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PURPOSE

- Safe methods for evaluation of patients are needed to reduce risk of transmission
- COVID-19 has changed the way ophthalmologists practice medicine
- In the hospital, many patients with COVID-19 infection need evaluation
- These techniques can be used for patients with any airborne pathogen

METHODS

Two solutions were developed for viewing and imaging patients with airborne communicable disease.

1) The first solution was a custom indirect ophthalmoscope barrier shield consisting of a 3D printed bracket and laser cut shield.

• The shields were mounted using a rubber band fastening device to allow easy removal and cleaning. The bracket spaced the shield from the user to prevent fogging and heat generation. The central aperture allowed an unobstructed view of the retina.

2) The second solution was a hand-held off the shelf portable fundus camera (Optomed Aurora IQ) used with a Controlled Air-Purifying Respirator (CAPR) (MaxAir) for providers examining patients in negative pressure rooms. Clinical viability was assessed with a survey completed by providers.

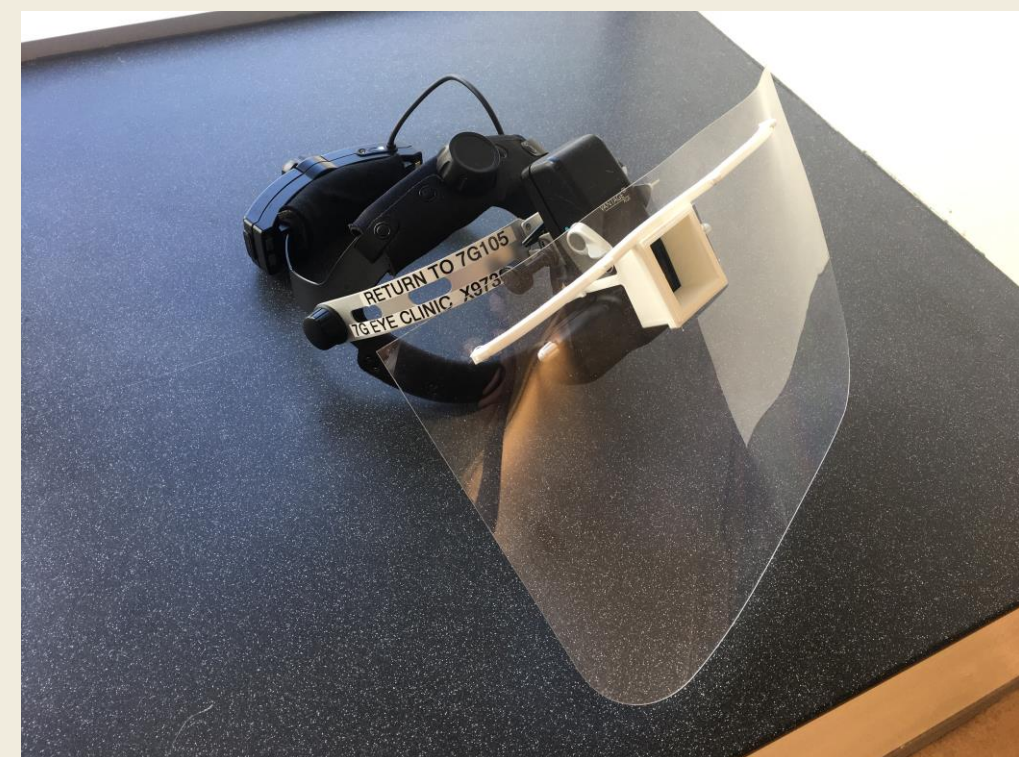


FIGURE 1: Custom indirect ophthalmoscope barrier shield



FIGURE 2: Portable fundus camera

RESULTS

Providers completed the survey after use. 2 providers used the indirect barrier shield to complete the survey. They found:

- No fogging obscured view of the retina.
- Ergonomically, the provider was able to maneuver and perform indirect ophthalmoscopy to the periphery.
- Spacing of the shield allowed use with a N95 and prevented heat buildup.

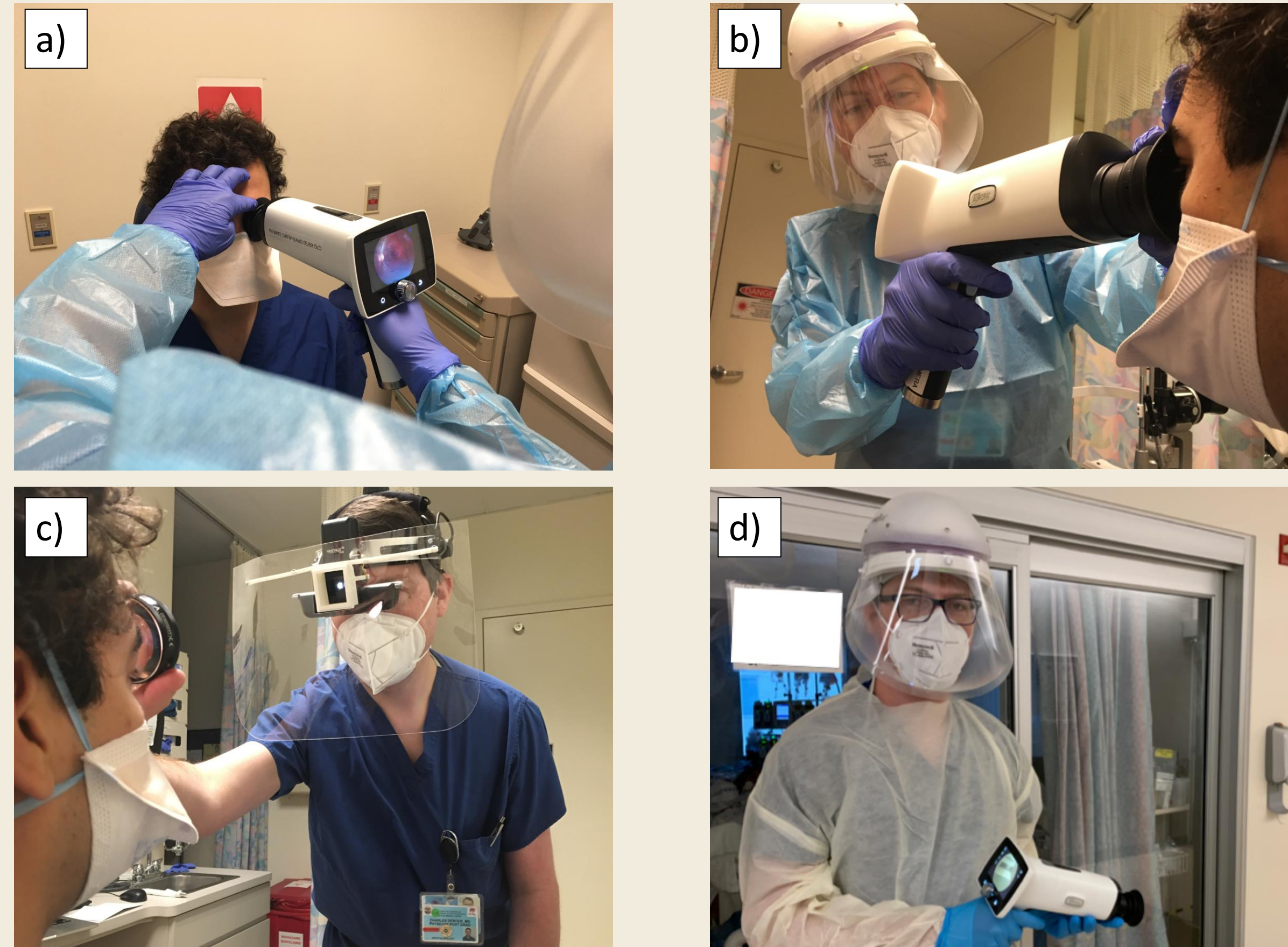
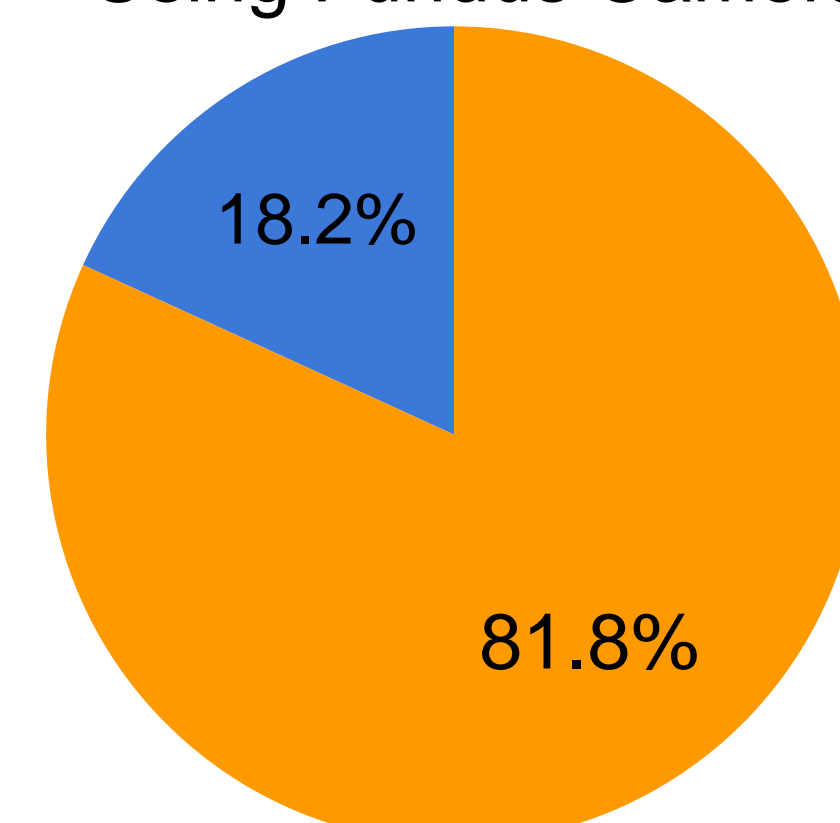


FIGURE 3: a) and b) Using fundus camera in clinic, c) using indirect ophthalmoscope barrier shield in clinic, d) using fundus camera in the ICU 11 providers were using the fundus camera

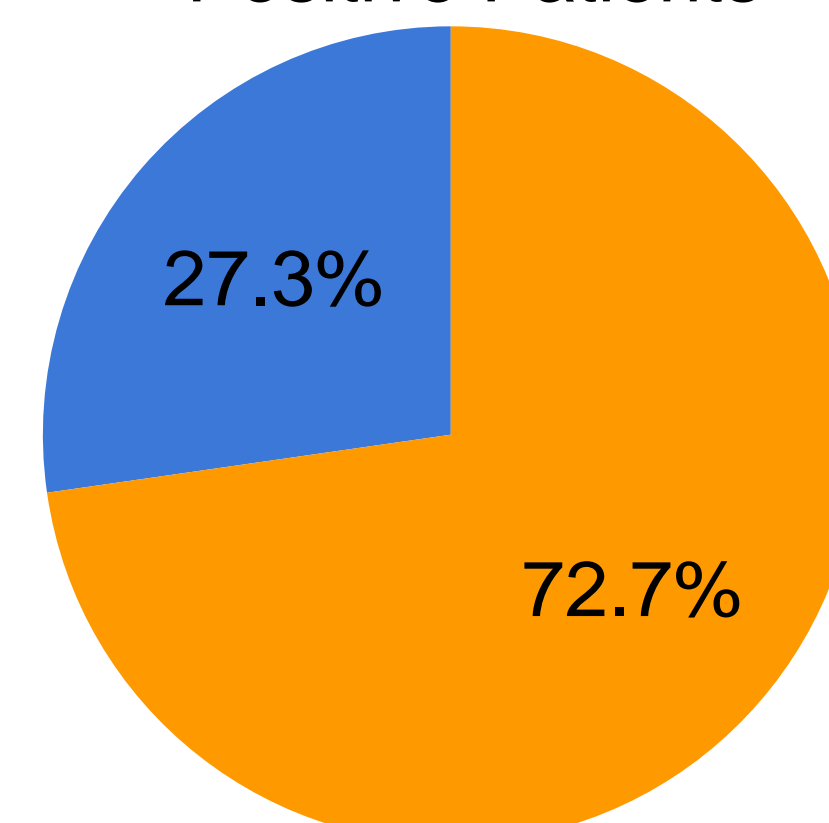
- 82% of providers could view to the mid-peripheral retina with the camera
- 73% of providers used the camera for viewing COVID positive patients
- 27% of providers used a CAPR with the fundus camera
- Other reasons for use included documentation of examination and retinal examination without requiring dilation of pupils.

Retinal Field of View Using Fundus Camera



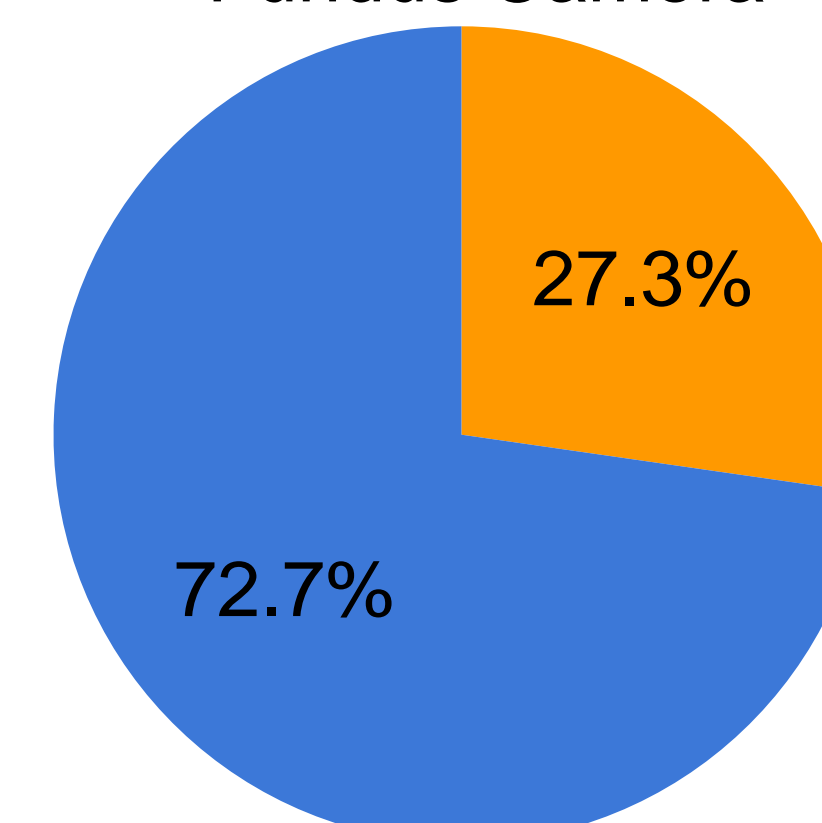
● Was limited to mid periphery
● Allowed full viewing of the retina

Used for COVID Positive Patients



● Yes ● No

Used a CAPR with Fundus Camera



● Yes ● No

Primary Reason for Using the Fundus Camera

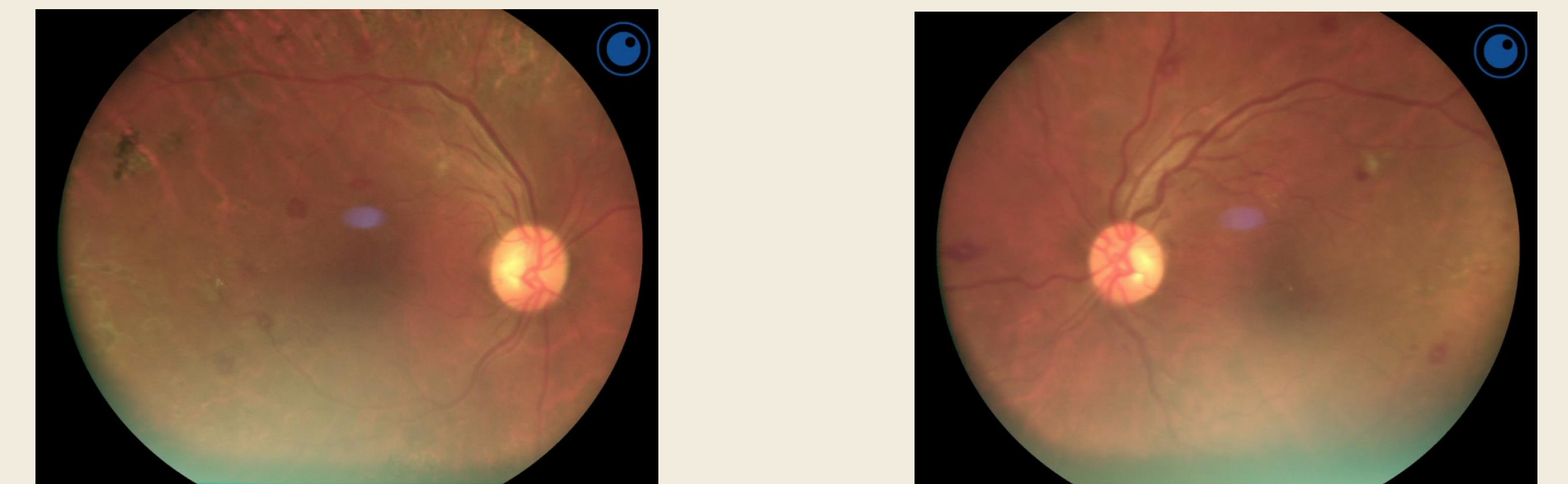
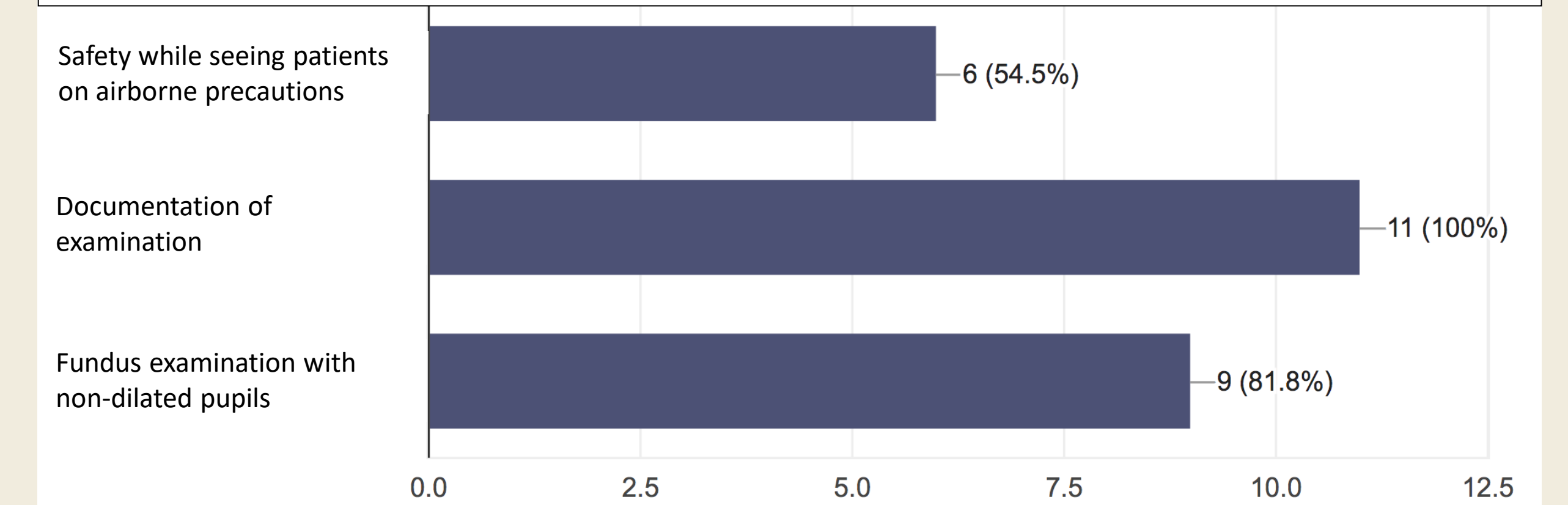


FIGURE 4: Example fundus photos from a COVID positive patient in the ICU

CONCLUSION

- 1) There is a need for improved personal protective equipment due to the spread of COVID-19. Both solutions allowed ophthalmologists to maintain airborne precautions when examining patients. The first solution was compatible with a N95 mask and provided an additional face shield. This solution allowed viewing of the macula as well as far periphery. The second solution allowed use of a CAPR, making it suitable for providers who do not fit N95 masks. Photographs of the macula and mid-peripheral retina were possible with this option and dilation was not needed for examination. However, peripheral retinal viewing was more limited compared with the first option.

REFERENCES

1. Fields, Brandon KK, et al. "3D printing novel PPE for response to COVID-19 related shortages." *16th International Symposium on Medical Information Processing and Analysis*. Vol. 11583. International Society for Optics and Photonics, 2020

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