

Effectiveness of Point-of-Care Testing to Reduce Unnecessary Antibiotic Use: A Systematic Review and Meta-Analysis of Randomised Controlled Trials

ABDULAZIZ ABDULLAH ABDULAZIZ ALYOUSEF^{1*}

1* Corresponding Author, DIRECTOR OF PHARMACEUTICAL SERVICES, aa.alyousef@psau.edu.sa, Prince Sattam Bin Abdulaziz University Hospital

Yahya Mansour Tayeb Shafie²

² Pharmacist, y.shafie@psau.edu.sa, Prince Sattam Bin Abdulaziz University Hospital

Abdullah Ahmad Abdullah Alasmari³

³ Pharmacist, aa.alasmari@psau.edu.sa, Prince Sattam Bin Abdulaziz University Hospital

Jarallah Masad Ayed Alharbi⁴

⁴ Pharmacy Technician, j.alharbi@psau.edu.sa, Prince Sattam Bin Abdulaziz University Hospital

Fawaz Saleh Saad Aldawood⁵

⁵ Pharmacy Technician, f.aldawood@psau.edu.sa, Prince Sattam Bin Abdulaziz University Hospital

Thabet Awdah Alaswad Alanazi⁶

⁶ Pharmacy Technician, t.alenazi@psau.edu.sa, Prince Sattam Bin Abdulaziz University Hospital

Abstract

Background: Most antibiotics in ambulatory care are prescribed for acute respiratory and febrile illnesses that are self-limiting or viral. Point-of-care tests (POCT) can give results within the consultation and may help clinicians withhold antibiotics safely. This review estimated the effect of POCT-guided management on antibiotic prescribing and compared the evidence base with the Saudi Arabian and wider Gulf/Middle East (GCC-MENA) context.

Methods: PubMed was searched to 4 October 2026 with eight documented strategies. Randomised controlled trials (individual, cluster or stepped-wedge) in primary care, community pharmacies, nursing homes, outpatient clinics or emergency departments that compared POCT-guided care with usual care and reported antibiotic prescribing were eligible. Biomarker tests (C-reactive protein [CRP], procalcitonin [PCT]), pathogen tests (group A streptococcus [GAS], influenza and multiplex respiratory panels) and POCT-integrated algorithms were included. Risk ratios (RR) were pooled with DerSimonian–Laird random-effects models; heterogeneity

was explored with prespecified subgroup, sensitivity and meta-regression analyses, and certainty was rated with GRADE.

Results: Of 377 unique records, 46 trials met the inclusion criteria and 33 trials (about 72,680 participants) contributed to meta-analysis. POCT-guided care reduced antibiotic prescribing (RR 0.73 (95% CI 0.68–0.78); $I^2 = 93\%$; 95% prediction interval 0.51–1.05; moderate certainty). At the median control-arm prescribing rate of 60%, this corresponds to about 16 fewer prescriptions per 100 patients (number needed to test about 6). Effects were consistent for CRP (RR 0.79 (95% CI 0.74–0.83); 17 trials), and present but more heterogeneous for PCT (RR 0.63 (95% CI 0.44–0.89)) and GAS tests (RR 0.70 (95% CI 0.49–0.99)); viral tests were not clearly effective (RR 0.78 (95% CI 0.56–1.09)). Benefits were seen in high-income and low- and middle-income countries, and recovery outcomes were generally similar between arms. No randomised trial from Saudi Arabia or the GCC was identified, although Saudi observational studies report antibiotic prescribing in 24–79% of upper respiratory and pharyngitis consultations.

Conclusions: POCT, particularly CRP with clear prescribing guidance, reduces antibiotic prescribing in ambulatory care by roughly a quarter without evident harm. The effect depends on how tests are embedded in decision rules and communication. Pragmatic trials in Saudi primary care, emergency departments and community pharmacies are needed before national scale-up.

Keywords: point-of-care testing; C-reactive protein; procalcitonin; rapid antigen detection test; antibiotic prescribing; antimicrobial stewardship; primary care; Saudi Arabia; meta-analysis

1. Introduction

Antimicrobial resistance is driven in large part by antibiotic use that offers patients little or no benefit. Acute respiratory tract infections are the commonest reason for antibiotic prescribing in ambulatory care, even though most are viral or resolve without treatment. The World Health Organization's AWaRe antibiotic book recommends no antibiotic for most of these presentations and encourages the use of diagnostic tests to target treatment (World Health Organization [WHO], 2022). Clinician-targeted strategies such as communication training, delayed prescribing and decision support can reduce prescribing (Tonkin-Crine et al., 2017), but diagnostic uncertainty at the time of the consultation remains a central driver.

Point-of-care tests are performed near the patient and return results within minutes. Two broad classes exist: host-response biomarkers such as C-reactive protein (CRP) and procalcitonin (PCT), which help distinguish self-limiting from more serious bacterial illness, and pathogen-detection tests such as rapid antigen or molecular tests for group A streptococcus (GAS) and respiratory viruses. Cochrane reviews have shown that CRP POCT probably reduces antibiotic prescribing in primary care (RR 0.77) without affecting recovery (Smedemark et al., 2022), and another meta-analysis found a similar effect with a modest increase in re-consultation (Martínez-González et al., 2020). PCT guidance reduces antibiotic exposure and side effects across settings (Schuetz et al., 2017), whereas evidence for influenza and multiplex molecular tests is less consistent (Lee et al., 2019; Li et al., 2026).

In Saudi Arabia, high outpatient antibiotic use has been documented repeatedly. Antibiotics were prescribed in 79% of pharyngitis consultations in primary care, of which only 28% were evidence-based (Olwi & Olwi, 2021), in 44% of upper respiratory consultations in Al-Madinah (Alharbi et al., 2024), and in 30% of respiratory consultations in Dammam, rising to 46% in a paediatric emergency department (Al-Baghli et al., 2023a). Across the Gulf region, up to 80% of outpatient and emergency antibiotic prescriptions have been

judged inappropriate (Mahmood et al., 2020). Public expectations reinforce this pattern: in a 13-country survey, 45% of Saudi respondents with sore throat had used antibiotics and 94% believed they were effective (van der Velden et al., 2020), and 83% of surveyed Jeddah residents had obtained antibiotics without a prescription (Badr et al., 2021). Saudi and Emirati stakeholders have called for wider use of rapid POCT for respiratory infections (Assiri et al., 2024; Dhaini et al., 2024).

Earlier reviews have usually examined a single test or setting. A combined, up-to-date synthesis across test types and ambulatory settings, which also maps the evidence relevant to the Saudi context, is lacking. This review therefore aimed to (1) estimate the effect of POCT-guided management on antibiotic prescribing compared with usual care, (2) examine whether the effect differs by test type, setting, population, country income and trial design, and (3) summarise safety outcomes and the applicability of the evidence to Saudi Arabia and the GCC.

2. Methods

2.1 Design and reporting

The review followed the PRISMA 2020 statement (Page et al., 2021). The protocol was not prospectively registered; eligibility criteria, outcomes and subgroup analyses were defined before data extraction.

2.2 Eligibility criteria

Eligibility followed a PICOS framework (Table 1).

Table 1. Eligibility criteria (PICOS)

Element	Inclusion	Exclusion
Population	Patients of any age presenting with acute respiratory, febrile or sore-throat illness, or COPD exacerbation, in ambulatory care	Hospitalised or intensive-care patients; sepsis; post-operative infections
Setting	Primary care, out-of-hours care, community pharmacies, nursing homes, community health workers, outpatient clinics and emergency departments	Inpatient wards; trials in which most outcomes were measured after admission
Intervention	Point-of-care or near-patient test (CRP, PCT, CRP/serum amyloid A, GAS rapid antigen or molecular test, influenza or multiplex respiratory panel) or a POCT-integrated clinical algorithm used to guide antibiotic decisions	Laboratory-only tests with results after the consultation; diagnostic accuracy studies
Comparator	Usual care, or the same algorithm without POCT	Delayed prescribing strategy as the sole comparator
Outcome	Primary: proportion of patients prescribed or receiving antibiotics (index consultation, or the earliest time point reported). Secondary: recovery, re-consultation, hospitalisation, mortality	No antibiotic outcome reported
Design	Randomised controlled trials (individual, cluster, cross-over or stepped-wedge)	Non-randomised, quasi-randomised and before-after studies; protocols; reviews

Note. COPD, chronic obstructive pulmonary disease; CRP, C-reactive protein; GAS, group A streptococcus; PCT, procalcitonin; POCT, point-of-care testing.

2.3 Information sources and search

PubMed/MEDLINE was searched from inception to 4 October 2026. Five core strategies combined CRP, PCT, rapid antigen, rapid viral and molecular POCT terms with antibiotic and randomisation terms, and with a GCC-MENA country filter; three supplementary strategies targeted landmark trials by known investigators, Saudi trials and Saudi prescribing data. Full search strings are given in Supplementary Table S1. PubMed Central full texts were retrieved where available to extract arm-level data.

2.4 Study selection and data extraction

Records were de-duplicated by PMID and screened on title and abstract; potentially eligible records were assessed using the abstract, indexing record and available full text. Excluded records and companion reports are listed in Supplementary Tables S2 and S3. For each trial, country, setting, population, design, intervention, comparator, outcome definition and arm-level event counts were extracted. Where only percentages were reported, counts were reconstructed from the stated denominators; when arm denominators were not reported they were inferred from equal allocation or from overall totals, and these trials were flagged. For three trials reporting only an adjusted effect, the adjusted RR (or the adjusted OR converted to an RR using the reported baseline risk) was used. In factorial or multi-arm trials, the POCT-only arm was compared with usual care; when two POCT arms differed only in threshold, they were combined.

2.5 Risk of bias and certainty of evidence

Risk of bias was judged with the domains of the Cochrane RoB 2 tool (Sterne et al., 2019), with attention to randomisation, recruitment after cluster randomisation, deviations from intended interventions, missing outcome data, outcome measurement and selective reporting. Because all trials were necessarily open-label but antibiotic prescribing is objectively recorded, lack of blinding alone was not treated as high risk. Certainty of evidence was rated with GRADE (Guyatt et al., 2008).

2.6 Statistical analysis

Risk ratios were analysed on the log scale and pooled with DerSimonian–Laird random-effects models (DerSimonian & Laird, 1986), chosen a priori because clinical heterogeneity was expected. Heterogeneity was summarised with Cochran's Q , I^2 and τ^2 , and 95% prediction intervals were calculated (IntHout et al., 2016). Prespecified subgroups were test type, care setting, population (adults, children, mixed ages), country income group and trial design; differences were assessed with a between-subgroup Q test. Sensitivity analyses restricted the analysis to low-risk-of-bias trials, excluded derived or converted estimates, excluded multi-test algorithms, and excluded a trial in which CRP was used without guidance. Leave-one-out analysis assessed single-trial influence; a random-effects meta-regression examined control-arm prescribing as a modifier; small-study effects were assessed with a funnel plot and Egger's test. Absolute effects were calculated by applying the pooled RR to the median control-arm risk. Cluster trials were included using reported counts; this ignores clustering and gives these trials somewhat narrow confidence intervals, which was examined by comparing cluster and individually randomised subgroups. Analyses used Python 3 (NumPy, SciPy, Matplotlib); figures were produced at 300 dpi with the Okabe–Ito colour-blind-safe palette.

3. Results

3.1 Study selection

The searches identified 411 records, of which 34 were duplicates (Figure 1). After title and abstract screening of 377 records, 69 were assessed in detail. Fifteen were excluded (four non-randomised, three in hospitalised populations, three protocols, four not primary trials, one with no extractable data) and eight were companion reports of included trials. Forty-six trials were included; 33 provided arm-level or adjusted data for meta-analysis and 13 were synthesised narratively.

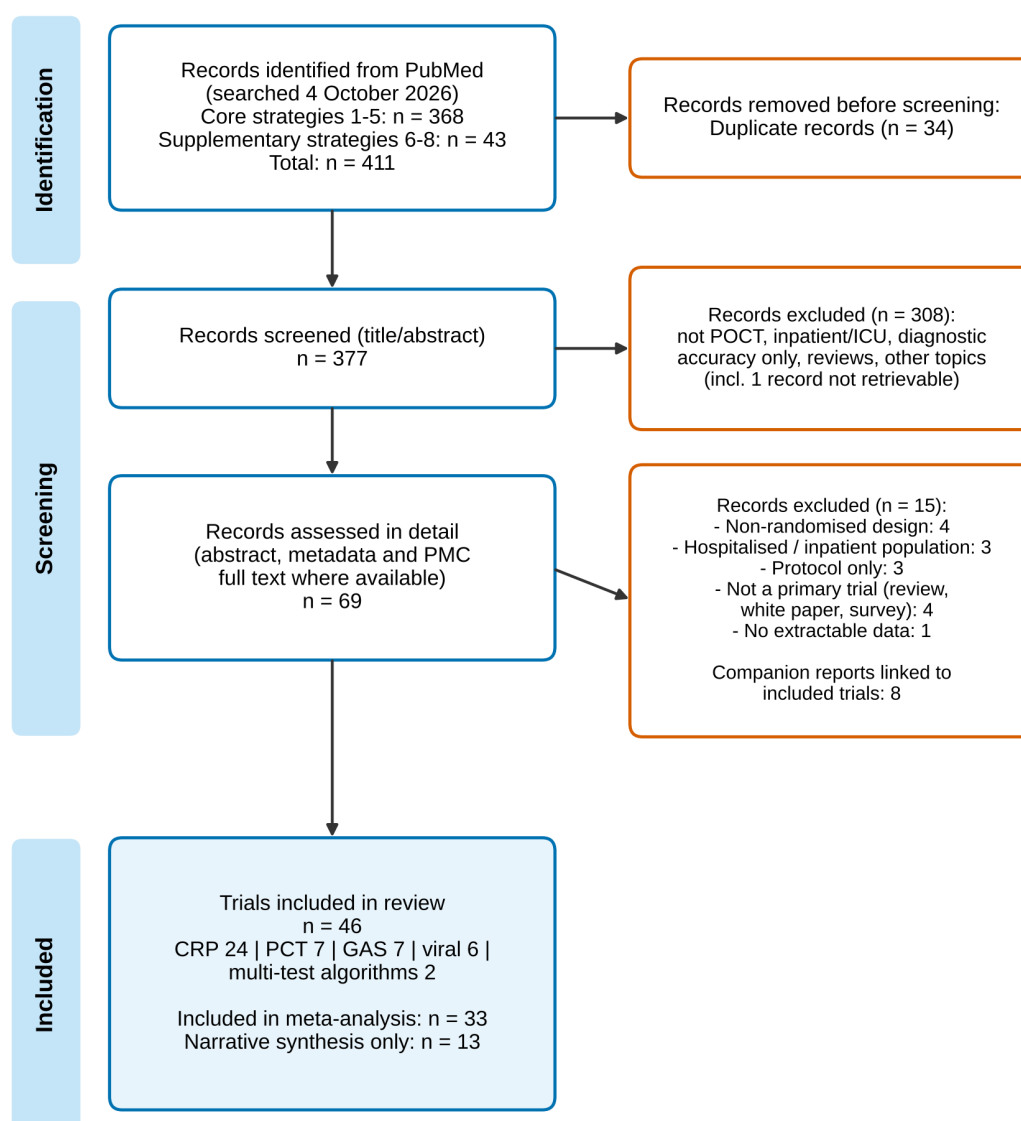


Figure 1. PRISMA 2020 flow diagram of record identification, screening and inclusion. PubMed searched 4 October 2026. CRP, C-reactive protein; GAS, group A streptococcus; PCT, procalcitonin; POCT, point-of-care testing.

3.2 Characteristics of included trials

The 46 trials were published between 1999 and 2026; 19 appeared from 2020 onwards (Figure 2). CRP was the most frequently evaluated test (24 trials), followed by PCT (7), GAS tests (7), viral or multiplex respiratory tests (6) and multi-test electronic algorithms (2). Most CRP and GAS trials were in primary care, whereas viral tests were evaluated mainly in emergency departments. Twenty-three of the 33 pooled trials were from high-income countries and ten from low- and middle-income countries (Vietnam, Thailand and Myanmar, Russia, Nigeria, Uganda, India, China, Tanzania and Cambodia). No randomised trial was conducted in Saudi Arabia, another GCC state or the wider Middle East. The characteristics of all trials, together with Saudi and Gulf contextual studies, are summarised in Table 2.

Effectiveness of Point-of-Care Testing to Reduce Unnecessary Antibiotic Use: A Systematic Review and Meta-Analysis of Randomised Controlled Trials

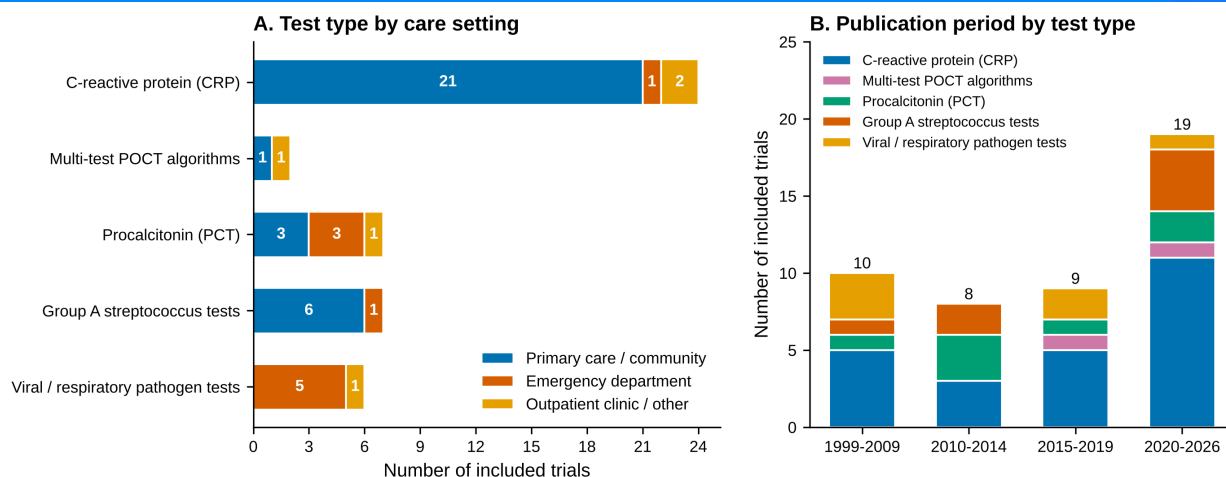


Figure 2. Evidence map of the 46 included trials. (A) Number of trials by test type and care setting. (B) Number of trials by publication period and test type. Counts are derived from Table 2. POCT, point-of-care testing.

Table 2 summarises each trial's design, setting tag, sample, comparison, outcome, principal findings and limitations.

Effectiveness of Point-of-Care Testing to Reduce Unnecessary Antibiotic Use: A Systematic Review and Meta-Analysis of Randomised Controlled Trials

Table 2. Evidence extraction table of included trials and contextual Saudi/GCC-MENA studies

Author (year)	Country	Setting tag	Design	Sample	Objective / comparison	Setting; outcome	Key findings	Limitations	Relevance	PubMed / DOI
<i>A. Trials included in the meta-analysis (n = 33)</i>										
Diederichsen et al. 2000	Denmark	International	Individual RCT	35 practices; 812 patients with RTI	CRP: CRP rapid test to support clinical assessment vs usual care	Primary care; antibiotic prescription at index consultation	43% vs 46% (OR 0.9, NS); more patients reported unchanged/worse morbidity at 1 week with CRP (12% vs 8%)	Single CRP test without guidance thresholds	High	PMID 10811042; doi:10.1080/02813430050202541
Cals et al. 2009	Netherlands	International	Cluster RCT (2x2 factorial)	20 practices; 431 patients with LRTI	CRP: CRP POCT (CRP-only arm extracted) vs usual care arm	Primary care; antibiotic prescribing at index consultation	CRP-only 39% vs usual care 67%; CRP + communication training 23%; recovery and satisfaction similar	Cluster design; factorial arms (CRP-only vs usual care used)	High	PMID 19416992; doi:10.1136/bmj.b1374
Cals et al. 2010	Netherlands	International	Individual RCT	32 physicians; 258 patients (LRTI, rhinosinusitis)	CRP: CRP-assisted prescribing incl. delayed prescriptions vs routine care	Primary care; antibiotic use after index consultation	43.4% vs 56.6% (RR 0.77, 95% CI 0.56-0.98); higher satisfaction with CRP	Arm sizes inferred from percentages (equal allocation)	High	PMID 20212299; doi:10.1370/afm.1090
Little et al. 2013	Six European countries	International	Cluster RCT (2x2 factorial)	246 practices; 4,264 patients with RTI	CRP: Internet training in CRP POCT use vs no crp training	Primary care; antibiotic prescribing at index consultation	33% vs 48% (adjusted RR 0.54); combined CRP + communication RR 0.38	Factorial; adjusted RR used	High	PMID 23915885; doi:10.1016/S0140-6736(13)60994-0
Andreeva & Melbye 2014	Russian Federation	International	Cluster RCT	179 patients with acute cough/RTI	CRP: CRP POCT vs usual care	Primary care; antibiotic prescribing	37.6% vs 58.9% (p = 0.006); fewer chest X-ray referrals; similar recovery	Small; open cluster design	High	PMID 24886066; doi:10.1186/1471-2296-15-80
Do et al. 2016	Vietnam	International	Individual RCT	10 primary health centres; 2,036 patients aged 1-65 years	CRP: CRP POCT with guidance vs routine care	Primary care; antibiotic use within 14 days	64% vs 78% (OR 0.49, 95% CI 0.40-0.61); no difference in recovery	Open label	High	PMID 27495137; doi:10.1016/S2214-109X(16)30142-5
Schot et al. 2018	Netherlands	International	Individual RCT	309 children aged 3 months-12 years with suspected LRTI	CRP: GP use of POC CRP vs usual care	Primary care; antibiotic prescription	30.9% vs 39.4% (OR 0.6, 95% CI 0.29-1.23)	Under-recruitment; follow-up incomplete	High	PMID 30564733; doi:10.3399/bjgpopen18X101600
Althaus et al. 2019	Thailand and Myanmar	International	Individual RCT (3-arm)	10 sites; 2,410 febrile patients	CRP: CRP POCT with 20 mg/L or 40 mg/L thresholds (arms combined) vs usual care	Primary care; antibiotic prescription day 0-5	36% (20 mg/L) and 34% (40 mg/L) vs 39%; aOR 0.80 for 40 mg/L arm; prescribing much lower when CRP below threshold	Low baseline prescribing in some sites	High	PMID 30554748; doi:10.1016/S2214-109X(18)30444-3
Butler et al. 2019	UK	International	Individual RCT	86 practices; 653 patients with COPD exacerbation	CRP: CRP-guided usual care vs usual care	Primary care; antibiotic prescription at initial consultation	47.7% vs 69.7% (aOR 0.31); patient-reported use within 4 weeks 57.0% vs 77.4%; COPD health status non-inferior	Open label; counts derived from percentages	High	PMID 31291514; doi:10.1056/NEJMoa1803185
Boere et al. 2021	Netherlands	International	Cluster RCT	11 nursing-home organisations; 241 residents with suspected LRTI	CRP: Access to CRP POCT vs usual care	Nursing home; antibiotic prescribing at initial consultation	53.5% vs 82.3%; 4.93-fold odds of no antibiotic; similar recovery and mortality	Imbalanced cluster sizes	High	PMID 34548288; doi:10.1136/bmj.n2198
Onwunduba et al. 2022	Nigeria	International	Cluster RCT	20 private community pharmacies; 600 simulated-client visits	CRP: CRP kits plus staff training vs no intervention	Community pharmacy; non-prescription antibiotic dispensing for rti	69.3% vs 85.3% (crude OR 0.30; adjusted OR 0.28)	Simulated clients; small number of clusters	High	PMID 36509332; doi:10.1016/j.ijid.2022.12.006
Jung et al. 2024	France	International	Individual RCT	26 GPs; 404 patients >=3 years with suspected LRTI	CRP: CRP POCT vs no crp poct	Primary care; antibiotic prescription at consultation	43.0% vs 47.7% (difference -4.7, 95% CI -14.4 to 5.0)	Recruitment during COVID-19	High	PMID 39067513; doi:10.1016/j.cmi.2024.07.014

Effectiveness of Point-of-Care Testing to Reduce Unnecessary Antibiotic Use: A Systematic Review and Meta-Analysis of Randomised Controlled Trials

Author (year)	Country	Setting tag	Design	Sample	Objective / comparison	Setting; outcome	Key findings	Limitations	Relevance	PubMed / DOI
Ciccone et al. 2024	Uganda	International	Stepped-wedge cluster RCT	15 villages; 1,220 children aged 2-59 months	CRP: CHW algorithm with CRP measurement vs iccm algorithm	Community health worker; antibiotic given/prescribed at initial visit	70.8% vs 91.8% (adjusted difference -24.6%); no excess clinical failure	Stepped-wedge; secular trends	High	PMID 39159269; doi:10.1371/journal.p med.1004416
Likopa et al. 2024	Latvia	International	Cluster RCT (cross-over periods)	80 practices; 2,670 children (period 1)	CRP: CRP POCT plus GP education vs usual care	Primary care; antibiotic prescribing at index consultation	aOR 0.89 (0.74-1.07); converted to RR using 29.3% baseline risk	aOR converted to RR	High	PMID 39335040; doi:10.3390/antibiotics13090867
Verbakel et al. 2025	Belgium	International	Cluster RCT	171 practices; 6,750 children 6 months-12 years	CRP: Decision tree + guided CRP POCT + safety-netting vs usual care	Primary care; antibiotic prescribing at index consultation	16% vs 22% (aOR 0.72, 95% CI 0.55-0.94); recovery and follow-up non-inferior	Multicomponent tool	High	PMID 41016406; doi:10.1016/S0140-6736(25)01239-5
Khanna et al. 2025	India	International	Individual RCT	208 febrile children	CRP: POCT CRP vs standard clinical care	Outpatient clinic; antibiotic prescription	59.4% vs 46.1% (p = 0.023), i.e. higher with CRP; no prescribing algorithm	Single centre; no CRP guidance	High	PMID 41111836; doi:10.7759/cureus.92646
Xu et al. 2026	China	International	Cluster RCT	40 village clinics; 35,108 ARI consultations	CRP: CRP + serum amyloid A POCT package vs usual care	Village clinic; antibiotic prescription at initial ari consultation	50.7% vs 67.5% (aRR 0.80, 95% CI 0.78-0.82); test used in only 7.4%	Low test uptake; routine data	High	PMID 42239972; doi:10.1016/j.lanwpc.2026.101888
Keitel et al. 2017	Tanzania	International	Individual RCT	9 clinics; 3,169 febrile children 2-59 months	POCT algorithm: e-POCT electronic algorithm (CRP, PCT, mRDT, Hb, oximetry) vs almanach electronic imci algorithm	Outpatient clinic; antibiotic prescription at day 0	11.5% vs 29.7% (RR 0.39, 95% CI 0.33-0.45); clinical failure non-inferior	Active comparator algorithm	High	PMID 29059253; doi:10.1371/journal.p med.1002411
Wynberg et al. 2026	Cambodia	International	Cluster RCT	30 health centres; 4,752 febrile patients	POCT algorithm: eCDSA with CRP and pulse oximetry vs routine care	Primary care; antibiotic prescription	56.1% vs 60.5% (aOR 0.64, 95% CI 0.20-1.99); 45.6% received antibiotics against algorithm advice	Low adherence	High	PMID 41520774; doi:10.1016/j.ijid.2026.108382
Briel et al. 2008	Switzerland	International	Individual RCT (non-inferiority)	53 physicians; 458 patients judged to need antibiotics	PCT: PCT-guided antibiotic therapy vs standard approach	Primary care; antibiotic prescription	72% relative reduction (95% CI 66-78%); restricted-activity days non-inferior	Selected patients in whom antibiotics were intended	High	PMID 18852401; doi:10.1001/archinte.168.18.2000
Burkhardt et al. 2010	Germany	International	Individual RCT (non-inferiority)	45 physicians; 550 patients with ARI	PCT: PCT-guided treatment (0.25 ng/mL) vs standard care	Primary care; antibiotic prescription	21.5% vs 36.7% (41.6% reduction); days of impairment similar	Arm sizes inferred (equal allocation)	High	PMID 20185423; doi:10.1183/09031936.00163309
Long et al. 2011	China	International	Individual RCT	156 low-risk outpatients with CAP	PCT: PCT-guided antibiotic use vs guideline-based care	Outpatient clinic; antibiotic prescription at presentation	84.4% vs 97.5% (p = 0.004); total exposure RR 0.55; shorter duration	Arm sizes inferred; single centre	High	PMID 21507143; doi:10.1111/j.1440-1843.2011.01978.x
Lhopitalier et al. 2021	Switzerland	International	Cluster RCT (3-arm)	60 practices; 469 patients with clinical pneumonia	PCT: PCT POCT-guided antibiotics (PCT-only arm) vs usual care	Primary care; antibiotic prescription by day 28	Probability 0.40 vs 0.70 (cluster-corrected difference -0.26); PCT + lung ultrasound similar to PCT alone	Counts reconstructed from probabilities	High	PMID 34548312; doi:10.1136/bmj.n2132
Manzano et al. 2010	Canada	International	Individual RCT	384 children 1-36 months with fever without source	PCT: PCT result revealed vs pct not revealed	Emergency department; antibiotic use (patients without diagnosed sbi)	9% vs 10% (difference -2%, 95% CI -8 to 5)	Low baseline prescribing	High	PMID 20637377; doi:10.1016/j.ajem.2009.02.022
van der Does et al. 2018	Netherlands	International	Individual RCT (non-inferiority)	2 hospitals; 551 febrile adults	PCT: Single PCT measurement with algorithm vs standard work-up	Emergency department; antibiotic regimens prescribed	73% vs 77% (p = 0.28); safety end point similar	High-acuity population	High	PMID 29870855; doi:10.1016/j.cmi.2018.05.011
Llor et al. 2011	Spain	International	Cluster RCT	543 adults with pharyngitis	GAS test: Rapid antigen detection test (RADT) vs usual care	Primary care; antibiotic prescription	43.8% vs 64.1% (p < 0.001); inappropriate prescribing 26.9% vs 60%; 30.7% of RADT-negative patients still received antibiotics	Cluster; open	High	PMID 21619748; doi:10.3399/bjgp.11X572436



Effectiveness of Point-of-Care Testing to Reduce Unnecessary Antibiotic Use: A Systematic Review and Meta-Analysis of Randomised Controlled Trials

Author (year)	Country	Setting tag	Design	Sample	Objective / comparison	Setting; outcome	Key findings	Limitations	Relevance	PubMed / DOI
Bonet-Esteve et al. 2021	Spain	International	Individual RCT	519 children 3-15 years with pharyngotonsillitis	GAS test: RADT added to Centor-based algorithm vs usual algorithm	Primary care; antibiotic prescription	45.5% vs 88.5% (p < 0.0001); adherence similar	Arm sizes derived from overall rate	High	PMID 34507074; doi:10.1016/j.aprim.2021.102102
Wächtler et al. 2023	Germany	International	Cluster RCT (3-arm)	61 practices; 516 patients with sore throat	GAS test: Guideline + RADT for scores ≥ 3 vs usual care	Primary care; antibiotic prescription at first consultation	43% vs 43%; no significant difference after accounting for clustering	UC denominator derived	High	PMID 36941540; doi:10.1186/s12875-023-01987-w
Gill et al. 2024	Not stated in record	International	Individual RCT	227 children 3-17 years with suspected GAS pharyngitis	GAS test: Molecular POC NAAT vs throat culture	Emergency department; antibiotic prescription	35% vs 79% (p < 0.001); earlier treatment, no change in symptom resolution	Single centre; comparator culture (not empirical care)	High	PMID 38498934; doi:10.1097/PEC.00000000000003154
Hain et al. 2026	Germany	International	Cluster cross-over RCT	25 paediatric offices; 1,111 children with tonsillopharyngitis	GAS test: Molecular POC GAS test vs standard care (optional radt)	Primary care; antibiotic prescription	68.1% vs 65.8% (NS); 95.5% of test-positive children treated	Control group frequently tested with RADT	High	PMID 41803575; doi:10.1007/s00431-026-06818-5
Berthod et al. 2015	Switzerland	International	Individual RCT	93 febrile returning travellers	Viral test: Rapid influenza antigen test vs usual care	Outpatient clinic; antibiotic prescription	23% vs 39% (p = 0.15); test sensitivity only 20%	Small; unequal arms	High	PMID 26358968; doi:10.1016/j.tmaid.2015.08.001
May et al. 2019	USA	International	Individual RCT	191 patients ≥ 12 months with URTI/ILI	Viral test: Rapid multiplex respiratory panel vs usual care	Emergency department; antibiotic prescription during ed visit	22% vs 34% (difference -12%, 95% CI -25% to 0.4%)	Single centre; small	High	PMID 32128326; doi:10.1093/ofid/ofz481
Mattila et al. 2022	Finland	International	Individual RCT (2:1)	1,243 children with fever/respiratory symptoms	Viral test: Multiplex PCR POCT (21 pathogens) vs routine care	Emergency department; antibiotic therapy in ed	27.3% vs 28.5% (no reduction); more pathogen-targeted therapy	Unblinded	High	PMID 35679047; doi:10.1001/jamanetw.orkopen.2022.16162
B. Trials synthesised narratively (n = 13)										
Dahler-Eriksen et al. 1999	Denmark	International	Randomised cross-over	29 practices; 1,853 patients	CRP vs usual care	Primary care	No reduction in antibiotic prescribing; fewer follow-up calls (63% to 53%)	Arm-level antibiotic counts not reported	Moderate	PMID 10102907
Takemura et al. 2005	Japan	International	Individual RCT	305 outpatients	CRP vs usual care	Outpatient clinic	84 vs 158 oral antibiotic prescriptions with advance CRP/WBC testing	Prescriptions, not patients, counted	Moderate	PMID 15964561; doi:10.1016/j.cccn.2005.04.017
Gonzales et al. 2008	USA	International	Individual RCT	131 adults with acute cough	CRP vs usual care	Emergency department	37% vs 31% when both arms used a clinical algorithm (p = 0.46)	Arm sizes not reported; algorithm co-intervention in both arms	Moderate	PMID 19095403; doi:10.1016/j.jemerm.2008.06.021
Lemiengre et al. 2018	Belgium	International	Cluster factorial RCT	131 FPs; 2,227 children	CRP vs usual care	Primary care	Unguided POC CRP did not change prescribing (aOR 1.01, 0.57-1.79)	Only adjusted OR without baseline risk	Moderate	PMID 29440016; doi:10.3399/bjgp18X695033
Eley et al. 2020	UK	International	Cluster RCT (Zelen)	16 practices; 268 CRP tests	CRP vs usual care	Primary care	Non-significant 21% lower odds of prescribing for cough	Practice-level data only	Moderate	PMID 33153517; doi:10.2807/1560-7917.ES.2020.25.44.1900408
Likopa et al. 2022	Latvia	International	Randomised controlled intervention	80 FPs; 2,039 children	CRP vs usual care	Primary care	No association between CRP + training and prescribing in regression	Arm-level counts not reported	Moderate	PMID 36127630; doi:10.1186/s12887-022-03608-4
Llor et al. 2024	Spain	International	Cluster factorial RCT	20 centres; 233 adults	CRP vs usual care	Primary care	CRP 43.8% vs usual care 56.7% (aOR 0.70, 0.29-1.68); stopped early (COVID-19)	Arm sizes not reported	Moderate	PMID 38724543; doi:10.1038/s41533-024-00368-9



Effectiveness of Point-of-Care Testing to Reduce Unnecessary Antibiotic Use: A Systematic Review and Meta-Analysis of Randomised Controlled Trials

Author (year)	Country	Setting tag	Design	Sample	Objective / comparison	Setting; outcome	Key findings	Limitations	Relevance	PubMed / DOI
Worrall et al. 2007	Canada	International	Four-arm RCT	40 family practitioners	GAS test vs usual care	Primary care	RADT alone 27% and RADT + rules 38% vs usual practice 58%	Arm denominators not available	Moderate	PMID 17872717
Little et al. 2013b	UK	International	Adaptive RCT	1,760 patients ≥ 3 years	GAS test vs usual care	Primary care	Antigen test and FeverPAIN score reduced symptom severity versus delayed prescribing	Comparator was delayed prescribing, not usual care	Moderate	PMID 24114306; doi:10.1136/bmj.f5806
Bonner et al. 2003	USA	International	Individual RCT	391 children (202 influenza-positive)	Viral test vs usual care	Emergency department	Physician awareness of influenza result reduced antibiotic prescribing in influenza-positive children	Counts not reported in record	Moderate	PMID 12897288; doi:10.1542/peds.112.2.363
Poehling et al. 2006	USA	International	Day-randomised trial	468 children < 5 years	Viral test vs usual care	Emergency department / clinic	Fewer diagnostic tests in the ED but no difference in antibiotic prescribing	Counts not reported in record	Moderate	PMID 16818837; doi:10.1001/archpedi.160.7.713
Doan et al. 2008	Canada	International	Individual RCT	204 children 3-36 months	Viral test vs usual care	Emergency department	No ED difference; fewer antibiotics after discharge (RR 0.36, 0.14-0.95)	ED counts not reported	Moderate	PMID 18814887; doi:10.1016/j.jpeds.2008.07.043
Andrade et al. 2023	USA	International	Individual RCT	200 patients 0-50 years	PCT vs usual care	Emergency department	39% vs 32% (difference 7.0%, -6.2 to 20.2) with PCT + flu/RSV + pharmacist education	Arm sizes not reported	Moderate	PMID 36773457; doi:10.1016/j.ajem.2023.01.041
C. Saudi and GCC-MENA contextual studies (not eligible for pooling)										
Al-Baghli et al. 2023a	Saudi Arabia (Dammam)	Saudi	Prospective observational	469 patients with URTI (PHCC + paediatric ED)	Antibiotic prescribing / POCT context	Observational	30.1% prescribed antibiotics (24.4% PHCC, 46.3% ED); positive RADT OR 41.75; most prescriptions unjustified	Non-randomised; context only	Moderate (context)	PMID 37649929; doi:10.7759/cureus.44298
Al-Baghli et al. 2023b	Saudi Arabia (Dammam)	Saudi	Prospective diagnostic	469 patients	Antibiotic prescribing / POCT context	Observational	RADT positive in 4.1% (0.6% PHCC, 14% ED); Centor ≥ 2 needs confirmatory testing	Non-randomised; context only	Moderate (context)	PMID 38090423; doi:10.7759/cureus.48607
Olwi & Olwi 2021	Saudi Arabia	Saudi	Cross-sectional	104 pharyngitis cases; 29 physicians	Antibiotic prescribing / POCT context	Observational	79% prescribed antibiotics; only 28% evidence-based; half broad-spectrum	Non-randomised; context only	Moderate (context)	PMID 33839717; doi:10.3855/jidc.12822
Badr et al. 2021	Saudi Arabia (Jeddah)	Saudi	Cross-sectional survey	689 public; 40 pharmacists	Antibiotic prescribing / POCT context	Observational	82.9% had obtained antibiotics without prescription; $> 90\%$ supported pharmacy RADT	Non-randomised; context only	Moderate (context)	PMID 34400861; doi:10.1016/j.jsps.2021.04.029
Mahmood et al. 2020	Gulf region	GCC-MENA	Systematic review	17 studies	Antibiotic prescribing / POCT context	Observational	Inappropriate outpatient/ED antibiotic prescribing up to 80% in Gulf countries	Non-randomised; context only	Moderate (context)	PMID 33424594; doi:10.3389/fphar.2020.585051

Note. All randomised trials were tagged International because none was conducted in Saudi Arabia or the GCC-MENA region. CHW, community health worker; COPD, chronic obstructive pulmonary disease; CRP, C-reactive protein; ED, emergency department; GAS, group A streptococcus; ICCM, integrated community case management; LRTI, lower respiratory tract infection; NAAT, nucleic acid amplification test; PCT, procalcitonin; RADT, rapid antigen detection test; RR, risk ratio; RTI, respiratory tract infection.



3.3 Risk of bias

Of the 33 pooled trials, 11 were judged at low risk of bias and 22 raised some concerns (Table 3). The commonest concerns were recruitment of participants after cluster randomisation, reconstruction of event counts from percentages, small samples and low adherence to test-based recommendations. No trial was judged at high risk of bias for the prescribing outcome, which was recorded from consultation documentation or prescriptions in all trials.

Table 3. Risk of bias summary for trials included in the meta-analysis

Trial	Design	Unit of randomisation	Main concern	Overall judgement
Diederichsen et al. 2000	Individual RCT	Individual	No important concerns identified	Low
Cals et al. 2009	Cluster RCT (2x2 factorial)	Cluster	Cluster design; factorial arms (CRP-only vs usual care used)	Some concerns
Cals et al. 2010	Individual RCT	Individual	No important concerns identified	Low
Little et al. 2013	Cluster RCT (2x2 factorial)	Cluster	Factorial; adjusted RR used	Some concerns
Andreeva & Melbye 2014	Cluster RCT	Cluster	Small; open cluster design	Some concerns
Do et al. 2016	Individual RCT	Individual	No important concerns identified	Low
Schot et al. 2018	Individual RCT	Individual	Under-recruitment; follow-up incomplete	Some concerns
Althaus et al. 2019	Individual RCT (3-arm)	Individual	No important concerns identified	Low
Butler et al. 2019	Individual RCT	Individual	No important concerns identified	Low
Boere et al. 2021	Cluster RCT	Cluster	Imbalanced cluster sizes	Some concerns
Onwunduba et al. 2022	Cluster RCT	Cluster	Simulated clients; small number of clusters	Some concerns
Jung et al. 2024	Individual RCT	Individual	No important concerns identified	Low
Ciccone et al. 2024	Stepped-wedge cluster RCT	Cluster	Stepped-wedge; secular trends	Some concerns
Likopa et al. 2024	Cluster RCT (cross-over periods)	Cluster	aOR converted to RR	Some concerns
Verbakel et al. 2025	Cluster RCT	Cluster	Multicomponent tool	Some concerns
Khanna et al. 2025	Individual RCT	Individual	Single centre; no CRP guidance	Some concerns
Xu et al. 2026	Cluster RCT	Cluster	Low test uptake; routine data	Some concerns
Keitel et al. 2017	Individual RCT	Individual	No important concerns identified	Low
Wynberg et al. 2026	Cluster RCT	Cluster	Low adherence	Some concerns
Briel et al. 2008	Individual RCT (non-inferiority)	Individual	No important concerns identified	Low
Burkhardt et al. 2010	Individual RCT (non-inferiority)	Individual	Arm sizes inferred (equal allocation)	Some concerns
Long et al. 2011	Individual RCT	Individual	Arm sizes inferred; single centre	Some concerns
Lhopitallier et al. 2021	Cluster RCT (3-arm)	Cluster	Counts reconstructed from probabilities	Some concerns
Manzano et al. 2010	Individual RCT	Individual	No important concerns identified	Low
van der Does et al. 2018	Individual RCT (non-inferiority)	Individual	No important concerns identified	Low
Llor et al. 2011	Cluster RCT	Cluster	Cluster; open	Some concerns
Bonet-Esteve et al. 2021	Individual RCT	Individual	Arm sizes derived from overall rate	Some concerns
Wächtler et al. 2023	Cluster RCT (3-arm)	Cluster	UC denominator derived	Some concerns
Gill et al. 2024	Individual RCT	Individual	Single centre; comparator culture (not empirical care)	Some concerns
Hain et al. 2026	Cluster cross-over RCT	Cluster	Control group frequently tested with RADT	Some concerns
Berthod et al. 2015	Individual RCT	Individual	Small; unequal arms	Some concerns
May et al. 2019	Individual RCT	Individual	Single centre; small	Some concerns
Mattila et al. 2022	Individual RCT (2:1)	Individual	No important concerns identified	Low

Note. Judgements informed by RoB 2 domains (Sterne et al., 2019) and based on the abstract and, where available, the PMC full text.

3.4 Effect of POCT on antibiotic prescribing

Across 33 trials, POCT-guided management reduced the proportion of patients prescribed antibiotics (RR 0.73 (95% CI 0.68–0.78); $p < 0.001$; $I^2 = 92.5\%$; $\tau^2 = 0.030$) (Figure 3). The 95% prediction interval (0.51–1.05) indicates that, in a new comparable setting, the effect is likely to be a reduction but could be negligible. The median control-arm prescribing rate was 59.7% (interquartile range 39–75%), so the pooled effect corresponds to an absolute reduction of 16.1 percentage points (95% CI 13.0–19.0), or one antibiotic prescription avoided for every 6 patients tested (95% CI 5–8).

By test type, CRP produced a consistent reduction (RR 0.79 (95% CI 0.74–0.83); 17 trials; $I^2 = 78\%$), with a prediction interval that excluded no effect (0.65–0.95). The largest CRP effects came from trials that combined testing with explicit guidance or training (Cals et al., 2009; Little et al., 2013; Butler et al., 2019; Boere et al., 2021), Reductions were also seen in Russian primary care (Andreeva & Melbye, 2014), whereas effects were small or non-significant in febrile patients in Thailand and Myanmar (Althaus et al., 2019), in French primary care during the COVID-19 period (Jung et al., 2024) and in children in the Netherlands and Latvia (Schot et al., 2018; Likopa et al., 2024); CRP without guidance did not reduce, and in one Indian paediatric trial increased, prescribing (Khanna et al., 2025). PCT reduced prescribing (RR 0.63 (95% CI 0.44–0.89); 6 trials), with the strongest effects in primary care (Briel et al., 2008; Burkhardt et al., 2010; Lhopitallier et al., 2021), a smaller effect in low-risk Chinese outpatients with pneumonia (Long et al., 2011) and little effect in emergency department populations where baseline prescribing was driven by more severe illness (van der Does et al., 2018; Manzano et al., 2010). GAS tests reduced prescribing (RR 0.70 (95% CI 0.49–0.99); 5 trials), mainly where clinicians would otherwise have treated empirically (Llor et al., 2011; Bonet-Estève et al., 2021; Gill et al., 2024); trials in which control clinicians already had access to rapid tests or applied guideline scores showed no difference (Wächtler et al., 2023; Hain et al., 2026). Viral and multiplex respiratory tests did not significantly reduce prescribing (RR 0.78 (95% CI 0.56–1.09); 3 trials) (Berthod et al., 2015; May et al., 2019; Mattila et al., 2022). The two POCT-integrated electronic algorithms produced widely divergent results: a 61% reduction in Tanzanian children (Keitel et al., 2017) but only a small reduction in Cambodia, where nearly half of patients for whom the algorithm advised against antibiotics still received them (Wynberg et al., 2026).

Pooled estimates for all subgroups and sensitivity analyses are presented in Table 4.

Table 4. Pooled risk ratios for antibiotic prescribing by subgroup and sensitivity analysis

Analysis	k	RR (95% CI)	95% PI	I ² (%)	p (subgroup)
All trials	33	0.73 (95% CI 0.68–0.78)	0.51–1.05	92.5	—
Test type					
C-reactive protein	17	0.79 (95% CI 0.74–0.83)	0.65–0.95	77.7	0.67
Multi-test algorithms	2	0.60 (95% CI 0.25–1.42)	—	99.1	
Procalcitonin	6	0.63 (95% CI 0.44–0.89)	0.18–2.13	95.7	
Group A streptococcus tests	5	0.70 (95% CI 0.49–0.99)	0.18–2.68	96.0	
Viral/respiratory pathogen tests	3	0.78 (95% CI 0.56–1.09)	0.02–24.32	50.3	
Care setting					
Primary care and community	24	0.73 (95% CI 0.68–0.79)	0.53–1.01	92.2	0.99
Emergency department	5	0.74 (95% CI 0.55–1.01)	0.25–2.18	86.6	
Outpatient clinic	4	0.72 (95% CI 0.41–1.24)	0.05–9.59	96.8	
Country income group					
High-income	23	0.70 (95% CI 0.61–0.79)	0.38–1.28	91.3	0.13
Low- and middle-income	10	0.79 (95% CI 0.72–0.86)	0.56–1.10	94.8	
Population					
Adults	13	0.65 (95% CI 0.56–0.76)	0.36–1.18	90.9	0.03
Children	11	0.74 (95% CI 0.61–0.89)	0.37–1.47	94.9	
Mixed ages	9	0.83 (95% CI 0.76–0.92)	0.61–1.14	91.7	
Trial design					
Individually randomised	19	0.71 (95% CI 0.61–0.82)	0.37–1.34	93.5	0.34
Cluster randomised	14	0.76 (95% CI 0.71–0.83)	0.57–1.02	91.3	
Risk of bias					
Low	11	0.72 (95% CI 0.59–0.87)	0.35–1.47	95.1	0.78

Effectiveness of Point-of-Care Testing to Reduce Unnecessary Antibiotic Use: A Systematic Review and Meta-Analysis of Randomised Controlled Trials

Analysis	k	RR (95% CI)	95% PI	I ² (%)	p (subgroup)
Some concerns	22	0.74 (95% CI 0.69–0.80)	0.54–1.01	90.7	
<i>Sensitivity analyses</i>					
Low risk of bias only	11	0.72 (95% CI 0.59–0.87)	0.35–1.47	95.1	
Excluding derived or converted estimates	21	0.77 (95% CI 0.71–0.83)	0.56–1.07	92.5	
Excluding multi-test algorithms	31	0.74 (95% CI 0.70–0.79)	0.54–1.03	89.9	
Excluding unguided CRP trial (Khanna et al., 2025)	32	0.72 (95% CI 0.67–0.77)	0.51–1.03	92.5	
CRP trials in primary care only	12	0.78 (95% CI 0.71–0.84)	0.59–1.03	73.1	

Note. Random-effects (DerSimonian–Laird) meta-analysis of log risk ratios. p (subgroup) is the between-subgroup Q test. CI, confidence interval; CRP, C-reactive protein; PI, prediction interval; RR, risk ratio.

Effectiveness of Point-of-Care Testing to Reduce Unnecessary Antibiotic Use: A Systematic Review and Meta-Analysis of Randomised Controlled Trials

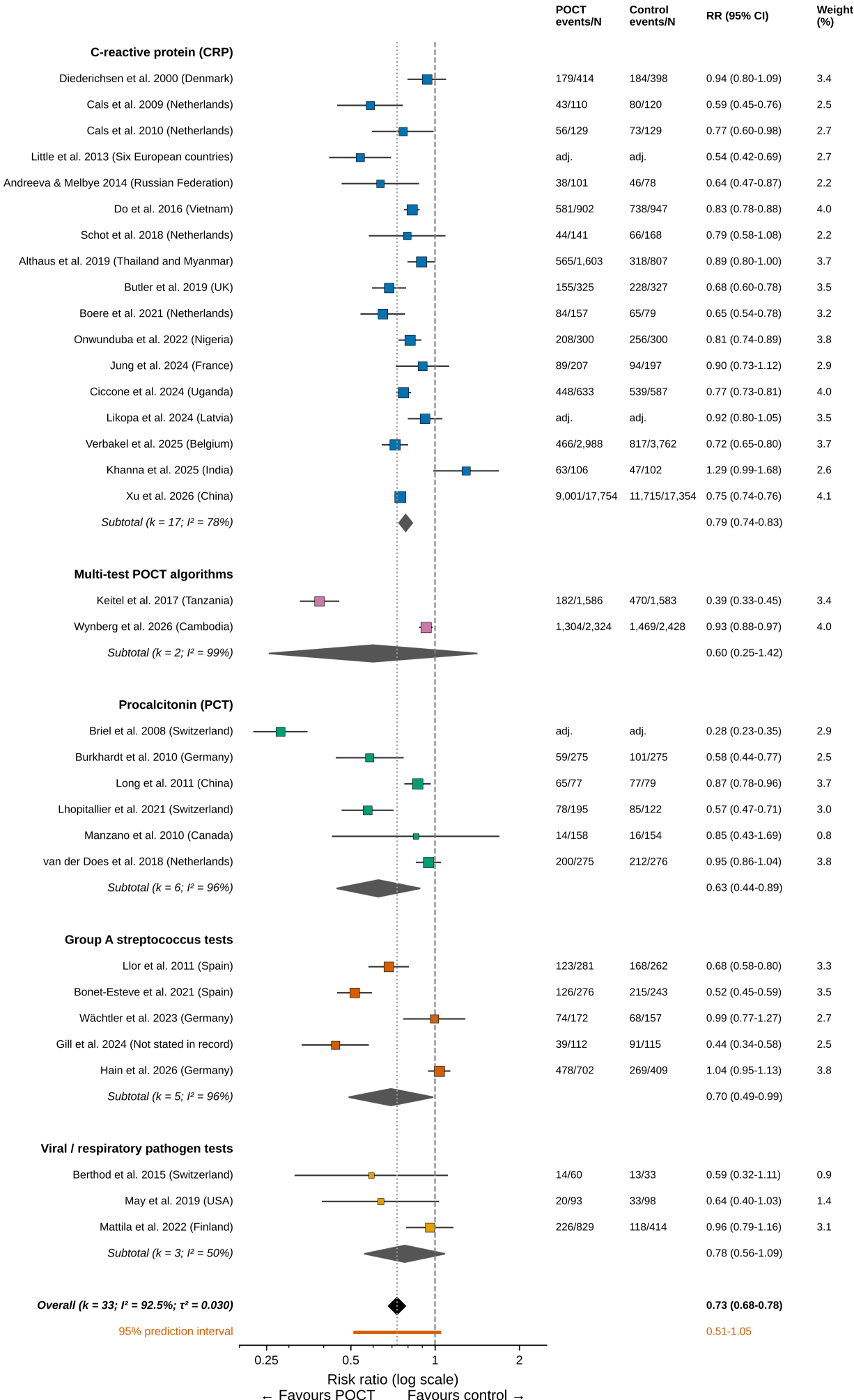


Figure 3. Forest plot of the effect of point-of-care testing on antibiotic prescribing, by test type ($k = 33$). Squares show trial risk ratios (marker size proportional to weight) with 95% CIs; diamonds show random-effects subtotals and the overall estimate; the orange bar shows the 95% prediction interval. 'adj.' indicates trials contributing an adjusted estimate. Data from Tables 2 and 4. CRP, C-reactive protein; PCT, procalcitonin; POCT, point-of-care testing; RR, risk ratio.

3.5 Subgroup, sensitivity and small-study analyses

Effects were similar in primary care and community settings (RR 0.73 (95% CI 0.68–0.79)) and emergency departments (RR 0.74 (95% CI 0.55–1.01); between-subgroup $p = 0.99$), and in high-income (RR 0.70 (95% CI 0.61–0.79)) and low- and middle-income countries (RR 0.79 (95% CI 0.72–0.86); $p = 0.13$) (Figure 4). The effect differed by population ($p = 0.03$): it was largest in adult-only trials (RR 0.65 (95% CI 0.56–0.76)), intermediate in children (RR 0.74 (95% CI 0.61–0.89)) and smallest in trials enrolling all ages (RR 0.83 (95% CI 0.76–0.92)). Individually and cluster-randomised trials gave similar estimates ($p = 0.34$), as did trials at low risk of bias and those with some concerns ($p = 0.78$).

All sensitivity analyses supported the main result, with pooled RRs between 0.72 and 0.78, and omitting any single trial changed the pooled RR only between 0.72 and 0.75. The funnel plot was broadly symmetrical (Egger $p = 0.54$), and control-arm prescribing did not modify the relative effect (meta-regression slope -0.05, 95% CI -0.36 to 0.26; $p = 0.75$) (Figure 5).

Effectiveness of Point-of-Care Testing to Reduce Unnecessary Antibiotic Use: A Systematic Review and Meta-Analysis of Randomised Controlled Trials

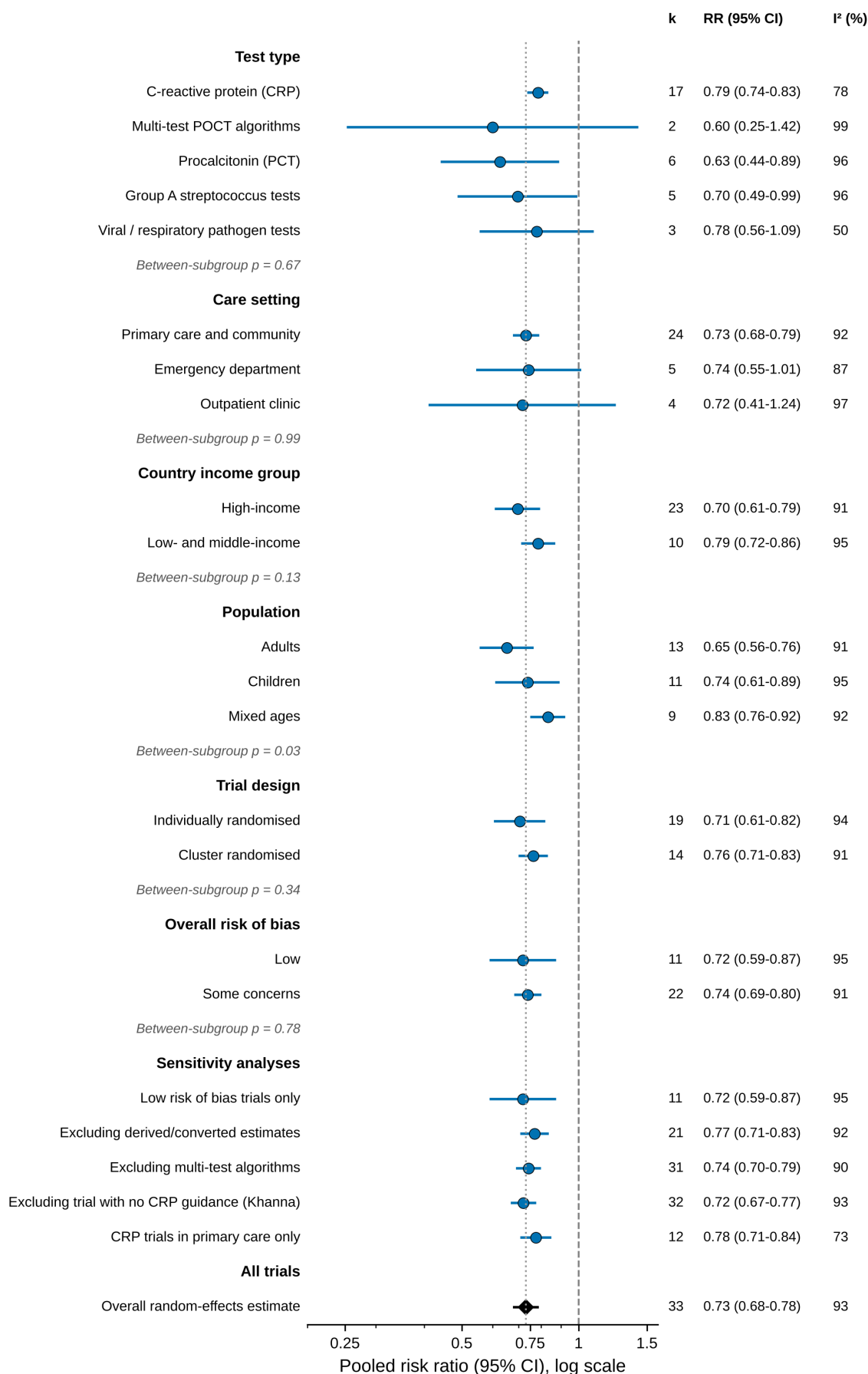


Figure 4. Pooled risk ratios for antibiotic prescribing by prespecified subgroup and in sensitivity analyses. Points show random-effects estimates with 95% CIs; between-subgroup p values are from Q tests. The dotted line marks the overall estimate. Data from Table 4. CRP, C-reactive protein; PCT, procalcitonin; POCT, point-of-care testing.

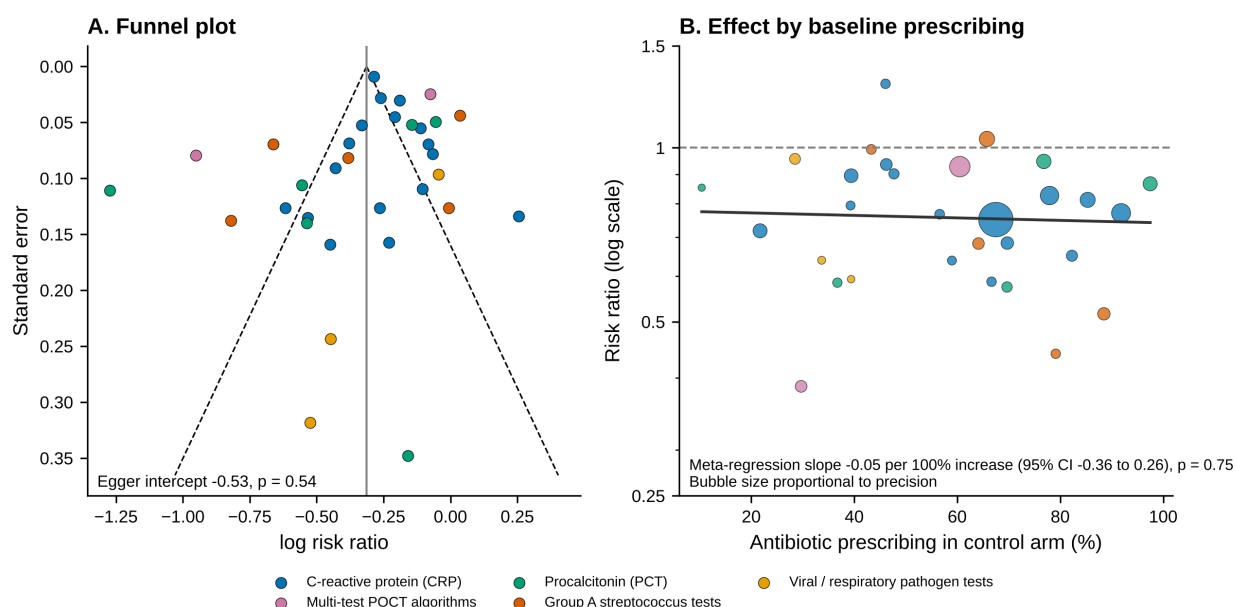


Figure 5. Assessment of small-study effects and effect modification. (A) Funnel plot of log risk ratios against standard errors with 95% pseudo-confidence limits; Egger regression test shown. (B) Random-effects meta-regression of trial risk ratios on control-arm antibiotic prescribing (bubble size proportional to precision). Data from the 30 trials with arm-level counts. CRP, C-reactive protein; PCT, procalcitonin; POCT, point-of-care testing.

3.6 Safety and patient outcomes

Trials that reported clinical outcomes generally found no detriment. Recovery, symptom duration and satisfaction were similar or better with POCT in primary care trials of CRP (Cals et al., 2009; Cals et al., 2010; Do et al., 2016; Butler et al., 2019; Verbakel et al., 2025), PCT (Briel et al., 2008; Burkhardt et al., 2010) and in nursing homes (Boere et al., 2021), and clinical failure was non-inferior with POCT-based algorithms in African children (Keitel et al., 2017; Ciccone et al., 2024). Two trials raised caution: in the earliest Danish trial, slightly more CRP-tested patients reported unchanged or worse illness at one week (12% vs 8%) (Diederichsen et al., 2000), and a Swiss PCT trial did not demonstrate non-inferiority for restricted-activity days (Lhopitallier et al., 2021). Previous meta-analyses report a small increase in re-consultation with CRP testing (Martínez-González et al., 2020) and a mortality reduction with PCT across settings (Schuetz et al., 2017).

3.7 Narrative synthesis of non-pooled trials

The 13 trials not suitable for pooling were consistent with the meta-analysis. Unguided or early CRP implementations showed no effect (Dahler-Eriksen et al., 1999; Lemiengre et al., 2018; Likopa et al., 2022) or a non-significant trend (Eley et al., 2020; Llor et al., 2024), and CRP added nothing when both arms already used a clinical algorithm in a US emergency department (Gonzales et al., 2008). Advance CRP and white-cell count testing roughly halved oral antibiotic prescriptions in a Japanese clinic (Takemura et al., 2005). For sore throat, rapid antigen tests lowered prescribing from 58% to 27% in Canadian family practice (Worrall et al., 2007), and a UK adaptive trial found that antigen testing and clinical scoring both reduced symptom severity compared with delayed prescribing (Little et al., 2013b). In paediatric emergency departments, rapid influenza or viral testing reduced antibiotic use only among virus-positive children or after discharge (Bonner et al.,

2003; Doan et al., 2008), and had no overall effect in a day-randomised trial (Poehling et al., 2006); combining PCT with influenza/RSV testing and pharmacist education did not reduce prescribing (Andrade et al., 2023).

3.8 Certainty of evidence

Certainty of evidence was moderate for the overall effect and for CRP, low for PCT, GAS and viral tests, and very low for multi-test algorithms (Table 5).

Table 5. Summary of findings and GRADE certainty of evidence for antibiotic prescribing

Comparison	Trials (participants)	RR (95% CI)	Prescriptions per 1,000 (control vs POCT)	Certainty	Reasons
All POCT	33 RCTs (72,680)	0.73 (95% CI 0.68–0.78)	597 vs 437	Moderate	Downgraded once for inconsistency ($I^2 > 90\%$); objective outcome; no small-study effect
C-reactive protein	17 RCTs	0.79 (95% CI 0.74–0.83)	597 vs 469	Moderate	Inconsistency (I^2 78%), although prediction interval excludes no effect
Procalcitonin	6 RCTs	0.63 (95% CI 0.44–0.89)	597 vs 375	Low	Inconsistency; indirectness (mix of primary care and ED populations)
Group A streptococcus tests	5 RCTs	0.70 (95% CI 0.49–0.99)	597 vs 416	Low	Inconsistency; imprecision (upper CI near 1)
Viral / multiplex tests	3 RCTs	0.78 (95% CI 0.56–1.09)	597 vs 466	Low	Imprecision; few trials, mostly in emergency departments
Multi-test algorithms	2 RCTs	0.60 (95% CI 0.25–1.42)	597 vs 359	Very low	Serious inconsistency and imprecision; different comparators

Note. Absolute effects assume the median control-arm prescribing rate across trials. ED, emergency department; POCT, point-of-care testing; RCT, randomised controlled trial; RR, risk ratio.

4. Discussion

4.1 Principal findings

This review of 46 randomised trials found that POCT-guided care reduces antibiotic prescribing in ambulatory settings by about a quarter (RR 0.73), equivalent to one prescription avoided for every six patients tested at typical baseline prescribing levels. The effect was most robust for CRP, held in high-income and low- and middle-income countries and in primary care and emergency settings, and was not explained by small-study effects or by individual trials. The wide prediction interval, however, shows that effects vary considerably between settings, and several trials found no benefit.

4.2 Comparison with previous reviews

The pooled CRP estimate (RR 0.79) closely matches the Cochrane estimate of 0.77 for CRP in primary care (Smedemark et al., 2022) and the 0.79 reported by Martínez-González et al. (2020). The present review adds more recent pragmatic trials, including large trials in Chinese village clinics (Xu et al., 2026), Belgian children (Verbakel et al., 2025) and Ugandan community health workers (Ciccone et al., 2024), and a trial in community pharmacies (Onwunduba et al., 2022). The limited effect of viral tests agrees with a meta-analysis of influenza POCT in ambulatory care (antibiotic RR 0.97) (Lee et al., 2019) and a 2026 review of molecular respiratory POCT (RR 0.95) (Li et al., 2026), which found benefits mainly in children. For sore throat, the effect of GAS testing depends on the comparator: tests reduce prescribing when they replace empirical treatment but add little where clinical scores or rapid tests are already used, in line with health technology assessment findings (Fraser et al., 2020).

4.3 What makes POCT work

Across trials, the test result changed prescribing only when it was embedded in a clear decision pathway. CRP with defined thresholds, training or communication support produced the largest effects (Cals et al., 2009; Little et al., 2013; Butler et al., 2019), whereas CRP made available without guidance had little or no effect (Lemiengre et al., 2018; Khanna et al., 2025). In Cambodia, almost half of patients for whom the algorithm advised against antibiotics still received them (Wynberg et al., 2026), and in Spain 31% of patients with a negative rapid streptococcal test were prescribed antibiotics (Llor et al., 2011). In China, the test was used in only 7.4% of consultations yet prescribing still fell, suggesting that the accompanying education and patient materials contributed to the effect (Xu et al., 2026). POCT should therefore be implemented as part of a stewardship package rather than as a stand-alone device.

4.4 The Saudi and regional context

The absence of any randomised POCT trial from Saudi Arabia, the GCC or the wider Middle East is the most important gap identified. Local observational data suggest the potential benefit could be large: antibiotic prescribing in Saudi primary care and paediatric emergency settings ranges from 24% to 79% for respiratory and pharyngitis presentations, with much of it judged inappropriate (Olwi & Olwi, 2021; Al-Baghli et al., 2023a; Alharbi et al., 2024). In Dammam, a positive rapid antigen test was a strong predictor of prescribing, yet GAS positivity was only 0.6% in primary care centres and 14% in the paediatric emergency department, suggesting that most sore-throat prescriptions in primary care could be avoided (Al-Baghli et al., 2023a; Al-Baghli et al., 2023b). High public expectation of antibiotics (van der Velden et al., 2020) and frequent non-prescription supply through pharmacies (Badr et al., 2021) point to two settings — the consultation and the community pharmacy — in which POCT could act, as demonstrated in the Nigerian pharmacy trial (Onwunduba et al., 2022) and in pharmacy POCT programmes elsewhere (Saha et al., 2026). National stakeholder papers in Saudi Arabia and the United Arab Emirates have called for rapid molecular POCT for respiratory infections (Assiri et al., 2024; Dhaini et al., 2024); the present findings suggest that low-cost CRP testing with prescribing guidance has the strongest trial evidence, whereas molecular respiratory panels have not consistently reduced antibiotic use.

4.5 Implications for practice and research

- **Practice:** Introduce CRP POCT for acute respiratory infections in primary care together with explicit thresholds, safety-netting advice and communication training; use GAS testing where empirical treatment of sore throat is common.
- **Policy in Saudi Arabia:** Align POCT introduction with the national antimicrobial stewardship programme, laboratory quality requirements for near-patient testing (training, internal quality control and external quality assessment), reimbursement and electronic documentation of results with the prescription.
- **Research:** Conduct pragmatic cluster-randomised trials of CRP and GAS POCT in Saudi primary health care centres, paediatric emergency departments and community pharmacies, reporting prescribing, re-consultation, safety and cost-effectiveness, and including the high-volume Hajj and Umrah settings.

4.6 Strengths and limitations

Strengths include a broad synthesis across test types and ambulatory settings, inclusion of recent large pragmatic trials, prediction intervals, multiple sensitivity analyses and explicit benchmarking against the Saudi and Gulf context.

Several limitations require attention before submission. Only PubMed was searched, so trials indexed elsewhere (Embase, CINAHL, CENTRAL, regional databases) may be missing. Screening, extraction and risk-of-bias assessment were performed by a single reviewer with AI assistance and relied on abstracts and open-access full texts; duplicate independent extraction from full reports is needed. For twelve trials, arm sizes or counts were reconstructed from percentages, or adjusted effects were used or converted, although excluding them did not change the conclusion. Cluster trials were pooled using unadjusted counts, which underestimates their uncertainty. Outcome timing varied (index consultation versus follow-up), and heterogeneity was substantial. Finally, no trial came from the GCC-MENA region, so applicability to Saudi Arabia is inferred rather than demonstrated.

5. Conclusions

Point-of-care testing reduces antibiotic prescribing for acute infections in ambulatory care by about a quarter, with the most consistent evidence for CRP used alongside clear prescribing guidance. Effects are weaker when tests are introduced without decision support or when clinicians already use rapid tests. Given high and often unnecessary antibiotic use in Saudi primary and emergency care, and the absence of local trials, carefully evaluated implementation of CRP and GAS POCT within national stewardship and laboratory quality frameworks is a priority.

Declarations

Ethics approval and consent: Not applicable; this review used published aggregate data.

Registration: Not prospectively registered. Registration in PROSPERO is recommended before submission of an expanded version.

Funding: No specific funding was received.

Conflicts of interest: The author declares no conflicts of interest.

Data availability: Extracted data are provided in Tables 2–5 and Supplementary Tables S1–S3; analysis code is available from the author on request.

Author contributions: A.A.A: conceived the review; approved the final manuscript. F.A.A.: defined the eligibility criteria; approved the final manuscript. H.F.A: interpreted the findings; approved the final manuscript. T.A.A: approved the final manuscript. A.H.A: approved the final manuscript.

Use of artificial intelligence: An AI assistant (Claude, Anthropic) was used to run the PubMed searches, support screening and data extraction, perform the meta-analysis, generate figures and draft the text. The author reviewed and verified the content and takes full responsibility for it.

References

- Al-Baghli, N. A., Al Saif, A. Z., Al Dorazi, S. A., Zainaldeen, M. H., Alameer, A. H., Albaghli, S., Al-Dawood, A. M., Buhelaiga, S. M., Alsalim, B. S., & Rabaan, A. A. (2023). Antibiotic-prescribing patterns among patients with respiratory symptoms in the Eastern Province, Kingdom of Saudi Arabia. *Cureus*, *15*(8), Article e44298. <https://doi.org/10.7759/cureus.44298>
- Al-Baghli, N. A., Al Saif, A., Al Dorazi, S. A., Bukhamseen, A. Y., Al Eithan, M., Albannai, A. R., Buhaliqa, Z. A., Bu-Khamseen, M. A., Alyousef, B., & Rabaan, A. A. (2023). Prevalence of positive rapid antigen detection test for Group A Streptococcus among patients with respiratory symptoms in Eastern Province, Kingdom of Saudi Arabia. *Cureus*, *15*(11), Article e48607. <https://doi.org/10.7759/cureus.48607>
- Alharbi, A. S., Alharbi, M. S., Almutairi, K. B., Alsaady, R. M., Alsaedi, R. M., & Alhejaili, R. S. (2024). The behavior of primary healthcare doctors toward antibiotic prescriptions for upper respiratory tract infections. *Cureus*, *16*(1), Article e53298. <https://doi.org/10.7759/cureus.53298>
- Althaus, T., Greer, R. C., Swe, M. M. M., Cohen, J., Tun, N. N., Heaton, J., Nedsuwan, S., Intralawan, D., Sumpradit, N., Dittrich, S., Doran, Z., Waithira, N., Thu, H. M., Win, H., Thaipadungpanit, J., Srilohasin, P., Mukaka, M., Smit, P. W., Charoenboon, E. N., . . . Lubell, Y. (2019). Effect of point-of-care C-reactive protein testing on antibiotic prescription in febrile patients attending primary care in Thailand and Myanmar: An open-label, randomised, controlled trial. *The Lancet Global Health*, *7*(1), Article e119-e131. [https://doi.org/10.1016/S2214-109X\(18\)30444-3](https://doi.org/10.1016/S2214-109X(18)30444-3)
- Andrade, A., Bang, H., Reddick, K., Villaseñor, B., Tran, N. K., & May, L. (2023). Evaluation of pharmacist guided intervention using procalcitonin and respiratory virus testing. *American Journal of Emergency Medicine*, *66*, 146–151. <https://doi.org/10.1016/j.ajem.2023.01.041>
- Andreeva, E., & Melbye, H. (2014). Usefulness of C-reactive protein testing in acute cough/respiratory tract infection: An open cluster-randomized clinical trial with C-reactive protein testing in the intervention group. *BMC Family Practice*, *15*, Article 80. <https://doi.org/10.1186/1471-2296-15-80>
- Assiri, A. M., Alshahrani, A. M., Sakkiha, H., AlGeer, A., Zeitouni, M., AlGohary, M., Dhaini, L., Verma, R., & Singh, H. (2024). Transforming respiratory tract infection diagnosis in the Kingdom of Saudi Arabia through point-of-care testing: A white paper for policy makers. *Diagnostic Microbiology and Infectious Disease*, *110*(4), Article 116530. <https://doi.org/10.1016/j.diagmicrobio.2024.116530>
- Badr, A. F., Humedi, R. A., Alfarsi, N. A., & Alghamdi, H. A. (2021). Rapid antigen detection test (RADT) for pharyngitis diagnosis in children: Public and pharmacist perception. *Saudi Pharmaceutical Journal*, *29*(7), 677–681. <https://doi.org/10.1016/j.jsps.2021.04.029>
- Berthod, D., Genton, B., Hatz, C., Blum, J., & de Vallière, S. (2015). Ability of physicians to diagnose influenza and usefulness of a rapid influenza antigen test in febrile returning travelers: A randomized controlled trial. *Travel Medicine and Infectious Disease*, *13*(5), 394–399. <https://doi.org/10.1016/j.tmaid.2015.08.001>
- Boere, T. M., van Buul, L. W., Hopstaken, R. M., van Tulder, M. W., Twisk, J. W. M. R., Verheij, T. J. M., & Hertogh, C. M. P. M. (2021). Effect of C reactive protein point-of-care testing on antibiotic prescribing for lower respiratory tract infections in nursing home residents: Cluster randomised controlled trial. *BMJ*, *374*, Article n2198. <https://doi.org/10.1136/bmj.n2198>
- Bonet-Esteve, A. M., Font-Ribera, L., Dorca-Vila, J., Retamal-Cañiz, A., Roura-Poch, P., & Vidal-Alaball, J. (2021). [Introduction of rapid streptococcal antigen test: Can its use improve adherence to antibiotic therapy?] *Atención Primaria*, *53*(10), Article 102102. <https://doi.org/10.1016/j.aprim.2021.102102>
- Bonner, A. B., Monroe, K. W., Talley, L. I., Klasner, A. E., & Kimberlin, D. W. (2003). Impact of the rapid diagnosis of influenza on physician decision-making and patient management in the pediatric emergency department: Results of a randomized, prospective, controlled trial. *Pediatrics*, *112*(2), 363–367. <https://doi.org/10.1542/peds.112.2.363>
- Briel, M., Schuetz, P., Mueller, B., Young, J., Schild, U., Nusbaumer, C., Périat, P., Bucher, H. C., & Christ-Crain, M. (2008). Procalcitonin-guided antibiotic use vs a standard approach for acute respiratory tract infections in primary care. *Archives of Internal Medicine*, *168*(18), 2000–2007. <https://doi.org/10.1001/archinte.168.18.2000>

- Burkhardt, O., Ewig, S., Haagen, U., Giersdorf, S., Hartmann, O., Wegscheider, K., Hummers-Pradier, E., & Welte, T. (2010). Procalcitonin guidance and reduction of antibiotic use in acute respiratory tract infection. *European Respiratory Journal*, 36(3), 601–607. <https://doi.org/10.1183/09031936.00163309>
- Butler, C. C., Gillespie, D., White, P., Bates, J., Lowe, R., Thomas-Jones, E., Wootton, M., Hood, K., Phillips, R., Melbye, H., Llor, C., Cals, J. W. L., Naik, G., Kirby, N., Gal, M., Riga, E., & Francis, N. A. (2019). C-reactive protein testing to guide antibiotic prescribing for COPD exacerbations. *New England Journal of Medicine*, 381(2), 111–120. <https://doi.org/10.1056/NEJMoa1803185>
- Cals, J. W., Butler, C. C., Hopstaken, R. M., Hood, K., & Dinant, G. J. (2009). Effect of point of care testing for C reactive protein and training in communication skills on antibiotic use in lower respiratory tract infections: Cluster randomised trial. *BMJ*, 338, Article b1374. <https://doi.org/10.1136/bmj.b1374>
- Cals, J. W., Schot, M. J., de Jong, S. A., Dinant, G. J., & Hopstaken, R. M. (2010). Point-of-care C-reactive protein testing and antibiotic prescribing for respiratory tract infections: A randomized controlled trial. *Annals of Family Medicine*, 8(2), 124–133. <https://doi.org/10.1370/afm.1090>
- Ciccone, E. J., Hu, D., Preisser, J. S., Cassidy, C. A., Kabugho, L., Emmanuel, B., Kibaba, G., Mwebembezi, F., Juliano, J. J., Mulogo, E. M., & Boyce, R. M. (2024). Point-of-care C-reactive protein measurement by community health workers safely reduces antimicrobial use among children with respiratory illness in rural Uganda: A stepped wedge cluster randomized trial. *PLoS Medicine*, 21(8), Article e1004416. <https://doi.org/10.1371/journal.pmed.1004416>
- Dahler-Eriksen, B. S., Lauritzen, T., Lassen, J. F., Lund, E. D., & Brandslund, I. (1999). Near-patient test for C-reactive protein in general practice: Assessment of clinical, organizational, and economic outcomes. *Clinical Chemistry*, 45(4), 478–485. <https://pubmed.ncbi.nlm.nih.gov/10102907/>
- DerSimonian, R., & Laird, N. (1986). Meta-analysis in clinical trials. *Controlled Clinical Trials*, 7(3), 177–188. [https://doi.org/10.1016/0197-2456\(86\)90046-2](https://doi.org/10.1016/0197-2456(86)90046-2)
- Dhaini, L., Verma, R., Gadir, M. A., Singh, H., Farghaly, M., Abdelmutalib, T., Osman, A., Alsayegh, K., Gharib, S. B., Mahboub, B., Suliman, E., Konstantinopoulou, S., Polumuru, S. R., & Pargi, S. (2024). Recommendations on rapid diagnostic point-of-care molecular tests for respiratory infections in the United Arab Emirates. *The Open Respiratory Medicine Journal*, 18, Article e18743064319029. <https://doi.org/10.2174/0118743064319029240815074449>
- Diederichsen, H. Z., Skamling, M., Diederichsen, A., Grinsted, P., Antonsen, S., Petersen, P. H., Munck, A. P., & Kragstrup, J. (2000). Randomised controlled trial of CRP rapid test as a guide to treatment of respiratory infections in general practice. *Scandinavian Journal of Primary Health Care*, 18(1), 39–43. <https://doi.org/10.1080/02813430050202541>
- Do, N. T., Ta, N. T., Tran, N. T., Than, H. M., Vu, B. T., Hoang, L. B., van Doorn, H. R., Vu, D. T., Cals, J. W., Chandna, A., Lubell, Y., Nadjm, B., Thwaites, G., Wolbers, M., Nguyen, K. V., & Wertheim, H. F. (2016). Point-of-care C-reactive protein testing to reduce inappropriate use of antibiotics for non-severe acute respiratory infections in Vietnamese primary health care: A randomised controlled trial. *The Lancet Global Health*, 4(9), e633–e641. [https://doi.org/10.1016/S2214-109X\(16\)30142-5](https://doi.org/10.1016/S2214-109X(16)30142-5)
- Doan, Q. H., Kisson, N., Dobson, S., Whitehouse, S., Cochrane, D., Schmidt, B., & Thomas, E. (2008). A randomized, controlled trial of the impact of early and rapid diagnosis of viral infections in children brought to an emergency department with febrile respiratory tract illnesses. *Journal of Pediatrics*, 154(1), 91–95. <https://doi.org/10.1016/j.jpeds.2008.07.043>
- Eley, C. V., Sharma, A., Lee, H., Charlett, A., Owens, R., & McNulty, C. A. M. (2020). Effects of primary care C-reactive protein point-of-care testing on antibiotic prescribing by general practice staff: Pragmatic randomised controlled trial, England, 2016 and 2017. *Eurosurveillance*, 25(44). <https://doi.org/10.2807/1560-7917.ES.2020.25.44.1900408>
- Fraser, H., Gallacher, D., Achana, F., Court, R., Taylor-Phillips, S., Nduka, C., Stinton, C., Willans, R., Gill, P., & Mistry, H. (2020). Rapid antigen detection and molecular tests for group A streptococcal infections for acute sore throat: Systematic reviews and economic evaluation. *Health Technology Assessment*, 24(31), 1–232. <https://doi.org/10.3310/hta24310>

- Gill, C., Chui, C., Goldfarb, D. M., Meckler, G., & Doan, Q. (2024). Molecular point-of-care testing in the emergency department for Group A Streptococcus pharyngitis: A randomized trial. *Pediatric Emergency Care*, 40(9), 632–637. <https://doi.org/10.1097/PEC.0000000000003154>
- Gonzales, R., Aagaard, E. M., Camargo, C. A., Ma, O. J., Plautz, M., Maselli, J. H., McCulloch, C. E., Levin, S. K., & Metlay, J. P. (2008). C-reactive protein testing does not decrease antibiotic use for acute cough illness when compared to a clinical algorithm. *Journal of Emergency Medicine*, 41(1), 1–7. <https://doi.org/10.1016/j.jemermed.2008.06.021>
- Guyatt, G. H., Oxman, A. D., Vist, G. E., Kunz, R., Falck-Ytter, Y., Alonso-Coello, P., & Schünemann, H. J. (2008). GRADE: An emerging consensus on rating quality of evidence and strength of recommendations. *BMJ*, 336(7650), 924–926. <https://doi.org/10.1136/bmj.39489.470347.AD>
- Hain, H., Jeanbat, V., Nevoret, C., Bureau, I., & Tenenbaum, T. (2026). Multi-center investigation on the influence of clinical characteristics and molecular group A streptococci diagnostics on the management of tonsillopharyngitis in pediatric practices in Berlin-BASE study. *European Journal of Pediatrics*, 185(3). <https://doi.org/10.1007/s00431-026-06818-5>
- Int'Hout, J., Ioannidis, J. P., Rovers, M. M., & Goeman, J. J. (2016). Plea for routinely presenting prediction intervals in meta-analysis. *BMJ Open*, 6(7). <https://doi.org/10.1136/bmjopen-2015-010247>
- Jung, C., Levy, C., Béchet, S., Aegerter, P., Cohen, R., & Touitou, R. (2024). Impact of C-reactive protein point-of-care testing on antibiotic prescriptions for children and adults with suspected respiratory tract infections in primary care: A French patient-level randomized controlled superiority trial. *Clinical Microbiology and Infection*, 30(12), 1553–1558. <https://doi.org/10.1016/j.cmi.2024.07.014>
- Keitel, K., Kagoro, F., Samaka, J., Masimba, J., Said, Z., Temba, H., Mlaganile, T., Sangu, W., Rambaud-Althaus, C., Gervais, A., Genton, B., & D'Acremont, V. (2017). A novel electronic algorithm using host biomarker point-of-care tests for the management of febrile illnesses in Tanzanian children (e-POCT): A randomized, controlled non-inferiority trial. *PLoS Medicine*, 14(10), Article e1002411. <https://doi.org/10.1371/journal.pmed.1002411>
- Khanna, S., Haseeb, M., Pania, A., Reddy, V. Y., Nelanuthala, M., & Sangle, A. L. (2025). Role of point-of-care C-reactive protein testing on antibiotic prescription in febrile children: A randomized controlled trial. *Cureus*, 17(9), Article e92646. <https://doi.org/10.7759/cureus.92646>
- Lee, J. J., Verbakel, J. Y., Goyder, C. R., Ananthakumar, T., Tan, P. S., Turner, P. J., Hayward, G., & Van den Bruel, A. (2019). The clinical utility of point-of-care tests for influenza in ambulatory care: A systematic review and meta-analysis. *Clinical Infectious Diseases*, 69(1), 24–33. <https://doi.org/10.1093/cid/ciy837>
- Lemiengre, M. B., Verbakel, J. Y., Colman, R., De Burghgraeve, T., Buntinx, F., Aertgeerts, B., De Baets, F., & De Sutter, A. (2018). Reducing inappropriate antibiotic prescribing for children in primary care: A cluster randomised controlled trial of two interventions. *British Journal of General Practice*, 68(668), Article e204-e210. <https://doi.org/10.3399/bjgp18X695033>
- Lhopitallier, L., Kronenberg, A., Meuwly, J. Y., Locatelli, I., Mueller, Y., Senn, N., D'Acremont, V., & Boillat-Blanco, N. (2021). Procalcitonin and lung ultrasonography point-of-care testing to determine antibiotic prescription in patients with lower respiratory tract infection in primary care: Pragmatic cluster randomised trial. *BMJ*, 374, Article n2132. <https://doi.org/10.1136/bmj.n2132>
- Li, Q., Zhou, Q., Fan, J., Feng, X., Lai, H., Chen, Y., Ye, Z., Song, F., Liu, J., Chen, D., Kang, R., Tang, D., Teboul, J. L., Timsit, J. F., Torres, A., De Waele, J. J., Carratalà, J., Jiang, J., Luo, Z., & Zeng, L. (2026). Impact of molecular point-of-care testing for respiratory pathogens on antibiotic use and clinical outcomes in acute respiratory tract infections: A systematic review and meta-analysis. *EClinicalMedicine*, 92, Article 103799. <https://doi.org/10.1016/j.eclim.2026.103799>
- Likopa, Z., Kivite-Urtane, A., Silina, V., & Pavare, J. (2022). Impact of educational training and C-reactive protein point-of-care testing on antibiotic prescribing in rural and urban family physician practices in Latvia: A randomised controlled intervention study. *BMC Pediatrics*, 22(1), Article 556. <https://doi.org/10.1186/s12887-022-03608-4>
- Likopa, Z., Kivite-Urtane, A., Strele, I., & Pavare, J. (2024). Effect of combination of point-of-care C-reactive protein testing and general practitioner education and long-term effect of education on reducing antibiotic prescribing

- for children presenting with acute infections in general practice in Latvia: A randomized controlled intervention study. *Antibiotics*, 13(9). <https://doi.org/10.3390/antibiotics13090867>
- Little, P., Hobbs, F. D., Moore, M., Mant, D., Williamson, I., McNulty, C., Cheng, Y. E., Leydon, G., McManus, R., Kelly, J., Barnett, J., Glasziou, P., & Mullee, M. (2013). Clinical score and rapid antigen detection test to guide antibiotic use for sore throats: Randomised controlled trial of PRISM (primary care streptococcal management). *BMJ*, 347, Article f5806. <https://doi.org/10.1136/bmj.f5806>
- Little, P., Stuart, B., Francis, N., Douglas, E., Tonkin-Crine, S., Anthierens, S., Cals, J. W., Melbye, H., Santer, M., Moore, M., Coenen, S., Butler, C., Hood, K., Kelly, M., Godycki-Cwirko, M., Mierzecki, A., Torres, A., Llor, C., Davies, M., . . . Yardley, L. (2013). Effects of internet-based training on antibiotic prescribing rates for acute respiratory-tract infections: A multinational, cluster, randomised, factorial, controlled trial. *The Lancet*, 382(9899), 1175–1182. [https://doi.org/10.1016/S0140-6736\(13\)60994-0](https://doi.org/10.1016/S0140-6736(13)60994-0)
- Llor, C., Madurell, J., Balagué-Corbella, M., Gómez, M., & Cots, J. M. (2011). Impact on antibiotic prescription of rapid antigen detection testing in acute pharyngitis in adults: A randomised clinical trial. *British Journal of General Practice*, 61(586), e244–e251. <https://doi.org/10.3399/bjgp11X572436>
- Llor, C., Trapero-Bertran, M., Sisó-Almirall, A., Monfà, R., Abellana, R., García-Sangenís, A., Moragas, A., & Morros, R. (2024). Effects of C-reactive protein rapid testing and communication skills training on antibiotic prescribing for acute cough. A cluster factorial randomised controlled trial. *npj Primary Care Respiratory Medicine*, 34(1), Article 9. <https://doi.org/10.1038/s41533-024-00368-9>
- Long, W., Deng, X., Zhang, Y., Lu, G., Xie, J., & Tang, J. (2011). Procalcitonin guidance for reduction of antibiotic use in low-risk outpatients with community-acquired pneumonia. *Respirology*, 16(5), 819–824. <https://doi.org/10.1111/j.1440-1843.2011.01978.x>
- Mahmood, R. K., Gillani, S. W., Saeed, M. W., Hafeez, M. U., & Gulam, S. M. (2020). Systematic review: Study of the prescribing pattern of antibiotics in outpatients and emergency departments in the Gulf region. *Frontiers in Pharmacology*, 11, Article 585051. <https://doi.org/10.3389/fphar.2020.585051>
- Manzano, S., Bailey, B., Girodias, J. B., Galetto-Lacour, A., Cousineau, J., & Delvin, E. (2010). Impact of procalcitonin on the management of children aged 1 to 36 months presenting with fever without source: A randomized controlled trial. *American Journal of Emergency Medicine*, 28(6), 647–653. <https://doi.org/10.1016/j.ajem.2009.02.022>
- Martínez-González, N. A., Keizer, E., Plate, A., Coenen, S., Valeri, F., Verbakel, J. Y. J., Rosemann, T., Neuner-Jehle, S., & Senn, O. (2020). Point-of-care C-reactive protein testing to reduce antibiotic prescribing for respiratory tract infections in primary care: Systematic review and meta-analysis of randomised controlled trials. *Antibiotics*, 9(9). <https://doi.org/10.3390/antibiotics9090610>
- Mattila, S., Paalanne, N., Honkila, M., Pokka, T., & Tapiainen, T. (2022). Effect of point-of-care testing for respiratory pathogens on antibiotic use in children: A randomized clinical trial. *JAMA Network Open*, 5(6), Article e2216162. <https://doi.org/10.1001/jamanetworkopen.2022.16162>
- May, L., Tatro, G., Poltavskiy, E., Mooso, B., Hon, S., Bang, H., & Polage, C. (2019). Rapid multiplex testing for upper respiratory pathogens in the emergency department: A randomized controlled trial. *Open Forum Infectious Diseases*, 6(12), Article ofz481. <https://doi.org/10.1093/ofid/ofz481>
- Olwi, R. I., & Olwi, D. I. (2021). Trends in the use of antibiotics for pharyngitis in Saudi Arabia. *Journal of Infection in Developing Countries*, 15(3), 415–421. <https://doi.org/10.3855/jidc.12822>
- Onwunduba, A., Ekwunife, O., & Onyilogwu, E. (2022). Impact of point-of-care C-reactive protein testing intervention on non-prescription dispensing of antibiotics for respiratory tract infections in private community pharmacies in Nigeria: A cluster randomized controlled trial. *International Journal of Infectious Diseases*, 127, 137–143. <https://doi.org/10.1016/j.ijid.2022.12.006>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., . . . Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, Article n71. <https://doi.org/10.1136/bmj.n71>

- Poehling, K. A., Zhu, Y., Tang, Y. W., & Edwards, K. (2006). Accuracy and impact of a point-of-care rapid influenza test in young children with respiratory illnesses. *Archives of Pediatrics & Adolescent Medicine*, 160(7), 713–718. <https://doi.org/10.1001/archpedi.160.7.713>
- Saha, S. K., Promite, S., Botheras, C. L., Manias, E., Mothobi, N., Robinson, S., & Athan, E. (2026). Point-of-care testing in community pharmacies to improve antimicrobial stewardship in respiratory infections: A scoping review of effectiveness, implementation and cost-effectiveness. *JAC-Antimicrobial Resistance*, 8(3), Article dlag106. <https://doi.org/10.1093/jacamr/dlag106>
- Schot, M. J., Van den Bruel, A., Broekhuizen, B. D., Cals, J. W., Noteboom, E. A., Balemans, W., Hopstaken, R. M., van Delft, S., de Wit, N. J., & Verheij, T. J. (2018). Point-of-care C-reactive protein to assist in primary care management of children with suspected non-serious lower respiratory tract infection: A randomised controlled trial. *BJGP Open*, 2(3), Article bjgpopen18X101600. <https://doi.org/10.3399/bjgpopen18X101600>
- Schuetz, P., Wirz, Y., Sager, R., Christ-Crain, M., Stolz, D., Tamm, M., Bouadma, L., Luyt, C. E., Wolff, M., Chastre, J., Tubach, F., Kristoffersen, K. B., Burkhardt, O., Welte, T., Schroeder, S., Nobre, V., Wei, L., Bucher, H. C., Annane, D., . . . Mueller, B. (2017). Effect of procalcitonin-guided antibiotic treatment on mortality in acute respiratory infections: A patient level meta-analysis. *The Lancet Infectious Diseases*, 18(1), 95–107. [https://doi.org/10.1016/S1473-3099\(17\)30592-3](https://doi.org/10.1016/S1473-3099(17)30592-3)
- Smedemark, S. A., Aabenhus, R., Llor, C., Fournaise, A., Olsen, O., & Jørgensen, K. J. (2022). Biomarkers as point-of-care tests to guide prescription of antibiotics in people with acute respiratory infections in primary care. *Cochrane Database of Systematic Reviews*, 10(10), Article CD010130. <https://doi.org/10.1002/14651858.CD010130.pub3>
- Sterne, J. A. C., Savović, J., Page, M. J., Elbers, R. G., Blencowe, N. S., Boutron, I., Cates, C. J., Cheng, H.-Y., Corbett, M. S., Eldridge, S. M., Emberson, J. R., Hernán, M. A., Hopewell, S., Hróbjartsson, A., Junqueira, D. R., Jüni, P., Kirkham, J. J., Lasserson, T., Li, T., . . . Higgins, J. P. T. (2019). RoB 2: A revised tool for assessing risk of bias in randomised trials. *BMJ*, 366, Article l4898. <https://doi.org/10.1136/bmj.l4898>
- Takemura, Y., Ishida, H., Saitoh, H., Kure, H., Kakoi, H., Ebisawa, K., & Kure, M. (2005). Economic consequence of immediate testing for C-reactive protein and leukocyte count in new outpatients with acute infection. *Clinica Chimica Acta*, 360(1-2), 114–121. <https://doi.org/10.1016/j.cccn.2005.04.017>
- Tonkin-Crine, S. K., Tan, P. S., van Hecke, O., Wang, K., Roberts, N. W., McCullough, A., Hansen, M. P., Butler, C. C., & Del Mar, C. B. (2017). Clinician-targeted interventions to influence antibiotic prescribing behaviour for acute respiratory infections in primary care: An overview of systematic reviews. *Cochrane Database of Systematic Reviews*, 9(9), Article CD012252. <https://doi.org/10.1002/14651858.CD012252.pub2>
- van der Does, Y., Limper, M., Jie, K. E., Schuit, S. C. E., Jansen, H., Pernot, N., van Rosmalen, J., Poley, M. J., Ramakers, C., Patka, P., van Gorp, E. C. M., & Rood, P. P. M. (2018). Procalcitonin-guided antibiotic therapy in patients with fever in a general emergency department population: A multicentre non-inferiority randomized clinical trial (HiTEMP study). *Clinical Microbiology and Infection*, 24(12), 1282–1289. <https://doi.org/10.1016/j.cmi.2018.05.011>
- van der Velden, A. W., Sessa, A., Altiner, A., Pignatari, A. C. C., & Shephard, A. (2020). Patients with sore throat: A survey of self-management and healthcare-seeking behavior in 13 countries worldwide. *Pragmatic and Observational Research*, 11, 91–102. <https://doi.org/10.2147/POR.S255872>
- Verbakel, J. Y., Burvenich, R., D'hulster, E., De Rop, L., Van den Bruel, A., Anthierens, S., Coenen, S., De Sutter, A., Heytens, S., Joly, L., Digregorio, M., Laenen, A., Luyten, J., & De Burghgraeve, T. (2025). A clinical decision tool including a decision tree, point-of-care testing of CRP, and safety-netting advice to guide antibiotic prescribing in acutely ill children in primary care in Belgium (ARON): A pragmatic, cluster-randomised, controlled trial. *The Lancet*, 406(10512), 1599–1610. [https://doi.org/10.1016/S0140-6736\(25\)01239-5](https://doi.org/10.1016/S0140-6736(25)01239-5)
- World Health Organization. (2022). The WHO AWaRe (Access, Watch, Reserve) antibiotic book. World Health Organization. <https://www.who.int/publications/i/item/9789240062382>
- Worrall, G., Hutchinson, J., Sherman, G., & Griffiths, J. (2007). Diagnosing streptococcal sore throat in adults: Randomized controlled trial of in-office aids. *Canadian Family Physician*, 53(4), 666–671. <https://pubmed.ncbi.nlm.nih.gov/17872717/>

- Wynberg, E., Mishra, A., Liverani, M., Vanna, M., Chanpheakdey, P., Chaikul, K., Suy, K., Bory, S., Voeurng, B., Callery, J. J., Chandna, A., Adhikari, B., Chamsukhee, V., Waithira, N., Tubprasert, J., Poonchai, A., Davoeung, C., Rekol, H., Nguon, C., . . . Chew, R. (2026). Impact of an electronic clinical decision support algorithm (eCDSA) on antibiotic prescribing in primary care in Cambodia: A cluster randomised controlled trial. *International Journal of Infectious Diseases*, 164, Article 108382. <https://doi.org/10.1016/j.ijid.2026.108382>
- Wächtler, H., Kaduszkiewicz, H., Kuhnert, O., Malottki, K. A., Maaß, S., Hedderich, J., Wiese, B., Donner-Banzhoff, N., & Hansmann-Wiest, J. (2023). Influence of a guideline or an additional rapid strep test on antibiotic prescriptions for sore throat: The cluster randomized controlled trial of HALS (Hals und Antibiotika Leitlinien Strategien). *BMC Primary Care*, 24(1), Article 75. <https://doi.org/10.1186/s12875-023-01987-w>
- Xu, M., Wang, J., Zhang, Z., Ge, E., Zhu, Y., Li, J., Gong, Y., Lu, Z., Wei, X., & Yin, X. (2026). Effect of a comprehensive package based on combined C-reactive protein and serum amyloid A point-of-care testing on antibiotic prescribing for acute respiratory tract infections at village clinics in China: A cluster randomised controlled trial. *The Lancet Regional Health - Western Pacific*, 71, Article 101888. <https://doi.org/10.1016/j.lanwpc.2026.101888>

Effectiveness of Point-of-Care Testing to Reduce Unnecessary Antibiotic Use: A Systematic Review and Meta-Analysis of Randomised Controlled Trials

Supplementary material

Supplementary Table S1. PubMed search strategies (4 October 2026)

#	Focus	Search string	Records
1	CRP POCT	("C-reactive protein"[tiab] OR CRP[tiab]) AND ("point-of-care"[tiab] OR "point of care"[tiab] OR "near-patient"[tiab]) AND (antibiotic[tiab] OR antimicrobial[tiab]) AND (randomized[tiab] OR randomised[tiab] OR trial[tiab])	114
2	Procalcitonin	procalcitonin[tiab] AND (antibiotic[tiab] OR antimicrobial[tiab]) AND (randomized[tiab] OR randomised[tiab]) AND ("primary care"[tiab] OR "general practice"[tiab] OR outpatient*[tiab] OR "emergency department"[tiab] OR ambulatory[tiab]) NOT (intensive care[ti] OR ICU[ti] OR sepsis[ti])	57
3	Pathogen tests	("rapid antigen"[tiab] OR "rapid strep"[tiab] OR "rapid antigen detection"[tiab] OR "rapid streptococcal"[tiab] OR "rapid influenza"[tiab] OR "rapid viral"[tiab] OR "multiplex PCR"[tiab] OR "molecular point-of-care"[tiab]) AND antibiotic*[tiab] AND (randomized[tiab] OR randomised[tiab])	76
4	GCC-MENA filter	("point-of-care"[tiab] OR "point of care"[tiab] OR "rapid test"[tiab] OR "rapid diagnostic"[tiab] OR procalcitonin[tiab] OR "C-reactive protein"[tiab]) AND antibiotic*[tiab] AND ("Saudi Arabia" OR Riyadh OR Kuwait OR Qatar OR "United Arab Emirates" OR Oman OR Bahrain OR Gulf OR Jordan OR Lebanon OR Egypt OR Iran OR "Middle East")[tiab]	88
5	Reviews	("point-of-care testing" OR "point-of-care tests" OR "point-of-care test")[tiab] AND ("antibiotic prescribing" OR "antibiotic prescriptions" OR "antibiotic use")[tiab] AND (systematic review[pt] OR meta-analysis[pt] OR "systematic review"[ti])	33
6	Landmark trials	(Diederichsen HZ[au] AND C-reactive protein) OR (Melbye H[au] AND "C-reactive protein" AND randomised[tiab]) OR (PRUDENCE AND point-of-care AND antibiotic*) OR (Esposito S[au] AND "rapid influenza" AND children) OR (Poehling KA[au] AND rapid influenza)	18
7	Saudi trials	(procalcitonin OR "C-reactive protein" OR "rapid antigen" OR "point-of-care")[tiab] AND antibiotic*[tiab] AND ("Saudi Arabia" OR Riyadh OR Jeddah OR Dammam)[tiab] AND (trial OR randomized OR prospective OR "quasi-experimental" OR intervention)[tiab]	5
8	Saudi prescribing context	"Saudi Arabia"[tiab] AND ("antibiotic prescribing" OR "antibiotic prescriptions")[tiab] AND ("primary care" OR "primary health care" OR outpatient OR "respiratory tract infection")[tiab] (first 20 of 23 by relevance)	20
	Total	Identified 411; duplicates 34; screened 377	411

Supplementary Table S2. Records excluded after detailed assessment (n = 15)

PMID	Study	Reason
21081543	Llor et al., 2010	Non-randomised before–after controlled study
21880122	Kavanagh et al., 2011	Non-randomised pilot
29876774	Demoré et al., 2018	Non-randomised pharmacy study
29017451	Andrews et al., 2017	Quasi-randomised (alternate days), hospitalised patients
30982631	Montassier et al., 2019	Hospitalised pneumonia; duration outcome
31574339	Saarela et al., 2019	Acute hospital care; antibiotic days outcome
25934044	Drozdz et al., 2015	Hospital UTI; exposure duration outcome
28166743	Brendish et al., 2017	Protocol (ResPOC)
32792425	Hubert et al., 2020	Protocol (DIAFEVERCHILD)
34380724	Pernica et al., 2021	Protocol
39321629	Assiri et al., 2024	White paper (cited in Discussion)
39872239	Dhaini et al., 2024	Recommendations paper (cited in Discussion)
34400861	Badr et al., 2021	Survey (contextual evidence)
41732193	Li et al., 2026	Systematic review (cited in Discussion)
12765923	Esposito et al., 2003	No abstract or extractable data

Supplementary Table S3. Companion reports linked to included trials (n = 8)

PMID	Report
34844915	Boere et al., 2021 (duplicate indexing)
30354904	Lemiengre et al., 2018 (secondary analysis of ERNIE2)
20331895	Madurell et al., 2010 (FARINGOCAT protocol of Llor et al., 2011)
11466986	Diederichsen et al., 2001 (Danish-language report)
40920832	Xu et al., 2025 (protocol)
34980633	Verbakel et al., 2022 (ARON protocol)
32103747	Boere et al., 2020 (UPCARE protocol)
41162196	Likopa et al., 2025 (secondary analysis)