VIEWPOINT

Effects of Photographic Image Processing in Dermatology

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High-quality and high-fidelity clinical photographs are critical in dermatology. Studies have shown that photograph quality is related to decision-making utility and diagnostic certainty.[1,2] Integration of smartphone-captured digital images into dermatology practice has provided new opportunities and challenges, as smartphones have become essential tools for capturing and transmitting images. Automatic editing features, nearly universal in smartphones, are intended to improve image quality. Similarly, the inclusion of smartphone-captured images in the electronic health record (EHR) offers the opportunity to capture clinical examination findings in perpetuity and share images with other practitioners. Given the importance of digital images in dermatology, the question of what impact these technologies have on the quality and utility of clinical images in dermatology should be explored.

The Role of Smartphones in Dermatology

In a recent study, approximately 73% of dermatologists reported regularly using a smartphone to photograph patients in clinic.[3] Smartphone cameras allow for high-quality photos to be taken without significant photography skills or the need for specialized cameras. Users, however, should be aware of the technological nuance of smartphone image capture and how it impacts image veracity. Smartphones lack the larger sensors, lenses, and other hardware that digital single-lens reflex (DSLR) and mirrorless interchangeable-lens cameras use to capture images. To make up for their limited hardware, modern smartphone operating systems automatically adjust images to produce more satisfactory photos.[4] While specifics vary between models and manufacturers, smartphone processing tends to make details appear sharper, tones warmer, and colors more saturated.[4,5] Layering of multiple images (known as high dynamic range) into a single photograph is used to increase the contrast between portions of the image.[4,5] These behind-the-scenes automated editing practices help nonexpert photographers capture clearer images, but they could pose problems in dermatology if the photographs no longer accurately portray real life. Editing features designed to smooth images may mask or obscure clinical findings, while enhancement of certain features could make skin findings appear unrealistically exaggerated.[4]

Digital Imagery and the EHR

Clinical photographs are subject to quality loss after any upload or transfer across platforms, including integration into EHR systems.[6] Many technology platforms automatically apply image file compression, trimming metadata and resolution to optimize for quicker uploads, less storage space, and faster image viewing.[4] However, image compression deletes data from the original file and, thus, often reduces resolution and blurs fine details.[6] Many processes play a role in the image quality degradation, including lossy compression (discarding data to decrease file size), generation loss, and metadata stripping.[6] Even when original images are high quality, the act of uploading, compression, and display in the EHR can diminish color accuracy, sharpness, and diagnostic detail; this is especially problematic in dermatologic contexts where subtle textural and color nuances are often critical. After image file quality is degraded, restoring lost details is impossible.

Optimizing Digital Imagery Applications

If desired, clinical photography can be done in a manner that avoids all automatic smartphone photograph editing. Third-party smartphone apps allow photographs to be taken as RAW files, providing an image file that is free of automatic editing. However, care should be taken to ensure that such apps are Health Insurance Portability and Accountability Act (HIPAA) compliant and do not compromise patient privacy. Of note, any use of a smartphone for clinical photography raises important questions regarding patient privacy. A traditional DSLR camera could be also used instead of a smartphone camera. However, use of a DSLR camera or RAW photography requires greater technical skill and may result in poorer image quality with an untrained photographer. As highlighted in a recent article,[7] standardized clinical photography protocols can optimize image quality and reproducibility by reducing variables such as lighting, contrast, and distance. While not a replacement for proper photographic technique, smartphone image processing may often improve image quality for the novice photographer by offsetting some detrimental image factors.

When uploading images into the EHR, practitioners should be aware that the quality and recoverability of their original image will be essentially lost. Care should be taken to ensure that an original, unadulterated image file be maintained in a HIPAA-compliant format, ideally in a high-quality format such as TIFF (larger file, uses less compression). When uploading to a computer, users should ensure that their smartphone is set to transfer full-resolution images (not thumbnails) to ensure that the highest possible image quality is maintained. File transfer methods that are more prone to image degradation, such as email, should be avoided. The **Figure** shows the substantial differences in image quality that can occur with changing the image processing method or after EHR upload.

Conclusions

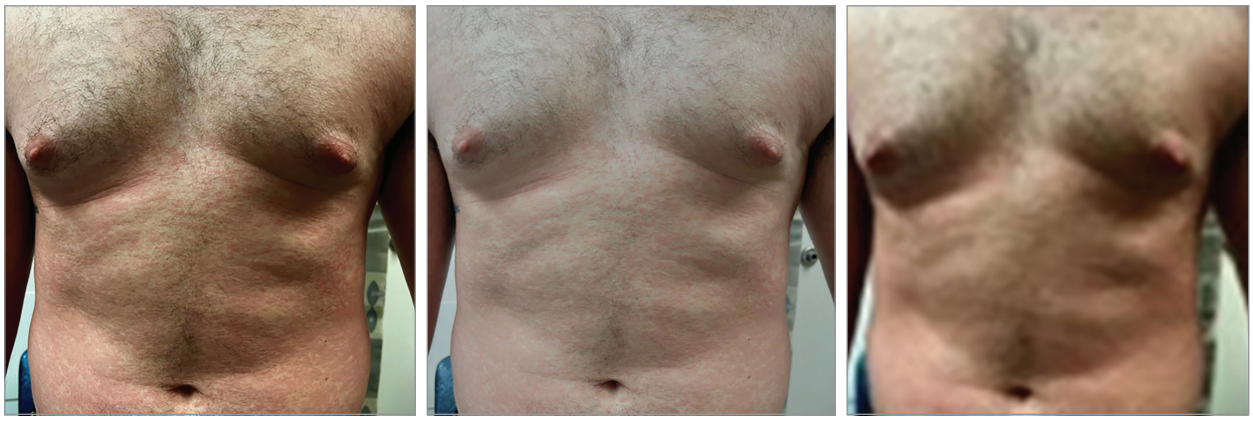
The use of digital images in dermatology has become ubiquitous and generally provides value for patients and practitioners. However, the impacts of automatic editing features of smartphone cameras and the image compromise inherent to inclusion in the EHR are relatively unknown to most dermatologists and can be substantial. We believe that the automatic photograph editing done by modern smartphones tends to improve image quality

Figure. Images of a Morbilliform Rash

A Default smartphone camera function with standard processing

B Unprocessed, RAW image

C Postupload image



Photographs were taken using the same iPhone 14 camera (Apple). A, Standard processing corrects suboptimal lighting, improves color, and improves the perceptibility of the lesion. B, Captured with a third-party camera app. C, Image in panel A following upload to a commercially available electronic health record.

compared with RAW images and that upload to an EHR tends to degrade the image. If changes are substantial enough, this could impact clinical decision-making, lesion monitoring, or use for educational purposes. We encourage the inclusion of a disclaimer in the EHR when clinical images are included, stating whether or not they have undergone automatic smartphone editing, and discouraging uploaded digital image use in diagnosis or treatment decisions. To our knowledge, no research exists on the potential impact of these technologies in dermatology. Further research is necessary to assess the potential benefits and consequences of automated digital image alterations to allow dermatologists to optimize use of clinical photography.

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