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Implementing an At-Home Smell Test for Early Assessment of COVID-19 in High-Risk Healthcare Workers

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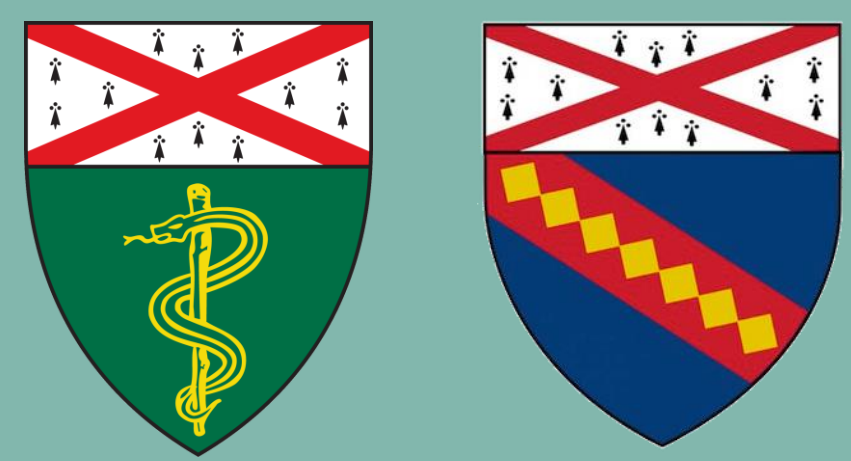
Background

- Reduced olfactory sensitivity, or anosmia, has been identified as a common manifestation of COVID-19
- However, smell loss has not yet been prospectively evaluated in asymptomatic and/or pre-symptomatic individuals undergoing regular, frequent SARS-CoV-2 testing
- It is unknown whether monitoring for smell loss can be used to identify asymptomatic infection among high-risk individuals, like healthcare workers (HCW)
- Testing for objective smell loss using standard laboratory or clinical techniques is not feasible for widespread testing, and self-report surveys are not sufficiently reliable

Objectives

1. To determine if smell sensitivity and loss using an at-home assessment could identify SARS-CoV-2 infection in HCW

Methods

Study Participants

- Physicians, nurses, and other HCW caring for COVID-19 patients in the medical ICU or dedicated COVID-19 units at Yale New Haven Hospital
- Participants were recruited and consented in the IMPACT (Implementing Medical and Public Health Action against Coronavirus) study during the height of the pandemic in Connecticut, between March 31 and July 7, 2020

Data Collected

- SARS-CoV-2 real-time quantitative polymerase chain reaction (RT-qPCR) testing was performed on self-collected nasopharyngeal and saliva specimens every three days
- The Yale Jiffy is an online survey developed to screen for smell loss that can be conducted in under two minutes using readily available household items
- HCW completed an online daily symptom questionnaire that included screening questions for changes in smell and taste.

Statistical Analyses

- Descriptive statistics were used to characterize the study population
- Fisher's exact and Wilcoxon rank-sum tests were used to compare SARS-CoV-2-positive and negative HCW
- We compared HCW reporting smell loss to a well-matched subset of HCW never reporting smell loss
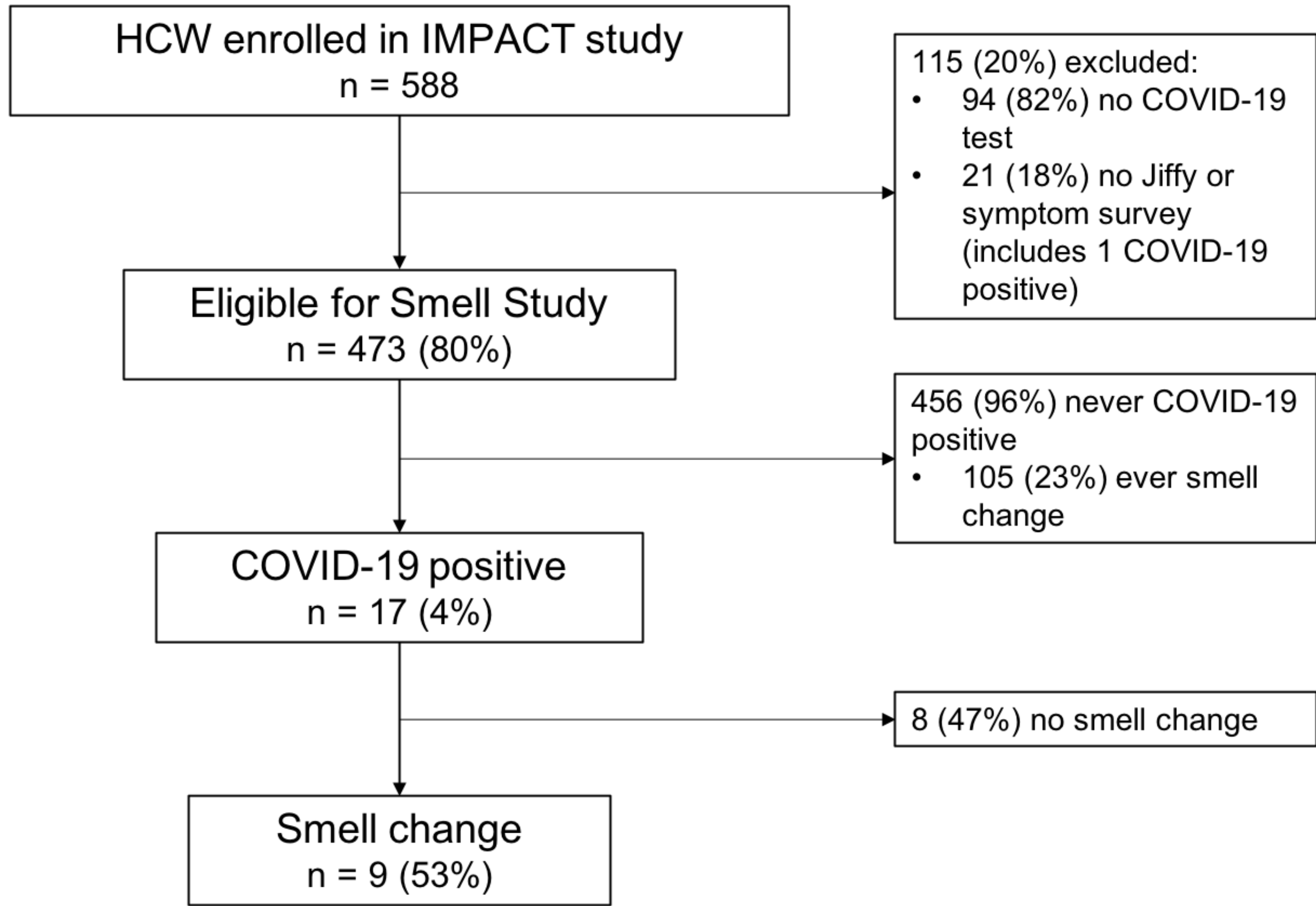
Acknowledgements

Results

FIGURE 1. Flow Diagram of Participants and Reported Changes in Smell by COVID-19 Status

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- HCW enrolled in IMPACT study n = 588
- 115 (20%) excluded:
  - 94 (82%) no COVID-19 test
  - 21 (18%) no Jiffy or symptom survey (includes 1 COVID-19 positive)
- Eligible for Smell Study n = 473 (80%)
- 456 (96%) never COVID-19 positive
  - 105 (23%) ever smell change
- COVID-19 positive n = 17 (4%)
- 8 (47%) no smell change
- Smell change n = 9 (53%)

TABLE 1. Baseline Characteristics of Participants in the Smell Sub-Study

	SARS-CoV-2 Positive HCW (n = 17)	SARS-CoV-2 Negative HCW (n = 456)	P Value	Adjusted OR (95% CI)
Demographics				
Age, y	30.0 (26.0, 48.0)	34.5 (29.0, 44.0)	0.47	--
Female sex	15 (88)	358 (79)	0.54	--
Ethnicity			0.84	--
White	16 (94)	359 (79)		
Black	0 (0)	15 (3)		
Hispanic	0 (0)	37 (8)		
Asian	1 (6)	36 (8)		
Other	0 (0)	9 (2)		
BMI, kg/m^2	25.0 (22.2, 35.2)	24.7 (22.7, 29.1)	0.74	--
Occupation			**0.01**	--
RN	15 (88)	246 (54)		
MD	0 (0)	98 (21)		
Other	2 (12)	112 (25)		
Number of surveys completed				
Symptom survey	10.0 (6.0, 22.0)	22.0 (10.0, 34.0)	0.08	--
Yale Jiffy	1.5 (1.0, 4.5)	8 (2.0, 24.0)	**0.03**	--
Smell loss				
Yale Jiffy	5/9 (56)	43/304 (14)	**0.005**	--
Symptom survey	8/17 (47)	83/456 (18)	**0.008**	--
Either survey	9/17 (53)	105/456 (23)	**0.009**	4.52 (1.61, 13.3)

FIGURE 2. Chronology of Smell Changes among COVID-positive Healthcare Workers relative to day of positive test

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Legend:
- No survey data
- x No smell changes
- x Smell changes
- YJ Jiffy response

Days prior to positive PCR test | Day of positive PCR test | Days after positive PCR test
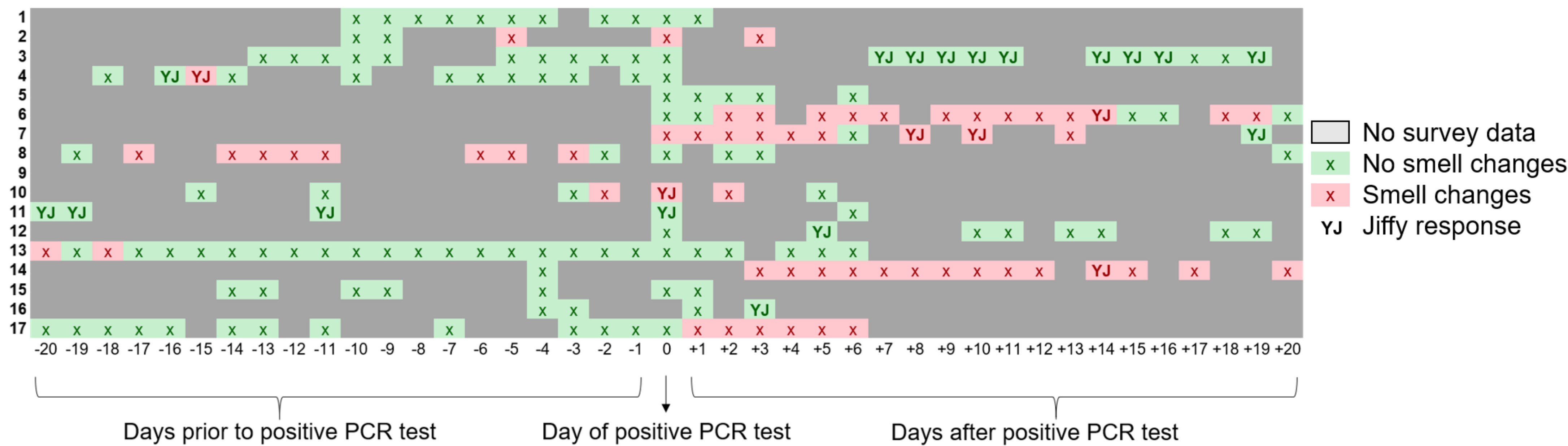
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FIGURE 3. Self-reported Severity of Smell Loss on the Yale Jiffy by COVID-positive and COVID-negative Healthcare Workers

FIGURE 3. Self-reported Severity of Smell Loss on the Yale Jiffy by COVID-positive and COVID-negative Healthcare Workers

- COVID-19 Positive
- COVID-19 Negative

$P = .005$ (None), $P < .001$ (Severe)

Severity of Smell Reduction: None, Slight, Moderate, Severe
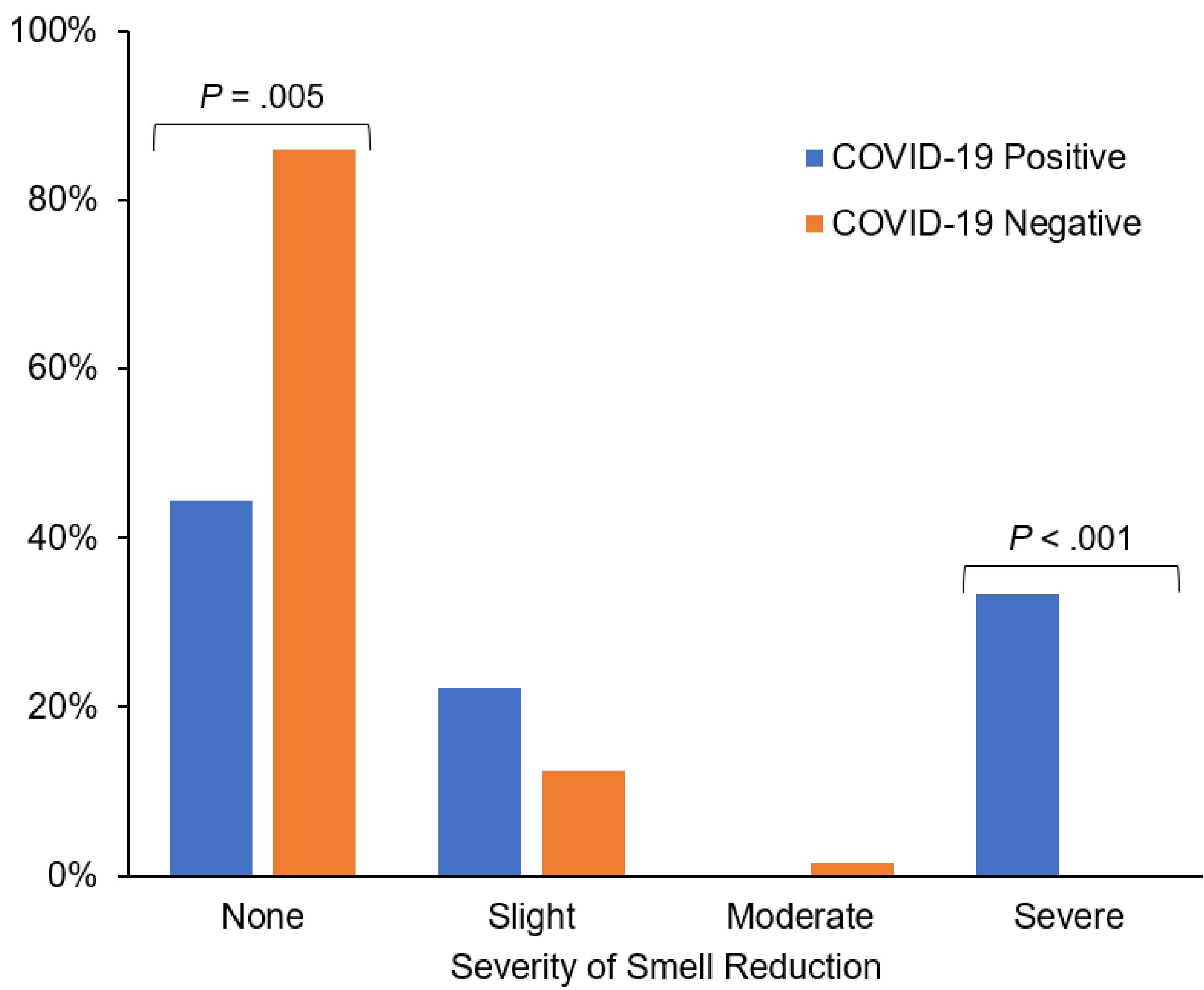
TABLE 2. Characteristics of SARS-CoV-2 Positive Healthcare Workers by Reported Smell Change

	Smell Change (n = 9)	No Smell Change (n = 8)	P Value
Cycle threshold, mean (SD)	27.7 (4.9)	30.2 (3.5)	0.28
Age, y	34 (30, 59)	26.5 (25.8, 33.8)	0.054
Female sex	9 (100)	6 (75.0)	0.21
Non-white race	0 (0)	1 (12.5)	0.47
BMI, kg/m^2	26.6 (22.3, 35.5)	23.7 (22.6, 27.7)	0.71
Smell change as presenting symptom	3 (33.3)	--	--
Any neurological symptoms	9 (100)	3 (37.5)	**0.009**
Neurological symptoms $\geq$ 7 days after positive test	4 (44.4)	1 (12.5)	0.29

Data are presented as median (IQR) for continuous variables and no. (%) for categorical variables unless otherwise indicated

Conclusions

- HCW with SARS-CoV-2 infection were more likely to report smell loss than those without SARS-CoV-2 infection
- 67% reported smell loss prior to having a positive SARS-CoV-2 test, and smell loss was reported a median of two days before testing positive
- Neurological symptoms were reported more frequently among SARS-CoV-2-positive HCW who reported smell loss compared to those without smell loss
- Self-reported changes in smell perception were predictive of SARS-CoV-2 infection in a healthcare worker population
- At-home smell assessments should be considered for non-invasive screening of groups that are at high risk for COVID-19