Evaluation of the organizational challenges of implementing POCT CRP in general practice for adults with acute cough.

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Table of contents

Abstract 5

Abstract (vertaald naar Nederlands) 6

Woord vooraf 7

Introduction 8

Background and epidemiology 8

Relevance within general practice 10

Context 11

Exploratory literature review 11

Research question 11

Search strategy 11

Findings 13

Can CRP POCT accurately estimate the need for antibiotics in respiratory tract infections? 13

Can the use of CRP POCT optimise GPs' antibiotic prescribing behaviour in adults with acute respiratory tract infections? 14

What is the opinion of the GP and the patients concerning POCT CRP? 15

Conclusion and added value of our study 16

Materials and methods 17

Study design 17

Study settings 17

Participant recruitment 18

Data collection 20

Data analysis 20

Results 21

Participant characteristics 21

POCT CTP is a minimally invasive test that guides treatment in cases of diagnostic uncertainty 23

POCT CRP reassures GPs when facing diagnostic uncertainty in patients with acute cough 23

POCT CRP is a minimal invasive test used by GPs when experiencing an uneasy gut feeling, with GPs finding it particularly useful in paediatric care as well as during home visits 24

Successful implementation of POCT CRP in GPs' workflow is supported by practical assistance by stakeholders and workflow integration 25

Installation and technical assistance by the laboratory and companies support easy implementation of POCT CRP in general practice 25

Easy incorporation of POCT CRP in GPs' existing workflow requires strategic device placement and physician flexibility as well as multitasking skills 26

Linkage of POCT CRP with EMR is not necessarily for GPs but could enhance continuity of care 28

Technical features of POCT CRP like small blood sample, quick and easy analyse and quality controls lead to an efficient and reliable CRP analyse in general practice 29
POCT CRP enhances decision-making and patient trust, but requires clinical context and careful interpretation 31
POCT CRP provides objective results, but requires clinical information to optimize decision-making 31
POCT CRP improves patient management, but requires careful interpretation 32
POCT CRP as a communication tool towards patients improves their trust in treatment choices 33
GPs who like to use POCT CRP in daily practice face challenges like the absence of guidelines, financial costs, and balancing objective results with clinical judgment 34
Discussion 35
Comparison with existing literature 36
Strength and limitations of this study 37
Implications for clinical practice and future research 38
Conclusion 38
References 39
Appendices 41
List of additional figures 41
Informed consent: Dutch 44
Interview guide Dutch 48
Survey: Dutch 50

Abstract

Background

Managing antimicrobial resistance (AMR) is an important challenge within the Belgian healthcare system. Improving antibiotic prescribing among general practitioners (GPs) could be important in addressing this issue. One potential solution is the implementation of point-of-care testing (POCT) for C-reactive protein (CRP) in general practice.

Objectives and methods

We explored the organizational challenges associated with the implementation of POCT CRP in general practice in Belgium. Participants were given the opportunity to use one or more POCT CRP devices in adults with acute cough over a three-month period. We conducted focus group discussions and a survey to gather their ideas and concerns regarding the implementation of the test.

Results

Implementing POCT CRP in daily general practice could offer GPs an additional tool to support their diagnostic and treatment decisions, alongside patient history and clinical examination. The primary motivation for using POCT CRP was to address diagnostic uncertainty. POCT CRP was easily integrated into the GP's existing workflow as it was a fast, simple and reliable test. However, the main obstacle to its implementation in Belgium is the financial aspect, as there is currently no reimbursement for these tests in general practice.

Conclusion

The ultimate goal of this study was to evaluate the implementation of POCT CRP with the intention to optimize antibiotic prescriptions among Belgian GPs to manage AMR. The objective results of POCT CRP could serve as a basis for decisions regarding diagnosis and treatment and could also function as a communication tool to help explain treatment decisions to patients. Further research should address the challenges highlighted in our study, particularly the reimbursement and development of guidelines. However, further research involving a larger sample of GPs from across Flanders, Brussels, and Wallonia needs to be performed.

Key words: Point-of-care test, CRP, Family Medicine, General practice

Abstract (vertaald naar Nederlands)

Achtergrond

Het aanpakken van antimicrobiële resistentie (AMR) vormt een belangrijke uitdaging voor de Belgische gezondheidszorg. Het verbeteren van het antibiotica voorschrijfgedrag van huisartsen kan bijdragen aan de oplossing voor dit probleem. De implementatie van point-of-care testen (POCT) voor C-reactief proteïne (CRP) in de huisartsenpraktijk is een mogelijke oplossing.

Doelstellingen en methoden

We onderzochten de organisatorische uitdagingen rondom de implementatie van POCT CRP in huisartsenpraktijken in België. De deelnemers kregen de mogelijkheid om gedurende drie maanden één of meerdere POCT CRP-apparaten te gebruiken bij volwassenen met acute hoest. Na afloop organiseerden we focusgroep discussies en een enquête om hun ideeën en bedenkingen over de implementatie van de test te verzamelen.

Resultaten

Het implementeren van POCT CRP in de dagelijkse praktijk zou huisartsen een ondersteuning kunnen bieden bij het maken van beslissingen rond diagnose en behandeling, naast de anamnese en klinisch onderzoek. De belangrijkste reden voor het gebruik van POCT CRP was het verminderen van diagnostische onzekerheid. De test was eenvoudig te integreren in de bestaande workflow van de huisarts, vanwege de snelheid, gebruiksvriendelijkheid en betrouwbaarheid ervan. Het grootste struikelblok voor de implementatie in België is echter het financiële aspect, aangezien er momenteel geen terugbetaling voor deze testen is in de huisartsenpraktijk.

Conclusie

Het doel van deze studie was om de implementatie van POCT CRP te evalueren met de bedoeling het voorschrijven van antibiotica bij Belgische huisartsen te optimaliseren om AMR te beperken. De objectieve resultaten van POCT CRP zouden kunnen dienen als basis voor beslissingen over diagnose en behandeling en zouden ook kunnen fungeren als communicatiemiddel naar patiënten. Verder onderzoek moet zich richten op de uitdagingen die in onze studie naar voren kwamen, met name de terugbetaling en de ontwikkeling van richtlijnen. Hiervoor is verder onderzoek nodig met een grotere steekproef van huisartsen uit zowel Vlaanderen, Brussel als Wallonië.

Trefwoorden: Point-of care test, CRP, Huisartsgeneeskunde, Huisarts

Woord vooraf

De afgelopen drie jaar heb ik gewerkt als huisarts-in-opleiding in diverse huisartsenpraktijken en heb ik bovendien een half jaar stagegelopen op de afdeling pediatrie van het Heilig Hart Ziekenhuis in Leuven. Gedurende deze opleiding maakte ik kennis met Point-of-care CRP-testen. De positieve ervaringen die ik hiermee opdeed, hebben mijn interesse gewekt om dit onderwerp verder te verkennen en bij te dragen aan de mogelijke implementatie ervan in de huisartsenpraktijk in België.

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Mol, 25 maart 2025 S.G.

Introduction

Background and epidemiology

The management of antimicrobial resistance (AMR) has been an important issue in our Belgian healthcare system for several years (1). The definition of AMR of the World Health Organisation (WHO) reads as follows: *"AMR occurs when bacteria, viruses, fungi and parasites change over time and no longer respond to medicines making infections harder to treat and increasing the risk of disease spread, severe illness and death. As a result, the medicines become ineffective and infections persist in the body, increasing the risk of spread to others"* (2).

The development of AMR is a natural selection process that micro-organisms undergo according to the 'survival of the fittest' principle (3,4). The microorganisms that are best adapted to their environment will survive. As an example, a bacterium that survives despite taking antibiotics has genetic material that makes this bacterium resistant to that type of antibiotics. So, when this bacterium starts to divide, a whole colony of bacteria resistant to these antibiotics is formed. When this colony of bacteria causes an infection, that type of antibiotics will no longer help fight these bacteria (3,4).

AMR is not only in Belgium but worldwide a public health threat. It is estimated that bacterial AMR was responsible for 1.27 million global deaths in 2019 (4). To better understand this problem, the WHO has been publishing a 'Global Antimicrobial resistance and use surveillance system: GLASS report' since 2015. The most recent GLASS report, from 2022, showed alarming high resistance rates for common bacterial pathogens. For example, the median percentage of methicillin-resistant Staphylococcus aureus (MRSA) is 35% (5).

In response to the alarming levels of AMR published by WHO, Belgium drew up an AMR National Action Plan in 2018 (1). It consists of ten guiding principles from which various objectives and actions were formulated. One of the guiding principles is: *"Set quantified and measurable targets to reduce antimicrobial use."* Specifically, the following three objectives were set for the general practice (1):

1. A gradual decrease of 5-10% per year in total AB consumption to reach an overall 40% decrease compared to 2019.
2. A decrease in the use of quinolones, to achieve a maximum consumption of 5% quinolones relative to total antibiotic consumption by 2024.
3. A continuous improvement in prescription quality (decrease in the prescription of broad-spectrum antibiotics relative to total antibiotics; increase in the amoxycillin/amoxycillin-clavulanic acid ratio from 51/49 in 2019 to a target value of 80/20 in 2024).

Figures obtained from a study conducted by the Independent Health Insurance in Belgium show that these targets have not yet been reached (1,6). Compared to the consumption rates of antibiotics in 2019, we see a decrease of 5% by the year of 2023 (6). It is an evolution in the right direction, however, this is still far from the target of achieving a 40% decrease by the end of 2024 (1). A decreasing trend can also be seen in the prescription of quinolones (10% of total antibiotic prescriptions in 2017 and 7% in 2023), however, the target of prescribing quinolones in up to 5% of total antibiotic prescriptions has not yet been reached (1,6). When we consider the ratio of broad-spectrum and narrow-spectrum antibiotics, we see a 54%/46% ratio of amoxycillin/amoxycillin-clavulanic acid in 2023 (6). In 2019, this ratio was 51%/49%, so it is also a shift in the right direction, but the goal of an 80%/20% ratio is not yet immediately within reach (1,6).

These targets around antibiotic use are different for ambulatory practice and hospital because doctors' prescribing behaviour differs in these two situations (7). We focus mainly on general practitioners (GPs) because most ambulatory antibiotic prescriptions are dispensed by GPs. In 2022, 67% of ambulatory antibiotic prescriptions were delivered by GPs (7). If we look within the GP practice, we see that the

most common presenting symptom is cough. One in ten patients who consult the GP have a cough (8). Acute cough is a cough that exists less than three weeks. It can have several underlying causes. A list of causes can be seen below in figure 1 (8). The figure depicts a diagnostic landscape around the presenting complaint acute cough, which is central. In the inner circle are diagnoses that are serious and treatable. The outer circle contains underlying causes that are less serious or serious causes that are untreatable (8,9).

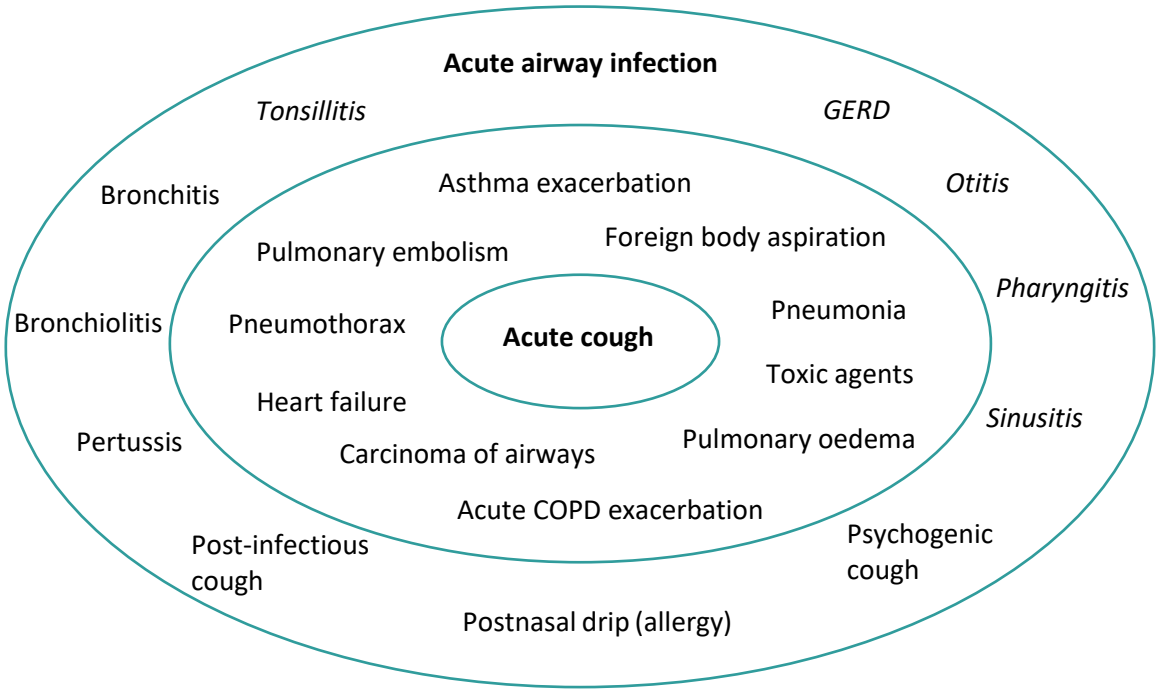


FIGURE 1: A DIAGNOSTIC LANDSCAPE WITH ACUTE COUGH AS PRESENTING COMPLAIN (8)
Inner circle: diagnoses that are serious and treatable
Outer circle: diagnoses that are less serious of untreatable
Text in *italics*: diagnoses that do not cause acute cough but where a cough is often present as a secondary symptom

In this diagnostic landscape, we see several common diagnoses linked with acute cough. The most common cause of acute cough in the general practice is an acute airway infection. Figures on Intego of the year 2023 showed an incidence of acute upper airway infection of 134,76 per 1,000 patients from the adult (>20 years) patient population (10). With this number, it is the most common diagnosis in general practice. Therefore, we focus in this study on adults with acute cough.

The Belgian guidelines of acute cough highlight the difficult differentiation between infectious and non-infectious causes of acute cough as well as the difference between viral and bacterial pathogens (8). With only the history and clinical examination, the GP first differentiate between acute life-threatening diseases or other causes of acute cough. If both are negative, the GP checks for signs of pneumonia, because this is the only diagnosis that needs antibiotics. At the same time, the GP checks for secondary causes of acute cough. If secondary causes are observed, proper guidelines need to be followed. If diagnosis is still uncertain after clinical examination, technical examinations like a blood sample and RX thorax can be useful (8).

Despite scientific evidence that acute respiratory infections are usually self-limiting and do not require antibiotics, antibiotics are still prescribed too often in Belgian general practices (8). Possible causes that could explain the irrational prescribing behaviour of Belgian GPs are diagnostic uncertainty, the fear of missing serious infections that need antibiotics, patient expectations and the organisation of the Belgian healthcare were GPs are paid per performance (8,11).

Compared to the Dutch guidelines on acute cough, the Belgian guidelines provide little information on decision making after carrying out technical examinations in cases with diagnostic uncertainty (8,12). This can possibly explain why Dutch GPs prescribe less antibiotics than Belgian GPs does (13). The Dutch guidelines recommend a POCT CRP (point-of-care test of c-reactive protein) in cases with diagnostic doubt. This guideline gives more practical tools to support the therapeutic choice of the GP whether or not to start antibiotics in patients with acute cough and minimise the diagnostic uncertainty (11,12).

Not only the Dutch guidelines but also the British guidelines on acute cough mention the POCT CRP as a practical tool to support the decision to start antibiotics or not (14). Both guidelines use the same cut-off values. A CRP less than 20mg/L can most likely rule out a serious respiratory infection, including pneumonia. With a CRP more than 100mg/L, a pneumonia is probably present, and antibiotics must be considered. A CRP value between 20mg/L and 100mg/L cannot exclude neither prove the presence of a serious airway infection. In function of the medical history of the patient and the clinical examination, the GP decides to start antibiotics or not (12,14).

Relevance within general practice

As mentioned earlier, most antibiotic prescriptions are provided by the GP (7). In primary care, there is still a long way to go to reach the goals mentioned in the AMR National action plan of Belgium (1,6). By analogy with countries such as the Netherlands and Great Britain, the Belgian guidelines may also benefit from the introduction of the CRP value as decision support for whether or not to start antibiotics in adults with acute cough (12,14).

If we look at the latest figures about total antibiotics consumption published by the European health initiative, we see that at baseline (2019) Belgium had a defined daily doses (DDDs) per 1000 inhabitants of 21.4 DDDs. This number is higher than the European average of 19.9 DDDs and much higher than the 9.5 DDDs of the Netherlands. If we want to achieve the target reduction in antibiotics consumption of 18% by 2030 (from 21.1 DDDs to 17.5 DDDs), we need to make changes to the prescription behaviour of the Belgian doctors (15). An overview was made in figure 2.

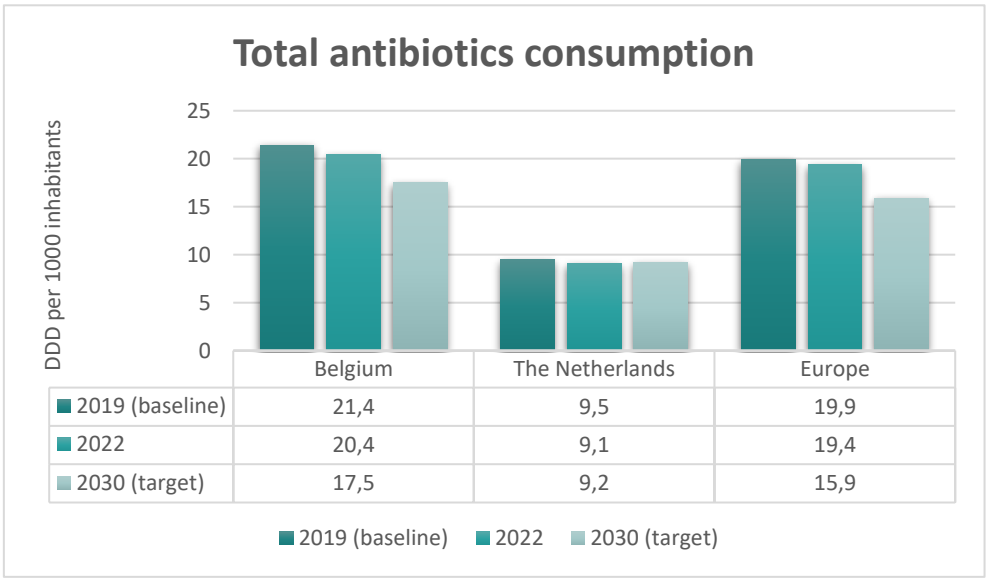


FIGURE 2: TOTAL ANTIBIOTICS CONSUMPTION PUBLISHED BY THE EUROPEAN HEALTH INITIATIVE (15)
The numbers are expressed in Defined Daily Doses (DDDs) per 1000 inhabitants.

Context

This master's thesis is part of the project 'Evaluation of the organisational challenges for out-of-hospital implementation of a point-of-care C-reactive Protein rapid test in adults with acute cough.' This project was designed to curb increasing antibiotic resistance and support responsible antibiotic prescribing in acute respiratory tract infections. The project is led by a consortium composed of experts from the Academic Centre for Family Medicine at KU Leuven, the Department of Family Medicine & Population Health at the University of Antwerp, the Department of Public Health and Primary Care at the University of Ghent, the 'Département des sciences cliniques', 'Médecine générale Et Soins primaires et santé' at the University of Liège, the Department of Clinical Laboratory Medicine at UCLouvain and the POCT working group of the National Clinical Biology Committee.

There are four work packages within the project:

- Work package 1: Linkage between point-of-care setting and clinical lab environment (validation of test results, connectivity with electronic patient record, reproducibility).
- Work package 2: End-user training and quality assurance.
- Work package 3: Evaluation of the implementation process and stakeholder engagement.
- Work package 4: Budget impact analysis of the point-of-care testing strategy in adults with acute cough in Belgium.

This master's thesis is situated in work package 3 in which we will use focus group discussions and a survey to look at the experiences and opinions about the work with POCT CRP of participating GPs, lab staff and company managers.

Within this master's thesis, we investigate the organizational challenges for successful implementation of POCT CRP in general practice in Belgium.

Exploratory literature review

Research question

Before we can answer the question regarding the implementation of POCT CRP in general practice, we need to explore the added value of this POCT CRP in general practice. For this purpose, we use exploratory literature review where we seek answers to the following research questions:

- Can CRP POCT accurately estimate the need for antibiotics in respiratory tract infections?
- Can the use of CRP POCT optimise GPs' antibiotic prescribing behaviour in adults with acute respiratory tract infections?
- What is the opinion of the GP and patients around POCT CRP?

Search strategy

This exploratory literature review aims to support research on the implementation of CRP POCT in general practice with knowledge from the current scientific literature. With this review, we try to find answers to the above research questions. Three MeSH terms, linked with AND were used to construct the literature review:

- 'CRP' or 'C-reactive protein'
- 'POCT' or 'point-of-care system'
- 'Cough' or 'acute airway infection'

These search terms were searched across three different databases: Medline via Pubmed, Embase and the ICHO-database for master theses. The search was conducted on September 26 and 27 2024. Pubmed generated 9 results, Embase generated 73 results, and the ICHO-database generated 23 results. First, duplicates, study protocols, and unavailable articles were removed. Only articles published in Dutch or English were accepted. The remaining articles were screened on title. This screening resulted in 21 articles. These articled were screened by abstract and this screening resulted in 14 articles. The reference lists of these articles were checked on relevant articles. One additional article was retained. At the end, 15 articles were approved for this literature review. A flowchart of this literature review can be found in figure 3.

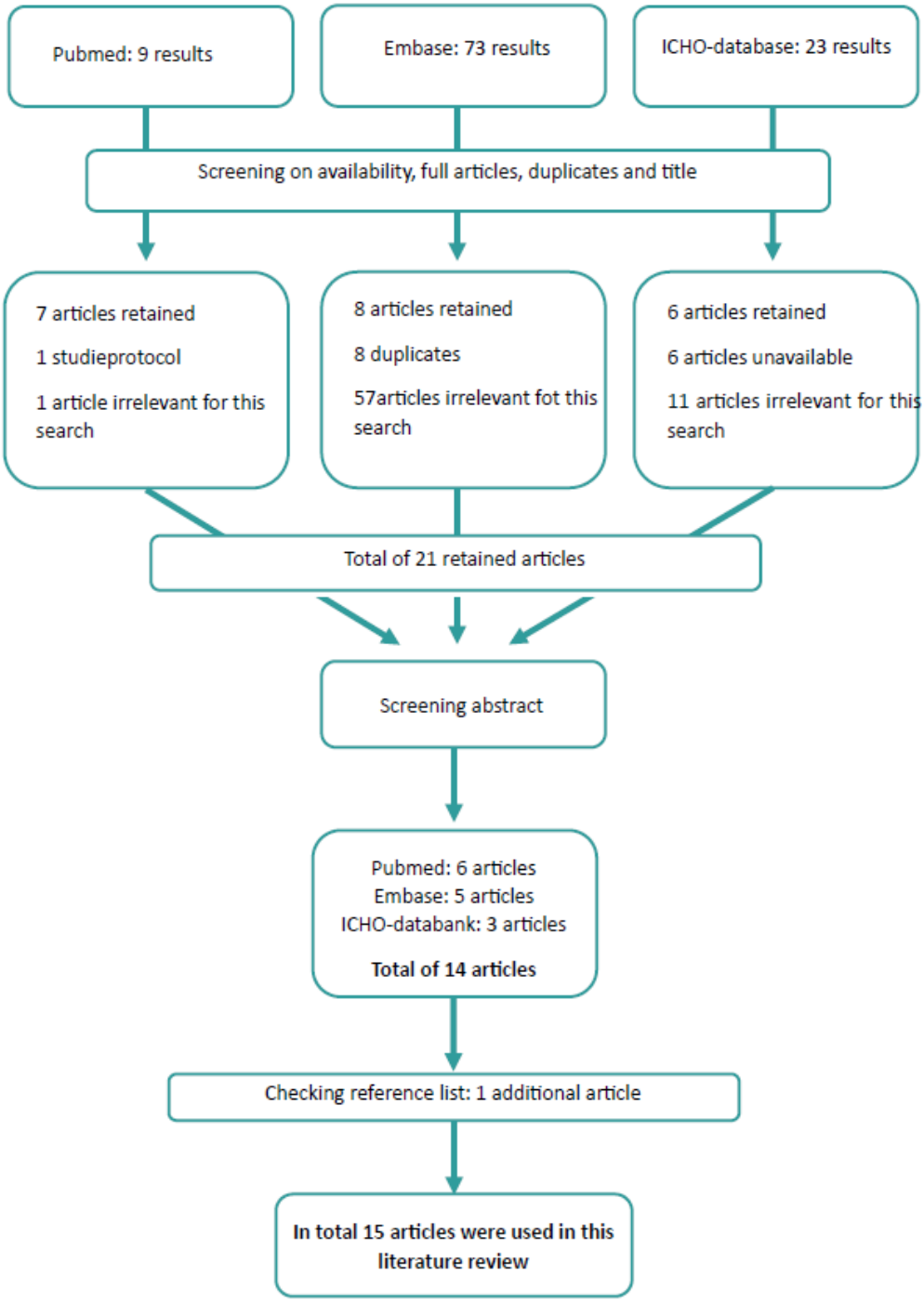


FIGURE 3: FLOWCHART SEARCH STRATEGIE

Findings

Can CRP POCT accurately estimate the need for antibiotics in respiratory tract infections?

CRP is an acute phase protein produced by the body in response to infection or inflammation. An acute phase protein activates your immune system, which starts clearing the causative factor of the infection (16). In patients with acute cough, CRP will rise in response to bacterial or viral pathogens that cause airway infections like pneumonia (16). In the blood, the CRP rise can be seen from six hours after contact with the microbial agent and it reaches its peak values after 48 hours (16).

A systematic review of Minnaard et al. showed that CRP has an added value in diagnostic accuracy of respiratory tract infections (16). This review looked specifically to patients with pneumonia, but the results can be extended to all acute respiratory tract infections. The group of correctly classified low-risk patients, i.e. patients who have a low risk to have a pneumonia, grew from 28% to 36% without increasing the number of false negatives. This means that more patients without pneumonia were correctly classified. The proportion of false-positive results were reduced from 58% to 49% (16). Following the Dutch or British guidelines, low-risk patients don't need antibiotics so better classification of patients with acute cough leads to less prescriptions of antibiotics (12,14).

A second statement they made was that with the addition of CRP, more high-risk patients, i.e. patients with a pneumonia (or severe airway infection in general), were correctly classified. This was shown by the increasing number of true-positive results, from 63% to 70% (16). However, given that the prevalence of pneumonia is rather low in primary care, around 5% to 10%, the additional benefit of diagnostic accuracy could not be reflected in large differences in daily practice given that still about half of patients fall within the grey zone for whether or not to prescribe antibiotics for a respiratory infection (16). This study showed that there is still too much of a margin to consider only the CRP value in our medical decision and thus additional clinical examination is necessary to offer a good judgement. CRP, in addition to information from history and clinical examination, has additional value in distinguishing patients with and without severe airway infections, like pneumonia (16).

The above study was performed on CRP determination in a blood sample, not on a POCT CRP test (16). To check the accuracy of POCT CRP, one study compared five POCT CRP devices and CRP determination in a serum tube (17). The devices used in this study were: Afinion, Nyco-Card Reader II, Eurolyser Smart 700|340, QuikRead Go, QuikRead 101. Ambulatory patients with acute cough received both a blood test and a POCT CRP test with pneumonia on RX as the clinically relevant outcome value. The variability seen between the results of POCT CRP and CRP determined on a blood sample did not translate into clinically relevant differences: all tests were equally accurate in detecting pneumonia (if the test was taken supplementary to clinical data) (17).

Several guidelines including the British and the Dutch ones use CRP values in the guidelines around acute respiratory tract infections and acute cough to estimate the severity of a respiratory tract infection and the need to start antibiotics or not (12,14). Both guidelines use CRP determination as an additional value where uncertainty remains around the diagnosis after the history and clinical examination. A CRP value below 20mg/L rules out a severe infection, like pneumonia. A wait-and-see policy is advised. With a CRP value above 100mg/L, a severe respiratory tract infection is often present, and antibiotics should be started. The grey zone is located between 20mg/L and 100mg/L where a prescription for antibiotics may or may not be made, based on clinical examination and existing risk factors (12,14).

The Belgian guidelines don't mention the CRP-value in there guidelines for acute cough (8). Vranken et al. made his master's thesis around the indications for POCT CRP in general practice, with a focus on respiratory tract infections (18). He made a flowchart that can possibly be useful in the Belgian guidelines for acute cough (figure 4) (18).

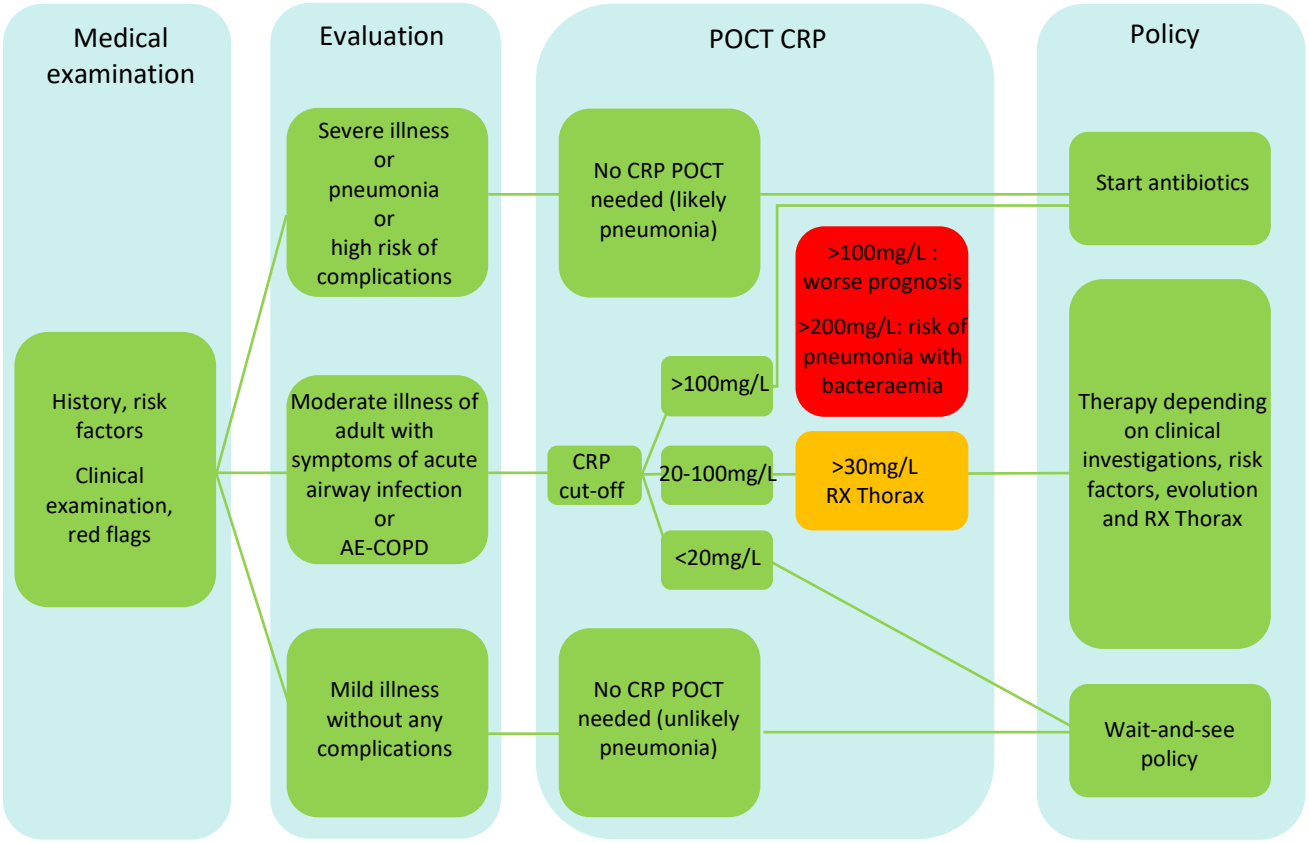


FIGURE 4: FLOWCHART ACUTE COUGH FROM VRANKEN, translated in English (18)

AE-COPD: acute exacerbation of chronic obstructive pulmonary disease
CRP >100mg/L: worse prognosis: higher mortality rate, more hospitalisations

Green: Evidence based
Orange: Evidence rather limited
Red: His own interpretation of literature

Can the use of CRP POCT optimise GPs' antibiotic prescribing behaviour in adults with acute respiratory tract infections?

Several studies show that the use of POCT CRP leads to the reduction of antibiotic prescribing without having an adverse effect on patient recovery (19–21). This effect was not always significant but was clinically relevant (22). In 27% of the patients in which a CRP test was performed, the doctor's decision to prescribe antibiotics was still modified by the CRP test result (23). The higher the CRP value, the more likely the GP did prescribe antibiotics, given a higher CRP value was also more likely to the existence of pneumonia (20). With a NNTB (number needed to treat for an additional beneficial outcome, prescribing fewer antibiotics) of 8 versus a NNTH (number needed to treat for an additional harmful outcome, prescribing antibiotics more often) of 27, the benefits of a POCT CRP outweighed the drawbacks (24).

Note that in one study only 41% of CRP tests were taken according to the guidelines, in this study the Dutch guidelines. 46% of the CRP POC tests were performed on patients with pre-test (after history and clinical examination) a low risk on complicated respiratory tract infections. Following the guidelines, these patients must follow a wait-and-see policy without CRP POCT. If POCT CRP was taken anyway, antibiotics were prescribed in 21% of cases, even though based on history and clinical examination you could already decide on a wait-and-see policy. These are avoidable antibiotic prescriptions by following the guidelines correctly (12,23).

13% of the cases, POCT CRP was performed on pre-test high-risk patients, namely patients with a high risk on a complicated airway infection. Antibiotics must be started, without POCT CRP because independent on the result, an antibiotic prescription is recommended (12,23).

The high number of inaccurate decisions to perform a POCT CRP, not following guidelines, indicates that GPs are not familiar with this additional test for patients with acute cough. It shows that their knowledge about the added value of CRP is insufficient. If they understand that the result of the CRP test is only useful in patients with acute cough with diagnostic uncertainly, they would not have taken the test anyway and they would decide to make an antibiotic prescription based on history and clinical examination (23).

What is the opinion of the GP and the patients concerning POCT CRP?

Studies conducted in England and the Netherlands, where POCT CRP is already implemented in the guidelines for acute cough, show that the GPs mainly find the diagnostic certainly an advantage (12,14,25). Patients where uncertainty remains around the diagnosis after history and clinical examination may benefit from rapid CRP determination (26). A key issue for implementation does remain clarity around cutoff values and interpretation of results. Without clear cut-off values, the GP rely more on his gut feeling than on the CRP test, because you can't rely on a test that you cannot interpretate (22,25,26).

Communication with patients about whether starting antibiotics or not, goes smoother after the determination of the CRP value (20,25,27). They have more realistic expectations of the treatment for their airway infection (25). Patients may be more easily convinced of the self-limiting nature of respiratory symptoms after a POCT CRP with low values (20,25,26,28). Patients were satisfied with the use of POCT CRP and had more confidence in the GP's final decision (19,20,22). The finger prick was not seen as a big issue (22).

In Belgium, few studies in individual general practices were conducted to explore the opinion of the GPs regarding the implementation of POCT CRP in general practice. These studies also demonstrated the same benefits as the studies above. The diagnostic certainly and the POCT CRP as a communication tool to convince patients that antibiotics are not needed for every cough, are two of the main benefits they mentioned (29,30). Belgian patients were also more satisfied with the treatment after a POCT CRP. They were more confident in the decision the GP made (29).

Major barriers to avoid using a POCT CRP device in general practice were cost, time investment, difficulties with usage and breaking the workflow during a consultation (25,27,30). If there is no reimbursement for the CRP POCT tests and/or the device, Belgian GPs are resistant to implement these test in their daily practice, because of the cost (30). Location and availability of the device could also be a limiting factor in the decision to use the device (25). These findings were similar in the studies conducted in England, the Netherlands and the few in Belgium.

Eley et al. made a framework for the implementation of POCT CRP in general practice in England. They described several behaviour determinants that are important for the implementation of POCT CRP in the daily practice of a GP. These determinants are listed below (25).

- Capability: skills and knowledge
    - Training to use POCT CRP device
    - Skills to take a finger prick blood sample
    - Skills to interpret POCT CRP results
    - Knowledge of POCT and CRP testing, link with antibiotic prescriptions (and AMR)
    - Understanding when and how to use CRP results in patients with acute cough

- Motivation: habits, motivations
    - Confidence in POCT CRP
    - Belief in benefits of POCT CRP
    - Belief that POCT CRP support clinical decision making
    - Belief that POCT CRP increase diagnostic certainty
    - Intent to use POCT CRP appropriately
    - Feel that patients will accept CRP POCT result
- Opportunity: physical and social environment
    - Clear guidelines about use of POCT CRP
    - Funding to support POCT CRP
    - Easy access to POCT CRP device
    - Time to use POCT CRP during consultation
    - Adapt clinical workflow
    - Belief that POCT CRP could manage patient education, expectations and antibiotic demands, and improve health professional-patient relationships

The training of the GP to take a finger prick blood sample and to use the POCT CRP device is important for the GP to implement this additional test is his workflow. The GP needs to become familiar with the POCT CRP device to use is regularly (25). In the few Belgian studies, GPs were worried about the time the POCT CRP would cost during a consultation (29). This is an opinion in contrast to those from the GPs from Engeland because the POCT CRP is embedded in their daily consultation routine and does not prolong the consultation (27). Moreover, the use of the POCT CRP results in fewer (telephone) follow-up consultations, which in this way also saves time (30).

Belgian GPs were also worried about the cost of POCT CRP (29,30). Before this test can be widely implemented in Belgium, there should be guidelines around reimbursement and costs of the test (29,30). Another remark of the Belgian GPs was the quality control of the test. They are worried about the reliability of the result if there is no control from the lab or the company. A lab as a first point of contact was suggested as a possible solution for the quality checks (29). GPs also saw added value in linking the device with the electronic medical record, as with other lab results (29).

When performing a rapid CRP test, the GP risks paying too much attention to the outcome of the technical examination. Following the British guidelines, the clinical view of the GP on the patient should remain of higher importance than the CRP test result (14,27). Due to the ease of use of the POCT CRP, GPs might being inclined to overuse this technical examination with the importance of the clinical examination being relegated to the background (30).

Conclusion and added value of our study

To conclude, in The Netherlands and England are several well-conducted studies that examined the added value of POCT CRP in patients with acute cough. Both countries have POCT CRP implemented in their guidelines for acute cough (12,14). This research is missing for the Belgian GPs. Only few studies, conducted in individual general practices were performed (18,29,30). Horemans et al. conducted a study in fourteen general practices. They were selected based on participation in another study (the ERNIE trial (31)) because they still used the POCT CRP device after this study. This could led to selection bias of GPs who are satisfied with the use of the CRP device (29). The study of De Freest was a study conducted within one general practice were a POCT CRP device was used so there could also be selection bias and small sample bias (30). No previous study examined the implementation of POCT CRP in both general practices in Flanders and Brussels on a bigger scale. This is why we set up this study.

With focus group discussions and a survey, we will investigate the ideas and concerns of the GPs about the implementation of POCT CRP in daily practice for patients with acute cough. The presence of good and clear guidelines about the use of the device is an important issue, as mentioned by the previous studies in Belgium (29,30). To initiate revision of the Belgian guidelines of acute cough, possible with the addition of POCT CRP, we need to study the conditions in which way the GP would implement POCT CRP in their consultations.

The goal of this study is to optimize the antibiotic prescribing behaviour of Belgian doctors to limit the development of AMR in Belgium.

Because GPs prescribe 67% of the total ambulant antibiotics, we conduct this study among general practices (7). Within the general practice, acute cough is the most common complain so that's the reason why we study the implementation of POCT CRP in patients with acute cough in general practice (8,10).

Materials and methods

In this qualitative study, both focus group discussions (FGD) and a survey were employed. The methods were reported following the Consolidated Criteria for Reporting Qualitative Studies (COREQ) guidelines (32). Qualtrics, an online survey tool, was used to collect data from the survey.

Study design

This masters' thesis is a part of a mixed-methods study entitled 'Evaluation of the organisational challenges for out-of-hospital implementation of a point-of-care C-reactive Protein rapid test in adults with acute cough.' An online survey was used to gather a broad range of information on participants' perspectives regarding the use of POCT CRP in general practice. The survey takes less than ten minutes to complete and can be done from any location. It provides structured data on specific topics selected by the researchers. To gain deeper insight into the ideas of the participants, FGDs were also organised in addition to the survey. The interaction between participants in the FGDs adds an extra layer to the data collection process. Typically, FGDs are held in person in a meeting room and last between 60 to 90 minutes. Participating in an FGD requires more time and effort compared to completing an online survey.

Study settings

In this study, 24 general practices, one guard post, and one nursing home used one or more POCT CRP devices. The POCT CRP test phase lasted three months, beginning after the launch event on September 5, 2023. The launch event, held in Groot-Bijgaarden, was a central gathering where all participating GPs were invited. The event began with a general introduction to the study and its objectives. Following that, three break-out rooms were organized, each dedicated to a practical session for a different device. Representatives from the device companies demonstrated how the GPs could use each device, and the GPs had the opportunity to try them out. The event concluded with an explanation of the project's practical organization, followed by a Q&A session. During this time, it was clarified that the participating GPs could use the POCT CRP devices for three months in accordance with the study protocol, which focused on adults with acute cough.

GPs selected patients eligible for a CRP test based on the predetermined study criteria, which specified that only adults with an uncertain diagnosis of acute cough were included. Patients received information about the study and the CRP test itself. Those who agreed to participate provided written informed consent. After completing the necessary paperwork, patients underwent a finger prick to collect a blood sample. The blood was collected by either the GP or a nurse using a sample collector, which was then placed into the device for rapid analysis. Results were available in just two to three minutes. The GP discussed the results with the patient and determined the appropriate course of

treatment. Additionally, the POCT CRP results could be integrated into the electronic medical record (EMR). In some practices, the POCT CRP device was automatically linked to the EMR, while in others, this connection was established manually.

The participating practices received support from four different medical laboratories and the manufacturers of the POCT CRP devices. Two medical laboratories were located in Flanders (OLV Hospital in Aalst and Medina in Aalter), and two were based in Brussels (LHUB Laboratory in Brussels and City Labs in Woluwé-St-Lambert). The POCT CRP devices used in this study included the Cobas B 101 (Roche), Quickread Go CRP (Aidian), and Afinion (Abbott).

The survey was launched on December 14, 2023, and was made available to all GPs in the participating practices. They were given a five-month period to complete the online survey, which was conducted using the Qualtrics platform. The survey was available in Dutch and French.

Four different FGDs were organised, two for the GPs linked with OLV Hospital Aalst, one for the GPs linked with Medina and one for the GPs in Brussels. This classification was determined based on native language and number of potential participants. The FGDs in Flanders were Dutch spoken and the FGD in Brussels was French spoken. We planned live meetings for the FGDs but due to weather conditions with unexpected snowfall, the first FGD in Aalst was converted to a Microsoft Teams online meeting.

The Dutch speaking FGDs were led by the Dutch speaking moderator, a 25-year-old female (SG). She was a student at KU Leuven following the GP speciality training. SG had no experience with the moderation of FGDs, so she was assisted by a 24-year-old PhD researcher (female, AD) at the KU Leuven, who already had experience with FGDs.

The French-speaking moderator was a 32-year-old female MD with a PhD in biomedical sciences. French was her native language, and she led the French-speaking FGD to ensure that small nuances were better understood in her native language. Similar to AD, she had prior experience conducting FGDs. In this particular FGD, she was assisted by the Dutch-speaking moderator, SG, who could keep an overview on all FGDs.

All FGDs started with an introduction. Everyone introduced themselves, starting with the moderator and the other researchers. The participants and researchers didn't know each other before the start of the study. Next, the purpose of the FGD was explained and the FGD was embedded in the bigger context of the overarching study. The moderator clarified the way in which the FGD would be conducted.

Participant recruitment

For the organization of the FGDs, the GPs who used the POCT CRP devices were divided into three groups based on their native language and the laboratory they were linked to. The FGDs were held in a meeting room at the respective laboratories. Participants in each group were contacted via email and asked to complete a Doodle poll to find a suitable date. The target number of participants for each FGD was five to nine people. Once enough GPs had filled in the Doodle poll, an email with the final location and time was sent to all potential participants, including those who had not filled in the poll. A confirmation of attendance was requested. A week before the FGD, a gentle reminder was sent to all possible participants. Staff from the laboratories and representatives from the companies providing the POCT CRP devices were also invited to attend the FGDs to answer any questions from the participants.

For FGD 1 (Aalst, 17th January 2024), 60 possible participants were addressed by email to fill in the doodle to pick a date. 15 of them responded (responses: present on one or more dates (nine), absent (six)). After the email with definitive date and location, ten participants confirmed their presence (seven GPs, one staff member of the lab and two members of POCT CRP Companies). Due to unexpected snowfall, the FGD was last minute switched to an online meeting. Participants who confirmed their attendance were approached by email and if possible, by telephone. Finaly, nine participants were present at the online meeting (six GPs, two company staff, one laboratory staff). On GP dropped out, due to personal circumstances.

FGD 2 (Brussels, 5th March 2024) was the only French spoken FGD. The participants were contacted by the linked laboratory. Before the meeting, we didn't have a clear idea how many participants would attend the meeting. In total, 11 participants were present (six GPs, one member of a POCT CRP Company, two staff members of the lab, one lab scientist and one medical manager).

FGD 3 (Aalter, 11th March 2024) was a live meeting with ten participants (six GPs, three members of POCT CRP Companies and one staff member of the lab). In total 35 participants were addressed by email to pick a date. First, ten persons responded the doodle, but we could not find a suitable date so a new doodle with other data was send a second time with twelve responders (responses: present on one or more dates (seven), absent (five)). After the definitive details of the meeting were emailed, ten persons confirmed their attendance, and they were alle present.

Due to the high number of potential participants in the Aalst region, a second FGD was scheduled on March 27, 2024. Ten people responded to the Doodle poll to select a date, with seven confirming their availability and three unable to attend on the proposed dates. Ten participants confirmed their attendance for the meeting, but on the day of the FGD, only six participants were present: two GPs, two representatives from the POCT CRP companies, and two staff members from the laboratory. The reasons for absence included forgetting about the FGD, already attending the first FGD (since one attendance was sufficient), difficulty finding a babysitter, and a last-minute agenda conflict. An overview of this recruitment process for all FGDs can be found in table 1.

	FGD 1	**FGD 2**	**FGD 3**	**FGD 4**
Number of possible participants addressed via email	60	unknown	35	60
Number of possible participants responded on doodle poll	15	unknown	12	10
- Present	9		7	7
- Absent	6		5	3
Real number of participants	9	11	10	6
- GP	6	6	6	2
- Company staff	2	1	3	2
- Laboratory staff	1	3	1	2
- Medical manager	0	1	0	0

Table 1: Overview of the participant recruitment process for the FGDs. Participating company staff could appear more than once in the table. Five different company staff members were present at the different FGDs.

The survey was available in Dutch and French. Participants from the different general practices were personally contacted by email in their native language. The email contained a direct link to the online survey in their native language. Before the participants could fill in the survey, they had to fill in the informed consent of the study. A reminder email was sent after a few weeks.

49 participants started the survey (45 Dutch speaking participants and four French speaking participants). Ten participants dropped out (eight Dutch speaking, two French speaking participants) with an unknown reason. Only the results of the 39 participants who fully completed the survey were analysed. Participants who used different POCT CRP devices during the study filled in the survey one time for each different POCT device they used. In total, 83 answers were collected (four French, 79 Dutch). Some answers differed in function of the used POCT CRP devices. It's not the purpose of this study to compare these devices so in the analysis, we will not take those differences into account. None of the participants had a connection with the moderators or researchers at the beginning of the study.

Data collection

Before the FGD started, all participants were asked to complete an informed consent form. The informed consent was available in both Dutch and French. The Dutch form is included in the appendix of this paper. The FGD was led by a moderator and an assistant moderator. In addition to the GPs, staff from the laboratory and representatives from the POCT CRP device companies were also present at the FGDs. Their contributions were included in the analysis, as their comments led to interesting discussions between the GPs. However, they only responded to questions and did not actively participate in the discussions. The interview guide was prepared prior to the meetings, with topics formulated based on previous master's theses and relevant literature on POCT CRP in general practice (29,30). This interview guide, available in Dutch and French, was not pilot tested before the first FGD. The Dutch interview guide can be found in the appendix of this study.

The duration of the FGDs ranged from 29 to 71 minutes (FGD 1: 55 minutes, FGD 2: 58 minutes, FGD 3: 71 minutes, FGD 4: 29 minutes). Data saturation was not specifically discussed after each FGD, as it was previously decided to organize four FGDs. All FGDs were audio recorded, and field notes were taken during the sessions. Participating GPs only attended one FGD, while laboratory and company staff could attend multiple FGDs.

The survey was sent via email with a link to an online survey platform, Qualtrics. The average time to complete the survey was seven minutes. Participants who used more than one POCT CRP device during the study were required to fill out a separate survey for each device they used. The questions and structure from the Dutch survey were noted in the appendix of this study.

Data analysis

The analysis of this qualitative data was performed by five researchers following the methodology of thematic analysis by Braun and Clark (33). Three of them were already involved in this study during the organisation of the FGDs. The other two joined the research team at the point of transcription of the audio recorded FGDs. The transcription was made with Amberscript© in the original language, Dutch or French, and was afterwards translated to English. The transcripts of the FGDs were not send to the participants for comment.

NVivo software was used to support the data analysis of the FGDs. All transcripts of the different FGDs were successively analysed. First, the data was coded by two independent researchers. Next, both researchers shared and discussed their findings. They adjusted the codes if needed. The final coded transcript was sent to a third coder and two other researchers who independently made remarks on the coded transcript. They all made themes and subthemes derived from the coding three. After this process, all the findings were discussed with these five researchers during an online meeting. Codes

and themes changed, were added and disappeared during the analysis of the second, third and fourth FGD. The first two coders and the two researchers who commented on the coded transcript were rotated for each analysis of a different FGD. The third coder, AD, who was also the moderator of the data analysis, remained the same.

The data from the online survey was extracted from Qualtrics on the 25th of May 2024. Incomplete surveys were removed from the analysis. Some participants completed the survey multiple times due to using different devices during the study. In cases where multiple responses were provided, we selected the most positive answer to give an overall picture of whether POCT CRP is used in general practice, without distinguishing between different devices. Two researchers independently performed this manual deduplication process. The results were then compared side by side. Both the full and deduplicated datasets were used in the survey analysis. The final graphics were created in March 2025. These graphics are the basis from which the results were further supplemented with information from the FGDs.

Results

In total 32 people participated in the four FGDs, 20 of them where GPs. Further, 39 GPs completed the survey. Table 2 summarises the participant characteristics of the FGDs and survey. Table 3 summarises the GPs' work office characteristics of the participants of the FGDs. This information was not obtained from the participants of the survey and could therefore not be used in this study. The FGD analysis yielded 73 codes, which were categorized into five main themes: "POCT CTP is a minimally invasive test that guides treatment in cases of diagnostic uncertainty", "Successful implementation of POCT CRP in GPs' workflow is supported by practical assistance by stakeholders and workflow integration", "Technical features of POCT CRP like small blood sample, quick and easy analyse and quality controls leads to an efficient and reliable CRP analyse in general practice", "POCT CRP enhances decision-making and patient trust, but requires clinical context and careful interpretation" and "GPs who like to use POCT CRP in daily practice face challenges like the absence of guidelines, financial costs, and balancing objective results with clinical judgment". Additionally, the survey results were incorporated into these five themes.

Participant characteristics

In both FGDs and the survey more females were represented than males. Specifically, 22 out of 32 participants in the FGDs were female (69%), while 28 out of 39 participants in the survey were female (72%). The age range of participants in the survey group was younger compared to the FGDs, with FGD 2 having a notably higher number of older participants (aged 60-69). In all FGDs, six GPs participated, except for FGD 4, where only two GPs were involved.

Most GPs worked in towns or suburbs, with only four practicing in cities. None worked in rural areas. The majority of GPs were based in East Flanders and the Brussels-Capital region, while only one GP practice was located in West Flanders. No GPs from other provinces in Flanders or Wallonia were included in the study.

Characteristics	Number of participants FGD 1	Number of participants FGD 2	Number of participants FGD 3	Number of participants FGD 4	Number of participants survey
Gender					
- Male	1	8	0	1	11
- Female	8	2+*1*	9+*1*	3+*2*	28
Age					
- 20 – 29 years	1	1	2	0	11
- 30 – 39 years	1	1	3	2	13
- 40 – 49 years	6	3	2+*1*	1+*1*	9
- 50 – 59 years	1	*1*	1	*1*	4
- 60 – 69 years	0	5	1	1	2
Occupation					
- Company POCT CRP device	2	*1*	2+*1*	*2*	/
- Staff member lab	1	3	1	2	/
- General practitioner	6	6	6	2	39
- Medical manager	0	1	0	0	/

Table 2: patient characteristics of the four FGDs and the survey.
The numbers in italics represent participants who already have participated in a previous FGD and therefore appear more than once in the table.

Characteristics of the GPs' work office	Number of participants FGD 1	Number of participants FGD 2	Number of participants FGD 3	Number of participants FGD 4
Rurality				
- Town-suburb	6	6	4	-
- City	-	-	2	2
Province				
- East-Flanders	6	-	5	2
- West-Flanders	-	-	1	-
- Brussels Capital Region	-	6	-	-

Table 3: characteristics of the GPs' work office from the participants of the FGDs.

POCT CTP is a minimally invasive test that guides treatment in cases of diagnostic uncertainty

POCT CRP reassures GPs when facing diagnostic uncertainty in patients with acute cough

The purpose of this study was to evaluate the use of POCT CRP for patients with acute cough. Some GPs used the device for all patients with acute cough, reporting many normal results. They recognized that using it in all patients with an acute cough was not the most appropriate approach. Other GPs used the device for patients with acute or occasionally more chronic coughs where they faced diagnostic uncertainty. If history taking and clinical examination could neither confirm nor rule out a diagnosis, POCT CRP was employed. If it was clear after clinical examination what the diagnosis and treatment would be, the GPs agreed that POCT CRP was not necessary. POCT CRP was thus mainly used when the GP experienced diagnostic uncertainty, a challenge they face daily.

> *"For me it was when I had a GAP between the history taking and the person looking like they were complaining a lot, and the clinical examination was rather reassuring. I thought, there's something wrong with this..."* (F2P9, GP with 15-19 years of experience)

One participant in FGD three mentioned that GPs might not fully trust the results blindly. The GPs agreed that while POCT CRP provides objective, reliable, and accurate results that could safely guide treatment decisions, it may not be sufficient on its own to entirely guide the GP's decision-making process. Information about history and clinical examination has to be considered besides the results of POCT CRP before GPs could make a decision. According to the answers of the GPs on the survey statement "The CRP test can be used safely to help choose treatment.", they don't seem to be aware of this potential pitfall (figure 5).

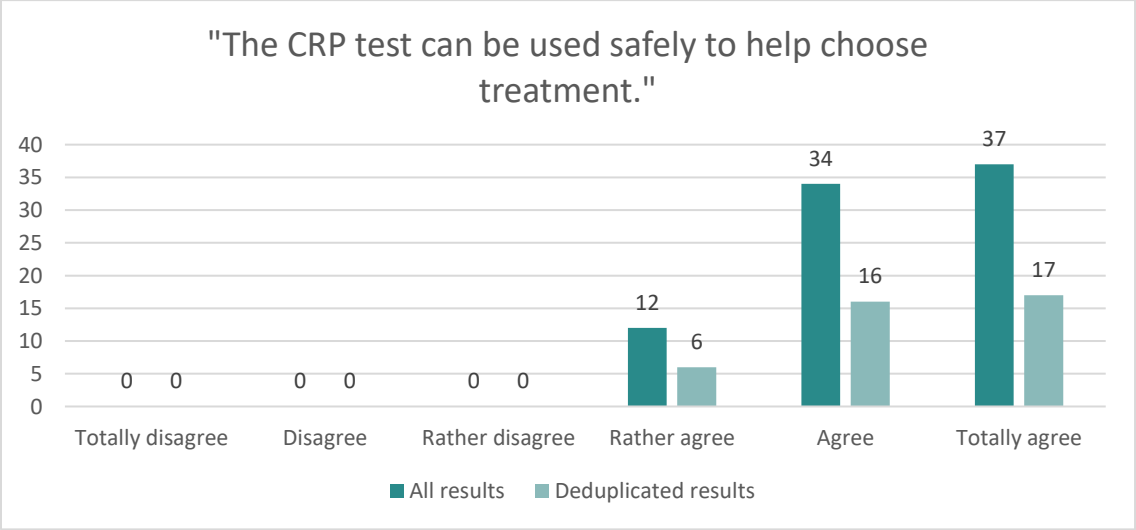


FIGURE 5: Survey statement: "The CRP test can be used safely to help choose treatment."

POCT CRP is a technical procedure with its own limitations, which may result in unreliable results. The participants thought about a machine that is not properly calibrated or where quality control was insufficient. The participants agreed that POCT CRP could be used as an additional argument in clinical decision making, but it may not overrule the intuitive feeling and ideas of the GP.

> *"…I think that this relationship with the patient, the discussion, the clinical examination, ... it's so important that I don't want general medicine to be overrun by biology machines and stuff."* (F2P4, GP with 1-4 years of experience)

The decision not to perform a POCT CRP was primarily driven by the absence of diagnostic uncertainty. If the diagnosis and treatment were clear after taking the patient's history and conducting a clinical examination, POCT CRP was unnecessary. Another reason cited was that some GPs wanted more information than just the CRP value, requiring a general blood test instead. Additionally, the administration and paperwork involved in participating in the study were also mentioned as factors influencing the decision.

POCT CRP is a minimal invasive test used by GPs when experiencing an uneasy gut feeling, with GPs finding it particularly useful in paediatric care as well as during home visits

The GPs also discussed the use of POCT CRP in children. One of the key advantages mentioned by the GPs was that POCT CRP doesn't require a venous blood sample, something that not all GPs feel confident about when it comes to children. POCT requires a capillary blood sample, obtained by a finger prick, which is described as a minimal invasive method. This could reduce the number of children needing referrals to paediatricians for CRP POCT or blood samples, allowing GPs to manage the case independently. This could enhance accessibility to primary care.

Several GPs mentioned that they often prescribe antibiotics too quickly for children due to diagnostic uncertainty, as they don't want to miss any serious conditions. If GPs had the right tools to distinguish between viral and bacterial infections, they think that fewer antibiotics would likely be prescribed.

Other indications mentioned by GPs included diverticulitis, appendicitis, tonsillitis, erysipelas, insect bites or pyelonephritis. In these cases, CRP could assist GPs in determining whether or not to start antibiotics and differentiate between infectious or non-infectious diseases.

> *"… Those well-known insect bites, which sometimes make you doubt: is it purely allergic or is there an infection component? … I think it really adds value for that too."* (F1P6, GP with 20-24 years of experience)

The most important reason for most GPs to use the POCT CRP outside the study scope was an uneasy gut feeling about the clinical situation. An example is described by one of the participating GPs of FGD one:

> *"… One Tuesday evening, very late, I had an old woman in her 80s with a sky-high CRP. Well, clinically I had suspected appendicitis, but I was in doubt to send her to A&E because the chances of appendicitis happening in people over 80 are so low. That sky-high CRP convinced me, and indeed she had had an appendectomy that same evening. …"* (F1P5, GP with 10-14 years of experience)

One GP from FGD two also used the device to follow up a patient by tracking changes in CRP levels over time, in order to determine if a medication dosage adjustment was necessary.

> *"I've used it for other things, for example to monitor a Polymyalgia Rheumatica and to avoid the patient to have a blood test very often. I think it's also a good indication for adapting corticosteroid doses."* (F2P1, GP with 30-34 years of experience)

In this study, one POCT CRP device was implemented in an out-of-hours service. We do not have a lot of information about the use of POCT CRP in that setting because the coordinator of the centre could not participate in an FGD. Another participant had used a POCT CRP in an out-of-hours service before this study and found it an added value to assess the severity of the clinical situation of the patient.

Some GPs used POCT CRP during home visits. GPs found that taking blood samples from older patients at home can be challenging, and the long wait for results can delay treatment decisions, which makes POCT CRP very useful in this situation.

> *"… if you go on a home visit, you come back at noon and then the lab is there at two o'clock. And then you only have it at six and then you still have to arrange it. That is difficult."* (F4P2, GP with 5-9 years of experience)

The same idea was followed in the care of nursing home patients but the device that was placed in a nursing home during this study was used less frequently than the GPs had expected. The reason for this was unclear.

Successful implementation of POCT CRP in GPs' workflow is supported by practical assistance by stakeholders and workflow integration

Installation and technical assistance by the laboratory and companies support easy implementation of POCT CRP in general practice

The installation of the POCT CRP device generally went very smoothly according to the GPs. The device was set up by the connected laboratory or the company that supplied it. Initially, there were some minor issues, such as linking it to the EMR, computer functionality, connectivity problems, unstable WIFI, and calibration issues. However, these problems were quickly addressed by one of the staff members. According to the survey, it took approximately 12 minutes for the GPs to become comfortable using the POCT CRP device once it was set up in their practices.

The laboratory and the company that provided the POCT CRP devices were closely involved in the study, which was seen as an added value for the participating GPs, as indicated by the survey results (figure A, see appendix). Only one participant disagreed that the link with the laboratory and companies was useful for the GPs. The reason for this opinion is unknow. If any issues arose after the installation of the device, GPs could always reach out to the laboratory or the company for support. According to the participants' feedback during the FGDs, this process went very smoothly. Additionally, if extra materials, such as sample discs or items for quality control, were needed, participants could contact the laboratory for assistance.

Easy incorporation of POCT CRP in GPs' existing workflow requires strategic device placement and physician flexibility as well as multitasking skills

The impact on the GP's workflow is a crucial factor for the successful implementation of POCT CRP in daily practice. As the survey shows, most GPs agreed that POCT CRP can easily be incorporated into their existing workflow, only one GP rather disagreed (figure B, see appendix). However, some GPs either disagreed or strongly disagreed with this statement. One GP, in particular, who completely disagreed, found one device too complicated to use. The same results were seen on the question if they feel confident about carrying out the CRP test during the consultation (figure C, see appendix).

GPs had different approaches to integrating the POCT CRP device into their workflow, mostly influenced by the device's location. The location of the POCT CRP device varied across practices, with placements in the secretarial office, the nurses' room, a GP's office, a centralised room, or even the practice kitchen. When the device was placed in a GP's office it was used less frequently, as they didn't want to disturb their colleague too often. The ideal location for the device was described as a centralized room, accessible to all GPs without interrupting colleagues, and equipped with a fridge. The reagents and discs for the blood samples need to be stored cold but must be brought to ambient temperature before GPs can use them. The device also needs a suitable ambient temperature. When it's too cold or too hot, the device could shut down and is no longer useful.

Before GPs could begin using the POCT CRP device in the study, they were required to obtaining an informed consent from patients participating in the study. For some GPs, this administrative process acted as a barrier, limiting their use of the device. However, they noted that if POCT CRP were to be used outside of the study, this paperwork would no longer be necessary.

They always used the POCT CRP device during the consultation and never asked patients to return for a test. The timing of the CRP test within the consultation varied. If the GP felt that an additional test was necessary to state their opinion about diagnosis and treatment, they could quickly decide to perform a POCT CRP, sometimes right after history taking. However, most often, they used it after the clinical examination, when they were still uncertain about the diagnosis and treatment.

Most GPs performed the finger prick themselves and analysed the results. In practices where a nurse was available, they sometimes had the nurse carry out the test, who called the GP afterward with the results. They also discussed about having the practice assistant perform the POCT CRP, but this is a relatively new concept in Belgium which is not yet elaborated but it could be a future option. GPs either waited for the results in the room with the device or returned to the patient, explaining something in the meantime before checking if the results were ready. In practices where the device was in a separate room, such as with the secretary, nurse, or another GP, the results could also be communicated by phone.

They noted that performing the test earlier in the consultation helped them to minimize the impact on the duration of the consultation, as the waiting period could be used for other tasks, mainly administrative. The survey revealed different opinions on this (figure 8). While one GP during the FGD pointed out that the test takes about three minutes, which can add time to a busy consultation, others argued that if a general blood test needed to be done instead, it would take more time. One GP mentioned using the test as much as seven to eight times a day, though other GPs questioned whether all these tests were necessary. Ultimately, the frequency of use depended on the types of cases encountered that day.

> *"…. it's not five minutes that we have to add to the consultation. It's five minutes that need to be incorporated into a consultation. …"* (F2P12, GP with 30-34 years of experience)

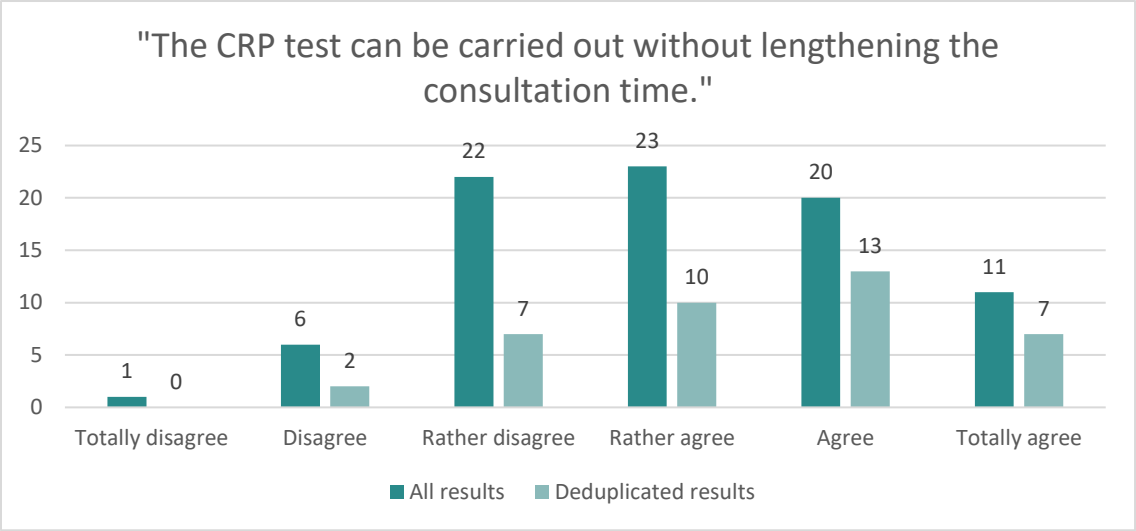


FIGURE 8: Survey statement: "The CRP test can be carried out without lengthening the consultation time."

The statement below: “The CRP test will reduce future consultations for similar complaints (cough).” showed various opinions (figure 9). This was not discussed during the FGDs, so we don’t have a further explanation why the opinions differ so much.

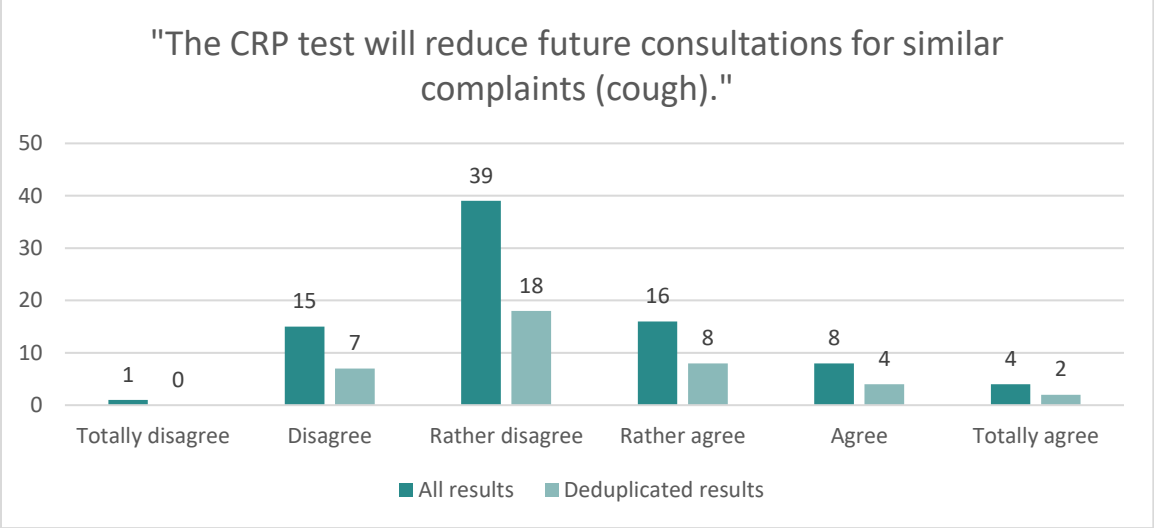


FIGURE 9: Survey statement: "The CRP test will reduce future consultations for similar complaints (cough)."

Participants in the FGDs also mentioned a difference in how younger and older physicians use the POCT CRP device. For the older GPs, integrating the device into their clinical workflow represented a bigger shift, as they had never used it before. In contrast, younger GPs started their careers with the POCT CRP already in practice. This could pose a challenge for younger GPs who might eventually work in practices without the device. Several GPs noted the importance of not becoming overly dependent on this additional test.

> *“… I also notice that in my practice especially the younger doctors used it a lot, although I used it the most, I think. Also because of that diagnostic uncertainty and that the slightly older doctors have used it a little less and gone on their experience earlier.”* (F3P8, GP speciality training)

Linkage of POCT CRP with EMR is not necessarily for GPs but could enhance continuity of care

The laboratory also attempted to establish a connection between the POCT CRP device, the laboratory, and the EMR. However, it was too expensive to implement this in every participating general practice, resulting in two groups: one with the linkage and one without it. If the device was not linked to the EMR, the GPs had to check the device directly to view the results or contact the secretary or nurse if the device was located elsewhere. In the future, the laboratory plans to work on improving this integration.

During the study, the linkage between the POCT CRP device and the EMR was facilitated through the laboratory. GPs had to scan a barcode linked to the patient, similar to the process for general blood tests. However, they had to wait briefly before they could use the device and access the linked barcode. One GP mentioned that, in the meantime, they explained the test to the patient, which added extra work but did not disrupt the consultation.

The following day, the results were uploaded to the EMR, just like the results from a general blood test. Since this process took a full day, many GPs recorded the results from the device in the 'objectives' section of the EMR to use them immediately and adjust their treatment if needed. In practices without the linkage, the results were also noted in the 'objectives' section. Most GPs felt that the delayed arrival of results in the laboratory system was not a major issue, as they had already used the results to modify treatment during the consultation. They noted that eliminating to scan the barcode and link the test to the patient would save time, but the linkage process itself was not burdensome, much like other laboratory tests.

> *"… I actually do think it's one less step if you don't have it linked and if you just note it yourself at objective …"* (F1P3, GP with 15-19 years of experience)
>
> *"Yes, but that wasn't really so much work. You did indeed have to scan it again, like you scan tubes for the lab, … that's extra work, but I didn't find it disturbing extra work."* (F1P5, GP with 10-14 years of experience)

The potential benefit of linking the POCT CRP results to the EMR would be that, if a patient was referred to the emergency department, specialists could access the GP's results. However, most GPs did not think this would be feasible in secondary care, as it was not yet a common practice for them to check previous results.

Overall, the GPs concluded that a linkage between the POCT CRP and the EMR could be useful in different situations like described above but it didn't matter for them whether there was a linkage or not.

Technical features of POCT CRP like small blood sample, quick and easy analyse and quality controls lead to an efficient and reliable CRP analyse in general practice

One feature that was extensively discussed during the FGDs was the amount of blood required to perform the POCT CRP test. Some GPs mentioned that it was a bit more challenging to obtain enough blood, and occasionally, the test would fail. However, once they became accustomed to it, most of them found it to be manageable. They noted that this challenge might be more pronounced when using the device with children, as it is harder to apply pressure to a child's finger without causing discomfort.

> *"… with that one disk you need the most blood, and the first week I was cursing at it. But we've had it for a long time now and in the last few days I haven't had any problems with it. …"* (F1P1, GP with 15-19 years of experience)

When it comes to using the device with children, the minimally invasive procedure of a finger prick is less traumatic than a general blood test. This approach can also be a good solution for patients who have a fear of needles, offering a good alternative for the general blood test, if you only want to check the CRP. If you want to check more parameters, the use of a multiparametric test could be a solution. Another feature that was discussed was the storage time of the sample. A sample that can be safely stored for up to two hours, could be used for home visits, which the GPs found very useful.

In the survey, GPs were asked how long it took them to perform a POCT CRP, from opening the sample collector to reading the results on the CRP device. The average time was six minutes, which was also confirmed during the FGDs. GPs did not view these minutes as wasted time, as they could use the waiting period to complete other tasks, such as making prescriptions or filling out attestations. They described the process as quick and efficient, something that could easily be done during the consultation. As mentioned earlier, they did not consider this as additional time, the time is incorporated in the consultation, time that would be spent on similar tasks, like taking a blood sample.

> *"… you usually already gave an explanation to the patient in anticipation of the blood result. Or you say, "do this for now". And then you have them on the phone again for the result of the blood test and then you have to give another explanation. I think you lose more time that way."* (F3P3, GP with 1-4 years of experience)

Sometimes, performing a POCT CRP did lengthen the consultation time, as described by one of the participants of FGD four.

> *"… I would always go and have a look too early and then … , it's not known yet, then I had to go all the way back again. I had to have another talk with the (patient), then of course I kept having a small talk with the patient for too long, then I went and looked again, was already known for a long time. So that perhaps disrupted the timing of the consultation a bit (laughs), but otherwise it wasn't that bad. …"* (F4P1, GP with 10-14 years of experience)

This is something that can be learned over time, allowing GPs to perform the procedure more efficiently and avoid going back too early to check if the results are ready. Similarly, the sampling method becomes easier and faster with more experience in performing POCT CRP. However, the time it takes for the machine to analyse the results cannot be influenced by the GPs. The faster this process is, the more beneficial it will be for the broader implementation of POCT CRP in daily practice. Similarly, ease of use is a crucial factor. If the device is too complicated to operate, GPs may be discouraged from using it and prefer a general blood test instead.

> *"… We're not lab assistants, so it's true that it has to be easy."* (F2P1, GP with 30-34 years of experience)
>
> *"The device has to be fast, simple and reliable!"* (F2P4, GP with 1-4 years of experience)

Similar to devices in the laboratory, the POCT CRP devices require regular quality controls to ensure reliable results. All GPs agreed in the survey that the POCT CRP provides reliable and accurate results (figure 10). However, during the FGD, lab assistants mentioned that the number of quality controls performed was very low during the study. One laboratory conducted the quality controls themselves and visited the general practices to perform the tests, but this approach would not be feasible if POCT CRP were widely implemented.

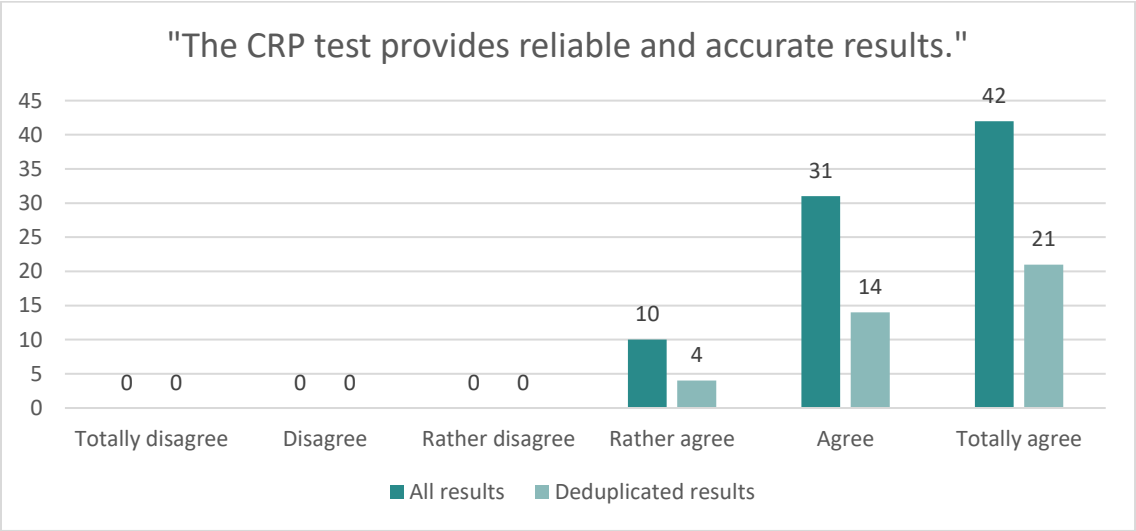


FIGURE 10: Survey statement: "The CRP test provides reliable and accurate results."

The laboratories carry out three quality controls at two levels each day for every parameter. This results in six quality checks each day to ensure accurate results. While this may not be necessary in general practice, a mandatory quality check must be conducted. Laboratories are accountable for the reliability of the results, but they cannot perform quality checks at the practices themselves. It should become a routine for the GPs to perform these checks regularly. It's not complicated and takes only six minutes. To assist them, one option could be to block the machine after multiple warnings about missing quality checks. Another option is to send quality control material to the general practices each month as a reminder to perform the checks.

> *" I think quality control is essential. … It's important if we want to guarantee that the doctor can have confidence in the result, that he interprets it, that he has this quality environment around... it's not just a test."* (F2P6, head of the laboratory)

During the FGDs, participants highlighted technical problems related to the device itself, as well as sample-taking issues. Some GPs encountered error messages and there were some linkage problems. These minor technical issues could become bigger challenges with broader implementation, as there might not be enough personnel to address all the problems. Lastly, human errors can render the device unusable. Issues with sample collection, such as taking an incomplete drop of blood or handling the sample incorrectly, make it unusable.

POCT CRP enhances decision-making and patient trust, but requires clinical context and careful interpretation

POCT CRP provides objective results, but requires clinical information to optimize decision-making

One feature of the POCT CRP which was very important for most GPs was the objective value that the POCT CRP device generated. It gives the opportunity to make a clear and objective difference between a low or high CRP. But during the FGDs it was clear that there was a lot of confusion about the values. However, in the survey they all agreed that they feel confident about the interpretation of the POCT CRP results (figure 11).

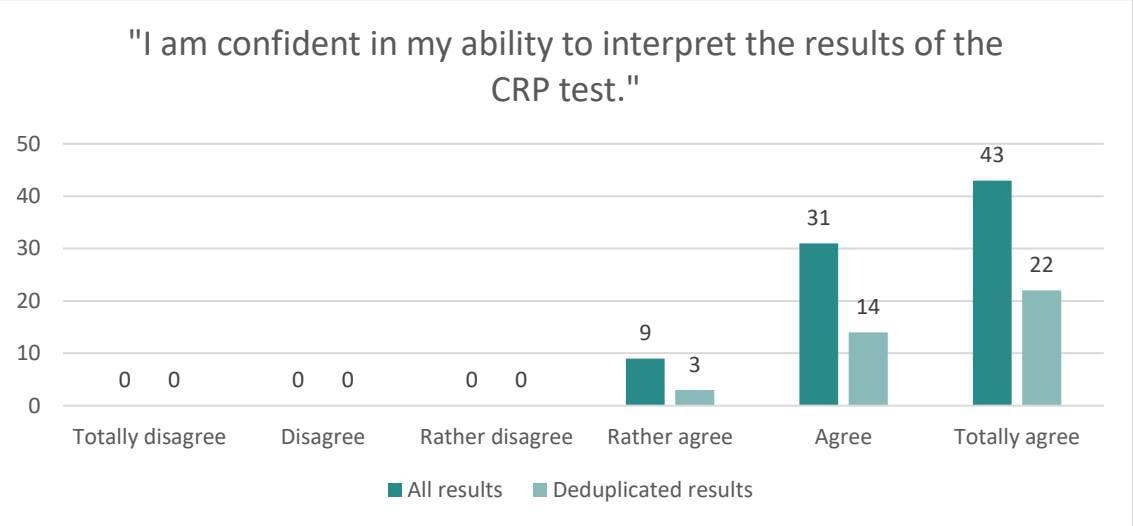


FIGURE 11: Survey statement: "I am confident in my ability to interpret the results of the CRP test."

There is no doubt about the objectivity of the test, but it must be noted that this additional objective information needs to be integrated into the GP's clinical decision-making, based on history and clinical examination, which is often more intuition driven. All the information together helps the GP distinguish between viral and bacterial infections. This is reflected in the survey results, where all GPs agreed with the statement: "The CRP test makes it possible to distinguish between viral and bacterial infections." (figure D, see appendix).

The survey questioned the confidence GPs had about explaining the results of the test to the patients. Unfortunately, something went wrong with the answers on this question, which makes it hard to interpret (figure E, see appendix). Following the information from the FGDs, we could note that GPs agree that they have confidence in explaining the results of POCT CRP.

POCT CRP improves patient management, but requires careful interpretation

According to the results of the survey, the GPs generally agree that CRP can be valuable in situations involving diagnostic doubt (figure 12). They mentioned in the FGDs some situations were POCT CRP could have a huge added value in patient management, like in the evening, when the GP consider sending the patient to the Emergency or not.

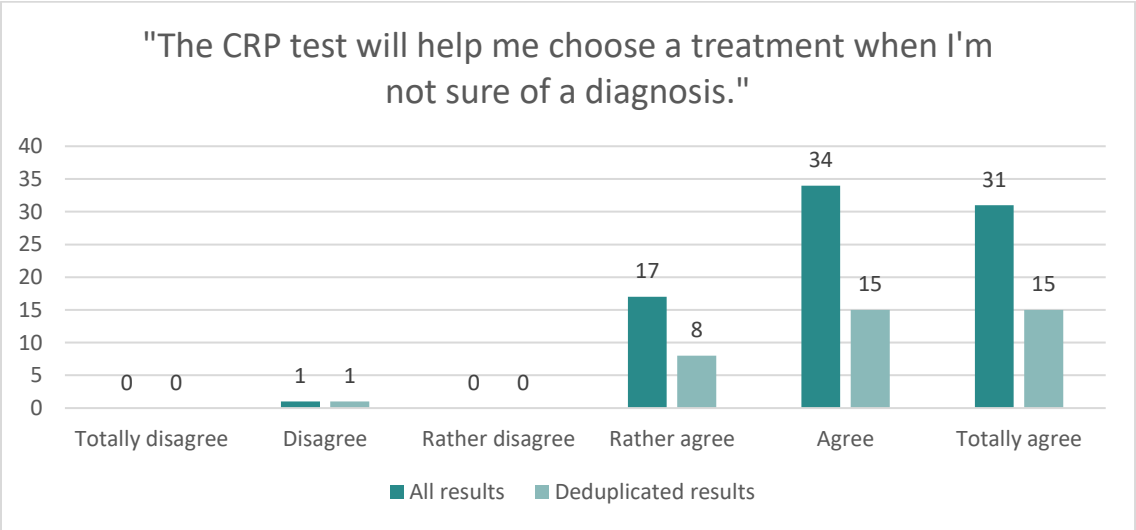


FIGURE 12: Survey statement: "The CRP test will help me choose a treatment when I'm not sure of a diagnosis."

The statement "I will make treatment decisions based on the results of the CRP test" was agreed upon by most participants in the survey (figure F, see appendix). This was also discussed in the FGDs. POCT CRP has the potential to confirm their clinical intuition, and provide reassurance about their intended course of action, or it could completely alter their intentions due to unexpected results, significantly impacting the patient's management.

> *"… A few times I was shocked in the positive sense, POCT results all negative. Maybe even earlier that I thought: that's pure viral here and then a CRP of 170 comes out, I didn't expect that at all. And also vice versa. …"* (F1P1 GP with 15-19 years of experience)

However, GPs need to assess the patient to estimate the severity of the illness, as POCT CRP could also falsely reassure GPs, much like regular blood tests. When the test is taken very early in the course of the disease, the CRP level may be low, even though the patient may ultimately need antibiotics. The CRP value might not yet be elevated, but it will rise in the following hours, as one of the FGD participants described.

> *"… We had a patient who seemed very, very sick, ... But the CRP actually falsely reassured us at the time. … Unfortunately, she was admitted two days later with septic shock with pneumonia on influenza. … But I think with or without CRP the situation had turned out just the same, we wouldn't have done anything differently, …"* (F1P1, GP with 15-19 years of experience)

Looking at the results of the survey regarding antibiotic prescriptions, we see that GPs have more confidence in a low CRP value, which supports a wait-and-see approach, compared to a high CRP value, which indicates the need to prescribe antibiotics (figure G and H, see appendix). More than 50% of the participating GPs totally agreed with not prescribing antibiotics if POCT CRP indicates that antibiotics are unlikely to have an effect. Compared to the statement: “I will prescribe antibiotics if the CRP POCT test shows they are likely to be favourable.”, where most of the GP agreed with, but not as convincingly as with the other statement. During the FGDs, participants mentioned that they made fewer delayed prescriptions for antibiotics because the POCT CRP result reassured them to adopt a wait-and-see approach in cases where they were in doubt.

Looking at patient participation in this study, no one refused the additional test. The patient management of GPs is based on probabilities, experience, anamnesis and clinical examination. Additional technical testing only reassures the patient more about the diagnosis and treatment of the GP. According to the GPs, tests like this must become indispensable in the GP office.

POCT CRP as a communication tool towards patients improves their trust in treatment choices

The main goal of using POCT CRP was to guide the decision-making process of the GP. However, the results of POCT CRP could also be used as a communication tool with patients. GPs noted that patients have more confidence in the decision of treatment the GP made, when this decision was based on objective, POCT CRP results.

The CRP value is often used to convince patients that they have a viral infection and therefore don’t need antibiotics. Most participants agreed with this statement in the survey, and it was also mentioned in the FGDs (figure 13). The POCT CRP value helps the GP explain why antibiotics are unnecessary for viral infections and provides reassurance about the benign nature of the infection.

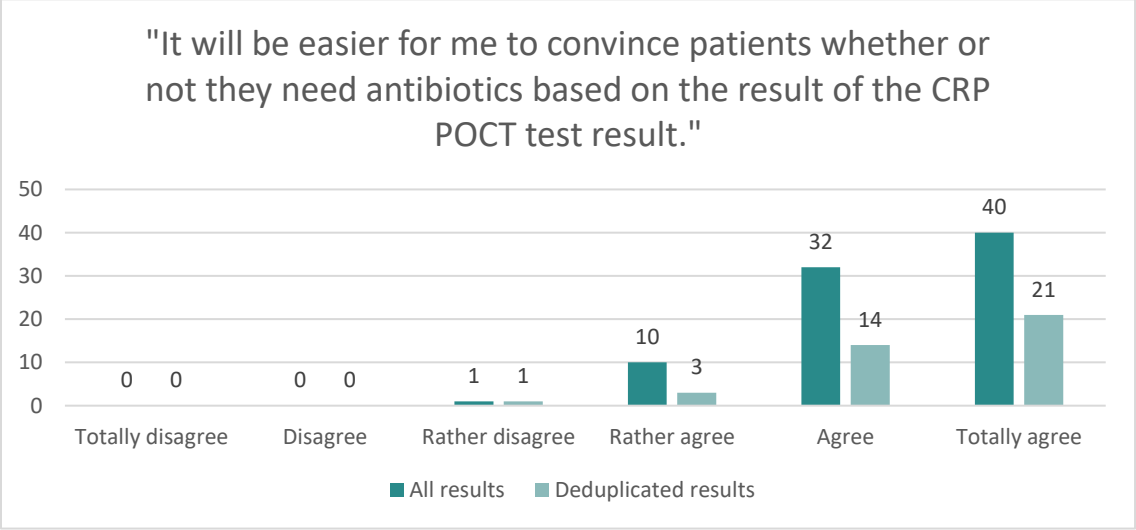


FIGURE 13: Survey statement: "It will be easier for me to convince patients whether or not they need antibiotics based on the result of the CRP POCT test result."

It can be challenging for GPs to explain why patients don't need antibiotics, especially when patients are consistently requesting them. Without the POCT CRP, GPs don't have an objective basis for their decision-making. However, with the results of the POCT CRP, the situation becomes clear, leaving little room for further discussion.

> *"… when you've got fifteen patients and by the sixteenth you've still got to fight, to tell him that there is no need for antibiotics at some point… I don't fight. So, this machine is going to … say, "it's under 5, no discussion" and people are, as you say, convinced straight away."* (F2P9, GP with 15-19 years of experience)

Patients themselves were also more satisfied after the consultation if the GP performed the POCT CRP test (figure I, see appendix). One GP mentioned that patients even came back afterward with the same complains, asking if the GP could do a CRP test. Some GPs experienced that, especially when the CRP value was high, GPs still wanted additional information and proposed a general blood test after the POCT CRP test. Patients never refused an additional general blood test when the GP wanted more information. It's not discussed if this also caused more general blood test in total. One GP used the POCT CRP in addition to a general blood test. He did a general blood test and used some of the blood to use in the POCT CRP device. He knew immediately the CRP value to adapt his treatment on and the other results followed the day after.

GPs who like to use POCT CRP in daily practice face challenges like the absence of guidelines, financial costs, and balancing objective results with clinical judgment

Although there are some exceptions, almost all GPs would like to use POCT CRP in their future daily practice. This can be seen in the results of the survey (figure 14) but was also very clear during the FGDs. There was one GP who never participated in a FGD because the use of the device was to complicate. Others were very grateful they had the opportunity to use the devices.

> *"... I think you spend longer discussing with the patient why that they don't need antibiotics or do need antibiotics than the result of the test takes."* (F1P8, GP with 20-24 years of experience)

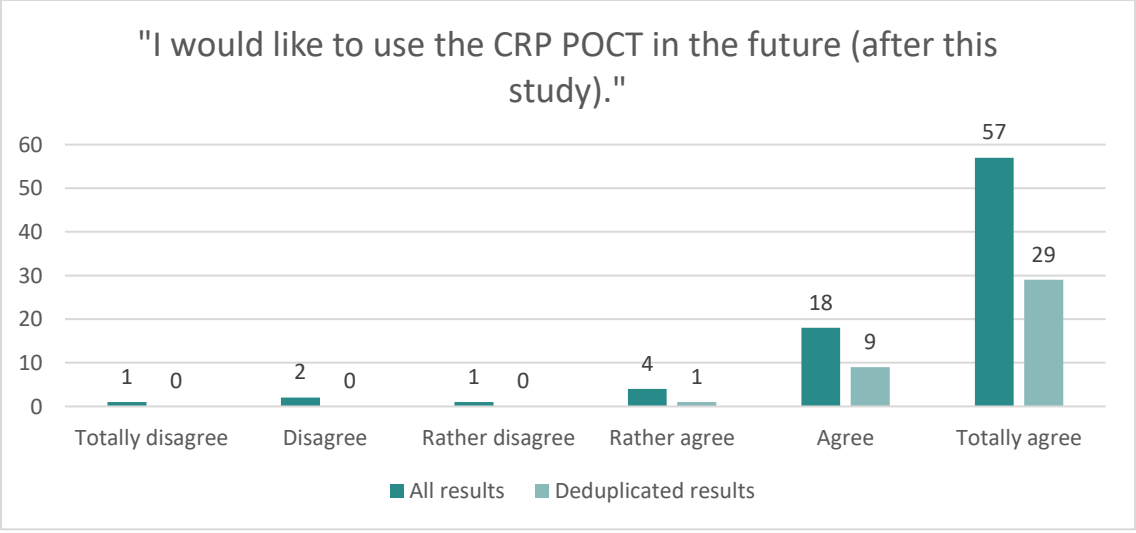


FIGURE 14: Survey statement: "I would like to use the CRP POCT in the future (after this study)."

On the other hand, there are some challenges to address before POCT CRP can be implemented in daily practice of the GP. The lack of guidelines in Belgium made it challenging for GPs to implement POCT CRP in their practices. They found it difficult to determine whether or not to use POCT CRP without the guidance provided by the guidelines. They used the POCT CRP device, they were confident in the good interpretation of the results, but it was challenging to know the thresholds. GPs also noted that general practices in the Netherlands are organized differently than in Belgium, though there is a visible trend in Belgium towards adopting the Dutch model—larger practices with the support of nurses and more advanced technical equipment.

GPs also expressed concerns that they might rely too heavily on the objective POCT CRP results rather than focusing on the patient's condition. They highlighted that the strength of general medicine lies in the combination of the patient relationship, history taking, clinical examination, and decisions based on knowledge and experience.

> *"… we must not lose this generalist side, but you can't go to war with a knife. I mean, at a given moment, if you can have a pistol, a machine gun and a grenade, I go to war with everything … . And if the day comes when I don't have the machine next to me, well, I'll adapt. But if I can have it all, I'll take it all."* (F2P9, GP with 15-19 years of experience)

The last challenge GPs discussed about was the financial aspect of POCT CRP and de possibilities for reimbursement. At present there is not yet reimbursement for POCT CRP in general practice. GPs could cover the cost by themselves, or the patient can pay for it. For the sample collectors it would be around five euros for each test. In comparison to a CRP check on the lab, which is basically free for the patient, this is a supplementary cost. GPs said during the FGDs that patients mostly don't mind paying for some additional, technical test if needed. The ideal situation would be that there is a refund for POCT CRP so it costs nothing to GPs or patients to perform a test when indicated but I may also not cause financial advantage, as this could generate unnecessary tests.

> *"I think it's not a financially heavy burden for health care. I think it will certainly save us as much care as it would have cost us in a reimbursed context. … By avoiding hospital admissions, or by acting earlier in certain cases. Or conversely by avoiding antibiotic resistance or antibiotic prescriptions by not prescribing those*." (F4P1, GP with 10-14 years of experience)

Discussion

This qualitative analysis of the implementation of POCT CRP in general practice showed that almost all participating GPs expressed interest in incorporating POCT CRP into their future daily practice. Although the primary focus of the study was on its use in adults with acute cough, GPs also identified opportunities to use POCT CRP in sick children and other situations. The main reason for using POCT CRP, in addition to history and clinical examination, was to resolve diagnostic uncertainty. However, GPs were aware of the potential pitfall of becoming overly reliant on the test. They emphasized that the strength of general practice lies in the integration of the patient relationship, history-taking, clinical examination, and decisions based on knowledge and experience, rather than making decisions only based on the results of technical tests.

The three key benefits of POCT CRP identified by GPs were the speed of the test, its ease of use, and its reliability. The POCT CRP takes a few minutes, which are not seen as wasted time but can be easily integrated into the existing workflow of the GP. One laboratory staff member noted that quality control measures must be in place to ensure the consistency and reliability of the results.

The greatest challenge to the implementation of POCT CRP in Belgium, according to the GPs, is the financial aspect. Currently, there is no reimbursement for such tests in general practice, unlike general blood tests. As a result, GPs hesitate to implement POCT CRP in their daily practice.

Comparison with existing literature

Eley et al. developed a framework for the implementation of POCT CRP in England in 2014 (25). A few years later, POCT CRP was implemented in the NICE guidelines for respiratory tract infections in England (14). The determinants identified in this study, were largely echoed during our qualitative analysis and could therefore also serve as a basis for creating a similar framework in Belgium. They outlined determinants related to capabilities, such as skills and knowledge; determinants related to motivation, including habits; and determinants linked to opportunity, such as the physical and social environment (25).

Diagnostic uncertainty was a key factor in GPs' decision to perform POCT CRP in our study. When GPs had concerns about the patient's condition or faced uncertainty in diagnosing, POCT CRP could help guide decisions regarding diagnosis and treatment. This finding aligns with studies conducted in the Netherlands and England, where POCT CRP is already in use (12,14,25,26). Studies conducted in Belgium also showed similar results (29,30). Participants said that GPs might have too much faith in POCT CRP results, potentially overriding their intuition about the clinical situation of the patient. This remark during the FGDs is supported by the systematic review of Minnaard et al. where an additional CRP value increased the rates of true positive classified patients (16). However, 30% of patients were still misclassified, which GPs should consider when interpreting the results. This statement was also supported by other studies in England and Belgium (27,30).

The skills and knowledge related to POCT CRP were key determinants identified by Eley et al. for the successful implementation of POCT CTP in Engeland (25). During our study, there was some confusion about the CRP thresholds and their implications for treatment, likely due to the lack of clear guidelines in Belgium (8). This stands in contrast to the Netherlands and England, where clear guidelines exist for the use of POCT CRP in adults with acute cough (12,14). Establishing clear guidelines and CRP thresholds is crucial before POCT CRP can be fully integrated into daily practice in Belgium (22,25,26).

The implementation of POCT CRP in the existing workflow of the GPs went smoothly. GPs emphasized the importance of having a user-friendly device that wouldn't take up too much time during consultations. A study in England found that POCT CRP does not prolong the consultation (27). In contrast, GPs in Belgium were initially concerned about the time it might add to consultations (29,30). However, GPs in our FGDs agreed with the findings of the English study, noting that POCT CRP becomes quicker and easier as they use it more frequently in their daily practice. The time spent on POCT CRP is not extra; rather, they multitask. During the waiting period for results, GPs can already take care of other administrative tasks, meaning the time isn't wasted, but simply rearranged.

A study of Eley et al. found that the finger prick, a minimal invasive method of sample taking, was not seen as a big issue by the patients (22). This was also the idea of the participating GPs. They used this feature to minimize the threshold to do additional investigations with children, as they normally have to refer them to the paediatrician for additional tests. This makes healthcare more accessible.

A previous study in Belgium showed that GPs recommended linking the POCT CRP device to the EMR, but our participants didn’t shared the same ideas (29). The GPs felt that the linkage was not necessary, as they could immediately view the results on the POCT CRP device’s display. In the absence of a linkage, GPs recorded the results in the "objectives" section of the EMR, which they found to be a fast and trackable method.

Before attempting implementation, it is crucial that patients accept this new technical device as an integral part of daily GP practice. The results of POCT CRP should help manage patient expectations, especially regarding antibiotic use, and contribute to patient education (25). Other studies have already supported these ideas (20,27,29,30). In our study, GPs noted that POCT CRP results could indeed serve as a useful communication tool with patients. They found that patients were more easily convinced that a cough is typically self-limited when POCT CRP shows a low value. Additionally, patients seemed to have more confidence in the proposed treatment when POCT CRP was used. These findings align with those of nearly all other studies on POCT CRP (20,25,26,28–30).

Strength and limitations of this study

The strength of this qualitative study lies in the wide range of data collected. The survey provided foundational information about the ideas and concerns of GPs regarding this topic, while the FGDs allowed for a deeper exploration of these ideas. The FGDs provide the advantage of flexibility in the discussion among all stakeholders. The moderator begins with a question or statement, allowing participants to express their views on the topic. The interaction between participants and the moderator can lead to new insights and ideas, offering a richer understanding of the subject. The survey was available in both Dutch and French, ensuring that language was not a barrier. Additionally, the FGDs were conducted in the participants' native language, making it easier to capture subtle nuances in their responses.

A survey also offers the added benefit of being easily replicable with a larger group of participants, as in our study the number of participants was rather low. There are already general practices using POCT CRP devices supplied by laboratories outside of research settings, which could provide valuable insights for further implementation. Applying the survey to a broader population could yield relevant information for expanding the use of POCT CRP in general practice. This could be an opportunity for further research.

A limitation of this study was that the number of participants in the FGDs was lower than expected, with only 20 GPs participating out of an estimated 105 involved in the study. The last FGD consisted of only two GPs, making it more of a duo interview than a true group discussion. However, despite these limitations, the responses from this FGD, when combined with those from the other FGDs, still provided valuable insights.

Another limitation of this study was that we did not analyse the data from the survey before we started the FGDs. This led to unexplained remarkable answers on some of the questions in the survey. For future research, it would be better if the researchers could zoom in on remarkable answers during the FGDs.

One GP refused to participate in an FGD because he no longer wished to use POCT CRP in daily practice. The GP cited the device's lack of user-friendliness as the reason it could not be utilized. Despite efforts from the researchers to explain that this could provide valuable information, the GP still refused to participate. This situation represents a form of participation bias in our study. We must acknowledge the possibility that the GPs who chose not to complete the survey or participate in the FGDs may have had different perspectives on the implementation of POCT CRP, potentially leading to views that are not fully reflected in the current results.

During the FGDs, both laboratory staff and company staff were present and shared their opinions in response to the participating GPs. The presence of these staff members could have introduced bias and potentially influenced the discussion. To ensure an objective and unbiased conversation, it is important that the moderator ensures during the conversation that every opinion can be addressed. It could be beneficial to incorporate staff members into the discussion. This would allow them to answer questions from participants and provide insights that might otherwise be missed, while minimizing the risk of bias by the moderator during the discussion.

Regarding the survey, only two French-speaking GPs completed it in full, which limited the ability to compare the views of Flemish and Brussels GPs. As a result, all responses were analysed together. Additionally, the researcher discusses the approach of analysation, but they did not use a clear, standardized strategy for analysing the survey data, which makes the analysis less replicable. This lack of a defined approach could affect the consistency and reliability of the findings.

Lastly, there could be some recall bias for both the survey and the FGDs. The survey was launched in mid-December 2023, two months after the study began. The FGDs were held between January and March 2024, after the study was completed. Some participants may have already used different devices with varying characteristics before they were asked to complete the survey or share their opinions in an FGD. To address this in future research, it would be beneficial to launch the survey at the beginning of the study so they could fill in this survey whenever they want. However, organizing FGDs at the start of the study is more complex, as it would require conducting additional FGDs to capture relevant information throughout the study period.

Implications for clinical practice and future research

Implementing POCT CRP in the daily practice of GPs could provide them with an additional tool to base their diagnosis and treatment decisions on, alongside patient history and clinical examination. It could also serve as a valuable communication tool, helping to increase patient confidence in the GP's decisions. Moreover, healthcare would become more accessible, as children would no longer need to be referred to a paediatrician just to get a CRP value. All participants in our study agreed that POCT CRP could provide added value in general practice, both for patients with acute cough and for other indications. It could particularly help reduce antibiotic prescriptions for airway infections, as demonstrated in several studies (19–21). However, a clear framework is needed for its implementation in Belgium. First, clear guidelines must be developed outlining the indications for POCT CRP use and the interpretation of results. Second, reimbursement remains one of the major barriers preventing widespread use of POCT CRP (25,27,29,30).

Further research should address the challenges highlighted in our study, particularly the financial aspect and reimbursement. This is already an ongoing project within the broader project where this study is also a part of: "Evaluation of the Organisational Challenges for Out-of-Hospital Implementation of a Point-of-Care C-Reactive Protein Rapid Test in Adults with Acute Cough."

Additionally, a framework for developing guidelines around POCT CRP in Belgium is essential. Before this can be achieved, further research involving a larger sample of GPs from across Flanders, Brussels, and Wallonia needs to be conducted.

Conclusion

This qualitative research used FGDs and a survey to explore the ideas and concerns of GPs regarding the use of POCT CRP in adults with acute cough. The ultimate goal of the study is to evaluate implementation of POCT CRP with the intention to optimize antibiotic prescriptions among Belgian GPs to align with the objectives of the National Action Plan on Antimicrobial Resistance (AMR) (1). GPs agreed that POCT CRP could add value to their daily practice if the test is fast, simple, and reliable. The objective results of POCT CRP could serve as a basis for decisions regarding diagnosis and treatment and could also function as a communication tool to help explain treatment decisions to patients. The major barriers to its implementation are the lack of clear guidelines on the use of POCT CRP in adults with acute cough, as well as uncertainties around reimbursement and costs. Further research involving more GPs who use the POCT CRP device from across the entire country is needed to facilitate the successful implementation of POCT CRP in Belgium. This would help to gather a broader range of insights and ensure that the findings are representative of the diverse experiences and needs of GPs in the whole country.

References

1. FOD Volksgezondheid veiligheid van de voedselketen en leefmilieu. Belgisch nationaal actieplan “One Health” voor de bestrijding van antimicrobiële resistentie 2020-2024 [Internet]. 02/12/2021. 2021 [cited 2024 Nov 4]. Available from: https://www.health.belgium.be/nl/belgisch-nationaal-actieplan-one-health-voor-de-bestrijding-van-antimicrobiele-resistentie-2020-2024
2. World Health Organization. Antimicrobial resistance [Internet]. s.d. [cited 2024 Oct 5]. Available from: https://www.who.int/health-topics/antimicrobial-resistance
3. Fields S, Johnston M. Chapter 16, The Law of Evolution: Darwin, Wallace, and the Survival of the Fittest. In: Genetic Twists of Fate [Internet] [Internet]. Cambridge (MA): MIT Press; 2010. Available from: https://www.ncbi.nlm.nih.gov/books/NBK559908/
4. World Health Organisation. Antimicrobial resistance: Fact sheets [Internet]. 21/11/2023. [cited 2024 Oct 5]. Available from: https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance
5. World Health Organisation. Global antimicrobial resistance and use surveillance system (GLASS) report: 2022 [Internet]. 09/12/2022. [cited 2024 Oct 5]. Available from: https://www.who.int/publications/i/item/9789240062702
6. Kestens W, Bruyneel L, Huyghebaerty C, Karakaya G, MACKEN E, SAERENS R. Het antibioticagebruik in België - een lichte daling tussen 2016 en 2023 maar nog ver verwijderd van de meeste doelstellingen [Internet]. Vol. 2023. 2023. Available from: https://www.mloz.be/sites/default/files/uitstel_van_verzorging_bij_chronisch_zieken_naar_aanleidin
7. RIZIV. Geneesmiddelenverbruik in openbare officina’s. Antibiotica: Analyse van de verdeling en van de evolutie van het verbruik in volumes en in uitgaven per verzekerde in België (analyses en tendensen per gewest, provincie en arrondissement) voor 2022 [Internet]. 16/10/2023. [cited 2024 Nov 4]. Available from: https://www.gezondbelgie.be/images/INAMI/Rapports/RAPPORT-NL-Antibiotiques_2022.pdf
8. Coenen S, Van Royen P, Van Poeck K, Michels J, Dieleman P, Lemoyne S, et al. Acute Hoest. Huisarts Nu. 2002;31(8):391–411.
9. Van den Ende J, Buffels J, Coenen S. Van algoritmes naar diagnostisch landschap. Tijdschr voor Geneeskd en gezondheidszorg. 2020;76(20):1–10.
10. KU Leuven: academisch centrum voor huisartsgeneeskunde. Intego [Internet]. [cited 2024 Nov 4]. Available from: https://www.intego.be/resultaten/tool
11. Leroy R, Christiaens W, Maertens de Noordhout C, et al. Proposals for a more effective antibiotic policy in Belgium – Short Report. 2019.
12. De Bont E, Greving J, Kurver M, Van der Mooren F, Van de Pol A, Prins J, et al. NHG-Standaard Acuut hoesten. 2024.
13. Bruyndonckx R, Adriaenssens N, Versporten A, Hens N, Monnet DL, Molenberghs G, et al. Consumption of antibiotics in the community, European Union/European Economic Area, 1997-2017. J Antimicrob Chemother. 2021;76(2):7–13.
14. s.n. Point of Care C-Reactive Protein (CRP) Testing in Primary Care for patients with Lower Respiratory Tract Infections [Internet]. Available from: https://www.shropshiretelfordandwrekinccg.nhs.uk/wp-content/uploads/CRP-Point_of_Care_Testing_in_Primary_Care_guideline_Nov_16.pdf
15. European Union. Infographic: Antimicrobial resistance targets - how is the EU doing? [Internet]. 17/11/2023. 2023 [cited 2024 Nov 4]. Available from: https://antibiotic.ecdc.europa.eu/en/publications-data/EU-antimicrobial-resistance-targets-2030
16. Minnaard MC, De Groot JAH, Hopstaken RM, Schierenberg A, De Wit NJ, Reitsma JB, et al. The added value of C-reactive protein measurement in diagnosing pneumonia in primary care: A meta-analysis of individual patient data. Cmaj. 2017;189(2):56–63.
17. Minnaard MC, Van De Pol AC, De Groot JAH, De Wit NJ, Hopstaken RM, Van Delft S, et al. The added diagnostic value of five different C-reactive protein point-of-care test devices in detecting pneumonia in primary care: A nested case-control study. Scand J Clin Lab Invest. 2015;75(4):291–5.
18. Vrancken C. Indicaties voor een C-reactief proteïne point-of-care test in de huisartspraktijk Deel B: Focus op lage luchtweginfecties, urineweginfecties, huid en weke delen infecties, alsook meningitis. KU Leuven; 2020.
19. Llor C, Trapero-Bertran M, Sisó-Almirall A, Monfà R, Abellana R, García-Sangenís A, et al. Effects of C-reactive protein rapid testing and communication skills training on antibiotic prescribing for acute cough. A cluster factorial randomised controlled trial. npj Prim Care Respir Med. 2024;34(9):1–8.

20. Andreeva E, Melbye H. 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 Fam Pract [Internet]. 2014;15:80. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L603802351%0Ahttp://dx.doi.org/10.1186/1471-2296-15-80%0Ahttp://sfx.library.uu.nl/utrecht?sid=EMBASE&issn=14712296&id=doi:10.1186%2F1471-2296-15-80&atitle=Usefulness+of+C-reactive+pr

21. Cooke J, Butler C, Hopstaken R, Dryden MS, McNulty C, Hurding S, et al. Narrative review of primary care pointof-care testing (POCT) and antibacterial use in respiratory tract infection (RTI). BMJ Open Respir Res. 2015;2:1–10.

22. Eley CV, Sharma A, Lee H, Charlett A, Owens R, McNulty CAM. 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 [Internet]. 2020;25(44):1–11. Available from: http://dx.doi.org/10.2807/1560-7917.ES.2020.25.44.1900408

23. Minnaard MC, van de Pol AC, Hopstaken RM, van Delft S, Broekhuizen BDL, Verheij TJM, et al. C-reactive protein point-of-care testing and associated antibiotic prescribing. Fam Pract. 2016;33(4):408–13.

24. Martínez-González NA, Keizer E, Plate A, Coenen S, Valeri F, Verbakel JYJ, et al. 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. 2020;9:1–31.

25. Eley CV, Sharma A, Lecky DM, Lee H, McNulty CAM. Qualitative study to explore the views of general practice staff on the use of point-of-care C reactive protein testing for the management of lower respiratory tract infections in routine general practice in England. BMJ Open. 2018;8(10):1–12.

26. Schuijt TJ, Boss DS, Musson REA, Demir AY. Influence of point-of-care C-reactive protein testing on antibiotic prescription habits in primary care in the Netherlands. Fam Pract. 2018;35(2):179–85.

27. Wood F, Brookes-howell L, Hood K, Cooper L, Verheij T, Goossens H, et al. A multi-country qualitative study of clinicians' and patients' views on point of care tests for lower respiratory tract infection. Fam Pract. 2011;28(6):661–9.

28. Llor C, Bjerrum L, Munck A, Cots JM, Hernández S, Moragas A. Access to point-of-care tests reduces the prescription of antibiotics among antibiotic-requesting subjects with respiratory tract infections. Respir Care. 2014;59(12):1918–23.

29. Horemans R. Evaluatie van de POC-CRP-test bij lage lucht- weginfecties in de huisartspraktijk: een kwalitatieve studie naar barrières en facilitators. KU Leuven; 2019.

30. De Freest T. Point-of-care CRP-testen in de eerste lijn : perspectief van de huisarts . Een praktijkverbeterend project . Universiteit Gent; 2023.

31. Lemiengre M, Verbakel J, Burghgraeve T De, Aertgeerts B, Baets F De, Buntinx F, et al. Optimizing antibiotic prescribing for acutely ill children in primary care (ernie2 study protocol, part b): A cluster randomized, Factorial controlled trial evaluating the effect of a point-of-care c-reactive protein test and a brief intervention combined with written safety net advice. BMC Pediatr. 2014;14(1):1–9.

32. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative studies (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Heal Care. 19(6):349–57.

33. Braun V, Clarke V. Using thematic analysis in psychology; In qualittaive research in psychology. Qual Res Psychol [Internet]. 2006;3(2):77–101. Available from: https://psychology.ukzn.ac.za/?mdocs-file=1176

Appendices

List of additional figures

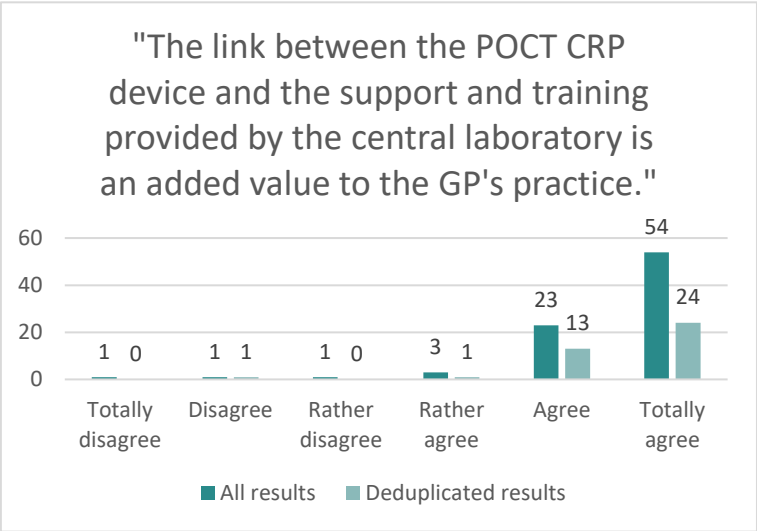


FIGURE A: Survey statement: "The link between the POCT CRP device and the support and training provided by the central laboratory is an added value to the GP's practice."

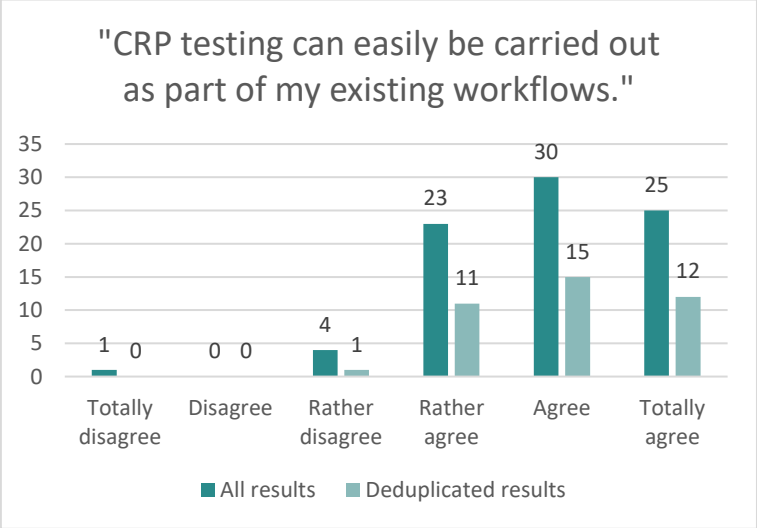


FIGURE B: Survey statement: "CRP testing can easily be carried out as part of my existing workflows."

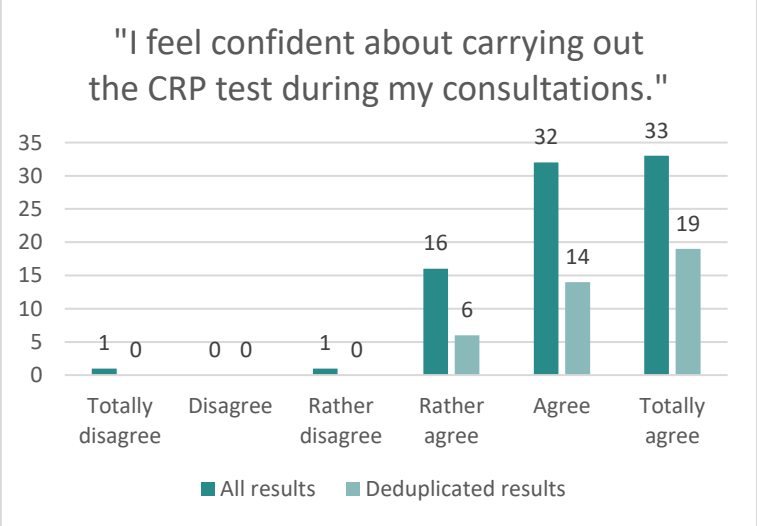


FIGURE C: Survey statement: "I feel confident about carrying out the CRP test during my consultations."

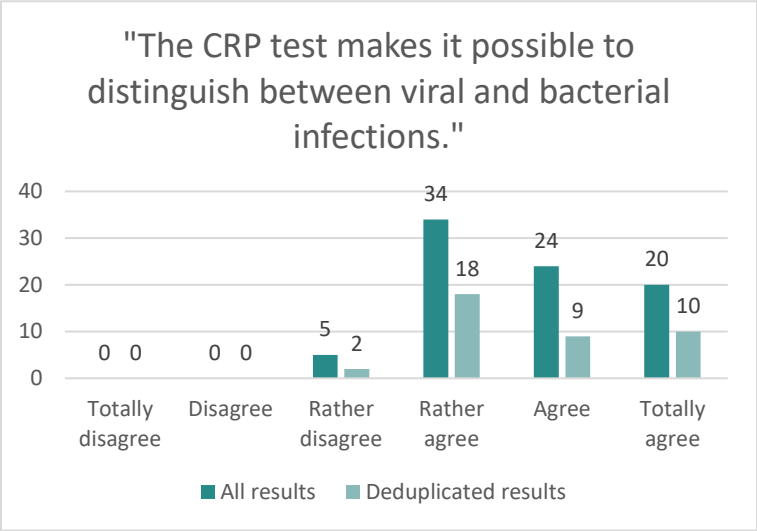


FIGURE D: Survey statement: "The CRP test makes it possible to distinguish between viral and bacterial infections."

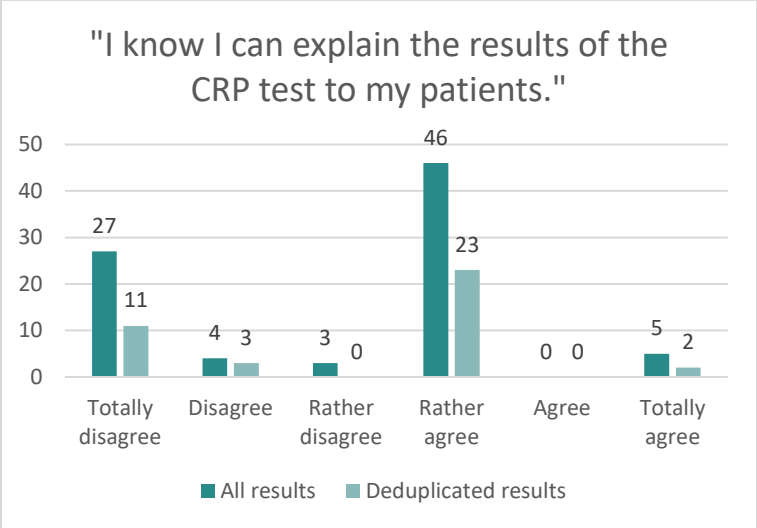


FIGURE E: Survey statement: "I know I can explain the results of the CRP test to my patients."

Note: The response options to this question were inadvertently set up incorrectly as the options 'totally agree', "agree", and 'rather agree' were not included in the Dutch survey. The results in this graphic are the original results. Following the information from the FGDs, we could switch the negative answers to the positive answers.

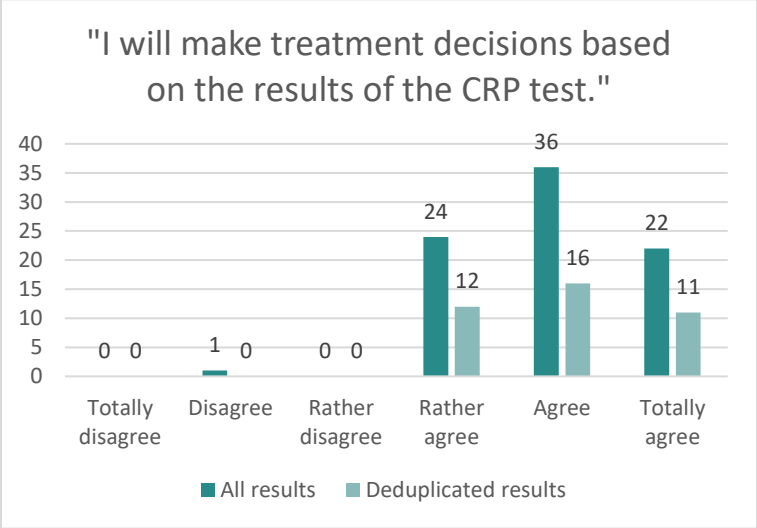


FIGURE F: Survey statement: "I will make treatment decisions based on the results of the CRP test."

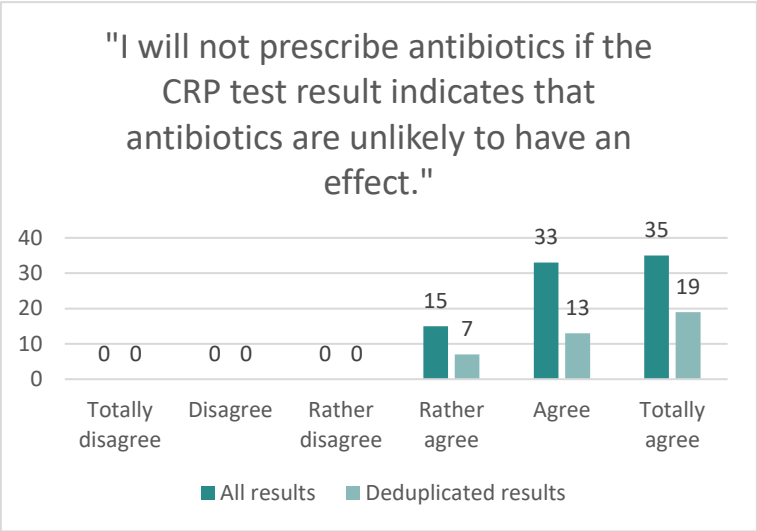


FIGURE G: Survey statement: "I will not prescribe antibiotics if the CRP test result indicates that antibiotics are unlikely to have an effect."

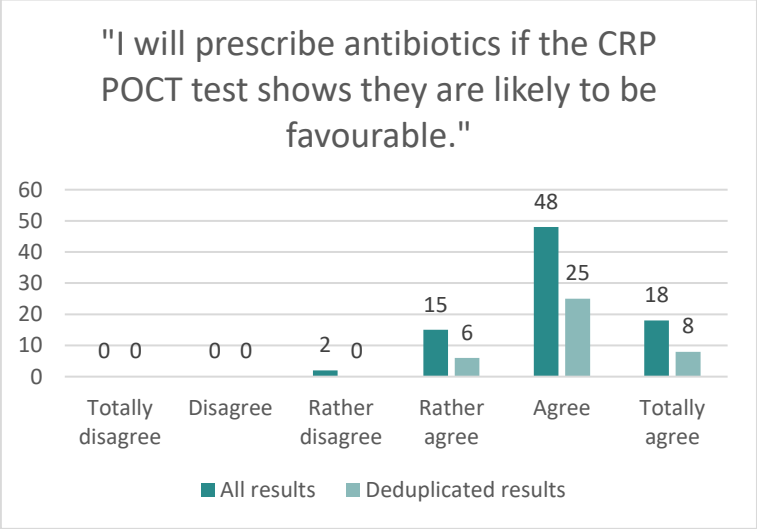


FIGURE H: Survey statement: "I will prescribe antibiotics if the CRP POCT test shows they are likely to be favourable."

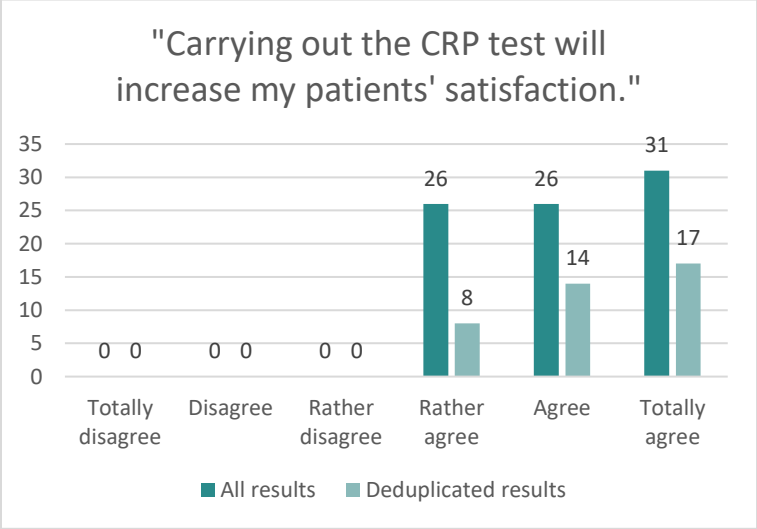


FIGURE I: Survey statement: "Carrying out the CRP test will increase my patients' satisfaction."

Informed consent: Dutch

Exemplaar voor de deelnemer

Titel van de studie:

Evaluatie van de organisatorische uitdagingen van de implementatie van POC CRP buiten het ziekenhuis bij volwassenen die hoesten.

Opdrachtgever: KU Leuven

Onderzoeksinstelling: Academisch Centrum voor Huisartsgeneeskunde, KU Leuven

Comité voor Medische Ethiek: Ethische Commissie Onderzoek UZ/KU Leuven

Lokale arts-onderzoeker:

Prof. Dr. Jan Verbakel

I Noodzakelijke informatie voor uw beslissing om deel te nemen

Inleiding

U wordt uitgenodigd om deel te nemen aan een onderzoek naar de implementatie van drie POCT CRP toestellen in de huisartsenpraktijk. Om u te helpen beslissen of u al dan niet aan deze studie wenst deel te nemen, willen we u vragen even de tijd te nemen om onderstaande informatie voor deelnemers door te nemen, zodat u een welbewuste beslissing kunt nemen. Dit wordt een “geïnformeerde toestemming” genoemd.

Wij vragen u de volgende pagina’s met informatie aandachtig te lezen. Hebt u vragen, dan kan u terecht bij de onderzoeker.

Dit document bestaat uit essentiële informatie die u nodig heeft voor het nemen van uw beslissing, uw schriftelijke toestemming en eventuele bijlagen waarin u meer details terugvindt over bepaalde onderdelen van de basisinformatie.

Als u aan deze studie deelneemt, moet u weten dat:

- Deze studie opgesteld is na evaluatie door de Ethische Commissie Onderzoek UZ/KU Leuven
- Uw deelname is vrijwillig; er kan op geen enkele manier sprake zijn van dwang. Voor deelname is uw ondertekende toestemming nodig. Ook nadat u hebt getekend, kan u de onderzoeker laten weten dat u uw deelname wilt stopzetten zonder hiervoor een reden op te geven.
- De gegevens die in het kader van uw deelname worden verzameld, zijn vertrouwelijk. Bij de publicatie van de resultaten is uw anonimiteit verzekerd.
- Indien u extra informatie wenst, kan u altijd contact opnemen met de onderzoekers.

Doelstellingen en verloop van de studie

Deze studie is een onderdeel van een door het FOD ondersteund project ‘Evaluatie van de organisatorische uitdagingen van de implementatie van POC CRP buiten het ziekenhuis bij volwassenen die hoesten (NAPAMR 2020-2024-POCT)’ onder supervisie van Prof. Jan Verbakel (KU Leuven, Huisartsgeneeskunde). Het onderzoek wordt gefinancierd door de FOD Volksgezondheid. De drie fabrikanten van de POCT toestellen zullen voor de duur van deze studie toestellen en testmateriaal leveren, maar er zal geen financiële steun van deze fabrikanten worden verleend. In verschillende Europese landen is de POCT CRP test in de huisartsenpraktijk reeds opgenomen in de diagnostische richtlijnen. In ons land echter, staan we nog voor een aantal organisatorische uitdagingen. Om hierop een antwoord te kunnen bieden werd er een project opgesteld dat bestaat uit verschillende onderdelen waarvan deze studie er eentje is. Er werd in de huisartsenpraktijk waar u werkt de voorbije maanden een POCT CRP toestel geïnstalleerd. Graag zouden wij meer te weten komen over hoe deze procedure van implementatie en gebruik in uw praktijk is verlopen. Daarom kreeg u een uitnodiging om deel te nemen aan deze focusgroep.

Aan deze studie zullen ongeveer 35 personen deelnemen. Om aan deze studie te kunnen deelnemen, moet de huisartsenpraktijk waar u werkt deelnemen aan het overkoepelende project ‘Evaluatie van de organisatorische uitdagingen van de implementatie van POC CRP buiten het ziekenhuis bij volwassenen die hoesten (NAPAMR 2020-2024-POCT)’. U moet de voorbije maanden regelmatig gebruik gemaakt hebben van het POCT CRP toestel.

De onderzoeker zal u vragen om een vragenlijst in te vullen die peilt naar uw ervaringen met het gebruik van de POCT CRP toestellen. Het invullen van deze vragenlijsten zal ongeveer 15 minuten van uw tijd in beslag nemen.

De onderzoeker zal u vervolgens vragen deel te nemen aan een focusgroep gesprek dat peilt naar uw ervaringen met het gebruik van de POCT CRP toestellen. Deelname aan dit gesprek zal ongeveer 90 minuten van uw tijd in

beslag nemen. Tijdens het gesprek worden geluidsopnames en beeldopnames gemaakt. De opnames zullen nadien enkel gebruikt worden voor transcriptie. Na transcriptie zullen alle beeld- en geluidsopnames vernietigd worden.

Beschrijving van de risico's en van de voordelen

U heeft zelf geen voordeel van deelname aan dit onderzoek; u kan wel, door het delen van uw kennis en/of ervaringen, bijdragen aan de mogelijkheid om POCT CRP toestellen te implementeer in de diagnostische richtlijnen voor de huisartsenpraktijk in België.

Intrekking van uw toestemming

U beslist zelf of u meedoet aan het onderzoek. Deelname is vrijwillig. Als u besluit niet mee te doen, hoeft u verder niets te doen. U hoeft niets te tekenen. U hoeft ook niet te zeggen waarom u niet wilt meedoen.

Als u wel meedoet, kan u zich altijd bedenken en toch stoppen, ook tijdens het onderzoek. U hoeft hiervoor geen reden te geven

Uw deelname is vrijwillig. U hebt het recht om uw deelname aan de studie om eender welke reden en zonder opgave van redenen stop te zetten.

Als u aan deze studie deelneemt, vragen wij om:

- Ten volle mee te werken voor een correct verloop van de studie.

Contact

Als u bijkomende informatie wenst kan u contact opnemen met de onderzoeker prof. dr. Jan Verbakel (telefoonnummer: 016/377286).

Als u vragen hebt met betrekking tot uw rechten als deelnemer aan de studie, kan u contact opnemen met de Ethische Commissie Onderzoek UZ/KU Leuven (*ec@uzleuven.be*; 016 34 86 00 (werkdagen tussen 10 en 11 uur)).

Titel van de studie:

Evaluatie van de organisatorische uitdagingen van de implementatie van POC CRP buiten het ziekenhuis bij volwassenen die hoesten.

II Geïnformeerde toestemming

Deelnemer

Ik verklaar dat ik geïnformeerd ben over de aard, het doel, de duur, de eventuele voordelen en risico's van de studie en dat ik weet wat van mij wordt verwacht. Ik heb kennisgenomen van het informatiedocument en de bijlagen ervan.

Ik heb voldoende tijd gehad om na te denken en indien gewenst met een door mij gekozen persoon te overleggen.

Ik heb alle vragen kunnen stellen die bij me opkwamen en ik heb een duidelijk antwoord gekregen op mijn vragen.

Ik begrijp dat mijn deelname aan deze studie vrijwillig is en dat ik vrij ben mijn deelname aan deze studie stop te zetten. Daarvoor hoef ik geen reden op te geven en ik weet dat er geen nadeel voor mij kan ontstaan.

Ik begrijp dat er tijdens mijn deelname aan deze studie gegevens over mij zullen worden verzameld en dat de onderzoekers de vertrouwelijkheid van deze gegevens verzekeren overeenkomstig de Europese en Belgische wetgeving ter zake.

Ik wil graag / Ik wil niet geïnformeerd worden over de algemene onderzoeksresultaten van de studie.

Ik heb een exemplaar ontvangen van de informatie aan de deelnemer en de geïnformeerde toestemming.

Naam, voornaam, datum en handtekening van de deelnemer

Onderzoeker

Ik ondergetekende Jan Verbakel, onderzoeker, verklaar de benodigde informatie inzake deze studie mondeling te hebben verstrekt evenals een exemplaar van het informatiedocument aan de deelnemer te hebben verstrekt.

Ik bevestig dat geen enkele druk op de deelnemer is uitgeoefend om hem/haar te doen toestemmen met deelname aan de studie en ik ben bereid om op alle eventuele bijkomende vragen te antwoorden.

Ik bevestig dat ik werk in overeenstemming met de ethische beginselen zoals vermeld in de "Verklaring van Helsinki", de "Goede klinische praktijk".

Naam, voornaam, datum en handtekening van de onderzoeker

Titel van de studie:

Evaluatie van de organisatorische uitdagingen van de implementatie van POC CRP buiten het ziekenhuis bij volwassenen die hoesten.

III Aanvullende informatie

1: Aanvullende informatie over de bescherming en de rechten van de deelnemer

Ethisch comité

Deze studie werd geëvalueerd door een onafhankelijk ethisch comité, namelijk Ethische Commissie Onderzoek UZ/KU Leuven, dat een gunstig advies heeft uitgebracht. Het ethische comité heeft als taak de personen die aan klinische studies deelnemen te beschermen.

Het controleert of uw rechten als deelnemer aan een studie gerespecteerd worden, of – uitgaande van de huidige kennis – de balans tussen risico's en voordelen gunstig is voor de deelnemers, of de studie wetenschappelijk relevant en ethisch verantwoord is.

.

U dient het positief advies van de Ethische Comités in geen geval te beschouwen als een aansporing om deel te nemen aan deze studie.

Vrijwillige deelname

Aarzel niet om alle vragen te stellen die u nuttig vindt voordat u tekent. Neem de tijd om er met een vertrouwenspersoon over te praten, als u dit wenst.

U heeft het recht om niet deel te nemen aan deze studie of met deze studie te stoppen zonder dat u hiervoor een reden hoeft te geven, zelfs al hebt u eerder toegestemd om aan deze studie deel te nemen. Uw beslissing zal in geen geval nadelige gevolgen hebben voor u.

Als u aanvaardt om aan deze studie deel te nemen, ondertekent u het toestemmingsformulier. De onderzoeker zal dit formulier ook ondertekenen en zal zo bevestigen dat hij u de noodzakelijke informatie voor deze studie heeft gegeven. U zult het voor u bestemde exemplaar ontvangen.

Kosten in verband met uw deelname

U zult een billijke vergoeding krijgen voor uw deelname aan deze studie aan de hand van een vergoeding op praktijkniveau (1 vergoeding per praktijk). Uw deelname zal voor u geen bijkomende kosten met zich meebrengen.

Vertrouwelijkheidgarantie

Uw deelname aan de studie betekent dat de onderzoekers gegevens over u verzamelen en gebruiken voor onderzoek en in het kader van wetenschappelijke en medische publicaties.

Uw gegevens zullen worden verwerkt overeenkomstig de

- Europese Algemene Verordening inzake Gegevensbescherming (AVG) van 27 april 2016 (van kracht sinds 25 mei 2018)
- Belgische Privacywet van 30 juli 2018 (gepubliceerd op 5 september 2018) betreffende de bescherming van natuurlijke personen in verband met de verwerking van persoonsgegevens.
- Belgische wet van Patiëntenrechten van 22 augustus 2022.

KU Leuven is de verwerkingsverantwoordelijke voor uw gegevens.

U hebt het recht om aan de onderzoekers te vragen welke gegevens zij over u hebben verzameld en waarvoor ze gebruikt worden in het kader van de studie. U hebt het recht om deze gegevens in te kijken en om verbeteringen te laten aanbrengen indien ze foutief zouden zijn[1].

De onderzoekers zijn verplicht om deze verzamelde gegevens vertrouwelijk te behandelen. Dit betekent dat zij zich ertoe verbinden om uw naam nooit bekend te maken in het kader van een publicatie of een conferentie en dat zij uw gegevens zullen coderen (uw identiteit zal worden vervangen door een identificatiecode in de studie). De overgedragen persoonlijke gegevens omvatten geen combinatie van elementen waarmee het mogelijk is u te identificeren [2].

1 Deze rechten zijn bepaald door de Europese Algemene Verordening Gegevensbescherming (AVG), door de Belgische Wetgeving betreffende de bescherming van natuurlijke personen met betrekking tot de verwerking van persoonsgegevens en door de wet van 22 augustus 2002 betreffende de rechten van de patiënt.

2 De database met de resultaten van de studie zal dus geen elementen bevatten zoals uw initialen, uw geslacht en uw volledige geboortedatum (dd/mm/jjjj).

De (gecodeerde) onderzoeksgegevens kunnen doorgegeven worden aan Belgische of andere regelgevende instanties, aan de ethische comités, aan andere onderzoekers en/of instellingen die samenwerken met de opdrachtgever. Dit gebeurt dan steeds in gecodeerde vorm.

De opdrachtgever zal de verzamelde gegevens gebruiken in het kader van de studie waaraan u deelneemt, maar wil ze ook kunnen aanwenden in het kader van andere studies met dezelfde context als deze studie. Buiten de context die wordt beschreven in dit document, kunnen uw gegevens enkel gebruikt worden als een ethisch comité zijn goedkeuring heeft gegeven.

Indien u uw toestemming tot deelname aan de studie intrekt, zullen de gecodeerde gegevens die al verzameld waren vóór uw terugtrekking, bewaard worden. Hierdoor wordt de geldigheid van de studie gegarandeerd. Er zal geen enkel nieuw gegeven aan de opdrachtgever worden doorgegeven.

Als u bijkomende informatie wenst kan u contact opnemen met de onderzoeker prof. dr. Jan Verbakel (telefoonnummer: 016/377286).

Als u vragen hebt met betrekking tot uw rechten als deelnemer aan de studie, kan u contact opnemen met de Ethische Commissie Onderzoek UZ/KU Leuven (*ec@uzleuven.be*; 016 34 86 00 (werkdagen tussen 10 en 11 uur)). Indien u naderhand nog bijzondere aandachtspunten heeft of klacht wenst neer te leggen, kan u terecht bij het privacy team van de KU Leuven op privacy@kuleuven.be

Tot slot, indien u een klacht heeft over de verwerking van uw gegevens, kunt u contact opnemen met de Belgische toezichthoudende instantie die toeziet op de naleving van de grondbeginselen van de bescherming van persoonsgegevens:

De Belgische toezichthoudende instantie heet:

Gegevensbeschermingsautoriteit (GBA)

Drukpersstraat 35,

1000 Brussel

Tel. +32 2 274 48 00

e-mail: contact(at)apd-gba.be

Website: www.gegevensbeschermingsautoriteit.be

Interview guide Dutch

Evaluatie van de implementatie van 3 POCT CRP toestellen in de huisartsenpraktijk.

Introductie

Voorstellen onderzoeksteam

Goedemiddag of goedenavond iedereen, welkom bij deze focusgroep discussie.

Ik ben ……, huisarts-in-opleiding aan de KU Leuven, en ik ben de moderator van het gesprek vandaag. Ik zal de discussie in goede banen lijden.

[Ieder lid van het onderzoeksteam stelt zichzelf kort voor.]

Algemene inleiding

Enkele maanden geleden werd er een of meerdere POCT CRP toestel geïnstalleerd in de huisartsenpraktijk waar u werkt. U heeft de kans gehad dit te gebruiken als aanvullend diagnostisch middel bij patiënten met een acute hoest. Graag zouden we nu aan de hand van deze focusgroep uw ervaringen en meningen horen over de implementatie van POCT CRP in uw huisartsenpraktijk.

In talrijke Europese landen is de POCT CRP reeds opgenomen in de diagnostische richtlijnen, kijk maar naar ons buurland Nederland. Om de toepassing en de economische haalbaarheid van de POCT CRP in België te evalueren werd de studie 'Evaluatie van de organisatorische uitdagingen van de implementatie van POC CRP buiten het ziekenhuis bij volwassenen die hoesten (NAPAMR 2020-2024-POCT)' onder supervisie van Prof. Jan Verbakel (KU Leuven, Huisartsgeneeskunde) opgezet. Deze studie wordt ondersteund door het FOD. De studie waar deze focusgroep over gaat, is een deel van dit overkoepelende project met als doel beleidsaanbeveling te kunnen formuleren om POCT CRP te kunnen implementeren in de Belgische huisartsenpraktijken.

Praktische afspraken

Om deze discussie zo vlot mogelijk te laten verlopen, is het volgende belangrijk:

- Elke mening is belangrijk. We vragen input van alle deelnemers.
- Reacties op de mening van anderen geeft ons ook waardevolle info.
- Ook tegengestelde meningen zijn van belang.
- Laat elkaar uitspreken.
- Hou het respectvol tijdens de discussie.

De focus groep discussie zal 60 tot 90 minuten duren. Moet iemand vroeger weg?

Voorstelling deelnemers

Om te beginnen stellen alle deelnemers zichzelf voor: uw naam, het beroep dat u uitoefent en de locatie van uw praktijk waar u werkt. Vermeld ook het POCT CRP device waar u mee gewerkt heeft.

Vragen

Inleidende vraag

Hoe hebt u de implementatie van het POCT CRP toestel in uw praktijk ervaren?

Overgangsvragen

Wat zijn de voordelen aan het ter beschikking hebben van een POCT CRP bij een patiënt met acute hoest?

Wat zijn de nadelen aan het ter beschikking hebben van een POCT CRP bij een patiënt met acute hoest?

Kernvragen

Hoe werd de implementatie van het POCT CRP toestel in uw praktijk georganiseerd?

- Hoe verliep in de installatie van het toestel?
- Bent u tijdens het gebruik op technische moeilijkheden gebotst? Zo ja, welke? Hoe heeft u deze aangepakt?
- Hoe verliep de koppeling van het toestel met het elektronisch medisch dossier?
- Wie was het aanspreekpunt in uw praktijk bij problemen of vragen over het POCT CRP toestel?

Hoe past het gebruik van het POCT CRP toestel in uw workflow?

- Bij welke patiënten gebruikte u het POCT CRP toestel en bij welke niet?
- Wat maakte dat u besloot het toestel wel te gebruiken?
- Wat maakte dat u besloot het toestel niet te gebruiken?
- Op welk moment van het consult besloot u het POCT CRP toestel te gebruiken?
- Gebruikte u het POCT CRP toestel tijdens de consultatie of liet u de patiënten terugkomen voor een staalname?
- Had u de indruk dat het gebruik van POCT CRP uw persoonlijke workflow verstoorde? Zo ja, op welke manier?

Haalbaarheid

- Bent u tijdens het gebruik van het POCT CRP toestel gebotst op zaken die u tegenhielden het toestel te gebruiken? Zo ja, welke?
- Heeft u zaken opgemerkt die maken dat het POCT CRP toestel niet kan geïmplementeerd worden in uw dagelijkse praktijkvoering? Zo ja, welke?
- Kon u bij elke consultatie waarbij dit gewenst was, gebruik maken van het POCT CRP toestel? Zo nee, wat waren de redenen daarvoor?

Slotvraag

Zijn er thema's die niet aan bod zijn gekomen tijdens deze focus groep discussie waar we over hadden moeten discussiëren, maar niet hebben gedaan?

Van alle karakteristieken van de klinische beslisondersteuning die we besproken hebben, welke is voor jou het belangrijkst? (Vraag voor iedere deelnemer)

Survey: Dutch

Q1 Met welk toestel heeft u de voorbije maanden gewerkt?

Q2 Wat is uw leeftijd (in jaar)? 20-30 / 31-40 / 41-50 / 51-60 / 60+

Q3 Hoeveel jaren ervaring heeft u als huisarts (in aantal jaren)? 0-5 / 6-10 / 11-20 / 21-30 / 30+

Q4 Wat is uw geslacht? Mannelijk / Vrouwelijk / Andere …

Q5 In wat voor type praktijk werkt u? Solopraktijk / Duopraktijk / Andere …

Q6 In wat voor type praktijk werkt u? Multidisciplinair / Huisartsenpraktijk / Andere …

Q7 Hoeveel tijd had u nodig voor de opleiding omtrent het uitvoeren van de POC CRP test (in het totaal, in minuten)?

Q8 Hoeveel tijd had u nodig voor het uitvoeren van de POC CRP test (per test, in minuten)?

Q9Hoeveel tijd had u nodig voor het uitvoeren van de stalen voor kwaliteitsborging (per controle-test, in minuten)?

Q10 In hoeverre bent u het eens met volgende stellingen?

Helemaal niet eens / Niet eens / Eerder niet eens / Eerder eens / Eens / Helemaal eens

- De CRP-sneltest zal betrouwbare en nauwkeurige resultaten opleveren.
- De CRP-sneltest kan veilig worden gebruikt als hulpmiddel bij keuzes omtrent behandeling.
- De CRP-sneltest kan gemakkelijk worden uitgevoerd binnen mijn bestaande workflows.
- De CRP-sneltest kan uitgevoerd worden zonder de consultatieduur te verlengen.
- Ik heb er vertrouwen in dat ik de CRP-sneltest kan uitvoeren tijdens mijn consultaties.
- Ik heb er vertrouwen in dat ik de resultaten van de CRP-sneltest kan interpreteren.
- De CRP-sneltest kan onderscheid maken tussen virale en bacteriële infecties.
- De CRP-sneltest zal mij helpen bij het maken van keuzes omtrent behandeling wanneer ik onzeker ben over een diagnose.
- Het uitvoeren van de CRP-sneltest zal de tevredenheid van mijn patiënten vergroten.
- Ik ben er zeker van dat ik CRP-testresultaten kan uitleggen aan mijn patiënten.
- Ik zal patiënten gemakkelijker kunnen overtuigen dat ze wel/geen antibiotica nodig hebben aan de hand van het resultaat van de CRP-sneltest.
- De CRP-sneltest zal toekomstige consultaties voor vergelijkbare klachten verminderen.
- Ik zal beleidsbeslissingen nemen op basis van de resultaten van de CRP-sneltest.
- Ik zal geen antibiotica voorschrijven als de uitslag van de CRP-sneltest aangeeft dat antibiotica waarschijnlijk geen effect zullen hebben.
- Ik zal antibiotica voorschrijven als uit de CRP-sneltest blijkt dat deze waarschijnlijk gunstig zijn.
- Ik zou graag de CRP-sneltest in de toekomst (na deze studie) gebruiken.

De koppeling van het POC CRP toestel, de ondersteuning, en de opleiding door het centraal lab is een meerwaarde voor de praktijkvoering als huisarts.