03467 | 03467 Smartphone automatic reading of the CrAg lateral flow assay using an AI algorithm can provide quantitative results

06. Fungal infection & disease

6b. Diagnostic mycology (incl molecular)

David Bermejo-Peláez [1], Narda Medina [2], Daniel Capellán-Martín [1], Elisa Álamo [1], Miguel Luengo-Oroz [1], Juan Luis Rodríguez-Tudela [3], Ana Alastruey-Izquierdo [4]

[1]Spotlab - Madrid (Spain), [2]Mycology Reference Laboratory. National Centre for Microbiology. Instituto de Salud Carlos III - Madrid (Spain), [3]Mycology Reference Laboratory. National Centre for Microbiology. Instituto de Salud Carlos III - Madrid (Spain) & Global Action Fund for Fungal Infections - Genève (Switzerland), [4]Mycology Reference Laboratory. National Centre for Microbiology. Instituto de Salud Carlos III - Madrid (Spain) & Global Action Fund for Fungal Infections - Madrid (Spain)

Please add any third party affiliations (research group, study group etc.) for your abstract here DBP and NM contributed equally to this work.

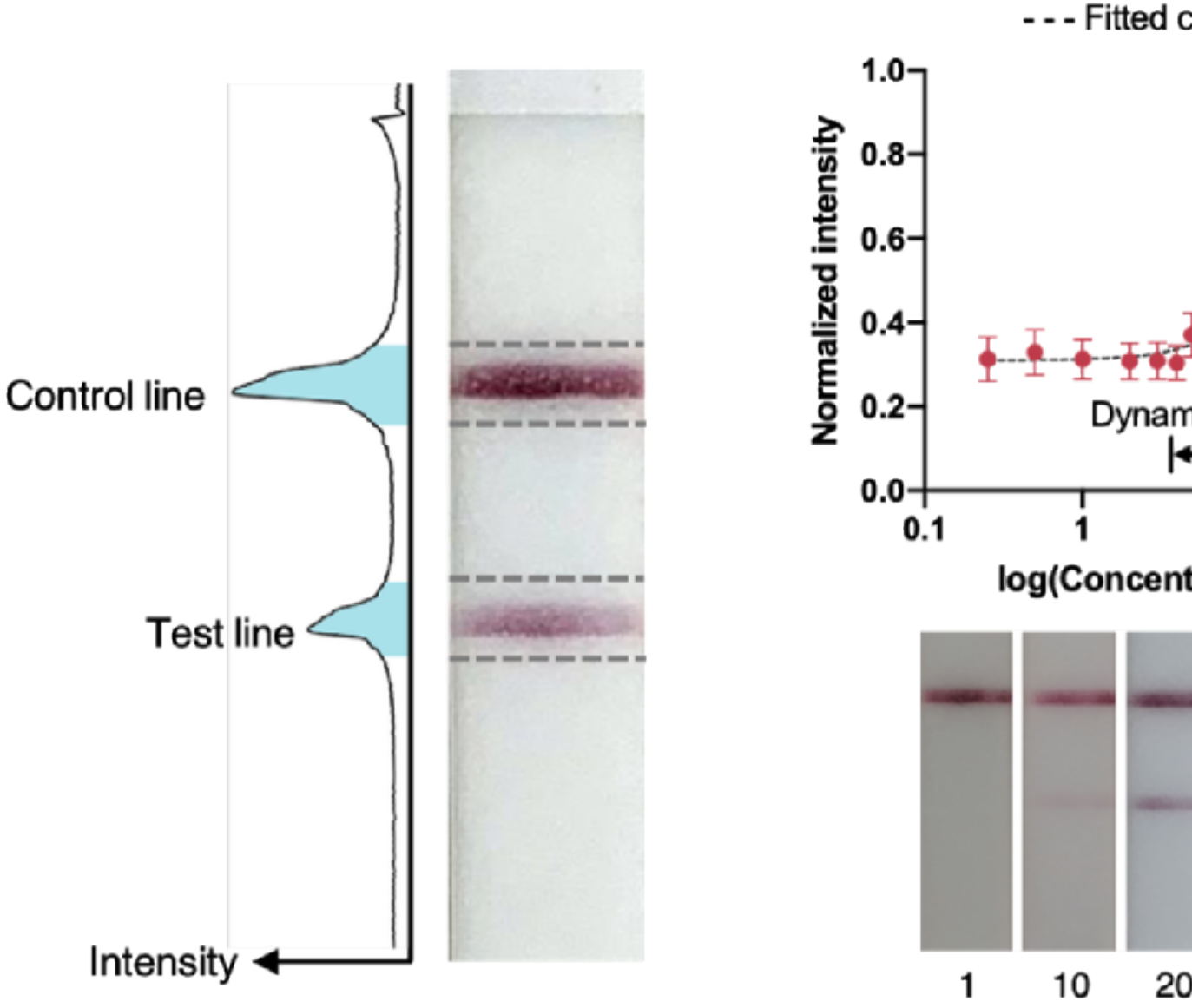
Background The cryptococcal antigen lateral flow assay (CrAg, IMMY, Norman, OK) is a point of care test (POCT) with sensitivity close to 100% and 95% specificity. WHO has recommended CrAg screening in patients with advanced HIV disease. It is used worldwide due to its unique characteristics (fast, sensitive, easy to do, and inexpensive) being considered one of the best techniques in microbiology. In addition, higher CrAg titers are strongly associated with meningitis and death. We describe the use of a mobile app and an artificial intelligence algorithm to quantify the visual signal, which relates to antigen concentration from a qualitative CrAg POCT.

Methods Thirty-six Cryptococcus antigen concentrations were tested in duplicate with the CrAg POCT. The concentrations range from 500 to 0.25 ng/ml. They were prepared from the positive control (provided by the kit) and diluted with reference human sera (Merck, Sigma-Aldrich, Madrid, Spain). Each test was digitalized using TiraSpot mobile app (Spotlab, Madrid, Spain) using three different smartphone models, leading to 514 acquired images. An AI algorithm to read CrAg POCT was developed. Each image was processed by identifying control and test lines and quantifying their intensities. In order to obtain a robust quantitative measurement, background intensity was corrected, and normalized intensity (ratio between test and control line) was calculated.

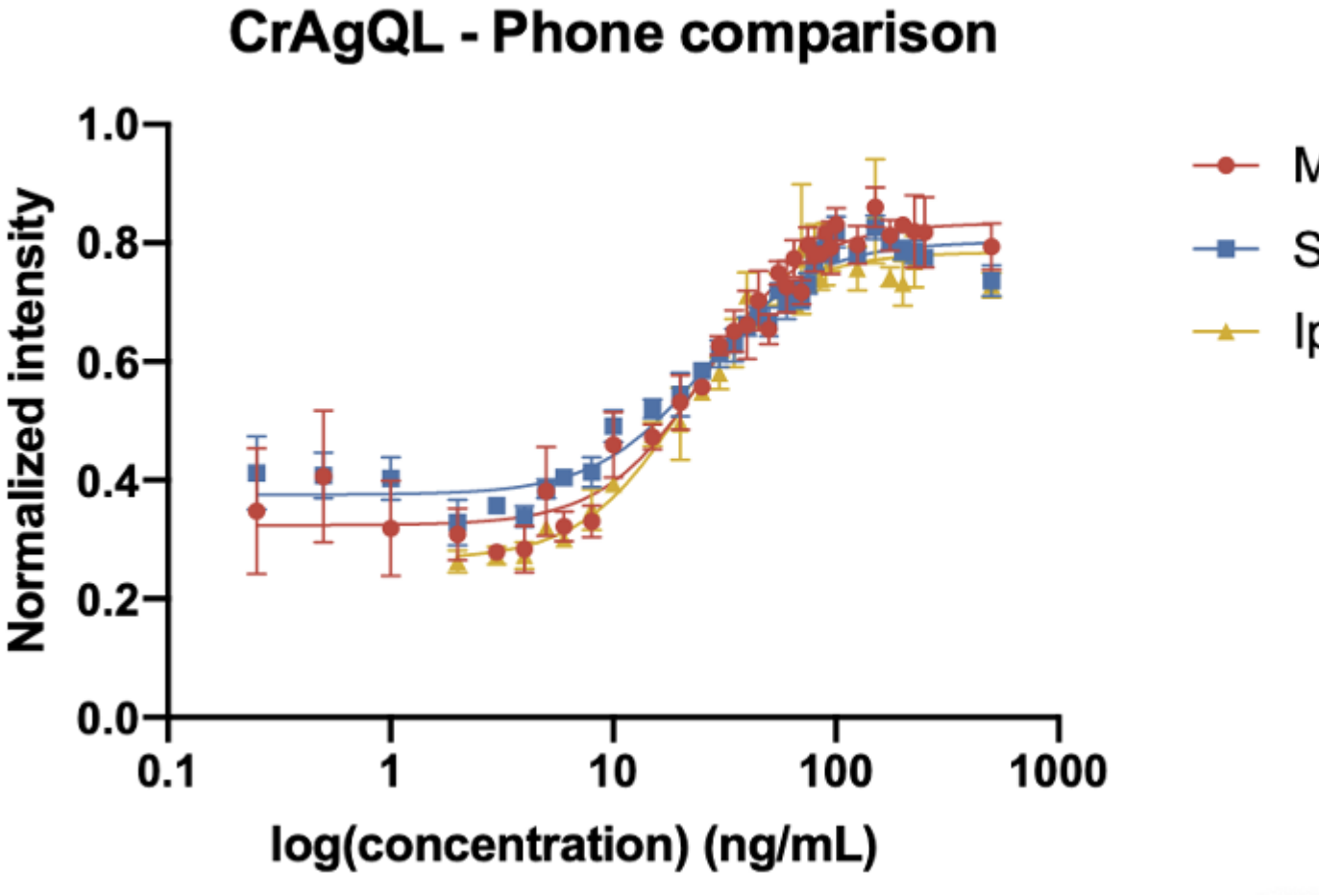
Results A logistic regression model (4PL) was used to relate the normalized intensity of the test line obtained by the algorithm, to concentration of the analyte. We found a good correlation with a R-squared of 0.985 (Fig1). The dynamic range was found to be from 4 to 100 ng/ml. No significant differences between smartphones were appreciated (Fig2).

Conclusions The AI-based readout system was able to quantify the signal obtained showing good correlation with the concentrations tested. Differences between smartphones used were no significant. This approach has several advantages as reduces the reading variability, data can be stored safely in in the cloud for large scale epidemiologic studies, but more notably it provides a quantitative result that could be potentially used to define likelihood to develop cryptococcal meningitis, directing to CSF testing, adjusted antifungal treatment and consequently improving patient survival.

Relation between LFA signal and concentration.



Fitted curves for different smartphones.



Conflicts of interest

Other support (please specify)
DBP, DCM, EA and MLO work for Spotlab. The rest of the authors declare no competing interests.