

Evaluation of Clinicians' Knowledge of Terbinafine-resistant Extensive Dermatophytosis in France

Alicia MORENO SABATER^{1,2*†}, Pablo RUIZ^{2,3†}, Marc REVERTE⁴, Sophie TAN⁵, Jeanne BIGOT², Geneviève CREMER⁶, Pascal Del GIUDICE⁷, Claude BACHMEYER⁸, Jean-Pierre GANGNEUX^{9,10} and Olivier CHOSIDOW^{11,12}

¹Sorbonne Université, Centre d'Immunologie et des Maladies Infectieuses (CIMI-PARIS), Inserm U1135, Paris, France, ²Service de Parasitologie-Mycologie, Hôpital Saint-Antoine, AP-HP, Paris, France, ³Unité de Parasitologie-Mycologie, Hôpitaux Universitaires Henri Mondor, AP-HP, Créteil, France, ⁴Fédération Française des Formateurs et Chargés d'Évaluation en Dermatologie Vénéréologie, Sainte-Maxime, France, ⁵Maison de santé Paris Lilas, Paris, France, ⁶Laboratoire Bioclinic Madeleine, Groupe Inovie, Paris, France, ⁷Unité de Maladies Infectieuses et Dermatologie, Hôpital Bonnet, Centre Hospitalier Intercommunal Fréjus Saint-Raphaël, Fréjus, France, ⁸Internal Medicine Department, Tenon Hospital, AP-HP, Paris, France, ⁹Laboratoire de Parasitologie et Mycologie, ECM Excellence Center, National Reference Center for Invasive Mycoses and Antifungals, CHU Rennes, Rennes, France, ¹⁰Univ Rennes, CHU Rennes, Inserm, EHESP, Irset UMR_S 1085, Rennes, France, ¹¹Ambroise Paré/UVSQ and Bicêtre/Paris Saclay University Hospitals, AP-HP, Unit of Dermatology, Le Kremlin-Bicêtre, France, and ¹²Groupe Infectiologie et Infections Sexuellement Transmissibles (GrIDIST) de la Société Française de Dermatologie, Paris, France. Email: alicia.moreno@aphp.fr

†These authors contributed equally to this work.

Submitted Apr 1, 2026. Accepted after revision Jun 30, 2026

Published Jul 21, 2026. DOI: 10.2340/actadv.v106.adv-2026-0565 Acta Derm Venereol 2026; 106: adv-2026-0565.

Dear Editor,

Dermatophytosis, traditionally regarded as a mild superficial fungal infection readily treated with terbinafine, has undergone a major epidemiological shift over the past decade. Increasing numbers of cases of terbinafine-resistant extensive dermatophytosis (TRED), largely associated with *Trichophyton indotineae*, have been reported worldwide (1–3). This highly transmissible pathogen has spread through population mobility and now represents an emerging public health concern in Europe, where autochthonous cases have recently been described, including exceptionally via sexual transmission (4). Although itraconazole is currently recommended as second-line therapy (5), management remains challenging because of limited availability, marked interindividual pharmacokinetic variability and frequent relapses. In addition, terbinafine resistance is increasingly reported in *T. rubrum* (6). However, data on clinicians' awareness and practices regarding TRED remain scarce.

We conducted a national cross-sectional survey among French dermatologists and general practitioners (GPs) to assess awareness and knowledge of TRED. A 19-item anonymous online questionnaire explored demographic characteristics, general knowledge, awareness of causative pathogens and at-risk populations, clinical experience, access to diagnostic tools, management of terbinafine-resistant infections and training needs. The survey was disseminated through the French Society of Dermatology, the French Federation of Trainers and Evaluation Officers in Dermatology and Venereology and professional social media groups. Responses were collected between July and September 2025. A weighted composite knowledge score was developed (maximum 13 points); a score of ≥ 7 was considered satisfactory. Factors associated with satisfactory knowledge were assessed using logistic regression. According to French regulations, formal ethics approval was not required for this anonymous, non-interventional study.

Among 300 respondents, 195 (65.0%) were dermatologists and 105 (35.0%) were GPs (Table 1). Overall, 142/300 (47.3%) had never heard of TRED. Among clinicians aware of TRED ($n=158$), 99 (62.7%) did not recognise travel to India or Bangladesh as a risk factor and 55 (34.8%) did not identify *T. indotineae* as the main causative species. Fifty-seven of 300 respondents (19.0%) reported having managed at least one suspected case. Access to laboratory-based dermatophyte identification was reported by 226/300 (75.3%), whereas only 169/300 (56.3%) had access to antifungal susceptibility testing. Only 125/300 (41.7%) correctly identified itraconazole as the recommended second-line treatment, and awareness of preventive measures to limit transmission (7) was particularly poor (46/300, 15.3%). The mean composite knowledge score was 3.9/13 (Fig. 1). Dermatologists performed

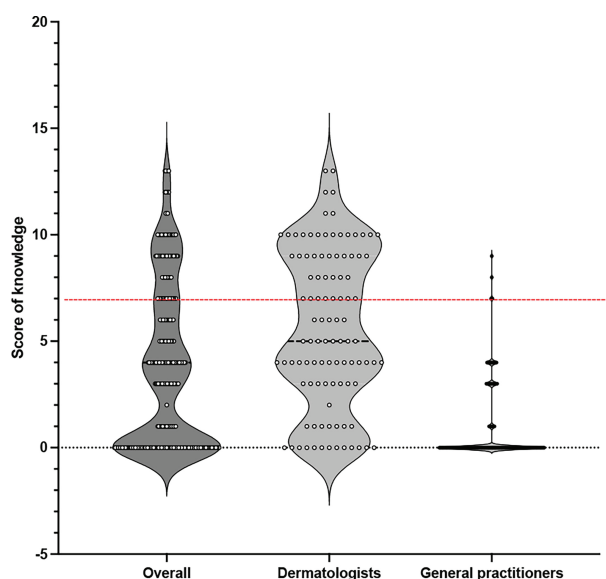


Fig. 1. Distribution of knowledge scores overall and according to physician profile. Violin plots showing the distribution of knowledge scores in the overall study population and by physician profile (dermatologists and general practitioners). Individual observations are overlaid. The red dashed line indicates the prespecified threshold for satisfactory knowledge, defined as a score of ≥ 7 .

Table 1. Awareness and knowledge of terbinafine-resistant extensive dermatophytosis among French clinicians

Item	Respondents n (%)	Correct responses n (%)
1. Demographic and professional characteristics		
Medical specialty	300 (100)	
Dermatologist	195 (65.0)	
General practitioner	105 (35.0)	
Primary practice setting	300 (100)	
Private practice	197 (65.7)	
Hospital practice	60 (20.0)	
Mixed practice	43 (14.3)	
2. General knowledge: pathogen and at-risk population		
Have you heard of TRED?	300 (100)	
No	142 (47.3)	
Yes	158 (52.7)	
What is your main source of information about this disease?	158 (100)	
Medical education	74 (46.8)	
Scientific publications	46 (29.1)	
Medical colleagues	34 (21.5)	
Mass media	3 (1.9)	
No answer	1 (0.6)	
Do you know the population most at risk for TRED?	158 (100)	158 (100)
No	52 (32.9)	99 (62.7)
Yes	106 (67.1)	59 (37.3)
Do you know the main causative species?	158 (100)	158 (100)
No	29 (18.4)	55 (34.8)
Yes	129 (81.6)	103 (65.2)
3. Clinical experience, access to diagnostics, and management		
Have you ever managed a patient with confirmed or suspected TRED?	300 (100)	
No	241 (80.3)	
Yes	57 (19.0)	
No answer	2 (0.7)	
Do you have access to laboratory tests for dermatophyte identification?	300 (100)	
No	66 (22.0)	
Yes	226 (75.3)	
No answer	8 (2.7)	
Do you have access to antifungal susceptibility testing?	300 (100)	
No	124 (41.3)	
Yes	169 (56.3)	
No answer	7 (2.3)	
Do you know the recommended second-line treatment in case of terbinafine resistance?	300 (100)	300 (100)
No	167 (55.7)	173 (57.7)
Yes	131 (43.7)	125 (41.7)
No answer	2 (0.7)	2 (0.7)
Are you aware of the main measures recommended to prevent dermatophyte transmission?	300 (100)	300 (100)
No	194 (64.7)	249 (83.0)
Yes	101 (33.7)	46 (15.3)
No answer	5 (1.7)	5 (1.7)

better than GPs (5.5±3.8 vs 0.9±1.8), although both groups remained below the satisfactory threshold. In multivariable analysis, being a GP (adjusted OR 16.2, 95% CI [5.7; 45.9]) and working in private practice (adjusted OR 2.1, 95% CI [1.1; 4.2]) were independently associated with insufficient knowledge. This national survey highlights major gaps in French clinicians' knowledge of TRED. Although nearly 1 in 5 respondents had already encountered suspected cases, awareness of *T. indotineae*, at-risk populations, treatment alternatives and preventive measures remained limited. These findings suggest under-recognition and underdiagnosis, compounded by

incomplete access to antifungal susceptibility testing. Targeted educational initiatives, wider dissemination of updated recommendations and improved access to species identification and susceptibility testing are therefore needed. In the context of increasing antifungal resistance and the spread of *T. indotineae* in Europe, improving clinician awareness is essential to optimise diagnosis, guide management and limit transmission. The knowledge gaps identified in this study should inform more effective training strategies. As *T. indotineae* continues to emerge worldwide, similar surveys should be conducted in all affected countries to identify local educational and diagnostic needs and support appropriate clinician training.

ACKNOWLEDGEMENTS

Funding sources: none.
Data availability statement: The datasets generated and analysed during the current study are available from the corresponding author on reasonable request.
Ethics committee: This study involved an anonymous, voluntary online survey of clinicians' knowledge about terbinafine resistance. No identifiable personal or patient data were collected. In accordance with national regulations and institutional policies, formal ethics committee approval was not required.

The authors have no conflicts of interest to declare.

REFERENCES

1. Gupta AK, Nguyen HC, Liddy A, Talukder M, Wang T, Magal L, et al. *Trichophyton indotineae*: epidemiology, antifungal resistance and antifungal stewardship strategies. J Eur Acad Dermatol Venereol 2026; 40: 29–45. <https://doi.org/10.1111/jdv.20810>

2. Kano R, Kimura U, Kakurai M, Hiruma J, Kamata H, Suga Y, et al. *Trichophyton indotineae* sp. nov.: a new highly terbinafine-resistant anthropophilic dermatophyte species. Mycopathologia 2020; 185: 947–958. <https://doi.org/10.1007/s11046-020-00455-8>

3. Rhodes J, Hui ST, Dellièvre S, Summerbell RC, Scott JA, Kaur A, et al. Emerging terbinafine-resistant *Trichophyton indotineae* between 2018 and 2023: a multinational genomic epidemiology study. Lancet Microbe 2026; 7: 101273. <https://doi.org/10.1016/j.lanmic.2025.101273>

4. Jabet A, Chiarabini T, Hennequin C, Bouscarat F, Valin N, Cruchet R, et al. Autochthonous transmission of *Trichophyton indotineae* through sexual contact, France, 2024. Euro Surveill 2025; 30: 26. <https://doi.org/10.2807/1560-7917.ES.2025.30.26.2500416>

5. Khurana A, Sharath S, Sardana K, Chowdhary A. Clinico-mycological and therapeutic updates on cutaneous dermatophytic infections in the era of *Trichophyton indotineae*. J Am Acad Dermatol 2024; 91: 315–323. <https://doi.org/10.1016/j.jaad.2024.03.024>

6. Moreno-Sabater A, Cordier C, Normand AC, Bidaud AL, Cremer G, Bouchara JP, et al. Autochthonous *Trichophyton rubrum* terbinafine resistance in France: assessment of antifungal susceptibility tests. Clin Microbiol Infect 2024; 30: 1613–1615. <https://doi.org/10.1016/j.cmi.2024.08.004>

7. Rengasamy M, Shenoy MM, Dogra S, Asokan N, Khurana A, Poojary S, et al. Indian Association of Dermatologists, Venereologists and Leprologists (IADVL) Task Force against Recalcitrant Tinea (ITART) consensus on the management of glabrous tinea (INTACT). Indian Dermatol Online J 2020; 11: 502–519. https://doi.org/10.4103/idoj.IDOJ_233_20