A Report and Proposals for Future Activity from the Inaugural Artificial Intelligence in Dermatology Symposium Held at the International Societies for Investigative Dermatology 2023 Meeting

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INTRODUCTION

It is clear that significant breakthroughs have been achieved in the field of artificial intelligence (AI) in dermatology. This year, 2023, has already witnessed notable milestones, including the introduction of AI and Image Analysis as a distinct abstract category for posters and oral presentations at a major international investigative dermatology conference. In addition, the inaugural AI in Dermatology session was held as a Satellite Symposium at the International Societies for Investigative Dermatology (ISID). These landmark developments mark substantial advancement in the integration of AI technology within the dermatology community.

The importance of AI in dermatology has been recognized globally, with substantial efforts through the International Skin Imaging Collaboration (ISIC) as well as the task forces, working groups, and committees on AI through prominent professional societies such as the British Association of Dermatologists (BAD), American Academy of Dermatology (AAD), and European Academy of Dermatology and Venereology (EADV). The foundational work of these organizations served as the basis of the creation of the AI in Dermatology symposium as a satellite meeting of ISID with the goal of providing an international forum for all researchers with broad interests across dermatology to exchange ideas, discuss current challenges, expand potential application (app) horizons, and formulate concrete plans for future directions using AI tools. Most importantly, this symposium provided the opportunity for in-person connections to be made with formal and informal discussion time. The workshop was held on May 10, 2023, at ISID in Tokyo; led by Reiko J. Tanaka (Imperial College London, London, United Kingdom), Nick J. Reynolds (Newcastle University, Newcastle upon Tyne, United Kingdom), and John Common (A*STAR, Singapore, Singapore); and sponsored by Imperial College London, AbbVie GK, and David M.C. Ju Foundation.

Invited speakers for the symposium were selected on the basis of expertise in AI across a variety of specialist domains relevant to dermatology: Nikhil Sharma provided expertise for in-silico modeling (BioCorteX, London, United Kingdom), opportunities in precision dermatology was presented by Shannon Wongvibulsin (University of California, Los Angeles, Los Angeles, CA), Claire Clibborn provided current industry practices in patient studies (Pfizer, Tadworth, United Kingdon), Tobias Sangers showcased the use of smartphone apps for AI research (Leiden University Medical Center, Leiden, The Netherlands), and Jack Li introduced the concepts of multimodal language models in dermatology (Taipei Medical University, Taipei, Taiwan). This report provides a brief summary of the event detailing the topics under discussion, our shared vision for further expanding this community, and an invitation to join us to move AI in dermatology FORWARD (FORum and Working group for Artificial intelligence Research in Dermatology).

SUMMARY OF TALKS

Accelerating clinical trials in atopic dermatitis using in-silico modeling

According to Deloitte's report, "Measuring the Return from Pharmaceutical Innovation 2022," research and development costs in drug development are currently estimated at $2284 million, yielding an internal rate of return (IRR) of 1.2% (Deloitte, 2022) (briefly, IRR is a measure of investment profitability; the higher the IRR, the more desirable the investment). The Inflation Reduction Act, aimed to decrease inflation with strategies such as reducing prescription drug prices, may further negatively impact the IRR in the United States. Mitigating the risk of a trial failure should be a specific target for development because it incurs almost 96% of research and development costs. There is growing evidence

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that microbes within the human gut can interact with nonantibiotic pharmaceuticals, potentially leading to trial failure due to unaccounted-for variance (Weersma et al, 2020). It is worth noting that microbes vary between preclinical facilities and across different countries, introducing unseen variance when moving from preclinical models to phase 1, and between phases 2 and 3 trials. Early reports suggest that it may affect both side effects and efficacy. This is especially important in atopic dermatitis trials, where interventions may interact with skin or gut microbiota and are often long term. The BioCorteX platform, CarbonMirror, conducted in silico trials of selected compounds in the atopic dermatitis pipeline, revealing significant differences in bacterial drug interactions among populations from different countries. CarbonMirror is a first principle mechanistic simulation that explores the interaction between drugs and bacteria in silico. Because it is based on biological mechanisms, not machine learning, it is able to explore new assets without the need for training data. By surfacing the unseen individual variance in drug–bacteria interactions using in silico trials, people living with chronic conditions such as atopic dermatitis diseases may benefit from an expanded therapeutic landscape, while pharmaceutical companies reduce research and development expenditure and increase IRR.

Enabling precision dermatology with AI

Although there have been impressive advancements in AI in dermatology, numerous fundamental challenges remain. In part, these challenges depend on the field of study, and some areas of applying AI are more advanced than others. For example, there are issues with lack of transparency and potential bias in AI datasets and algorithms. Furthermore, disparities in dermatology AI performance on diverse data have been shown (Daneshjou et al, 2022b). Many unknowns also remain in terms of potential data issues. For instance, surgical skin markings have been shown to impact the diagnostic performance of a deep-learning convolutional neural network for melanoma recognition (Winkler et al, 2019). The CLEAR Derm (Checklist for Evaluation of Image-Based AI Algorithm Reports in Dermatology) published in *JAMA Dermatology* offers guidance toward developing fair, reliable, and safe algorithms (Daneshjou et al, 2022a). In addition, for precision dermatology to be achieved (ie, delivering the right treatments, at the right time, every time to the right person), it is important that diverse data rather than solely imaging data are used. Beyond imaging data, other rich data sources include electronic medical record data, patient-generated data, digital skin measurements, genomics, metabolomics, and epigenetics (Whitehouse.gov, 2020; Wongvibulsin et al, 2020, 2022). There are a growing number of AI algorithms in dermatology, ranging from disease diagnosis to prediction of treatment response. Most prominently, there are a number of publicly available skin cancer smartphone apps. Nevertheless, the evidence for the real-world use of these apps is generally lacking, and currently, there is a scarcity of formal testing in appropriate real-life clinical settings (eg, considering how such AI algorithms would be used in clinical practice). Consequently, there have been warnings issued against using phone apps to detect skin cancer. To increase transparency, further work is necessary for a more standardized app labeling process, such as a nutrition facts style Health App Facts detailing the essential details regarding the app's development and evidence. Overall, steps toward fair, reliable, and safe algorithms require us to work together as a global community, including multidisciplinary teams (Wongvibulsin et al, 2022).

Patient-focused AI in dermatology: an industry perspective

AI-supported drug discovery is becoming well-understood and an industry standard, but how industry can support the understanding of diseases and disease management through AI is an emerging space. The understanding of data and combined datasets, disease symptomology, and the differences between patient and physician perspectives can help to bring new insights and opportunities for understanding disease and treatment paradigms. The number of publications using machine learning or comparative analysis to understand datasets has exploded across disease areas such as oncology, cardiology, ophthalmology, radiology, and dermatology. A nice example of using AI to develop new insights has come from the development of wearable devices for understanding disease symptoms and for real-time patient monitoring, sometimes turning what were thought to be unmeasurable disease manifestations into validated algorithms that can be used to monitor patients (Acosta et al, 2022). Through these innovations, teams are now able to improve patient outcomes and transform the healthcare landscape in a very tangible way.

AI in dermatology smartphone apps

Mobile health (mHealth) apps hold tremendous potential to reach a global population of over 6.4 billion smartphone users, presenting a unique opportunity for enhancing dermatology care. Among the various apps of mHealth, skin cancer detection utilizing AI algorithms stands as a prominent use case. Despite the implementation of mHealth apps for skin cancer detection in healthcare systems globally, concerns persist regarding their accuracy and overall effectiveness (Freeman et al, 2020; Matin and Dinnes, 2021). Conducting a multilevel evaluation is crucial to comprehensively assess the impact of these apps on healthcare systems. In the Netherlands, several health insurers have implemented a skin cancer detection app, enabling a thorough multilevel evaluation. The initial phase comprised a clinical study in a secondary care setting, aimed at assessing the sensitivity and specificity of the implemented app in detecting skin premalignancies and malignancies among patients presenting with suspicious skin lesions. The results demonstrated an overall sensitivity of 86.9% (95% confidence interval [CI] = 82.3–90.7) and specificity of 70.4% (95% CI = 66.2–74.3) for accurately identifying premalignant and malignant skin lesions, benchmarked against histopathological diagnoses, or when unavailable, clinical diagnoses by a dermatologist (Sangers et al, 2022).

Subsequently, population-based research indicated an increase in skin premalignancies and malignancies among app users compared with that among nonusers as well as a threefold rise in health claims related to benign lesions (Smak Gregoor et al, 2023). Qualitative research served as a third level of evaluation, exploring the perspectives of key

stakeholders, including laypersons, general practitioners, and dermatologists, thereby identifying barriers and facilitators for app adoption (Sangers et al, 2021, 2023). Combined, the studies from the multilevel evaluation underscore the numerous challenges that must be addressed and overcome to ensure the successful implementation of mHealth apps for skin cancer detection. As the field of AI in dermatology apps evolves, ongoing multilevel evaluations are essential to gauge their overall impact and effectiveness.

Will Multimodal Large Language Models lead to the demise of dermatology as a discipline?

Multimodal large language models (MLLMs) have gained widespread attention with the release of ChatGPT, an AI chatbot developed by OpenAI. This rapid advancement of AI has led to enormous excitement for the use of AI chatbots both in medical and nonmedical fields. However, it has also caused concern for God-like AI, which could be dangerous without appropriate regulation of this technology. In fact, given fears that AI systems with uncontrolled intelligence could pose significant risks, an open letter has been issued calling for a pause in the creation of giant AI to allow for time for the technology to be appropriately studied and regulations to be developed (Future of Life Institute, 2023). At the same time, there has been great interest in the potential use of MLLMs to improve patient care and help alleviate the burden of administrative tasks for physicians (Asch, 2023; Kung et al, 2023). Currently, the potential impact of MLLMs in dermatology is unclear, but models such as ChatGPT have already shown impressive performance in the examination setting, passing the United States Medical Licensing Examination but also other examinations such as the Bar Examination administered to law degree graduates.

HIGHLIGHTS FROM THE PANEL DISCUSSION

After the talks, the speakers participated in a panel discussion on the technical challenges of AI in dermatology and ways forward, regulatory positions in different countries and barriers to use of AI in clinics, and how we can work together to develop the community in this field. It quickly became apparent that an hour-long discussion would not be sufficient to address these complicated topics. Moreover, the specific considerations depend in part on the particular field of study. It is important that AI-dependent algorithms are tested and validated in the appropriate settings in which they are intended to be used (ie, tested by the relevant staff or patients who will use them). General concerns were also discussed surrounding data standardization, training bias, data privacy/security/ownership, lack of transparency, responsibility of funders, methods of reimbursement, and need for prospective validation. Regarding regulatory positions in different countries, regulations for quality and accountability seem to be a work in progress globally, with different countries working to keep up with the pace of development in AI. For example, in the United States, the Food and Drug Administration (FDA) held meetings in the Summer of 2022 with a panel of experts to obtain feedback on skin lesion apps and devices (Food and Drug Administration, 2022, Food and Drug Administration, 2020). The FDA panelists stressed the importance of the potential dangers of these devices causing false positives, resulting in concerned patients requesting unnecessary biopsies, and false negatives providing false reassurance, leaving cancers undetected and untreated (Young, 2022). Similar concerns were discussed during the symposium, specifically related to the impact of direct-to-consumer diagnostic apps/devices on the patient–clinician relationship. For example, it is already clear that primary care physicians are unlikely able to reassure patients who present with a lesion of concern identified by an AI algorithm. In terms of discussion on standards, further research in this area remains necessary, and specific standards may depend on the kinds of data being studied and the intended user (eg, dermatologist vs other clinician vs patient). Health equity was also an important part of the discussion, with general consensus that research should encompass people across all skin types and also consider people/populations who may not have access to smartphones. Overall, a robust conversation was held by the panelists and moderators with valuable comments from the audience members.

CONTINUING TO BUILD THE COMMUNITY AND FORUM FOR FURTHER DISCUSSION

Prior and ongoing work through ISIC and dermatology societies such as BAD, AAD, and EADV have contributed substantially to building communities centered around AI in dermatology. We hope that our efforts through FORWARD will help accelerate opportunities for collaboration and progress in dermatology AI research. Progress in this field requires multidisciplinary expertise, including but not limited to dermatologists and clinicians, engineers and data scientists, regulatory bodies and industry, and patients and caretakers. The fully packed symposium with an engaged audience >150 participants at the ISID AI in dermatology satellite symposium highlights the interest in this research field and the success of this symposium in bringing together interested investigators. To continue the discussion and collaboration beyond the meeting, participants were able to share their contact information and areas of interest through an electronic form circulated for the symposium. We have now created an online forum to continue to build this community, and we invite you to join FORWARD, the FORum and Working group for Artificial intelligence Research in Dermatology (www.forward.skin).

DATA AVAILABILITY STATEMENT

No datasets were generated or analyzed for this manuscript.

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CONFLICT OF INTEREST

NJR has received travel support, research grants, and/or funding for lectures/advisory boards (Newcastle University) from AbbVie, Almirall, Boehringer Ingelheim, Celgene, Janssen, Novartis, Pfizer, Sanofi Genzyme Regeneron, and UCB Pharma and is also an investigator on MRC-funded PSORT consortium, which has multiple industry partners (www.psort.org.uk). TS reports receiving speaker fees from Janssen-Cilag, UCB, Pfizer, and AbbVie and

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