by the paramedics themselves, the GP practices and the wider health system, as the opportunities for developing a broader skill set may benefit patients, improve job satisfaction and contribute to workforce retention. As we obtained further qualitative interview data, this theory was tempered slightly with the potential complexities of rotational working, including challenges with delivering induction for multiple rotating staff, and GP and practice manager perceptions of the 'lost investment' when rotating paramedics move on.

One potential way of classifying models is to look at how paramedics are contracted and by whom. In our stakeholder event (rapid realist review; see *Chapter 2*), the structure of the employment relationship (by the practice, by the PCN or externally with an ambulance service) was the least prioritised item in terms of its potential impact on the success of PGP models, slightly challenging our earlier thoughts. Nevertheless, we theorised that even if the specifics of the contractual relationship were of less importance, some component of whether the paramedic was a relative outsider who occasionally worked at the practice or a fully integrated, inducted core member of the practice team was felt to be important (e.g. foundations of IPT 16 – integration and teamwork).

We began with the aim of creating a taxonomy of different PGP models, with a view to configuring our subsequent case study analysis around as many of these taxa as our experimental design would permit. As a result of synthesising the various data sources in our rapid realist review, theories soon centred on the notion that it would be necessary to characterise the different PGP models according to a variety of 'domains of variation'. *Figure 12* outlines one particular early representation of the multiple axes of variation identified when attempting to deconstruct models according to 'which patients do paramedics see?'.

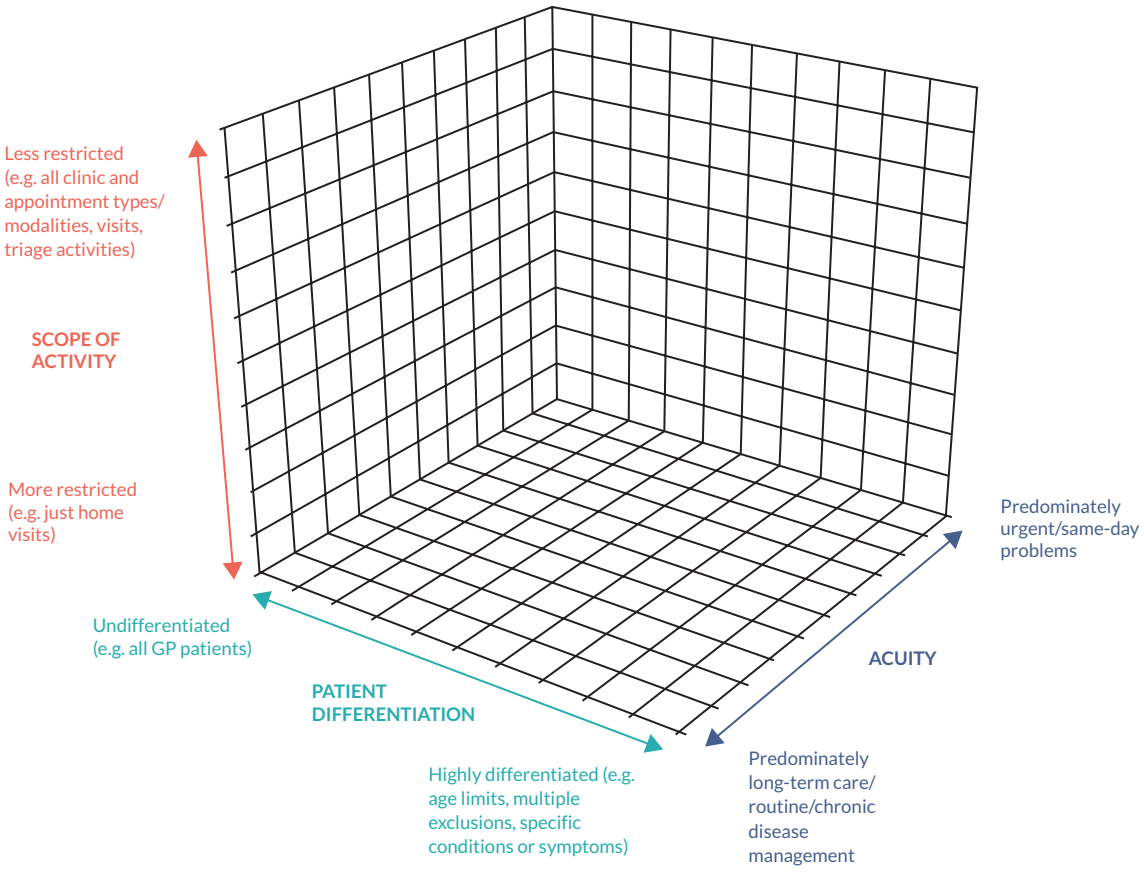

FIGURE 12 Domains of variation in PGP service delivery.

These domains of variation included configurations defined by the acuity of the patients seen (i.e. same-day vs. planned care/chronic disease), according to specific appointment types (e.g. telephone triage, home visits) or whether paramedics see a restricted, specified set of clinical problems. There is certainly plenty of evidence from the rapid realist review academic literature and grey-source synthesis included in the rapid realist review that many primary care settings exclude some patient groups or conditions from PGP care on the basis of perceived risk (e.g. pregnancy, mental health). Accordingly, a PGP model definition could be built around the spectrum of highly selected versus fully undifferentiated patients.

As data from the retrospective quantitative analysis highlight, certain consulting modalities appear to reflect different patient demographics and costs of care episode (e.g. home visits being more commonly for older patients, and more expensive overall). As such, our earlier view of defining models according to how the paramedic consults (phone, face-to-face triage, home visit etc.) is likely a too simplistic model definition, as it is the complexity of the patient that appears more of a defining characteristic. Combining our site pen portraits, retrospective routine data analysis and qualitative interviews identified that, in reality, paramedics usually conduct a variety of consultation types across more than one modality, meaning defining PGP models by consulting modality may be of limited real-world use.

For our case study analysis, we therefore settled on defining models of PGP care according to integration of the paramedic (low, medium and high), and complexity of patients seen (low, medium and high). There is a degree of qualitative evidence to suggest that both of these models can and do arise 'by intent', with highly integrated models borne out of an appreciation and investment in inducting and embedding paramedics into the primary care team (e.g. IPT 16 – integration and teamwork; provisional CMOC 3). Similarly, qualitative evidence supports the recognition of certain patient groups as more complex than others, including an awareness by patients that some of their problems are 'simple' (e.g. urinary tract infection) and some are more complicated (e.g. frailty). Our rapid realist review stakeholder event identified several examples of paramedics leading on complex frailty care.

Other ways that models can be classified are according to the 'dose' of paramedic care as a proportion of all clinicians in a service – a concept we have arrived at by comparing ratios of WTE paramedics to WTE GPs in a given practice or PCN (see *Appendix 2*). While we theorised that 'paramedic-heavy' models may be in some way different to 'paramedic-light' ones, in reality we have not found this definition of a model to have much utility in our analysis.

Additionally, as will be discussed further below, PGP models can be classified more simplistically by the skills, competencies and qualifications of the paramedics themselves. Prescribing is consistently identified as a desirable skill due to the potential to complete the care episode in one contact (e.g. IPT 14 – prescribing). However, in our case study sites, PGP services were often delivered by a combination of prescribing and non-prescribing paramedics, meaning it was largely impossible to make a distinction between PGP services that would be 'prescribing' versus 'non-prescribing' models. Additionally, as theorised by Provisional CMOC 1, the inconsistencies and substantial variation in terminology, skills, experience and equivalence of post-registration qualifications meant that defining models according to these elements remains problematic.

Summary

There is no standard model of PGP care in England. There exist multiple domains of variation in PGP service delivery that can form the basis of model definitions. For this analysis, classifying models according to the complexity of patients seen by paramedics and the degree of integration into the practice team had the most utility, as these can be influenced at practice level. Model definitions based on individual paramedic characteristics (skills, qualifications) or consulting modality alone may be the least useful. Models are to some extent dynamic and do evolve over time as they become embedded into practice or personnel changes occur. Even within models, variation exists. Although apparently discrete, rotational models also encompass a spectrum of variation which may have some limitations.

What are the crucial mechanisms that underpin effective paramedics in general practice? (RQ2)

Integrating qualitative data from the existing body of literature, stakeholder consensus work and qualitative interviews at case study sites suggests three critical underpinning components of PGP success:

1. A sufficiently trained workforce, with appropriate initial qualifications and access to an ongoing programme of professional development relevant to general practice and primary care.

Provisional CMOC 4 summarises the importance of initial induction and supervision geared towards delivery of safe primary care. Provisional CMOC 2 theorises the potential trade-offs associated with providing quality supervision, in that it is time-consuming (at least to begin with). Based on qualitative interview data from practitioners of all backgrounds, provisional CMOC 3 further details the importance of initial and ongoing training to support reframing the paramedic skill set into the environment of primary care. Flexible initial training needs to account for a broad range of previous experience, often with limited exposure to some clinical situations common in primary care.

2. The need to support patients to understand the role and remit of PGP, to build confidence and acceptance.

Provisional CMOC 5 theorises about how patient perception is important for PGP success. Where paramedics are visible core members of the primary care team, patients can develop familiarity with the role and grow in acceptance of PGP being part of their care (interim CMOC 5.2). When patients felt genuinely listened to and understood, their confidence in the PGP role grew.

3. Finding the 'right fit' of individuals who are able to grow and develop in the role.

While equally applicable to other clinical roles (including GPs), it is important that the skills and expectations of paramedics are matched to the particular needs of the service. It is unlikely that paramedics will be able to deliver a full spectrum of primary care services from the outset, requiring consideration of scope of practice and which activities are the best fit for individual skills (provisional CMOCs 1 and 2). There is inevitably some initial service disruption following implementation of PGP (interim CMOC 3), and there may be specific consequences of certain skill–task configurations, such as the possible increase in medication costs in low-complexity PGP models. Supporting paramedics to develop new areas of practice is an important component of wider workforce development, and important for long-term sustainability (interim CMOC 5.3).

Summary

Effective PGP requires selection of appropriately qualified and experienced paramedics for the needs of the service, underpinned by an ongoing programme of primary-care-focused supervision and training. Beyond a baseline set of clinical skills and competencies, paramedics each bring a unique range of experience and capabilities that will require careful matching with the needs of the practice, at least initially. Services need to be proactive about communicating the role and remit of paramedic with their patients.

How does paramedic care in general practice impact on patient clinical outcomes (e.g. unplanned hospital admissions, prescriptions, referrals, tests and investigations)? (RQ3)

The majority of direct evidence to answer this question came from the retrospective analysis of routine electronic healthcare records and the prospective questionnaire elements focusing on healthcare resource use.

In earlier stages of theorising, the idea of the traditional background of the paramedic as an ambulance practitioner who may be used to protocolised care resulted in some stakeholders having concerns about the potential impact this may have on decisions to admit to hospital. While framed in the potential benefits to the wider system of rotational working, provisional CMOC 6 highlighted the concern that paramedics new to general practice may have difficulty with the more nuanced presentations, which may be reflected in higher hospital admission rates. Among the PGP sites recruited to this study, rotational working was under-represented to offer firm conclusions on this, and qualitative interview evidence largely focused on the logistical issues of rotational working with respect to team integration and induction rather than patient-level resource use. Nevertheless, retrospective quantitative data indicate that even among low-integration PGP models, hospital admission rates are not substantially different between PGP and no PGP, offering a counter to this line of theory.

The importance of timely access to medications, including a preference by patients for seeing a prescribing professional, is a key theme arising from the qualitative data. The retrospective analysis identified a possible increase in prescriptions when patients are seen in a low-complexity PGP model (e.g. paramedics see acute, single-problem, same-day issues of minor illness). Qualitative data also highlight the importance patients place on their health professional having the ability to access prescriptions and referrals quickly. Interim CMOC 1 is developed from the importance that patients place on prompt access to referrals and tests necessary for their care. The retrospective data indicated that tests and referrals are not adversely impacted by PGP models, with similar rates when corrected for practice and patient factors. Overall, it appears PGP care can meet the expectations of patients with respect to access to medications, tests and specialist referrals as part of their care, albeit with some caveats about how well understood these capabilities may be.

With respect to the resource of 'time', Interim CMOC 5.1 reflects the importance that both patients and primary care clinicians of all professional groups place on the importance of having enough time to address concerns and expectations in appointments for them to be clinically effective. While more time with more complex patients is seen as a potential advantage of PGP, there is limited direct evidence to build on. Paramedic consultations are slightly longer, although slightly less expensive overall. As discussed above, time required for supervision and induction is not included in our cost estimates and is likely to be substantial if the PGP model is to achieve a high degree of integration, reducing the savings for the NHS at least in the short term.

With respect to broader resource use, patient perceptions of the 'appropriateness' of seeing a paramedic for their problem are an important consideration, as higher reconsultation rates would not only indicate reduced satisfaction but would also suggest suboptimal resource utilisation. Interim CMOC 5.2 refers to the potential challenges here, as the 'appropriateness' of a paramedic to deal with some problems may challenge the overall efficiency of service delivery. The absence of a substantial difference between recontact rates between PGP and non-PGP models is important to interpret alongside this, as while this concern is clearly very real for patients, there is no direct evidence that PGP care leads to higher recontact rates and less cost efficiency.

Summary

Paramedics in general practice models do not result in substantial differences in objective clinical outcomes, including overall healthcare resource use. In PGP models where paramedics predominantly see low-complexity patients, there may be a slight increase in prescribing and referrals/investigations. This is possibly due to the characteristics of patients seen by paramedics in this configuration (i.e. those with new acute problems more likely to require investigation or referral), combined with the fact that less experienced clinicians who are more likely to work in low-complexity models are known to have higher testing and referral rates generally. Patients' perspectives on prescribing resource use are mainly framed around concerns about the timeliness and appropriateness of medications issued, preferring paramedics with appropriate skills and qualifications to permit immediate access to these resources if required (i.e. prescribing). In models where these capabilities are well understood, PGP care can meet patient needs (including access to tests and referrals) without substantial increase in spillover resource use, although the overall cost to the NHS may not be substantially reduced when supervision is factored in.

How does paramedic care in general practice impact on patient-reported outcomes (e.g. concern, confidence in health plan, ability to manage symptoms, health-related quality of life) compared to non-paramedics in general practice care? (RQ4)

In this study, patient-reported outcomes were drawn from prospective questionnaire data [PCOQ, PREOS-PC and EuroQol-5 Dimensions (EQ-5D)] and realist interviews. The latter provided an opportunity to counter and further nuance some of the findings from the quantitative analysis, particularly where some subtle differences appear between models of PGP care.

The use of the PCOQ at two time points (after initial consultation and 30 days) provides, with some caveats, insights into patients' understanding of their illness or symptoms, confidence in their health plan, level of concern, and ability to manage symptoms (including some specific symptoms, such as pain). Similarly, the EQ-5D provides insights into self-rated elements of physical and mental health, including broader determinants of QoL and activities of daily living.

Timely access to NHS services that can support physical and psychological well-being have been theorised to be key determinants of a valued PGP service (e.g. interim CMOC 1), thus the synthesis of how these objective measures sit with the qualitative evidence that prioritises them is of importance.

The finding of a slightly lower 'confidence in health provision' score immediately after the initial index appointment in PGP models versus non-PGP care is possibly reflected in some of the qualitative interviews about the initial uncertainties patients have about PGP care overall. This aligns with the issues of 'acceptability' theorised in provisional CMOC 5, whereby patients and carers may be more familiar with paramedics in their traditional context of providing ambulance-based care and may take time to get used to the paramedic role in general practice. The absence of changes across any of the domains of concern, confidence, and ability to manage symptoms between PGP and non-PGP care would support the theories of provisional CMOC 5 that these marginal differences (if they are true differences, accepting that PCOQ was not designed to make comparisons in this way) do not widen with increasing time after paramedic contact. This is also consistent with the near-zero difference in QALYs between PGP and non-PGP models.

Patients expressed some reservations about the appropriateness of seeing PGP for their range of health issues and needs. Interim CMOC 5.1 and interim CMOC 5.2 summarise countering, but related, theoretical positions derived from the qualitative data, in that patients may worry that their complex medical and psychosocial needs could be unmet when seeing a paramedic. If these needs were truly unmet, we would expect to see a difference in one (or more) patient-reported domains pertaining to concern, confidence or QoL. The absence of any notable differences across these domains suggests that these concerns, although very real, are not realised. This has important implications for efforts to offer education and assurance about the role paramedics might play in the primary care team.

When comparing prospective quantitative analysis focusing on patient-reported outcomes, and retrospective analysis of routine data looking at clinical outcomes, the absence of any substantial 30-day differences suggests that achieving similar objective clinical outcomes between PGP and non-PGP care is not at the expense of QoL or patient experience (and vice versa).

Summary

Patients expressed some concerns about whether PGP care will meet their medical and psychosocial needs and may have some reservations about the 'appropriateness' of seeing PGP. These concerns were not reflected by any notable difference in patient-reported outcomes between PGP and non-PGP care 30 days after their appointment. There are implications for how patients may be educated about the role paramedics play, particularly as timely access to NHS services is valued by service users.

Does paramedic care in general practice result in patient-reported safe management? (RQ5)

Qualitative data suggested that, for patients, issues of access and safety are intrinsically related. Providing better same-day access for urgent problems, including home visits, was generally viewed as supporting 'safer' care (interim CMOC 2 – safety with improved access).

While PGP sites are generally regarded to have better access to same-day care, the practice activation component of the PREOS-PC was scored lower in PGP versus non-PGP sites, both immediately after the index consultation and at 30 days. This would suggest that patients felt their practice is less proactive in its approach to patient safety, although the differences were relatively small.

Early theorising during the rapid realist review suggested that for both patients and professionals, potential safety concerns were associated with inconsistent use of and misunderstanding of role titles, such as 'advanced practitioner' (provisional CMOC 1), where this may lead to paramedics being asked to see patients outside of their competencies.

Education and supervision were the main ways in which both professionals and patients consider safety can be enhanced, with the qualitative analysis showing both groups view this a critical component of PGP care (provisional

CMOCs 3 and 4). This view may also be represented in the PREOS-PC scoring, where medium- and low-integration PGP models appear to have higher rates of harm to physical health and more problems with diagnosis.

The finding of slightly lower overall VAS scores on the PREOS-PC ('general perceptions of safety') at medium- and high-complexity PGP sites is also interesting in the context of qualitative findings that indicate those patients with multiple complex health conditions may have more reservations about whether paramedics can meet their needs.

Although there are no quantitative data specifically on supervision, it is interesting to note that patients appeared to view paramedics 'checking' things with a GP as reassuring and supporting safe practice.

Other indirect markers of safety, including prescribing rates, hospital admissions and subsequent healthcare resource use, did not appear to follow any particular associations.

Summary

Safety and access to primary care are intrinsically related concepts, with better access to care, particularly same-day urgent care, valued by patients as improving service safety overall. Both professionals and patients consider adequate supervision and education of paramedics to be crucial components of safe PGP care and acknowledge that there are resource implications. Different models of PGP care may result in subtle differences in perceptions of safety; however, there was no objective evidence of any major patient safety concerns.

What are the direct costs/savings associated with paramedic care in general practice and does it provide good value for money? (RQ6)

As discussed above, PGP care appeared slightly less expensive overall, with the retrospective analysis of routine data suggesting a modest reduction of £20 per 30-day care episode, and the prospective analysis of case study participants suggesting no clear association between care model (PGP vs. non-PGP) with NHS costs.

However, the importance of comprehensive induction, supervision and a period of embedding was reflected strongly in the stakeholder/professional interviews (from paramedics, GPs and others) and summarised in provisional CMOCs 3 and 4. The direct costs of providing this are challenging to estimate, and our patient-level economic data do not directly address this. Qualitative interviews and site pen portraits provided enough evidence to inform some indirect costing assumptions for the economic analysis, in particular lending support to the assumption that paramedics are likely operating 'more like' GP registrars in training than practice nurses with respect to longer appointment times and numbers of patients seen. The provisional conclusions of our rapid realist review were confirmed during our case study phase, in that PGP sites employed a wide spectrum of paramedic skills and experience, meaning these assumptions of how PGPs are operating span a broad range.

While interim CMOC 1 builds on the theory that increasing the number of primary care paramedics helps limit workforce costs during a time of substantial challenge of GP availability, it is probable that any cost reductions were at least partially offset by the processes of induction, supervision and embedding. Qualitative interview evidence also highlighted that GP surgeries recognise that there is essentially a need to 'start all over again' with this embedding when a paramedic moves on as part of a planned rotation or natural attrition, meaning that achieving a highly integrated model does not necessarily result in substantial long-term cost savings (although similar is likely true of GPs joining/leaving a practice). These concerns may dissipate in high-integration practices if paramedics can be retained and develop experience and independence in their role. It is important to place this alongside the finding that, after adjustment of practice and patient factors, there was no clear relationship between level of integration and 30-day cost.

When combined with the discussion of RQ3 above, it is possible (particularly in low-complexity models) that the costs of PGP care appear to slightly increase, when considering resources, such as tests and medicines. Even though this difference reduces a little after adjustment for patient and practice factors, qualitative findings that helped develop the definition of 'low complexity' would suggest that the clinical problems this 'low-complexity' patient group presents with may be different. Qualitative evidence from the rapid realist review stakeholder events prioritised the importance

of skill level and experience as determinants of the effectiveness of paramedics in PGP roles. Paramedics who are less experienced or have fewer extended skills may be more likely to refer on or make greater use of tests/investigations, which may also go some way to explain this if they are more likely to be deployed in a low-complexity model. The challenge in balancing the need for high levels of experience to manage complexity (coming at greater upfront financial cost) and the time-consuming and resource-heavy nature of some activities for GPs (such as home visits) is also reflected in provisional CMOC 2.

Interim CMOC 4 describes how workforce innovation may come with hidden costs (particularly infrastructure and workforce support costs arising from governance arrangements). Capturing these is challenging, but important in the big questions of cost-effectiveness. In attempting to determine whether PGP care is good value for money, much of this value judgement has to be informed by the potential implication of the alternatives (no PGP at all, including interim CMOC 1) which would suggest in a time of workforce crisis something that does not appear to substantially increase costs but does ameliorate the GP shortage could be reasonable. This value judgement is helpfully informed by the PPIE contribution to this project, where overall 'cost' of the models was acknowledged as important but perhaps not the primary determinant of whether these were valuable developments in primary care.

Summary

Paramedic care in general practice may result in similar or slightly reduced NHS costs per care episode. The costs of induction, supervision and embedding in the team are challenging to estimate, particularly if paramedics rotate frequently. Once infrastructure costs are factored in, any overall cost savings of PGP care may be marginal or entirely offset. There was no clear relationship between overall cost and degree of PGP integration. The skills and qualification level of paramedics were consistently prioritised as important determinants of PGP success. The impact of these factors on overall cost may depend upon the complexity of patients seen, with low-complexity PGP models possibly having higher medication costs.

Does paramedic care in general practice lead to improved experience, how and for which patients? (RQ7)

In this study, patient experience was considered according to how patients received care that is respectful and responsive to their individual needs, preferences and values. The majority of evidence was qualitative, although components of the economic analysis of routine data and patient-reported outcomes contributed to the richer picture.

Access is a key component of patient experience – being able to get an appointment when needed, particularly when needing same-day urgent care. Theories arising from qualitative interview data highlight the delicate balance between improved access to *anyone* and improved access to the *right* person: IPT1a theorises that paramedics providing greater access to appointments is acceptable because it means patients can be seen more quickly. However, this is countered by theories in IPT1b suggesting that being directed routinely to paramedics first may mean they are seen as a barrier to accessing GP care. Additionally, interview data suggested that primary clinical triage by paramedics may also ensure the right clinician is seen from the outset (preliminary theory on clinical triage).

The quantitative data suggested that despite some patient concerns, seeing a paramedic does not result in a substantially higher reconsultation rate with a GP than non-PGP care models. There are few clinically significant differences in patient-reported outcomes between PGP and non-PGP care, and the overall QoL does not appear adversely impacted by seeing paramedics. Multivariable models do not suggest that outcomes related to experience are substantially different for specific subsets of patients.

Preliminary theories on the experience of receiving PGP care (e.g. IPT 19) arise from understanding how patients value quick access as this reduces the time waiting for medical advice while feeling vulnerable, anxious and uncertain. Assuming that PGP care can meet their expectations around safety, this overall results in an acceptability for PGP care and an enhanced experience (interim CMOC 5.1).

Patient expectation (and therefore satisfaction when met or otherwise) is a component of experience. Qualitative data provide much of our understanding about expectations of the PGP role, and how well these are met. Interim CMOC 5.2 summarises theorising on how preconceived ideas about the role of the GP and lack of understanding about the paramedic remit might introduce doubts or reservations. It follows that patient experience may be adversely impacted when the role of the paramedic is not well understood, rather than by a measurable and objective difference in clinical or reported outcomes. This suggests an important role for patient education in supporting a positive experience of PGP.

The experience of receipt of good primary care is about more than just the clinician seen. While framed in the context of patient safety, free-text response boxes in the PREOS-PC questionnaire provided the opportunity for patient participants to highlight broader issues of significance for them. Often tangentially (if at all) related to safety, qualitative analysis of these responses identified a broad range of patient experience issues prioritised by those in receipt of PGP and non-PGP care. Ability to access face-to-face appointments, perceived inefficiencies with systems and processes, and challenges with achieving continuity and relationship-based care were often cited. Paramedics were identified (sometimes incorrectly) as both facilitators and barriers to these experience issues. Where paramedics can support better delivery of these omnirelevant primary care challenges, they appear to be viewed as improving the overall experience.

Summary

Access to appointments is highly valued by patients, so long as this means seeing the right clinician for their needs from the outset and is not a barrier to seeing a GP when necessary. There is a strong link between improved access and patient experience. Where paramedics are seen to assist with some of the well-established challenges of delivering primary care services (including capacity), they appear to improve patient experience. Experience is influenced by perceptions and understanding of the role of the paramedic. When patients understand the remit of paramedics and believe they can meet their needs, the improved access to a clinician (particularly for same-day acute problems) appears to improve overall experience. Where the role is not understood or seen as a barrier to some of the established, traditional, continuity relationships with a GP, experience may be adversely impacted.

Chapter 8 Patient and public involvement and knowledge mobilisation

Patient and public involvement and engagement

Introduction

Our approach to patient and public involvement and engagement (PPIE) is based on the principle that the people in the best position to determine what will maximise the health and well-being of patients and carers are patients and carers themselves. We have therefore sought, throughout this research project, to keep the issues that matter most to our public contributors at the centre of our work. In order to do this, we have provided training and support to our public contributors in realist methodology, as described below. This process was not an aim in itself but designed to ensure that the evidence produced by the research throws light on the issues that are important to patients, carers and the public.

Our group was recruited from public contributor networks developed by both the University of Bristol and the University of the West of England and was led by our two public involvement leads, Julie Clayton and Andy Gibson. The group has 10 people and includes both patients and carers. They have experience of general practice and urgent and emergency care services. The group helped develop the PPIE plan for this project and review the research protocol. Upon notification of the successful outcome of our research funding application, our public contributors were recontacted. All agreed that they would like to be involved with the project.

We conducted an initial introductory meeting to orientate our public contributors to our plans for running the project and to look at how they could be involved in the research. This covered the different research methods employed; that is, realist literature review, inclusion of non-paramedic GP practices as case controls, and the collection of quantitative retrospective and prospective data and qualitative data. This was designed to give our public contributors an overview of the different types of data we were collecting, why we were collecting it, and how it would help answer our research questions. The discussion was an opportunity for public contributors to raise questions about the acceptability to patients of being seen by a paramedic rather than a GP, for example with regard to their level of training and qualifications, and patient safety. The discussion also highlighted points within this process where public involvement would be helpful to the team. We invited our public contributors to give feedback and suggestions for improvement on these plans and suggestions about what data we might need to collect to answer questions relevant to patients and carers.

Training and support

Throughout the research process, various members of the team worked with our public contributors to ensure that they were supported to fully understand and become involved in the research process. All our public contributors took part in introductory training on realist methodology. This included developing an understanding of the focus of realist approaches; that is, that they are concerned with developing an understanding of how an intervention might work rather than proving that it does work. The research team received more in-depth training in realist evaluation, and public contributors were also invited to attend. We made video recordings of these training sessions available to our public contributors to allow them to gain a more in-depth understanding of realist methodology, if they wished to.

Work package 1: literature review

We invited public contributors to contribute to the rapid realist literature review by reviewing research papers and in identifying potential CMOCs.

The research team presented candidate CMOCs at a stakeholder consensus event. Our public contributors contributed to this event by creating a video discussion of the issues raised by CMOCs relevant to patients and carers. This video session involved three of our public contributors and was chaired by one of our PPIE leads. Public contributors participated in an ensuing discussion session with stakeholders in attendance at the event.

Work package 2: realist evaluation and case studies

Public contributors were involved in reviewing our ethics application and helped to write the study poster, patient information sheet and consent form. They also contributed to the refinement of our data collection instruments, including to the design of the patient qualitative interview schedule. This included, for example, taking into account feedback from public contributors about the potential influence on patients' perceptions of paramedics depending on what uniform they may or may not be wearing, and the importance of communication with patients, for example, introducing and explaining the role of paramedics in GP practice. Two public contributors also took part in pilot interviews.

Qualitative data analysis and interpretation

Our PPIE lead worked with our qualitative researcher to identify key interview extracts highlighting particular issues that would benefit from public contributor feedback. Interview extracts were shared with public contributors on the clear understanding that they were confidential and not to be shared outside the team. We reminded our public contributors of our research aims and questions and asked them to highlight key issues emerging from the interview material that were important for them. They did this by using the 'highlight' and 'insert comment' functions in Microsoft Word. We then held a workshop in which we asked the public contributors to contribute their analysis and interpretation of the data. The qualitative researcher then shared their interpretation and analysis. Areas of convergence and divergence in interpretation were discussed and insights from our public contributors were incorporated into the overall analysis of the qualitative data.

Quantitative data interpretation

We held a workshop with public contributors and our quantitative researchers to discuss both the retrospective data and prospective data. We explained the difference between statistical significance and clinical/patient significance and presented data on all the key outcomes identified by our research team. The research team answered any questions or provided clarifications; for example, it was surprising to learn that employing paramedics in primary care is not necessarily cheaper than a employing a GP because of longer consultations and a greater level of prescribing. We discussed interpretations of these findings, including the possibility that the type of patients being seen by paramedics might be the cause of the longer consultations and greater levels of prescribing. The public contributors were interested to discover that on most outcomes there were no statistically significant differences and that on those where there were, the differences were of small clinical/patient significance.

Data synthesis

We held a workshop with our public contributors in which we summarised the findings from both the quantitative data and the qualitative data and asked the public contributors to give their interpretation of the findings. As mentioned above, the quantitative data were equivocal on the benefits of placing PGP. The qualitative data did not always shed light on the issues that might explain the quantitative data, although these data did provide a lot of useful information about how paramedics might work in general practice. In order to focus the discussion, we asked the public contributors to discuss whether they would recommend their local general practice to employ paramedics. Although public contributors raised some reservations about the lack of conclusive findings, they did reach the conclusion that the key outcome they wished to see dealt with was improved access to services, with the proviso that patient safety was not compromised. They felt that if other indicators differed only marginally between paramedic and non-paramedic practices, then increased access to services would be sufficient to justify support for using PGP. The public contributors also expressed concern about the potential negative impact that moving paramedics into general practice might have on staffing problems in emergency services, but this research was not designed to provide evidence on this issue.

Conclusion

By integrating public involvement throughout the project, we were able to ensure that the patient perspective was a central concern throughout our research. Provision of appropriate support and a team commitment to incorporating meaningful public involvement in our work helped to ensure that we successfully delivered our public involvement plan. This was demonstrated by public contributors being able to contribute to discussions and make recommendations based on the implications of a complex and nuanced set of findings.

NB During this project, one of our public contributors was involved in the development of a public involvement impact log. They used it within this project as a way of tracking the impact of their involvement and testing the usefulness of the log. An extract from this log can be found in *Report Supplementary Material 13*.

Knowledge mobilisation

Knowledge mobilisation is about sharing knowledge between different communities to catalyse change.[78] Within health care, it is a field that has developed to address the gap between research and practice, with approaches that are aimed at facilitating a research impact pathway, as well as the incorporation of research in practice-based decision-making. In its broadest sense it incorporates dissemination strategies, which are often described as one-way or linear models of knowledge mobilisation, as well as more complex two-way, multiple-perspective approaches, such as co-production.

Knowledge mobilisation treats knowledge as a process rather than as a product and should be considered at the outset of the research, ideally prior to topic prioritisation and identification of the research questions. The knowledge mobilisation element of this study is covered in five stages:

1. a stakeholder analysis
2. identification of approaches and theoretical underpinnings
3. design of strategy
4. delivery of strategy
5. evaluation.

The first three stages were conducted during the project delivery and are described in this section of the report with accompanying documentation in *Report Supplementary Material 14*. The final two stages will be reported on in the 12-month post-study completion knowledge mobilisation and dissemination report.

Stakeholder analysis (stage 1)

The main stakeholders who were likely to be influenced, interested or affected by the research being conducted and subsequent findings were identified during a scoping study conducted prior to the design and application process of the research (*Table 34*) This work was used as a basis for the identification of stakeholders for analysis for stage 1.[10] The key stakeholders and their relationship to the research study are outlined in *Report Supplementary Material 14*.

Identification of approaches and theoretical underpinnings (stage 2)

From the stakeholder analysis, the key stakeholders to involve in the research process wherever possible to ensure adoption of useful findings were GPs, practice managers and paramedics; other key stakeholder groups identified were local commissioners and patients and carers.

Knowledge mobilisation approaches

A recent systematic review has identified five main approaches to two-way knowledge sharing in the literature.[79] These are embedded models, where an individual from one organisation is seconded to work in another to facilitate knowledge sharing; knowledge brokering, where an individual works between the two organisations; stakeholder engagement, which would cover round-tables and discussion meetings; involvement of non-researchers in the research or service design process, normally using co-production techniques; and organisational collaborative partnerships between universities and healthcare organisations. Some of these approaches are more appropriate for particular stakeholder groups and are also affected by proximity, resources and existing relationships.

The approaches facilitated knowledge sharing often across several of the stakeholder groups but were targeted at one of the key stakeholder groups to ensure knowledge was mobilised effectively with these individuals. For this study, due to the perceived restriction on time for the key stakeholders of GPs, practice managers and paramedics, the approach of stakeholder engagement in the form of a discussion meeting was chosen. To reach local commissioners, a knowledge brokering approach was planned based on the literature showing success using this strategy in commissioning organisations.[80,81] For patients and carers, it was anticipated based on the patient involvement work conducted at

TABLE 34 Mapping of stakeholders' interest and power in terms of adoption of findings

		Interest		
		High	**Medium**	**Low**
Influence	High	**GPs and primary care managers:** These will be the main decision-makers as to whether paramedics are introduced into the practice teams or not. Information on models of care involving paramedics is likely to be of high interest to this group.	**Local policy-makers:** Key decision-makers for the adoption of models of paramedics in primary care. However, most of the decision-making is likely to be at the primary care team and PCN levels.	**National policy-makers:** Although of high influence in decision-making, most decision-making to adopt models is likely to occur at the local level. However, general trends in the workforce will be of interest.
	Medium	**Paramedics (working within primary care):** The study findings could have implications directly on paramedics' employability in primary care. Paramedics are likely to have high engagement.	**Patients and carers:** It is likely that the findings will be of interest to patients and carers due to the potential to change access to care and specifically access to the GP.	
	Low	**Other members of primary care team:** This group is likely to have high interest but low influence over whether paramedics are employed in primary care.	**Academics:** Researchers are likely to have interest in these results to understand the changes in the workforce but little ability to influence the adoption of any findings.	**Paramedics (working in the ambulance service):** This group will have less interest and influence over the implementation of results but may be impacted by colleagues leaving the service.

Note
Influence: influence over how the study's findings are interpreted, disseminated and implemented.
Interest: importance of the study's findings and the extent to which they will be actively looking for this kind of information.

the outset of the research (detailed at the beginning of this chapter) that knowledge sharing would be best achieved through involvement in the research process itself and would likely focus on how to communicate and educate patients on these roles. More detail on the approaches is given in *Report Supplementary Material 14*.

Design of strategy (stage 3)

The multilayered knowledge mobilisation plan outlined above was designed to facilitate the sharing of knowledge at the individual, organisational and system levels, in order to support sustainable change. It was anticipated that the approaches of stakeholder engagement and knowledge brokering with the wider organisations would incorporate wider perspectives and highlight any barriers within the organisations or systems. In addition, a comprehensive dissemination plan was also developed to support the in-depth work and to ensure a mechanism for wider sharing of the study results and knowledge generation to a national audience.[82–84] More detail on the strategy is given in *Report Supplementary Material 14*.

Chapter 9 Discussion and conclusions

Summary

Improving access to appointments in UK general practice remains a crucial objective for patients, staff, and the wider NHS. There is a shortage of GPs, and paramedics are one of the non-medical workforce groups increasingly used to meet demand. Research on this workforce organisation to date has been largely descriptive. To our knowledge, this is the first study to investigate the clinical and cost-effectiveness of deploying PGP.

Case study approach and model classification

Data in this study were collected by recruiting 34 general practices as case study sites to provide data. A sampling frame was used to ensure that representation of sites varied according to geographical area, practice size, deprivation and rurality.

Strengths/limitations

Case study sites provided real-world, detailed and in-depth information and enabled a comprehensive understanding of PGP. This provided the opportunity for identifying unique insights, hidden patterns, emergent phenomena and novel perspectives that may not have been apparent through other research methods. We were able to classify models according to two domains of variation (integration and complexity) to investigate commonalities and differences between sites within each classification.

There were some limitations to the use of case studies. The sites were self-selecting in that they volunteered to participate in response to information made available to them by the study team or by the CRN. Motivation to participate may have been influenced by several factors, including: a desire to demonstrate (or not) the effectiveness of PGP, a motivation to enhance research profile, or for research funding reasons. For these reasons, the findings from the case studies are not necessarily generalisable to general practice across England. There may have been factors that were prohibitive to certain sites that did not participate; for example, general practices that are struggling to meet patient demand due to staff shortage and did not volunteer to take part due to capacity issues. The research questions that the study set out to address are particularly relevant to these sites, and it is possible that they are not well represented in the findings.

Due to the substantial variation in models of PGP that were identified during the rapid realist review, it was more difficult than anticipated to classify models. At the outset of the study, it was anticipated that three models of PGP would be investigated and that sites would be recruited according to the respective models. However, the team were unable to determine the key variables to be used for classification until the qualitative data analysis was progressing. This meant that site classification took place after data collection had finished but before quantitative data analysis commenced. We were unable, therefore, to use formal model classification for site selection; classification was applied retrospectively, and distribution of the models was uneven.

Qualitative interview study

The qualitative findings from the study provided valuable insights supporting the notion that paramedics play a significant role in improving access, particularly for same-day care, and that this is generally well received by both patients and staff. Patient concerns about safety primarily stem from access-related challenges, which reinforces the positive contribution of paramedics towards ensuring safe care. To ensure the successful integration of new paramedics or new PGP services, it is vital to provide an adequate 'bedding-in' period. During this time, paramedics

should undergo a tailored induction process and receive relevant training. Additionally, allocating longer appointment slots and offering regular supervision are crucial elements of this process. Moreover, the bedding-in period facilitates the integration of the paramedic within the team. Effective communication and collaboration between the paramedic and other team members enables trusting relationships and a shared understanding of the paramedic's skills and capabilities. This, in turn, promotes efficient teamworking and enhances overall job satisfaction. Clear and consistent communication of the paramedic's skills, capabilities and added value to patients is essential. By managing expectations and bolstering confidence in the role, patients can better understand the benefits that paramedics bring to general practice. Consequently, emphasising the paramedic's contributions leads to enhanced acceptability and confidence among patients.

Strengths/limitations

Interviews with more than 60 staff and patients closely involved with the delivery of PGP provided valuable insights on a variety of perspectives and enabled a contextual understanding of the factors that shaped the views of participants. The use of realist interviews meant that evolving programme theories could be thoroughly explored and challenged, which led to a comprehensive account of the key mechanisms (resources and reasoning) influencing a variety of outcomes including acceptability, safety and effectiveness.

There are several limitations associated with qualitative interviews. The participants were a self-selecting sample and it is possible that they volunteered to take part due to either extremely positive or negative experiences of PGP; the sample is not necessarily representative of the population served. Qualitative interviews are influenced by the subjectivity of both the researcher and the participant. The researchers' biases, preconceived notions, or questioning styles may have inadvertently influenced the participants' responses. Similarly, participants may have selectively shared information based on their understanding of what the research aimed to achieve, or as a result of their broader positioning on the issue of primary care workforce identities.

Prospective cohort study (patient questionnaires)

We found little evidence that PGP care per se or the specific model of PGP care had a large impact on clinical or economic outcomes. In all four domains of the primary outcome, PCOQ scores showed little change between the index visit and day 30. This finding was broadly consistent across different PGP models of integration and patient complexity. However, there was some evidence that by day 30, reported 'confidence in the health plan' deteriorated more among patients at high-complexity PGP sites than at non-PGP sites. Patients at PGP sites also reported lower scores than patients at PGP sites immediately after index visit and at 30 days for the PCOQ 'confidence in health provision' domain. This finding was consistent across different PGP models of integration and patient complexity.

With regard to the safety outcomes, the PREOS-PC practice activation scores were lower in the PGP sites, and sensitivity analysis indicated that participants at medium- and high-complexity sites may have been more likely to give a rating of < 90/100 on the PREOS-PC VAS score at follow-up. Few other differences were observed on the PREOS-PC measures. There was very little evidence that paramedic-led care, or any model thereof, was associated with a change in HRQoL as measured by EQ-5D-5L scores or QALYs at day 30. The HRQoL scores of all groups generally improved over this period. Despite the lower initial costs of paramedic-led care, total primary care costs (including prescriptions) were very similar. Mean secondary healthcare costs, informal care costs and productivity losses were influenced by a small number of high-cost patients, but there was no evidence that these costs differed systematically between paramedic-led and non-paramedic-led care.

Strengths/limitations

We believe that this is the first prospective cohort study to describe how specific models of paramedic-led care are associated with patient perceptions of primary care quality and safety, and to quantify NHS costs alongside patient outcomes. This study has follow-up data from a relatively large sample of participants, and the use of prospective data collection allowed us to explore how patient perceptions of care and HRQoL changed over time.

The response rate at the 30-day follow-up was higher than anticipated (68% compared to the 50% target). However, the study did not reach the 30-day sample size target (489/552; 89%). This was due to recruitment being slower than anticipated despite recruiting from more practices than initially planned. Conducting the study during the recovery from the COVID-19 pandemic and during a time of atypical demand pressures (caused by a group A *Streptococcus* outbreak) impacted upon some sites' capacity to recruit to initial target and timescales. Participant numbers are small in some of the PGP classifications; in particular, there were only 48 participants in the low-integration category with 30-day follow-up data. This was partly because model configurations were not determined prior to recruitment. As previously detailed, model configurations were developed from our evolving understanding of 'domains of variation' identified through the rapid realist review, and as findings from the qualitative interviews provided evidence to challenge or support our assumptions about how this variation resulted in difference service architecture. The small numbers in some categories resulted in a reduction in statistical power.

The appropriate choice of comparator group is challenging in an observational study, particularly as paramedics fulfilled different roles in different practices. We selected GP-led care as an appropriate comparator as paramedics were often employed to deliver care (e.g. home visits) typically provided by GPs. Despite adjusting for some patient, consultation and practice characteristics, the observational nature of the study makes it difficult to be certain whether the differences we observed in some PCOQ and PREOS-PC responses were attributable to the index appointment (with a paramedic or non-paramedic) or other unobserved differences. The PCOQ asks questions about primary care outcomes 'at the moment', whereas the PREOS-PC frames questions about safety 'in the last 12 months'. Therefore, the PCOQ might be considered more likely to identify any immediate concerns with the care received at the index consultation, whereas the PREOS-PC might reflect more long-standing views about the safety of care, which are not necessarily a result of the index consultation.

The PCOQ has been designed to be used as a change score, rather than at a single time point.[54] It is possible that changes are not being observed, as the index measure is already picking up the effect of the consultation. Unadjusted analysis revealed there were differences in index visit scores for the 'confidence in health provision' domain, which remained in the post hoc adjusted analysis (see *Appendix 4*).

Although the PREOS-PC is a validated instrument for patient-reported experiences and outcomes relating to safety, the study team were alerted to some instances where the questions may not have been fully understood. Where participants elected to have telephone assistance from the study team in completing the questionnaire, they struggled to interpret questions about care '***in*** their surgery' if they had only received remote/virtual consultations (i.e. they had not physically been into the clinic). There were also instances where the VAS was completed as scoring 10 (care is completely safe) while simultaneously reporting a number of specific safety problems. As discussed further below, the PREOS-PC provides only a partial perspective on the complex issue of patient safety and health care-related harm.

The estimation of NHS and other resource use relied on patient recollection over a 30-day period and will be affected by recall bias. Furthermore, approximately one-third of participants did not respond to the 30-day questionnaire, potentially introducing a response bias. We aimed to mitigate response bias by using multiple imputation in a sensitivity analysis, which provided broadly consistent findings.

Comparison with related literature

In a systematic review published in 2020,[11] Eaton *et al.* identified a small number of studies that evaluated patient satisfaction with paramedic care in primary care home visits. The review concluded that although there were high satisfaction levels with paramedic care, a minority of patients remained keen to be assessed by their GP and/or remained unclear about the purpose of the paramedic assessment. The study was different in that it included a larger number of patients who had seen a paramedic across a broad range of primary care settings and included contemporaneous controls. Our findings that patients who had seen a PGP had lower confidence in health provision after the consultation and that confidence in the health plan deteriorated more by day 30 in patients seen by paramedics at high-complexity practices add to this small evidence base. 'Confidence in health provision' includes questions relating to confidence in being listened to when needed; practitioners' medical knowledge; and trust in practitioners. 'Confidence in the health plan' includes questions relating to confidence in dealing with health problems; managing in daily life; and following medication or treatment plans. Although these findings raise concerns, we

cannot directly attribute them to paramedic-led care because the PCOQ questions about health provision and health plan typically refer to 'doctors and nurses you usually see' or 'support you have in life, from both your health centre and elsewhere'.

Previous work by our group has highlighted the need for more evidence on the effect of PGP on patient safety.[10] Our findings on patient safety are novel and indicate that patients who received care from paramedics had more concerns about practice activation. The 'practice activation' domain includes questions about availability of practitioners to talk to and provision of information about the side effects of treatment. Once again, these concerns may relate more generally to the practice rather than specifically to the paramedic, but are worth further investigation.

We are aware of only one previous estimate of the cost of care for paramedics working across primary care. The analysis by Mason *et al*.[85] was conducted in 2006 and reflects a different model of 'emergency care practitioner' deployment across prehospital, emergency department, walk-in clinic and general practices. Their estimate of the cost of an average emergency care practitioner contact (£24–29), reflecting a median contact duration of 25 minutes, was similar to our estimate (£27). However, the similarity is probably coincidental given the differences in methods of cost estimation between the two studies.

Implications for research

Additional research to see whether our findings are replicated in other primary care settings is important. Such research might use bespoke questions about the quality and safety of care at the most recent consultation in addition to questionnaires about care at the practice more generally. This would help tease apart practice-related and paramedic-related concerns. Larger studies with longer follow-up are needed to more fully evaluate rare outcomes (e.g. hospital admissions) which may ultimately define the safety and (cost-)effectiveness of paramedics in primary care. Additional work is also needed to understand how clinical outcomes observed here might compare with differing primary care workforce compositions (i.e. other AHP and ARRS roles), and how this might vary with future changes in GP numbers and multiprofessional team working practices.

Implications for practice

Although statistically significant, many of the differences in experience and safety outcome measures were small, and it is unclear how meaningful they are. For example, although there were statistically significant differences in PCOQ domain scores after the index visit, the median scores in all PGP configurations and non-PGP practices were close to the average scores reported by the questionnaire developers.[70] Even so, if our findings are replicated in other work, there are some important implications for general practice. These include careful planning in how paramedics are deployed in primary care so that they can quickly gain the trust of the patients that they see. They also include well-designed paramedic training and in situ supervision to ensure that they have the right medical knowledge and can clearly convey healthcare plans to the groups of patients that they will be working with. There may also be a place for better communication between the practice and patients about the role of paramedics within their practice to manage expectations and provide reassurance.

Retrospective study using general practitioner electronic medical record data

Key findings

Our work illustrates the potential for paramedics to take on a large volume of primary care workload without substantial spillover effects on NHS colleagues via increased reconsultations, secondary care referrals or unplanned hospital admissions. Paramedic-led care had relatively little association with the patterns of subsequent patient care, with the possible exception of increased rates of prescribing. This finding was observed for both paramedics who were independent prescribers and those who were not, and requires further exploration.

In analyses adjusting for differences in appointment, patient and practice characteristics, we found that paramedic-led care has the potential to reduce the cost of NHS care by approximately £20 per 30-day episode of care. In the longer term, savings would be larger if the costs of GP and PGP training are included in unit cost calculations. However, these findings should be interpreted cautiously given the observational nature of this study and the relatively small number of practices providing data.

There was no single model of paramedic use in primary care. For example, practices classified as having 'highly integrated' paramedics were much more likely to deploy paramedics in remote consultations and less likely to deploy them in clinic consultations or home visits than practices where paramedics were less integrated, while paramedics working in practices that assigned them to high-complexity patients were seeing patients who were on average older than patients seen by GPs at non-PGP practices and paramedics working at medium- and low-complexity practices.

After adjustment for appointment, patient and practice characteristics, there was no convincing evidence that the level of paramedic integration within a GP practice was associated with substantial differences in the costs of care episodes. Perhaps surprisingly, the costs of care episodes tended to be lowest with paramedics classified as working with high-complexity patients, although these differences were no longer evident after adjustment for appointment, patient and practice characteristics. The initial differences were largely driven by higher referral and testing rates among paramedics working with low-complexity patients, which may merit further exploration.

Strengths/limitations

To our knowledge, this is the first study to utilise routinely collected general practice data to explore the potential impact of paramedic-led care on subsequent healthcare and NHS costs. EHRs provide access to data on a very large number of patients which can be extracted quickly and at relatively low cost. However, these data are not collected for research purposes, and therefore our analyses are restricted to the variables (e.g. patient age, appointment type) most likely to be recorded accurately in the medical record. In particular, the duration of paramedic- and GP-led consultations and GP time spent supervising less experienced paramedics are not recorded accurately. Without this information it is impossible to quantify the overall impact of paramedic-led care on the primary care workload.

We elected to extract data directly from selected GP case study sites rather than use nationwide data sets (e.g. CPRD Aurum)[86] so that we could cross-reference findings from the qualitative work on PGP models of care with quantitative data on healthcare use and costs. One limitation of this approach is that we extracted data from a relatively small number of practices. Furthermore, there were imbalances evident between PGP and non-PGP practices in potentially important factors, such as ethnicity. While we attempted to address this through multivariable regressions, the relatively small number of practices meant that we had limited ability to adjust for practice-level covariates.

While our analyses provide insight into the process of primary health care following paramedic- and GP-led consultations, they are likely to provide an incomplete picture of care in other sectors of the NHS (e.g. secondary care) which may not be consistently coded in the primary care record. Furthermore, although comparisons of healthcare use and costs are important components in evaluating the role of paramedics in primary care, they do not allow us to explore how that care affected patient satisfaction or well-being.

Comparison with related literature

Two previous reviews[10,11] have highlighted the lack of quantitative evidence on the impact of PGP on primary care workload and the cost-effectiveness of care. Qualitative work has identified concerns that the use of paramedics may not reduce GP workload if paramedic-led care results in higher reconsultation rates and/or requires a high level of supervision beyond the initial training period.[10] On the first concern, our findings are reassuring as reconsultation with a GP was lower within the first 7 days following a paramedic-led consultation than a GP-led consultation. Our data cannot address the second concern, although this is likely to vary from practice to practice depending on the quality of PGP postgraduate training and individual characteristics of paramedic. Another potential issue picked up in qualitative research is that the savings and additional capacity anticipated following the introduction of PGP may be dissipated if paramedics spend substantially longer with patients.[10] Our work does not directly measure this; however, the study sites reported very similar booked (i.e. planned) appointment durations for paramedics and GPs, with only very slightly longer durations allowed for telephone and urgent consultations performed by paramedics (2.5 minutes).

Implications for research

Large cluster randomised controlled trials are the gold standard method for evaluating the impact of practice-level initiatives, such as PGP. Such trials are expensive and become increasingly difficult to implement as the use of PGP becomes more widespread, but might have an important role to play in comparing different models of PGP implementation. Other, non-randomised, study designs (e.g. controlled interrupted time series) using routine data

sets (e.g. CPRD Aurum)[76] would provide an opportunity to explore whether our findings are replicable across a much larger number of practices. This would be particularly important to confirm our finding that paramedic-led care does not lead to increased reconsultations and to further explore the potential association between paramedic-led care and subsequent prescribing. Time and motion studies tracking workday activities of GPs and PGP would be a valuable way of accurately estimating the duration of paramedic and GP consultations and the supervision/mentoring time requirements for GPs and other practice staff. With respect to outcomes relating to patient safety and appropriate/correct diagnoses and clinical management, further work could consider a more detailed objective review of a sample of clinical case notes, and triangulate this with practice-level incident reports and significant event data. In addition, longer follow-up periods would be necessary to detect any differences in rare but potentially serious misdiagnosis events (e.g. delayed cancer diagnoses).

Implications for practice

The finding that paramedics can contribute to primary care workload without substantial spillover effects is important for practices that are struggling to recruit GPs or otherwise increase capacity to meet patient needs. It is equally important for patients trying to access GP services. However, as has been discussed elsewhere,[10] there may be spillover effects in other sectors of the health service, specifically ambulance services, if more experienced paramedics leave to work in general practice. The initiative to employ paramedics in primary care needs to be supported by commensurate NHS workforce planning.

Although financial savings may not be the primary motivator for employing paramedics, our work demonstrates that they have the potential to save NHS money. This is important for practices and Integrated Care Boards that face major challenges to provide health care for ageing populations with multimorbidity from within highly constrained budgets. Our work underlines the importance of continuing to monitor and provide guidance for the evolving role of PGP. Paramedics will only operate (cost-)effectively if they are used in roles for which their postgraduate training and continued professional development adequately prepare them.

This element of the research project is less informative about which model(s) of PGP deployment are likely to be most cost-effective. Our work suggests that no single model predominates. This could be viewed as a positive, indicating that paramedics have the ability to contribute to the general practice workload flexibly in ways most required by individual practices; alternatively, it could be viewed as a negative, indicating ongoing uncertainty about how best to utilise paramedics in primary care. Either way, it represents a challenge to postgraduate programmes in providing the breadth of training to prepare paramedics for a career in primary care.

Previous work has identified concerns that paramedics might exclusively work with 'simpler' cases, leading to increased stress for GPs left with a higher proportion of more complex cases in their workload.[10] In this context, our observation that in two of the detailed case study practices, paramedics had been allocated to high-complexity patients without any substantial increase in the reconsultation rate compared to GP-led consultations in non-PGP practices should be seen as reassuring. Ultimately, however, qualitative research with paramedics, GPs and patients may be the best method to inform decisions about how best to use paramedics in primary care.

Equality, diversity and inclusion

While this study took a proactive approach to anticipating potential equality, diversity and inclusion (EDI) issues, it is important to recognise the limitations of our methods and approach when assessing the overall generalisability of our findings. Case study sites were identified to include areas of known demographic variation and deprivation, with proactive support of the CRNs. During the design and set-up of the study, we consulted widely on matters pertaining to EDI, including – where relevant – our PPIE contributors and Study Steering Committee. During recruitment, data pertaining to key diversity characteristics were reviewed regularly at weekly core team meetings, and continuous close dialogue was maintained with recruitment contacts at our case study sites to anticipate and respond to any EDI issues. Despite these efforts, the final study sample for the prospective components of this work does not represent the full diversity of the practice populations or the wider national picture. It is also recognised that some specific minority groups already experience significant inequity of access to GP services – a situation that may have been

further exacerbated by the challenges of the COVID-19 pandemic, the latter stages of which coincided with our data collection period.

It is possible that our recruitment methods may have limited the involvement of non-English speakers, as study materials were only initially produced in English. While translation services were commissioned to support requests for study materials in other languages, the study team received no requests for materials in other languages. While the study team did have access to resources to transcribe materials into more accessible formats (including large print, audio or Braille), and offered the option of assisted telephone completion, initial awareness of the study may have been limited for those with reduced levels of literacy or specific communication needs.

With respect to our analysis and conclusions, the specific limitations relating to EDI are discussed throughout this report under the relevant headings.

Patient and public involvement and engagement

Please see *Chapter 8* for a discussion of PPIE.

Conclusions

Paramedics in general practice can provide a safe, cost-effective component of primary care service delivery, supporting better access to general practice (particularly same-day and acute care). Acceptance of PGP models is based on an understanding of the primary care paramedic role, and confidence that mechanisms are in place to support it. PGP models exhibit substantial variation, and there is no single optimal model. Nevertheless, PGP care does have a role in meeting patients' medical and psychosocial needs. The types of patients paramedics are asked to see may have some impact upon the cost-effectiveness of the model, with those operating in a low-complexity (urgent same-day minor illness) environment potentially using slightly more resource than standard care.

Where safety concerns exist, these are usually born of limited knowledge of the paramedic skill set outside of more familiar ambulance roles. Safety is achieved through a combination of comprehensive induction, ongoing supervision, appropriate postgraduate training, and continuing primary care-focused education – all of which require substantial resource. The degree of PGP integration has less of an obvious impact on individual patient-level outcomes and may be more associated with staff satisfaction, professional identity and role longevity.

Paramedics in general practice models involve paramedics working as part of the primary care team, alongside (rather than instead of) GPs, to support delivery of a component of primary health care, at a time where compound pressures are driving new workforce structures. Those involved in delivering PGP services consistently highlight how important it is to find the right 'fit' of paramedics for the intended roles and responsibilities in general practice, recognising that the paramedic skill set and scope is broad yet variable. It may take time to adapt to the clinical context of primary care when transitioning from other areas of practice, and some evolution of services over time is likely when first operationalising PGP. Rotational working may mitigate some of the potential system-wide impacts on the emergency care workforce, but such models can require more investment from general practice to sustain. Nevertheless, PGP provides opportunities for the paramedic profession to develop and evolve.

Additional information

CRediT contribution statement

Matthew Booker (https://orcid.org/0000-0002-6680-9887): Conceptualisation, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualisation, Writing – original draft, Writing – editing and reviewing.

Sarah Voss (https://orcid.org/0000-0001-5044-5145): Conceptualisation, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualisation, Writing – original draft, Writing – editing and reviewing.

Nicky Harris (https://orcid.org/0000-0002-1982-1461) (in memoriam): Data curation, Formal analysis, Investigation, Methodology, Supervision, Validation, Visualisation, Writing – original draft, Writing – editing and reviewing.

William Hollingworth (https://orcid.org/0000-0002-0840-6254): Conceptualisation, Data curation, Funding acquisition, Methodology, Supervision, Validation, Writing – original draft, Writing – editing and reviewing.

Nouf Jeynes (https://orcid.org/0009-0007-3623-2128): Data curation, Formal analysis, Methodology, Supervision, Validation, Writing – original draft, Writing – editing and reviewing.

Hazel Taylor (https://orcid.org/0000-0003-3430-5278): Conceptualisation, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Supervision, Validation, Writing – original draft, Writing – editing and reviewing.

Kirsty Garfield (https://orcid.org/0000-0002-8301-3602): Data curation, Formal analysis, Methodology, Supervision, Validation, Writing – original draft, Writing – editing and reviewing.

Helen Baxter (https://orcid.org/0000-0002-3320-2915): Conceptualisation, Funding acquisition, Methodology, Supervision, Validation, Writing – editing and reviewing.

Jonathan Benger (https://orcid.org/0000-0001-6131-0916): Conceptualisation, Funding acquisition, Methodology, Supervision, Validation, Writing – editing and reviewing.

Andy Gibson (https://orcid.org/0000-0002-9524-984X): Conceptualisation, Funding acquisition, Methodology, Supervision, Validation, Writing – editing and reviewing.

Trudy Goodenough (https://orcid.org/0000-0003-2824-5854): Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualisation, Writing – original draft, Writing – editing and reviewing.

Justin Jagosh (https://orcid.org/0000-0001-6807-2957): Conceptualisation, Formal analysis, Funding acquisition, Investigation, Methodology, Supervision, Validation, Visualisation, Writing – editing and reviewing.

Kim Kirby (https://orcid.org/0000-0002-8092-7978): Methodology, Supervision, Validation, Writing – editing and reviewing.

Cathy Liddiard (https://orcid.org/0000-0002-9384-1866): Data curation, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualisation, Writing – original draft, Writing – editing and reviewing.

Alyesha Proctor (https://orcid.org/0000-0001-5763-5419): Conceptualisation, Funding acquisition, Methodology, Supervision, Validation, Writing – editing and reviewing.

Sarah Purdy (https://orcid.org/0000-0002-3445-986X): Conceptualisation, Funding acquisition, Methodology, Supervision, Validation, Writing – editing and reviewing.

Behnaz Schofield (https://orcid.org/0000-0001-5290-4640): Conceptualisation, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Validation, Writing – editing and reviewing.

Hannah Stott (https://orcid.org/0000-0002-2177-3577): Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualisation, Writing – original draft, Writing – editing and reviewing.

Grace Scrimgeour (https://orcid.org/0000-0002-7334-8150): Investigation, Methodology, Project administration, Supervision, Validation, Writing – editing and reviewing.

Nicola Walsh (https://orcid.org/0000-0002-0499-4829): Conceptualisation, Funding acquisition, Methodology, Supervision, Validation, Writing – editing and reviewing.

Dave Coates: Methodology, Supervision, Validation, Writing - editing and reviewing.

Alison Diaper: Methodology, Supervision, Validation, Writing - editing and reviewing.

Karen Amegashitsi: Methodology, Resources, Validation.

Sarah Blake: Methodology, Resources, Supervision, Validation.

Tony Denham: Methodology, Resources, Validation.

Joanna Denman: Methodology, Resources, Validation.

Martin Gray: Methodology, Resources, Validation.

Shuma Kahnom: Methodology, Resources, Validation.

Vickie Knighton: Methodology, Resources, Validation.

Jane Spackman: Methodology, Resources, Validation.

Amanda Threfall: Methodology, Resources, Validation.

Adele Webb: Methodology, Resources, Supervision. Validation.

Katherine Checkland: Supervision.

Joanna Charles: Supervision.

Rob Goodwin: Supervision.

Graham McClelland: Supervision.

Kara Stevens: Supervision.

Acknowledgements

We would like to thank the NIHR for their support with this study, particularly our NIHR project managers: Alan Marshall, Hugh Hiscock, and Alexis Palmer.

We would also like to acknowledge:

The interviewees and stakeholder event participants in work package 1. Thank you for your time and contributions to this part of the work.

All of the staff and patient participants from our case study sites in work package 2. The study took place towards the end of the COVID pandemic, coinciding with a time of increased pressures on the health service and for primary care in particular. We are grateful to our case study sites for their commitment and support throughout the study despite these challenging times.

Staff at the English CRNs, particularly the West of England CRN. Thank you for all of your support and advice in recruiting and supporting our case study practices.

All of our PPIE group members: Ms Karen Amegashitsi, Ms Sarah Blake, Mr Tony Denham, Mrs Joanna Denman, Mr Martin Gray, Ms Shuma Kahnom, Mrs Vickie Knighton, Mrs Jane Spackman, Mrs Amanda Threfall and Mrs Adele Webb, who contributed to the study so thoughtfully throughout. We also would like to acknowledge Julie Clayton for all her support with organising and facilitating the PPIE workshops.

The study management group, including Dr Alison Diaper and Mr Dave Coates. Thank you for your time, support and advice throughout the study.

The study steering group members: Professor Kath Checkland (Chair); Dr Rob Goodwin; Dr Graham McClelland, Dr Joanna Charles, Dr Kara Stevens, Mrs Adele Webb and Ms Sarah Blake. Thank you for your advice, support and enthusiasm throughout the study.

Professor Olena Doran, Associate Dean (Research and Enterprise), University of the West of England.

Our grant hosts at NHS Bristol, North Somerset, South Gloucestershire Integrated Health Board. Thank you to Paul Roy, Rachel Avery, Katalin Bagi and Alison Diaper.

Patient data statement

This work uses data provided by patients and collected by the NHS as part of their care and support. Using patient data is vital to improve health and care for everyone. There is huge potential to make better use of information from people's patient records, to understand more about disease, develop new treatments, monitor safety and plan NHS services. Patient data should be kept safe and secure, to protect everyone's privacy, and it's important that there are safeguards to make sure that they are stored and used responsibly. Everyone should be able to find out about how patient data are used. #datasaveslives. You can find out more about the background to this citation here: https://understandingpatientdata.org.uk/data-citation.

Data-sharing statement

All data requests should be submitted to the Chief Investigators (Matthew Booker and Sarah Voss). Access will be granted where possible in line with Open Access principles, providing all anonymity is preserved.

Ethics statement

Rapid realist review

Ethical approval was obtained from the University of the West of England (Bristol) Faculty of Health and Applied Sciences Research Ethics committee (ref. HAS.21.07.175) for the system leader interviews and stakeholder event. All participants provided informed consent to take part in the study.

Case study

Research ethics approval was granted by: Yorkshire and The Humber – Bradford Leeds Research Ethics Committee (dated 30 December 2022, ref. 21/YH/0275), Health Research Authority (HRA) Integrated Research Application System (30 December 2022, ref. 279049). Approval was ratified by University of the West of England (Bristol) Faculty of Health and Applied Sciences Ethics Committee (ref. HAS.22.01.053, dated 22 January 2023).

Information governance statement

University of the West of England (UWE) Bristol undertakes research under its public function to provide research for the benefit of society. As a data controller we are committed to protecting the privacy and security of your personal data in accordance with the (EU) 2016/679 the General Data Protection Regulation (GDPR), the Data Protection Act 2018 (or any successor legislation) and any other legislation directly relating to privacy laws that apply (together 'the Data Protection Legislation'). General information on Data Protection law is available from the Information Commissioner's Office (https://ico.org.uk/). You can find out more information about lawful bases at the following webpage: https://ico.org.uk/for-organisations/guide-to-data-protection/guide-to-the-general-data-protection-regulation-gdpr/lawful-basis-for-processing/

For more information about how we handle your personal data, including how to exercise your individual rights and the contact details for the UWE (Bristol) Data Protection officer here: dataprotection@uwe.ac.uk.

Disclosure of interests statement

Full disclosure of interests: Completed ICMJE forms for all authors, including all related interests, are available in the toolkit on the NIHR Journals Library report publication page at https://doi.org/10.3310/GTJJ3104.

Primary conflicts of interest: Matthew Booker declares NIHR Award of Advanced Fellowship (November 2022); NHS England: Honorary Contracts National Clinical Advisor, Senior Academic GP, South Western Ambulance Service NHS FT, Honorary Contract & Leadership Role as Deputy Medical Director, Member of NIHR RfPB SW Regional Advisory Committee. William Hollingworth declares 2016–21 Member of the NIHR HTA Clinical Evaluation and Trials Funding Board. Sarah Purdy declares Non-Executive Director North Bristol NHS Trust and HSDR Panel Member 2017–20. Nicola Walsh declares Member of the NIHR HS&DR Seacole Funding Panel 2022–6.

Publications

Papers

Stott H, Goodenough T, Jagosh J, Gibson A, Harris N, Liddiard C, *et al*. Understanding paramedic work in general practice in the UK: a rapid realist synthesis. *BMC Prim Care* 2024;**25**:32. https://doi.org/10.1186/s12875-024-02271-1

Hollingworth W, Gadah-Jeynes NS, Taylor H, Garfield K, Voss S, Booker M. Paramedic or GP consultations in primary care: prospective study comparing costs and outcomes. *Br J Gen Pract* 2025;BJGP.2024.0469. https://doi.org/10.3399/BJGP.2024.0469

Conference presentations

Stott H. *What Is It about Paramedics Working in General Practice That Works (or Doesn't Work)? A Rapid Realist Review*. Society for Academic Primary Care (SAPC), 50th Annual Scientific Meeting, University of Central Lancashire, Preston, 22 July 2022.

Harris N, Voss S. *A Realist Evaluation of Paramedics Working in General Practice: An Assessment of Clinical and Cost Effectiveness*. London Metropolitan University, online event 1 February 2023.

Voss S. *A Realist Evaluation of Paramedics Working in General Practice*. University of Bristol Centre for Academic Primary Care Workforce webinar, 12 June 2023.

Voss S. *Paramedics in General Practice – Hitting the Target? The READY Study*. Centre for Health and Clinical Research, Research Showcase, University of the West of England (Bristol), 7 July 2023.

Voss S. *A Realist Evaluation of Paramedics Working in General Practice*. Bristol North Somerset and South Gloucestershire Integrated Care Board Research Showcase, 17 July 2023.

Booker M. *A Realist Evaluation of the Clinical- and Cost Effectiveness of Paramedics Working in General Practice*. Society for Academic Primary Care (SAPC), 51st Annual Scientific Meeting, Brighton, 18–20 July 2023.

Voss S. *Paramedics in General Practice – an Evaluation of Clinical and Cost Effectiveness*. REACH Annual Showcase, Bristol, 1 November 2023.

Study-led webinars

Booker M, Voss S, and the READY Research Team. Webinar. 28 February 2022.

READY: Paramedics in General Practice. Interim Dissemination Event. Online Event.

References

1. Hobbs FDR, Bankhead C, Mukhtar T, Stevens S, Perera-Salazar R, Holt T, Salisbury C; National Institute for Health Research School for Primary Care Research. Clinical workload in UK primary care: a retrospective analysis of 100 million consultations in England, 2007–14. *Lancet* 2016;***387***:2323–30.
2. Baird B, Charles A, Honeyman M, Maguire D, Das P. *Understanding Pressures in General Practice*. London: King's Fund; 2016.
3. NHS Digital. *Appointments in General Practice, October 2018*. 2018. URL: https://digital.nhs.uk/data-and-information/publications/statistical/appointments-in-general-practice/oct-2018 (accessed 26 July 2023).
4. NHS Digital. NHS Payments to General Practice – England, 2017/18. 2018. URL: https://digital.nhs.uk/data-and-information/publications/statistical/nhs-payments-to-general-practice/england-2017-18 (accessed 26 July 2023).
5. NHS England. *General Practice Forward View*. 2016. URL: www.england.nhs.uk/wp-content/uploads/2016/04/gpfv.pdf (accessed 26 July 2023).
6. NHS Digital. *General Practice Workforce, 30 April 2023*. 2023. URL: https://digital.nhs.uk/data-and-information/publications/statistical/general-and-personal-medical-services/ (accessed 26 July 2023).
7. PULSE. *Revealed: 450 GP Surgeries Have Closed in the Last Five Years*. 2018. URL: www.pulsetoday.co.uk/news/politics/revealed-450-gp-surgeries-have-closed-in-the-last-five-years/ (accessed 26 July 2023).
8. NHS. *NHS Long Term Plan*. 2019. URL: www.longtermplan.nhs.uk (accessed 26 July 2023).
9. Turner J, Williams J. *An Evaluation of Early Stage Development of Rotating Paramedic Model Pilot Sites*. URL: https://uhra.herts.ac.uk/handle/2299/21174 (accessed 26 July 2023).
10. Schofield B, Voss S, Proctor A, Benger J, Coates D, Kirby K, *et al*. Exploring how paramedics are deployed in general practice and the perceived benefits and drawbacks: a mixed-methods scoping study. *BJGP Open* 2020;***4***:bjgpopen20X101037.
11. Eaton G, Wong G, Williams V, Roberts N, Mahtani KR. Contribution of paramedics in primary and urgent care: a systematic review. *Br J Gen Pract* 2020;***70***:e421–6.
12. Proctor A. Home visits from paramedic practitioners in general practice: patient perceptions. *J Paramed Pract* 2019;***11***:115–21.
13. Moule P, Clompus S, Lockyer L, Coates D, Ryan K. Preparing non-medical clinicians to deliver GP out-of-hours services: lessons learned from an innovative approach. *Educ Prim Care* 2018;***29***:376–80.
14. Woollard M. The role of the paramedic practitioner in the UK. *Australas J Paramed* 2006;***4***:1–9.
15. Rasku T, Kaunonen M, Thyer E, Paavilainen E, Joronen K. The core components of Community Paramedicine – integrated care in primary care setting: a scoping review. *Scand J Caring Sci* 2019;***33***:508–21.
16. Ball L. Setting the scene for the paramedic in primary care: a review of the literature. *Emerg Med J* 2005;***22***:896–900.
17. Anthony BF, Surgey A, Hiscock J, Williams NH, Charles JM. General medical services by non-medical health professionals: a systematic quantitative review of economic evaluations in primary care. *Br J Gen Pract* 2019;***69***:e304–13.
18. Eaton G, Tierney S, Wong G, Oke J, Williams V, Mahtani KR. Understanding the roles and work of paramedics in primary care: a national cross-sectional survey. *BMJ Open* 2022;***12***:e067476.
19. Pawson R. *Evidence-Based Policy: A Realist Perspective*. London: SAGE Publications Ltd; 2006.

20. Pawson R, Tilley N. An Introduction to Scientific Realist Evaluation. In Chelimsky E, Shadish WR, editors. *Evaluation for the 21st Century: A Handbook*. London: SAGE Publications Ltd; 1997. pp. 405–18.
21. Jagosh J. Realist synthesis for public health: building an ontologically deep understanding of how programs work, for whom, and in which contexts. *Annu Rev Public Health* 2019;***40***:361–72.
22. Dalkin SM, Greenhalgh J, Jones D, Cunningham B, Lhussier M. What's in a mechanism? Development of a key concept in realist evaluation. *Implement Sci* 2015;***10***:49.
23. Saul JE, Willis CD, Bitz J, Best A. A time-responsive tool for informing policy making: rapid realist review. *Implement Sci* 2013;***8***:103.
24. Wong G, Greenhalgh T, Westhorp G, Buckingham J, Pawson R. RAMESES publication standards: realist syntheses. *BMC Med* 2013;***11***:21.
25. College of Paramedics. *The Journey of the College of Paramedics*. 2021. URL: https://collegeofparamedics.co.uk/COP/About_Us/The_Journey_of_the_College.aspx (accessed 26 July 2023).
26. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, *et al*. The PRISMA 2020 statement: an updated guidelines for reporting systematic reviews. *BMJ* 2021;***372***:n71.
27. Mahtani KR, Eaton G, Catterall M, Ridley A. Setting the scene for paramedics in general practice: what can we expect? *J R Soc Med* 2018;***111***:195–8.
28. Booker M, Voss S. Models of paramedic involvement in general practice. *Br J Gen Pract* 2019;***69***:477–8.
29. O'Hara R, Johnson M, Siriwardena AN, Weyman A, Turner J, Shaw D, *et al*. A qualitative study of systemic influences on paramedic decision making: care transitions and patient safety. *J Health Serv Res Policy* 2015;***20***:45–53.
30. Brooke Petter Associates. *A 'How-to' Guide: Recruitment and Development of Paramedics in Primary Care*. URL: https://gmpcb.org.uk/wp-content/uploads/Recruitment-and-Development-of-Paramedics-in-Primary-Care.pdf (accessed 26 July 2023).
31. Eaton G, Wong G, Tierney S, Roberts N, Williams V, Mahtani KR. Understanding the role of the paramedic in primary care: a realist review. *BMC Med* 2021;***19***:145.
32. Spence D. Bad medicine: good medicine – the GP paramedic. *Br J Gen Pract* 2017;***67***:562.
33. Jeanes J, Hamilton R. *Making Best Use of Paramedics to Support a Sustainable Urgent and Emergency Care System*. 2018. URL: https://glosprimarycare.co.uk/making-best-use-of-paramedics-to-support-a-sustainable-urgent-and-emergency-care-system (accessed 26 July 2023).
34. NHS England. *Supporting Sustainable General Practice: Innovation in Primary Care – Examples and Case Studies For General Practice*. 2016 URL: www.bnssgtraininghub.com/wp-content/uploads/College-of-Paramedics-Employers-Guide.pdf (accessed 26 July 2023).
35. Eaton G, Happs I, Tanner R. Designing and implementing an educational framework for advanced paramedic practitioners rotating into primary care in North Wales. *Educ Prim Care* 2021;***32***:289–95.
36. Campbell D. The paramedic will see you now: home visits by ambulance staff lighten GPs' load. *The Guardian*, 14 November 2021. URL: www.theguardian.com/society/2021/nov/14/the-paramedic-will-see-you-now-home-visits-by-ambulance-staff-lighten-gps-load (accessed 26 July 2023).
37. Cope J. How employing a paramedic solved our recruitment problem. *Pulse*, 24 August 2015. URL: www.pulsetoday.co.uk/resource/workforce/how-employing-a-paramedic-solved-our-recruitment-problem/ (accessed 26 July 2023).
38. Daly J. The paramedic in the community: my story. *Prim Health Care* 2012;***22***:16–9.
39. Salisbury H. Helen Salisbury: No room for growth at general practices. *BMJ* 2021;***374***:n1691.

40. Barker RO, Stocker R, Russell S, Hanratty B. Future-proofing the primary care workforce: a qualitative study of home visits by emergency care practitioners in the UK. *Eur J Gen Pract* 2021;***27***:68–76. https://doi.org/10.1080/13814788.2021.1909565

41. Creton D, Halter M, LaTrobe C. PP33 A service evaluation of the experiences of specialist paramedics working in rotational environments using a retrospective cohort. *Emerg Med J* 2020;***37***:e16.

42. Wagstaff B, Mistry V. The integration of paramedics into primary care. *Br J Gen Pract* 2020;***70***:123.

43. College of Paramedics. *Paramedic Specialist in Primary and Urgent Care Core Capabilities Framework*. 2018. URL: www.hee.nhs.uk/sites/default/files/documents/Paramedic%20Specialist%20in%20Primary%20and%20Urgent%20Care%20Core%20Capabilities%20Framework.pdf (accessed 26 July 2023).

44. College of Paramedics. *Employers' Guide Paramedics in Primary and Urgent Care*. 2019. URL: www.bnssgtraining-hub.com/wp-content/uploads/College-of-Paramedics-Employers-Guide.pdf (accessed 26 July 2023).

45. Fareham and Gosport and South Eastern Hampshire Clinical Commissioning Groups. *A Guide for General Practice Employing a Paramedic*. 2nd edn. 2018. URL: https://wessex.hee.nhs.uk/wp-content/uploads/sites/6/2020/04/PCTH-Paramedics-GP-Toolkit-for-Employing-a-Paramedic-in-Primary-Care.pdf (accessed 26 July 2023).

46. NHS Health Education England. *First Contact Practitioners and Advanced Practitioners in Primary Care: (Paramedic) A Roadmap to Practice*. 2021. URL: www.hee.nhs.uk/sites/default/files/documents/Paramedics-FINAL%20%28002%29.pdf (accessed 26 July 2023).

47. Malterud K, Siersma VD, Guassora AD. Sample size in qualitative interview studies: guided by information power. *Qual Health Res* 2016;***26***:1753–60.

48. Murphy M, Hollinghurst S, Cowlishaw S, Salisbury C. Primary Care Outcomes Questionnaire: psychometric testing of a new instrument. *Br J Gen Pract* 2018;***68***:e433–40.

49. Ricci-Cabello I, Avery AJ, Reeves D, Kadam UT, Valderas JM. Measuring patient safety in primary care: the development and validation of the 'Patient Reported Experiences and Outcomes of Safety in Primary Care' (PREOS-PC). *Ann Fam Med* 2016;***14***:253–61.

50. Ricci-Cabello, I, Valderas, JM, Reeves D. *PREOS-PC Compact. Questionnaire 1–7*. 2018. URL: https://innovation.ox.ac.uk/wp-content/uploads/2018/07/PREOS-PC-27-item-version-SAMPLE.pdf (accessed 26 July 2023).

51. Herdman M, Gudex C, Lloyd A, Janssen M, Kind P, Parkin D, *et al*. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Qual Life Res* 2011;***20***:1727–36.

52. Garfield K, Husbands S, Thorn JC, Noble S, Hollingworth W. Development of a brief, generic, modular resource-use measure (ModRUM): cognitive interviews with patients. *BMC Health Serv Res* 2021;***21***:371.

53. REILLY Associates. *WPAI:GH*. URL: www.reillyassociates.net/WPAI_GH.html (accessed 6 December 2023).

54. Landfeldt E, Zethraeus N, Lindgren P. Standardized questionnaire for the measurement, valuation, and estimation of costs of informal care based on the opportunity cost and proxy good method. *Appl Health Econ Health Policy* 2019;***17***:15–24.

55. Shearn K, Allmark P, Piercy H, Hirst J. Building realist program theory for large complex and messy interventions. *Int J Qual Methods* 2017;***16***:774179.

56. Gilmore B, McAuliffe E, Power J, Vallières F. Data analysis and synthesis within a realist evaluation: toward more transparent methodological approaches. *Int J Qual Methods* 2019;***18***:985975.

57. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap): a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;***42***:377–81.

58. Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, *et al*.; REDCap Consortium. The REDCap consortium: Building an international community of software platform partners. *J Biomed Inform* 2019;***95***:103208.

59. NHS England. *The NHS Patient Safety Strategy*. 2019. URL: www.england.nhs.uk/patient-safety/the-nhs-patient-safety-strategy/ (accessed 26 July 2023).

60. Doyle C, Lennox L, Bell D. A systematic review of evidence on the links between patient experience and clinical safety and effectiveness. *BMJ Open* 2013;***3***:e001570.

61. NICE. *NICE Health Technology Evaluations: The Manual*. URL: www.nice.org.uk/process/pmg36/chapter/introduction-to-health-technology-evaluation (accessed 1 December 2023).

62. Hernández-Alava M, Pudney S. Eq5Dmap: a command for mapping between EQ-5D-3L and EQ-5D-5L. *Stata J* 2018;***18***:395–415.

63. Manca A, Hawkins N, Sculpher MJ. Estimating mean QALYs in trial-based cost-effectiveness analysis: the importance of controlling for baseline utility. *Health Econ* 2005;***14***:487–96.

64. Jones K, Weatherly H, Birch S, Castelli A, Chalkley M, Dargan A, *et al. Unit Costs of Health and Social Care 2022 Manual*. Kent: PSSRU, University of Kent; 2023.

65. NHS England. *National Cost Collection: National Schedule of NHS Costs – Year 2020-21 – NHS Trust and NHS Foundation Trusts*. 2022. URL: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.england.nhs.uk%2Fwp-content%2Fuploads%2F2022%2F07%2F2_National_schedule_of_NHS_costs_FY20-21.xlsx&wdOrigin=BROWSELINK (accessed 26 July 2023).

66. NHS Business Services Authority. *Prescription Cost Analysis – England: National Summary Tables – Calendar Year 2020*. 2020. URL: www.nhsbsa.nhs.uk/statistical-collections/prescription-cost-analysis-england/prescription-cost-analysis-england-202021 (accessed 26 July 2023).

67. Gopfert A, Deeny SR, Fisher R, Stafford M. Primary care consultation length by deprivation and multimorbidity in England: an observational study using electronic patient records. *Br J Gen Pract* 2021;***71***:e185–92.

68. Personal Social Services Research Unit; Curtis L. *Unit Costs of Health and Social Care 2013. University of Kent and National Schedule of Reference Costs Year 2012*. 2013. URL: https://kar.kent.ac.uk/41636/1/4578.pdf (accessed 26 July 2023).

69. Office for National Statistics. *Annual Survey of Hours and Earnings (ASHE)*. 2021. URL: www.ons.gov.uk/surveys/informationforbusinesses/businesssurveys/annualsurveyofhoursandearningsashe (accessed 26 July 2023).

70. University of Bristol. *Primary Care Outcomes Questionnaire (PCOQ) User Guide*. URL: www.bristol.ac.uk/media-library/sites/primaryhealthcare/documents/PCOQShortUserGuide_Oct2016.pdf (accessed 26 July 2023).

71. The Health Foundation. *Chart: Characteristics of Frequent Attenders at General Practice*. 2017. URL: www.health.org.uk/chart/chart-characteristics-of-frequent-attenders-at-general-practice (accessed 26 July 2023).

72. Hoch JS, Briggs AH, Willan AR. Something old, something new, something borrowed, something blue: a framework for the marriage of health econometrics and cost-effectiveness analysis. *Health Econ* 2002;***11***:415–30.

73. Office for Health Improvements and Disparities. *Fingertips Public Health Data*. URL: https://fingertips.phe.org.uk/ (accessed 26 July 2023).

74. Office for National Statistics. *Deaths Registered by Area of Usual Residence, UK*. 2023. URL: www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/deathsregisteredbyareaofusualresidenceenglandandwales (accessed 26 July 2023).

75. EMIS Health. *EMIS Web*. URL: www.emishealth.com/products/emis-web (accessed 26 July 2023).

76. Wolf A, Dedman D, Campbell J, Booth H, Lunn D, Chapman J, Myles P. Data resource profile: Clinical Practice Research Datalink (CPRD) Aurum. *Int J Epidemiol* 2019;***48***:1740.

77. Dada S, Dalkin S, Gilmore B, Hunter R, Mukumbang FC. Applying and reporting relevance, richness and rigour in realist evidence appraisals: advancing key concepts in realist reviews. *Res Synth Methods* 2023;***14***:504–14.

78. Knowledge Mobilisation Alliance (KMA). *Sharing Knowledge, Catalysing Change*. 2019. URL: https://kmalliance.co.uk/ (accessed 26 July 2023).

79. Baxter H, Bearne L, Stone T, Thomas C, Denholm R, Redwood S, *et al*. *Mechanisms of Knowledge Sharing in NIHR Funded Research: A Systematic Review*. Health Services Research UK Conference 2023, University of Birmingham; 2023.

80. Wye L, Cramer H, Carey J, Anthwal R, Rooney J, Robinson R, *et al*. Knowledge brokers or relationship brokers? The role of an embedded knowledge mobilisation team. *Evid Policy* 2019;***15***:277–92.

81. Wye L, Cramer H, Beckett K, Farr M, le May A, Carey J, *et al*. Collective knowledge brokering: the model and impact of an embedded team. *Evid Policy* 2020;***16***:429–52.

82. Buick F, Blackman D, O'Flynn J, O'Donnell M, West D. Effective practitioner-scholar relationships: lessons from a coproduction partnership. *Public Adm Rev* 2016;***76***:35–47.

83. Batalden M, Batalden P, Margolis P, Seid M, Armstrong G, Opipari-Arrigan L, Hartung H. Coproduction of healthcare service. *BMJ Qual Saf* 2016;***25***:509–17.

84. Heaton J, Day J, Britten N. Collaborative research and the co-production of knowledge for practice: an illustrative case study. *Implement Sci* 2016;***11***:20.

85. Mason S, Coleman P, O'Keeffe C, Ratcliffe J, Nicholl J. The evolution of the emergency care practitioner role in England: experiences and impact. *Emerg Med J* 2006;***23***:435–9.

86. Medicines and Healthcare products Regulatory Agency. *Primary Care Data for Public Health Research*. 2023. URL: https://cprd.com/primary-care-data-public-health-research (accessed 6 December 2023).

Appendix 1 Changes to the case study protocol

Amendments to Health Research Authority approval

We submitted five ethics amendments, of which three included changes to the study protocol for case studies.

Amendment 01

This was to clarify that patient participants were to be offered a £10 gift voucher to thank them for their time when they had completed and returned both their baseline and follow-up patient questionnaire booklets. Patient participants who took part in the study qualitative interviews were also offered a £10 gift voucher as a small thank you for their time. This information was omitted in our initial and revised submission to IRAS. We edited the participant information sheets (questionnaire study and participant interview) and study protocol to correct this omission.

Amendment 02

Addition of all English LCRNs as named research sites.

Amendment 03

We added two posters to the study documents provided to our case study sites. Our initial poster, displayed at our detailed case study sites, let patients know they could contact the study team directly if they were interested in taking part in our study interview. In discussion with our core sites (with paramedics employed) and control case study sites (no paramedics) where no patient interviews were to take place, we added posters to publicise the study with no reference to patient interviews.

Amendment 04

This amendment added that all staff participants participating in the study qualitative interviews were offered a £10 gift voucher as a small thank you for their time. This 'thank you' gift voucher was added in recognition of the time pressures general practice staff and commissioners are under and to improve the response rate for staff qualitative interviews. The participant information sheets (GP staff participant interview and staff participant commissioner interview) and study protocol were edited to detail this change.

Amendment 05

This amendment was in three parts.

Additional sites

We requested approval to add up to 12 additional case study sites (general practices) to our original 24 case study sites. The additional sites were deemed necessary to attain the study recruitment target of 552 patient participants (23 patients per case study site) who complete questionnaire data at baseline and follow-up. The recruitment target of 552 participants was specified by the study statisticians as required for the statistical and health economic analysis of the participant-provided quantitative data. Following a review of recruitment across our 24 case study sites, and despite providing a range of support measures to sites, it was considered unlikely that this recruitment target would be met with our existing sites. Some sites had been recruiting well and could potentially over-recruit. However, the study

statisticians recommended that a more robust analysis would be achieved by opening to more sites rather than over-recruiting patients at our existing sites.

We had also received many more expressions of interest from general practices than we were able to accommodate within our original 24-site limit, and thus this approach enabled more interested sites to participate, while ensuring robustness of our intended analysis.

Addition of patient-level 'data query' for core sites

As stated in the protocol, the patient-level 'anonymised data query' was planned to be carried out in our 12 detailed case study sites (GP practices) that used either EMIS or SystmOne electronic systems. These data identify consulting patterns and inform the economic analysis between sites which do or do not have a paramedic. Searches were developed and tested for both EMIS and SystmOne platforms.

The extraction of data using EMIS was completed as planned, but it was not possible to capture the same data from SystmOne practices due to the differences in the software architecture, despite significant efforts in search development.

Thus, to provide sufficient data for all aspects of the planned statistical analysis of the anonymised patient-level data, we sought approval to invite our eight EMIS core case study sites (GP practices) to undertake the data extraction in addition to their original research activities. Sites taking part as 'core' sites were invited to undertake this additional activity that was already taking place at 'detailed' sites and took about 15–30 minutes.

This additional data query was funded within the costings of the study. Each core case study site was be issued with an amended Organisation Information Document outlining the additional research costs that were payable to them for this work.

Extension of data collection period

To provide sufficient time for the additional case study sites to reach their recruitment targets for baseline and follow-up questionnaires as outlined above, we requested approval to extend the data collection period as detailed in the Study Protocol from 31 December 2022 to 28 February 2023. The resources for this extension for the additional sites were covered by the existing study service support costs and research costs as agreed with sites when they are recruited into the study.

Appendix 2 Site characteristics and model classification

Site name	PGP/ non PGP	IT[a]	EMIS extract	Interview data	LSOA rural/ urban[b]	Practice size	Practice size category[c]	Deprivation decile	Deprivation category[d]	Mortality	Ethnicity % (not white British)	Integration[e]	Complexity[f]	Maturity[g]	Paramedics WTE	GPs WTE	Proportion PGP/GP	Proportion category[h]
Basil	PGP	Syst	No	No	UCT	13,080	Med	8	Low	1078.4	4.1	High	Med	Low	0.8	4	0.20	Med
Bluebell	PGP	EMIS	Yes	Yes	UCT	8261	Small	2	High	1130.5	1.5	Med	Low	High	1	3	0.33	High
Bramble	PGP	Syst	No	No	RTF	9094	Small	9	Low	898.7	1.5	High	Low	Low	1	5	0.20	Med
Camellia	PGP	Syst	No	No	UCT	33,293	Large	8	Low	796.9	2.5	Med	Low	Low	2	12	0.17	Med
Clove	No	Syst	No	No	UCT	4932	Small	8	Low	898.7	1.7							
Dahlia	PGP	Syst	Yes	Yes	UCT	13,001	Med	9	Low	846.2	2.8	High	Low	Low	0.6	7	0.09	Low
Daisy	PGP	EMIS	Yes	No	UCT	16,019	Med	4	Mod	1120.1	27.5	High	Med	Low	2	8	0.25	High
Fennel	PGP	EMIS	Yes	No	UCT	30,711	Large	3	High	960.4	1.7	Med	Med	High	3.2	14	0.23	Med
Fern	PGP	EMIS	Yes	No	UCT	9957	Small	10	Low	891.3	2.5	High	High	High	1	4.5	0.22	Med
Foxglove	PGP	EMIS	No	No	UMC	18,242	Med	2	High	1214	16.1	High	High	High	1	6	0.17	Med
Geranium	No	Syst	No	No	UCT	7900	Small	8	Low	931.5	3							
Hibiscus	PGP	Syst	No	No	RTF	44,964	Large	10	Low	760.6	3.9	Med	High	High	4	20.5	0.20	Med
Iris	PGP	Syst	No	Yes	UCT	36,169	Large	7	Mod	1024.3	11.4	Med	Med	High	5	12	0.42	High
Ivy	No	Syst	No	No	UCT	10,761	Med	9	Low	914.2	18.5							
Lavender	PGP	Syst	No	Yes	UCT	16,361	Med	5	Mod	962.3	3	High	Med	High	3.4	6.8	0.50	High
Lily	PGP	EMIS	Yes	No	UMC	13,207	Med	8	Low	1220	4.2	High	Low	Low	0.225	8	0.03	Low
Magnolia	No	EMIS	Yes	No	UMC	6758	Small	5	Mod	1029.9	41.7							
Marigold	PGP	EMIS	Yes	Yes	UMC	19,432	Med	8	Low	1123.3	2.4	Low	Med	Low	0.1	11	0.01	Low
Nettle	PGP	Syst	No	No	UCT	24,754	Med	1	High	1160.3	2.8	Med	High	High	4	14	0.29	Low
Orchid	PGP	EMIS	Yes	Yes	UCT	13,099	Med	3	High	1314.8	4.8	High	High	High	1	7.5	0.13	Low
Pansy	No	EMIS	Yes	No	UMC	11,192	Med	6	Mod	1029.9	49.1							
Peony	No	Syst	Yes	Yes	UMC	31,860	Large	7	Mod	1057.5	31.7							
Petunia	PGP	EMIS	Yes	No	UCT	37,871	Large	4	Mod	1120.6	5.5	Low	Low	Low	0.6	10	0.06	Low
Primrose	No	Syst	Yes	Yes	RVD	7645	Small	8	Low	1064.7	1.4							

Site name	PGP/ non PGP	IT[a]	EMIS extract	Interview data	LSOA rural/ urban[b]	Practice size	Practice size category[c]	Deprivation decile	Deprivation category[d]	Mortality	Ethnicity % (not white British)	Integration[e]	Complexity[f]	Maturity[g]	Paramedics WTE	GPs WTE	Proportion PGP/GP	Proportion category[h]
Privet	PGP	EMIS	No	Yes	RTF	5682	Small	9	Low	780.1	1.1	Low	Low	Low	0.4	4	0.10	Low
Quince	PGP	EMIS	No	Yes	UMC	3965	Small	2	High	1057.3	7.9	Low	Low	Low	1	2	0.50	High
Reed	No	EMIS	Yes	Yes	UCT	14,240	Med	10	Low	802	11.2							
Rose	PGP	EMIS	Yes	Yes	UMC	14,671	Med	10	Low	936.8	21.3	Low	High	Mod	0.4	4	0.10	Low
Saffron	PGP	EMIS	No	No	UCT	8233	Small	5	Mod	1120.6	10.2	High	Low	Low	0.8	5	0.16	Med
Sunflower	No	EMIS	Yes	Yes	RVD	4710	Small	9	Low	1060.5	1.7							
Thyme	PGP	EMIS	No	No	UCT	13,327	Med	5	Mod	1086.5	12.9	High	Med	Low	1	7.5	0.13	Low
Tulip	PGP	EMIS	Yes	Yes	UCT	24,042	Med	9	Low	846.2	2.4	High	Med	Low	2.5	10	0.25	High
Vervain	PGP	EMIS	No	No	UCT	15,332	Med	6	Mod	1092.9	4.3	High	High	Mod	2	6	0.33	High
Violet	PGP	Sys	Yes	Yes	RTF	12,817	Med	9	Low	816.9	2.3	Low	High	Low	0.2	7.5	0.03	Low

a IT: practice EHR system. Syst = SystmOne; EMIS = EMIS.
b LSOA Rural/Urban: Rural/Urban Classification (2011 Census) by Lower layer Super Output Area; RTF, rural town and fringe; RVD, rural village and dispersed; UCT, urban city and town; UMC, urban major conurbation.
c Practice size: low < 10K; medium; 10–30K; > Large 30K.
d Deprivation category: high 1–3; moderate 4–7; low 8–10.
e Integration: level of paramedic integration to the general practice team: low; medium; high (see *Site classification*).
f Complexity: level of complexity of patients seen by paramedics: low; medium; high (see *Site classification*).
g Maturity: length of time PGP services have been in operation. Low < 12 months; moderate 12–36 months; high > 36 months.
h Proportion category: proportion of paramedics to GPs: low ≤ 0.15; medium = 0.151–0.249; high ≥ 0.250.

Appendix 3 Unit cost calculations for general practitioner-, nurse- and paramedic-led care

Cost component	GP	Nurse (Band 6)	Paramedic	Source
1. Salary and oncosts	£145,862	£47,432	£62,578	GP[64] (Table 9.4.1) Nurse[64] (Table 9.2.1) Paramedic: Survey of PGP adverts + ≈ 30% oncosts
2. Qualifications	£45,998	£8502	£11,333	GP[64] (Table 9.4.1) Nurse[64] (Table 9.3.1) Paramedic: nurse estimate inflated by 33% (to reflect extra year of training – e.g. MSc)
3. Practice expenses	£119,784	£28,839	£42,833	GP[64] (Table 9.4.1) Nurse[64] (Table 9.3.1) Paramedic: assumed to be relative to GP and nurse salary
4. Capital expenses	£13,366	£5366	£6597	As above
Total	£325,010	£90,139	£123,341	
Total salary + qualifications	£191,860	£55,934	£73,911	
i. Working hours pa	1738.80	1552.50	1552.50	GP[64] (Table 9.4.1) Nurse[64] (Table 9.3.1) Paramedic: Assumed to be same as practice nurse
ii. Face-to-face time	0.61	0.77	0.61	GP[64] (Table 9.4.1) Nurse[64] (Table 9.3.1) Paramedic: assumed to be same as GP
iii. Surgery consultation minutes	9.22	9.72	12.53	GP[64] (Table 9.4.1) Nurse[1] Paramedic: assumed to be approximately 36% longer than GP – similar to the difference in duration between GP and GP registrar[67]
iv. Virtual consultation minutes	5.40	5.69	7.34	GP[1] Nurse[1] Paramedic: assumed to be approximately 36% longer than GP – similar to the difference in duration between GP and GP registrar[67]
Including overheads and qualifications				
Cost per working hour	£187	£58	£79	
Cost per hour of patient contact	£307	£75	£130	
Cost per surgery consultation	£47	£12	£27	
Cost per virtual consultation	£28	£7	£16	
Cost per home visit	£119	£31	£69	All: home visit cost inflated by approximately 253% of surgery consultation cost to reflect the relative difference in these costs last time the PSSRU reported both[68] (Table 7.8b)

Cost component	GP	Nurse (Band 6)	Paramedic	Source
Excluding overheads and qualifications				
Cost per hour	£84	£31	£40	
Cost per hour of patient contact	£138	£40	£66	
Cost per surgery consultation	£21	£6	£14	
Cost per virtual consultation	£12	£4	£8	
Cost per home visit	£54	£16	£35	As above

Appendix 4 Post hoc adjusted analysis of Primary Care Outcomes Questionnaire, confidence in provision at index visit and at 30 days

Results from multilevel modelling showing adjusted[a] difference in means compared to no PGP (95% CIs)

	PGP			*p*-value
Confidence in provision at index visit, *n* = 451	−0.33 (−0.53 to −0.14)			0.001
Confidence in provision at 30 days, *n* = 457	−0.32 (−0.49 to −0.15)			< 0.001
	High integration	***Medium integration***	***Low integration***	***p-value***
Confidence in provision at index visit	−0.34 (−0.52 to −0.15)	−0.13 (−0.43 to 0.17)	−0.39 (−0.75 to −0.02)	0.0028; $p < 0.001$ for high vs. non-PGP
Confidence in provision at 30 days	−0.30 (−0.47 to −0.13)	−0.26 (−0.52 to −0.01)	−0.42 (−0.68 to −0.16)	0.0024; $p = 0.001$ for high vs. non-PGP, $p = 0.002$ for low vs. non-PGP
	Low complexity	***Medium complexity***	***High complexity***	***p-value***
Confidence in provision at index visit	−0.35 (−0.56 to −0.13)	−0.40 (−0.69 to −0.11)	−0.30 (−0.51 to −0.08)	0.0061; $p = 0.001$ for low vs. non-PGP and $p = 0.007$ for medium, high vs. non-PGP
Confidence in provision at 30 days	−0.31 (−0.50 to −0.12)	−0.37 (−0.61 to −0.13)	−0.31 (−0.50 to −0.13)	0.0032; $p = 0.002$ for medium vs. non-PGP. $p = 0.001$ for low, high vs. non-PGP

a Adjusting for the patient-level factors: age (continuous), sex, ethnicity (white or not white) and the number of attendances (0–1, 2–3, 4+, unknown), and for the practice-level factors: age-standardised mortality rate (continuous), % non-white (continuous), urban vs. rural, practice size (small, medium, large) and deprivation decile (1–3, 4–7, 8–10), with site fitted as a random effect.

Appendix 5 Number of cases with complete and missing data

Variable	Non-missing, *n* (%)	Missing, *n* (%)
Post-index utility score	700 (97.90%)	15 (2.10%)
Follow-up utility scores	484 (67.69)	231 (32.31%)
GP costs	442 (61.82%)	273 (38.18%)
Other HCP costs	440 (61.54%)	275 (38.46%)
Prescription costs	438 (61.26%)	277 (38.74%)
Outpatient costs	450 (62.94%)	265 (37.06%)
A&E visits costs	453 (63.36%)	262 (36.64%)
Day cases costs	452 (63.22%)	263 (36.78%)
Overnight stays costs	449 (62.80%)	266 (37.20%)

Appendix 6 SNOMED codes for identifying blood tests and unplanned admissions

Blood tests:

248301000000103	Phlebotomy domiciliary visit done
313334002	Blood sample taken
82078001	Collection of blood specimen for laboratory

Unplanned admissions:

183452005	Emergency hospital admission
50849002	Emergency room admission
32485007	Hospital admission
305230000	Admission by general practitioner

Appendix 7 Flow charts of referral and medication codes

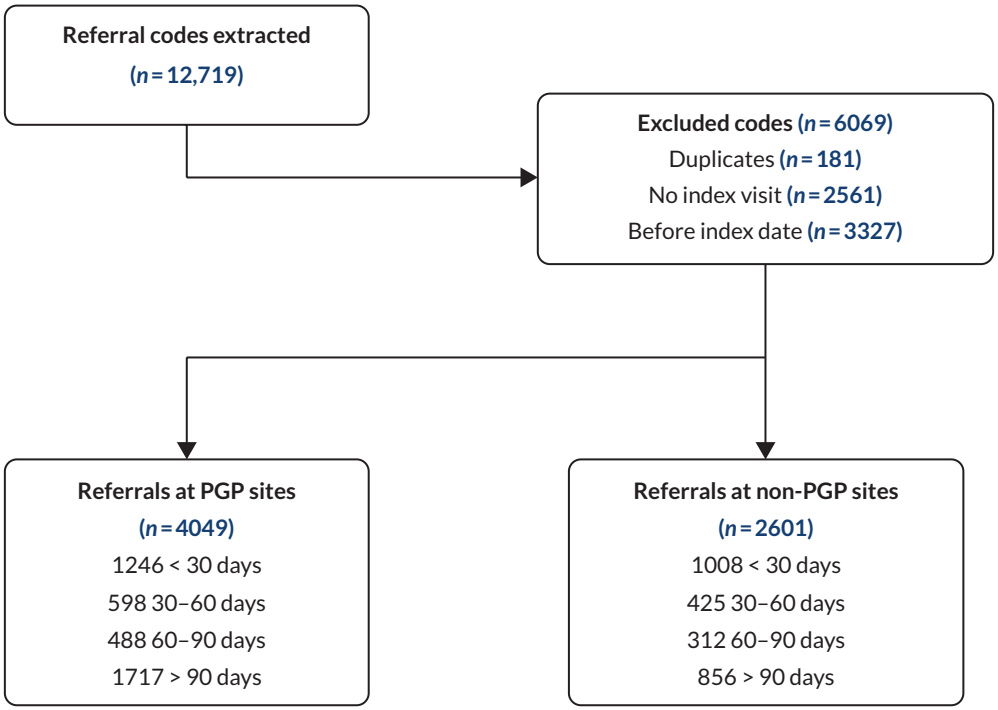

FIGURE 13 Flow chart of referrals to specialists, associated HCPs and diagnostic imaging.

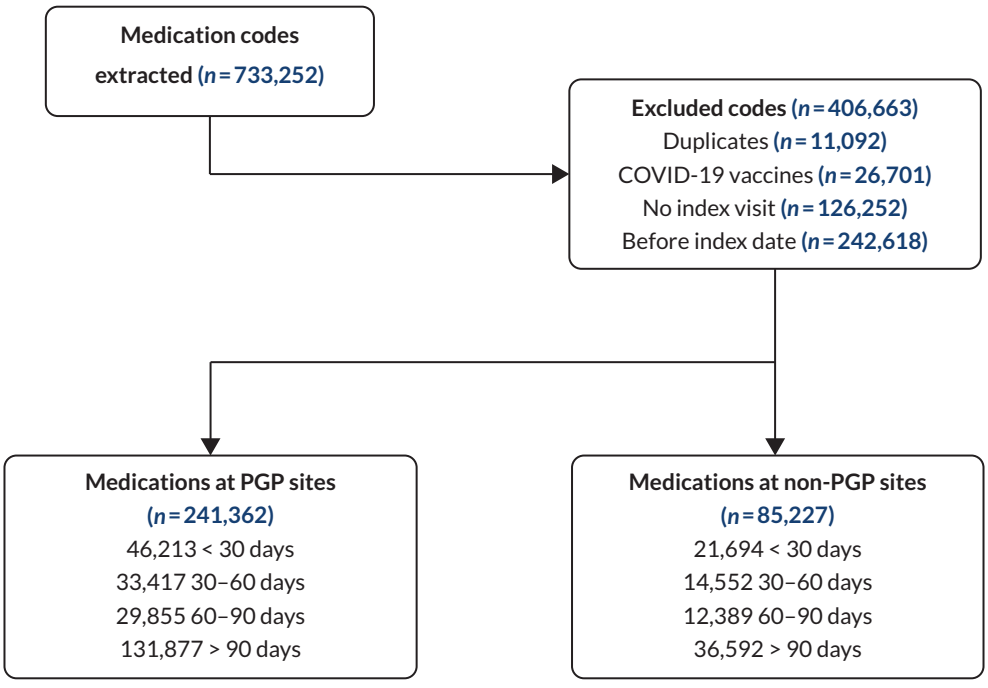

FIGURE 14 Flow chart of medicines prescribed.

Appendix 8 Thirty-day episode costs: integration and complexity

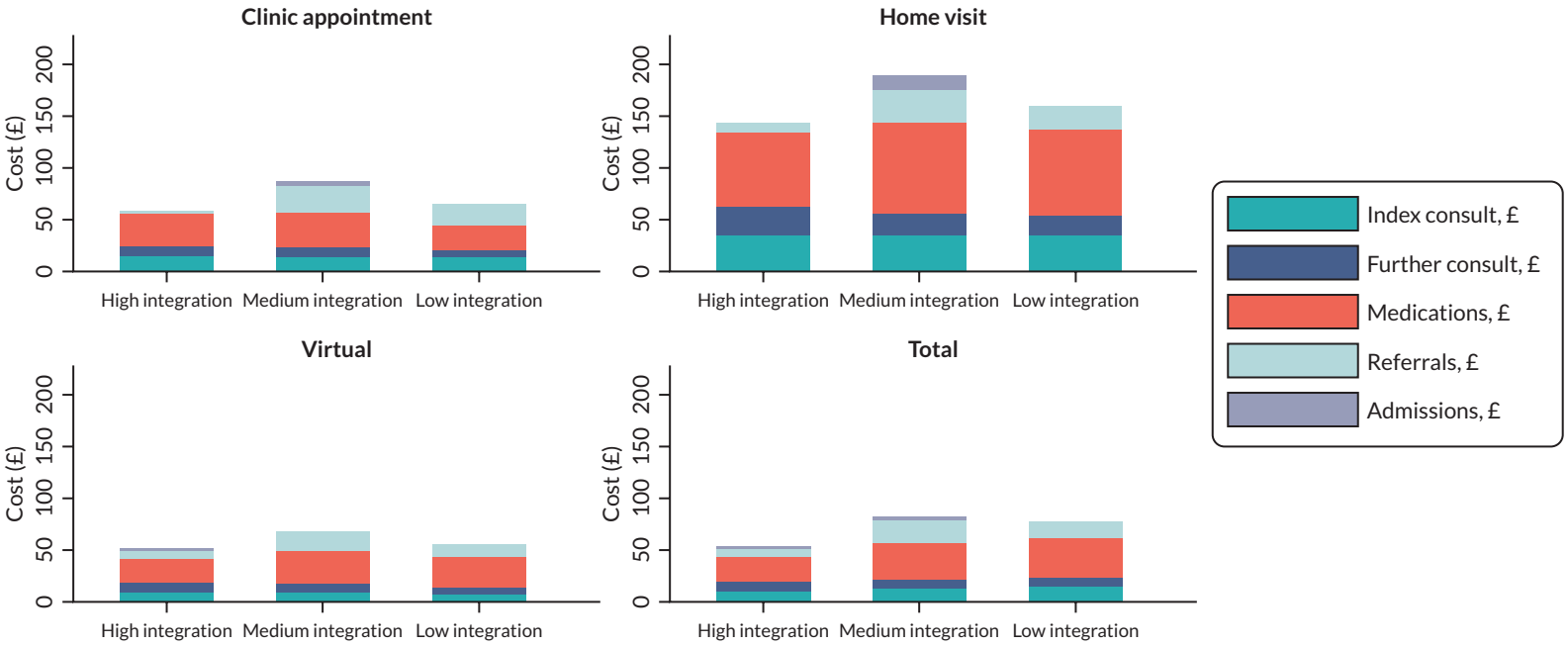

FIGURE 15 Thirty-day episode costs (PGP integration), stratified by index visit type.

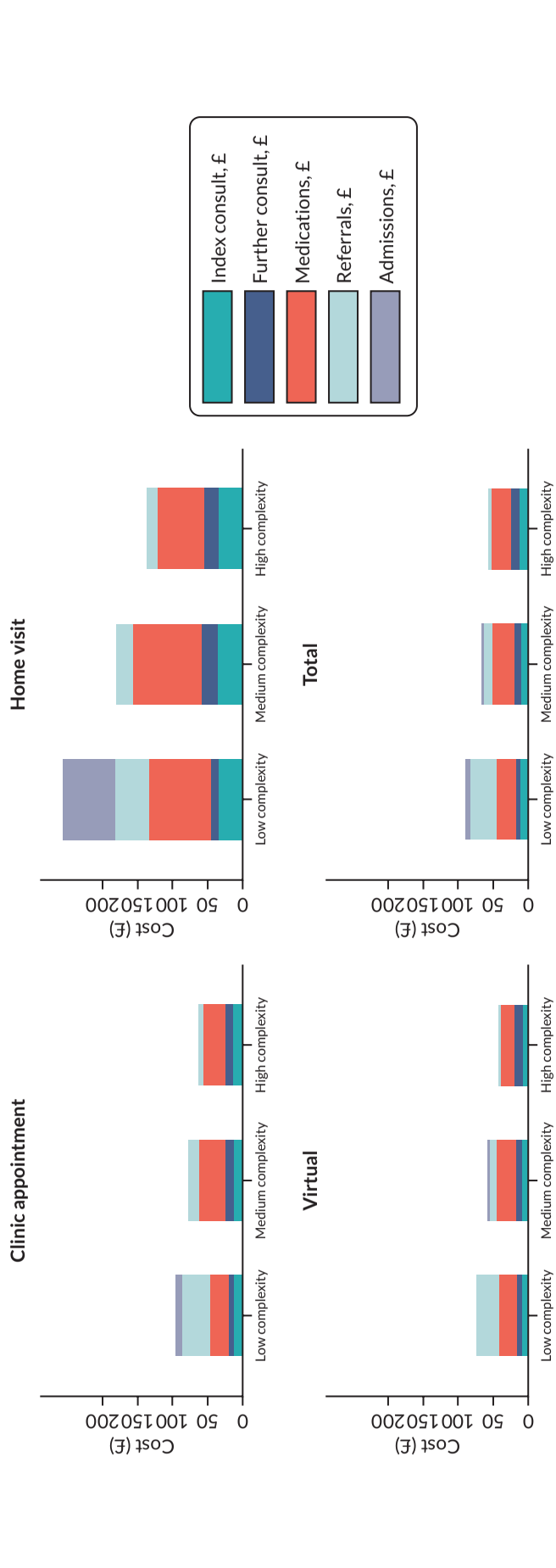

FIGURE 16 Thirty-day episode costs (PGP patient complexity), stratified by index visit type.

EME
HSDR
HTA
PGfAR
PHR

Part of the NIHR Journals Library
www.journalslibrary.nihr.ac.uk

Published by the NIHR Journals Library