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ORIGINAL ARTICLE

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International clinical assessment of smell: An international, cross-sectional survey of current practice in the assessment of olfaction

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Abstract

Objectives: Olfactory dysfunction (OD) is common and carries significant personal and societal burden. Accurate assessment is necessary for good clinical and research practice but is highly dependent on the assessment technique used. Current practice with regards to UK/international clinical assessment is unknown. We aimed to capture current clinical practice, with reference to contemporaneously available guidelines. We further aimed to compare UK to international practice.

Design: Anonymous online questionnaire with cross-sectional non-probability sampling. Subgroup analysis according to subspeciality training in rhinology ('rhinologists' and 'non-rhinologists') was performed, with geographical comparisons only made according to subgroup.

Participants: ENT surgeons who assess olfaction.

Results: Responses were received from 465 clinicians (217 from UK and 17 countries total). Country-specific response rate varied, with the lowest rate being obtained from Japan (1.4%) and highest from Greece (72.5%). Most UK clinicians do not perform psychophysical smell testing during any of the presented clinical scenarios—though rhinologists did so more often than non-rhinologists. The most frequent barriers to testing related to service provision (e.g., time/funding limitations). Whilst there was variability in practice, in general, international respondents performed psychophysical testing more frequently than those from the UK. Approximately 3/4 of all respondents said they would like to receive training in psychophysical smell testing. Patient reported outcome measures were infrequently used in the UK/internationally. More UK respondents performed diagnostic MRI scanning than international respondents.

Conclusions: To our knowledge, this is the most comprehensive UK-based, and only international survey of clinical practice in the assessment of OD. We present recommendations to improve practice, including increased education and funding for psychophysical smell testing. We hope this will promote accurate and reliable olfactory assessment, as is the accepted standard in other sensory systems.

KEYWORDS
assessment, clinical practice, international, olfactory dysfunction, UK

1 | INTRODUCTION

1.1 | Background

Olfactory dysfunction (OD) affects ~22% of the general adult population[1,2]—a figure likely set to increase due to the long-term chemosensory effects of COVID-19. With its attendant effects on nutrition, social function and mental health, OD represents a significant burden of disease, with both direct and indirect healthcare and wider societal costs.[3–5] Accordingly, olfaction and its disorders are the justified focus of clinical and research interest.

Appropriate assessment of olfaction is paramount for good clinical and research practice—enabling accurate diagnosis, therapeutic decision making and outcomes assessment. However, the current state of UK and international practice with regards to clinical assessment is unknown, with the last available UK data from 2009.[6] Since this time, international guidelines on the assessment and treatment of OD have been published.[7–10] In particular, these guidelines recommend use of psychophysical testing, given evidence that subjective assessment correlates poorly with more objective chemosensory tests.[11] Again, however, adherence to such guidelines is unknown. Furthermore, there have been no prior attempts to characterise geographical variations in practice.

1.2 | Objectives

We therefore performed the International Clinical Assessment of Smell (ICAS) Survey—the first comprehensive cross-sectional survey of UK and international clinical practice amongst ENT surgeons in the

assessment of OD, with particular interest in psychophysical smell testing, and with reference to the only available international guidelines at time of survey—the Position Paper on Olfactory Dysfunction (PPOD). Finally, as we were particularly interested in practice variation between UK and international clinicians, we aimed to compare these geographical cohorts.

Key points

- The accuracy of olfactory assessment is dependent on the technique used. Current guidelines make recommendations on how to assess olfaction, including the use of psychophysical smell tests to improve accuracy.
- Current clinical practice in the assessment of olfactory dysfunction (OD) is unknown. Furthermore, geographical comparison of practice has not previously been performed.
- We performed an anonymous online survey of clinical practice in the assessment of OD, with reference to contemporaneously available guidelines, and with particular focus on psychophysical testing.
- Responses were obtained from 465 clinicians across 17 counties, with the largest cohort in the UK (217). Psychophysical testing and patient reported outcome measures were infrequently used—the former less so in the UK than internationally. Use of diagnostic MRI was, however, more common in the UK.
- We present recommendations to improve clinical practice in the assessment of olfaction and OD, including but not limited to increased education and funding for psychophysical testing.

2 | MATERIALS AND METHODS

2.1 | Survey design/setting/participants

An anonymous online questionnaire was created targeting ENT surgeons who assess olfaction. The questionnaire was developed with the aid of a UK-based panel of four consultant rhinologists with special interest in olfaction, three consultant rhinologists/general ENT surgeons and a non-ENT surgeon (included for technical review). The inclusion of clinicians with varying interest in olfaction during development and piloting allowed better approximation of respondents within the target population.[12] Item generation was performed in two steps: 1: guideline/supporting literature review and identification of assessment domains of interest; 2: simultaneous item generation/reduction. Step 2, as well as survey piloting, was performed during three iterative rounds of panel review.

Three main assessment domains were identified: A—psychophysical assessment (and barriers thereof); B—subjective assessment (patient reported outcome measures, 'PROMS'); C—imaging (MRI/other). Questions referred to routine practice—except for a separate stem on the effects of the pandemic—and were carefully worded to be clear, unambiguous and unbiased.[13] During piloting, several topics were deemed highly specialist, so made optional (skippable using branching logic). Copies of the PPOD[7] and BRS Consensus Guidelines on Management of New Onset Anosmia in the COVID Pandemic[14] were offered to respondents as incentives to complete the survey.

Following development, the survey was approved for distribution by the ENT-UK survey guardian and distributed electronically between May and June 2021 (cross-sectional non-probability sampling[12]). Reminder rounds were sent but read-receipts were not available.

Prior to international distribution, the survey underwent further review and piloting amongst an international panel of 10 further experts in olfaction, comprising members of the Clinical Olfactory Working Group (COWoG). Minor changes were made for international audiences (e.g., insurance) if needed, but no changes were made to existing questions that would prevent UK/international comparison. The survey was written in English. Distribution was facilitated by local panel members with circulation via professional society mailing lists where possible. International distribution took place between September 2021 and January 2022.

See Data S1 for further development details and full questionnaires.

2.2 | Ethical considerations

As a service evaluation/audit, this was not classified as research according to NHS HRA guidance. Audit registration for national/international distribution was approved by the Royal National ENT & Eastman Dental Hospitals (part of University College London Hospitals NHS Foundation Trust). Where required, further local permissions were obtained by distributing COWoG members. As all data were anonymous and 'non-sensitive', there were no data protection issues of note. Identical copies of the survey were provided in 'Microsoft Forms' (GDPR compliant)/'Google Forms'/'Survey Monkey' (ENT-UK), as required.

2.3 | Statistical analysis/reporting

Results are reported in line with the CROSS guidelines. As this was a service evaluation with no minimum significant difference available for the main outcome measures, a power calculation was not performed, and an a priori sample size was not set.

Quantitative data were analysed using GraphPad Prism. Data were assessed for normality and parametric/nonparametric tests used. If response rates to individual questions were lower than total respondents (due to dropout/branching logic), this is stated. Missing data were excluded from statistical analysis. Proportions are given for total respondent number or total response number, where answers were non-mutually exclusive.

For qualitative data analysis methods, please see Data S1.

Subgroup analysis was performed for 'UK' and 'international' responses—comparison between cohorts was performed for the main assessment domains.

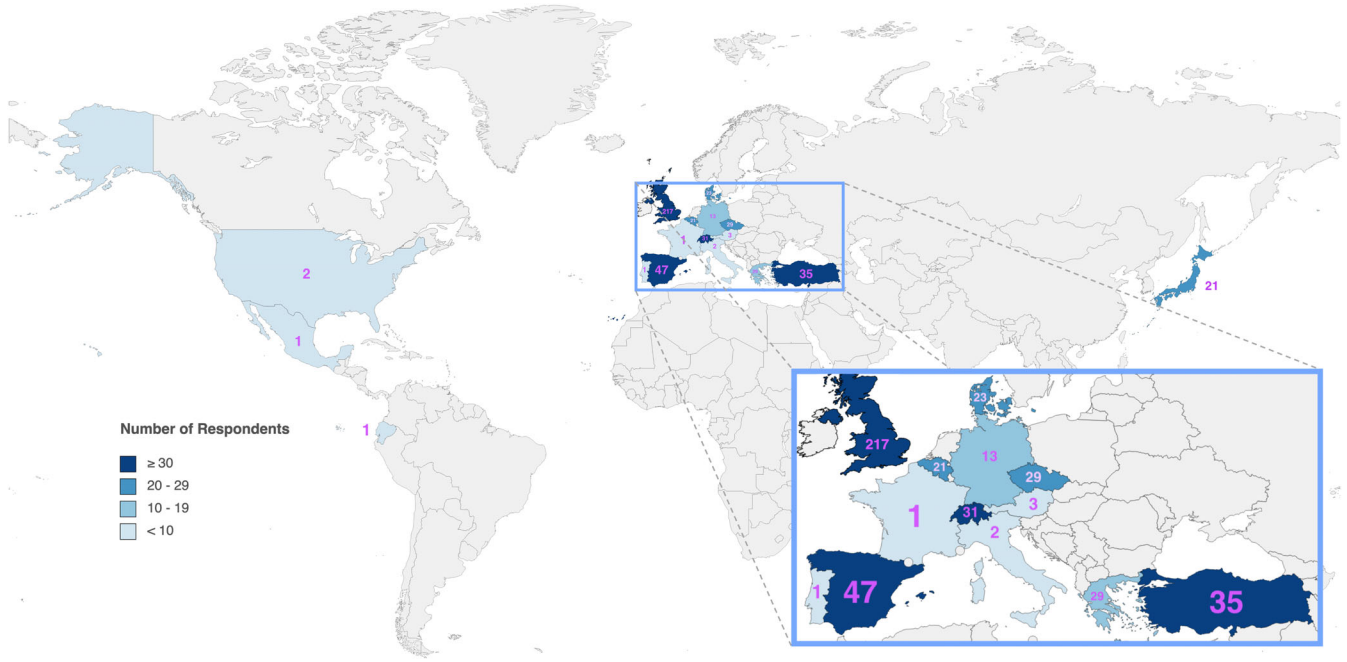

FIGURE 1 Geographical distribution of international respondents.

TABLE 1 Response rates and distribution methods.

Country	Response rate (%)	Surveys distributed	Distribution method
Greece	72.5	40	Regional/local mailing list
Belgium	70.0[a,b]	30[a]	Regional/local mailing list
Switzerland	66.0	47	National mailing list (rhinology)
Turkey	42.7	82	Regional/local mailing list
Denmark	15.3[a,c,d]	150[a]	Conference, regional/local mailing list
UK	10.0[e]	2165	National mailing list
Czech Republic	6.9[e]	420	National mailing list
Germany	4.3[e]	300	National mailing list
Spain	1.6[e]	3000	National mailing list
Japan	1.4[e]	1513	National mailing list

[a]Approximate response rate.
[b]Survey distribution delegated to nominated clinician within specified healthcare centres (snowball sampling).
[c]Distribution at conference involving word of mouth (convenience/snowball sampling).
[d]Distribution included international recipients beyond country of origin.
[e]Mailing list including multiple subspecialities/specialties (including allied).

3 | RESULTS

3.1 | Sample population

Results were obtained from 465 respondents, of whom 217 were from the UK. The geographical distribution of remaining 'international' respondents (17 countries in total) is shown in Figure 1.

Within the UK, 90.8% of respondents saw patients with OD and 20.5% were 'rhinologists'/had subspecialty training in rhinology. 53.9% worked in a district general hospital (DGH), 36.4% in a tertiary referral hospital (TRH) and the remainder another setting ('other', 9.7%) (165 respondents). Internationally, 96.4% of respondents saw patients with OD and 40.7% had subspecialty training in rhinology (significantly higher than in the UK, $\chi^2_{(1)} = 17.5$, $p < .0001$). Most respondents worked in a TRH (47.6% of 248 respondents), followed by DGHs (27.4%), private clinics (23.0%) or 'other' (2.0%).

Country-specific response rate varied from 1.4% to 72.5%, with lower rates being obtained where distribution was to mailing lists including multiple specialties/subspecialties (Table 1). As distribution method, response rates and proportion of 'rhinologists' varied geographically, direct country comparison was not performed, due to probable differences in selection bias. Instead, subgroup analysis

TABLE 2 UK and international results for psychophysical assessment, imaging, and subjective assessment.

Psychophysical assessment											
Initial Diagnosis											
OD as presenting or isolated symptom		**UK**				**International**				**UK vs. International**	
		All ($n = 164$)	**Rhinologist ($n = 33$)**	**Non-Rhinologists ($n = 128$)**	**Rhinologists vs. Non-Rhinologists**	**All ($n = 233$)**	**Rhinologist ($n = 93$)**	**Non-Rhinologists ($n = 131$)**	**Rhinologists vs. Non-Rhinologists**	**Rhinologists**	**Non-Rhinologists**
	Always	5.5%	27.3%	2.3%	$\chi^2_{(1)} = 23.6, p < .0001$	39.5%	59.1%	24.4%	$\chi^2_{(1)} = 27.6, p < .0001$	$\chi^2_{(1)} = 9.9, p = .002$	$\chi^2_{(1)} = 27.0, p < .0001$
	Most of the time	7.3%	9.1%	6.3%	ns	15.9%	20.4%	12.2%	ns	ns	ns
	Sometimes	14.6%	15.2%	14.8%	ns	8.6%	7.5%	9.9%	ns	ns	ns
	Rarely	17.7%	15.2%	18.0%	ns	12.9%	5.4%	17.6%	$\chi^2_{(1)} = 7.4, p = .007$	ns	ns
	Never	54.9%	33.3%	58.6%	$\chi^2_{(1)} = 6.7, p = .01$	23.2%	7.5%	35.9%	$\chi^2_{(1)} = 23.9, p < .0001$	$\chi^2_{(1)} = 13.3, p = .0003$	$\chi^2_{(1)} = 13.4, p = .0003$
OD in association with another presenting symptom		**All ($n = 160$)**	**Rhinologist ($n = 31$)**	**Non-rhinologists ($n = 124$)**	**Rhinologists vs. non-rhinologists**	**All ($n = 229$)**	**Rhinologist ($n = 100$)**	**Non-rhinologists ($n = 129$)**	**Rhinologists vs. non-rhinologists**	**Rhinologists**	**Non-rhinologists**
	Always	2.5%	6.5%	1.6%	ns	14.9%	21.0%	10.1%	$\chi^2_{(1)} = 5.3, p = .02$	ns	$\chi^2_{(1)} = 8.1, p = .004$
	Most of the time	12.5%	12.9%	11.3%	ns	21.0%	30.0%	14.0%	$\chi^2_{(1)} = 8.6, p = .003$	ns	ns
	Sometimes	13.1%	25.8%	12.1%	ns	24.5%	31.0%	19.4%	$\chi^2_{(1)} = 4.1, p = .04$	ns	ns
	Rarely	16.3%	19.4%	15.3%	ns	10.9%	10.0%	11.6%	ns	ns	ns
	Never	55.6%	35.5%	59.7%	$\chi^2_{(1)} = 5.7, p = .02$	28.8%	8.0%	45.0%	$\chi^2_{(1)} = 37.5, p < .0001$	$\chi^2_{(1)} = 14.4, p = .0001$	$\chi^2_{(1)} = 5.5, p = .02$
Outcomes assessment											
Before medical intervention (where OD most troublesome symptom)		**UK**				**International**				**UK vs. International**	
		All ($n = 159$)	**Rhinologist ($n = 27$)**	**Non-rhinologists ($n = 131$)**	**Rhinologists vs. non-rhinologists**	**All ($n = 219$)**	**Rhinologist ($n = 100$)**	**Non-rhinologists ($n = 119$)**	**Rhinologists vs. non-rhinologists**	**Rhinologists**	**Non-rhinologists**
	Always	6.3%	7.4%	4.6%	ns	33.3%	47.0%	21.8%	$\chi^2_{(1)} = 15.5, p < .0001$	$\chi^2_{(1)} = 14.1, p = .0002$	$\chi^2_{(1)} = 16.7, p < .0001$
	Most of the time	10.7%	14.8%	9.9%	ns	19.2%	25.0%	14.3%	$\chi^2_{(1)} = 4.02, p = .045$	ns	ns
	Sometimes	5.7%	3.7%	6.1%	ns	12.3%	15.0%	10.1%	ns	ns	ns
	Rarely	16.4%	18.5%	16.0%	ns	11.0%	6.0%	15.1%	$\chi^2_{(1)} = 4.6, p = .03$	$\chi^2_{(1)} = 4.2, p = .04$	ns
	Never	61.0%	55.6%	63.4%	ns	24.2%	7.0%	38.7%	$\chi^2_{(1)} = 29.7, p < .0001$	$\chi^2_{(1)} = 35.0, p < .0001$	$\chi^2_{(1)} = 15.2, p < .0001$

(Continues)

TABLE 2 (Continued)

After medical intervention (where OD most troublesome symptom)		All ($n = 156$)	Rhinologist ($n = 27$)	Non-rhinologists ($n = 128$)	Rhinologists vs. non-rhinologists	All ($n = 215$)	Rhinologist ($n = 99$)	Non-rhinologists ($n = 116$)	Rhinologists vs. non-rhinologists	Rhinologists	Non-rhinologists
	Always	5.1%	11.1%	3.9%	ns	21.4%	28.3%	15.5%	$\chi^2_{(1)} = 5.2$, $p = .02$	ns	$\chi^2_{(1)} = 9.6$, $p = .002$
	Most of the time	7.7%	3.7%	8.6%	ns	20.5%	31.3%	11.2%	$\chi^2_{(1)} = 13.3$, $p = .0003$	$\chi^2_{(1)} = 8.5$, $p = .004$	ns
	Sometimes	9.0%	3.7%	8.6%	ns	20.5%	23.2%	18.1%	ns	$\chi^2_{(1)} = 5.3$, $p = .02$	$\chi^2_{(1)} = 4.8$, $p = .03$
	Rarely	18.6%	25.9%	17.2%	ns	14.4%	11.1%	17.2%	ns	ns	ns
	Never	59.6%	55.6%	61.7%	ns	23.3%	6.1%	37.9%	$\chi^2_{(1)} = 30.4$, $p < .0001$	$\chi^2_{(1)} = 22.1$, $p < .0001$	$\chi^2_{(1)} = 13.8$, $p = .0002$
Before surgical intervention (where OD most troublesome symptom)		**All ($n = 159$)**	**Rhinologist ($n = 31$)**	**Non-rhinologists ($n = 128$)**	**Rhinologists vs. non-rhinologists**	**All ($n = 168$)**	**Rhinologist ($n = 81$)**	**Non-rhinologists ($n = 84$)**	**Rhinologists vs. non-rhinologists**	**Rhinologists**	**Non-rhinologists**
	Always	3.8%	6.5%	1.6%	ns	30.4%	40.7%	21.4%	$\chi^2_{(1)} = 7.2$, $p = .007$	$\chi^2_{(1)} = 12.3$, $p = .0005$	$\chi^2_{(1)} = 23.4$, $p < .0001$
	Most of the time	5.7%	16.1%	3.9%	$\chi^2_{(1)} = 6.3$, $p = .01$	20.8%	29.6%	9.5%	$\chi^2_{(1)} = 10.7$, $p = .001$	ns	ns
	Sometimes	11.3%	16.1%	11.7%	ns	9.5%	11.1%	8.3%	ns	ns	ns
	Rarely	17.6%	22.6%	16.4%	ns	14.9%	11.1%	19.0%	ns	ns	ns
	Never	61.6%	38.7%	66.4%	$\chi^2_{(1)} = 8.05$, $p = .005$	24.4%	7.4%	41.7%	$\chi^2_{(1)} = 25.9$, $p < .0001$	$\chi^2_{(1)} = 16.3$, $p < .0001$	$\chi^2_{(1)} = 12.6$, $p = .0004$
After surgical intervention (where OD most troublesome symptom)		**All ($n = 158$)**	**Rhinologist ($n = 31$)**	**Non-rhinologists ($n = 127$)**	**Rhinologists vs. non-rhinologists**	**All ($n = 159$)**	**Rhinologist ($n = 85$)**	**Non-rhinologists ($n = 74$)**	**Rhinologists vs. non-rhinologists**	**Rhinologists**	**Non-rhinologists**
	Always	1.9%	6.45%	0.8%	$\chi^2_{(1)} = 4.3$, $p = .04$	20.0%	25.9%	12.2%	$\chi^2_{(1)} = 4.8$, $p = .03$	$\chi^2_{(1)} = 5.2$, $p = .02$	$\chi^2_{(1)} = 12.8$, $p = .0003$
	Most of the time	5.7%	9.68%	5.5%	ns	14.2%	21.2%	5.4%	$\chi^2_{(1)} = 8.3$, $p = .004$	ns	ns
	Sometimes	10.8%	19.35%	8.7%	ns	25.2%	31.8%	21.6%	ns	ns	$\chi^2_{(1)} = 6.8$ $p = .009$
	Rarely	19.6%	25.81%	18.1%	ns	20.0%	11.8%	28.4%	$\chi^2_{(1)} = 7.0$, $p = .008$	ns	ns
	Never	62.0%	38.71%	66.9%	$\chi^2_{(1)} = 8.4$, $p = .004$	20.6%	9.4%	32.4%	$\chi^2_{(1)} = 13.0$, $p = .0003$	$\chi^2_{(1)} = 13.7$, $p = .0002$	$\chi^2_{(1)} = 22.4$, $p < .0001$

TABLE 2 (Continued)

Perioperative testing in normosmics (olfactory complications)											
Before surgical intervention that could cause OD as a complication (pre-op)		**UK**				**International**				**UK vs. international**	
		All ($n = 161$)	**Rhinologist ($n = 33$)**	**Non-rhinologists ($n = 128$)**	**Rhinologists vs. non-rhinologists**	**All ($n = 213$)**	**Rhinologist ($n = 96$)**	**Non-rhinologists ($n = 116$)**	**Rhinologists vs. non-rhinologists**	**Rhinologists**	**Non-rhinologists**
	Always	1.2%	3.0%	0.8%	ns	13.6%	16.7%	11.2%	ns	$\chi^2_{(1)} = 4.0$, $p = .046$	$\chi^2_{(1)} = 12.2$, $p = .0005$
	Most of the time	1.2%	9.1%	0.8%	$\chi^2_{(1)} = 7.5$, $p = .006$	10.8%	18.8%	3.4%	$\chi^2_{(1)} = 13.2$, $p = .0003$	ns	ns
	Sometimes	3.7%	9.1%	2.3%	ns	5.2%	6.3%	4.3%	ns	ns	ns
	Rarely	11.2%	15.2%	10.9%	ns	16.4%	24.0%	10.3%	$\chi^2_{(1)} = 7.1$ $p = .008$	ns	ns
	Never	82.6%	63.6%	85.2%	$\chi^2_{(1)} = 7.8$, $p = .005$	54.0%	34.4%	70.7%	$\chi^2_{(1)} = 27.9$, $p < .0001$	$\chi^2_{(1)} = 8.6$, $p = .003$	$\chi^2_{(1)} = 7.5$, $p = .006$
After surgical intervention that could cause OD as a complication (post-op)		**All ($n = 160$)**	**Rhinologist ($n = 31$)**	**Non-rhinologists ($n = 127$)**	**Rhinologists vs. non-rhinologists**	**All ($n = 204$)**	**Rhinologist ($n = 92$)**	**Non-rhinologists (= 112)**	**Rhinologists vs. non-rhinologists**	**Rhinologists**	**Non-rhinologists**
	Always	0.6%	0.0%	0.8%	ns	4.4%	7.6%	1.8%	$\chi^2_{(1)} = 4.2$, $p = .04$	ns	ns
	Most of the time	1.3%	9.7%	0.8%	$\chi^2_{(1)} = 8.0$, $p = .005$	5.4%	8.7%	2.7%	ns	ns	ns
	Sometimes	3.1%	6.5%	2.4%	ns	14.2%	18.5%	10.7%	ns	ns	$\chi^2_{(1)} = 7.1$, $p = .008$
	Rarely	14.4%	22.6%	11.8%	ns	25.0%	34.8%	17.0%	$\chi^2_{(1)} = 8.6$, $p = .003$	ns	ns
	Never	80.6%	61.3%	84.3%	$\chi^2_{(1)} = 8.1$, $p = 0.004$	51.0%	30.4%	67.9%	$\chi^2_{(1)} = 28.3$, $p < .0001$	$\chi^2_{(1)} = 9.4$, $p = .002$	$\chi^2_{(1)} = 8.9$, $p = .003$
Imaging											
MRI brain/olfactory tract during the initial assessment of OD as a presenting/isolated symptom		**UK**				**International**				**UK vs. International**	
		All ($n = 163$)	**Rhinologist ($n = 33$)**	**Non-rhinologists ($n = 130$)**	**Rhinologists vs. non-rhinologists**	**All ($n = 239$)**	**Rhinologist ($n = 102$)**	**Non-rhinologists ($n = 119$)**	**Rhinologists vs. non-rhinologists**	**Rhinologists**	**Non-rhinologists**
	Always	31.3%	36.4%	30.0%	ns	15.1%	14.7%	16.0%	ns	$\chi^2_{(1)} = 7.3$, $p = .007$	$\chi^2_{(1)} = 6.8$, $p = .009$
	Most of the time	35.6%	36.4%	35.4%	ns	28.5%	29.4%	27.7%	ns	ns	ns
	Sometimes	22.1%	24.2%	21.5%	ns	37.7%	43.1%	32.8%	ns	ns	$\chi^2_{(1)} = 4.0$, $p = .046$
	Rarely	4.9%	0.0%	6.2%	ns	13.4%	9.8%	16.0%	ns	ns	$\chi^2_{(1)} = 6.2$, $p = .01$
	Never	6.1%	3.0%	6.9%	ns	5.4%	2.9%	7.6%	ns	ns	ns

(Continues)

TABLE 2 (Continued)

Subjective Assessment												
Use of PROMs during assessment of OD (isolated/presenting or associated symptom)	UK				International				UK vs. International			
	All ($n = 163$)	Rhinologist ($n = 33$)	Non-rhinologists ($n = 129$)	Rhinologists vs. non-rhinologists	All ($n = 239$)	Rhinologist ($n = 102$)	Non-rhinologists ($n = 137$)	Rhinologists vs. non-rhinologists	Rhinologists	Non-rhinologists
Always	6.1%	21.2%	2.3%	$\chi^2_{(1)} = 16.2$, $p < .0001$	13.4%	19.6%	8.8%	$\chi^2_{(1)} = 5.9$, $p = .02$	ns	$\chi^2_{(1)} = 5.2$, $p = .02$
Most of the time	11.7%	18.2%	10.1%	ns	15.9%	21.6%	11.7%	$\chi^2_{(1)} = 4.3$, $p = .04$	ns	ns
Sometimes	9.8%	18.2%	7.8%	ns	13.8%	19.6%	9.5%	$\chi^2_{(1)} = 6.4$, $p = .01$	ns	ns
Rarely	16.0%	15.2%	16.3%	ns	19.2%	15.7%	21.9%	ns	ns	ns
Never	56.4%	27.3%	63.6%	$\chi^2_{(1)} = 14.1$, $p = .0002$	37.7%	23.5%	48.2%	$\chi^2_{(1)} = 15.1$, $p = .0001$	ns	$\chi^2_{(1)} = 6.4$, $p = .01$

Note: Where individual question response rates were less than the total, this was due to either branching logic or dropout. Test statistic (parametric or non-parametric as appropriate) and associated p value given for statistically significant results (where $p < .05$). Statistical significance tested between groups as per headings (UK rhinologists vs. non-rhinologists; international rhinologists vs. non-rhinologists; UK vs. international rhinologists; UK vs. international non-rhinologists). Note- percentages shown rounded to one decimal place.
Abbreviation: ns, non-statistically significant.

according to subspeciality training in rhinology ('rhinologists' and 'non-rhinologists') was performed, with geographical comparisons only made according to subgroup.

3.2 | Psychophysical testing

Within the UK, across all respondents, and within the rhinologist and non-rhinologist subgroups, the largest proportion of clinicians 'never' performed psychophysical testing in any of the clinical scenarios presented (covering diagnostics, outcomes and complications). Comparing rhinologist to non-rhinologist subgroups, a statistically significantly higher proportion of rhinologists 'always' or 'most of the time' performed testing during the initial assessment of OD as a presenting/isolated symptom, before/after surgical intervention, and before/after surgical intervention that could cause OD as a complication (for full results and statistics—see Table 2).

For international respondents, there was greater variation in practice across assessment scenarios, and greater proportions of clinicians performing psychophysical testing, particularly within the rhinologist subgroup. When comparing rhinologist to non-rhinologist subgroups, statistically significantly higher proportions of rhinologists 'always', 'most of the time' or 'sometimes' performed psychophysical testing across all of the clinical scenarios presented (Table 2).

Comparing UK and international responses, in both rhinologist/non-rhinologist subgroups, where statistically significant differences in proportions of testing were found, it was more frequently performed internationally (Table 2). Figure 2 compares UK/international psychophysical test use during the initial assessment of OD. Figure 3 shows country-specific diagnostic practice in rhinologist/non-rhinologist subgroups.

In both the UK and internationally, the most common type of test used was odour identification, followed by discrimination and threshold (UK—27.3%, 12.9% and 6.7% of responses, respectively; international—38.4%, 21.6% and 21.4%, respectively). The most common specific type of test was the 'Smell Identification Test' in the UK, the 'Sniffin' Sticks' internationally.

Barriers to routine psychophysical testing, as well as maximum acceptable duration of smell testing are shown in Figure 4.

Approximately one in five of both UK and international respondents had no knowledge/experience of psychophysical smell tests (21.8% and 18.6%, respectively). Across both cohorts, the most frequent source of knowledge was clinical experience, followed by self-directed study, post-graduate training, courses, medical school and 'other'. Most respondents (UK—77.6% and international—63.3%) said they would like to receive training in use of psychophysical tests.

3.3 | Imaging

The highest proportions of UK respondents, overall and within rhinologist/non-rhinologist subgroups, performed diagnostic MRI scanning 'always' or 'most of the time'. Indeed, 36.4% of rhinologists 'always' scanned. Internationally, the highest proportion of respondents

'sometimes' scanned, followed by 'most of the time'. There was no significant difference in frequencies of scanning between rhinologist or non-rhinologist subgroups (UK/internationally). Comparing UK and international practice, in both rhinologist/non-rhinologist subgroups, a significantly higher proportion of UK respondents 'always' scanned. In the non-rhinologist subgroup, significantly more international respondents 'sometimes' or 'rarely' scanned (Table 2).

In both the UK/internationally, the most frequent aim of performing MRI scanning was to 'exclude neoplasm', followed by 'exclude non-neoplastic structural abnormality upstream of the OB' and 'assess OB (gross – present/absent)'. More international respondents performed volumetric assessment than in the UK (16.4% vs. 8.4% of total responses, respectively). CT of the paranasal sinuses was the most frequent 'other' scan.

3.4 | PROMs

Across all clinicians, rhinologist and non-rhinologist subgroups, the highest proportion of respondents 'never' used PROMs during their initial assessment of OD, both in the UK and internationally (Table 2). However, practice varied between rhinologist/non-rhinologists, with the latter group using PROMS more frequently. In both the UK and internationally, the 'SNOT-22' questionnaire was the most frequently used PROM.

3.5 | Further questions

Please see Data S1 for full results.

4 | DISCUSSION

To our knowledge, this is the first detailed international survey of clinical practice in the assessment of olfaction. Responses were received from 465 clinicians, with the largest cohort originating from the UK, and country-specific response rate ranging from 1.4% to 72.5%.

Assessment of OD can be performed using approaches ranging from subjective report to functional neuroimaging and electrophysiology. Subjective report can be captured through clinical history, anchored scales/questions, or more formally using validated PROMs. These methods are important for understanding patient experience and calculating the minimal clinically important difference. However, subjective assessment has been shown to correlate poorly with more objective chemosensory testing, in both patient and healthy populations.[15–18] Psychophysical smell tests involve presentation of odour stimuli, with score based on the subject's perceptual response. They include the well-validated Smell Identification Test (also known as the 'SIT-40' or previously as the 'University of Pennsylvania Smell Identification Test'), which tests odour identification, and 'Sniffin' Sticks', which tests odour identification, discrimination and threshold. Such tests are reliable and accurate, and arguably represent the gold standard of clinical assessment.[11] Therefore, in the first (PPOD[7]), and subsequent sets of international guidelines,[8,9] a key recommendation is that subjective report should not be performed in isolation, but rather combined with psychophysical smell testing. This mirrors the standard of care that is expected during the assessment of hearing or visual impairment.

Within the UK, most clinicians do not perform psychophysical testing in any of the clinical scenarios presented, including diagnosis, outcomes assessment or surgical complications monitoring. Comparing rhinologists with non-rhinologists, as could be expected, there was higher uptake in the former group, particularly at the extremes of testing frequency. The most common barriers to routine smell testing in the UK related to service provision (insufficient funding/time/staff) and lack of experience/training. It therefore follows that most respondents felt testing should take <5 min, irrespective of clinical scenario. Interestingly, despite poor rates of psychophysical testing, PROMs were not used consistently in the UK.

Whilst comparisons between UK and international cohorts should be interpreted with care (see limitations section), in general, there were higher levels of psychophysical testing amongst international respondents, across all clinical scenarios. The most common barrier to routine psychophysical testing amongst international clinicians was 'insufficient time', though other issues surrounding service provision (including insufficient staff/hospital-related funding) were also common. Despite this, international respondents were more tolerant towards longer smell tests, with most choosing 5–15 min as maximum acceptable testing time. As in the UK, PROMs were not consistently used—though they were more so in the rhinologist subgroup.

Interestingly, in both the UK and international cohorts, 'refer on to specialist clinic' was an infrequent reason for not performing routine psychophysical testing. Furthermore, in both cohorts, ~3/4 of respondents said they would like to receive further training in psychophysical testing.

Regarding imaging, a large proportion of UK-respondents 'always' performed MRI scanning of the brain/olfactory tract during the initial assessment of OD (31.3% of all respondents, 36.4% of rhinologists). Compared with the UK, international respondents performed MRI scanning less frequently and with more variability—with 'sometimes' being the most frequently chosen response. MRI can be used to provide diagnostic (through identification of structural abnormalities, e.g., neoplasia or OB hypo−/aplasia) and/or prognostic information (through volumetric assessment of the OB or other structures). Whilst lack of hypothetical-aetiology information and relative subjectivity of the Likert-frequency terms used (particularly 'most of the time'/'sometimes'/'rarely') limits interpretation of our data, it is likely that the cohort of clinicians who 'always' scan contains two subgroups—those who perform MRI scanning to obtain prognostic information, and those who scan for more indiscriminate diagnostic purposes (supported by 'exclusion of neoplasm' being the most frequently chosen aim of scanning overall). In the latter subgroup, a more tailored approach could be encouraged through increased psychophysical testing, education and more comprehensive imaging guidelines.[7,19] Such an approach could enable more cost-effective healthcare and limit patient burden, including associated indirect healthcare costs. At the

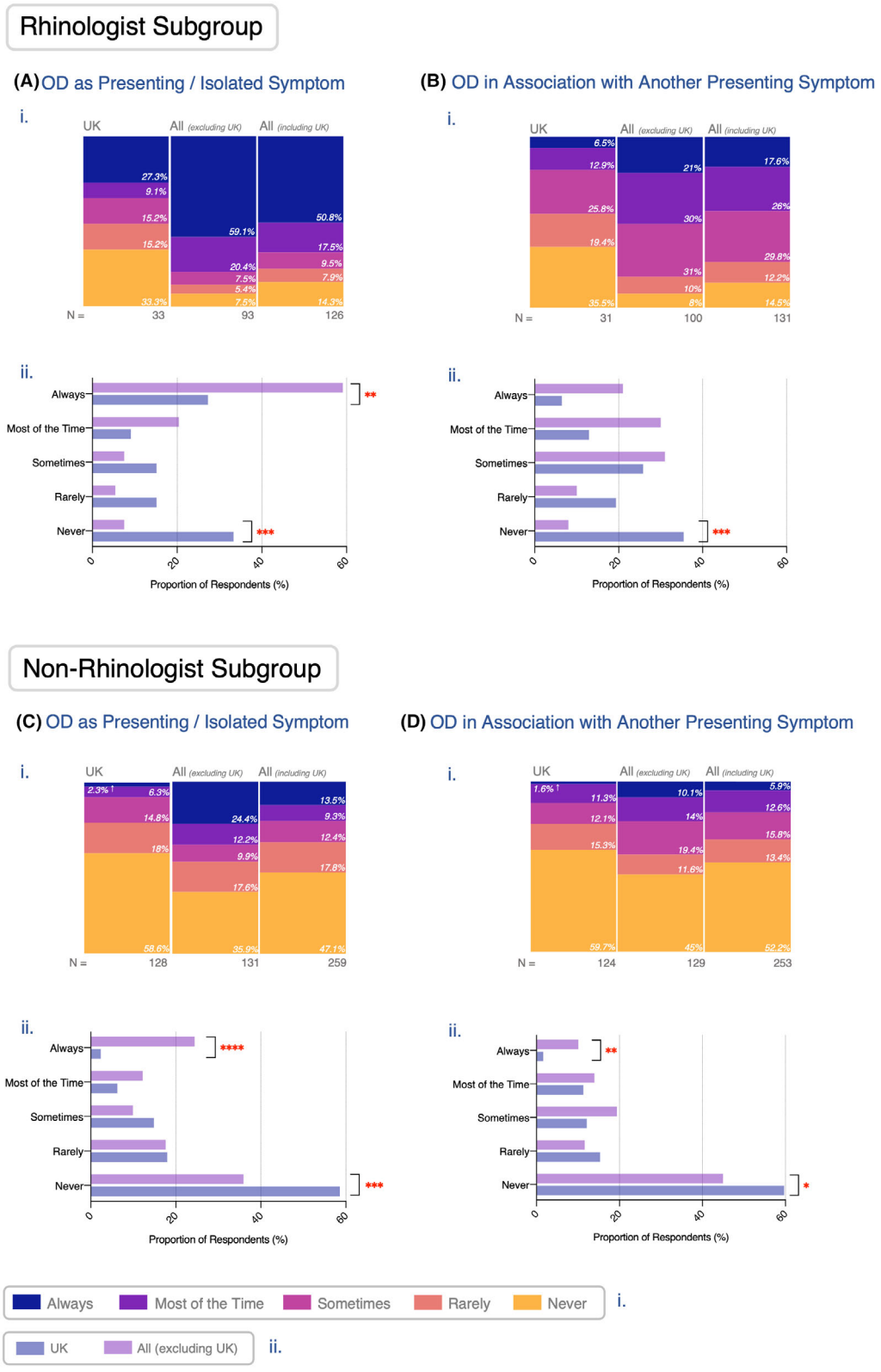

FIGURE 2 UK and international smell testing during initial assessment of olfactory dysfunction (OD). (i): Percent stacked column charts showing distribution of testing frequencies in the UK, all (excluding UK) and all (including UK) in rhinologist and non-rhinologist subgroups, for OD as a presenting/isolated symptom (A/C) or OD in association with another presenting symptom (B/D). (ii): Bar charts comparing distribution of testing frequencies between UK and all (excluding UK), for OD as a presenting/isolated symptom (A/C) or OD in association with another presenting symptom (B/D). Asterisks indicate statistically significant results—* $p < .05$, ** $p < .01$, *** $p < .001$, **** $p < .0001$. Note- percentages shown rounded to one decimal place.

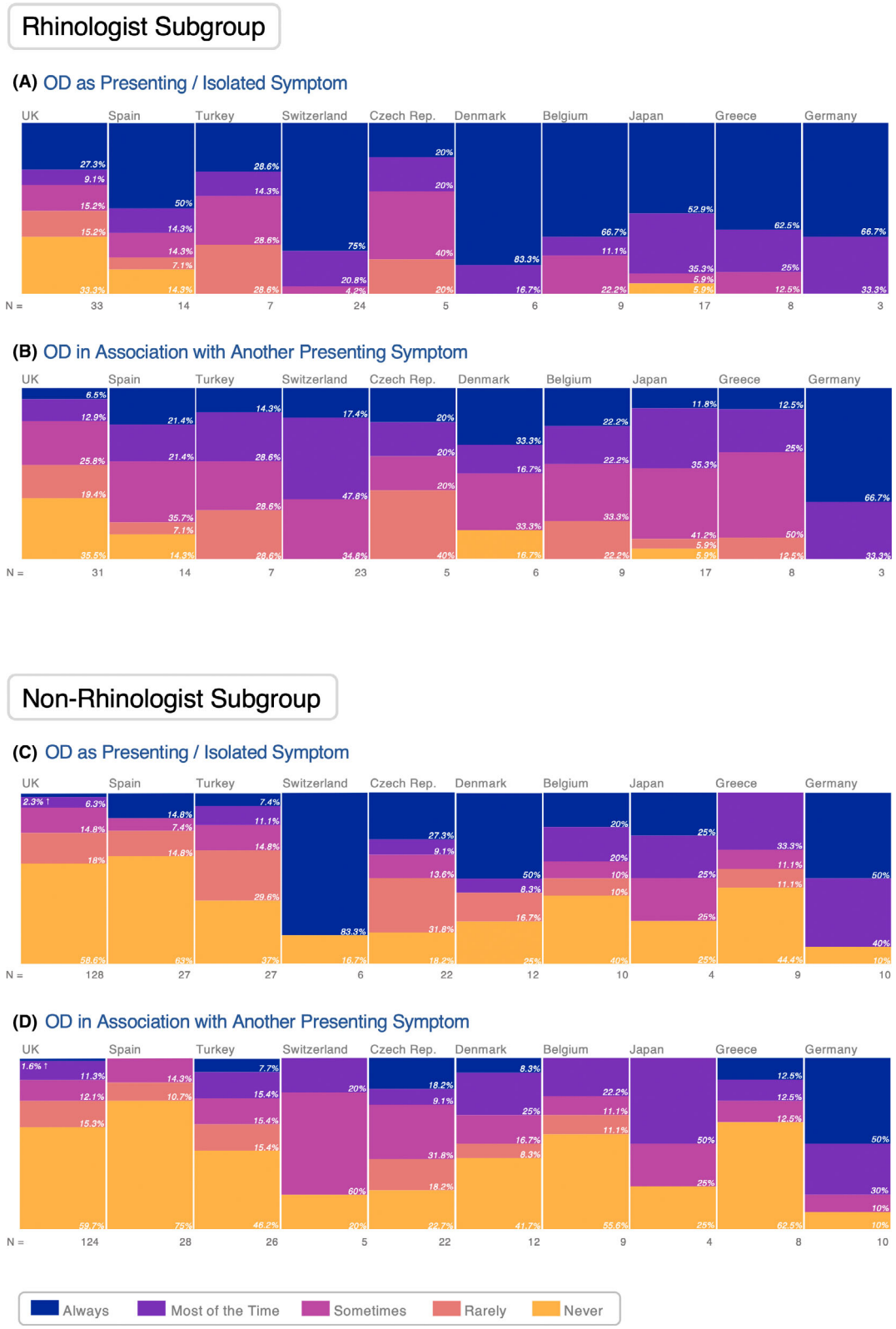

FIGURE 3 UK and international smell testing during initial assessment of olfactory dysfunction (OD). Percent stacked column charts showing distribution of testing frequencies in all countries with total respondents $n \geq 10$ (from left to right in order of descending total (rhinologist + non-rhinologist) participant number), in rhinologist and non-rhinologist subgroups, for OD as a presenting/isolated symptom (A/C) or OD in association with another presenting symptom (B/D). Note- percentages shown rounded to one decimal place.

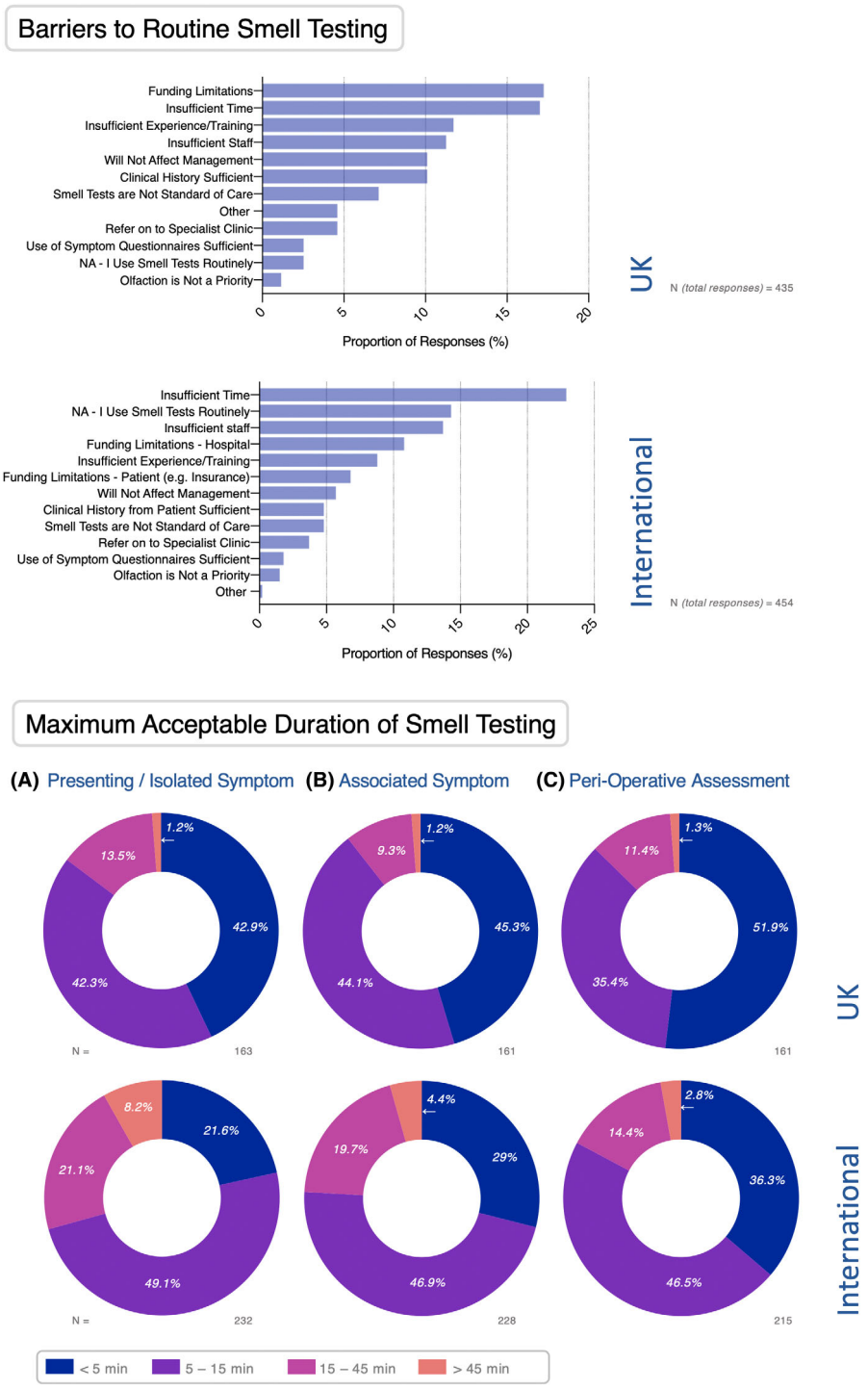

FIGURE 4 UK and international barriers to routine psychophysical testing (bar chart, top - note N = total non-mutually exclusive responses) and maximum acceptable testing time (donut chart, bottom: for the assessment of (A) OD as a presenting/isolated symptom, (B) OD in association with another presenting symptom, (C) during the perioperative assessment of olfaction for a surgical intervention that could cause OD as a complication). Note- percentages shown rounded to one decimal place.

time of survey, no imaging guidelines were available; however, the 2023 update to the PPOD now provides expert-agreed recommendations on scanning practice for different suspected aetiologies of OD.[10] Future work should aim to interrogate imaging practice in more detail, through prospective auditing of aetiology-specific scanning and subsequent diagnostic/prognostic outcome yield. Ultimately, the establishment of evidence-based imaging practice amongst all clinicians is needed to ensure that patients receive access to appropriate investigations as standard.

Various other results of interest can be found in the main and Data S1 results section.

4.1 | Comparisons with other studies

To our knowledge, the only available UK data on the assessment of OD was published in 2007 and 2009.[6,20] In these studies, 54.8% and 63% of respondents did not perform psychophysical testing for

'olfactory disorders' or post-infectious OD, respectively—similar figures to our 54.9% who 'never' tested for OD as an isolated/presenting symptom (across all participants). Furthermore, 36.6% and 29% in these studies performed MRIs (for 'disorders'/post-infectious, respectively)—also comparable to our 31.3% who 'always' performed MRI. Accordingly, there appears to have been little change in UK-based practice over the last decade. We have now significantly expanded on these early findings, providing insights into practice in different clinical scenarios, in different subspecialty groups, as well as barriers to psychophysical testing. To our knowledge, no other unified international surveys have been conducted.

4.2 | Study limitations and Generalisability

The major limitations to this study were: 1. variable distribution method/response rate; 2. comparison of different healthcare systems; 3. language barriers; 4. intercurrent pandemic.

Whilst survey distribution was conducted via national mailing lists/professional societies where possible, alternative methods were necessary in four countries. Response rates varied with distribution method and were lower where mailing lists targeting multiple subspecialties (including clinicians who do not see patients with OD) were employed. This, in addition to geographical differences in the proportion of respondents with subspeciality training in rhinology, prevented direct country comparisons, due to probable differences in selection bias. To mitigate these effects, as well as inherent differences in healthcare systems, only subgroup comparison according to subspecialty training in rhinology was performed. Whilst we recognise such training may itself vary geographically, we argue that appropriate olfactory assessment should be standard of care, and both known/available to all 'rhinologists' across healthcare systems. However, to further mitigate the effects of selection bias and improve the generalisability of the results obtained, future studies should aim to use probability sampling with a standardised distribution method across geographical boundaries. Additionally, given that voluntary survey response rates are often low (mean 15.7% in recent review of OMFS questionnaires[21])—future work should consider strategies to increase responses, for example, financial incentives.[22] Finally, due to software limitations, we were unable to gather information on unique site visitor/completion rate. As survey drop-out may represent a source of selection bias (with those completing the survey having greater interest in olfaction compared with those who did not), future work should aim to collect this information, which could in turn be used to determine systematic differences between 'drop-out' and 'non-drop-out' respondent groups and ultimately better inform the generalisability of gathered data.

Unfortunately, funding was not available to facilitate translation of the survey. This may have excluded clinicians with limited English literacy skills. Future work should provide standardised translation to the local language of the target country.

This survey was distributed during the COVID-19 pandemic. Whilst it was targeted at routine practice, we recognise that it was undertaken at a uniquely challenging time that may limit the generalisability of our results. We intend to repeat this survey in future, non-pandemic circumstances.

5 | CONCLUSION

To our knowledge, this is the most detailed description of current practice in the assessment of OD to date. We have outlined various areas in which such practice falls short of the standards outlined by the PPOD guidelines.

Accordingly, we make the following key recommendations:

- Increased education in olfaction and appropriate psychophysical testing at under−/postgraduate level.
- Increased publicity for existing/future guidelines on the assessment of olfaction, including key documents being available via open access and distributed via national/international societies/other mailing lists.
- Increased funding for provision of psychophysical testing—covering provision of tests, staff and clinic time.
- Clear referral pathways to specialist clinics where full assessment is not locally available.
- Future psychophysical tests should be efficient but clinically informative. Use of novel technologies (e.g., automation) to reduce clinical testing burden should be explored.

Much of the above would be better introduced and sustained through the engagement of national and international societies and/or clinical and research collaboratives, both those that are specifically dedicated to olfaction, and those that serve rhinology and ENT more generally.

We hope that these recommendations will help to shape future practice, and rightfully promote accurate and reliable olfactory assessment, as is the accepted standard in other sensory systems.

AUTHOR CONTRIBUTIONS

Katherine L. Whitcroft contributed to project conception/administration, questionnaire development, data gathering, statistical analysis, write up, and agrees to be accountable for all aspects of the work. Isam Alobid contributed to project administration, data gathering, review of manuscript, and agrees to be accountable for all aspects of the work. Aytug Altundag contributed to project administration, questionnaire development, data gathering, review of manuscript, and agrees to be accountable for all aspects of the work. Peter Andrews contributed to project administration, questionnaire development, and review of manuscript, and agrees to be accountable for all aspects of the work. Sean Carrie involved in questionnaire development, review of manuscript, and agrees to be accountable for all aspects of the work. Miriam Fahmy contributed to project administration, review of manuscript, and agrees to be accountable for all aspects of the work. Alexander W. Fjældstad involved in project administration, questionnaire development, data gathering, review of manuscript, and agrees to be accountable for all aspects of the work. Simon Gane involved in

questionnaire development, review of manuscript, and agrees to be accountable for all aspects of the work. Claire Hopkins involved in questionnaire development, review of manuscript, and agrees to be accountable for all aspects of the work. Julien Wen Hsieh contributed to project administration, questionnaire development, data gathering, review of manuscript, and agrees to be accountable for all aspects of the work. Caroline Huart contributed to project administration, questionnaire development, data gathering, review of manuscript, and agrees to be accountable for all aspects of the work. Thomas Hummel contributed to project administration, questionnaire development, data gathering, review of manuscript, and agrees to be accountable for all aspects of the work. Iordanis Konstantinidis contributed to project administration, questionnaire development, data gathering, review of manuscript, and agrees to be accountable for all aspects of the work. Baslie N. Landis involved in project administration, questionnaire development, data gathering, review of manuscript, and agrees to be accountable for all aspects of the work. Eri Mori involved in project administration, questionnaire development, data gathering, review of manuscript, agrees to be accountable for all aspects of the work. Joaquim Mullol contributed to project administration, questionnaire development, data gathering, review of manuscript, and agrees to be accountable for all aspects of the work. Carl Philpott involved in questionnaire development, review of manuscript, and agrees to be accountable for all aspects of the work. Aristotelis Poulios involved in questionnaire development, review of manuscript, agrees to be accountable for all aspects of the work. Jan Vodička performed project administration, questionnaire development, data gathering, review of manuscript, and agrees to be accountable for all aspects of the work. Victoria M. Ward involved in questionnaire development, review of manuscript, and agrees to be accountable for all aspects of the work.

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CONFLICT OF INTEREST STATEMENT

Carl Philpott is AE of the journal and co-author of this article. They were excluded from the peer-review process and all editorial decisions related to the acceptance and publication of this article. Basile Landis is an Editorial Board member of Clinical Otolaryngology and a co-author of this article. To minimise bias, they were excluded from all editorial decision-making related to the acceptance of this article for publication.

PEER REVIEW

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1111/coa.14123.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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