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Clinical and operational impact of rapid point-of-care SARS-CoV-2 detection in an emergency department

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ABSTRACT

Study objective: Rapid point-of-care (POC) SARS-CoV-2 detection with Abbott ID NOW™ COVID-19 test has been implemented in our Emergency Department (ED) for several months. We aimed to evaluate the operational impact and potential benefits of this innovative clinical pathway.

Methods: We conducted a prospective, descriptive, interventional, non-randomized study, before-after trial with the comparison of patient cohorts from two consecutive periods of seven weeks (observational pre-POC period vs interventional POC period).

Results: In 2020, throughout weeks 37 to 50, 3333 patients were assessed for eligibility and among them 331 (9.9%) were positive for SARS-CoV-2 infections. Among the included patients, 136 (9.2%) were positive for SARS-CoV-2 infection in the pre-POC period and 195 (10.5%) in the POC period. Among positive patients for SARS-CoV-2 related infection in-hospital mortality rate was similar between the two groups but the hospitalization rate was higher in the POC group (81.6% vs. 65.4%; $p < 0.001$). More patients in the POC period were able to leave the ED within 6 h. We examined rates of antibiotic, anticoagulant, and corticosteroid prescriptions among patients tested for SARS-CoV-2 in the ED. Only the rate of prescribed anticoagulants was found to be higher in the POC period (40% vs. 24.2%; $p < 0.003$).

Conclusion: We demonstrated that COVID-19 point-of-care testing speeds up clinical decision-making, improving use of recommended treatments for COVID-19, such as anticoagulants. Moreover, it improves the boarding time and significantly shortened the length of stay in the ED for patients requiring outpatient care.

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1. Introduction

Since the first case of coronavirus disease 2019 (COVID-19) in Wuhan, China, in December 2019 [1], pandemic illness has spread to millions of persons worldwide. This global pandemic of the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is one of the most compelling and concerning global health crises of modern day, posing great threats to the world and affecting all aspects of human life. Highly sensitive and specific tests are crucial to identify and manage COVID-19 patients as well as implementing control measures to limit the outbreak. Thus, laboratory testing plays a critical role in defining disease characteristics and epidemiology in addition to controlling the spread of an emerging infectious pathogen, such as SARS-CoV-2.

Real-time reverse transcription polymerase chain reaction (RT-PCR) testing with respiratory samples is currently the recommended laboratory method for the diagnosis of acute SARS-CoV-2 infection [2,3]. Although, RT-PCR is the gold standard for COVID-19 diagnostic testing [4], samples are often transported to centralized testing laboratories and batched for processing within <6 h, leading to turnaround times of 24 h or more. Point-of-care (POC) molecular tests have the potential to allow earlier detection and²isolation of confirmed SARS-CoV-2 cases, compared to laboratory-based diagnostic methods, thereby reducing household and community transmission [5,6]. Thus, the use of self-enclosed systems, such as the ID NOW™ platform which integrates nucleic acid extraction, amplification, and detection; may be useful tools when utilized within a busy hospital or near patient testing environments [7]. The first commercially available ID NOW™ (formerly Alere™ i) assay was developed to diagnose seasonal influenza [8,9] and an assay for SARS-CoV-2 testing is available. The ID NOW™ COVID-19 assay is a rapid (13 min or less), molecular in vitro diagnostic test utilizing an isothermal nucleic acid amplification technology

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(NAAT), intended for the qualitative detection of SARS-CoV-2 viral RNA in direct nasopharyngeal swabs from individuals who are suspected of COVID-19 [10]. In previous work, we demonstrated that the routine use of rapid point-of-care testing (POCT) with the Abbott ID NOW™ (formerly Alere i Influenza A & B assay in an emergency department (ED) is associated with a lower rate of unnecessary biological tests or procedures such as chest X-rays. Furthermore, a decrease in ED length of stay was observed [11]. Several rapid POC tests for SARS-CoV-2 have now been developed and are likely to reduce time to results however, there is little evidence for their clinical effect. The aim of this study was to assess the clinical impact of POC testing (POCT) using the ID NOW™ COVID-19 assay in adults presenting to the ED during the second wave of the COVID-19 pandemic in France.

2. Materials and methods

2.1. Study design and setting

This was a prospective, descriptive, interventional, non-randomized, before-after trial in an ED. The trial was conducted from September to December 2020 during the second wave of the pandemic in France. All patients were recruited from the ED of our tertiary hospital, with approximately 56,000 annual encounters and 687 beds, including acute and intermediate beds.

SARS-CoV-2 detection was evaluated during two consecutive periods of seven weeks and compared:

- Observational period 1 (pre-POC; corresponding to weeks 37 to 43 of 2020): RT-PCR SARS-CoV-2 testing was performed in the centralized microbiology laboratory as the standard of care (SOC). This cohort is designated as the control group.
- Interventional period 2 (POC; corresponding to weeks 44 to 50 of 2020): Diagnosis of SARS-CoV-2 infection was performed with the POC ID NOW™ COVID-19 test in the ED.

During the observational period 1, ED patients underwent a diagnostic test if they had a clinical suspicion of moderate or severe COVID-19 or if they required urgent surgery or hospitalization. Patients having a clinical suspicion of benign COVID-19 and no comorbidities, were immediately discharged and a COVID-19 diagnostic test was done in the ambulatory setting. For COVID-19 positive patients, emergency physicians use specific medications in line with current guidelines for the SOC [12–14]. A prophylactic anticoagulant should be used in hospitalized patients having a body mass index (BMI) <30 while a curative anticoagulant should be used in patients with any of the following: underlying cancer, history of thrombosis, BMI >30, d dimers >3 µg/mL, or fibrinogen >8 g/L. Corticosteroid treatments should be used in patients requiring oxygen >4 L/min. Emergency physicians should minimize the use of broad-spectrum antibiotics for patients with radiological abnormalities compatible with bacterial infection and/or requiring oxygen therapy of ≥6 L/min.

2.2. Participants

Patients (18 years of age or older) with the capacity to give consent were considered eligible for this study. All included patients provided their informed consent for the collection of data and participation in the study. Patients who were under guardianship, did not consent to the collection of information, or did not receive social security to cover their treatment costs were excluded. For each patient, several data were collected including demographic, clinical quick SOFA score, biological data and treatments.

Quick SOFA scores ranged from 0 to 3, using three criteria and assigning one point each for low blood pressure (SBP ≤100 mmHg), high respiratory rate (≥22 breaths per min), or altered mentation (Glasgow coma scale 15).

2.3. Methods and measurements

Between September to October 2020, the standard of care (SOC) for SARS-CoV-2 diagnosis was RT-PCR testing with the Simplexa COVID-19 Direct assay (DiaSorin, Saluggia, Italy) in the centralized laboratory. This cohort is referred to as the pre-point-of-care (pre-POC) testing cohort with diagnosis during period 1. Testing was done between 8:00 a.m. and 6:30 p.m. from Monday to Saturday and between 8:00 a.m. and 5:00 p.m. on Sunday. Specimens were transferred from the ED to the laboratory, where they were recorded and their receipt confirmed on the same day by the laboratory staff. Therefore, the total time for the procurement of a result included the transfer, the actual analysis carried out on the LIAISON MDX modular platform (1 h), the technical validation and the ensuing biological validation, as well as the communication to the clinicians, which was done either telephonically or online.

The ID NOW™ COVID-19 assay is a rapid molecular diagnostic test which uses nicking enzyme amplification reaction (NEAR) technology for the detection of SARS-CoV-2 RNA, targeting the RdRp gene [10]. Samples can only be tested one at a time. Thus, nasopharyngeal swabs were collected with a flexible nasopharyngeal flocked swabs from patients having a clinical suspicion of COVID-19 by the attending nurse in the ED. During Period 2, swabs were directly tested on the ID NOW™ COVID-19 assay at POC by ED trained nurses previously trained and certified for use it. Following an initial 3 min warm-up of the test system, a dry swab is added to elution buffer in the sample receiver and then mixed for 10 s. Using the sample transfer device, 200 µL of sample is transferred into the test cartridge, the lid is closed, and the instrument automatically initializes the assay, which runs for 10 min. The ID NOW™ test provides a qualitative result and does not report cycle threshold (Ct) values to the user. The instrument software interprets amplification data and final results are reported as positive, negative, or invalid. Samples that yield an initial invalid result are repeated. If an invalid result is generated twice, the final result is reported as invalid.

2.4. Outcomes

The primary endpoint was the time spent in the ED corresponding to when patients infected with SARS-CoV-2 were examined and when they were discharged. Secondary endpoints include the relevance of corticosteroids or anticoagulation treatment, the hospitalization rate, the reduction of antibiotic treatment, and emergency practitioners' perceptions on the implementation of COVID-19 POCT in the ED.

2.5. Statistical analysis

Data relating to quantitative variables were analyzed using percentages and the level of statistical significance between data from the pre-POC period 1 and the POC period 2 as determined using the Chi-squared test or Fisher's exact test. Continuous variables were summarized with median and interquartile range (IQR) and were compared using Mann-Whitney or Kruskal-Wallis tests as appropriate. A difference was considered significant at a level of 5% or greater (alpha risk). All statistical analyses were performed with Epi Info™ Software (United States Centers for Disease Control and Prevention, Atlanta, GA, USA).

2.6. Healthcare satisfaction survey

Upon completion of the study, medical and paramedical clinical staff were given a satisfaction survey regarding the implementation of COVID-19 POCT, measured on a 5 range Likert scale. Qualitative analysis of free-form responses was performed by lexical encoding with Dedoose™ Software version 8.3.44 (Los Angeles, California, USA).

2.7. Ethical statement

This study followed the Standards for Reporting of Diagnostic Accuracy studies (STARD) guidelines and was previously approved by the clinical ethic committee board IRB 00012157 and registered in clinical trial NCT04786249. Informed oral consent for participation was obtained from each participant, in accordance with French law.

3. Results

3.1. Characteristics of study subjects

Between September 7th to December 13th, 2020, 3630 patients were eligible for this study and 297 (8.2%) were excluded, bringing the total number of patients included to 3333 (Fig. 1). Among them, 331 (9.9%) were positive for SARS-CoV-2 infection. Baseline characteristics of the patients are shown in Table 1. POC group 2 patients were significantly older than those of the pre-POC control group (median age 74 years [59–84] vs. 70 years [46–85]); $p = 0.002$ and had more cardiovascular comorbidities (22.4% vs. 17.5%; $p = 0.0004$). Clinical parameters at admission to the ED were similar in both groups. Rates of patients initially requiring oxygen or with quick SOFA score ≥ 2 were similar in both groups (p -values at 0.93 and 0.84, respectively). Moreover, for biological parameters collected, no differences were noted between the two groups.

3.2. Comparison pre-POC period versus POC period

Table 2 shows the impact of implementation of POCT had on primary and secondary outcomes. Among the 3333 patients included, 136 (9.2%) were positive for SARS-CoV-2 in the pre-POC control period 1 and 195 (10.5%) in the POC period 2. Among positive SARS-CoV-2 patients, the hospitalization rate was higher in the POC period 2 (81.6% vs. 65.4%, $p < 0.001$). Between the two periods, no differences were observed in either the number of admission stays greater than 24 h or in-hospital mortality. While the median length of stay was comparable for the two groups (6.7 and 7.2 h), more patients were discharged from the ED within three hours (5.6% vs. 16.4%; $p = 0.003$) in the POC group. Indeed, for patients without hospitalization criteria, the time spent in the ED was less than three hours or 36.1% of patients in the POC group as

Table 1
Baseline characteristics of patients and medical management according to the testing method for SARS-CoV-2 detection during each period.

Characteristics	Pre-POC cohort (control; period 1)	POC cohort (period 2)	p-value
	n = 1477	n = 1856	
Age, years			
Median [IQR]	70 [46–85]	74 [59–84]	0.002
< 50, n (%)	410 (27.7)	435 (23.4)	0.005
50–59, n (%)	134 (9.1)	194 (10.5)	0.19
60–69, n (%)	190 (12.9)	226 (12.2)	0.56
70–79, n(%)	237 (16)	325 (17.5)	0.26
≥ 80 , n (%)	506 (34.3)	676 (36.4)	0.2
Sex, men, n (%)	672 (45.5)	854 (46)	0.78
Cardiovascular comorbidities, n (%)	258 (17.5)	416 (22.4)	0.0004
Observations at admission			
Pulse rate, beats per min, median [IQR]	86 [74–99]	86 [74–100]	0.67
Oxygen saturation, %, median [IQR]	98 [96–100]	98 [96–100]	0.73
Systemic blood pressure, mmHg, median [IQR]	134 [119–150]	136 [120–154]	0.58
Oxygen treatment, n (%)	204 (15.9)	268 (14.4)	0.93
Quick SOFA score ≥ 2 , n (%)	31 (2.1)	36 (1.9)	0.84
Laboratory and radiological parameters			
C-reactive protein concentration, mg/L, median [IQR]	39.95 [11.7–108.3]	38.85 [11.7–104.8]	0.54
White blood cell count, $\times 10^9/L$, median [IQR]	8.66 [6.68–11.7]	8.74 [6.8–11.6]	0.67
Neutrophil count, $\times 10^9/L$, median [IQR]	6.22 [4.24–9.06]	6.29 [4.33–9]	0.9
Lymphocyte count, $\times 10^9/L$, median [IQR]	1.39 [0.93–2.02]	1.41 [0.93–2.06]	0.78
Chest x-ray done, n (%)	572 (38.7)	713 (38.4)	0.85
Thoracic CT, n (%)	66 (3.6)	68 (3.7)	0.24

Data are number (%) or medians [IQR].

compared to 14.9% of patients in the control group ($p = 0.037$). The median time to result for POC and pre-POC periods were 10.7 min [10.6–10.9] and 257.4 min [194.6–380], respectively. During the POC period, 85% of patients had their result in less than one hour versus 19 h for the pre-POC period. When analyzing the prescription of medications specific for the treatment of COVID-19, the rate of anticoagulant use was significantly higher for the POC group than for the control

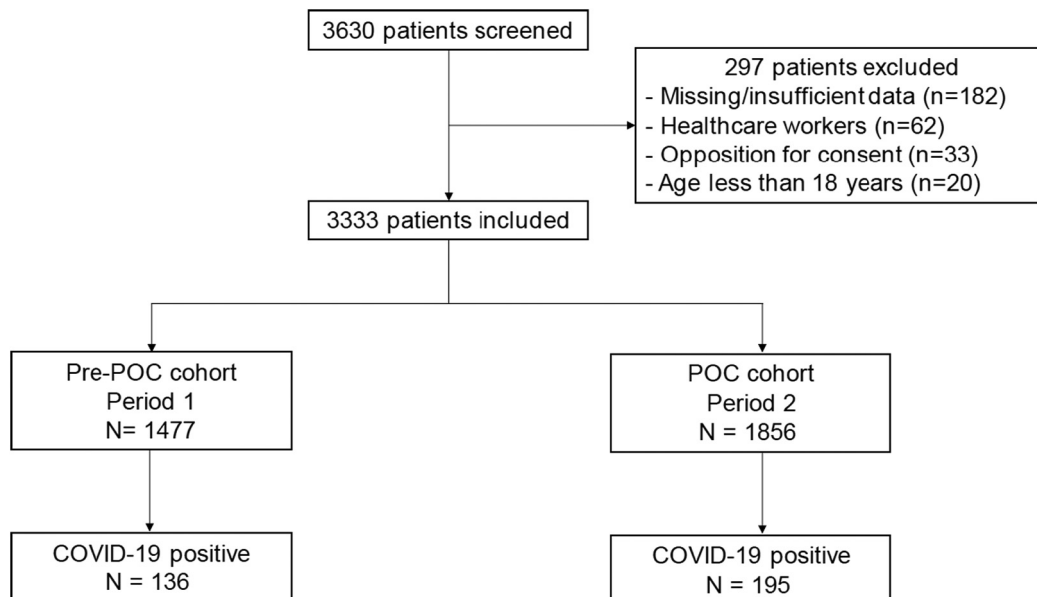


Fig. 1. Flow chart.

Table 2
Primary and secondary outcomes according to the testing method for SARS-CoV-2 detection during each period.

	Pre-POC cohort (control; period 1) n = 1477	POC cohort (period 2) n = 1856	p-value
COVID-19 positive, n (%)	136 (9.2)	195 (10.5)	–
Admitted for > 24 h, n (%)	76/136 (55.8)	114/195 (63.6)	0.17
Hospitalization, n (%)	89/136 (65.4)	159/195 (81.6)	< 0.001
Length of stay in ED, median, hours	6.7 [4.6–9.2]	7.2 [4.4–9.45]	0.43
< 3 h, n (%)	8 (5.6)	32 (16.4)	0.003
3–6 h, n (%)	50 (36.9)	39 (20)	0.0009
6–12 h, n (%)	66 (48.5)	104 (53.3)	0.34
> 12 h, n (%)	12 (8.8)	20 (10.2)	0.85
Length of stay <3 h for patients without hospitalization criteria, n (%)	7 (14.9)	13 (36.1)	0.037
Treatment			
Antibiotic use, n (%)	21 (15.4)	29 (14.7)	0.87
Anticoagulant, n (%) use	33 (24.2)	78 (40)	0.003
Corticosteroids use, n (%)	30 (22)	55 (28.2)	0.24
In-hospital mortality	13/136 (9.5)	16/195 (8.2)	0.69

group (40% vs 24.2%: $p = 0.003$), whereas the rate of corticosteroids use was similar in both groups (22% vs. 28.2%: $p = 0.24$). The rates of antibiotic use and thoracic CT imaging for the two groups were also found to be the same during both periods (~15% and ~4%, respectively).

At the end of the study, a total of 52 emergency practitioners (EP) responded to a survey to share their opinions about the implementation of COVID-19 POCT. Respondents included 31 nurses (60%) and 21 physicians (40%), working during days (42%), nights (19%), or both (39%). Survey responses are shown in Fig. 1. All EP reported the implementation of ID NOW™ COVID-19 POCT was straightforward as part of patient work-up (100%). POCT was reported to improve compliance convenience with hygiene rules (94%). Overall, the self-reported “real-life” experiences of EPs regarding COVID-19 POCT implementation on the primary and secondary outcomes was consistent with our analyses. When considering the impact in reducing the duration of care in the ED, only one nurse was undecided. Over 80% of EP respondents perceived that specific medications treating COVID-19 infection were used more quickly during the POC period than during pre-POC period. These opinions were reinforced with the statistical analyses of anticoagulants use ($p = 0.003$) and were similar to the results for corticosteroids use. Although not significant ($p = 0.24$), the rate of corticosteroid use was found to be slightly higher during the POC period than during the pre-POC period (28.2% vs. 22%). As expected after statistical analyses, approximately half of EPs were doubtful about the impact of COVID-19 POCT on antibiotics prescription (48%). Perceptions about supplementary radiological exams were heterogeneous. Nearly half of EPs (42%) reported observing no differences between the rates of thoracic CT imaging during the two periods (42%), consistent with statistical analysis ($p = 0.24$) (Table 1). About two thirds were undecided or disagreed for outcomes on thoracic angio-CT (68%), as it depends on other clinical and biological parameters. In free-form responses, some nurses noted that the warm-up wait time (3 min) and the unavailability of the ID NOW™ COVID-19 assay for batched specimen processing (due to the one-by-one testing procedure) could lead to a small loss of time.

4. Discussion

Delays in time to results (TTR) due to the use of RT-PCR test strategies in centralized laboratories have frequently been recognized as a major challenge for hospitals in effectively responding to the COVID-19 pandemic. The diagnostic value of the ID NOW™ COVID-19 POC

test has been evaluated by our team in this prospective study. The ID NOW™ COVID-19 assay yielded a sensitivity, specificity, PPV and NPV of 98.0%, 97.5%, 96.2% and 98.7%, respectively, in comparison with the RT-PCR reference assay [7]. With the availability of reliable and rapid platforms, the concept of POCT for COVID-19 diagnosis offers an alternative to centralized laboratory tests. Our study is the first to assess the clinical impact of Abbott ID NOW™ COVID-19 assay used at the POC in an ED.

Compared to routine laboratory RT-PCR testing, the use of COVID-19 POC led to a large decrease in the time to results and improvements in the ED's workflows. This decrease was also associated with a reduction in the ED length of stay, as showed by the higher rate of patients spending either <3 h or < 6 h in the ED in the POC group. As expected, our results also found that the implementation of COVID-19 POCT did not impact ED boarding times (i.e. patients spending either more than 6 h ($p = 0.34$) or more than 12 h ($p = 0.85$) in the ED). This may be explained by a significantly higher rate of hospitalization in the POC group than in the pre-POC control group ($p < 0.001$). Unfortunately, in real-life experiences, long ED boarding times are frequently due to bed capacity within the hospital, especially for elderly patients [15].

Comparison of treatment outcomes between the two groups revealed that using POCT for diagnosis of SARS-CoV-2 infection was also associated with an improvement of COVID-19 specific treatment. By allowing accelerated clinical decisions, POCT led to improved preventive and curative management of thromboembolic diseases for patients with COVID-19. This result is highly important as it demonstrates how a rapid and available technology could optimize the management of thromboembolic diseases in predisposed COVID-19 patients [12–14]. However, the absence of differences in the prescription of corticosteroids between the two groups could be explained by similar rates of patients requiring their use, by means of similar rates of oxygen treatment in the two groups ($p = 0.93$). This is consistent with the current literature, which does not recommend the use of dexamethasone for the treatment of COVID-19 in patients that do not require supplemental oxygen [16–21]. Indeed, there was no difference between the rate of patients having treatment oxygen ($p = 0.93$) or having a SOFA score ≥ 2 ($p = 0.84$). In line with COVID-19 treatment guidelines, the rate of antibiotic use for COVID-19 was very low and had no statistical difference in the two groups (15%, $p = 1$) and usage was limited to patients with a high suspicion or documented bacterial pneumonia or sepsis [22].

It was expected that we would find no difference in the prescription rates of biological and radiological exams between the two groups. Physicians require additional investigations such as biological parameters (D-dimer, creatinine, BNP, troponin) and radiological exams (chest x-ray, thoracic CT or angio CT) to make appropriate patient management decisions. Both types of exams are required for managing differential diagnoses when COVID-19 POCT results are negative and for diagnoses of complications when COVID-19 POCT results are positive, particularly for pulmonary embolism and bacterial pneumonia [22–27]. We did not assess thoracic angio-CT prescriptions due to the lack of consensus about D-dimer threshold selection [26,27].

Our results also suggested that the early detection of SARS CoV-2 infection should enable rapid management measures to limit transmission of the virus and protect all staff and patients/residents [1,2]. Indeed, we have shown that POCT with the ID NOW™ COVID-19 assay is a rapid, sensitive and reliable testing method [7] allowing for timely clinical decisions in the management of patients in ambulatory or hospital settings. Implementation of POCT should lead to improvements in the necessary isolation measures to control the spread of COVID-19 in the hospital, thereby protecting staff and patients. Almost all EPs reported improvements in compliance with infection control guidelines (94%) and a reduction in contamination risks (78%) since COVID-19 POCT implementation (Fig. 2). Nevertheless, we could not assess the time to isolate because this parameter was not routinely recorded in the ED. Furthermore, a comparison of inpatients staying in a double

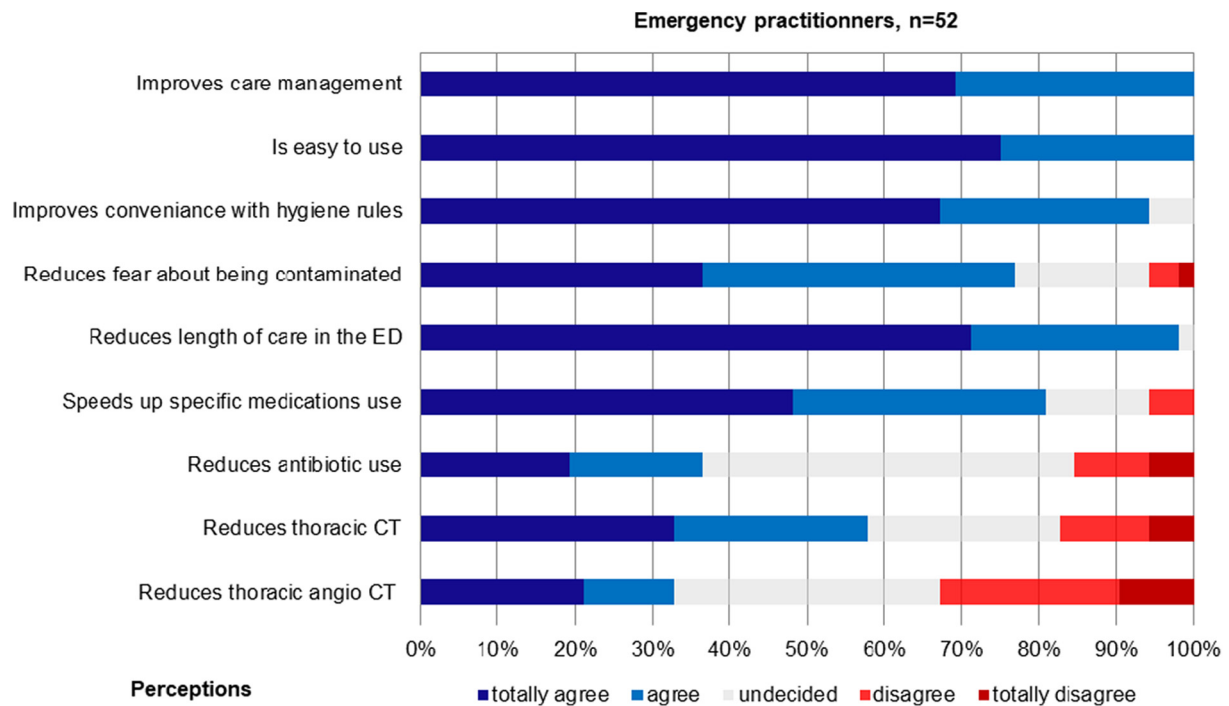


Fig. 2. Emergency practitioners (EP) perceptions regarding COVID-19 POC implementation in the ED.

versus single room would have been subject to many biases, as it depends especially on hospital bed capacity and saturation during epidemic periods and others clinical factors.

4.1. Limitations

Our study has several limitations. Firstly, it is a monocentric study. A multi-center prospective study could have provide better external validity, however at the time Abbott ID NOW™ COVID-19 POC assay was implemented in our ED (October 2020), only few EDs in France had already implemented POC for the diagnosis of COVID-19.

Secondly, the optimal assessment of the impact of COVID-19 POCT implementation should be evaluated in an unbiased randomized-controlled trial. Although, two large groups of emergency patients were tested during the same pandemic period and with the same standard of care, some demographic and clinical differences between the two periods may have led to an interpretation bias considering the impact on the use of anticoagulant during the POC period. Indeed, it was noted that patients were older ($p = 0.002$) and had more cardiovascular comorbidities ($p = 0.0004$) during the POC period, than seen during the pre-POC period. Thus, the rate of anticoagulant use may have been higher ($p = 0.003$) because more patients required hospitalization in this group than the pre-POC group ($p = 0.001$). Unfortunately, increased SARS-CoV-2 infections in France in late of 2020, required us to design a non-randomized before-after trial. Indeed, the burden on ED teams was extremely high, as shown by the higher rate of total patients throughout the POC period than during the pre-POC period (Table 1). In this context, we were unable to randomize patients to limit the impact of various biases with either the laboratory standard RT-PCR test or the POCT, as it may have led to delays in treating high-risk patients or unjustified increases in the length of stay.

Thirdly, we did not assessed clinical and operational impacts of COVID-19 POCT implementation in patients having a negative diagnostic test. Indeed, many confusing factors could influence their ED boarding times such as imaging delay, surgery delay, hospital bed capacity and variable availability of referral departments during the same pandemic period.

In addition, it may also be worthwhile to initiate a medico-economic analysis to assess the impact of the implementation of the COVID-19 POCT on direct and indirect hospital costs during the pandemic.

Indeed, in some cases, accelerations of clinical decisions based on POCT could led to increased costs for purchase and maintenance of equipment and staff training [28]. We determined that POCT is only beneficial if it provides rapid decision-making for patients diagnosed with COVID-19 and improvements in treatment.

Finally, we did not assess patient satisfaction during the study period as many confounding factors can influence patient expectations during a stay in the ED. Some studies have demonstrated that longer length of stays were associated with overall dissatisfaction with ED care [29,30].

5. Conclusion

In this prospective study, we demonstrated that implementing the ID NOW™ COVID-19 assay as a point-of-care test in an emergency department could influence clinical decision-making by reducing the length of stay in the ED for patients undergoing outpatient care. Further research is still needed to estimate the impact on the use of specific COVID-19 treatments. Finally, it was important to connect our quantitative results with the qualitative assessment of EPs experiences during the COVID-19 pandemic. Thus, self-reported perceptions of EPs were consistent with the benefits for efficiency and safety in healthcare.

Credit author statement

CG contributed to the conceptualization, data curation, formal analysis, methodology, validation, writing original draft, writing review editing.

BP contributed to the conceptualization, data curation, formal analysis, methodology, validation, writing original draft, writing review editing.

OG contributed to supervision, project administration.

ALM contributed to supervision, project administration.

JCNV contributed to conceptualization, data curation, formal analysis, methodology, project administration, supervision, validation, visualization, writing original draft writing review and editing.

JCNV drafted the manuscript to which all authors provided critical comments and a final consent to the publishing.

Declaration of Competing Interest

This work presented was not funded. None of the authors declare any personal or financial conflict of interest in relation to this manuscript.

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References

- [1] Wu F, Zhao S, Yu B, et al. A new coronavirus associated with human respiratory disease in China. *Nature*. 2020;579:265–9.
- [2] Younes N, Al-Sadeq DW, Al-Jighefee H, et al. Challenges in laboratory diagnosis of the novel coronavirus SARS-CoV-2. *Viruses*. 2020;12:582.
- [3] Hanson KE, Caliendo AM, Arias CA, et al. The infectious diseases society of America guidelines on the diagnosis of COVID-19: molecular diagnostic testing. *Clinical infectious diseases*; 2021; ciab048.
- [4] Cheng MP, Papenburg J, Desjardins M, et al. Diagnostic testing for severe acute respiratory syndrome-related coronavirus 2: a narrative review. *Ann Intern Med*. 2020; 172:726–34.
- [5] Lu R, Wu X, Wan Z, Li Y, Jin X, Zhang C. A novel reverse transcription loop-mediated isothermal amplification method for Rapid detection of SARS-CoV-2. *Int J Mol Sci*. 2020;21.
- [6] Augustine R, Hasan A, Das S, et al. Loop-mediated isothermal amplification (LAMP): a Rapid, sensitive, specific, and cost-effective point-of-care test for coronaviruses in the context of COVID-19 pandemic. *Biology (Basel)*. 2020;9.
- [7] Nguyen Van J-C, Gerlier C, Pilmis B, et al. Prospective evaluation of ID NOW COVID-19 assay used as point-of-care test in an emergency department. *Emerg Med*. 2021. <https://doi.org/10.1101/2021.03.29.21253909> Accessed 20 April 2021.
- [8] Nie S, Roth RB, Stiles J, et al. Evaluation of Alere i influenza a&B for rapid detection of influenza viruses a and B. *J Clin Microbiol*. 2014;52:3339–44.
- [9] Nguyen Van JC, Caméléna F, Dahoun M, et al. Prospective evaluation of the Alere i influenza a&B nucleic acid amplification versus Xpert Flu/RSV. *Diagn Microbiol Infect Dis*. 2016;85:19–22.
- [10] Abbott Laboratories. ID now COVID-19 package insert. Chicago, IL: Abbott Laboratories; 2021 <https://www.fda.gov/media/136525/download>.
- [11] Trabattoni E, Le V, Pilmis B, et al. Implementation of Alere i influenza a & B point of care test for the diagnosis of influenza in an emergency department. *Am J Emerg Med*. 2018;36(6):916–21. <https://doi.org/10.1016/j.ajem.2017.10.046> Epub 2017 Oct 18. PMID: 29137903.
- [12] Levi M, Thachil J, Iba T, Levy JH. Coagulation abnormalities and thrombosis in patients with COVID-19. *Lancet Haematol*. 2020;7:e438–40.
- [13] Lodigiani C, Iapichino G, Carenzo L, et al. Venous and arterial thromboembolic complications in COVID-19 patients admitted to an academic hospital in Milan, Italy. *Thromb Res*. 2020;191:9–14.
- [14] Llitjos J-F, Leclerc M, Chochois C, et al. High incidence of venous thromboembolic events in anticoagulated severe COVID-19 patients. *J Thromb Haemost*. 2020;18: 1743–6.
- [15] Haq N, Stewart-Corral R, Hamrock E, Perin J, Khaliq W. Emergency department throughput: an intervention. *Intern Emerg Med*. 2018;13:923–31.
- [16] Horby P, Lim WS, et al, RECOVERY Collaborative Group. Dexamethasone in hospitalized patients with COVID-19 - preliminary report. *N Engl J Med*. 2021;384(8): 693–704. <https://doi.org/10.1056/NEJMoa2021436> Epub 2020 Jul 17. PMID: 32678530; PMCID: PMC7383595.
- [17] WHO Rapid Evidence Appraisal for COVID-19 Therapies (REACT) Working Group, JAC Sterne, Murthy S, et al. Association between administration of systemic corticosteroids and mortality among critically ill patients with COVID-19: a meta-analysis. *JAMA*. 2020;324:1330–41.
- [18] Jeronimo CMP, Farias MEL, Val FFA, et al. Methylprednisolone as adjunctive therapy for patients hospitalized with COVID-19 (Metcovid): a randomised, Double-Blind, Phase IIb, placebo-controlled trial. *Clin Infect Dis*. 2021;72(9):e373–81. <https://doi.org/10.1093/cid/ciaa1177> PMID: 32785710; PMCID: PMC7454320.
- [19] Fadel R, Morrison AR, Vahia A, et al. Early short course corticosteroids in hospitalized patients with COVID-19. *Clin Infect Dis*. 2020. <https://doi.org/10.1093/cid/ciaa601> PMID: 32427279; PMCID: PMC7314133.
- [20] Sanders JM, Monogue ML, Jodlowski TZ, Cutrell JB. Pharmacologic treatments for coronavirus disease 2019 (COVID-19): a review. *JAMA*. 2020;323(18):1824–36. <https://doi.org/10.1001/jama.2020.6019> Available at: <https://jamanetwork.com/journals/jama/fullarticle/2764727>. Accessed 1 April 2021; PMID: 32282022.
- [21] Mehta N, Mazer-Amirshahi M, Alkindi N, Pourmand A. Pharmacotherapy in COVID-19: a narrative review for emergency providers. *Am J Emerg Med*. 2020;38:1488–93.
- [22] Aljondi R, Alghamdi S. Diagnostic value of imaging modalities for COVID-19: scoping review. *J Med Internet Res*. 2020;22:e19673.
- [23] Wiersinga WJ, Rhodes A, Cheng AC, Peacock SJ, Prescott HC. Pathophysiology, transmission, diagnosis, and treatment of coronavirus disease 2019 (COVID-19): a review. *JAMA*. 2020;324:782–93.
- [24] Garcia-Olivé I, Sintés H, Radua J, Abad Capa J, Rosell A. D-dimer in patients infected with COVID-19 and suspected pulmonary embolism. *Respir Med*. 2020;169:106023.
- [25] Rodriguez-Sevilla JJ, Rodó-Pin A, Espallargas I, et al. Pulmonary embolism in patients with Covid-19 pneumonia: the utility of D-dimer. *Arch Bronconeumol*. 2020;56: 758–9.
- [26] Ventura-Díaz S, Quintana-Pérez JV, Gil-Boronat A, et al. A higher D-dimer threshold for predicting pulmonary embolism in patients with COVID-19: a retrospective study. *Emerg Radiol*. 2020;27:679–89.
- [27] Korevaar DA, van Es J. Pulmonary embolism in COVID-19: D-dimer threshold selection should not be based on maximising Youden's index. *Eur Respir J*. 2021;57: 2004279.
- [28] Florkowski C, Don-Wauchope A, Gimenez N, Rodriguez-Capote K, Wils J, Zemlin A. Point-of-care testing (POCT) and evidence-based laboratory medicine (EBLM) – does it leverage any advantage in clinical decision making? *Crit Rev Clin Lab Sci*. 2017;54:471–94.
- [29] Parker BT, Marco C. Emergency department length of stay: accuracy of patient estimates. *West J Emerg Med*. 2014;15:170–5.
- [30] Bleustein C, Rothschild DB, Valen A, Valatis E, Schweitzer L, Jones R. Wait times, patient satisfaction scores, and the perception of care. *Am J Manag Care*. 2014;20: 393–400.