cases. The missed NDM infections at baseline may be related to the sensitivity of the culture.

Classical treatments with azoles or terbinafine are mostly effective for DMPs.[5,6] Once an oral antifungal drug is administered, DMPs, which usually respond to oral antifungal monotherapy, are nearly wholly eradicated. However, as NDMs are usually refractory to the classical treatment agents,[1] they can overgrow the DMPs in the SDA of a culture, which subsequently produces a positive result for NDMs. Due to the difficulty in treating NDM onychomycosis, the treatment outcomes were found to be worse for mixed-infection onychomycosis than for pure DMP onychomycosis (45% and 55% complete cure rates, respectively; $P = 0{\cdot}043$).[7] Specifically, the mean duration of the oral antifungals used and the median duration to a complete cure for the mixed-infection cases were significantly longer than for those with a pure DMP infection.[7] If the demographic data, risk factors and clinical findings of DMP, NDM and mixed-infection onychomycoses are not distinguishable, then their treatment outcomes are unable to be determined at baseline.[7]

Fungal foot infections can occur concomitantly with onychomycosis. The relationship of the organisms isolated in the feet and nails in this study strongly suggests that the foot of the patients was the main reservoir of the pathogen causing their onychomycosis. Foot culture results can be a useful tool to predict mixed infections. This study suggests that when a diagnosis of onychomycosis is made, an examination of the soles of the feet should be performed. If a fungal foot infection is suspected, mycological laboratory testing, including KOH and fungal culture, should be conducted in order to predict a subsequent NDM foot and nail infection.

The criteria for the diagnosis of NDM onychomycosis are still controversial. The present study diagnosed NDM onychomycosis when the repeat culture results showed NDMs on at least two consecutive occasions. However, another suggested diagnostic criterion for NDM diagnosis is positive fungal culture in three separate samples taken during a subsequent visit, and this may be an effective and simple option.[8]

Acknowledgments: We thank Assistant Professor Chulaluk Komoltri for invaluable support.

S. Bunyaratavej, P. Limphoka, R. Kiratiwongwan and C. Leeyaphan

Department of Dermatology, Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok, Thailand
Correspondence: Charussri Leeyaphan.
E-mail: charussrilee@gmail.com

References

1 Lurati M, Baudraz-Rosselet F, Vernez M *et al.* Efficacious treatment of non-dermatophyte mould onychomycosis with topical amphotericin B. *Dermatology* 2011; **223**:289–92.
2 Gupta AK, Drummond-Main C, Cooper EA *et al.* Systematic review of nondermatophyte mold onychomycosis: diagnosis, clinical types, epidemiology, and treatment. *J Am Acad Dermatol* 2012; **66**:494–502.
3 Segal R, Shemer A, Hochberg M *et al.* Onychomycosis in Israel: epidemiological aspects. *Mycoses* 2015; **58**:133–9.
4 Moreno G, Arenas R. Other fungi causing onychomycosis. *Clin Dermatol* 2010; **28**:160–3.
5 Feng X, Xiong X, Ran Y. Efficacy and tolerability of amorolfine 5% nail lacquer in combination with systemic antifungal agents for onychomycosis: a meta-analysis and systematic review. *Dermatol Ther* 2017; **30**:e12457.
6 Gupta AK, Gregurek-Novak T, Konnikov N *et al.* Itraconazole and terbinafine treatment of some nondermatophyte molds causing onychomycosis of the toes and a review of the literature. *J Cutan Med Surg* 2001; **5**:206–10.
7 Salakshna N, Bunyaratavej S, Matthapan L *et al.* A cohort study of risk factors, clinical presentations, and outcomes for dermatophyte, nondermatophyte, and mixed toenail infections. *J Am Acad Dermatol* 2018; **79**:1145–6.
8 Shemer A, Davidovici B, Grunwald MH *et al.* New criteria for the laboratory diagnosis of nondermatophyte moulds in onychomycosis. *Br J Dermatol* 2009; **160**:37–9.

Funding sources: none.

Conflicts of interest: none to declare.

Attitudes towards artificial intelligence within dermatology: an international online survey

DOI: 10.1111/bjd.18875

Dear Editor, Artificial intelligence (AI) has emerged as a hot topic within dermatology, and during recent years several studies have demonstrated its benefits in a research setting. While this development is unravelling rapidly and has also been made available to consumers, little is known about the attitudes towards AI among dermatologists. To increase our understanding of dermatologists' attitudes towards AI within dermatology we prepared an anonymous and voluntary online survey including 29 questions. The survey was distributed to dermatologists through several online channels, including mailing lists, to members of the International Dermoscopy Society. The survey was set up using SurveyMonkey® (SurveyMonkey, San Mateo, CA, U.S.A.) and was open from January to June 2019. The complete survey text and aggregated survey responses are available online.[1,2]

Linear regression models were used to correlate answers to sex and age group using a score for the answers. All tests were two sided and P-values $< 0{\cdot}05$ were considered statistically significant.

In total, 1271 surveys were completed and further analysed. Overall 55·4% of respondents were female, and the median age was 46 years (interquartile range 37–56); 92 countries were represented. Most of the respondents worked in Europe (69·8%, n = 887), and the majority (53·5%, n = 680) mainly

© 2020 The Authors. *British Journal of Dermatology* published by John Wiley & Sons Ltd on behalf of British Association of Dermatologists
This is an open access article under the terms of the Creative Commons Attribution-NonCommercial License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

Table 1 Distribution of answers for questions regarding attitudes and feelings about artificial intelligence (AI)

Question	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	I don't know	Score increase per age interval (95% CI)	P-value	Score difference by sex (95% CI)[a]	P-value
AI will revolutionize medicine in general	9 (0·7)	117 (9·2)	260 (20·5)	651 (51·2)	234 (18·4)	0 (0·0)	−0·04 (−0·08, 0·003)	0·069	0·12 (0·02, 0·22)	0·015
AI will revolutionize dermatology	15 (1·2)	84 (6·6)	272 (21·4)	588 (46·3)	291 (22·9)	21 (1·7)	−0·02 (−0·06, 0·03)	0·45	0·04 (−0·07, 0·14)	0·48
AI will revolutionize dermatology more than other medical specialties in general	21 (1·7)	198 (15·6)	449 (35·3)	431 (33·9)	122 (9·6)	50 (3·9)	0·00 (−0·04, 0·04)	0·99	−0·08 (−0·19, 0·02)	0·12
In the foreseeable future all physicians will be replaced by AI	532 (41·9)	497 (39·1)	146 (11·5)	56 (4·4)	18 (1·4)	22 (1·7)	0·00 (−0·04, 0·04)	0·92	−0·08 (−0·18, 0·02)	0·13
The human dermatologist will be replaced by AI in the foreseeable future	482 (37·9)	571 (44·9)	126 (9·9)	56 (4·4)	14 (1·1)	22 (1·7)	0·00 (−0·04, 0·04)	0·86	−0·09 (−0·18, 0·01)	0·083
A development with increased use of AI in dermatology frightens me	199 (15·7)	515 (40·5)	328 (25·8)	182 (14·3)	47 (3·7)	0 (0·0)	0·03 (−0·02, 0·07)	0·26	−0·22 (−0·34, −0·10)	<0·001
A development with increased use of AI in dermatology makes dermatology more exciting to me	19 (1·5)	125 (9·8)	325 (25·6)	630 (49·6)	172 (13·5)	0 (0·0)	−0·01 (−0·05, 0·03)	0·61	0·13 (0·03, 0·23)	0·011
A development with increased use of AI makes medicine in general more exciting to me	23 (1·8)	110 (8·7)	369 (29·0)	613 (48·2)	156 (12·3)	0 (0·0)	−0·06 (−0·10, −0·02)	0·0027	0·19 (0·09, 0·28)	<0·001
AI will improve dermatology	15 (1·2)	56 (4·4)	193 (15·2)	766 (60·3)	216 (17·0)	25 (2·0)	−0·02 (−0·06, 0·01)	0·19	0·15 (0·06, 0·24)	0·001
AI will improve medicine in general	12 (0·9)	55 (4·3)	212 (16·7)	765 (60·2)	201 (15·8)	26 (2·0)	−0·04 (−0·08, −0·01)	0·017	0·17 (0·09, 0·26)	<0·001
AI should be part of medical training	13 (1·0)	37 (2·9)	172 (13·5)	723 (56·9)	291 (22·9)	35 (2·8)	0·01 (−0·02, 0·05)	0·42	0·04 (−0·05, 0·12)	0·43

Data are n (%) unless otherwise stated. CI, confidence interval. The five possible answers were transformed into a numerical score (from 1, 'strongly disagree' to 5, 'strongly agree'), which was used as the dependent variable. A linear regression model with both sex and age group as predictors was used. The age groups (18–24, 25–34, 35–44, 45–54, 55–64, 65–74 and ≥ 75 years) were used as numerical values in the regression model (i.e. numbers ranging from 1 to 7). All 'I don't know' answers were excluded from the regression model. [a]Female was used as the reference.

British Journal of Dermatology (2020) **183**, pp158–192

© 2020 The Authors. British Journal of Dermatology published by John Wiley & Sons Ltd on behalf of British Association of Dermatologists

worked in a hospital setting. While 85·1% of respondents were aware of AI as an emerging topic in dermatology, only 23·8% had either good or excellent knowledge about AI within dermatology. The respondents were asked about three applications for AI within dermatology. The strongest potential was considered for dermatoscopic images, which was significantly higher than the potential seen for clinical or dermatopathological images (data not shown).

Only 5·5% (70 of 1271) of the respondents agreed or strongly agreed that the human dermatologist will be replaced by AI in the foreseeable future. Among dermatologists working in a hospital setting, 17·1% (116 of 680) expressed fear towards increased use of AI within dermatology. The corresponding figure for dermatologists working in a private office group was 18·7% (100 of 535; $P = 0·43$).

For the entire group, 77·3% agreed or strongly agreed that AI will improve dermatology, and 79·8% thought that AI should be a part of medical training. Increasing level of knowledge of AI within dermatology was correlated with a positive attitude ($P < 0·001$). Men showed more excitement and less fear about the use of AI within dermatology, as well as within medicine in general. An overview of the specific questions relating to attitudes is presented in Table 1.

The results from this survey suggest that AI is well received within the field of dermatology. Despite the overall optimistic responses, it is still too early to predict how AI will be implemented and used in everyday clinical practice. In a recent editorial, the pros and cons of putting an AI model either before or after the clinician were discussed.[3] Moreover, in a neighbouring perspective article, Lim and Flaherty argued that AI must be judiciously integrated into mainstream clinical practice only after dermatologists have received training in its use.[4]

A recent survey demonstrated that German undergraduate medical students are not concerned that AI will replace human radiologists, and they are aware of the potential applications and implications of AI in radiology and medicine in general.[5] Another general survey including 669 Korean physicians and medical students demonstrated that, while only 6·0% of the respondents agreed or strongly agreed that they had a good familiarity with AI, 73·4% thought that it has useful implications in the medical field.[6] Recently, the overall attitude towards AI in diagnostic pathology was positive among 487 respondents from 54 countries. In fact, 73·3% of respondents expressed either interest or excitement about the integration of AI tools. Only a minority of the respondents reported being concerned (17·6%) or extremely concerned (2·1%) that AI tools would displace human jobs.[7]

The majority of respondents received the survey invitation via their interest in dermatoscopy. Therefore, dermatologists with a special interest in this field were more likely to have received the invitation. On the other hand, diagnosis of skin tumours is currently the most appealing target for AI within dermatology. Furthermore, setting up an online link rather than solely inviting dermatologists from a predetermined mailing list voided the possibility to obtain a survey response rate. Finally, the possibility of selection bias is real and it can be speculated that physicians with positive attitudes were more likely to have answered and completed the survey.

Our results demonstrate an overall optimistic attitude towards AI among dermatologists. The majority of surveyed dermatologists believe it will improve our diagnostic capabilities. A minority of respondents were concerned about being replaced by AI in the foreseeable future.

S. Polesie,[1,2] M. Gillstedt,[1,2] H. Kittler,[3] A. Lallas,[4] P. Tschandl,[3] I. Zalaudek[5] and J. Paoli[1,2]

[1]*Department of Dermatology and Venereology, Institute of Clinical Sciences, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden;* [2]*Region Västra Götaland, Sahlgrenska University Hospital, Department of Dermatology and Venereology, Gothenburg, Sweden;* [3]*Vienna Dermatologic Imaging Research Group, Department of Dermatology, Medical University of Vienna, Vienna, Austria;* [4]*First Department of Dermatology, Aristotle University, Thessaloniki, Greece; and* [5]*Dermatology Clinic, Maggiore Hospital, University of Trieste, Trieste, Italy*

E-mail: *sam.polesie@vgregion.se*

References

1 Polesie S. Complete survey text. Available at: https://doi.org/10.6084/m9.figshare.11553456.v2 (last accessed 14 January 2020).
2 Polesie S. Aggregated survey responses. Available at: https://doi.org/10.6084/m9.figshare.11553453.v2 (last accessed 14 January 2020).
3 Janda M, Soyer HP. Can clinical decision making be enhanced by artificial intelligence? *Br J Dermatol* 2019; **180**:247–8.
4 Lim BCW, Flaherty G. Artificial intelligence in dermatology: are we there yet? *Br J Dermatol* 2019; **181**:190–1.
5 Pinto Dos Santos D, Giese D, Brodehl S *et al.* Medical students' attitude towards artificial intelligence: a multicentre survey. *Eur Radiol* 2019; **29**:1640–6.
6 Oh S, Kim JH, Choi SW *et al.* Physician confidence in artificial intelligence: an online mobile survey. *J Med Internet Res* 2019; **21**:e12422.
7 Sarwar S, Dent A, Faust K *et al.* Physician perspectives on integration of artificial intelligence into diagnostic pathology. *NPJ Digit Med* 2019; **2**:28.

Funding sources: none.

Conflicts of interest: P.T. reports personal fees from Silverchair and grants from MetaOptima Technology Inc. outside the submitted work.

Demographics and outcomes of eccrine porocarcinoma: results from the National Cancer Database

DOI: 10.1111/bjd.18874

Dear Editor, Eccrine porocarcinoma (EPC) is a rare, malignant tumour of the eccrine sweat glands. It was first described as 'epidermotropic eccrine carcinoma' in 1963 by Pinkus and

© 2020 British Association of Dermatologists