The place of technology in dermatology: pros and cons

The plethora of dermatology applications (apps) which are available do not come without risk. Although some apps offer potential for early diagnosis and patient education, they are not currently subject to regulation or monitoring. This raises concerns regarding app accuracy and reliability.

Current practise

To diagnose dermatological conditions, a clinical assessment involving a detailed history, full body examination, dermatoscopy and often histopathological analysis is required.

Dermatology in the technological era

With the increasing number of smartphone users, the field of telemedicine has begun a period of evolving growth. There are now over 530 dermatology apps available for public download. Dermatology apps have experienced an 80.8% growth since 2014, mirroring the general app growth rate (Flaten et al, 2018).

There's an app for that

A plethora of mobile apps with varying functions are available to the public for many dermatological conditions including psoriasis, eczema, acne and melanoma. Some apps offer patient education on conditions, skin cancer prevention advice and monitoring of conditions via photograph diaries. Others offer treatment plans based on the severity of the photographed lesions, provide beauty and aging advice from aestheticians, diagnose melanoma and other skin conditions, and even claim to cure acne.

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Specifically, photo storage and monitoring apps reminds users to take photographs of lesions each month. Users can track any changes and either present these to their GP or obtain a likelihood of melanoma score via the app. Education-focused apps can inform users of the ABCDE method of melanoma detection and important red flag signs. Patient education is important for melanoma prevention and so these apps can serve as public health tools.

Diagnosis and self-surveillance apps vary widely, especially skin cancer-related apps. Most apps allow users to upload photographs of lesions and receive algorithm-based advice or dermatologist feedback, often at a cost, regarding the malignant potential. Wolf et al (2013) found that the diagnostic accuracy and sensitivity of apps based around calculating risk or diagnosing melanoma ranged from 6.8 to 91.8%. According to Maier et al (2015), incorporating teledermatology (defined below) into the image analysis process (88% sensitivity, 97% specificity) was better than apps which used fractal analysis (73% sensitivity, 83% specificity) based on the identification of irregular shapes and textures. Emerging methods of image analysis include using artificial intelligence, in the form of deep convolutional neural networks. Haenssle et al (2018) found that convolutional neural networks performed at least as well as 58 dermatologists in melanoma diagnosis, offering great potential for significant clinical impact when used to improve diagnosis in primary care and aid clinical decisions.

A range of apps with different functions is available for download (*Table 1*). Some apps involving dermatologist review of images include FirstDerm, Pocket Derm, Skin Scanner and Dermlink. The number of educational apps grew by 32% between 2014 and 2017, emphasizing the demand for these apps (Flaten et al, 2018).

Teledermatology

The number of teledermatology apps has tripled between 2014 and 2017 (Flaten et al, 2018). Teledermatology involves photographing a skin lesion, either directly by the patient or via the primary health doctor, followed by remote evaluation of the image by a dermatologist. In the UK, the use of store-and-forward teledermatology has been proposed as a service delivery

Table 1. Dermatology applications and their functions

Application name	Function	Cost	Platform	No. of user reviews
Ultraviolet – UV Index	Ultraviolet recommendations	Free	Apple	355
VisualDx	Reference for doctors	Free trial period and payment thereafter	Apple, Android	306
SpotMole	Melanoma diagnosis	Free	Android	50
PocketDerm	Teledermatology	Payment required	Apple	46
SkinVision	Skin cancer risk calculation and teledermatology	Payment required	Apple	41
Doctor Mole	Analysis of image using the ABCDEs of skin cancer and provides a photo library of abnormal moles	Payment required	Android	36

Adapted from Brewer et al (2013)

model to manage capacity and is becoming increasingly implemented in NHS trusts (Loane et al, 2000). Following patient consent, a GP or nurse records a clinical history using the teledermatology app, and uploads and sends a dermatoscopic image to a secure encrypted server over WiFi to be assessed by a dermatologist or a skin specialist GP (Loane et al, 2000).

Benefits

Apps can educate users about a variety of skin conditions and encourage personal responsibility, serving as an important cancer prevention tool. Photo diaries can also provide doctors with images to assess change over time, which may help guide diagnosis and treatment.

Tan et al (2010) and Halpern (2010) concluded that teledermatology and teledermoscopy can be a time and cost-effective triaging tool and can alleviate pressure on the NHS, especially with the current deficit of dermatologists. Since teledermoscopy images have been deemed high quality, teledermatology offers an opportunity for dermatological education with primary care physicians, and provides equitable services to remote areas and a method of following up stable patients (Tan et al, 2010).

Warnings

First and foremost, apps available for public download are not subject to ongoing monitoring or peer review, nor are they regulated by professional bodies. There are safety concerns surrounding the accuracy and reliability of material offered on apps, especially since the public is not equipped to critically evaluate the information presented. Difficulties also arise when the user has multiple moles or lesions and a full body examination is required.

Additionally, when patients photograph their own lesions, the lack of a smartphone dermatoscope will limit the level of detail that can be obtained. Factors including poor contrast and brightness and skin hairs covering the mole can negatively influence photographs. False negatives can delay treatment, while false positives caused by non-cancerous pigmented lesions such as seborrheic keratosis can cause unnecessary anxiety.

Although teledermatology can be used to triage, there are no rigorous UK-based trials to confirm that teledermatology is as effective as a face-to-face consultation with a dermatologist, especially since teledermatology does not provide the opportunity for a full body examination by a dermatologist (British Association of Dermatologists, 2010).

The future

The combination of developing technology and demand for dermatological care will continue to lead to the growth of teledermatology and integration of artificial intelligence. The regulated integration of artificial intelligence provides great opportunity for diagnosis and optimizing patient care, ensuring that subtle pathological signs are not missed.

In a recent TEDMED talk, Greg Corrado, co-founder of Google Brain and Principal Scientist on Google's Artificial Intelligence Healthcare team estimated that artificial intelligence is likely to be 'as important in medicine in the next 100 years, as antibiotics were in the last.'

Apps available for public download require regulation before they can be endorsed by professional bodies. Further UK-based research into the efficacy, acceptability and economic viability of teledermatology is also required before it can be recommended and implemented as a widespread method for skin cancer triage, where some patients are not seen by secondary care (British Association of Dermatologists, 2010).

Conclusions

To avoid harm to users, apps should be reviewed to ensure that they do not deceptively claim accurate diagnosis or calculation of melanoma risk and that scientific evaluation of apps is publicised.

Patient consent to photographic documentation, safe encryption of images and strict adherence to European guidelines on information collection is central in teledermatology. As per the British Association of Dermatologists (2010) recommendations, teledermatology should be used where clinical governance applies to the team and the primary–secondary care system is highly integrated.

Technological advances in dermatology offer great opportunity for improved patient care. However, technology can currently supplement but not substitute for standard medical care. **BJHM**

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KEY POINTS

- Dermatology applications available for public download are on the rise.
- Apps vary from educational and prevention based, to diagnostic and treatment based.
- Studies have shown artificial intelligence to be as effective as dermatologists at diagnosing melanoma.
- The risks of false negatives, inaccurate information and false claims made by apps can endanger the public.
- There are concerns regarding the lack of regulation, specialty input, peer review and ongoing monitoring of apps.
- Teledermatology services are being implemented around the UK with further expansion predicted, but further UK-based studies are required to assess their overall effectiveness.
- The British Association of Dermatologists emphasizes the need for patient consent and safe image encryption databases.

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