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Point-of-Care diagnostic of SARS-CoV-2: knowledge, attitudes, and perceptions (KAP) of medical workforce in Italy

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Summary. *Introduction.* The present study aims to characterize knowledge, attitudes and beliefs in a sample of medical professionals towards point-of-care (POC) rapid tests for SARS-CoV-2 in Italy (April 2020). *Material and Methods.* A total of 561 professionals (42.6% males, 26.9% ≥ 50-year-old) compiled a specifically designed web questionnaire on characteristics of POC rapid tests. They were asked whether they would change their daily practice and make clinical decisions according to POC tests. Multivariate odds ratios (aOR) for predictors of propensity towards the aforementioned behavioral outcomes were calculated through regression analysis. *Results.* Overall, only 51.9% knew the official recommendations of the Italian Health Authorities for POC tests, while 26.0% of respondents considered POC tests for COVID-19 highly reliable. Still, 40.3% of respondents would change their daily practice because of such tests, and 38.5% would make clinical decisions based on their results. Knowledge of POC tests's sensitivity and specificity was not associated with the assessed behavioral outcomes: main positive effectors were: perceived reliability and usefulness of rapid tests, acknowledging the existence of official recommendations, understanding the limited clinical implications of POC tests, and working as occupational physicians were characterized as negative effectors. *Conclusions.* Propensity of sampled professionals towards POC tests for COVID-19 was diffusely unsatisfying. While actual understanding of accuracy of such tests was not a main effector of propensity, previous experiences with other POC tests in daily practice, particularly among occupational physicians may have impaired overall acceptance of such instruments. (www.actabiomedica.it)

Key words: Point-of-care tests; Rapid tests; COVID-19; SARS-CoV-2; Knowledge, attitudes, practices

Introduction

Timely and accurate COVID-19 laboratory testing is an essential step in the management of COVID-19 pandemic (1). Despite its practical limitations (i.e. the relatively invasive and complicated sampling, the time-consuming procedure to generate results, the need for specialized operators and certified laboratories), both ECDC and World Health Organization (WHO) recommend the real-time polymerase chain reaction (RT-PCR) in respiratory samples as the gold standard for COVID-19 diagnosis (1–3). Unfortunately, the skyrocketing request for daily diagnostic samples led to limited availability of operational ma-

terial for both respiratory sample collection and molecular diagnostic, urging the need of alternative, rapid, and reliable diagnostic procedures (4–6). Implementation of alternative diagnostic procedure may alleviate the pressure on laboratories, and expand testing capacity, ultimately allowing large scale screening and ensure timely treatment of patients (1,5,6).

Reliable point of care testing (POC) for COVID-19 based on antibody detection may be particularly useful in various medical settings, ranging from the rapid (i.e. "bedside") diagnosis of patients seeking medical advice, to epidemiological studies aimed to more properly define the actual burden of COVID-19 disease in the general population (2,4,7). Still, the reliability of POC for COVID-19 remains extensively questioned, as previous experiences with this method for influenza viruses suggests that POC test are likely to suffer from poor sensitivity (9), and as well the analysis of available data suggest that their actual sensitivity may fail to exceed 70% (2,5,6,8,9).

Despite such significant limitations, several stakeholders across high-income countries have recommended the use of POC to guarantee a sort of "*immunity passport*", i.e. identify subjects that, having been previously infected, and having developed an appreciable immune response, may be considered at somewhat low risk to develop COVID-19 when interacting again with SARS-CoV-2 (1–3). More precisely, extensive use of POC COVID-19 screening tests has been suggested as instrumental to lift the lockdown measures in occupational settings, as it would allow Occupational Physicians (OPh) to create a sort of "*immune cocoon*" through immunized workers around subjects at higher risk for COVID-19 complications because of pre-existing comorbidities. Particularly in Italy, increasing and possibly unjustified expectations on such diagnostic instruments have been diffusely spread by media, urging health authorities (10,11) and scientific societies to recommend a more cautious use (12).

Therefore, the main objective of this study was assessing the knowledge, attitudes, and beliefs of a sample of Italian medical professionals regarding POC for COVID-19, specifically focusing on the attitudes of OPh in the light of their possible extensive use (April 2020).

Materials and Methods

Study design

A cross-sectional questionnaire-based study was performed in April 2020, involving subjects participating in six different private Facebook group pages and four closed forums focusing on general medicine, occupational medicine, and COVID-19, whose application was officially limited to medical professionals. The invitation text was formulated as "*What do you think about rapid (point-of-care) testing for COVID-19*?". In total, the group pages had approximately 10,534 unique members, including medical doctors of various specialties, nurses, physician assistants, technical professionals, but no information could be obtained regarding how many of these members were actively using Facebook. To post the study invitation on the closed (non-public) Facebook pages, the principal researchers contacted the group administrator and asked to be invited. Facebook users who clicked on the invitation text were provided with the full study information, an opportunity to give their informed consent, and a web link to the survey (Google Forms; Google LLC; Menlo Park, California, USA). The survey was conducted in Italian. To be included in the sample, the professional was supposed to be living and working in Italy in 2020: if a potential participant was found not to match the inclusion criteria, the survey closed down. The survey was anonymous, and no personal data such name, IP address, email address, or personal information unnecessary to the survey was requested, saved or tracked. No monetary or other compensation was offered to the participants.

Questionnaire

The questionnaire was formulated in Italian, and its test-retest reliability was preventively assessed through a survey on 10 medical doctors completing the questionnaire at two different time points. The testing questionnaires were ultimately excluded from the final analyses. All questions were self-reported, and not externally validated. The final questionnaire comprised the following areas of inquiry:

1. Individual characteristics. Included: age, sex, occupational qualification, medical specialization (medical doctors only).

2. Knowledge of POC testing. Participants were initially asked whether they knew that POC rapid tests for COVID-19 do exist (yes/no), and that official recommendations for POC testing in suspected COVID-19 have been issued by Italian Health Ministry (yes/no). The questionnaire then included 5 multiple choice questions on POC testing for COVID-19 (i.e. "*POC tests for COVID-19 are performed on…*", correct answer: "*capillary blood*"; "*POC tests for COVID-19 sample…*", correct answer: "*IgG + IgM*"; "*actual sensitivity of POC tests ranges…*", correct answer: "*70 to 89%*"; "*actual specificity of POC tests ranges…*", correct answer: "*90 to 100%*"; "*A positive POC test allows a clinical diagnosis of COVID-19…*", correct answer: "*never, official recommendations for diagnosis of COVID-19 do not include POC testing*"). Data on actual specificity/sensitivity of POC were extracted from previously consulted meta-analys of existing data (2,5,6,9).

3. Attitudes and perceptions on testing for COVID-19. Participants were initially requested to report whether they judge useful or not, and whether they would change clinical practice and/or take clinical decision based on their results (i.e. "*I would change my daily practice because of POC rapid tests"; "I would make clinical decisions based on the results of POC rapid tests for COVID-19*"). Similarly, participants were requested to report their perceived trust in POC tests, rhinopharyngeal / oropharyngeal swabs for RT-PCR, high-resolution computed tomography (HRCT), for a reliable diagnosis of COVID-19. All aforementioned statements were eventually dichotomized in "*totally agree/agree*" vs. "*neutral/disagree/totally disagree*".

Eventually, participants were asked about the appropriate pricing for POC rapid tests (i.e. < 10€; 10-19€; 20-29€; 30-39€; 40 – 50€; not relevant issue).

5. Practices. Participants were eventually asked whether they have previously employed any POC testing (yes/no, with a further indication of the specific settings), and whether they have previously employed any POC testing for COVID-19 (yes/no).

6. Ethical considerations. Before giving their consent to the survey, participants were briefed that all the information would be gathered anonymously and handled confidentially. Participation was voluntary, and the questionnaire was collected only from subjects who had expressed consent for study participation. As individual participants cannot be identified based on the presented material, this study caused no plausible harm or stigma to participating individuals. As the study neither included clinical data about patients nor was conceived as a clinical trial, while its anonymous design assured adequate protection of study participants, a preliminary evaluation by an Ethical Committee was statutorily not required.

7. Data analysis. Even though medical professionals other than medical doctors (MD) could fill the questionnaire, only the latter were ultimately included in the analyses. Similarly, all participants that had no previous knowledge about the existence of POC rapid tests for COVID-19 were excluded from final analyses.

Categorical variables were reported as percent values, and their distribution was initially analyzed through chi-squared test for the following variables: (a) being likely to change daily practice (*somewhat agree vs. somewhat not agree*), i.e. whether the medical professional is likely or not to include POC testing in his/her daily practice, irrespective from disclosing clinical decision based on subsequent results; (b) being likely to make clinical decisions (i.e. diagnosis or suspected diagnosis of COVID-19, readmission to workplaces or restrain from workplace, notification to the Local Health Authority and so on) based on the results of POC rapid tests for COVID-19 (*somewhat agree vs. somewhat not agree*).

All categorical variables that in such sub-analyses were associated (either positively or negatively) with a $p < 0.05$ with the aforementioned outcome variables were included in a stepwise binary logistic regression analysis model as effectors variables in order to calculate multivariate odds ratios (aOR) and their respective 95% confidence intervals (95%CI). All statistical analyses were performed using IBM SPSS Statistics 25.0 for Macintosh (IBM Corp. Armonk, NY).

Results

Descriptive analysis

As shown in Table 1, a total of 561 MD (5.3% of the eligible population) participated to the inquiry. The respondents had a mean age of ≥ 40 years (67.5%);

Table 1. Characteristics of the 561 Medical workers (MD) participating into the survey on Point-of-Care (POC) tests for COVID-19 (Italy; April 2020). All the comparisons were performed by means of chi squared test (note: HRCT = high-resolution chest tomography; RT-PCT = real-time polymerase chain reaction)

		TOT (No./561; %)
Age groups		
	< 30 y.o.	23, 4.1%
	30 – 39 y.o.	159, 28.3%
	40 – 49 y.o.	228, 40.6%
	50 – 59 y.o.	88, 15.7%
	≥ 60 y.o.	63, 11.2%
Gender		
	Males	239, 42.6%
	Females	322, 57.4%
Occupational status		
	Occupational Physicians	236, 42.1%
	General Practitioners	117, 20.9%
	Public health Specialists	65, 11.6%
	Clinicians	99, 17.6%
	Radiologists	24, 4.3%
	Laboratory professionals	20, 3.6%
Previous use of POC tests for COVID-19		53, 9.4%
Knows that official recommendations of the Italian Health Ministry do exists		291, 51.9%
Previous experiences with other POC rapid tests:		
	Diagnosis of infectious diseases	219, 39.0%
	Diagnosis of alcohol use/abuse	226, 40.3%
	Diagnosis of illicit drugs use/abuse	225, 40.1%
	Diagnosis of metabolic disorders	62, 11.1%
POC tests for COVID-19 are performed on …		
	Capillary samples (correct answer)	397, 70.8%
	Venous samples	107, 19.1%
	Saliva	27, 4.8%
	Serous samples	24, 4.3%
	Plasma	6, 1.1%
	Urine	0, -
POC tests for COVID-19 sample …		
	IgG alone	40, 7.1%
	IgM alone	18, 3.2%
	IgG + IgM (correct answer)	492, 87.7%
	Don't knows	11, 2.0%
At your knowledge, the actual sensitivity of POC tests ranges…		
	< 50%	92, 16.4%
	50 – 69%	95, 16.9%
	70 – 89% (correct answer)	235, 41.9%
	≥ 90%	122, 21.7%

Table 1. Characteristics of the 561 Medical workers (MD) participating into the survey on Point-of-Care (POC) tests for COVID-19 (Italy; April 2020). All the comparisons were performed by means of chi squared test (note: HRCT = high-resolution chest tomography; RT-PCT = real-time polymerase chain reaction)

	TOT (No./561; %)
Age groups	
Don't knows	17, 3.0%
At your knowledge, the actual specificity of POC tests ranges…	
< 50%	54, 9.6%
50 – 69%	112, 19.9%
70 – 89%	256, 45.7%
≥ 90% (correct answer)	125, 22.3%
Don't knows	14, 2.4%
A positive POC test allows the diagnosis of COVID-19 …	
… when associated with a "compatible" clinical status	85, 15.2%
… when associated with a CT image reporting interstitial pneumonia	28, 5.0%
… independently from the Real-Time PCR on swab specimens	68, 12.1%
… when followed by a positive Real-Time PCR on swab specimens, all cases	261, 46.5%
… when followed by a positive Real-Time PCR on swab specimens, cases with doubtful clinical status	51, 9.1%
… never (correct answer)	60, 10.7%
Don't knows	8, 1.4%
POC rapid tests for COVID-19 are highly reliable (agree / totally agree)	146, 26.0%
POC rapid tests for COVID-19 may be useful in the daily practice (*agree / totally agree*)	326, 58.1%
I would change my daily practice because of POC "rapid tests" for COVID-19 (*agree / totally agree*)	226, 40.3%
I would make clinical decisions based on the results of POC rapid tests for COVID-19 (*agree / totally agree*)	216, 38.5%
Rhinopharyngeal/Oropharyngeal swabs for Real-Time PCR are reliable diagnostic tests for COVID-19 (*agree / totally agree*)	410, 73.1%
HRCT is a reliable diagnostic test for COVID-19 (*agree / totally agree*)	394, 70.2%
Appropriate pricing for a POC "rapid test" for COVID-19 should be…	
< 10 €	323, 57.6%
10 – 19 €	110, 19.6%
20 – 29 €	51, 9.1%
30 – 39 €	6, 1.1%
40 – 50 €	12, 2.1%
Not relevant issue	59, 10.5%

42.6% were males, and 57.4% females. The majority of respondents referred practicing as specialist in occupational medicine (42.1%), followed by General Practitioners (20.9%), Clinicians (17.6%), specialists in Hygiene and Public Health (11.6%), radiologists (4.3%), and laboratory professionals (3.6%).

Overall, 47.8% of participant achieved a KS ≥ 3: focusing on the single statements, 51.9% of participants knew that official recommendations have been issued by the Italian Health Ministry, but only 10.7% of respondents knew that the Ministry did not recommend a definitive diagnosis of COVID-19 status based on POC testing at the time of the study. Moreover, while a large majority of respondents correctly reported that POC are performed on capillary blood (70.8%), testing IgG and IgM (87.7%), only a smaller share of participants appropriately identified both actual specificity (i.e. ≥ 90%) and sensitivity (i.e. 70 –

89%), that were reported only by 22.3% and 41.9% of respondents, respectively.

As shown in Table 1, around a quarter of participants (i.e. 26.0%) characterized POC rapid tests for COVID-19 as highly reliable, while around half of respondents agreed or totally agreed that their referral may be useful in daily practice (58.1%), compared to 73.1% for molecular tests based on nasal swabs, and 70.2% for HRCT, with an ideal pricing < 10€ per POC test reported by 57.6% of participants. Moreover, 40.3% of MD agreed/totally agreed that POC rapid tests for COVID-19 may elicit changes in daily practices, while 38.5% would make clinical decisions based on their results.

Interestingly, around 40.3% of participants had previous experience with POC tests for the diagnosis of alcohol use/abuse, followed by ascertainment of illicit drugs use/abuse (40.1%), infectious diseases (39.0%), and metabolic disorders (11.1%). On the contrary, only 9.4% of respondents reported any previous use of POC tests for COVID-19.

Univariate analysis

As shown in Table 2, tagreement towards changes in daily practices was more frequently reported by respondents of male gender (50.9% agree vs. 37.0% not agreeing), who reported having previously used POC tests for metabolic disorders (15.5% vs. 8.1%), with a higher degree of perceived trust in POC rapid tests (48.7% vs. 10.7%, p < 0.001), correctly reporting appropriate specificity of POC tests (28.3% vs. 18.2%), and acknowledging that POC rapid tests for COVID-19 may be useful in daily practice (90.7% vs. 36.1%). On the contrary, professionals working as OPh (28.3% vs. 51.3% not agreeing), reporting previous use of POC tests for illicit drug use/abuse (32.3% vs. 45.5%), and being aware that a positive POC test does not allow a definitive diagnosis of COVID-19 (2.7% vs. 16.1% < 0.001) were less likely to disclose likely changes in daily practices.

Focusing on the likeliness to make clinical decisions based on the results of POC rapid tests for COVID-19, agreement was more frequently reported in subjects of male sex (56.9% vs. 33.6% in subjects not agreeing, p < 0.001), acknowledging the actual sensitivity of the POC tests (i.e. 70-89%, 48.6% vs. 37.7%, p < 0.001), reporting higher trust in POC (46.8% vs. 13.0%, p < 0.001), and higher perceived usefulness in daily practice (88.9% vs. 38.8%, p < 0.001). On the contrary, subjects aged 50 years or older (22.9% vs. 33.3%, p = 0.007), working as OPh (28.2% vs. 50.7%, p < 0.001), aware that POC rapid tests do not allow an official diagnosis of COVID-19 (4.2% vs. 14.8%, p < 0.001) and that official recommendations have been issued by the Italian Health Ministry (44.7% vs. 56.7%, p = 0.005), were less likely to make clinical decisions. Interestingly, subjects likely to make clinical decisions based on POC tests identified as appropriate a lower pricing (i.e. < 10€ per sample) than in participants who disagreed with the main statement (52.3% vs. 60.9%).

Multivariate analysis

Results of both regression analysis models are reported in Table 3. As shown, likeliness to change daily practice because of POC "rapid tests" for COVID-19 and to make clinical decisions based on POC rapid tests were positively associated with male gender (aOR 1.893, 95%CI 1.183 to 3.029, and aOR 2.876, 95%CI 1.838 to 4.502, respectively), higher trust in rapid tests for COVID-19 (aOR 6.858, 95%CI 3.977 to 11.824, and aOR 4.267, 95%CI 2.624 to 6.939), and agreeing in their perceived usefulness (aOR 12.872, 95%CI 7.318 to 22.640, and aOR 10.021, 95%CI 5.905 to 17.006). On the contrary, working as OPh (aOR 0.500, 95%CI 0.306 to 0.817, and aOR 0.518, 95%CI 0.323 to 0.800), and being aware that POC rapid tests for COVID-19 do not allow the eventual diagnosis of COVID-19 aOR 0.152, 95%CI 0.054 to 0.423, and aOR 0.334, 95%CI 0.138 to 0.808), were characterized as negative effectors for both outcome variables.

Discussion

SARS-CoV-2 is a highly contagious infectious agent, whose clinical course might evolve into a severe or even critical disease, needing mechanical ventilation, sub-intensive or even intensive care (7,13–15). However, as nearly 80% of actual cases do not evolve in the clinical syndrome (i.e. into COVID-19), rather exhibiting a substantially favorable clinical course, or evolving in asymptomatic or pauci-symptomatic in-

Table 2. Association of the outcome variables "*likely to change daily practice because of Point-of-Care (POC) rapid tests for COVID-19*", and "*make clinical decisions based on the results of POC rapid tests for COVID-19*" with the individual characteristics of 561 medical doctors included in the analyses (Italy, April 2020). Comparisons were performed by means of chi squared test.

	I would change my daily practice because of POC rapid tests for COVID-19			**I would make clinical decisions based on the results of POC rapid tests for COVID-19**		
	Somewhat agree (No./226, %)	Somewhat disagree (No./335; %)	P value	Somewhat agree (No./216, %)	Somewhat disagree (No./345, %)	P value
Age ≥ 50 y.o.	69, 30.5%	82, 24.5%	0.113	79, 22.9%	72, 33.3%	0.007
Male Gender	115, 50.9%	124, 37.0%	0.001	123, 56.9	116, 33.6%	< 0.001
Occupational status			< 0.001			< 0.001
Occupational medicine	64, 28.3%	172, 51.3%		61, 28.2%	175, 50.7%	
Primary care	59, 26.1%	58, 17.3%		47, 21.8%	70, 20.3%	
Public health	28, 12.4%	37, 11.0%		27, 12.5%	38, 11.0%	
Clinicians	51, 22.6%	48, 14.3%		51, 23.6%	48, 13.9%	
Radiologists	15, 6.6%	9, 2.7%		18, 8.3%	6, 1.7%	
Technicians	9, 4.0%	11, 3.3%		12, 5.6%	8, 2.3%	
Previous use of POC tests for COVID-19	20, 8.8%	33, 9.9%	0.691	20, 9.3%	33, 9.6%	0.904
Knows that official recommendations of the Italian Health Ministry do exists	101, 44.7%	190, 56.7%	0.005	106, 49.1%	185, 53.6%	0.294
Previous experiences with other POC rapid tests:						
Diagnosis of infectious diseases	93, 41.2%	126, 37.6%	0.399	89, 41.2%	130, 37.7%	0.405
Diagnosis of alcohol use/abuse	95, 42.0%	131, 39.1%	0.488	89, 41.2%	137, 39.7%	0.726
Diagnosis of illicit drug use/abuse	73, 32.3%	152, 45.4%	0.002	90, 41.7%	135, 39.1%	0.551
Diagnosis of metabolic disorders	35, 15.5%	27, 8.1%	0.006	23, 10.6%	39, 11.3%	0.809
POC tests for COVID-19 are performed on capillary samples (correct answer)	151, 66.8%	246, 73.4%	0.091	147, 68.1%	250, 72.5%	0.264
POC tests for COVID-19 sample IgG + IgM (correct answer)	196, 86.7%	296, 88.4%	0.564	183, 84.7%	309, 89.6%	0.089
At your knowledge, the actual sensitivity of POC tests ranges 70 – 89% (correct answer)	99, 43.8%	136, 40.6%	0.450	105, 48.6%	130, 37.7%	0.011
At your knowledge, the actual specificity of POC tests ranges ≥ 90% (correct answer)	64, 28.3%	61, 18.2%	0.005	48, 22.2%	77, 22.3%	0.979
A positive POC test allows the diagnosis of COVID-19 … never (correct answer)	6, 2.7%	54, 16.1%	< 0.001	9, 4.2%	51, 14.8%	< 0.001
POC rapid tests for COVID-19 are highly reliable (agree / totally agree)	110, 48.7%	36, 10.7%	< 0.001	101, 46.8%	45, 13.0%	< 0.001
POC rapid tests for COVID-19 may be useful in the daily practice (*agree / totally agree*)	205, 90.7%	121, 36.1%	< 0.001	192, 88.9%	134, 38.8%	< 0.001
Rhinopharyngeal/Oropharyngeal swabs for Real-Time PCR are reliable diagnostic tests for COVID-19 (*agree / totally agree*)	169, 74.8%	241, 71.9%	0.457	156, 72.2%	254, 73.6%	0.716
HRCT is a reliable diagnostic test for COVID-19 (*agree / totally agree*)	153, 67.7%	241, 71.9%	0.281	144, 66.7%	250, 72.5%	0.144
Appropriate pricing for a POC "rapid test" for COVID-19 should be < 10€	123, 54.4%	200, 59.7%	0.215	113, 52.3%	210, 60.9%	0.046

Table 3. Multivariate analysis of main drivers of the outcome variables "*likely to change daily practice because of POC (Point-of-Care) rapid tests for COVID-19*", and "*make clinical decisions based on the results of POC rapid tests for COVID-19*". A binary logistic regression analysis was modeled by including all variables that, in univariate analysis, were associate $p < 0.05$ with the outcome variables, and calculating correspondent adjusted Odds Ratio (aOR) with their 95% Confidence Intervals (95%CI).

	I would change my daily practice because of POC rapid tests for COVID-19		**I would make clinical decisions based on the results of POC rapid ests for COVID-19**	
	aOR	95%CI	aOR	95%CI
Age ≥ 50 y.o.	-	-	1.714	1.025; 2.865
Male Gender	1.893	1.183; 3.029	2.876	1.838; 4.502
Occupational status	0.500	0.306; 0.817	0.518	0.323; 0.800
Knows that official recommendations of the Italian Health Ministry do exists	0.643	0.401; 1.030	-	-
Previous experiences with other POC rapid tests:				
Diagnosis of illicit drug use/abuse	1.031	0.640; 1.686	-	-
Diagnosis of metabolic disorders	0.713	0.340; 1.492	-	-
At your knowledge, the actual sensitivity of POC tests ranges 70 – 89% (correct answer)	-	-	1.175	0.756; 1.824
At your knowledge, the actual specificity of POC tests ranges ≥ 90% (correct answer)	1.629	0.947; 2.801	-	-
A positive POC test allows the diagnosis of COVID-19 … never (correct answer)	0.152	0.054; 0.423	0.334	0.138; 0.808
POC rapid tests for COVID-19 are highly reliable (agree / totally agree)	6.858	3.977; 11.824	4.267	2.624; 6.939
POC rapid tests for COVID-19 may be useful in the daily practice (*agree / totally agree*)	12.872	7,318; 22.640	10.021	5.905; 17.006
Appropriate pricing for a POC "rapid test" for COVID-19 should be < 10€	-	-	1.105	0.709; 1.723

fection (14,15), availability of rapid diagnostic tests would radically improve our understanding of the ongoing pandemic. More precisely, by improving our current testing capacity for COVID-19, giving results more quickly with a lower-cost detection (16), POC rapid tests have the potential to guarantee a better understanding of SARS-CoV-2 burden of disease, pointing to more appropriate public health interventions, including contact tracing and patient isolation (1,2,4–6,9).

POC rapid diagnostic tests are small stand-alone tests that are relatively simple to perform, being directly deployable outside hospitals and other healthcare facilities. Moreover, POC do not require specialized, time-consuming training as specimens (in the case of COVID-19, usually capillary blood samples) do not need to be particularly processed. As POC can be employed by decentralized testing infrastructure, their extensive use has been proposed as instrumental to identify a sort of "immunity passport", being particularly attractive for preventive and periodic assessment of post-lockdown workforce (4).

Our study identified a diffuse lack of confidence in POC by medical workforce, particularly among OPh, as only one quarter of participants acknowledged POC as highly reliable, compared to 70.2% for HRCT, and 73.1% for molecular test. Even though knowledge status was not clearly associated with likeliness to refer to such tests in daily activities, several knowledge gaps were diffusely identified, particularly on actual understanding of Specificity and Sensitivity of available tests. While Specificity was more homogenously underestimated, Sensitivity of POC was both over- and under-estimated, possibly mirroring the confusing communication that has involved such instruments in the weeks preceding the survey (2,5,6,9).

Not coincidentally, less than half of total respondents were reportedly favorable to include POC tests in their daily practice (40.3%), and in making clinical decisions based on their results (38.5%).

Reasonably, such attitudes were directly influenced by two specific factors. On the one hand, the rational understanding of the actual limits of available tests in terms of reliability, and particularly their doubtful legal status, both in general terms, and more specifically on the possible identification of COVID-19 cases. Following similar statements from ECDC and WHO, Italian Ministry of Health has defined POC available at the time of the survey as useful only in epidemiological settings, i.e. in order to more properly define the actual population dynamics of SARS-CoV-2 infection (1,3,11). On the other hand, there is the individual trust in such instruments, possibly perceived as instrumental or at least a possible option in discriminating doubtful cases, not fulfilling official recommendations for molecular tests of oro-/rhinopharyingeal specimens, and still requiring the professionals to make some specific interventions, including the notification to the local health authorities, or the readmission/exclusion from the workplaces. As COVID-19 is diffusely and understandably perceived as a severe health threat, it is likely to interpret such statements as a consequence of the emotional desire to guarantee the patients at least one diagnostic option, averting possible contacts, both in household and workplace settings (17–19).

Interestingly, our study identified another significant effector in working as OPh, as such professionals were reportedly less likely to employ POC in their practice. This is noteworthy, as Italian OPh have a long and somewhat conflicting experience with POC testing, particularly for illicit drugs and alcohol in the workplaces (20–22). Even though such screening tests are highly reliable – or, at least, much more reliable than POC tests for COVID-19, their results have often involved the professionals in conflicting and sometimes legally confused diagnostic procedures. In other words, while only few participants had a previous experience with POC tests for COVID-19, a more extensive familiarity with similar procedures may have impaired the perceived reliability of such instruments, and above all the actual usefulness in clinical practice. Not coincidentally, the Emilia Romagna Regional Health Authorities, have recently issued severe restrictions in the use of POC rapid tests, including their preventive authorization based on the characteristics of the specific kit employed by the OPh, the mandatory referral to high-quality quantitative serological tests, requiring molecular testings for all cases hinting towards ongoing viral replication (i.e. IgM positive status) (10).

Despite the possible significance of our results, particularly in the eve of the post-lockdown phase of SARS-CoV-2 pandemic, our study is affected by significant limitations. First and foremost, it shares the implicit limits of Internet-based surveys (23,24). Web surveys are reliable and cost-effective as they usually require fewer resources, being also much faster than conventional surveys. Still, participation is affected by a sort of "self-selection": i.e. the final sample may potentially over-represent some sub-groups of the original population, and particularly subjects from younger age groups, with a greater literacy on the assessed theme, and more accustomed to the internet access. Therefore, it is not possible to rule out the existence of a significant selection bias. While participating voluntarily could be due to a proactive attitude or a perceived greater knowledge about POC testing, lack of participation could be understood as negative attitude or lack of knowledge about the assessed theme.

Again, we cannot rule out that our results may have been affected by a significant social desirability bias, with participants reporting "*socially appropriated*" rather than their authentic behaviors, so that our result could have ultimately overstated the share of respondents having an effective understanding of POC tests, as suggested by the very heterogenous assessment of sensitivity and specificity. Similarly, the actual share of respondents likely to include POC tests in their daily practice may be largely overestimated, biasing all estimates of the correspondent effectors.

Moreover, our sample was of relatively limited size, including only 561 out of over 250,000 medical professionals operating in Italy in 2020, and 236 out of 7166 OPh from the official national list of OPh, and their geographic origin was deliberately not assessed in order to improve the protection of study participants. As a consequence, our results should be cautiously interpreted as representative of the National level (25–

27). On the other hand, while a certain selection is usually performed by social media managers of specific discussion groups (e.g. by registering only subjects who receive a specific invitation by the manager; answering to specific "selection" questions; etc), often requesting to certificate their professional activity, we cannot rule out that some of the study participants were not actively working as medical professionals, thereby limiting the fulfillment of our initial selection criteria.

Finally, the data we collected were not externally validated, lacking an estimate of the actual practices of respondents. More specifically, we are unable to ascertain how often sampled professionals actually had actually employed POC tests before our survey, or had actually used similar POC in their professional settings.

Conclusions

In conclusion, our results suggest that a large share of Italian medical professionals may show some resistances in including POC rapid tests for COVID-19 in their daily practice, particularly among OPh. Moreover, our results suggest that a significant share of medical professionals ignores more recent recommendations towards a limited and well-defined use of POC in clinical practice. Interestingly, as knowledge status was not a main predictor of a proactive attitude towards the use of POC tests, it is reasonable that individual, somewhat emotional factors may be the main effectors of a more positive attitude towards such instruments. As inappropriate trust in POC tests may lead to potentially catastrophic consequences (i.e. failing to properly identify true positive asymptomatic cases) because of their low sensitivity, while their dismissal may slow down or even radically impair the post-lockdown phase, proper guidelines on their use in daily practice should be preventively identified and shared among professionals.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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