

Exploring Perspectives on AI Integration in Dermatology and Its Implications for Skin Color Bias

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Article History

Received: 08.08.2025

Revised: 15.09.2025

Accepted: 24.10.2025

Published: 05.11.2025

Abstract: *Background:* Artificial intelligence (AI) is increasingly utilized in dermatology for its ability to enhance diagnostic accuracy and efficiency. However, ethical concerns, including skin color bias and inequities in AI training datasets, threaten its equitable implementation. Limited research explores stakeholder awareness and perceptions of these biases, highlighting a critical gap in understanding and addressing them. *Methods:* A cross-sectional survey was conducted among 300 participants, comprising 150 healthcare providers and 150 patients. The survey assessed demographics, general attitudes toward AI, perceived benefits and concerns, and awareness of skin color bias. *Statistical analysis,* including chi-square tests and t-tests, was performed to evaluate group differences. *Results:* Healthcare providers demonstrated higher familiarity with AI (87%) compared to patients (42%) ($p < 0.001$). Both groups acknowledged AI's potential to improve diagnostic accuracy, though healthcare providers rated its usefulness more favorably (82% vs. 61%; $p = 0.003$). Trust in AI was significantly lower among patients (38%) than healthcare providers (76%) ($p < 0.001$). Key concerns included bias against skin tones (64% of patients with Fitzpatrick types IV–VI) and data privacy (38% of patients, 53% of providers). Providers emphasized the importance of inclusive datasets (72%) and regular audits (61%), while patients prioritized transparency and human oversight (75%). *Conclusion:* Healthcare providers and patients exhibit differing levels of familiarity, trust, and concerns regarding AI in dermatology. Addressing skin color bias, enhancing transparency, and improving patient education are critical to fostering trust and equity in AI applications. Collaborative efforts among stakeholders are essential to ensuring ethical and inclusive implementation of AI in dermatology.

Keywords: Artificial intelligence, dermatology, skin color bias, inclusivity, patient education, trust.

INTRODUCTION

Artificial intelligence (AI) is rapidly reshaping the landscape of healthcare, offering tools that can significantly enhance diagnostic precision, operational efficiency, and treatment personalization. In dermatology, AI applications have gained particular attention for their potential to analyze dermatological images with high accuracy, aiding in the detection and classification of various skin conditions. These technologies promise to address pressing challenges, such as the global shortage of dermatologists and the high variability in diagnostic accuracy among practitioners (1,2).

However, the integration of AI into dermatology is accompanied by ethical and societal concerns, particularly regarding biases embedded in AI systems. Disparities in the performance of AI algorithms across different skin tones have raised questions about their fairness and inclusivity. As dermatology heavily relies on visual diagnostics, any bias in image analysis algorithms could disproportionately affect patients with darker skin tones, exacerbating existing health disparities. This issue is further complicated by limited research exploring stakeholder awareness of these biases and their implications for clinical practice (3,4). This study aims to investigate perceptions and awareness of AI biases in dermatology, particularly those related to skin color. It also seeks to highlight the inadequacies in

the composition of AI training datasets, which frequently underrepresent darker skin tones, and to propose strategies for improving the inclusivity and fairness of AI models in dermatological applications.

The increasing reliance on AI in dermatology necessitates a critical evaluation of its capabilities and limitations. While numerous studies have demonstrated the potential of AI to match or exceed the diagnostic accuracy of dermatologists in controlled settings, concerns about algorithmic bias remain underexplored. Skin tone bias, in particular, represents a significant barrier to the equitable deployment of AI systems. Studies suggest that AI models trained on predominantly lighter skin tones may underperform when analyzing images of darker skin, potentially leading to misdiagnoses or delayed treatment for certain populations (5,6).

Furthermore, despite the growing body of research on the technical aspects of AI in dermatology, there is a paucity of studies examining the awareness and perceptions of these biases among key stakeholders, including clinicians, patients, and AI developers. Understanding these perspectives is critical for developing actionable solutions to mitigate bias and improve the inclusivity of AI systems. Additionally, the lack of diverse training datasets show the urgency of addressing this issue to ensure that AI technologies benefit all patient groups equitably.

This research is particularly timely as AI adoption in dermatology continues to accelerate. By identifying gaps in knowledge and raising awareness about biases, this study aims to contribute to the development of more ethical and inclusive AI models, ultimately enhancing the quality of dermatologic care across diverse populations.

Aim & Objectives:

- To assess the attitudes and perceptions of medical professionals regarding AI in dermatology.
- To evaluate awareness and concerns about skin color bias in AI tools.

MATERIALS & METHODS:

Study Design: This study employs a cross-sectional, survey-based design to assess perceptions, attitudes, and awareness of AI biases, specifically in the context of dermatology.

Population: The target population includes a spectrum of individuals engaged in medical practice and education, encompassing medical students, residents, dermatologists, and other relevant specialists. The inclusion criteria are as follows:

- **Medical students** in their 3rd or 4th year of training.
- **Residents** specialising in dermatology, internal medicine, or family medicine.
- **Dermatologists** and other practising specialists with experience in dermatologic care.

Participants with incomplete survey responses or those not affiliated with the medical profession were excluded from the study to ensure data integrity and relevance.

Sample Size: A total of 300 participants was chosen to provide sufficient power for detecting statistically significant differences in responses across subgroups.

Survey Development

The survey was developed through a combination of a thorough literature review and consultation with experts in dermatology, AI, and medical ethics. The questionnaire was structured into the following sections:

1. **Demographics:** Including age, gender, medical specialty, years of experience, and current role (e.g., student, resident, board-certified physician).

2. **General Attitudes Toward AI:** Exploring participants' familiarity with and perceptions of AI applications in healthcare.
3. **Perceived Benefits and Concerns:** Assessing participants' views on the potential advantages and challenges of AI in dermatology, including diagnostic accuracy, efficiency, and ethical issues.
4. **Awareness of Skin Color Bias:** Specific questions to gauge understanding and perceptions of biases in AI models, particularly those related to skin tone diversity.

The questionnaire underwent pilot testing with a small group of medical professionals to ensure clarity and validity.

Data Collection: The survey was administered online via email invitations and professional networks such as medical societies, academic institutions, and professional associations. Participation was voluntary, and informed consent was obtained from all participants before they completed the survey. The survey was distributed with an introductory statement explaining the study's purpose, confidentiality measures, and estimated time to complete.

Data Analysis

Quantitative data analysis was conducted using statistical software SPSS version 26.0. Descriptive statistics, such as means, medians, and standard deviations, were calculated to summarize participant characteristics and overall trends. The following statistical methods were employed:

- **Chi-square tests:** To evaluate associations between categorical variables, such as awareness of AI biases and demographic factors.
- **T-tests:** To compare means between two groups, such as residents and board-certified dermatologists.
- **ANOVA (Analysis of Variance):** To compare mean responses across multiple groups, such as different specialties or levels of training.

All statistical analyses were conducted with a significance level set at $p < 0.05$, and adjustments for multiple comparisons were made when necessary.

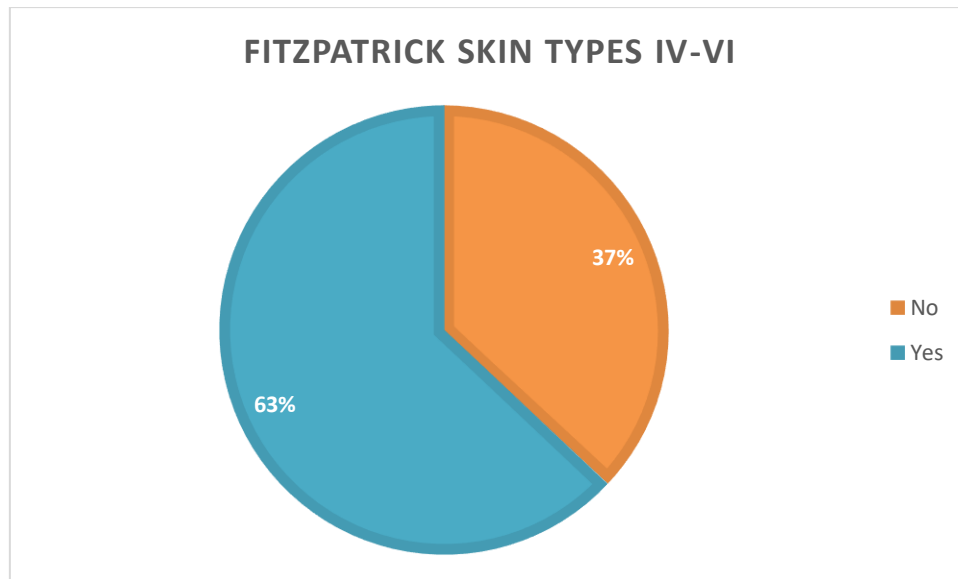
RESULTS

A total of 300 participants (150 healthcare providers and 150 patients) completed the survey. The mean age of healthcare providers was 32.1 years, while the mean age of patients was 38.5 years. A majority of healthcare providers (67%) and patients (59%) were female. Among patients, 63% reported Fitzpatrick skin types IV–VI.

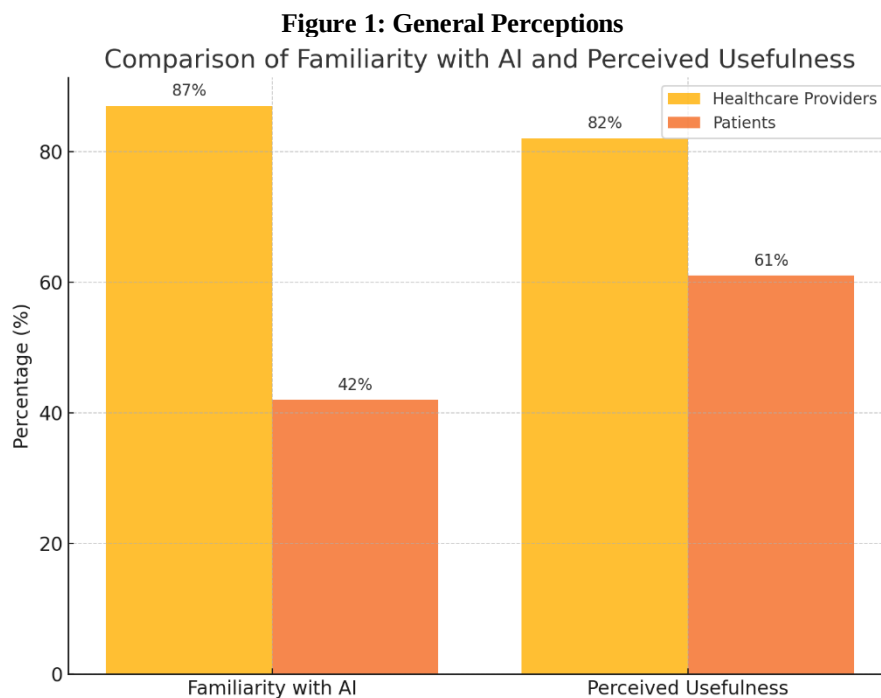
Table 1: Participant Demographics

Category	Healthcare Providers	Patients
Number of Participants	150	150
Mean Age (years)	32.1	38.5

Male (%)	33	41
Female (%)	67	59
Fitzpatrick Skin Types IV-VI (%)	N/A	63

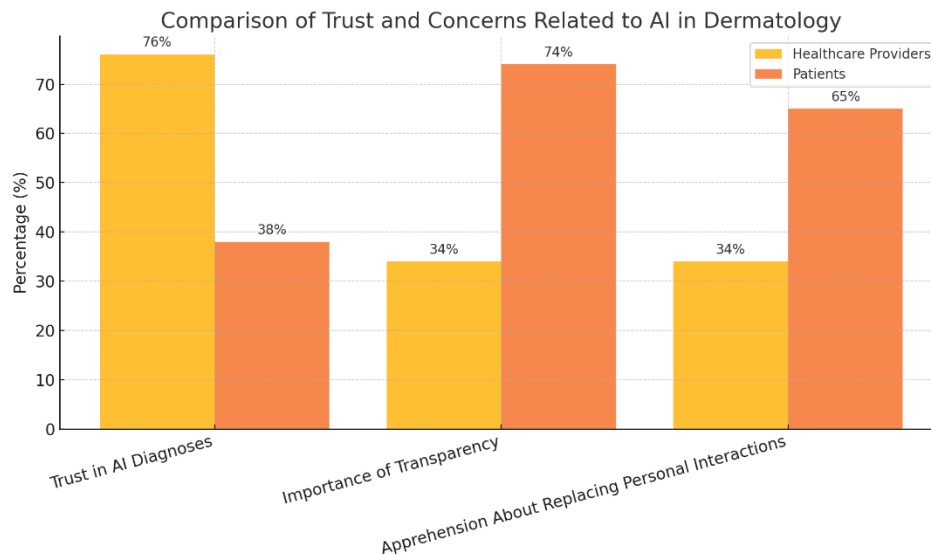


Familiarity with AI: Healthcare providers reported significantly higher familiarity with AI (87%) compared to patients (42%) ($p < 0.001$). **Perceived Usefulness:** Both groups recognized AI's potential to improve diagnostic accuracy, but healthcare providers rated usefulness higher (82%) than patients (61%) ($p = 0.003$).

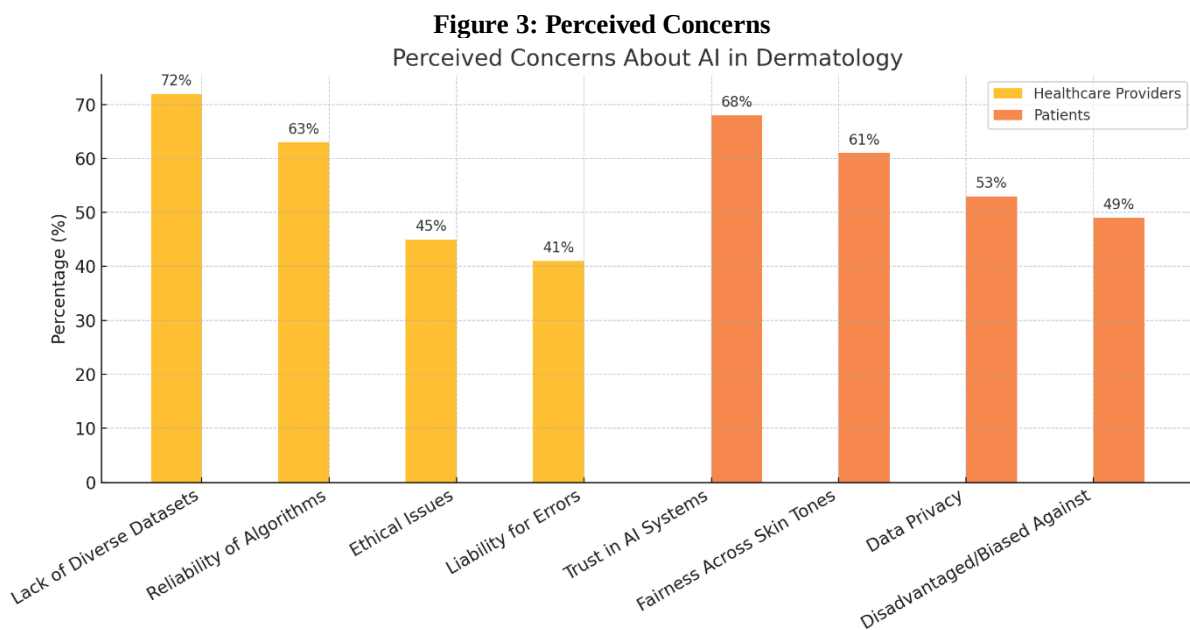


Only 38% of patients expressed trust in AI-assisted diagnoses, compared to 76% of healthcare providers ($p < 0.001$). Patients emphasized the importance of transparency in AI decision-making, with 74% requesting explanations for AI-driven diagnoses. Patients reported apprehension about AI potentially replacing personal interactions with dermatologists (65%), compared to 34% of healthcare providers.

Figure 2: Trust in AI



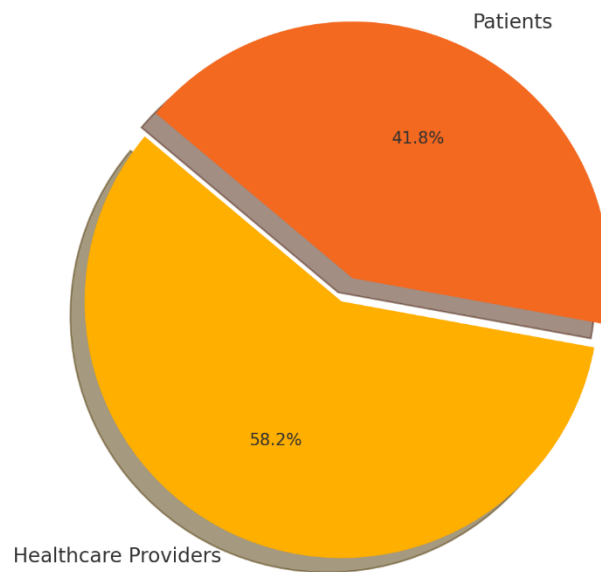
Healthcare Providers: Concerns included the lack of diverse datasets (72%), reliability of algorithms (63%), ethical issues (45%), and potential liability for AI-driven errors (41%). Patients: Key concerns centered on trust in AI systems (68%), fairness across skin tones (61%), data privacy (53%), and the feeling of being disadvantaged or biased against (49%).



38% of patients expressed apprehensions about how their dermatological images and medical data would be stored and used by AI tools, compared to 53% of healthcare providers ($p = 0.015$). Patients emphasized the need for stricter regulations on AI developers to ensure confidentiality.

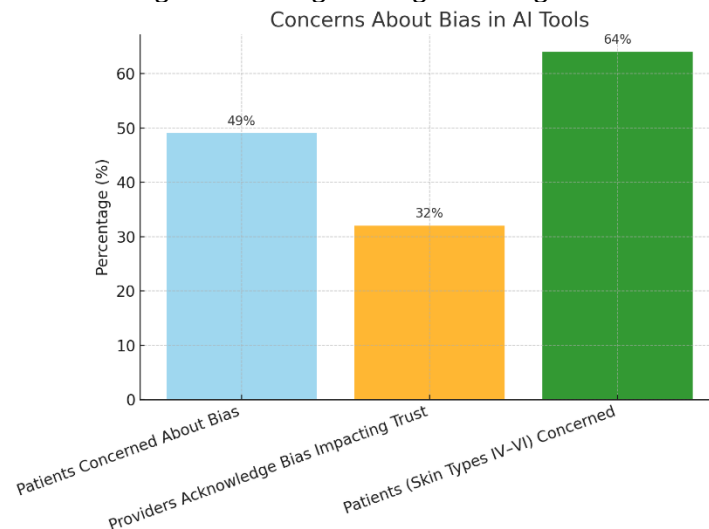
Figure 4: Awareness of Privacy Concerns

Apprehensions About Data Use in AI Tools



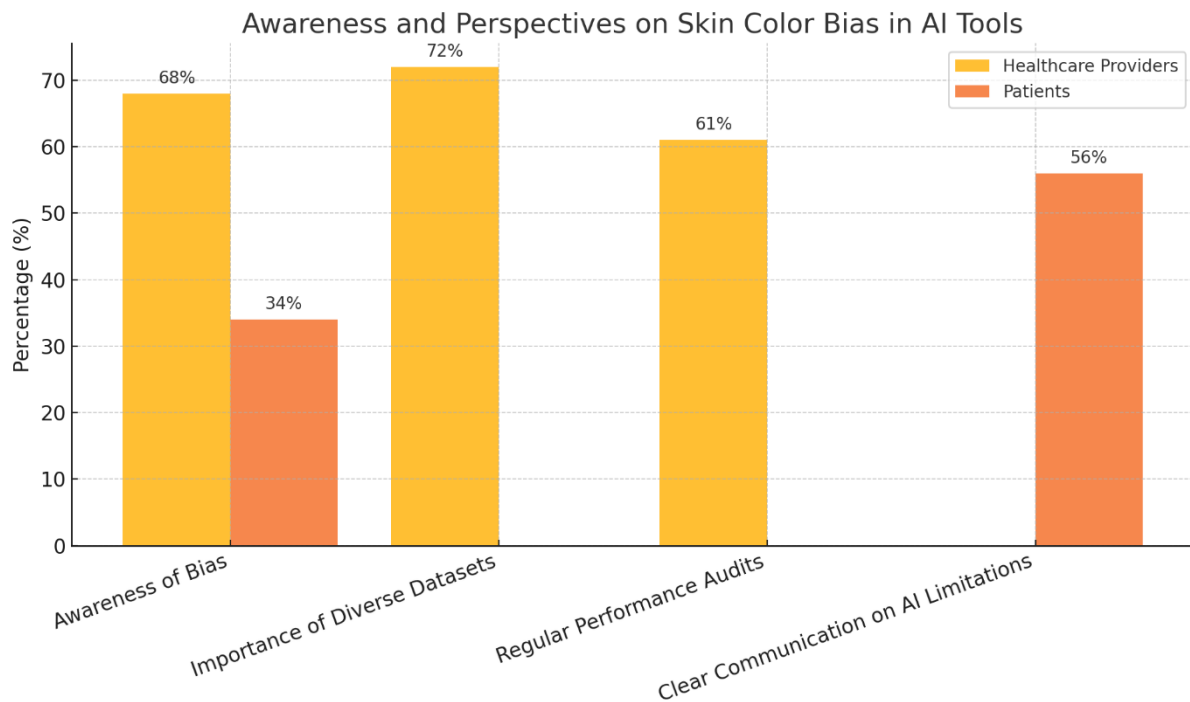
49% of patients reported concerns that AI tools might be biased against their skin type or tone, while 32% of healthcare providers acknowledged that bias might affect patient trust. Among patients with Fitzpatrick skin types IV–VI, this concern was even higher, with 64% feeling that AI tools might disadvantage darker skin tones.

Figure 5: Feeling of Being Biased Against



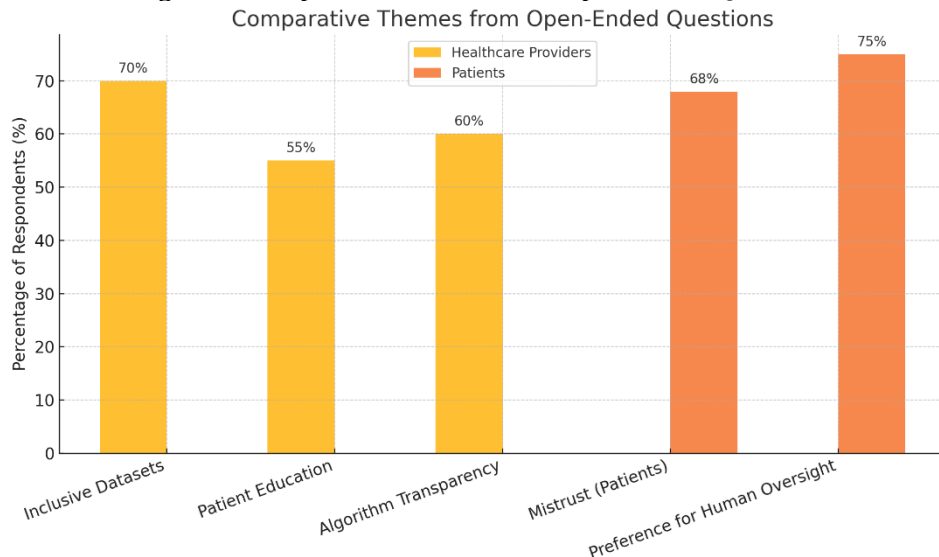
Awareness of skin color bias was significantly higher among healthcare providers (68%) than patients (34%) ($p < 0.001$). Healthcare providers highlighted the importance of training AI models on diverse datasets (72%) and conducting regular performance audits (61%). Patients emphasized the need for clearer communication about AI limitations and efforts to ensure fairness (56%).

Figure 6: Awareness of Skin Color Bias



Healthcare Providers: Frequently suggested strategies included the need for more inclusive datasets (70%), educating patients about AI (55%), and enhancing algorithm transparency (60%). These strategies reflect a proactive approach to addressing biases and fostering trust in AI systems. **Patients:** Expressed significant mistrust (68%) stemming from the perceived lack of inclusivity in AI systems and fear of systemic bias. A majority (75%) also voiced a preference for maintaining human oversight in AI-assisted decision-making to ensure fairness and empathy in care.

Figure 7: Comparative Themes from Open-Ended Questions



DISCUSSION

This study highlights the varied perspectives of healthcare providers and patients regarding the integration of AI in dermatology, particularly focusing on familiarity, perceived usefulness, trust, concerns, and awareness of potential biases. The findings provide valuable insights into the opportunities and challenges associated with implementing AI tools in dermatological practice.

The participant demographics reveal a balanced representation of healthcare providers and patients, with a significant proportion of patients reporting Fitzpatrick skin types IV–VI (63%). This is crucial given the ongoing concerns about the inclusivity of AI in dermatology. Healthcare providers demonstrated significantly higher familiarity with AI (87%) compared to patients (42%), indicating a knowledge gap that may influence perceptions and adoption of AI tools. These

findings suggest the need for broader patient education to align their understanding of AI capabilities with that of healthcare providers. The disparity in familiarity with AI between healthcare providers and patients observed in this study is consistent with prior research. A study by Nelson et al. (7) reported that clinicians demonstrated significantly higher awareness of AI tools compared to patients, who often had limited exposure to the technology. This knowledge gap may influence patients' perceptions, as evidenced by the lower perceived usefulness of AI among patients in both this study (61%) and others, where similar patterns were noted (8). These findings highlight the need for targeted educational initiatives to improve patient understanding and acceptance of AI technologies.

Both healthcare providers and patients recognized the potential of AI to improve diagnostic accuracy, but providers rated its usefulness more favorably (82% vs. 61%). This disparity likely stems from providers' greater familiarity and confidence in technological applications. However, trust remains a significant challenge: only 38% of patients expressed trust in AI-assisted diagnoses compared to 76% of providers. The demand for transparency, with 74% of patients requesting explanations for AI-driven decisions, highlights a critical area for improvement. The apprehension among patients (65%) about AI replacing personal interactions with dermatologists enhance the importance of preserving the human aspect of care. Trust in AI has been a persistent challenge across studies. The finding that only 38% of patients trust AI-assisted diagnoses mirrors results from a study by Lupton et al. (9), which identified trust as a critical barrier to AI adoption among patients. Lupton et al. emphasized the role of transparency in building trust, a sentiment echoed in this study, where 74% of patients requested explanations for AI-driven decisions. Similarly, healthcare providers in previous studies have advocated for clear, interpretable AI systems to improve trust and clinical integration (10). These parallels highlight the universal importance of transparency in fostering confidence in AI tools.

Concerns about bias and privacy were prominent among both groups, though their emphasis varied. Providers highlighted technical and ethical issues, including the lack of diverse datasets (72%) and reliability of algorithms (63%). Patients were more concerned about fairness across skin tones (61%) and feeling disadvantaged or biased against (49%). Among patients with Fitzpatrick skin types IV–VI, this concern rose to 64%, emphasizing the urgency of addressing skin tone bias in AI training datasets. Bias in AI systems, particularly related to skin tone, has been a recurring concern in dermatology research. A study by Adamson and Smith (3) highlighted the underrepresentation of darker skin tones in dermatological datasets, leading to potential disparities in diagnostic accuracy. This aligns with the current findings, where 64% of patients with Fitzpatrick skin types IV–VI expressed concern about

being disadvantaged by AI tools. Similarly, Gupta et al. (5) called for more inclusive datasets to ensure equitable AI performance across diverse populations, reflecting the priorities identified by healthcare providers in this study.

Privacy apprehensions were also significant, with 38% of patients and 53% of providers expressing concerns about the storage and use of dermatological images. Patients' emphasis on stricter regulations for AI developers suggests a gap in current policy frameworks governing the use of sensitive medical data. Apprehensions about data privacy, as expressed by 38% of patients and 53% of healthcare providers in this study, are consistent with findings from prior research. A systematic review by Krittanawong et al. (11) noted that privacy concerns were among the top barriers to AI adoption in healthcare, with patients expressing fear about the misuse of their medical data. The emphasis on stricter regulations observed in this study parallels the recommendations of previous studies advocating for robust legal frameworks to protect patient confidentiality.

Awareness of skin color bias was significantly higher among providers (68%) compared to patients (34%). Providers proposed actionable strategies, such as using inclusive datasets (72%) and conducting regular performance audits (61%). Patients, on the other hand, emphasized clearer communication about AI limitations and fairness efforts (56%). These findings underline the need for collaborative efforts between developers, providers, and patients to ensure the ethical and equitable deployment of AI in dermatology. The open-ended suggestions for addressing bias, including the use of diverse datasets, patient education, and algorithm transparency, are supported by prior studies. For example, Obermeyer et al. (4) recommended regular performance audits and the inclusion of underrepresented populations in training datasets to minimize algorithmic bias. The preference for human oversight, particularly among patients, aligns with findings from Topol (12), who argued for maintaining human empathy and judgment alongside AI to preserve the trust inherent in patient-provider relationships.

Open-ended responses revealed further nuances. Healthcare providers emphasized the importance of technical improvements, including algorithm transparency (60%) and patient education (55%), to mitigate mistrust. In contrast, patients frequently expressed mistrust (68%) due to perceived lack of inclusivity and systemic bias, with 75% favoring human oversight alongside AI. These themes highlight the divergent priorities of the two groups, suggesting that both technical and relational strategies are essential to foster trust and acceptance of AI tools.

Implications and Future Directions

The findings of this study show several critical areas for intervention:

1. **Education and Transparency:** Increasing patient education about AI's capabilities and limitations is crucial. Transparent decision-making processes can help bridge the trust gap, particularly for patients concerned about bias and fairness.
2. **Inclusivity in AI Development:** The significant concerns about skin tone bias call for the use of diverse datasets in training AI models. Developers must prioritize inclusivity to ensure equitable performance across populations.
3. **Policy and Regulation:** The need for stricter regulations on data privacy and regular performance audits of AI systems is evident. Clear guidelines will not only protect patient data but also enhance confidence in AI applications.
4. **Maintaining Human Oversight:** Patients' preference for human involvement highlights the importance of preserving the patient-provider relationship. AI should be viewed as a complementary tool rather than a replacement for human judgment.

This study provides valuable insights into the perceptions and concerns of healthcare providers and patients regarding AI in dermatology. While AI offers immense potential to improve diagnostic accuracy and accessibility, addressing issues of bias, privacy, and trust is paramount for its successful adoption. Collaborative efforts that combine technical innovation with ethical considerations and patient engagement will be essential to harness the full potential of AI in dermatology.

CONCLUSION

This study aimed to assess the attitudes and perceptions of medical professionals and patients regarding AI in dermatology and to evaluate awareness and concerns about skin color bias in AI tools. The findings reveal significant differences in familiarity, trust, and perceived usefulness of AI between healthcare providers and patients, highlighting a need for enhanced patient education and engagement to bridge this gap. Awareness of skin color bias was notably higher among healthcare providers, who emphasized the importance of diverse datasets and regular performance audits to address inequities. In contrast, patients expressed mistrust and a preference for human oversight, particularly among those with Fitzpatrick skin types IV–VI, who reported heightened concerns about potential biases in AI systems. The study's objectives were met, providing valuable insights into the challenges and opportunities associated with AI in dermatology. Addressing issues of transparency, inclusivity, and patient engagement is critical to fostering trust and ensuring equitable adoption of AI technologies. These findings contribute to the growing body of evidence calling for collaborative

efforts among developers, clinicians, and patients to maximize the benefits of AI while mitigating its limitations.

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