

# Impact of olfactory disorders on personal safety & wellbeing: a cross-sectional observational study

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July 10, 2023

## Abstract

**Abstract** Objectives: Olfactory dysfunction can expose individuals to day-to-day safety hazards. We sought to investigate the perceptions of safety in individuals affected with olfactory dysfunction, quantify the incidence of hazardous events, and how safety scares/incidents manifest through patient stories. Methods: A survey that included questions to capture quantitative and qualitative data was created. Responses were collected from 25th February 2022 to 28th September 2022. The survey was distributed through Fifth Sense media channels and open to anyone who claimed to suffer from olfactory dysfunction. Results: Our survey collected responses from 432 individuals. The majority were female (79.6%), ages 41-70. Around a fifth (16.7%) were non-UK residents, encompassing 21 different countries. Covid-19 was the commonest cause of olfactory dysfunction (22%). Majority (85.9%) were worried about any form of safety due to their smell dysfunction. Gas, smoke and food were major concerns. Specifically, 32.2%, 14.8%, 34.5%, 18.5% of participants have experienced at least one food incident, gas incident, gas scare, and work scare, respectively. Affected individuals have taken preventative measures at home (60.2%). Conclusion: There is an unmet need in mitigating safety concerns/events for individuals with olfactory dysfunction. We suggest educating the public sector and high-risk sectors such as gas companies, and introduction of safety 'scratch and sniff' cards as a screening method. Regular assessment of an individual's olfactory ability, similar to routine assessments for other sensory systems (sight, hearing) would allow proactive identification of at-risk people, and allow corrective measures to take place.

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There is an unmet need in mitigating safety concerns/events for individuals with olfactory dysfunction. We suggest educating the public sector and high-risk sectors such as gas companies, and introduction of safety ‘scratch and sniff’ cards as a screening method. Regular assessment of an individual’s olfactory ability, similar to routine assessments for other sensory systems (sight, hearing) would allow proactive identification of at-risk people, and allow corrective measures to take place.

### **Key points**

1. The study investigated safety perceptions and incidences of hazardous events among individuals with olfactory dysfunction.
2. The survey gathered responses from 432 individuals, primarily women aged 41-70 from different countries, including 16.7% non-UK.
3. Majority (85.9%) expressed safety concerns, particularly around gas, smoke, and food, with notable incidents recorded.
4. 5-year incidence of hazardous events remains substantial.
5. The study identifies a need for better safety measures and routine assessments for people with olfactory dysfunction.

## **1. Introduction**

### *1.1. Background and rationale*

Loss of smell is a common but debilitating condition. It is estimated that the prevalence of either complete loss of smell (anosmia) or incomplete loss of smell (hyposmia) is approximately 2.7% to 24.5% in population-based studies based on objective olfactory assessment . Loss of smell disproportionately affects older people . Loss of smell can affect individual safety in many settings. However, people with olfactory dysfunction remain understudied and under-represented compared to other conditions in ENT. The increased risk of coal gas poisoning in individuals with smell loss was highlighted in 1957 . However, since then, only a few studies have assessed the safety risks of loss of smell. Studies have quantitatively demonstrated the high prevalence of safety risks, but with limited detail on incidence for number of hazardous events . In addition, few studies captured the qualitative aspect and the nuances of how these risks manifest . Consequently, limited progress has been made in mitigating these safety risks. A survey in 2014 highlighted the safety aspects of smell impairment, suggesting the safety issue remains a concern . With Covid-19 and an ageing population contributing to the increased prevalence of olfactory dysfunction it is crucial to amplify the patients’ voices and tackle the challenges through appropriate support and protection .

### *1.2 Objectives*

We sought to investigate the perception of safety reported by individuals with loss of smell, estimate its incidence, and how safety scares/incidents tend to manifest. The findings from this survey will be significant in identifying unmet needs in providing safety support for individuals with loss of smell.

## **2. Materials and Methods**

### *2.1 Study design*

This study is a cross-sectional survey exploring the personal safety and emotional well-being of those affected with olfactory dysfunction. The survey was created on SurveyMonkey, designed to capture both quantitative and qualitative data. This survey included a combination of multiple-choice answers, a rating scale, and opportunities for participants to enter free text. Data included in analyses were responses from 25th February

2022 to 28th September 2022. The survey remains open for continuous data collection. The study complied to the STROBE guidelines.

As the survey was anonymous and considered to be service evaluation, there was no ethical approval sought in line with the Health Regulation Authority guidance: [http://www.hra-decisiontools.org.uk/research/docs/DefiningResearchTable\\_Oct20\\_17-1.pdf](http://www.hra-decisiontools.org.uk/research/docs/DefiningResearchTable_Oct20_17-1.pdf).

## 2.2 Setting

Data was collected through the UK charity Fifth Sense which supports people affected by smell and taste disorders. The survey was shared via email newsletter and social media channels and open to individuals worldwide. The participants could access the survey online free of charge.

## 2.3 Participants

Anyone with a medical diagnosis or those who self-identified as having a problem with their sense of smell were eligible to participate in the survey.

## 2.4 Data sources and Variables

The survey collected demographics (gender, age, and region of residence), details about olfactory dysfunction (cause and duration), safety concerns and its effect on day-to-day living. Full survey is available here: <https://www.surveymonkey.co.uk/r/2BR3XTC>.

## 2.5 Bias

As the survey was distributed online via a UK-based charity, there is a selection bias towards the members of the charity, members with internet access and UK residents. In addition, individuals with more significant olfactory dysfunction may be more likely to respond. There is a risk of response bias as participants tend to agree or provide positive answers in, e.g. in rating scales and yes/no questions. We aimed to mitigate this issue by incorporating free text boxes to allow participants to be more nuanced.

## 2.6 Study size and statistical methods

No minimum sample size was required for the study as no statistical analyses were performed. All figures were created on R using ggplot2 package .

# 3. Results

## 3.1 Participants

The survey gathered responses from 432 participants. Answers from all 432 participants were analysed in the study.

## 3.2 Descriptive data

Patient demographics are summarized in Table 1. Out of the participants, most participants were female (79.6%), followed by male (18.5%). The most common age groups were between 41-55 and 56-70. There was a wide range of ‘professions’, with top 3 most common answers being retired (26.9%), teacher (4.4%), and administrator job (3.1%). Majority of respondents were from England, but a significant portion (16.7%) were from across the world with 48 out of 72 participants abroad from United States.

## 3.3 Main results

### 3.3.1 Causes and duration of olfactory dysfunction

Covid-19 infection was reported by 95 people as cause for their olfactory dysfunction, closely followed by idiopathic reported by 90 people. Remaining causes in descending order were congenital (62), post-traumatic head injury (61), viral infection other than Covid-19 (47), sino-nasal disorder (46), and other causes (36). Within other causes, a myriad of aetiologies was mentioned including intracranial lesions (e.g. meningioma

and chondrosarcoma), iatrogenic (secondary to brain/nasal operation), facial trauma and large doses of analgesia.

Roughly half of the respondents have had olfactory dysfunction for more than 5 years (234), followed by 2-5 years (73), 1-2 years (63), less than a year (54), and eight respondents were unsure of the duration.

### 3.3.2 Safety concerns

When asked about safety, majority of respondents stated they were worried about safety with 371 (85.9%) responding yes, 31 responding no (7.2%), and 30 who have not thought about it until now (6.9%). Gas, food freshness and smoke were major concerns for majority of respondents (Fig. 1). Other household odours were the most popular answer for 'somewhat concerned', followed by personal hygiene and food freshness. Hygiene of babies and children was the most popular answer in 'haven't thought about until now' and 'not concerned at all' group. A separate figure for UK participants only was created but the trend of answers remained unchanged (Supplementary Material, Fig. 1).

Other worries written by the respondents were burning food when cooking, faulty exhausts in cars, perfume, and missing out on the smell of others.

### 3.3.3 Quantification and examples of hazardous events past 5 years

We sought to quantify any hazardous events experienced in the last 5 years (Fig. 2). For all types of scares/incidents, most have not experienced any adverse events. A separate figure for UK participants only was created but the trend of answers remained unchanged (Supplementary Material, Fig. 2).

Recurring words were "worry", "concern", "anxiety", "paranoid", "avoid". For instance, one respondent responded "I have this paranoid habit to check the gas multiple times a day, before leaving the house, before going to bed or right in the middle of a movie just in case I forgot. When I'm out I always wonder if I triple checked that the gas was off so I have this anxiety to come back to a blown up house... not fun!".

In terms of the incidence, 32.2%, 14.8%, 34.5%, 18.5% of participants have experienced at least one food incident, gas incident, gas scare, and work scare the past 5 years respectively (Supplementary Material, Table 1). When considering only UK respondents, the percentages of at least one experience were similar at 29.7%, 14.7%, 34.8%, 15.3% in the order of food incident, gas incident, gas scare, and work scare (Supplementary Material, Fig. 1). Examples of hazardous events are provided in Table 2.

### 3.3.4 Mitigations

Approximately 60% stated they have taken measures at home to reduce the risks associated with olfactory dysfunction. Recurring examples were installing gas detectors, being more cautious (e.g. throwing food away past best before date, not having gas at all, etc.), and relying on another person's sense of smell. For individuals who did not take measures at home they said they were unaware gas detectors existed. Measures taken by employer (43%) includes setting up smoke/gas detectors, requiring to work with a colleague, and providing extra protection against Covid-19. However, it should be noted that roughly a quarter of the participants were retired, and therefore deemed the question as not relevant.

## 4. Discussion

### 4.1 Key results

This international survey highlights the impact of olfactory disorders on personal safety. Post-viral olfactory loss including Covid-19 accounted for 32.9% of respondents, highlighting the increasing prevalence of olfactory dysfunction since the start of the pandemic. Irrespective of the cause, 85.9% were concerned about safety. The percentages of at least one hazardous experience were 32.2%, 14.8%, 34.5%, 18.5% in the order of food incident, gas incident, gas scare, and work scare. There was a recurrent use of words that suggested an underlying anxiety that led to precautionary measures in fear of having an accident.

### 4.2 Strengths and limitations

It is essential to highlight the strengths of this cross-sectional survey. Firstly, many respondents with a range of olfactory disorders participated in this survey shedding light on the impact of olfactory disorders on personal health and safety. Secondly, this survey quantified the occurrence of safety scares/incidents in the preceding 5 years allowing qualitative data to be collected detailing such events. Lastly, data were collected anonymously allowing respondents to give honest accounts of their experiences.

However, there are important limitations with this study. Firstly, the major limitation is selection bias of this study as aforementioned. The gender distribution is heavily skewed towards females, and the aetiology of olfactory dysfunction within our population group is different from less biased retrospective studies. This could be because individuals with limited treatment options, such as idiopathic and congenital olfactory dysfunction, seek help from charities and support groups more compared to individuals with e.g. sino-nasal olfactory dysfunction which has more treatment options. In addition, approximately half of the respondents have lived with olfactory dysfunction for more than 5 years, allowing them more time to set mitigations to reduce hazardous events. This may underestimate the 5-year incidence rate. Secondly, all responses were self-reported, including the aetiology of olfactory dysfunction, number of hazardous events, and the details of how the events manifested. These could introduce bias and inaccuracies due to forgetfulness, misunderstanding of questions, or intentional misrepresentation. Thirdly, this survey may be prone to non-response bias, and the response rate is unknown. There might be a non-response bias, i.e., the views of those who did not respond might systematically differ from those who did. Lastly, a subgroup analysis was not conducted to determine which specific demographic groups might be at a higher risk to hazardous events.

#### 4.3 Interpretation

A retrospective study by Santos et al. (2004) reported that there was an positive trend in number of hazardous events and degree of olfactory impairment. Within the completely anosmic group, 45.2% reported they experienced a hazardous event during their lifetime, in contrast to 19% in the normosmic group. Of the hazardous events, cooking-related hazard (e.g. burning pots and pans) was experienced by 45%, and gas leak was experienced by 23%. Another retrospective study echoed these findings, reporting burning pots and pans was the most common form of hazardous event experienced by <25%, and only <10% experienced an unnoticed gas leak. Our findings report 14.8% had at least one gas incident, and 34.5% had at least one gas scare the past 5 years. While direct comparison is challenging due to differences in hazard definition, our findings highlight a similarly substantial percentage of individuals affected. Considering our survey specifically captured hazardous events the past 5 years, the proportion of individuals who experienced at least one hazardous event during their lifetime is expected to be higher.

Another important finding in our survey is the impact of olfactory disturbance on a person's quality of life, not just limited to physical safety and hygiene, but also their emotional well-being as a consequence of living in fear. Studies that performed thematic analyses identified olfactory disturbance to impact different aspects of life, including the detection of hazards, the feeling of social isolation, negative emotions including depression, and physical health. Our findings echo the results of Keller and Malaspina's online survey of 1000 patients with olfactory dysfunction, where 72% were concerned about hazard avoidance and the lack of food enjoyment. Miwa et al. highlighted that 75% of participants were concerned about spoiled food and 61% were concerned about the failure to detect fire, gas or smoke. These themes were concordant with other surveys' results. In our survey, a recurring method to mitigate adverse events was having another person present in the house or workplace to help alert the respondent of danger. However, this mitigation is of no help to people who live alone. According to Office of National Statistics data, around 30.1% over the age of 65 in the UK live alone.

#### 4.4 Generalisability

The safety implications are relevant for anyone with olfactory dysfunction, and protection for this population group is crucial. In the UK, smoke and carbon monoxide detectors are routinely installed. New legislation introduced in October 2022 in England made these detectors mandatory in both socially and private rented properties. To the contrary, natural gas detectors is not commonplace and has no legal requirement for

them to be installed. The cost of gas detectors can range anywhere from 20 GBP to 5000 GBP depending on the specifications. There is a need for greater recognition of these safety risks, and education about the possible solutions, including making standardised, low-cost gas detectors widely available.

## Conclusion

We have demonstrated the safety concerns among individuals with olfactory dysfunction, incidence of hazardous events over the last 5 years, and highlighted the impact on mental well-being. There is a need for collaborative strategies from the government, healthcare sector and high-risk sectors such as gas companies to address this issue. Key areas of discussion would be the safety risks faced by individuals with olfactory dysfunction, cost-effective natural gas detectors to be made widely available along with simple tools such as scratch and sniff cards as a screening method to identify and protect vulnerable individuals susceptible to safety hazards. Routine assessment of olfactory ability in public health settings, particularly for older people, will also play a key role in identifying ‘at risk’ individuals.

## References

### List of titles/captions for each figure

Figure 1. Degree of safety concerns for gas, smoke, food freshness, personal hygiene, hygiene of babies and children, and other household odours (e.g. waste bins or pets).

Figure 2. Scares and incidents in the last 5 years. We defined a ‘scare’ as a situation in which the individual was not harmed, such as a simple appliance (e.g. cooker or hob) not being properly turned off and rectified soon after. We defined an ‘incident’ as a situation in which the individual was at risk of serious harm such as a widespread gas leak and appliances catching on fire, or has led to harm such as explosion and experiencing symptoms.

### Hosted file

Main figures and tables document - Edited.docx available at <https://authorea.com/users/637644/articles/653859-impact-of-olfactory-disorders-on-personal-safety-wellbeing-a-cross-sectional-observational-study>