

Smartphone use risks eye examination misdiagnosis

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Clinicians who use smartphones to capture photographs of patients' eyes risk misdiagnosis if they base their decisions on objective data extracted from non-calibrated cameras, according to new research published this week in the *Nature* journal *Scientific Reports*.

Clinicians increasingly use smartphones in conjunction with ophthalmic imaging equipment, such as the eyepiece of a slit lamp, because of their portability, ease of use and relative low cost. The connectivity also allows for upload to the cloud, which is useful for telemedicine—the remote diagnosis and treatment of patients using telecommunications technology—and artificial intelligence applications that store thousands of images from different institutions.

Eye examinations to look for redness in the eye can indicate a variety of conditions including conjunctivitis, dry-eye disease and tear-gland dysfunction. However, [camera](#) colour sensors vary and as a result, images of the same eye may appear different depending on the model of smartphone used.

Researchers from Anglia Ruskin University's Vision and Eye Research Institute took 192 images of eyes using three smartphone cameras, two different lighting levels and two zoom levels (x10 and x6). The images were duplicated and one set was white balanced and colour corrected (calibrated) and the other left unaltered.

The researchers took photographs in autofocus mode with the iPhone 6s,

the Google Nexus 6p and the Bq Aquaris U Lite, and found that the iPhone results were significantly different from the other two devices, when computing relative redness of each eye, and when compared to a clinician's diagnosis. However, when the images were calibrated, the differences between lighting levels and camera types were significantly minimalised—with differences between smartphones reduced by approximately 30%.

Lead author Carles Otero, of Anglia Ruskin's Vision and Eye Research Institute said: "The use of smartphones in conjunction with ophthalmic equipment is becoming more and more widespread. Using smartphones is convenient and portable, meaning there's no need to carry bulky equipment between sites.

"However, this is the first time that the performance of three different [smartphone cameras](#) were evaluated in the context of a clinical application. Camera manufacturers have their own autofocus algorithms and hardware specifications, and this means different cameras can produce different results for the same scene. It is important that clinicians bear this in mind.

"Our results show that while the clinician's subjective evaluation was not affected by different cameras, lighting conditions or optical magnifications, calibration of a [smartphone](#)'s camera is essential when extracting objective data from images. This can affect both telemedicine and artificial intelligence applications."

More information: Carles Otero et al, Comparison of different smartphone cameras to evaluate conjunctival hyperaemia in normal subjects, *Scientific Reports* (2019). [DOI: 10.1038/s41598-018-37925-5](https://doi.org/10.1038/s41598-018-37925-5)

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