

Point-of-care tests to manage acute respiratory tract infections in primary care: a systematic review and qualitative synthesis of healthcare professional and patient views

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Objectives: To review the evidence on healthcare professionals' (HCPs) and patients' views of the use of point-of-care tests (POCTs) in the management of acute respiratory tract infections (RTIs) in primary care settings.

Methods: We conducted a systematic review of studies up to 28 April 2023. We included studies that included qualitative methods and results; focused on HCPs' and/or patients' views/experiences of POCTs for acute RTIs; and were conducted in primary care settings. We conducted a thematic synthesis to identify how their views on POCTs and interventions can support test use (PROSPERO registration: CRD42019150347).

Results: We included 33 studies, developing 9 categories each for HCP and patient data. We identified 38 factors affecting POCT use: 28 from HCPs and 10 from patients. Factors exist outside and within consultations, and post-consultations, illustrating that some cannot be addressed by HCPs alone. Fourteen interventions were identified that could address factors and support POCT use, with 7 interventions appearing to address the most factors. Some interventions were beyond the scope of HCPs and patients and needed to be addressed at system and organizational levels. Both groups had mixed views on the use of POCTs and highlighted implementation challenges.

Discussion: This review highlights numerous factors affecting POCT use in primary care. Policy-makers planning to implement POCTs are likely to achieve more by providing multi-faceted interventions that target factors outside, within, and post-consultation. Some interventions may need to be already established before POCT introduction. Whilst evidence beyond general practice is limited, similar factors suggest that similar context-tailored interventions would be appropriate.

Introduction

The overconsumption of antibiotics in human medicine is a significant factor contributing to antimicrobial resistance and global consumption increased by 37% between 2000 and 2010.^{1,2} The majority of antibiotics consumed by humans are prescribed in

primary care, notably for acute respiratory tract infections (RTIs).^{3–5} Efforts are needed to optimize antibiotic prescribing, and various interventions, including point-of-care tests (POCTs), have shown to be effective in trials at safely reducing antibiotic prescribing for acute RTIs in primary care settings.^{4,6} POCTs are diagnostic tools conducted at the time of patient presentation

in primary care, often providing results within minutes.⁷ These tests can help healthcare professionals (HCPs) identify patients who are more or less likely to benefit from antibiotics.⁸ Despite studies indicating that POCTs can reduce antibiotic prescribing and the European Union (EU) urging EU countries to encourage the adoption of diagnostic tests, implementation into routine care remains inconsistent.^{4,9–11}

Failure of the implementation of complex innovations in healthcare settings is high, ranging anywhere between 30% and 90%.¹² Qualitative methods are crucial in implementation research to understand how evidence-based practices can be successfully adopted into clinical settings.¹³ A substantial number of qualitative studies have already been conducted in primary care settings to explore views on the use of POCTs for the management of RTIs. These studies provide rich narratives on the views and experiences of HCPs and patients using POCTs, but also explore some of the concerns that dissuade them from adopting them into routine care. Moreover, the studies propose strategies to address some of these concerns and challenges.

We aimed to review this evidence to map the influences that impact POCT use and interventions that may support their implementation in primary care settings. Furthermore, we aimed to triangulate HCPs' and patients' views and experiences to identify similarities and discrepancies.

In this review, we use the term HCPs to refer to healthcare workers across primary care settings, including GPs, nurses, healthcare assistants, and pharmacists. Where relevant, we specified the types of HCPs for clarity and context.

Methods

We undertook a systematic review and qualitative meta-synthesis. The review is registered on the PROSPERO register of systematic reviews (ref. CRD42019150347).

Search strategy, eligibility, and screening

A search strategy based on title, abstract, author keywords, and subject headings for primary care, RTIs, POCTs, and qualitative/mixed methods was developed in collaboration with an information specialist (N.R.).

We searched six databases from inception until 28 April 2023: CINAHL (EBSCOHost)[1982–]; Embase (OvidSP)[1974–]; MEDLINE (OvidSP)[1946–]; PsycINFO (OvidSP)[1806–]; and Science Citation Index and Social Science Citation Index (Web of Science Core Collection)[1900–]. Results were exported to EndNote, and duplicates, animal studies, and case reports were removed. There were no date or language restrictions, but conference abstracts and preprints were excluded. We also searched the reference lists of studies meeting the inclusion criteria.

We included qualitative and mixed methods studies, which reported qualitative methods and results. Studies had to focus on experiences and/or views of HCPs and/or patients about the use of POCTs for acute RTIs in primary care settings. HCPs referred to any staff members in primary care settings who used POCTs, including non-prescribers. Acute RTIs included acute otitis media, acute sore throat/pharyngitis/tonsillitis, common cold, acute rhinosinusitis, acute cough/acute bronchitis, and COVID-19. Primary care settings were defined as general practices, out-of-hours settings, community care facilities (e.g. care homes), community pharmacies, and emergency care services.

The first reviewer (M.E.H.) screened all titles and abstracts according to the inclusion criteria, and the second reviewer (A.J.B.) examined 30% of them. M.E.H. carried out full-text screening of all short-listed papers,

with A.J.B. screening 50%. Any discrepancies were discussed and resolved through team discussions.

Quality assessment was based on the Critical Appraisal Skills Programme (CASP) assessment tool for qualitative studies (Table S1, available as [Supplementary data](#) at JAC Online).¹⁴ The CASP assessment tool was also used to appraise mixed methods studies, focusing on the qualitative methods and results reported. M.E.H. appraised all studies meeting the inclusion criteria, with A.J.B. evaluating half. A three-point scale was used for each CASP criterion (0=criterion not met; 1=criterion partially met; 2=criterion fully met).¹⁵ Discrepancies were resolved through discussions within the research team.

The final list of included papers was sent to the first authors of those papers for their review to ensure no relevant studies were missed.

Analysis

A meta-synthesis can produce a novel and aggregated interpretation of primary studies.¹⁶ The included papers were uploaded to NVivo (v.1.6.1), where M.E.H. read each paper and extracted study characteristics, which were then reviewed by the rest of the authors. We conducted a thematic synthesis that allowed us to both align closely to the results of the included studies and synthesize new concepts transparently.¹⁷ We coded the HCPs and patient data separately and first coded studies with the highest CASP scores that focused on either HCPs only or patients only in general practice settings with C-reactive protein (CRP) tests. These studies were selected first as most studies were conducted in this setting and focused on CRP. The HCP-only studies were Cals *et al.*,¹⁸ Anthierens *et al.*,¹⁹ Schot *et al.*,²⁰ and Hardy *et al.*,²¹ and the patient-only study was Tonkin-Crine *et al.*²² The remaining general practice studies were coded in descending order of their CASP scores, followed by the studies conducted in out-of-hours settings, and finally those in pharmacies. M.E.H. initially coded the HCP data from the studies before focusing on the patient data.

M.E.H. coded the results and discussion (where relevant) sections of each paper line by line, creating descriptive codes from the first- and second-order constructs included in the papers to translate concepts across the studies.¹⁷ M.E.H. identified similarities and differences between codes, grouping them into a hierarchical tree structure (separate for HCP and patient data) with new descriptive codes capturing the meaning of the grouped codes.¹⁷ Codes were reviewed at different stages by the research team to ensure clarity. M.E.H. grouped the codes within each data set into higher-level categories, resulting in two separate lists for HCPs and patients. Regular discussions with the research team were held throughout the analysis phase to refine the categories iteratively.

We used mind-mapping techniques to visualize the relationships between HCP and patient categories, facilitating optimal data representation. This approach also promoted a reflexive approach, especially as we had prior experience with POCT-focused qualitative studies.²³

We identified interventions addressing influences on POCT use across HCP and patient categories, linking interventions to influences when studies explicitly made this connection. Additionally, we assessed how these interventions could address influences not discussed in the studies.

Results

The search yielded 1587 articles; 829 records were removed before screening, of which 783 were duplicates and 46 were animal studies and case reports. Seven hundred fifty-eight papers were screened based on titles and abstracts, and 696 were excluded. Full-text screening was conducted on 62 papers, with 33 papers included (Figure 1). Study characteristics are presented in Tables 1 and 2.

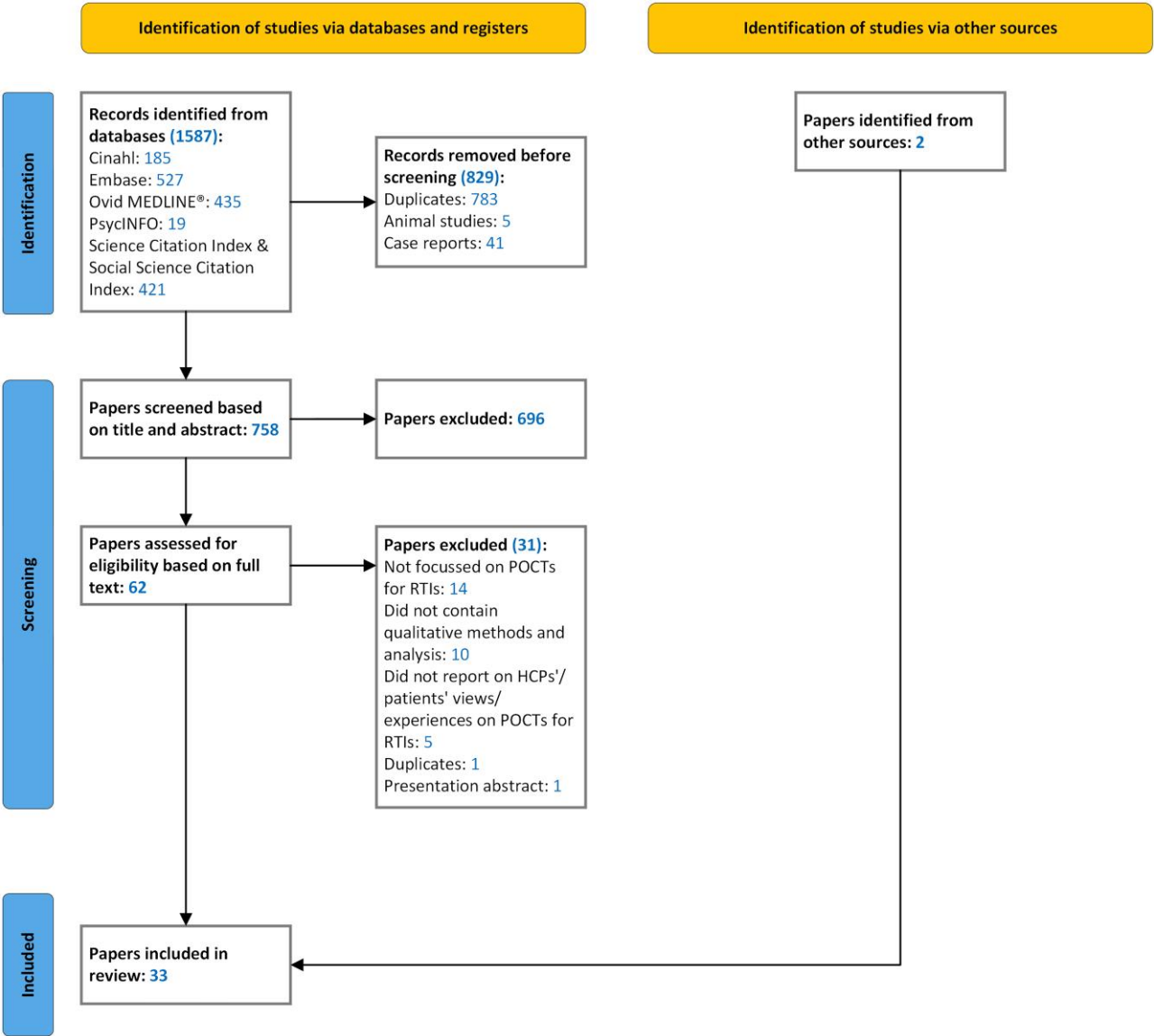


Figure 1. Study flow diagram. This figure appears in colour in the online version of JAC and in black and white in the print version of JAC.

Most studies took place in general practice (76%) with general practitioners (GPs) (82%) as the main participants. CRP tests were most common (56%), followed by group A streptococcus (GAS) tests (19%). Four studies did not specify the type of POCT but referred to ‘POCTs for RTIs’.

Most studies took place in Europe (88%), with the majority solely in the UK (64%). Eight (24%) were multi-country European studies. Interviews were the main data collection method (76%), and a minority used surveys or focus groups to collect data. Fewer than 10% used mixed methods. Two studies occurred during the COVID-19 pandemic.

Regarding the quality appraisal of the studies, CASP scores ranged from 15 to 18, out of a possible 18 points showing that studies were generally high quality (Table S1). Points were mainly lost in reporting the methods of the studies where

it was unclear whether authors considered and addressed the relationship between researcher and participant. All 33 studies were included.

We identified nine categories each from the HCP and patient data sets (Table S2), which are described in detail below. These were grouped into three high-level levels to represent the trajectory of POCT implementation in primary care settings: (a) factors affecting POCT use outside a consultation; (b) factors affecting POCT use within a consultation; and (c) factors affecting POCT use post-consultation (Figure 2).

Within categories, we identified influences affecting the use of POCTs and termed these as ‘factors’. Interventions that supported the use of POCTs were also identified in the included studies and are reported below. We defined an ‘intervention’ as a single method or strategy for promoting change.⁵² Using this

Table 1. Study characteristics of the 33 included papers

Paper	Country of study	Setting of study	Types of participants (n=number of participants)	Types of POCs studied	Data collection methods	Data analysis methods	Aims
Sahr <i>et al.</i> ²⁴	USA	Pharmacy	Patients (n = 11)	GAS and influenza tests	Semi-structured telephone interviews	Thematic analysis	To determine patients' experiences with rapid strep A and influenza tests administered at community pharmacies
Dixon <i>et al.</i> ²⁵	UK (England)	Out-of-hours service	GPs and healthcare professionals (n = 16)	CRP	Semi-structured telephone and in-person interviews	Thematic analysis with mind mapping	To evaluate service improvement in out-of-hours services that offered access to CRP tests
Czarniak <i>et al.</i> ²⁶	Australia	Pharmacy	Pharmacists (n = 10)	CRP	Semi-structured telephone interviews	Thematic analysis	To explore pharmacists' experiences and perspectives of CRP testing and the sustainability of testing in RTI management in pharmacies
Khalid <i>et al.</i> ²⁷	UK (England)	General practice	GPs, test processors, and health administrators (n = 22)	Multi-viral respiratory test	Semi-structured telephone and in-person interviews	Thematic analysis	To evaluate the use of a multi-viral respiratory test for suspected RTIs
Kierkegaard <i>et al.</i> ²⁸	UK (England)	General practice	GPs (n = 22)	SARS-CoV-2	Semi-structured online interviews	Behavioural change wheel	To understand the barriers and facilitators to implementing SARS-CoV-2 testing
Mantzourani <i>et al.</i> ²⁹	UK (Wales)	Pharmacy	Patients (n = 242)	GAS	Surveys with open-text section	Inductive analysis	To explore if patients found pharmacists offering consultation services with POCs for sore throats acceptable and how this influences future health-seeking behaviour
Saliba-Gustafsson <i>et al.</i> ³⁰	Malta	General practice	GPs (n = 20)	POCs for RTIs	Semi-structured in-person interviews	Manifest and latent analysis	To understand barriers and facilitators to prudent antibiotic prescribing for RTIs
Borek <i>et al.</i> ³¹	UK (England)	General practice	GPs (n = 50)	CRP	Focus groups	Thematic analysis	To explore the views of GPs on the implementation of CRP tests to reduce antibiotic prescribing
Essilini <i>et al.</i> ³²	France	Pharmacy	Pharmacists (n = 27)	GAS	Semi-structured in-person interviews	Thematic analysis	To explore pharmacists' views on antibiotic stewardship activities and antibiotic resistance

Bisgaard et al. ³³	Denmark	General practice	GPs (n = 7)	CRP	Semi-structured in-person interviews	Systematic text condensation	To explore GPs' experiences with managing patients with RTIs
De Lusignan et al. ³⁴	UK (England)	General practice	GPs (n = 6)	Influenza	Questionnaire survey	Sociotechnical perspective	To assess the feasibility of implementing influenza tests into general practices
Van Hecke et al. ³⁵	South Africa	General practice	GPs and nurses (n = 23)	POCTs for RTIs	Narrative and semi-structured interviews	Thematic analysis	To explore the views of clinicians on their experiences of existing POCTs and barriers and opportunities for introducing new POCTs
Mantzourani et al. ³⁶	UK (Wales)	Pharmacy	Pharmacists (n = 7)	GAS	Semi-structured interviews	Thematic analysis	To explore the views of pharmacists offering sore throat testing services
Eley et al. ³⁷	UK (England)	General practice	GPs, nurses, healthcare assistants, and pharmacists (n = 26)	CRP	Semi-structured telephone interviews, in-person focus groups	Behavioural change wheel	To explore the views of clinicians on CRP tests to manage acute coughs and the barriers and facilitators in implementing them
Johnson et al. ³⁸	UK	Unspecified primary care setting	GPs, clinicians, and commissioners (n = 7)	CRP	Qualitative survey	Inductive analysis	To explore approaches to implementing POCTs and identify barriers and facilitators
Schot et al. ²⁰	The Netherlands	General practice	GPs (n = 11)	CRP	Semi-structured interviews	Thematic analysis	To explore views of GPs on using CRP tests on children and compare to perceptions of use in adults
Hardy et al. ²¹	USA	General practice	GPs, nurses, and healthcare assistants (n = 30)	CRP	Focus groups	Grounded theory	To explore clinicians' views on the barriers and facilitators of using CRP tests
Tonkin-Crine et al. ³⁹	Belgium, The Netherlands, Poland, Spain, UK (England and Wales)	General practice	GPs (n = 66); patients (n = 62)	CRP	Semi-structured interviews	Pairwise comparison	To triangulate mixed methods data from the process evaluation of a trial on the use of training in communication skills and CRP tests to manage acute coughs
Andre et al. ⁴⁰	Sweden	General practice	GPs (n = 25)	CRP and GAS	Semi-structured interviews	Template-based analysis	To describe GPs' strategies in managing uncertainty in patients with sore throats in relation to guidelines
Huddy et al. ⁴¹	Denmark, Norway, The Netherlands, Sweden, UK (England)	General practice	GPs, pharmacists, commissioners, laboratory scientist, and primary care manager (n = 18)	CRP	Interviews and workshop	Grounded theory	To explore the barriers and facilitators to adopting CRP testing in the UK for diagnosing lower RTI

Continued

Table 1. Continued

Paper	Country of study	Setting of study	Types of participants (n=number of participants)	Types of POCTs studied	Data collection methods	Data analysis methods	Aims
Hughes <i>et al.</i> ⁴²	UK (Wales)	General practice	GPs and nurses (n=11); patients (n=5)	CRP	Surveys with clinicians; focus group with patients	Data analysis method not specified	To assess if CRP testing had an impact on antibiotic prescription rates
Peirce <i>et al.</i> ⁴³	UK	Unspecified primary care setting	GPs and commissioners (n=28)	CRP	Semi-structured interviews	Grounded theory	To explain how and why technologies are not widely adopted
Gröndal <i>et al.</i> ⁴⁴	Sweden	General practice	GPs (n=16)	CRP and GAS	Semi-structured interviews	Systematic text condensation-content analysis	To understand the role of POCTs in the decision-making of GPs who do not follow guidelines in managing sore throats
Anthierens <i>et al.</i> ¹⁹	Belgium, The Netherlands, Poland, Spain, UK (England and Wales)	General practice	GPs (n=66)	CRP	Semi-structured telephone and in-person interviews	Thematic and framework analysis	To explore GPs' experiences of training in communication skills and the use of a patient booklet, and/or CRP tests to reduce antibiotic prescribing
Tonkin-Crine <i>et al.</i> ²²	Belgium, The Netherlands, Poland, Spain, UK (England and Wales)	General practice	Patients (n=42)	CRP	Semi-structured telephone interviews	Thematic and framework analysis	To explore patients' experiences of consultations where clinicians are trained in communication skills and in communication skills and a patient booklet, and/or a CRP test are used
Leydon <i>et al.</i> ⁴⁵	UK (England)	General practice	GPs and nurses (n=42); patients (n=9)	GAS	Semi-structured interviews	Inductive thematic analysis	To explore clinicians' and patients' experiences of the use of GAS tests for sore throats
Anthierens <i>et al.</i> ⁴⁶	Belgium, England, The Netherlands, Spain, Poland	General practice	GPs (n=30)	CRP	Think aloud interviews	Thematic analysis	To explore GPs' acceptability of a web-based intervention to reduce antibiotic prescribing for acute coughs
Brookes-Howell <i>et al.</i> ⁴⁷	Belgium, Hungary, Spain, Poland, Italy, Norway, The Netherlands, UK (England and Wales)	General practice	GPs (n=80)	CRP	Semi-structured interviews	Five-stage analytical framework	To explore the clinical influences of GPs on antibiotic prescribing for lower RTI and identify areas for improvement
Wood <i>et al.</i> ⁴⁸	Belgium, Hungary, Spain, Poland, Italy, Norway, The Netherlands, UK (England and Wales)	General practice	GPs (n=80); patients (n=121)	POCTs for RTIs	Semi-structured in-person interviews	Thematic analysis	To explore GPs' and patients' views on POCTs to support the diagnosis and management of lower RTI

Tonkin-Crine et al. ⁴⁹	Belgium, France, Poland, Spain, UK	General practice	GPs (n = 52)	POCTs for RTIs	Semi-structured telephone and in-person interviews	Thematic analysis	To explore GPs' views and experiences of ways to encourage prudent antibiotic prescribing
Cals et al. ¹⁸	The Netherlands	General practice	GPs (n = 20)	CRP	Semi-structured, in-person interviews	Thematic analysis	To explore GPs' experiences of introducing CRP tests for lower RTI
Cals et al. ⁵⁰	The Netherlands	General practice	GPs (n = 20)	CRP	Semi-structured interviews	Thematic analysis	To understand the views of GPs with experience in implementing contrasting interventions compared to GPs with no experience in implementing the interventions
Butler et al. ⁵¹	UK (Wales)	General practice	GPs (n = 40)	Bacteria/ virus test	Semi-structured interviews	Thematic analysis	To explore the views of GPs on the introduction of POCTs to manage common infections

definition, we first identified the interventions within our categories and listed the studies that discussed these interventions in their results and/or discussion sections. We then referred to our list of factors affecting POCT use and noted the studies that discussed these factors. Next, we identified studies that discussed both factors and interventions and re-read the results and discussion sections of those studies. We ensured that these studies mentioned the link between factors on POCT use and interventions. To ensure that no links between factors and interventions were missed, we re-read the results and discussion sections of all studies where interventions were initially identified.

A total of 38 factors were identified from the HCP and patient studies (Table S2), along with 14 interventions. Table S3 presents a table showing the factors, corresponding interventions, and illustrative quotes from the studies.

Our results are divided into two parts. Part 1 provides an overview of the factors affecting POCT use and the interventions discussed in the studies. Part 2 provides secondary analysis of the interventions conducted by the review authors.

Part 1 of results: overview of factors affecting POCT use and interventions discussed in studies

Figure 2 shows the HCP and patient categories (representing the factors influencing POCT use/implementation) organized into the three higher-level categories described above. Positioned beneath are the interventions, presented in purple boxes, with solid arrows connecting each to the relevant category/factor. These arrows indicate the connection that studies made, suggesting which interventions addressed which factors.

(a). Factors affecting POCT use outside consultations

(a).1. Encouraging the adoption of POCTs in primary care This higher-level category captures the different factors outside consultations that impact POCT uptake with challenges at system and organizational levels. We identified 6 categories and 11 interventions that addressed factors that exist outside a consultation (Table S3).

(a).1.1. HCPs need to be convinced of the value of POCTs HCPs raised concerns about the cost-effectiveness of POCTs, citing the low cost of antibiotics,^{21,35,43,48} whilst studies from the UK and the USA highlighted the need for more evidence.^{38,43} Many studies reported their uncertainty about the accuracy and effectiveness of POCTs, such as CRP tests or their use on children, and their impact on antibiotic prescribing.^{20,21,25–28,30–32,35,37,41,45–48,51} GPs and out-of-hours clinicians questioned the added value of POCTs for their diagnoses, especially as experienced HCPs reported feeling confident in their clinical judgement.^{19–21,25,27,30,31,33,35,37,40,41,43,44,48,50,51} Some were also concerned with the inappropriate use of POCTs and used to diagnose complaints for which their use was not intended.⁴³ To address some of these issues, out-of-hours clinicians felt that including POCTs in guidelines would help reassure them of their clinical effectiveness, coinciding with a Dutch study suggesting that guidelines accompanied with information on the value of POCTs could encourage uptake.^{18,25}

Several studies also observed limited interest in using POCTs amongst GPs and pharmacists.^{30,36–38,45} In Europe, they were

Table 2. A summary of characteristics of the included studies

Characteristic	Number of studies
Primary care setting	
General practice	25
Pharmacies	5
Out-of-hours settings	1
Unspecified primary care setting	2
Types of participants ^a	
GPs	27
Pharmacists	4
Nurses/Healthcare assistants	8
Patients	7
Other professionals/Stakeholders	3
Types of POCTs ^b	
CRP test	20
GAS test	7
Unspecified	4
SARS-CoV-2	1
Influenza	2
Multi-viral	1
Bacteria/virus test	1
Continent where studies took place	
Europe	29
North America	2
Africa	1
Oceania	1
Experienced use or hypothetical views of POCTs ^c	
Experienced use of POCTs	26
Hypothetical views of POCTs	14
Type of data collection	
Interviews	25
Focus groups	2
Survey	3
Mixed methods	3
Total number of HCPs across all studies: 931	
Total number of patients across all studies: 439	

^aSome studies included multiple participant groups; thus, the total number of studies exceeds 33.
^bSome studies discussed multiple types of POCTs; thus, the total number of studies exceeds 33.
^cSome studies include a mix of participants with experienced use of POCTs and participants sharing their hypothetical views; thus, the total number of studies exceeds 33.

worried about lack of funding for the implementation and maintenance of POCTs, feeling reluctant to adopt them if burdened with the financial responsibility.^{30,38,41,43,45,48,51} Studies suggested implementing appropriate reimbursement and incentivization strategies to offset equipment costs, encouraging HCPs to adopt POCTs.^{18,26,28,31,37,38,41,43} HCPs also favoured POCTs tailored to their needs, offering reliable and rapid results.³⁰ Furthermore, training on the use of POCTs^{18,25,28} and leveraging the experiences of early adopters were seen as facilitators in England and The Netherlands.^{25,28,31}

Studies in the USA, Malta, South Africa, and England identified limited access to tests, lack of understanding of what POCTs are,

and how they work hindered as barriers to the use of POCTs.^{21,28,30,35} Welsh pharmacists also reported feeling concerned about using GAS tests as it required new skills.³⁶ Training was seen to address these barriers by providing information from credible sources and improving HCPs' confidence in operating POCTs.^{18,19,22,26,28,36-38,41,43,45}

In the UK, HCPs raised concerns about maintaining quality control of POCTs, which may hinder their uptake.^{31,51} This concern can be addressed by having laboratories to support practices with quality control and maintenance of POCTs may be necessary.⁴¹

Furthermore, research findings from European studies highlighted GPs' concerns regarding patients' acceptance of POCTs, including children's, being used in consultations.^{30,48,51} Some pointed to the invasiveness of blood tests, such as CRP POCTs, and the apprehension of potentially losing patients if they choose not to prescribe antibiotics as a result of using POCTs to guide prescribing decisions.^{30,37,51}

(a).1.2. Patients' acceptability of POCTs European patient studies reported mixed patients' acceptability of POCTs, such as CRP tests. Whilst some welcomed them in their consultations,^{22,39,42} others worried about test invasiveness, hygiene practices associated with their administration, and the financial implications associated with adopting these tests.⁴⁸ Some Belgian and Dutch patients voiced concerns about the underlying motivations of HCPs using POCTs, questioning potential commercial interests, and the handling of genetic data derived from such tests.⁴⁸ Despite these concerns, patients expressed trust in their HCPs' judgement if POCTs were deemed necessary.⁴⁸

(a).1.3. Workflow and staff capacity HCPs across countries and settings felt that POCTs could lengthen consultations, thereby impacting workflows and discouraging them from adopting these tests.^{18,21,25,26,28,30,31,35-38,41-43,48,51} However, not all HCPs were concerned with this, including those with experience of using CRP, multi-viral respiratory, and GAS POCTs.^{18,19,26,27,35-37,39,42,45,50} A few noted that the impact of conducting tests was manageable and some even argued that using POCTs may save them time from counselling patients about no-antibiotic decisions.^{21,25,35,42}

Several studies indicated that additional staff support, such as healthcare assistants and nurses, to perform POCTs could mitigate time constraints and alleviate workload.^{19,22,25,28,31,33,34,36,37,41,42} Workflow optimization strategies were also suggested such as triaging patients for testing, dedicating a HCP for RTI consultations, or pre-consultation testing.^{33,34,37} Interestingly, studies from England and Australian reported that concerns about disruption with CRP and GAS POCTs decreased as HCPs became more accustomed to the tests, suggesting that longitudinal training and experience can mitigate time constraints.^{22,26,45} Optimizing POCT technology itself, by making them simpler and faster, reduces the time to administer them and would help in assuaging these concerns.^{18,19,22,42} Additionally, some studies noted that the placement of POCTs within practices influenced workflows and test usage,^{21,22,25,27,37,38} as accessibility issues arose when devices were located in separate rooms.^{25,37,38} Some practices addressed this by placing CRP machines on trolleys, highlighting the importance of considering portability in POCT design.^{34,37}

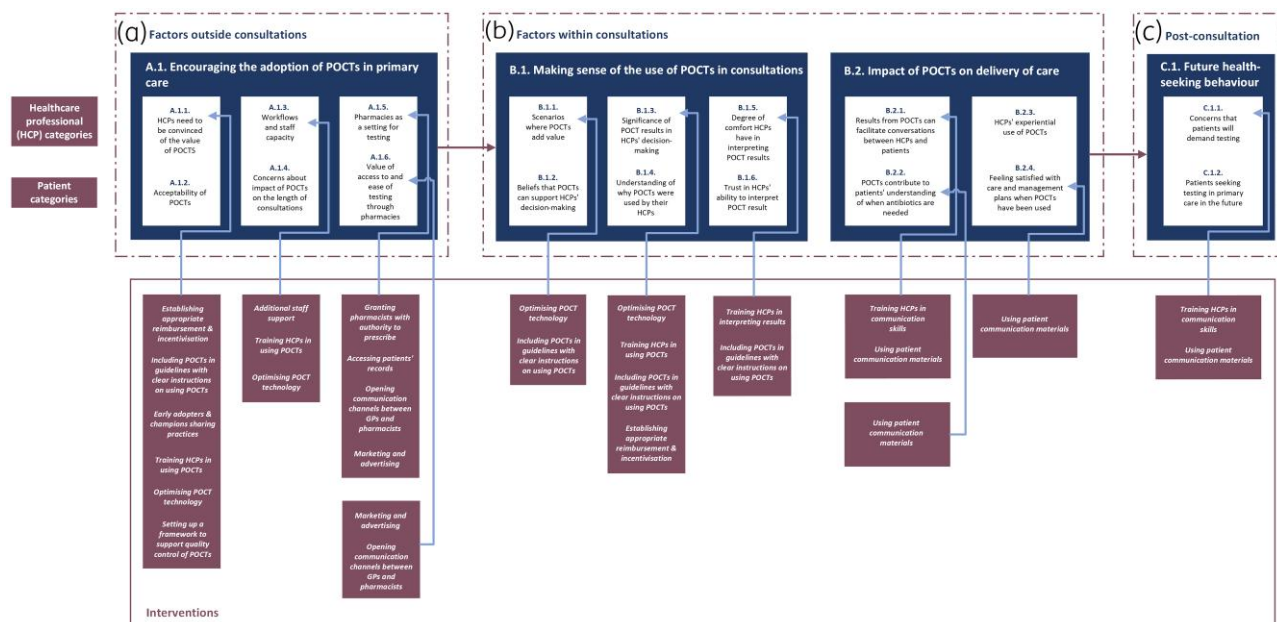


Figure 2. Model illustrating the HCP- and patient-specific factors on POCT uptake/implementation linked with interventions to address these factors. This figure appears in colour in the online version of JAC and in black and white in the print version of JAC.

(a).1.4. Patient concerns about impact of POCTs on the length of consultations Patient studies revealed varied opinions on the impact of POCTs on consultation length some concerns around time constraints and subsequent delays.^{22,48} In another study, patients did not mind waiting for their results, appreciating the convenience of not being required to visit their practice at a specific time for a blood test.⁴² Patients also identified that the availability of POCTs be beneficial for HCPs, saving them from asking patients to come in again for a blood test and to send results to a laboratory.⁴⁸

(a).1.5. Pharmacies as a setting for POCTs More recently published studies in the USA, Wales, Australia, and France explored pharmacies as a potential primary care setting for patients to access POCTs, such as CRP and GAS tests.^{24,26,29,32,36} Several pharmacists perceived themselves as strategically positioned within the community, seeing the potential to alleviate pressure on GPs by providing testing services due to their accessibility.^{26,36} In addition, a study noted that granting pharmacists in the UK with prescribing authority may make implementation of POCTs more feasible⁴¹; an initiative that some French pharmacists also supported under specific circumstances³²—but in both cases, the reasoning for this was not explicit.

Pharmacists in Wales and Australia encountered obstacles in the adoption of POCTs, including the need to acquire new skills in using the tests³⁶ and the lack of access to patients' medical records.²⁶ These influences can be addressed by training pharmacists on the use of GAS tests, promoting confidence and reaffirming their existing knowledge³⁶ whilst the use of digital systems grants them access to patients' records.^{26,36}

Collaboration between pharmacists and GPs can also impact testing provision in pharmacies. Studies from Wales and France revealed barriers when pharmacists perceived GPs as unwilling

to engage or feared strain on their relationships.^{32,36} Therefore, promoting open channels of communication and engagement with HCPs in general practices could support wider adoption of POCTs in pharmacies.^{26,29,32,36} Australian pharmacists suggested raising awareness amongst GPs through marketing and advertising to facilitate uptake.²⁶

(a).1.6. Patients value access to and ease of testing through pharmacies Patients in Wales and the USA valued the accessibility of testing in pharmacies, as compared to general practices, due to being available outside of GP hours, proximity to home and work, and not needing an appointment.^{24,29} However, some expressed concerns about overburdening pharmacies with testing services.²⁹ In the USA, patients appreciated the affordability of pharmacies compared to other settings where they might lack insurance coverage or would have to face co-payments in general practice compared to a flat fee at pharmacies.²⁴ This study also highlighted that without GAS and influenza POCTs in pharmacies, patients would have self-managed or resorted to emergency services if symptoms worsened.²⁴

In the Welsh study, patients noted barriers to accessing POCTs for sore throats due to inconsistency across pharmacies and that GPs referred them to pharmacies not offering tests.²⁹ Underutilization of GAS POCTs at pharmacies could have also been attributed to a lack of public awareness. Therefore, advertising campaigns could boost awareness and utilization of these services, a finding that resonated with an Australian study.^{26,29}

(b). Factors affecting POCT use within consultations

This section describes HCPs' and patients' perspectives on the use of POCTs in their consultations if adopted in primary care settings. Studies have proposed seven interventions to support HCPs' decisions to use POCTs, alongside one intervention to improve patient

understanding of antibiotic use and contribute to feeling reassured during consultations (Table S3).

(b).1. Making sense of the use of POCTs in consultations When considering the use of POCTs in, and impact on, consultations, HCPs discussed the circumstances when they used or would use POCTs, integrating results into their decision-making, and their comfort level with interpreting results. Patients offered perspectives on how POCTs might have influenced HCPs' decisions.

(b).1.1. Scenarios where POCTs add value Studies spanning various countries and settings showed that HCPs found POCTs useful in reducing uncertainty, confirming diagnoses, and informing antibiotic prescribing decisions, increasing their confidence in their decision-making.^{18-21,25-31,33,35,37-51} UK, Swedish, and Danish GPs saw value in POCTs to differentiate between viral and bacterial infections, a feature also desired by English out-of-hours clinicians.^{25,27,33,40,42,44,51} POCTs were also perceived as particularly useful in out of hours by providing additional diagnostic information when medical records are unavailable and in negotiating delayed antibiotic prescriptions.²⁵ Australian pharmacists used CRP tests to triage patients and refer them to GPs when antibiotics or further care was deemed necessary.²⁶

European GP studies noted that POCTs, like CRP tests, were used for a variety of purposes including assessing infection severity, ruling out serious infections, and monitoring disease progression.^{18,19,33} A study in The Netherlands and England noted that GPs were interested in using CRP POCTs to diagnose non-RTI complaints, such as abdominal complaints and urinary tract infections.^{18,37} Additionally, POCTs were seen as helpful during seasonal (winter) infection spikes, for medicolegal reasons (perceiving POCTs as potential medical evidence), in unclear cases where prescribing guidelines did not help, and in managing high-risk patients.^{21,31,51} For the latter, GPs in a US study specified that POCTs would be useful for patient groups such as Native American populations, who are at risk of developing complications from acute RTIs.²¹

Moreover, studies showed differing opinions amongst GPs regarding the use of POCTs with children. Some UK GPs expressed willingness to use POCTs in some paediatric cases,³¹ whilst some Dutch GPs felt less diagnostic uncertainty with children and, thus, did not use POCTs.²⁰

Studies proposed optimizing POCTs to fit HCPs' needs would be desirable, including distinguishing between viral and bacterial infections,²⁵ detecting multiple strains of bacteria,^{27,45} or providing rapid results.⁴⁸ Furthermore, establishing guidelines outlining specific clinical scenarios for POCT use could encourage their utilization.^{18,21,31,37,41}

(b).1.2. Patients' beliefs that POCTs can support HCPs' decision-making Some studies showed that patients in Europe believed that POCTs aided HCPs' decision-making, providing clarity on their diagnosis for better treatment decisions.^{22,48} Consequently, some patients perceived benefits by getting the 'best' treatment leading to faster recovery or minimizing potential complications by indicating the necessity of antibiotics.^{42,48} In Wales, some patients consulting pharmacies for sore throats noted reduced diagnostic uncertainty amongst pharmacists due to the use of GAS POCTs.²⁹

(b).1.3. The significance of POCT results in HCPs' decision-making European studies in general practices and out-of-hours settings showed that POCTs were primarily used to guide antibiotic prescribing decisions.^{18,19,25,33,44,46,47,49} HCPs in these settings emphasized avoiding excessive reliance on POCT results at the expense of clinical assessments, and that a balance was needed between POCT results and clinical assessments.^{18,20,21,25,27,31,33,35,40,41,44,47,48} Danish GPs indicated that some of their decisions were driven by intuition and a 'gut feeling', whilst Swedish GPs reported relying predominantly on clinical assessments for diagnosing typical GAS infections, considering them visibly evident.^{33,44} GAS POCTs were used when clinical presentations were unclear; however, if negative, GPs reported using CRP POCTs.⁴⁴ Swedish GPs also mentioned using a combination of GAS POCTs, clinical examination, and clinical scoring for sore throat differential diagnoses.⁴⁰

Pharmacists from Wales and Australia demonstrated that POCTs, such as CRP and GAS tests, were instrumental in their decision-making.^{26,36} Elevated CRP values were a reason to refer patients to GPs, whilst low values led to self-management recommendations.²⁶

Studies identified training on integrating POCT results with clinical assessments and clear guidelines for using POCTs in uncertain situations as facilitators for adoption.^{18,21,37,40,41} Some HCPs believed that incentivizing POCTs when used in certain circumstances could encourage their appropriate use.⁴¹ Other factors included technology characteristics, such as rapid time to results, test specificity, and accuracy, that were crucial in influencing HCPs' decisions to incorporate POCT results into their decision-making.^{18,19,26,27,43,48}

(b).1.4. Patients' understanding of why POCTs were used by their HCP European studies reported that patients had varying perceptions of why POCTs were used including determining antibiotic necessity and differentiating between viral and bacterial infections.^{39,42,48} However, a study demonstrated that some patients misunderstood CRP POCTs, believing they detected the presence of bacteria in the blood.⁴⁸ Furthermore, some patients expressed that POCTs should be considered in conjunction with other clinical findings.⁴⁸

(b).1.5. Degree of comfort HCPs have in interpreting POCT results Research indicated varying levels of HCP comfort in interpreting POCT results. In general practice, HCPs interpreted 'high' CRP values as indicative of bacterial infections, supporting antibiotic prescribing decisions, and had confidence in interpreting 'normal' or 'low' CRP values as indicating self-limiting infections.^{18,25,33,37,44} However, cut-off values for 'high' or 'low' CRP values varied, ranging from 50 to >100 mg/L.^{18,25,33,37,40,44} Similarly, in an Australian study, pharmacists were confident in referring patients with 'higher than expected' CRP values to GPs, but specific thresholds were not mentioned.²⁶ Concerning GAS tests, HCPs in general practices and pharmacies reported confidence in interpreting results.^{32,40}

On the other hand, HCPs in both general practice and out-of-hours expressed concerns about handling borderline and intermediate CRP values.^{18,25,31,43,48} Other concerns included deciding a course of action when POCT results did not align with clinical assessments, explaining intermediate results

to patients, or that CRP values may be elevated for other reasons besides infection.^{18,25,31,41,45}

Addressing these issues, some studies proposed that including POCTs in guidelines with clear thresholds indicating when antibiotics can offer benefit could assuage HCPs' concerns in interpreting POCT results.^{18,19,21} Furthermore, training HCPs on interpreting POCT results and managing unexpected results would be crucial in their implementation.^{18,25,43}

(b).1.6. Patients' trust in their HCPs' ability to interpret POCT results A study with patients consulting in general practice in Europe indicated that most patients trusted their HCPs' assessments of CRP test values.⁴⁸ However, some patients in this study expressed concerns about the precision of tests that may then affect HCPs' diagnoses or that CRP values may still rise, post-consultation, if POCT is used early in a disease.⁴⁸

(b).2. Impact of POCTs on delivery of care These categories present HCPs' and patients' views and experiences on the impact of POCTs on delivery of care.

(b).2.1. Results from POCTs can facilitate conversations between HCPs and patients Studies in general practices and out-of-hours found HCPs valued POCTs for communicating non-prescribing decisions to patients. POCT results helped them convince patients that antibiotics were unnecessary and perceived that patients appreciated the 'objectivity' of tests.^{18–21,25,27,31,33,35,37–39,41–43,48–51} This also helped to counter patient pressure for antibiotics.^{18,20,25,27,31,35,37,39,41,42,51} In one US study, some GPs felt patients viewed their decisions as guesswork and the absence of an antibiotic prescription implied that they were dismissing their patients' concerns; POCTs were therefore seen as a way to justify their decisions.²¹ Interestingly, another study noted that GPs emphasized POCT certainty to patients despite reservations about the tests themselves.³¹

Across Europe and South Africa, GPs believed that POCTs, such as CRP and GAS tests, could be used to 'educate' patients in prudent antibiotic use by helping patients understand that antibiotics were unnecessary for acute RTIs.^{18,19,31,35,37,39,41–43,45,48} In some studies, HCPs described telling patients that low CRP values signified that patients did not need antibiotics.^{18,20,31,46} In particular cases, HCPs specified that low CRP values indicated a viral infection.³³ Tests such as multi-viral POCTs or GAS tests also helped HCPs to explain to patients that a positive or negative result determined whether antibiotics would be necessary.^{27,45} Similarly, studies conducted in French, Australian, and Welsh pharmacies demonstrated that POCTs, such as CRP and GAS tests, convinced patients of management decisions, reassuring them that a GP visit was unnecessary, stating that the test result indicated a viral infection and the illness was therefore self-limiting.^{26,32,36}

In South Africa, GPs further reported that POCTs could be particularly beneficial for patients with low health literacy, helping them understand that antibiotics may not be necessary.³⁵ Some perceived POCTs could facilitate patients' understanding of self-limiting infections, reducing future consultations for similar illnesses.^{18,41,45,48} However, a Europe-wide study indicated that some HCPs believed that POCTs did not help in 'educating' patients on self-limiting infections and antibiotic use.³⁹

Although some South African HCPs worried that POCTs could disrupt their communication with patients,³⁵ studies in European general practices showed training in communication boosted GPs' confidence in explaining POCT results and managing antibiotic expectations.^{19,50} Patient engagement was also recognized as a contributing factor to the success of the testing service in Australian pharmacies.²⁶ In addition, the use of patient communication materials, alongside POCTs, helped to structure their discussions with patients and provided written information on the use of POCTs from a credible source.¹⁹

(b).2.2. POCTs contribute to patients' understanding of when antibiotics are needed European studies with patients in general practices and pharmacies revealed varied perceptions regarding the necessity of antibiotics following the use of POCTs in their consultations.^{22,29,39,42,48}

One European study reported that for low CRP values, patients were satisfied that antibiotics would not be useful, and some would feel less concerned about future similar infections.²² In another European study, patients understood that CRP tests could help avoid over-prescribing antibiotics, demonstrate to other patients that antibiotics were unnecessary, and help HCPs decide which antibiotic to use.⁴⁸ In Wales, some patients recognized that GAS testing in pharmacies could prevent visits to GPs, reducing unnecessary antibiotic prescribing.²⁹ They reported that the use of GAS tests in pharmacies facilitated discussions around bacterial versus viral infections, promoting education around antimicrobial stewardship.²⁹

However, some patients consulting in general practices and pharmacies could not understand why antibiotics were not prescribed for their symptoms after POCTs were used.^{29,39,42} Patients in a Welsh general practice suggested that communication materials, such as leaflets, would have been useful in explaining why antibiotics were not prescribed.⁴² This aligns with findings in a European study where patients welcomed communication materials, which lent credibility to their HCPs' decisions and provided valuable references for self-care and future illnesses for themselves and their families.^{22,39}

(b).2.3. HCPs' experiential use of POCTs in primary care Across studies and settings, studies found HCPs viewed POCTs as reassuring for patients, making them feel heard and perceiving POCTs as objective references.^{18,25,31,35,37,45,48} In an English study, HCPs observed that patients appeared more satisfied with an 'objective' test result than with clinical judgment alone, despite guidance for treatment decisions to consider overall patient condition rather than solely relying on POCT results.³¹

In Europe, general practice studies reported that HCPs believed that POCTs helped increase patients' trust in HCPs, enhancing clinician-patient relationships.^{19,37,41,48} Australian pharmacists similarly felt that testing services improved their professional image and attracted new customers.²⁶

Studies showed divided opinions on POCTs' value. Some valued them for learning new knowledge and improved their clinical pattern recognition, whilst others felt that improving their communication skills and using communication materials were more beneficial for patients.^{18,19} Dutch GPs agreed with the latter, prioritizing communication skills over CRP POCTs, considering communication a key component in their profession.⁵⁰

(b).2.4. *Patients feeling satisfied with care and management plans when POCTs have been used* Patient studies across European and US general practice and pharmacies revealed diverse views on delivery of care, with most feeling reassured irrespective antibiotic prescriptions.^{22,24,29,39,42,45} In a US pharmacy study, patients not only appreciated clear communication of POCT results, the discussions about their condition and treatment plans, and follow-up calls but also felt the personalized care exceeded that received from a visit to a GP.²⁴ However, patients in certain studies expressed dissatisfaction, either due to antibiotic denial or perceived impersonal care associated with the use of POCTs.^{22,24,48}

The use of CRP tests with accompanying patient communication materials was found to be helpful in reassuring patients, but POCTs alone did not improve consultation satisfaction.^{22,39}

(c). *Factors affecting POCT use post-consultation*

(c).1. Future health-seeking behaviour These categories describe the views of HCPs and patients on how POCTs may impact patients’ future health-seeking behaviour. Notably, one intervention was identified from the studies that could address HCPs’ concerns on patients demanding to be tested (Table S3).

(c).1.1. *HCP concerns that patients will demand testing* Studies conducted in general practice identified that HCPs were concerned with patients’ future potential requests for testing and the medicalizing of self-limiting infections, encouraging patients to re-consult in the future as a result of POCT implementation.^{19,21,27,31,35,41,43,45,48} On the other hand, studies also indicated that not all HCPs shared this belief.^{19,35} A European-wide study demonstrated that some HCPs believed that the use of communication materials helped patients understand self-limiting infections and when antibiotics would be necessary.¹⁹

(c).1.2. *Patients seeking testing with POCTs in primary care in the future* From the patient studies, patients in Europe voiced mixed opinions on the impact of POCTs on their health-seeking behaviour in the future. A study in England revealed that patients would not change their consultation behaviour despite that availability of GAS POCTs in general practices.⁴⁵ In contrast, some European patients mentioned considering earlier consultations for POCTs in the future, whilst other would not change their behaviour.²²

Part 2 of results: secondary analysis on interventions identified

We carried out a secondary analysis comparing the factors affecting the use of POCTs and interventions. We first identified that 9 factors from the 38 factors were not linked to any interventions in the studies (Table 3). We assessed these and proposed our own hypothesized links between the interventions and these nine factors. In addition, we proposed additional links between the remaining factors and interventions that study authors had not previously linked (Table S4). Table S4 provides a detailed overview of our proposal on how the range of interventions identified could address these factors. Figure 3 depicts the same model of HCP and patient categories as Figure 2, with the addition of our proposed connections illustrated with dashed arrows.

Table 3. Factors affecting POCT use not linked to any interventions in the reviewed studies and the review authors’ proposed interventions

Factors	Interventions proposed by review authors to address these factors
Concerns over POCTs being used for non-RTI complaints	Optimizing POCT technology
Incentivization leading to overuse of POCTs	Establishing appropriate reimbursement and incentivization Including POCTs in guidelines with clear instructions on using POCTs
Patients’ acceptability of POCTs	Using patient communication materials Training HCPs in communication skills
Medicolegal implications of using/not using POCTs	Including POCTs in guidelines with clear instructions on using POCTs
Concerns about the invasiveness of tests	Optimizing POCT technology Training HCPs in communication skills
Concerns about HCPs’ motivations for recommending POCTs	Training HCPs in communication skills
Concerns about costs in implementing POCTs	Establishing appropriate reimbursement and incentivization
Concerns on length of consultations	Additional staff support Training HCPs in using POCTs Optimizing POCT technology
Lack of understanding of why HCPs use POCTs during consultations	Using patient communication materials Training HCPs in communication skills

Figures 2 and 3 indicate that some interventions can potentially target multiple factors and at different levels (outside, within, and post-consultations). We propose that two interventions, training HCPs in communication skills and the use of patient communication materials, can target factors at all levels. These were felt to work by equipping HCPs with tools to help patients accept the use of POCTs (outside consultations); by being used as adjuncts to POCTs by facilitating conversations with patients and communicate management decisions (within consultations); and by addressing patients’ future testing demands following consultations (post-consultations). We further propose that five other interventions can address factors at two levels (outside and within consultations): (i) establishing appropriate reimbursement and incentivization; (ii) including POCTs in guidelines with clear instructions on using POCTs; (iii) early adopters and champions to share practices; (iv) training HCPs to use POCTs; and (v) optimizing POCT technology.

These seven interventions each appeared to potentially address more than five factors from the 38 identified (Table 4). However, there did not appear to be any intervention that could address all categories proposed in our model (Table 4). Therefore, a multi-component intervention package, including at least some of the seven interventions listed above, is likely to target the greatest number of factors on POCT use in primary care.

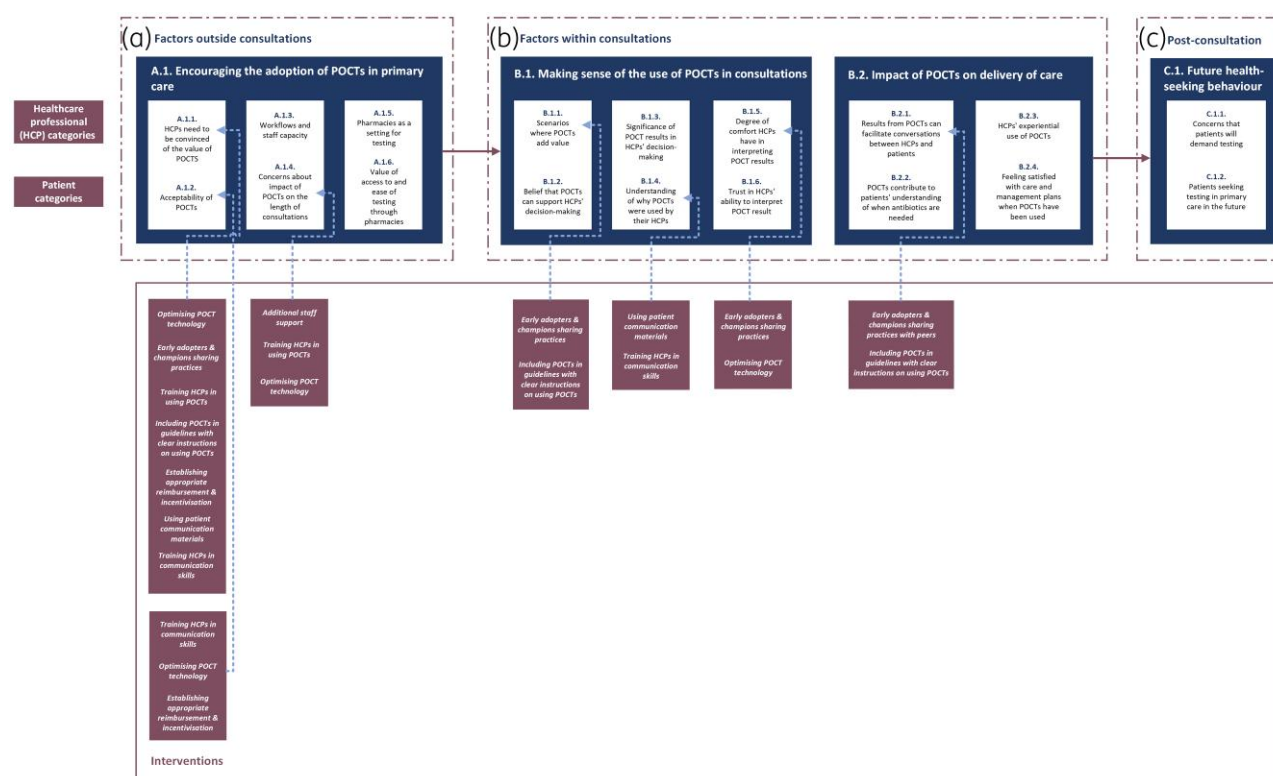


Figure 3. Model displaying additional proposed links between interventions and factors that were not mentioned in the included papers. This figure appears in colour in the online version of JAC and in black and white in the print version of JAC.

Discussion

Summary of main findings

We synthesized findings from 33 studies to develop a model (Figure 2) illustrating how POCT use in primary care is influenced by factors outside, within, and post-consultation and how interventions targeting these factors could help to support POCT use. Despite diverse perspectives and healthcare systems across countries, the categories presented were broadly consistent. Overall, we identified nine HCP and nine patient categories, arranging them into three higher-level groups that follow the trajectory of POCT implementation: outside, within, and post-consultation. We also identified 38 factors that impact POCT use, with 28 from HCP perspectives and 10 from patients, with these factors related, directly and indirectly, to available resources and time. From the included studies, we identified 14 interventions that support POCT use. We propose that seven of these are better equipped to facilitate the implementation of POCTs by addressing factors on use.

Our review demonstrates the ambivalent perspectives of HCPs and patients on the use of POCTs in primary care settings to manage acute RTIs. Although studies in this review showed that there is a potential role for POCTs in clinical practice, they also revealed challenges in their implementation and use. HCPs' concerns about their use include, for example, the uncertainty behind the added value of using POCTs; potential inappropriate use of POCTs; the impact on existing workflows; POCT results not aligning with clinical assessments; and the medicalization of

self-limiting infections. From the perspective of patients, studies reported concerns about the cost implications of using POCTs; the impact of POCTs on the length of consultations; the accuracy of the tests; and not receiving antibiotics when expected as a result of POCT results. These perceived drawbacks in the use of POCTs in primary care settings need to be addressed if POCTs are to be widely implemented. They may also suggest that the role of POCTs is more limited than sometimes advocated for.

The decision to implement POCT should therefore be carefully considered, taking into account the specific clinical context, resource availability, and potential impact on patient outcomes and healthcare delivery. Moreover, it is crucial to critically evaluate the available evidence to determine where POCT is most beneficial. By weighing these factors against the potential drawbacks, HCPs and policy-makers can make more informed decisions about where and when to implement POCT, ensuring its use is targeted to situations where it offers the greatest net benefit to patients and healthcare systems.

POCT implementation might benefit from complex, multi-component interventions

A qualitative study by some of the current authors on HCPs' antibiotic prescribing decisions emphasized influences at both the system and practice levels, underscoring the importance of adopting a whole-systems approach when addressing antibiotic prescribing.⁵³ Here, we argue for a similar approach in POCT implementation, recognizing that certain influences extend beyond

Table 4. Interventions and the number of categories and the factors they potentially address

Interventions	Number of categories addressed	Number of factors addressed
1. Including POCTs in guidelines with clear instructions on using POCTs	5	11
2. Optimizing POCT technology	7	10
3. Training HCPs in communication skills	5	9
4. Using patient communication materials	6	9
5. Training HCPs to use POCTs	4	8
6. Early adopters and champions to share practices	4	6
7. Establishing appropriate reimbursement and incentivization	3	6
8. Additional support staff	2	4
9. Opening communication channels between GPs and pharmacists	2	2
10. Marketing and advertising	2	2
11. Setting up a framework to support quality control of POCTs	1	1
12. Granting pharmacists with authority to prescribe	1	1
13. Accessing patients' records	1	1
14. Training HCPs in interpreting POCTs	1	1

HCP and patient control, necessitating involvement from other stakeholders and the wider health system (part A of the models in Figures 2 and 3). The HCP and patient categories underscore that implementing POCTs goes beyond merely providing HCPs with POCTs. Our findings reveal numerous factors impacting POCT use that exist outside, within, and post-consultations.

Understanding the factors affecting POCT use and where they lie can guide effective interventions. Our review identified 14 interventions that targeted factors at different levels. A systematic review comparing multi-faceted interventions to single-component interventions found no clear advantage of multi-faceted interventions for changing HCPs' behaviour.⁵⁴ However, our findings show that there is no universal solution or intervention for implementing POCTs, and the multitude of influences reflects the complexity of primary care settings.⁵⁵

The studies reviewed indicated that combining some interventions, such as training HCPs in POCT usage, improving communication skills, and using patient communication materials, could enhance POCT utilization. Therefore, we stress that a multi-faceted intervention package is likely to be most successful at addressing multiple factors at all three levels and maximizing the chances of successful POCT implementation.⁵⁶ However, there is a lack of research assessing how interventions operate with

one another and the effectiveness of them. Further research is therefore needed to determine the effectiveness of using multi-faceted interventions proposed in this review when implementing POCTs.

It is crucial to also note that all interventions discussed in this review require resources, especially time, adding to the complexity of these interventions. Developing guidelines on how HCPs should use POCTs and reorganizing workflows of primary care settings requires time. Others, such as training HCPs, developing communication materials, and establishing reimbursement and incentive schemes, require time and resources from both HCPs and public health bodies. In addition, interventions such as guidelines, communication materials, reimbursement and incentive schemes, and training materials for HCPs will need to first be developed before POCTs can be introduced into primary care settings.

Finally, several interventions to support POCT use, such as reimbursement and incentive schemes and guidelines, are designed to be long-term solutions to ensure sustained use of POCTs over an extended period. However, further studies are needed to evaluate the long-term use of POCTs as a limited number of studies in this review had POCTs implemented in routine use in primary care settings. A follow-up study on the use of CRP tests a year after their introduction in European general practices as part of a clinical trial on the management of acute RTIs demonstrated that CRP tests did not have an effect in the long run.⁵⁷ Establishing robust monitoring and evaluation frameworks may be needed to understand the sustained use of POCTs. Having these frameworks in place would allow for the generation of real-world evidence that can then provide recommendations on how to optimize practices' use of POCTs and how they can be adopted in practices that have not yet implemented them.^{58,59} In Norway, where POCTs are in routine use, a system is in place that offers support to HCPs and monitors their use of tests.⁶⁰ These monitoring frameworks may also evaluate antibiotic prescribing rates at local and national levels, collecting real-world evidence, and be used to motivate other practices reluctant to adopt POCTs if demonstrating that antibiotic prescribing is optimized.

POCTs are perceived differently in different primary care settings

The COVID-19 pandemic has expanded the role of pharmacies in some countries to provide services such as testing and vaccinations, presenting an opportunity for them to play a larger role in managing infectious diseases.⁶¹⁻⁶⁵ However, our review suggests that implementing POCTs in pharmacies may affect how these tests are used and patients' perceptions of pharmacies.

Studies have indicated that pharmacists viewed POCT results as instrumental in their decision-making compared to HCPs in general practices and out-of-hours settings who prioritized clinical assessments over POCT results. A study conducted in Norway reported similar findings, with GPs expressing that pharmacists do not carry out clinical assessments in the same manner as GPs.⁶⁶ This difference in skillsets between GPs and pharmacists may need to be considered when implementing POCTs. If POCTs for acute RTIs are to be routinely implemented in pharmacies, interventions other than those identified in the reviewed studies may be necessary to support appropriate POCT use, such as training for pharmacists to carry out clinical assessments

for RTIs. Guidelines may need to be tailored to context and provide a rigid protocol for pharmacists to follow if POCTs are used.

In addition, pharmacies offering POCTs may lead patients to seek care for minor illnesses earlier than usual, potentially leading to the medicalization of self-limiting infections. The study conducted in US pharmacies supported this as patients indicated that had pharmacies not provided testing, they would have waited longer before seeking care.²⁴ To mitigate unintended consequences, pharmacists could benefit from a set of interventions such as training in communication skills and providing them with patient-facing materials (e.g. patient information leaflets), as previously trialled with GPs.

Strengths and limitations

This is the first systematic review synthesizing qualitative literature on HCP and patient views of POCTs for RTIs in primary care. By establishing known qualitative evidence on POCTs for RTIs in primary care, we can guide the focus of new research, avoiding unnecessary replication and recruitment when the answer is already known. Our study offers a summary of the factors that determine how well POCTs are adopted in practice and identifies interventions from the literature can support the use of POCTs. The included studies were heterogeneous in terms of participants, settings, countries, and time. However, differences between different patient populations were not explicitly explored in included studies. Patient views from different socio-economic backgrounds and ethnicities on the views of POCT use may vary. However, the categories identified were often supported by several studies with varied characteristics indicating potential applicability to other settings and contexts. The proposed interventions may be applicable across diverse contexts and countries where qualitative research on POCTs is limited. Whilst individual study nuances may be lost in a meta-synthesis, detailed descriptions of included studies enable readers to identify relevant contexts. The iterative approach also ensured representative and consistent categories whilst allowing for contextual differences in findings.

In addition, it was crucial to consider potential biases during the analysis, especially as certain members of the research team (authors A.J.B., S.T.-C., and S.A.) had authored studies included in this review.⁶⁷ To ensure a reflexive approach, the reading and coding was initially carried out by author M.E.H., who had no prior experiences with conducting research on HCPs' or patients' views on using POCTs. Comprehensive discussions on codes and categories were held throughout the analysis phases, leveraging the diverse backgrounds of team members for a reflexive and nuanced examination of the data.¹⁶

Implications for future research

Real-life implementation studies to assess the effectiveness of interventions highlighted in this review and their optimal combinations can inform scaling up the adoption of POCTs in primary care settings. Moreover, investigating the sustained use of POCTs in countries where they have already been in use over a long period of time may shed light on strategies to ensure their continued use after successful implementation. The literature on sustainability underscores the need for robust monitoring and evaluation frameworks to ensure the continued use of an

innovation.^{58,59} Such frameworks allow for a nuanced understanding of potential adaptations to the tests, systems, and interventions that may be required.

Furthermore, the implementation of POCTs in clinical settings represents a complex intervention requiring comprehensive training across multiple components. Whilst our findings underscore the importance of thorough HCP training, we must also consider the practical challenges of implementing such intensive training programmes in real-world healthcare environments.

There exists a tension between the ideal scenario of comprehensive training and the pragmatic realities of clinical practice. Time constraints and competing demands on HCPs' schedules may render extensive training programmes challenging to implement fully. This dichotomy between best practice and feasible implementation warrants careful consideration.

Moreover, it is crucial to acknowledge that in response to these practical limitations, healthcare systems may be tempted to seek abbreviated training approaches or 'shortcuts'. However, such compromises may lead to suboptimal outcomes in POCT implementation and utilization.

Therefore, we propose that future research and implementation strategies should focus on developing and evaluating training methodologies that balance comprehensiveness with practicality. This may include exploring modular training approaches, leveraging e-learning platforms, or implementing ongoing support systems to supplement initial training efforts.

The studies included in this review also indicated that POCTs may need to be reimbursed to ensure that HCPs and patients are not overburdened with the cost of implementation. However, the studies did not fully explore or directly address equity issues. This is important to consider and address in future research or implementation efforts because POCT use can be both affected by health inequalities and affect them. Depending on the health system, individuals in low-income communities may have limited access to POCTs due to financial constraints. Furthermore, some communities may be more vulnerable to RTIs but supplies of POCTs may be limited at their primary care service. Therefore, future research may be needed to explore the views of vulnerable or at-risk patient groups regarding the use of POCTs and identify ways to address challenges to equitable POCT access.

Finally, conducting ethnographic research in POCT implementation within primary care can provide a richer narrative of the complex interactions between POCTs and HCPs, and help tailor interventions to context. This methodological approach allows for a comprehensive understanding of dynamics, illuminating both successful instances and failures in clinician-technology engagement, moving beyond the confines of randomized clinical trials of technology.⁶⁸⁻⁷⁰

Conclusions

This review consolidates existing knowledge and can inform future primary research, preventing the replication of data. Qualitative studies on HCPs' and patients' views and experiences of POCTs in primary care settings have revealed many factors affecting their use that exist outside and within consultations, and post-consultations. Different interventions can address these to promote POCT use/implementation. However, as primary care

settings are complex, multi-faceted interventions may need to be considered to address these factors and, therefore, support the implementation of POCTs. HCPs in different settings place varying importance to POCT results in decision-making and so certain interventions may be necessary to mitigate differences across settings when assimilating POCTs into diagnoses. Furthermore, introducing POCTs in pharmacies can have unintended consequences on patients' behaviour by encouraging the medicalization of self-limiting infections.

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Transparency declarations

None to declare.

Supplementary data

Tables S1–S4 are available as [Supplementary data](#) at JAC Online.

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