

Artificial Intelligence in Moroccan Dermatology: Knowledge, Use, and Perceptions among Dermatologists and Residents

Badr El Idrissi^{1*}, Sokaina Chhiti¹, Mohammed Chaouche¹, Laila Lahlou², Radia Chakiri¹

¹Department of Dermatology and Venereology, Mohammed VI University Hospital, Route Nationale No. 1, BP 56, Agadir 80000, Morocco

²Department of Epidemiology and Community Medicine, Faculty of Medicine and Pharmacy, University Hospital Souss Massa, Agadir 80000, Morocco

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*Corresponding author: Badr El Idrissi

Department of Dermatology and Venereology, Mohammed VI University Hospital, Route Nationale No. 1, BP 56, Agadir 80000, Morocco

Abstract

Original Research Article

Artificial intelligence (AI) is increasingly relevant to dermatology because many tasks are image based. This study assessed knowledge, use, and perceptions of AI among dermatologists and dermatology residents in Morocco. We conducted a cross-sectional online survey distributed through national professional mailing channels between January and June 2021. The questionnaire explored demographics, AI awareness and knowledge, prior use, perceived diagnostic potential across image modalities, and attitudes toward implementation. Linear regression models assessed associations between age group, sex, practice sector, and response scores. Among 183 respondents, 79.8% were women and 37.2% were aged 30-40 years. Awareness of AI use in dermatology was reported by 69.4%, but only 32.2% had read medical publications on the topic and 13.1% had used AI in practice. High or very high diagnostic potential was reported for dermoscopic images by 60.6%, histologic images by 51.9%, and clinical images by 45.9%. Most respondents believed that AI would improve dermatology (61.7%) and should be included in medical training (70.0%), whereas 82.5% disagreed that AI would replace dermatologists. Older age was associated with higher perceived diagnostic potential and more favorable views of AI, while male respondents reported lower fear scores than women. Moroccan dermatologists showed an overall favorable view of AI, but this optimism contrasted with limited engagement with the literature and limited practical use. Structured education is needed before wider implementation.

Keywords: Artificial intelligence, dermatology, Morocco, survey, medical education.

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INTRODUCTION

Artificial intelligence has become one of the most visible technological developments in modern dermatology. Because dermatologic diagnosis relies heavily on clinical, dermoscopic, and histopathologic image interpretation, the specialty is particularly well suited to computer-vision tools and machine-learning models [1]. Previous studies have shown that deep learning systems can reach expert-level performance for selected image-classification tasks, especially in skin cancer recognition [2-4].

At the same time, implementation in real clinical practice depends on more than algorithmic performance alone. Physician acceptance, familiarity and trust in AI, and perceived educational needs are likely to influence whether AI is effectively integrated

into clinical practice rather than remaining a theoretical innovation [5,6]. International surveys suggest that dermatologists are generally optimistic about AI, yet they also report limited hands-on experience, persistent uncertainty, and a strong preference for collaborative rather than replacement-based models of care [5,6,8,9,10].

Data from North Africa remain scarce. Understanding how Moroccan dermatologists perceive AI is important because local readiness, training opportunities, and implementation barriers may differ from those described in Europe, North America, Asia, or Australia. A national survey can therefore provide a useful baseline for future educational and organizational strategies.

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The primary objective of this study was to assess Moroccan dermatologists' and dermatology residents' knowledge of AI in dermatology. Secondary objectives were to describe current use of AI in practice, evaluate perceived diagnostic potential across different image modalities, explore attitudes toward implementation and replacement, and examine whether age, sex, and practice sector were associated with AI-related perceptions.

MATERIALS AND METHODS

This study was designed as a cross-sectional online survey of practicing dermatologists and dermatology residents in Morocco. The questionnaire was distributed through national professional mailing channels using Google Forms and remained open from January to June 2021. Participation was voluntary and anonymous. Eligible participants were dermatologists and dermatology residents practicing in Morocco.

No prospective ethics committee review was sought for this anonymous, voluntary questionnaire survey of healthcare professionals. The study involved no clinical intervention and collected no patient data, biological material, or directly identifying information. All participants provided informed consent before completing the questionnaire.

The survey collected demographic and professional data, including sex, age, practice setting, and years of dermatology experience. It also assessed awareness of AI in daily life and in dermatology, self-rated knowledge of AI in dermatology, familiarity with medical publications on the topic, previous use of AI in dermatologic practice, main sources of information, perceived diagnostic potential of AI for clinical, dermoscopic, and histologic images, and attitudes toward

future implementation, replacement, fear, enthusiasm, and medical education.

The final sample included all fully completed questionnaires received during the study period. Categorical variables were summarized as counts and percentages. For selected perception and attitude items, responses were coded on ordinal scales from 1 to 5 and analyzed using linear regression models. "I don't know" responses were excluded from regression analyses. The predictors entered into the models were age group, sex, and practice sector. Practice sector was dichotomized as public versus private; the public sector group included public hospital dermatologists, residents, and university professors. Statistical analyses were performed using Jamovi version 2.6.2, and P values below 0.05 were considered statistically significant.

Because the survey was anonymous and self-administered, the main anticipated sources of bias were selection bias, self-report bias, and possible overrepresentation of clinicians with greater interest in digital tools.

RESULTS

A total of 183 completed questionnaires were analyzed, with women accounting for 79.8% of responders. The mean age was 39.9 years, and the most represented age group was 30-40 years (37.2%), followed by participants younger than 30 years (26.2%). Most participants (61.7%) worked in the public sector, including public-sector specialists (28.4%), residents (26.2%), and university professors (7.1%). Early-career clinicians were well represented: 50.8% had 0-5 years of dermatology experience, whereas only 18.7% had more than 26 years of experience (Table 1).

Table 1: Demographic characteristics of the participants

Characteristic	n = 183 (%)
Sex	
Female	146 (79.8)
Male	37 (20.2)
Age group (years)	
<30	48 (26.2)
30-40	68 (37.2)
40-50	24 (13.1)
50-60	14 (7.7)
>60	29 (15.8)
Practice setting	
Private specialists	70 (38.3)
Public specialists	52 (28.4)
Residents	48 (26.2)
University professors	13 (7.1)
Dermatology experience (years)	
0-5	93 (50.8)
6-10	26 (14.2)
11-15	13 (7.1)
16-20	8 (4.4)

21-25	9 (4.9)
26-30	17 (9.3)
31-35	12 (6.6)
35-40	3 (1.6)
>40	2 (1.1)

Note. Percentages are based on 183 completed questionnaires.

Knowledge of AI was relatively widespread, although its depth remained limited. Overall, 72.1% of responders were aware of AI use in daily life, and 69.4% were aware of its applications in dermatology. Nevertheless, only 32.2% had read medical publications on AI in dermatology. Self-assessed knowledge levels were generally low. Specifically, 35.0% reported having only heard about the topic, 34.4% reported having basic

knowledge, and 18.6% reported having no knowledge at all, whereas only 11.5% and 0.5% rated their knowledge as good and excellent, respectively. Media (40.2%) and conferences (24.2%) were the main sources of information. Actual use in clinical practice remained limited, with only 13.1% of responders reporting prior use of AI in dermatology (Table 2).

Table 2: Knowledge about AI and information sources

Variable	Yes (%)	No (%)
Aware of AI use in daily life	132 (72.1)	51 (27.9)
Aware of AI use in dermatology	127 (69.4)	56 (30.6)
Familiarity with medical literature on AI in dermatology	59 (32.2)	124 (67.8)
Previously used AI in dermatologic practice	24 (13.1)	159 (86.9)
Self-rated knowledge of AI in dermatology		
Heard about it	64 (35.0)	
Basic knowledge	63 (34.4)	
No knowledge	34 (18.6)	
Good knowledge	21 (11.5)	
Excellent knowledge	1 (0.5)	
Main source of information on AI		
Media	74 (40.2)	
Conferences	44 (24.2)	
Social media	39 (21.2)	
Friends	26 (14.4)	

Note. AI, artificial intelligence.

Perceived diagnostic potential varied according to image modality. AI was rated as having high or very high potential by 45.9% of responders for clinical

images, 60.6% for dermoscopic images, and 51.9% for histologic images (Table 3).

Table 3A: Perceived diagnostic potential of AI according to image modality (%)

Image modality	Very high	High	Moderate	Low / no potential	I don't know
Clinical images	10.8	35.1	35.8	0.0	18.3
Dermoscopic images	15.0	45.6	16.7	11.1	11.6
Histologic images	13.4	38.5	23.5	11.2	13.4

Note. AI, artificial intelligence.

Table 3B: Factors associated with perceived AI potential by image modality

Image modality	Score increase per age group (95% CI)	P value	Male sex: score difference (95% CI) [Ref. female]	P value	Public sector: score difference (95% CI) [Ref. private]	P value
Clinical images	0.20 (0.05 to 0.35)	0.010	-0.28 (-0.73 to 0.16)	0.211	0.34 (-0.03 to 0.71)	0.073
Dermoscopic images	0.22 (0.08 to 0.36)	0.003	-0.37 (-0.80 to 0.06)	0.092	0.25 (-0.11 to 0.61)	0.171
Histologic images	0.21 (0.06 to 0.35)	0.007	-0.33 (-0.77 to 0.11)	0.137	0.15 (-0.22 to 0.52)	0.431

Note. Responses were coded from 1 to 5 as follows: no potential = 1, low potential = 2, moderate potential = 3, high potential = 4, and very high potential = 5. "I do not know" responses were excluded from the regression models. Linear regression models included

age group, sex, and practice sector. Age groups were coded ordinally as <30 years = 1, 30-39 years = 2, 40-49 years = 3, 50-59 years = 4, and ≥60 years = 5. Practice sector was dichotomized as public versus private; the public sector group included public hospital

dermatologists, residents, and university professors. Abbreviations: AI, artificial intelligence; CI, confidence interval.

Attitudes toward implementation were overall favorable. A total of 59.6% agreed that AI will revolutionize dermatology, 61.7% believed that AI will improve dermatology, and 82.5% disagreed that dermatologists will be replaced by AI (Table 4).

Table 4: General attitudes toward artificial intelligence

Item and response category	n = 183 (%)	Score increase per age group (95% CI)	P value	Male sex: score difference (95% CI) [Ref. female]	P value	Public sector: score difference (95% CI) [Ref. private]	P value
AI will revolutionize dermatology		0.19 (0.05 to 0.33)	0.007	-0.36 (-0.76 to 0.05)	0.082	0.45 (0.11 to 0.79)	0.010
Strongly agree	26 (14.2)						
Agree	83 (45.4)						
Neutral / I don't know	51 (27.9)						
Disagree	22 (12.0)						
Strongly disagree	1 (0.5)						
Dermatologists will be replaced by AI		0.09 (-0.03 to 0.22)	0.146	-0.01 (-0.38 to 0.36)	0.951	0.25 (-0.05 to 0.55)	0.108
Strongly disagree	76 (41.5)						
Disagree	75 (41.0)						
Neutral / I don't know	25 (13.7)						
Agree	5 (2.7)						
Strongly agree	2 (1.1)						

Note. Responses were coded from 1 to 5 as follows: strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, and strongly agree = 5. Linear regression models included age group, sex, and practice sector. Negative coefficients for male sex indicate lower scores in men than in women. Abbreviations: AI, artificial intelligence; CI, confidence interval.

Emotional responses were mixed. While 27.9% agreed that increasing AI use in dermatology is frightening, 67.2% believed that it makes dermatology more exciting. Most responders (70.0%) also supported including AI in medical training (Table 5).

Table 5A: Emotional responses to artificial intelligence

Item and response category	n = 183 (%)	Score increase per age group (95% CI)	P value	Male sex: score difference (95% CI) [Ref. female]	P value	Public sector: score difference (95% CI) [Ref. private]	P value
Increasing AI use in dermatology is frightening		0.06 (-0.10 to 0.22)	0.462	-0.71 (-1.19 to -0.22)	0.004	0.19 (-0.21 to 0.59)	0.358
Neutral / I don't know	72 (39.4)						
Disagree	39 (21.3)						
Agree	37 (20.2)						
Strongly disagree	21 (11.5)						
Strongly agree	14 (7.7)						
Increasing AI use in dermatology is exciting		0.12 (-0.04 to 0.28)	0.131	0.15 (-0.33 to 0.62)	0.539	-0.04 (-0.42 to 0.35)	0.856
Agree	62 (33.9)						
Strongly agree	61 (33.3)						
Neutral / I don't know	34 (18.6)						
Disagree	13 (7.1)						
Strongly disagree	13 (7.1)						

Note. Responses were coded from 1 to 5 as follows: strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, and strongly agree = 5. Linear regression

models included age group, sex, and practice sector. Abbreviations: AI, artificial intelligence; CI, confidence interval.

Table 5B: Attitudes toward AI training

Item and response category	n = 183 (%)	Score increase per age group (95% CI)	P value	Male sex: score difference (95% CI) [Ref. female]	P value	Public sector: score difference (95% CI) [Ref. private]	P value
AI should be part of medical training		0.18 (0.04 to 0.31)	0.010	-0.00 (-0.40 to 0.40)	0.996	0.07 (-0.26 to 0.40)	0.686
Agree	96 (52.5)						
Strongly agree	32 (17.5)						
Neutral / I don't know	41 (22.4)						
Disagree	8 (4.4)						
Strongly disagree	6 (3.3)						

Note. Responses were coded from 1 to 5 as follows: strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, and strongly agree = 5. Linear regression models included age group, sex, and practice sector. Abbreviations: AI, artificial intelligence; CI, confidence interval.

In linear regression analyses, older age groups showed significantly higher scores for the perceived diagnostic potential of AI in clinical ($P = 0.010$), dermoscopic ($P = 0.003$), and histologic imaging ($P = 0.007$), and were also more likely to agree that AI will revolutionize dermatology ($P = 0.007$), improve dermatology ($P = 0.003$), and should be incorporated into medical training ($P = 0.010$). Public-sector participants were more likely to agree that AI will revolutionize dermatology ($P = 0.010$), whereas male responders reported lower fear scores regarding increasing AI use in dermatology ($P = 0.004$), indicating greater concern among women. No statistically significant association was identified between sex or practice sector and the perceived diagnostic potential of AI according to image modality, or between participant characteristics and the belief that AI would revolutionize dermatology more than other specialties, replace dermatologists, or make dermatology more exciting.

DISCUSSION

This survey suggests a consistent pattern: Moroccan dermatologists appear generally receptive to AI, yet routine clinical adoption remains limited. The gap between optimism and actual use is important and suggests that barriers may lie less in attitudinal rejection than in limited exposure to the scientific literature, insufficient structured training, and uncertainty about how AI can be integrated into everyday clinical workflows.

Our findings are in line with other international reports. Polesie *et al.*, found a generally positive attitude toward AI among dermatologists, coupled with clear calls for better education before implementation [5]. A similar balance between optimism and caution has been described in other physician surveys, including those from the United States, China, Saudi Arabia, India, and Australia [6-10]. Taken together, these observations suggest that our results fit within a broader transitional phase in dermatology, in which clinicians recognize the potential of AI but have not yet integrated it widely into routine care.

The stronger perceived value of AI for dermoscopic and histologic images is also clinically plausible. These domains rely on relatively standardized visual patterns and are among the areas in which AI systems have shown strong performance in prior studies [2-4]. By contrast, ordinary clinical photographs are more heterogeneous in framing, lighting, lesion selection, and contextual information, which may explain the more cautious ratings observed in our survey.

Equally important is the strongly negative response to the idea that dermatologists will be replaced by AI. This perspective is consistent with the growing shift from a human-versus-machine framework toward an augmented intelligence model, in which AI is intended to support, rather than replace, clinical decision-making [1,4,6]. Such a model may be particularly relevant in dermatology, where diagnosis depends not only on pattern recognition, but also on clinical history, full-body examination, therapeutic judgment, patient counselling, and longitudinal follow-up.

Further analyses showed that older age was associated with more favorable perceptions of AI across several domains, while women reported greater concern

regarding the increasing use of AI in dermatology. These findings suggest that acceptance of AI may vary according to clinician profile and support the need for tailored educational strategies.

Strengths and limitations

This study addressed a timely question in a national sample and included both specialists and residents, allowing a broad view of professional attitudes across levels of experience. It also examined several dimensions of AI readiness, from basic awareness and literature exposure to emotional response and educational priorities.

The study also has limitations. Participation was voluntary and online, which may have introduced selection bias. Responses were self-reported and may not fully reflect actual knowledge or practice. Women and early-career clinicians were overrepresented, which may have influenced the overall profile of responses. These factors should be considered when interpreting the findings and when extrapolating them to all Moroccan dermatologists.

CONCLUSION

In conclusion, Moroccan dermatologists and dermatology residents showed an overall positive perception of artificial intelligence, particularly regarding its potential diagnostic value and its integration into medical education. At the same time, actual use in daily practice and familiarity with the scientific literature remained limited. These findings suggest that the most relevant next step is to strengthen education and training in this field, with particular attention to diagnostic performance, dataset-related bias, limitations in skin of color, data privacy, explainability, and the need for continued clinician oversight. In this context, the responsible integration of AI into dermatology should be approached as a means of supporting clinical practice rather than replacing medical expertise [11-13].

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Ethics and consent

No prospective ethics committee review was sought for this anonymous, voluntary questionnaire survey of healthcare professionals. The study involved no clinical intervention and collected no patient data, biological material, or directly identifying information. All participants provided informed consent before completing the questionnaire. Data were analyzed and reported only in aggregate.

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Competing interests

The authors declare no competing interests.

Author contributions

All authors contributed to drafting the manuscript, developing and validating the questionnaire, and conducting the statistical analyses. All authors critically reviewed and approved the final manuscript.

Previous dissemination

Preliminary findings from this dataset were published as a non-peer-reviewed conference abstract: Chakiri R, Lahlou L. Attitudes Toward Artificial Intelligence Among Dermatologists in Morocco: A National Survey. *iProc.* 2021;7:e35389. <https://doi.org/10.2196/35389>. The submitted manuscript provides the full descriptive and adjusted multivariable analyses and is not under consideration elsewhere.

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