Diagnostic Performance of Self-Reported Smell and Taste Disorders Varies with COVID-19 Prevalence in Primary Care Settings

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April 15; second period = low prevalence: April 16 to June 9) using STATA 15.1 (College Station, USA).

INTRODUCTION

Studies in primary care, including our own, showed that patients with COVID-19 frequently complained of smell and/or taste disorders.^{1, 2} This finding is possibly related to the tropism of SARS-CoV-2 for the nerves of the ENT system.³ In an epidemic context, the high specificity of these two symptoms, taken alone or in combination, could help primary care physicians (PCPs) in their diagnostic approach when examining patients suspected of having COVID-19.⁴ To our knowledge, the diagnostic contribution of these symptoms in low COVID-19 prevalence periods or settings (< 5%) is unknown.

We conducted a study in France with primary care patients to compare the diagnostic performance of smell and/or taste disorders in high versus low COVID-19 prevalence.

METHODS

This cross-sectional study was conducted between March 24 and June 9, 2020, in two French regions (Lyon and Marseille). Patients suspected of having COVID-19 were referred by their PCP to a medical laboratory (two in Lyon and six in Marseille) for nasopharyngeal RT-PCR testing. Before the test, patients answered a questionnaire on sociodemographic characteristics and the presence or absence of smell and taste disorders. We assessed the association between these symptoms and SARS-CoV-2 infection using logistic regression adjusted for gender, age group, and clustering within laboratories. Then, we examined the diagnostic performance of these symptoms by computing sensitivity, specificity, ROC area, and positive and negative likelihood ratios. All analyses were done for two periods (first period = high prevalence of infection: March 24 to

RESULTS

We included 2514 consecutive patients (women = 59%, median age = 43 years (interquartile range = 28)). There were 1543 patients recruited in Lyon (61%) and 971 in Marseille (39%). Overall, 272 patients tested positive for SARS-CoV-2 (11%). The proportion of positive tests was 23% during the first period of data collection ($N = 224/971$) and 3% during the second period ($N = 48/1543$). During the first period, the odds of positive testing was > 5 times the odds of negative testing for smell and/or taste disorders in both univariable and multivariable analyses (Table 1). During the second period, the differences in odds were not statistically significant.

The diagnostic performance table shows several substantial differences between the two periods (Table 2). The overall performance (ROC area) for the individual or combined presence of these two symptoms decreased from 0.60–0.67 for period 1 to 0.49–0.51 for period 2, and the positive likelihood ratio decreased from 3.0–4.4 to 0.8–1.4 (with confidence intervals including 1).

DISCUSSION

In this primary care population, the overall performance (ROC area) and positive likelihood ratio of taste and/or smell disorders was 0.5 and close to 1, respectively, in a period of low COVID-19 prevalence (test positivity rate = 3%). These results suggest that the diagnostic test used (i.e., the presence of taste and/or smell disorders) has no discriminatory ability to diagnose patients with and without the condition (i.e., with a positive or negative RT-PCR test), and is therefore not useful for the diagnostic approach.

For example, among 63 patients reporting anosmia, 61 tested negative and only two tested positive (i.e., one test was positive for every 31 tests that were negative), and among 1457 patients without anosmia, there were 1411 negative tests and 46 positive tests (i.e., again a positive to negative test ratio of 1:31).

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Table 1 Association Between Smell and/or Taste Disorders, and Positivity of the SARS-CoV-2 RT-PCR Test

Symptom	Overall N (%)	Patients with a positive test N (%)	Patients with a negative test N (%)	OR (95% CI)	p-value ¹	Adjusted OR (95% CI)	p-value ²
First period of data collection ³	N = 970	N = 224	N = 746				
Smell disorder ⁴	190 (19.6)	94 (42.0)	96 (12.9)	4.9 (4.2–5.7)	<0.001	5.1 (4.3–6.1)	<0.001
Taste disorder ⁵	166 (17.1)	83 (37.1)	83 (11.1)	4.7 (3.9–5.7)	<0.001	5.1 (4.0–6.6)	<0.001
Smell and taste disorder ^{4,5}	107 (11.0)	60 (26.8)	47 (6.3)	5.5 (3.5–8.5)	<0.001	5.8 (3.6–9.4)	<0.001
Smell or taste disorder ^{4,5}	249 (25.7)	117 (52.2)	132 (17.7)	5.1 (4.5–5.8)	<0.001	5.5 (4.7–6.4)	<0.001
Second period of data collection ⁶	N = 1521	N = 48	N = 1472				
Smell disorder ⁴	63 (4.1)	2 (4.2)	61 (4.2)	1.0 (0.3–3.2)	0.99	1.0 (0.3–3.1)	0.93
Taste disorder ⁵	67 (4.4)	2 (4.2)	65 (4.4)	0.9 (0.3–3.0)	0.92	0.9 (0.3–2.8)	0.81
Smell and taste disorder ^{4,5}	45 (3.0)	2 (4.2)	43 (2.9)	1.4 (0.5–4.7)	0.54	1.3 (0.4–4.4)	0.64
Smell or taste disorder ^{4,5}	84 (5.5)	2 (4.2)	82 (5.6)	0.7 (0.2–2.3)	0.60	0.7 (0.2–2.2)	0.54

¹Univariable logistic regression (adjusted for clustering within laboratories)²Multivariable logistic regression (adjusted for clustering within laboratories, gender, and age group)³First period of data collection: March 24 to April 15, 2020⁴Anosmia or hyposmia⁵Ageusia or hypogeusia⁶Second period of data collection: April 16 to June 9, 2020

Our study sample was not a random community sample. The prevalence of SARS-CoV-2 infection was probably higher in this population, which consisted of patients sent for laboratory testing by their PCP. Furthermore, the results of our

study could theoretically be biased by the diagnostic performance of the RT-PCR test. However, this test seems to lead to very few false positive/negative results. A strength of our study is that it was conducted in the same conditions over

Table 2 Diagnostic Performance of Smell and/or Taste Disorders

Symptom	Sensitivity (95% CI)	Specificity (95% CI)	ROC area (95% CI)	Positive likelihood ratio (95% CI)	Negative likelihood ratio (95% CI)
First period of data collection ¹					
Smell disorder ²	42.0 (35.4–48.7)	87.1 (84.5–89.5)	0.65 (0.61–0.68)	3.3 (2.6–4.2)	0.7 (0.6–0.8)
Taste disorder ³	37.1 (30.7–43.7)	88.9 (86.4–91.0)	0.63 (0.60–0.66)	3.3 (2.6–4.3)	0.7 (0.6–0.8)
Smell and taste disorder ^{2,3}	26.8 (21.1–33.1)	93.7 (91.7–95.3)	0.60 (0.57–0.63)	4.3 (3.0–6.0)	0.8 (0.7–0.9)
Smell or taste disorder ^{2,3}	52.2 (45.5–58.9)	82.3 (79.4–85.0)	0.67 (0.64–0.71)	3.0 (2.4–3.6)	0.6 (0.5–0.7)
Second period of data collection ⁴					
Smell disorder ²	4.2 (0.5–14.3)	95.9 (94.7–96.8)	0.50 (0.47–0.53)	1.0 (0.3–4.0)	1.0 (0.9–1.1)
Taste disorder ³	4.2 (0.5–14.3)	95.6 (94.4–96.6)	0.50 (0.47–0.53)	0.9 (0.2–3.7)	1.0 (0.9–1.1)
Smell and taste disorder ^{2,3}	4.2 (0.5–14.3)	97.1 (96.1–97.9)	0.51 (0.48–0.54)	1.4 (0.4–5.7)	1.0 (0.9–1.1)
Smell or taste disorder ^{2,3}	4.2 (0.5–14.3)	94.5 (93.1–95.5)	0.49 (0.46–0.52)	0.8 (0.2–3.0)	1.0 (1.0–1.1)

¹First period of data collection: March 24 to April 15, 2020²Anosmia or hyposmia³Ageusia or hypogeusia⁴Second period of data collection: April 16 to June 9, 2020

the two prevalence periods, limiting the probability that different diagnostic performances be due to different population characteristics.

In conclusion, the diagnostic performance of SARS-CoV-2 symptoms may vary according to the prevalence of infection as estimated by the positivity rate of screening tests. In low COVID-19 prevalence settings (< 5%), the presence (or absence) of taste and/or smell disorders does not appear to be useful in guiding clinicians in their diagnostic approach of COVID-19. This finding should be confirmed in other primary care patient populations.

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Data Availability: The data underlying this article will be shared on reasonable request to the corresponding author.

Paul Sebo, MD MSc¹
Dagmar M. Haller, MD-PhD¹
Hubert Maisonneuve, MD¹

¹University Institute for Primary Care (IuMFE), Faculty of Medicine, University of Geneva, 1, rue Michel-Servet, 1211Geneva, Switzerland

Corresponding Author: Paul Sebo, MD MSc; University Institute for Primary Care (IuMFE), Faculty of Medicine, University of Geneva, 1, rue Michel-Servet, 1211Geneva, Switzerland (e-mail: paulsebo@hotmail.com).

Declarations:

Ethical Approval: All methods were carried out in accordance with relevant guidelines and regulations. Informed consent was obtained from all participants. The study was approved by the Ethics Committee of the Collège National des Généralistes Enseignants (number 200423163) and the French CNIL (data protection authority).

Conflict of Interest: The authors declare that they do not have a conflict of interest.

REFERENCES

1. Tudrej B, Sebo P, Lourdaux J, et al. Self-Reported Loss of Smell and Taste in SARS-CoV-2 Patients: Primary Care Data to Guide Future Early Detection Strategies. *J Gen Intern Med* 2020; **35**: 2502–4.
2. Lechien JR, Chiesa-Estomba CM, De Siati DR, et al. Olfactory and gustatory dysfunctions as a clinical presentation of mild-to-moderate forms of the coronavirus disease (COVID-19): a multicenter European study. *Eur Arch Oto-Rhino-Laryngol* 2020; **277**: 2251–61.
3. Glezer I, Bruni-Cardoso A, Schechtman D, Malnic B. Viral infection and smell loss: The case of COVID-19. *J Neurochem* 2021; **157**: 930–43.
4. Zayet S, Klopfenstein T, Mercier J, et al. Contribution of anosmia and dysgeusia for diagnostic of COVID-19 in outpatients. *Infection* 2020; **49**: 361–5.

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