New onset of loss of smell or taste in household contacts of home-isolated SARS-CoV-2 positive subjects

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Abstract

**Purpose** To estimate the prevalence of smell or taste impairment in household contacts of mildly symptomatic home-isolated SARS-CoV-2 positive patients.

**Methods** Cross sectional study based on *ad hoc* questions.

**Results** Of 214 mildly symptomatic COVID-19 patients managed at home under self-isolation, 179 reported to have at least one household contact, with the total number of no study participants contacts being 296. Among 175 household contacts not tested for SARS-CoV-2 infection, 67 (38.3%) had SARS-CoV-2 compatible symptoms, 39 (22.3%) had loss of smell or taste with 7 (4.0%) having loss of smell or taste in the absence of other symptoms. The prevalence of smell or taste impairment was 1.5% in patients tested negative compared to 63.0% of those tested positive for SARS-CoV-2 (p<0.001).

**Conclusion** Smell or taste impairment are quite common in not-tested household contacts of mildly symptomatic home-isolated SARS-CoV-2 positive patients. This should be taken into account when estimating the burden of loss of sense of smell and taste during COVID-19 pandemic, and further highlights the value of loss of sense of smell and taste as a marker of infection.

Introduction

There is mounting evidence that a new onset of altered sense of smell or taste is strongly related to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. The prevalence of self-reported smell or taste impairment in patients with coronavirus disease 2019 (COVID-19) ranges from 11% to 87% in severe and mild-moderate cases, respectively [1,2].

According to World Health Organization (WHO) recommendation, patients testing positive for SARS-CoV-2 and having mild illness and no risk factors can be managed at home, as long as they can be followed up and cared for by family members [3].

In our Region, following the recommendations of the European Centre for Disease Prevention and Control [4], household contacts of SARS-CoV-2 positive subjects are placed in self-isolation for 14 days with daily monitoring for COVID-19 symptoms, including fever of any grade, cough or difficulty breathing, with nasopharyngeal and throat swabs being performed only in subjects that develop these symptoms.

However, a substantial proportion of SARS-CoV-2 infections may be asymptomatic or paucisymptomatic [5] with the sudden onset of the loss of sense of smell or taste has been reported as isolated symptom in 3% of cases [6].

In order to better estimate the burden of smell and taste impairment during COVID-19 pandemic, we searched for the prevalence of these symptoms in subjects at high risk for SARS-CoV-2 infection i.e.
Methods

We previously reported the prevalence of loss of the sense of smell or taste as well as other COVID-19 symptoms in a case series of 202 home-isolated mildly symptomatic confirmed cases of SARS-CoV-2 infection [6].

All these patients and additional 27 other subjects with PCR-positive SARS-CoV-2 infection residents in Treviso province, Italy, were contacted during March and April 2020, to record symptoms and their evolution. During telephone interviews, home-isolated patients were questioned regarding the presence of adult (≥ 18 years) home-isolated household contacts. Consenting household contacts were then themselves asked about the presence of COVID-19 related symptomatology, as well as about new onset of smell or taste impairment. Household contacts were asked if they had undergone nasopharyngeal and throat swabs for SARS-CoV-2 detection and the testing result. All residents in Treviso province are referred to COVID-19 referral center where, according to WHO recommendations [7], SARS-CoV-2 infection is searched for by real time polymerase chain reaction (RT-PCR) in nasopharyngeal and throat swabs.

Symptom prevalence was expressed as percentage of total patients, and 95% confidence interval (CI) were calculated using Clopper-Pearson method. Prevalences were compared using Fisher exact test. P-values < 0.05 (2 sided) were considered statistically significant. Statistical analyses were performed using R 3.6.

The study was conducted with the approval of the institutional ethical review board and informed consent was obtained verbally for telephone interviews.

Results

Of 229 mildly symptomatic COVID-19 patients, 214 (93.4%) were successfully contacted: two patients died after study enrollment due to a sudden and rapid deterioration of general conditions and additional 13 patients, of which two needed hospitalization, did not answer or refused the interview.

Among these 214 patients, 179 reported to have at least one household contact during their home isolation period, with the total number of study participant’s contacts available for the interview being 296.

Table 1 shows symptoms experienced by 296 household contacts of home-isolated SARS-CoV-2 positive subjects according to swab test. Overall, 74 (25.0%, 95% CI: 20.2%-30.3%) household contacts complained new onset of loss of smell or taste.

Of these, 121 underwent nasopharyngeal and throat swabs to detect SARS-CoV-2 by RT-PCR: 54 household contacts tested positive for SARS-CoV-2 and 34 (63.0%, 95% CI: 48.7-75.7) had loss of smell or
taste, while 67 tested negatives and 1 (1.5%, 95% CI: 0.0-8.0) had loss of smell or taste. Thus, a new onset of altered sense of smell and taste has reported a sensitivity of 63.0% (95% CI: 48.7%-75.7%) and a specificity of 98.5% (95% CI: 92.0%-100%) in detecting COVID-19 positive patients, with a positive predictive value of 97.1% (95% CI: 85.1%-100%) and a negative predictive value of 76.7% (95% CI: 66.4% to 85.2%).

Among 175 household contacts not tested for SARS-CoV-2 infection, 67 (38.3%, 95% CI: 31.1%-45.9%) had SARS-CoV-2 compatible symptoms, 39 (22.3%, 95% CI: 16.4%-29.2%) had loss of smell or taste with 7 (4.0%, 95% CI: 1.6%-8.1%) having loss of smell or taste in the absence of other symptoms.

Thus, the prevalence of altered sense of smell or taste was by far lower in subjects negative to SARS-CoV-2 compared to both positives (p<0.001) and non-tested cases (p<0.001).

Discussion

The prevalence of smell or taste impairment in household contacts of mildly symptomatic home-isolated SARS-CoV-2 positive patients was 1.5%, 22.3%, and 63.0% in subjects tested negative, non-tested, and tested positive for SARS-CoV-2 infection, respectively.

These results confirmed previously reported data showing that about two thirds of mildly symptomatic COVID-19 patients complain of an altered sense of smell or taste [6]. This is in line with experimental evidence that the transmembrane serine protease 2 and angiotensin-converting enzyme 2 (ACE2), the two key players in the binding and entry of the SARS-CoV-2 into human cells, are highly co-express in olfactory sustentacular cells [8], thus making this a potential target for SARS-CoV-2 infection.

In our Region, nasopharyngeal and throat swabs are indicated in household contacts of SARS-CoV-2 positive subjects that develop COVID-19 related symptoms. Unfortunately, due to temporary lack of resources (either test swabs or transportation) or patients’ impaired health, co-morbidities, and preferences, not all symptomatic patients have been tested. Thus, in this study we observed that many household contacts not-tested for SARS-CoV-2 had symptoms compatible with COVID-19 and a substantial proportion complained an altered sense of smell or taste. However, 7 subjects reported only altered sense of smell or taste.

There remains a paucity of data on the risks of household transmission – although cohabiting family members are advised to maintain social distancing as the risk of transmission is thought to be high, recent reports give secondary transmission rates of 16 [9] – 30% [10]. Our study found 54 confirmed secondary infections and 75 likely cases who were not tested, suggesting a secondary infection rate of 43%.

Finally, the prevalence of smell or taste impairment was rare in patients tested negative, thus showing that a new onset of altered sense of smell or taste has a high positive predictive value of SARS-CoV-2 infection. This is makes it a very useful marker of infection where capacity for testing is limited.
These results must be taken cautiously, due to several study limitations: data were self-reported, based on ad hoc questions, the sample was relatively small, and only subjects ≥ 18 years were considered.

However, this study showed that smell or taste impairment are quite common in not-tested household contacts of mildly symptomatic home-isolated SARS-CoV-2 positive patients. This should be taken into account when estimating the burden of loss of sense of smell and taste during COVID-19 pandemic. Furthermore, due to the robust association between the loss of sense of smell or taste and the SARS-CoV-2 infection as well as the possible existence of a monosymptomatic form of COVID-19 characterized by isolated smell or taste impairment, the new onset of these symptoms during COVID-19 pandemic should be considered a manifestation of SARS-CoV-2 infection until proven otherwise.

**Declarations**

**Funding:** none

**Conflicts of interest/Competing interests:** none

**Availability of data and material:** Additional informed consent was obtained from all individual participants for whom identifying information is included in this article

**Code availability:** n/a

**Ethics approval:** The study was conducted with the approval of the ethic committee for clinical experimentation of Treviso and Belluno provinces (ethic vote: 780/CE).

**References**

[1] Mao L, Jin H, Wang M, Hu Y, Chen S, He Q, et al. Neurologic Manifestations of Hospitalized Patients With Coronavirus Disease 2019 in Wuhan, China. JAMA Neurol 2020. https://doi.org/10.1001/jamaneurol.2020.1127.

[2] Lechien JR, Chiesa-Estomba CM, De Siati DR, Horoi M, Le Bon SD, Rodriguez A, 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 Off J Eur Fed Oto-Rhino-Laryngol Soc EUFOS Affil Ger Soc Oto-Rhino-Laryngol - Head Neck Surg 2020. https://doi.org/10.1007/s00405-020-05965-1.

[3] Home care for patients with COVID-19 presenting with mild symptoms and management of their contacts n.d. https://www.who.int/publications-detail/home-care-for-patients-with-suspected-novel-coronavirus-(ncov)-infection-presenting-with-mild-symptoms-and-management-of-contacts (accessed April 27, 2020).
COVID-19. Eur Cent Dis Prev Control n.d. https://www.ecdc.europa.eu/en/covid-19-pandemic (accessed April 27, 2020).

Nishiura H, Kobayashi T, Suzuki A, Jung S-M, Hayashi K, Kinoshita R, et al. Estimation of the asymptomatic ratio of novel coronavirus infections (COVID-19). Int J Infect Dis IJID Off Publ Int Soc Infect Dis 2020. https://doi.org/10.1016/j.ijid.2020.03.020.

Spinato G, Fabbris C, Polesel J, Cazzador D, Borsetto D, Hopkins C, et al. Alterations in Smell or Taste in Mildly Symptomatic Outpatients With SARS-CoV-2 Infection. JAMA 2020. https://doi.org/10.1001/jama.2020.6771.

Technical guidance n.d. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance (accessed April 27, 2020).

Fodoulian L, Tuberosa J, Rossier D, Landis BN, Carleton A, Rodriguez I. SARS-CoV-2 receptor and entry genes are expressed by sustentacular cells in the human olfactory neuroepithelium. BioRxiv 2020:2020.03.31.013268. https://doi.org/10.1101/2020.03.31.013268.

Li W, Zhang B, Lu J, Liu S, Chang Z, Cao P, et al. The characteristics of household transmission of COVID-19. Clinical infectious diseases : an official publication of the Infectious Diseases Society of America. 2020.

Wang Z, Ma W, Zheng X, Wu G, Zhang R. Household transmission of SARS-CoV-2. J Infect. 2020.

### Tables

**Table 1. Symptoms in 296 household contacts of 179 home-isolated SARS-CoV-2 positive subjects**

| Symptoms                        | Tested positive | RT-PCR for SARS-CoV-2 | Fisher exact test |
|---------------------------------|-----------------|------------------------|------------------|
|                                 | n (%)           | (95% CI)               | Tested negative  | (95% CI)                 | Not tested | (95% CI) | p       |
| Total patients                  | 54 18.3         | 67 22.6                | 175 59.1         |                             |            |         |         |
| Fever                           | 29 53.7         | (39.6-67.4)            | 12 17.9          | (9.6-29.2)                 | 65 37.1    | (30.0-44.8) | p<0.001 |
| Dry or productive cough         | 21 38.9         | (25.9-53.1)            | 10 14.9          | (7.4-25.7)                 | 39 22.3    | (16.4-29.2) | p=0.008 |
| Problems breathing              | 14 25.9         | (15.0-39.7)            | 1 1.5            | (0.0-8.0)                  | 3 1.7      | (0.0-4.9)    | p<0.001 |
| Altered sense of smell or taste | 34 63.0         | (48.7-75.7)            | 1 1.5            | (0.0-8.0)                  | 39 22.3    | (16.4-29.2) | p<0.001 |
| Other symptoms                  | 21 38.9         | (25.9-53.1)            | 47 70.1          | (57.7-80.7)                | 41 23.4    | (17.4-30.4) | p<0.001 |
| No symptoms                     | 0 0.0           | (0.0-6.6)              | 4 6.0            | (1.7-14.6)                 | 59 33.7    | (26.8-41.2) | p<0.001 |

SARS-CoV-2: severe acute respiratory syndrome coronavirus 2; RT-PCR: real-time polymerase chain reaction