

## Sniffin' Sticks and Scentsor for integrating the "forgotten sense" into everyday practice

Abhilash Balakrishnan<sup>1</sup> FRCSEd, Neville Wei Yang Teo<sup>1</sup> MMed(ORL), Shuhui Xu<sup>1</sup> MMed(ORL)

The sense of smell has been one of the most neglected of the 5 human senses, perhaps due to its intangible, amorphous, ephemeral and seemingly subjective nature. A survey of the UK public revealed that the sense of smell was valued behind sight, hearing, balance, touch and even taste!<sup>1</sup> Smell testing has also been traditionally sidelined compared to testing of vision, hearing and balance, and is limited mostly to research.

The importance of the sense of smell, however, is highly underestimated. Olfactory dysfunction affects up to 34% of community-dwelling older residents in Singapore, which is higher than the global average of 22.2%.<sup>2,3</sup> It is associated with various neurodegenerative and health conditions. Cross-sectional studies have shown that olfactory dysfunction is associated with a 2-fold increased risk of cognitive impairment<sup>2</sup> and a higher hazard ratio of all-cause mortality<sup>4</sup>; and has a strong, graded association with and potential use as a biomarker of frailty.<sup>5</sup> Longitudinal studies have similarly shown associations between olfactory impairment and development of frailty and cognitive decline.<sup>6,7</sup> Olfactory dysfunction has also been shown to be an early marker of neurodegenerative diseases, such as Parkinson's disease and Alzheimer's disease.<sup>8,9</sup>

The COVID-19 pandemic brought olfaction into sharp focus, with sudden smell loss emerging as one of the hallmark symptoms. It sparked off much-needed research and discussions around its repercussions on personal safety, nutrition, quality of life and, increasingly, our understanding of neurocognitive health. The Singapore Smell and Taste Test,<sup>10</sup> consisting of 2 odours and 4 tastes, was developed to rapidly measure smell and taste loss associated with COVID-19. This was an initial attempt to develop a rapid self-administered test with the potential to screen for COVID-19 in communities without easy access to formal COVID-19 testing. This highlighted the need for culturally adapted tools to monitor olfactory function, particularly in diverse, multicultural populations like Singapore where odour familiarity varies widely. Numerous other olfaction-related studies emerged from COVID-19, looking at both short-term

effects and longer-term sequelae of the coronavirus infection.

In this issue of the *Annals*, the authors of the study "Development and validation of odour identification tests for olfactory assessment in Singapore" have set out to address a longstanding gap in the local assessment of olfactory function.<sup>11</sup> This study marks a significant advancement by introducing and validating 2 culturally tailored odour identification tests for Singapore: the Singapore-version of Sniffin' Sticks (SS-Sg) and a novel locally developed test named "Scentsor". This work aligns Singapore with other Asian countries—such as Malaysia, Vietnam, Korea and Taiwan<sup>12-15</sup>—that have developed customised smell panels to reflect their population's unique cultural and olfactory landscapes.

The foundational premise of this study—that olfactory identification is inherently culture-bound—is both intuitive and empirically supported. Familiarity with specific odours influences recognition and identification, rendering unmodified foreign-developed tests problematic for non-Western populations. Indeed, this study's Phase 1 survey revealed that over 50% of odour descriptors in the standard Sniffin' Sticks test (SS blue and purple sets) were unfamiliar to most Singaporeans.

This insight is not trivial. Incorrect assumptions about cultural familiarity could result in diagnostic inaccuracies, under-reporting of impairment, or misclassification. By carefully identifying odours recognised by ≥75% of surveyed Singaporeans, the authors created culturally coherent test sets. Notably, familiar odours such as pandan, durian, curry and lemongrass made their way into Scentsor, reflecting local culinary and cultural sensibilities. Furthermore, by creating Scentsor, the authors came up with a completely new set of scents that were not dependent on the Sniffin' Sticks test kits, thereby allowing for less reliance on an odour identification test kit that was developed overseas for a culturally different population. There was further finetuning and replacement of unfamiliar smells in Phase 2. Both tests were further validated in Phase 3 on a robust sample

---

The *Annals* is an open access journal, allowing non-commercial use under CC BY-NC-SA 4.0.

<sup>1</sup> Department of Otorhinolaryngology—Head and Neck Surgery, Singapore General Hospital, Singapore

Correspondence: Prof. Abhilash Balakrishnan, Department of Otorhinolaryngology-Head and Neck Surgery, Singapore General Hospital, Outram Rd, Singapore 169608.

Email: [abhilash\\_balakrishnan@yahoo.com.sg](mailto:abhilash_balakrishnan@yahoo.com.sg)

Accepted: 30 May 2025

Published: 9 June 2025

of 473 healthy individuals aged 21–83 years. This rigorous, multiphase development process lends strong credibility to the tools' validity.

In specialties such as otolaryngology, geriatrics, neurology and primary care, validated olfactory testing can now be feasibly incorporated into routine practice. In otolaryngology, diseases and surgeries that potentially affect the olfactory system, such as chronic rhinosinusitis, will benefit from objective and accurate smell documentation. As biologics like dupilumab and mepolizumab show efficacy in improving smell, validated testing is important for monitoring therapeutic response.

In geriatrics, olfactory testing can be evaluated as a potential low-cost screening tool for various neurodegenerative diseases, like mild cognitive impairment and subclinical Alzheimer's disease. It is predicted that 24% of the Singapore population will be ≥65 by 2030, thereby driving national policies to prioritise healthy ageing. As alluded to by the authors, there are 2 parts to a successful response: recognition of smell and an intact executive function. These customised olfactory tests remove unfamiliarity as a barrier to an accurate response and can help identify at-risk individuals for targeted interventions and mitigate downstream healthcare burdens.

Further possible research efforts can be undertaken to examine how Scentsor and SS-Sg perform in specific disease states such as Parkinson's disease, mild cognitive impairment and depression. Longitudinal studies tracking olfactory function in at-risk populations could uncover early indicators of health decline. Evaluating whether treatment of olfactory dysfunction can prevent or slow the development of neurodegenerative diseases will also be of great public health significance.

The potential of developing a means for individuals to easily access and test their own olfaction at home is also immense, as this can uncover undiagnosed conditions, reduce accident risks (from undetected gas leaks or spoiled food), and identify those at higher risk of isolation or malnutrition due to sensory loss. In addition, integration of odour identification into digital platforms for automated scoring or remote administration will also enhance scalability and accessibility, particularly in community and eldercare settings, and alert healthcare professionals to early olfactory dysfunction in affected individuals.

As Singapore grapples with an ageing population and the long-term complications of COVID-19, olfactory testing may become a staple of routine care, as familiar as hearing tests or blood pressure measurements. SS-Sg and Scentsor offer clinicians, researchers and policymakers a timely and adaptable platform for integrating the “forgotten sense” into everyday practice.

## Ethics statement

*Not applicable*

## Declaration

*The authors have no affiliations or financial involvement with any commercial organisation with a direct financial interest in the subject or materials discussed in the manuscript.*

**Keywords:** odour identification, olfactory assessment, olfactory testing, otorhinolaryngology, Scentsor

## REFERENCES

1. Enoch J, McDonald L, Jones L, et al. Evaluating Whether Sight Is The Most Valued Sense. *JAMA Ophthalmol* 2019;137:1317-20.
2. Man REK, Wong CMJ, Gupta P, et al. Understanding the Prevalence and Risk Factor Profile of Olfactory Impairment and Its Impact on Patient Health Indicators and Economic Outcomes in Community-Dwelling Older Asian Adults. *Innov Aging* 2024;8:igae088.
3. Desiato VM, Levy DA, Byun YJ, et al. The Prevalence of Olfactory Dysfunction in the General Population: A Systematic Review and Meta-analysis. *Am J Rhinol Allergy* 2021;35:195-205.
4. Pang NY, Song HJJMD, Tan BKJ, et al. Association of Olfactory Impairment With All-Cause Mortality: A Systematic Review and Meta-analysis. *JAMA Otolaryngol Head Neck Surg* 2022; 148:436-45.
5. Yeo BSY, Chan JH, Tan BKJ, et al. Olfactory Impairment and Frailty: A Systematic Review and Meta-Analysis. *JAMA Otolaryngol Head Neck Surg* 2024;150:772-83.
6. Wang E, Wroblewski KE, McClintock MK, et al. Examining the Longitudinal Relationship Between Olfactory Dysfunction and Frailty in Community-Dwelling Older US Adults. *Otolaryngol Head Neck Surg* 2024;171:261-8.
7. Windon MJ, Kim SJ, Oh ES, et al. Predictive value of olfactory impairment for cognitive decline among cognitively normal adults. *Laryngoscope* 2020;130:840-7.
8. Haehner A, Hummel T, Reichmann H. Olfactory dysfunction as a diagnostic marker for Parkinson's disease. *Expert Rev Neurother* 2009;9:1773-9.
9. Bouhaben J, Delgado-Lima AH, Delgado-Losada ML. The role of olfactory dysfunction in mild cognitive impairment and Alzheimer's disease: A meta-analysis. *Arch Gerontol Geriatr* 2024;123:105425.
10. Sheen F, Tan V, Lim AJ, et al. The COVOSMIA-19 trial: Preliminary application of the Singapore smell and taste test to objectively measure smell and taste function with COVID-19. *Food Qual Prefer* 2022;97:104482.
11. Xu X, Zhang MRX, Low TH, et al. Development and validation of odour identification tests for olfactory assessment in Singapore. *Ann Acad Med Singap* 2025;54:xxx-xxx.
12. Sai-Guan L, Husain S, Zahedi FD, et al. Cultural Adaptation of Sniffin' Sticks Smell Identification Test: The Malaysian Version. *Iran J Otorhinolaryngol* 2020;32:213-22.
13. Hsu NI, Lai JT, Shen PH. Development of Taiwan Smell Identification Test: a quick office-based smell screening test for Taiwanese. *Am J Rhinol Allergy* 2015;29:e50-4.
14. Tran TN, Thi Dang TH, Thai TT, et al. Development and validation of the Vietnamese smell identification test. *Parkinsonism Relat Disord* 2023;113:105494.
15. Hong SC, Yoo YS, Kim ES, et al. Development of KVSS Test (Korean Version of Sniffin' Sticks Test). *Korean J Otolaryngol-Head Neck Surg* 1999;42:855-60.