Parosmia is prevalent and persistent amongst those with COVID-19 olfactory dysfunction*

Ethan Cook[1], Chrissi E. Kelly[2], Duika L. Burges Watson[3], Claire Hopkins[1]

[1] Guy's and St. Thomas' NHS Hospital Foundation Trust, London, UK

[2] AbScent, Andover, Hampshire, UK

[3] Faculty of Medical Sciences, Newcastle University, Newcastle, UK

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To the Editor:

Since early reports suggesting an association between loss of smell and COVID-19 infection in mid-March, olfactory dysfunction (OD) is now recognised as one of the most prevalent symptoms of COVID-19 in symptomatic adults[1, 2], and has been added to the diagnostic criteria in many countries and the World Health Organisation. Although there are now numerous publications on the prevalence and severity of OD, there are still relatively few studies looking at long-term outcomes in affected patients. This may reflect that many report such a high rate of early recovery, even within the first two weeks, and perhaps the risk of long term loss has therefore been overlooked. Furthermore, qualitative olfactory disorders, including parosmia, have largely been neglected.

AbScent, a charity for patients with loss of smell, has reported a large increase in membership since the onset of the pandemic. It hosts a Facebook group, and in late March established a new group for those attributing their loss of smell and taste to COVID-19. Members may post comments and questions and respond to others. There are currently 9314 members of the COVID-19 loss of smell group.

A review of posts made in September show that recovery of loss of smell (or the absence of recovery) and the onset of distorted smells in response to odorant exposure (parosmia) are frequent topics. We therefore sought to survey members regarding these issues to determine if further research is needed to address these concerns.

In order to estimate recovery rates and the prevalence of parosmia in users of the group, a post asked all members to report when they lost their sense of smell, if it had recovered completely, partially or not at all, whether they had experienced parosmia, and if so, when this started and if it had recovered. Members were encouraged to respond even if they had recovered completely.

Within 1 week of posting the question, 403 usable responses had been posted; this reflects the second highest response to any post made within the group. These were extracted and analysed.

More than half the respondents reported that they had lost their sense of smell in March. The distribution and self-reported recovery rates for each time point is shown in Figure 1. Overall, 18.4% report having fully recovered their loss of smell, 71% partially recovered and 10.6% report no recovery.

Of those who responded to the question (n-357), 74.9% reported having developed parosmia. The mean time from onset of loss of sense of smell was 3 months, with a range of 1-5 months. Of those who had developed parosmia, this had resolved in only 5 (1.8%) of respondents, all of whom lost their sense of smell in March. Eighty-three reported some improvement in parosmia (31.8%), while the majority (66.3%) had not noticed any improvement in parosmia at the time of response. Higher rates of parosmia were reported in patients who had completely and partially recovered that those who had not, overall (Table 1, Chi^2 90.99, $p<0.001$), and at each time point (Table 2).

Unexpectedly, 41 (15.4%) people added a comment that their sense of smell had recovered prior to developing parosmia.

The majority of patents reported onset of olfactory loss in March, in keeping with the peak of the pandemic in the UK. While we do not know the location in relation to each response, AbScent is a UK based charity with a global membership, and the majority of those responding to a post asking about their location live in the UK.

Studies evaluating recovery in prospective series suggest that many patients rapidly regain their sense of smell, with signi-

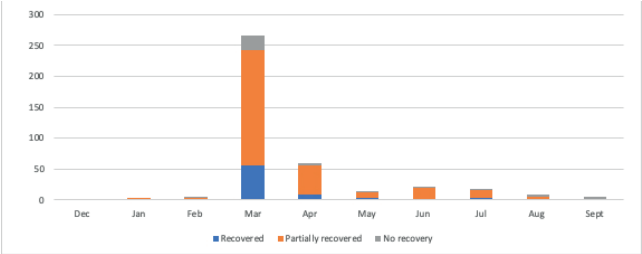

Figure 1. Distribution of cases by month of onset demonstrating self-reported recovery rates at each time point as recovered, fully recovered or no reported recovery.

ficant improvement in psychophysical olfactory scores being observed by 20 days after onset[3], and a reduction in patients reporting loss of smell and taste from 60% at baseline, 37% at 4 weeks and 19% at 8 weeks[4], The lower self-reported rates of complete recovery in our cohort suggest that many of those who recover quickly do not seek out support groups, or leave the group once recovered and we are therefore likely sampling a selected cohort with more persistent OD.

Parosmia has previously been reported to affect a high proportion of patients with post-infectious loss, with 56% cases reporting parosmia in one study[5]. In our cohort the prevalence is even higher – although this may again reflect selection bias with patients troubled by parosmia may be more likely join such groups looking for advice than those without. However, our results suggest that this is a prevalent symptom, and one that has largely been overlooked. Parma et al. reported that parosmia was a rare finding in a survey study, being reported by only 7% of patients with confirmed COVID-19[6]; however, this study was performed in April and specified that anyone completing the survey be within two weeks of experiencing symptoms. Parosmia received very little mention in other studies and will likely be overlooked where studies focus only ongoing loss of smell[7].

The mean interval between loss of smell and onset of parosmia in our cohort was 3 months highlighting the importance of longer-term follow-up of patients with OD. In the study by Reden et al.[5], 29% reported relief of their parosmia, over an average period of 12 months, therefore studies must continue beyond this time point to fully capture recovery rates, but our patients can be reassured at this stage that there is still hope for recovery. The presence of parosmia has previously been reported as a positive predictor associated with a lower chance of anosmia as the long-term outcome[8], and is reported to be typically associated with quantitative loss of smell[9]. Histological examination of olfactory epithelium excised to treat parosmia and phantosmia showed evidence of loss of olfactory neurones and a predominance of immature neurones. We were surprised that a significant number of patients were reporting resolution of loss of sense of smell prior to the development of parosmia.

Table 1. Rate of parosmia by self-reported recovery rates. Parosmia significantly associated with recovery Chi^2 90.99, p<0.001.

Recovery status of Sense of Smell	N	% Parosmia
Recovered	74	81
Partially recovered	286	72
Not recovered	43	0

Table 2. Rate of parosmia by self-reported recovery rate, separated by month of onset.

Month of onset	Recovery status (self-reported)	Developed Parosmia N (%)	Did not develop Parosmia	Did not answer
February	Recovered	1 (50)	1	0
	Partially recovered	0 (0)	1	1
	Not recovered	0 (0)	1	0
March	Recovered	43 (78.2)	10	2
	Partially recovered	140 (74.9)	27	20
	Not recovered	1 (4)	15	9
April	Recovered	9 (100)	0	0
	Partially recovered	37 (78.7)	6	4
	Not recovered	0 (0)	3	1
May	Recovered	3 (100)	0	0
	Partially recovered	17 (80.9)	3	1
	Not recovered	0 (0)	0	2
June	Recovered	1 (!00)	0	0
	Partially recovered	14 (82.3)	3	1
	Not recovered	0 (0)	2	0
July	Recovered	3 (75)	1	0
	Partially recovered	6 (50)	3	3
	Not recovered	0 (0)	1	1
August	Recovered	0 (0)	0	0
	Partially recovered	0 (0)	4	1
	Not recovered	0 (0)	2	1
September	Recovered	0 (0)	0	0
	Partially recovered	0 (0)	1	0
	Not recovered	0 (0)	5	0

A detailed discussion surrounding the correlation between self-reported smell loss and results of psychophysical testing is beyond the limits of this short report. In healthy subjects, a poor correlation has been reported[10]. In contrast, in the setting of disease, such as chronic rhinosinusitis, there is moderate correlation between self-reported loss of smell and the results of psychophysical testing[11], and therefore there are limitations in our data as we were unable to formally assess olfaction. Psychophysical testing in COVID-19, while considered a gold standard, is

limited by the absence of baseline data and may over-estimate prevalence of olfactory dysfunction by including pre-existing but undiagnosed hyposmia. In contrast, self- reported rating may over-estimate recovery; in one study evaluating resolution of post-COVID-19 OD at 7 weeks after onset, 61.7% participants self-reported complete recovery, while only 46% were normosmic on psychophysical testing[12]. It is therefore possible that those patients reporting complete recovery in our study still had persisting OD. Future studies should use both measures. Moreover, given reports on Facebook suggest parosmia can occur months after infection and initial recovery, it may also be that we have not yet seen the extent of 'late onset' parosmia. Certainly, this is an area where further research is required prospectively evaluating the long-term outcomes of OD.

Further limitations of this study are the lack of confirmatory testing to establish that the loss of smell was indeed caused by COVID-19, and the high risk of selection bias caused by surveying members of a group for smell and taste loss. Furthermore, although many users of the group have become very familiar with terminology associated with olfactory dysfunction, we did not seek to further characterise what was reported as parosmia, and some people may be instead describing phantosmia, the perception of smells without exposure to an odorant.

Patients with olfactory dysfunction following COVID-19 should be reassured by the very high rates of recovery reported and our findings may not be representative of the wider population. Nonetheless we believe that this short report highlights the need for further studies to look at the prevalence and onset of parosmia following COVID-19 associated olfactory dysfunction, its underlying pathophysiology, long-term recovery rates and the impact of therapies, such as smell-training, on long-term outcomes.

This may be an important feature of Long-COVID that merits further study.

Conflict of interest

No conflict in interest.

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Authorship contribution

EC: Data collection and analysis, preparing manuscript; DW and CK: design of study, data interpretation, editing of manuscript; CH design of study, data collection and analysis, preparing manuscript.

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Claire Hopkins
Professor of Rhinology
Guy's and St. Thomas' NHS Hospital Foundation Trust
London
SE1 9RT
United Kingdom

E-mail: clairehopkins@yahoo.com