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ABSTRACT

01323 Development of an artificial intelligence mobile phone app connected to a telemedicine platform for automatic readout of rapid diagnostic COVID-19 tests

12. COVID-19

E. Álamo [1], D. Marcos-Mencía [2], M. Rodriguez-Dominguez [3], D. Bermejo-Peláez [1], A. Mousa [1], E. Dacal [1], L. Lin [1], D. Cuadrado [1], E. Sukosd [1], A. Soto [1], B. Romero-Hernández [2], M. Luengo-Oroz [1], R. Cantón [4]

[1]Spotlab - Madrid (Spain), [2]Microbiology Service. IRYCIS. Hospital Universitario Ramón y Cajal - Madrid (Spain), [3]Microbiology Service. IRYCIS. CIBERESP. Hospital Universitario Ramón y Cajal - Madrid (Spain), [4]Microbiology Service. IRYCIS. REIPI. Hospital Universitario Ramón y Cajal - Madrid (Spain)

Background

Rapid diagnostic tests (RDTs) are being widely used to manage COVID-19 pandemic. We describe the use of a mobile app and an artificial intelligence (AI) readout system for antibody (COVID-Ab) and antigen (COVID-Ag) RDTs connected to a web telemedicine platform.

Methods

12 human sera from SARS-CoV-2 positive PCR patients with a positive ELISA test (ref.G1032;MA1032) were used. Each serum sample was serially diluted until it reached a negative result when inoculated in a COVID-Ab test. Each dilution was inoculated in 9 RDTs, 3 replicates for each of the 3 brands tested (refs.INCP-402B;ICO-T402;UNCOV-40), resulting in 434 RDTs inoculated (61 IgG+/IgM+; 166 IgG+/IgM-; 43 IgG-/IgM+; 164 negative). 12 COVID-Ag RDTs (ref.41FK10) (6+,6-) were also analyzed. Visual reading of RDTs was recorded as a reference result. An AI algorithm to read RDTs was developed. Each inoculated RDT was digitized by using TiraSpot mobile app (Spotlab, Madrid, Spain) using a total of 9 smartphone models, leading to 3566 images. From all acquired images of both COVID-Ab and COVID-Ag RDTs, we randomly selected 80% for training the AI algorithm (convolutional neural networks), while the remaining 20% were used for its validation. The area under the ROC curve (AUC), sensitivity and specificity at optimal cut-off were calculated. DeLong's test was used for comparing AUCs.

Results

For the identification of the IgG band, the AI algorithm obtained an AUC of 99.3% (sensitivity 96.6%, specificity 99.9%), while was 97% (sensitivity 90.9%, specificity 93.9%) for the IgM band. No statistically significant differences between COVID-Ab RDT kits nor different smartphones were detected. The AUC for the automatic readout of COVID-Ag RDTs was 100% (sensitivity 100%, specificity 100%).

Conclusions

The AI algorithm is equivalent to the reading achieved by trained human eyes and confers several advantages: (i) no training needed for reading RDTs; (ii) decrease the reading variability; (iii) can be potentially used with any RDT, (iv) allows quality control; (v) data can be stored safely in the cloud with patient metadata for large scale epidemiologic studies; (vi) allows deployable screening campaigns using the mobile app and (v) opens the door for the development of self-testing devices and results recording, monitoring and tracing.

Mobile app, AI algorithm and web platform.