The digital age of melanoma management: detection and diagnostics

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Practice points

- Software-enabled smartphone applications (apps) have been developed to assess the likelihood that a lesion is a malignant melanoma. The performance of these applications is currently low, but may improve in the near future.
- Teledermatology services allow patients to send images of suspicious lesions to dermatologists. Patients typically receive physician input more quickly than in-person care, and can be triaged rapidly. This development has the potential to reduce the time between lesion identification, diagnosis and treatment.
- Physician-directed melanoma detection using advanced software and imaging has the potential to improve prebiopsy diagnostic accuracy. In addition to established technologies such as total body photography, novel imaging modalities such as high-frequency ultrasonography and Raman spectroscopy have shown promise.
- Genomics has the potential to identify individuals at higher risk for melanoma development in order to better target early intervention. More than 33 single nucleotide polymorphisms associated with melanoma development have been identified, as have genes associated with familial melanoma syndromes.
- Technologies have been developed to aid in the histopathological diagnosis of melanoma based on the genetic profiles of pathological specimens, which may soon improve diagnostic accuracy.
- Tumor genetics panels have been developed to differentiate the metastatic potential of low-stage melanomas, which provides the potential to guide treatment decisions and improve patient outcome.
- The recent technological developments in melanoma detection and diagnosis are promising, and many have the potential to improve patient outcomes and reduce healthcare costs.

New technologies are increasingly impacting the way melanoma is detected and diagnosed. Devices, software and diagnostics abound, ranging from smartphone applications that purport to predict which lesions are likely to be malignant, to genomic analysis of low-stage melanomas to predict metastatic risk. The purpose of this review is to concisely update practitioners on the research behind the latest tools available for melanoma detection and diagnosis, as well as the implications of these technologies for melanoma management.

Background

Is the digital age of melanoma management upon us? Since the introduction of the hand-held polarized light dermatoscope in the early 2000s, which enabled practitioners to visualize the pigment network of a melanocytic lesion, new technologies are increasingly impacting the way patients and physicians detect, diagnose and manage melanoma. Now, a range of devices, software and diagnostics abound, ranging from smartphone applications that purport to predict which lesions

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are likely to be malignant to genomic analysis of low-stage melanomas to predict metastatic risk.

Given that early detection and diagnosis of melanoma is a critical factor in guiding prognosis and treatment decisions, advances in this area are welcome. However, the broad range technological advances in melanoma available to both patients and providers can make it difficult to determine which technologies are established, which are emerging and which are likely to emerge, as well as the clinical evidence behind each. The purpose of this article is to concisely update practitioners on the research behind the latest tools available for melanoma detection and diagnosis, as well as the implications of these technologies for melanoma management.

Detection

Inexpensive technologies that can enhance melanoma self-detection and improve triage are welcome. The medical community has largely moved away from the American Medical Association's 2001 'Trust you doctor, not a chat-room' [1] philosophy to recognize that knowledge-empowered patients are valuable members of the care team [2]. However, it is essential to protect our patients from the pitfalls of self-diagnosis.

More than half of all Americans own a smartphone equipped with the ability to transmit high-quality images, audio and video [3]. Smartphones are increasingly being used for health education and monitoring, and smartphone software applications (apps) have relevant to melanoma been developed. These apps have features that range from educational information about melanoma and self-skin examination techniques to apps that utilize an image of a patient's skin lesion to provide a software-enabled assessment of the probability that the lesion is a malignant melanoma. Here we focus on those with the most clinical impact: 'self-diagnostic' and teledermatology apps.

• Self-diagnostic apps

Self-diagnostic apps typically utilize the smartphone's camera functionality, and their internal software either detects a pigmented lesion automatically when held over the skin or analyzes to a photograph input by the patient [4]. These applications use proprietary image analysis algorithms that include border detection, fractal analysis [5] and color pattern-recognition to produce a risk prediction [4]. While self-diagnostic

apps provide patients with an assessment as to the likelihood of whether or not a pigmented lesion is a melanoma, they describe themselves as 'educational' and recommend that patients seek medical attention for any concerning skin lesion, regardless of the app's prediction. These apps are not US FDA approved, and it is not always clear how their software develops a melanoma risk prediction. Additionally, it is not always clear which apps have had their test characteristics compared with the gold standard of a board-certified dermatologist's evaluation. Furthermore, these apps differ substantially from telemedicine apps in that no board-certified dermatologists or other physicians are consulted in the process.

Currently available melanoma detection apps offer low performance. A 2013 comparison study of the three leading self-diagnostic apps found that all incorrectly classified 30% or more of melanomas as 'unconcerning' [4]. The apps were found to have sensitivities ranging from 6.8 to 70%, and specificities ranging from 39.3 to 93.7% [4]. However, new algorithms are currently being developed that may improve the accuracy of these devices. A recent algorithm designed for smartphone implementation produced a sensitivity of 73% and a specificity of 83% in detecting melanoma as compared with histopathology, versus 88 and 97%, respectively, for a board-certified dermatologist [5].

The poor performance of these apps is concerning from a patient safety perspective. Self-diagnostic apps are being largely unregulated by the FDA, though the FDA has taken steps toward oversight of some nondermatological medical smartphone applications [6]. Though self-diagnostic apps typically present disclaimers that they should be used solely for educational purposes, it is not unforeseeable that patient self-reliance on poor-performing apps could delay the diagnosis of melanoma. Recently the Federal Trade Commission (FTC) has taken false-advertising action against two melanoma self-diagnostic app makers, MelApp and Mole Detective [7]. The FTC has proposed settlements with the firms that will prevent claims that 'any device detects or diagnoses melanoma or its risk factors, or increases users' chances of early detection, unless the representation is not misleading and supported by competent and reliable scientific evidence in the form of human clinical testing of the device' [7]. The FTC's actions are a welcome step, and regulation to ensure diagnostic quality is essential for this field.

Despite the poor performance of currently available self-diagnostic apps, it is possible that future iterations could produce systems with comparable performance to in-clinic software-enabled methodologies [8]. Developments in this area may result in patients reaching oncologists faster, which has the potential to improve outcomes. Further study in this area is encouraged, as more accurate software-enabled lesion assessments have the potential to improve triage and reduce healthcare utilization.

• **Teledermatology apps**

Teledermatology has been the subject of interest within the healthcare community for many years [9]. It has demonstrated utility in patient care [9], triage [10], as well as skin cancer screenings [11] and other uses [12]. Research-setting comparisons of teledermatology care versus in-person care have shown high levels of diagnostic agreement (64–88%) [13,14], acceptable patient satisfaction [13,15] and reduced healthcare utilization [10,16]. Given the shortage of dermatologists [17], the importance of medical cost-minimization, and the visual nature of the specialty, teledermatology has the potential to become an important component of skin cancer screening, triage and management [15].

Smartphone apps offering teledermatology services that can be used for melanoma detection have recently become available [18]. Speed of access, convenience and lower costs are likely drivers of the growth in this area. A 2013 study found eight direct-to-patient teledermatology apps available across smartphone platforms [19]. For a cash fee, these apps either allow patients to submit photographs of lesions which are asynchronously evaluated by a dermatologist, known as a ‘store-and-forward’ model, or allow a patient to communicate in real-time video with a dermatologist, known as ‘live interactive’ model, or allow a combination of photographs and video, known as ‘hybrid’ model [20].

A recent study evaluating a commercially available store-and-forward teledermatology app for melanoma diagnosis revealed a sensitivity of 98.1% and a specificity of 30.4% [4]. In this trial, only one of 53 melanomas was incorrectly diagnosed as ‘benign.’ Additionally research on the viability teledermatology apps for skin cancer screening revealed an 81% diagnostic concordance between the in-person and the teledermatology physician, an acceptable similar level to computer-based teledermatology services [11].

Live interactive teledermatology services have also been shown to be effective in the diagnosis and management of numerous dermatological diseases, though work specific to melanoma is needed [21].

Teledermatology apps have the potential to provide patients in underserved communities with access to dermatology services [22]. It is currently believed that upward of 75% of teledermatology patients live in remote locations, and have incomes at or below 200% of the federal poverty level [9]. As mobile technology continues to improve and become more affordable, teledermatology apps may offer a promising way to expand board-certified dermatologist care to underserved and rural populations. Research has demonstrated that increased access to dermatological care is associated with an increased odds of early-stage melanoma diagnosis [23], though this study was limited to in-person care. However, the expansion of teledermatology should not come at the expense of in-clinic visits, which have great value in skin cancer detection and management. It is estimated that upward of 60% of melanomas may be detected incidentally, a component of care that is unlikely to occur using teledermatology [24].

• **Mobile teledermoscopy**

The field of mobile teledermoscopy for patient self-skin examination and short-term monitoring has recently gained attention. The advent of affordable, smartphone-attachable mobile dermatoscopes has driven this interest. These technologies enable patients to capture high quality images of skin lesions at very close up magnification, which can then be sent to a dermatologist for diagnosis and triage. These technologies have recently been evaluated in clinical trials as tools for the short-term monitoring of clinically atypical nevi, as well as for melanoma detection on self-skin examination.

A 2015 study on the short-term monitoring of clinically atypical nevi among patients using a commercially available mobile dermatoscope found that 97% of patients obtained baseline and follow-up images that were able to be evaluated by the teledermatologist, and furthermore, that diagnostic concordance between in-person visits and teledermoscopy was 0.87 [25]. A 2014 study assessed whether patient self-skin examinations can be performed using smartphone-based mobile teledermoscopy, both with and without an educational intervention designed

to improve self-skin examinations, and found that this technique could complement melanoma screening efforts [26]. The sensitivity and specificity of self-skin examination combined with teledermoscopy at the skin-examination level were found to be 81.8 and 89.6%, respectively [26]. However, at the individual lesion level, the specificity and sensitivity dropped to 56.3 and 41.9% [26]. Interestingly, participants both the intervention and control groups submitted and missed a similar number of lesions on self-examination, indicating that an educational intervention may not be necessary to improve melanoma screening and early detection [26].

While physicians should not expect the majority of their patients to purchase at-home dermatoscopes in the near future, it is possible that these technologies may be adopted by high-risk individuals identified either by the presence of suspicious lesions warranting frequent evaluation, a strong family history of melanoma, or a genetic profile suggesting an increased risk of melanoma. Additionally, it is conceivable that at-home dermatoscopes may become more widespread through bundling with other at-home health evaluation products, such as those containing smartphone-enabled otoscopes.

• Physician-directed detection

Novel technologies have played a major role in the noninvasive, early detection of melanoma in the last 15 years. Imaging technologies, such as dermoscopy and reflectance confocal microscopy have been shown to increase the sensitivity and specificity of melanoma diagnosis [27–29]. Digital monitoring methods, such as total body photography and mole mapping, have also provided noninvasive means to monitor lesions [30,31]. Additionally, automated, software-enabled imaging modalities, such as MelaFind (Mela Sciences, NY, USA), have been shown to have high sensitivity and specificity, and potential to aid to detection of early melanoma and identify pigmented lesions that should be considered for biopsy to rule out melanoma [8].

In addition to the biopsy decision, technological advances are being applied to assess the Breslow index for melanoma thickness *in vivo*. The applicability of high-frequency ultrasonography (HFUS) in this area has recently been studied [32]. HFUS was found to have good agreement with histology, with a correlation coefficient of 0.807 and good interrater reproducibility [32]. Not only was this method found

to be reliable noninvasive measurement technique, it was found to take approximately 1–2 min to conduct, indicating that it is feasible for use in a busy clinical setting [32].

Other imaging modalities are being developed for guiding biopsy decisions. Raman spectroscopy has recently received attention after a recent small study found that this method achieved a sensitivity and specificity of 100 and 100%, respectively, in differentiating malignant melanoma from nonmalignant pigmented lesions [33]. Larger studies of this imaging modality are needed. Optical coherence tomography (OCT) has also been proposed, but the results of the applicability of this technology are mixed, with a recent comparison versus HFUS revealing OCT has a poor level of agreement with histopathology and poor interrater reproducibility in measuring melanoma depth *in vivo* [32].

The rapid advancements in the field of detection suggest that we are moving toward a world in which suspicious lesions are identified more quickly and differentiated as benign or malignant more accurately prior to biopsy. It is not inconceivable that many of these steps will occur without a physician's involvement as direct to consumer diagnostics improve. However, these improvements in convenience and cost must not come at the expense of patient care. Researchers must work to assess the accuracy and applicability of new technologies, and regulators must ensure that these technologies are marketed appropriately. Furthermore, given the frequency of incidental skin cancer diagnoses, the value of the in-person clinical encounter must not be overlooked.

• Genomics

Genome-wide association studies (GWAS) have discovered more than 200 SNPs associated with skin disease, including 33 associated with melanoma (Table 1) [34]. Currently, few predictive genetic tests are utilized clinically in dermatology, and patients normally present to the clinic after developing disease manifestations.

Until recently, patients could directly send a saliva sample to companies for direct-to-consumer (DTC), SNP-based genomics analysis and receive purported risk assessments for melanoma development. Over 300,000 patients underwent this type of genomic analysis [35]. This field was highly controversial because the diagnostic validity and clinical utility of genomic

Table 1. SNPs associated with melanoma.

Gene	Population	SNP	RAF	p-value	OR (95% CI)	Date reported
<i>DOCK3</i>	494 European ancestry cases,	rs1031925	NR	8E-6	1.15 (1.08–1.22)	January 2015
<i>ACTRT3</i>	5628 European ancestry controls	rs13097028	NR	7E-7	1.12 (1.08–1.18)	January 2015
<i>TET2</i>		rs4698934	NR	8E-7	1.18 (1.10–1.25)	January 2015
<i>EYS</i>		rs1889497	NR	2E-6	1.15 (1.09–1.22)	January 2015
<i>TYR</i>		rs1847134	NR	6E-8	1.25 (1.15–1.35)	January 2015
<i>MC1R</i>		rs258322	NR	2E-9	1.50 (1.31–1.71)	January 2015
<i>FTO</i>	1353 European ancestry cases, 3566 European ancestry controls	rs16953002	0.17	4E-12	1.16 (1.11–1.20)	11 June 2013
<i>CASP8</i>	2804 European ancestry cases,	rs13016963	0.37	9E-10	1.14 (1.09–1.19)	10 December 2011
<i>ATM</i>	7618 European ancestry controls	rs1801516	0.87	3E-9	1.19 (1.12–1.27)	10 December 2011
<i>MX2</i>		rs45430	0.61	3E-9	1.14 (1.09–1.18)	10 December 2011
<i>TERT, CLPTM1L</i>		rs401681	0.46	3E-8	1.20 (1.12–1.28)	10 December 2011
<i>SLC45A2</i>		rs35390	0.98	2E-7	2.78 (1.89–4.35)	10 December 2011
<i>CDKN2A, MTAP</i>		rs7023329	0.51	7E-9	1.20 (1.14–1.28)	10 December 2011
<i>TYR</i>		rs1393350	0.28	2E-13	1.30 (1.21–1.39)	10 December 2011
<i>MC1R</i>		rs258322	0.11	3E-27	1.70 (1.54–1.87)	10 December 2011
<i>ASIP</i>		rs2284378	0.33	1E-7	1.21 (1.13–1.29)	10 December 2011
<i>PLA2G6</i>		rs6001027	0.65	2E-6	1.18 (1.09–1.27)	10 December 2011
<i>ARNT, SETDB1, LASS2, ANXA9, MCL1, CTSK</i>	2168 European ancestry cases, 4387 European ancestry controls	rs7412746	0.55	9E-11	1.15 (NR)	2 November 2011
<i>PARP1</i>		rs3219090	0.67	9E-8	1.15 (NR)	2 November 2011
<i>ANXA9</i>	1804 European ancestry cases, 1026 European ancestry controls	rs1722784	NR	2E-6	1.12 (NR)	7 October 2011
<i>NR</i>	156 European ancestry cases from 34 high-risk families, 2150 European ancestry controls	rs17119461	0.04	7E-12	8.40 (4.20–17.0)	20 July 2011
<i>CDKN2A</i>	1539 European ancestry cases,	rs7023329	0.50	4E-7	1.18 (1.10–1.25)	16 July 2009
<i>TYR</i>	3917 European ancestry controls	rs1393350	0.27	2E-14	1.29 (1.21–1.38)	16 July 2009
<i>MC1R</i>		rs258322	0.09	3E-27	1.67 (1.52–1.83)	16 July 2009
<i>MC1R</i>		rs4785763	0.32	6E-22	1.36 (1.28–1.45)	16 July 2009
Intergenic		rs2284063	0.37	2E-9	1.20 (1.14–1.28)	16 July 2009
<i>CDC91L1</i>	864 European ancestry cases, 864 European ancestry controls	rs910873	0.09	1E-15	1.75 (1.53–2.01)	15 November 2015

NR: Not reported; OR: Odds ratio; RAF: Relative allele frequency; SNP: Single nucleotide polymorphism.

analysis is still uncertain [36]. Additionally, studies found that disease risk predictions varied across DTC genomics companies due to differing algorithms and curations of the GWAS literature [37]. This field was unregulated until late 2013, when the FDA mandated that DTC genomics companies discontinue health prediction services until achieving medical device approval [36,38]. In February 2015 the FDA classified DTC genomic screening tests as class II medical devices and authorized DTC genomic risk predictions for Bloom Syndrome, citing that “in many circumstances it is not necessary for consumers to go through a licensed practitioner to have direct access to their personal genetic information” [39].

Given the current regulatory environment, the advancement of genomic science, and the nearly half a million patients that have received some level of assessment of their genetic risk for melanoma, physicians are likely to care for patients with questions about genomic risk predictions. Given the uncertainties surrounding DTC genomics, traditional disease risk management is still advised and current genomic information does not replace traditional risk factors such as family history and photoprotection behaviors, and is not used to guide treatment decisions [40].

• Physician-ordered genetic testing

Driver mutations have been identified in some familial melanoma syndromes, and genetic

testing for these mutations is available through multiple CLIA-certified laboratories. Mutations in the *CDK2NA* and *CDK4* genes, and more recently *POT1* gene, have been recognized as the most common mutations in these syndromes [41–44]. *CDK2NA* is the most common mutation overall, accounting for an estimated 39% of familial melanoma syndromes worldwide (20% in Australia, 45% in North America, 57% in Europe) [42]. For patients with the *CDK2NA* mutation, lifetime melanoma prevalence is approximately 80% [42].

Although the detection of germline *CDKN2A* mutations can have a huge impact in stratifying an individual's risk of melanoma, the prevalence and predictive value of these mutations is relatively low. One study suggests that the incidence of *CDKN2A* mutations among patients with multiple primary melanomas is 3% [45]. Even among patients with three first-degree relatives affected with melanoma, the probability of a *CDKN2A* gene is only between 20 and 40% [46]. Additionally, no association between *CDKN2A* or *CDK4* mutations and an increased risk of melanoma prior to age 40 years has been shown [47].

For these reasons, the Melanoma Genetics Consortium and the American Society for Clinical Oncology do not currently recommend genetic testing for melanoma in any patient outside a research setting [48,49]. This may change in the future if patients likely to have mutations can be readily identified, given the very high lifetime risk of melanoma these mutations confer.

Although mutation testing is not routinely performed for dermatological purposes, the increasing use of cancer gene panel testing, which provides simultaneous sequencing of multiple cancer susceptibility genes, may provide patients with information on gene mutations relevant to increased melanoma risk. Genes linked to an increased risk for familial melanoma have also been linked to an increased risk of pancreatic, breast, and other cancers where genetic testing is indicated [42,50–51].

For patients presenting with genetic results relevant to melanoma, current best practices are limited to those used for traditional high-risk patients: careful clinical surveillance and education on risk-reducing behaviors, such as photoprotection. A recent study suggests that patients with an increased genetic risk for melanoma may be highly receptive to physician-led education of disease-risk lowering lifestyle changes [41].

We therefore recommend that physicians utilize genetic information as a way to connect with and educate their patients.

Diagnostics

Differentiating melanomas based on metastatic risk in order to better tailor adjuvant therapy decisions is a clinical imperative. Currently, 20% of patients with the lowest risk cutaneous melanomas (stage I and II) die from this disease within 4 years of initial diagnosis [52]. While tumor thickness and node positivity are the best predictors of metastatic potential, there is limited ability to determine at the time of diagnosis which patients are likely to progress. Better prognostic information in melanoma is indicated, and prognostic information based on genetic analysis of pathological samples has already improved the management of several neoplastic diseases, including breast cancer, uveal melanoma and thymoma [53–57]. In these diseases, genomic prognostic profiles augment, rather than replace, classical clinical factors such as TNM staging.

In June 2013, Castle Biosciences introduced DecisionDX-Melanoma, a prognostic gene expression profile for the metastatic potential of stage I and II cutaneous melanoma was made commercially available (Castle Biosciences, TX, USA) [58]. This test uses a 28-gene expression tumor profile based on genes identified from multiple published studies of the genomic profiles of cutaneous melanomas [58]. One study found this test to be strongly predictive of metastatic potential in cutaneous melanoma, and more accurate than commonly utilized clinical prognostic factors, including AJCC stage, Breslow thickness and mitotic rate [52]. The study analyzed 220 stage I and II melanoma cases with 5 years or more of follow-up, and found that the algorithm predicted the risk of metastasis with high accuracy in both development (ROC = 0.93) and validation (ROC = 0.91) tumor tissue cohorts [52]. Further validation of this technology is warranted.

More work to identify the likely behaviors of low-stage melanomas is indicated. If accurate, the value of current genomic prognostic tests is limited to augmenting the decision of whether to up- or down-stage an individual patient. It is currently unknown whether tumors with different prognostic scores respond differently to adjuvant therapy, as has been demonstrated with prognostic genomic tests in breast cancer [56]. It

is hoped that these tests can someday be used to better target adjuvant therapy.

The clinical and histopathological diagnosis of melanoma is difficult, and improved accuracy is desired. Research suggests that board-certified dermatopathologists disagree on diagnoses in 14.3–45.5% of melanoma cases [59,60]. Another study found that 15.8% of atypical melanoma cases were either misdiagnosed or given an uncertain diagnosis by an internationally recognized expert panel of dermatopathologists [61]. In addition to the morbidity and mortality to patients, misdiagnosis of melanoma can have substantial ramifications to physicians. Issues related to diagnosis and management of melanoma are believed to have accounted for 13% of all US medical malpractice claims between 1995 and 2001, and melanoma is believed to be the second most common cause of malpractice litigation in the USA [62].

In late 2013, Myriad Genetics, a gene testing firm with CLIA-certified laboratories, began offering MyPath, a genetic test for melanocytic lesions that provides an assessment as to whether a lesion is benign or malignant (Myriad Genetics, UT, USA) [63]. This assessment is purported to have a sensitivity of 91% and a specificity of 90%, with 9% of total lesions studied classified as ‘indeterminate’ versus 14.8% classified as indeterminate by a board-certified dermatopathologist [64]. The test bases its recommendations on a 23 gene expression profile, and requires one representative 3–5 µm H&E slide plus 5–8 consecutive 4–5 µm unstained slides [63,64].

This test represents an encouraging potential step forward, but more research is needed, as all clinical evidence for this test has been presented at conference proceedings rather than in peer-reviewed journals. Concerns over corporate ‘stealth research,’ in which biomedical products and devices are developed based on research that is not reported the peer-reviewed literature, has recently been highlighted [65]. Additionally, it is important to note that while FDA-classified ‘laboratory developed tests’ such as this one are subject to FDA oversight, the FDA does not currently exercise regulatory authority in this area.

Conclusion

Technological advances are changing the landscape of melanoma management. Advances in smartphone technology are changing how patients evaluate pigmented skin lesions,

providing greater convenience, and expanding access to dermatological services. Improvements in the understanding of melanoma genetics are impacting our concept of which patients are at greater risk for developing disease, which lesions are likely to be malignant, and which melanomas are likely to metastasize. All of these advances suggest a future in which melanoma is increasingly detected early and diagnosed accurately, and in which patients are better monitored for disease progression.

Despite these advances, challenges still remain, and it is critical for physicians to be abreast of newly introduced technologies, regulations, practice guidelines and reimbursement rules. It is essential for patient safety that regulation of software providing purported diagnoses of melanoma to patients without physician oversight be developed. Additionally, while digital care has the potential to expand access to patients, the importance of the in-clinic visit in the early detection of melanoma must not be overlooked. Furthermore, research is needed on the value and applicability of diagnostic and prognostic aids in melanoma, as these technologies are relatively new and loosely regulated. Finally, the importance of disease prevention must be highlighted, and public education efforts on the gravity of melanoma, the importance of photoprotection and the benefits of professional skin checks must continue.

Future perspective

Many devices, software and diagnostics that seek to improve the detection and diagnosis of melanoma now exist. While most of these tools are early in their development, practitioners should anticipate an increasing role of technology in melanoma management. These technologies have the potential to improve patient outcomes in melanoma and reduce healthcare costs. Additional study is needed to assess and confirm the clinical utility of these digital tools.

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