

# **Supplementary Material**

## **Using artificial intelligence-assisted retinal imaging devices operated by non-specialist workers in detecting diabetic retinopathy in Sri Lanka**

Nilmini Wijemunige, Moditha Madhuwanthi Dissanayake, Tanya Vimarshani Gamage, Hasitha Rajakaruna, Pavithra Maniyangamage, Niroshani Wisidagama, Malinda De Silva, Manjula D Nugawela, Mapa Prabhath Piyasena, Sobha Sivaprasad, Sarath Samarage, Shanti Dalpatadu, Ravindra Prasan Rannan-Eliya.

**Table S1 Proportion of ungradable eyes captured by each subgroup of image capturer, before and after dilation**

| Image capturer characteristic        | Pre-dilated |            |             | Post-dilated |            |             |
|--------------------------------------|-------------|------------|-------------|--------------|------------|-------------|
|                                      | Individuals | N          | %           | Individuals  | N          | %           |
| <b>Sex</b>                           |             |            |             |              |            |             |
| Male                                 | 7           | 142        | 38.0        | 7            | 148        | 10.1        |
| Female                               | 5           | 96         | 32.3        | 7            | 90         | 10.0        |
| <b>Image capturer qualifications</b> |             |            |             |              |            |             |
| Medical student                      | 10          | 200        | 35.5        | 10           | 208        | 11.1        |
| Medical graduate                     | 2           | 36         | 33.3        | 2            | 18         | 5.6         |
| Non-medical graduate                 | 0           | 2          | 100.0       | 2            | 12         | 0.0         |
| <b>Image capturing experience</b>    |             |            |             |              |            |             |
| < 40 images during pilot             |             |            |             | 6            | 88         | 6.8         |
| ≥ 40 images during pilot             |             |            |             | 8            | 150        | 12.0        |
| <b>Total</b>                         | <b>12</b>   | <b>238</b> | <b>35.7</b> | <b>14</b>    | <b>238</b> | <b>10.1</b> |

*Notes:* No statistically significant differences found between image capturer category levels using Fisher's exact test.

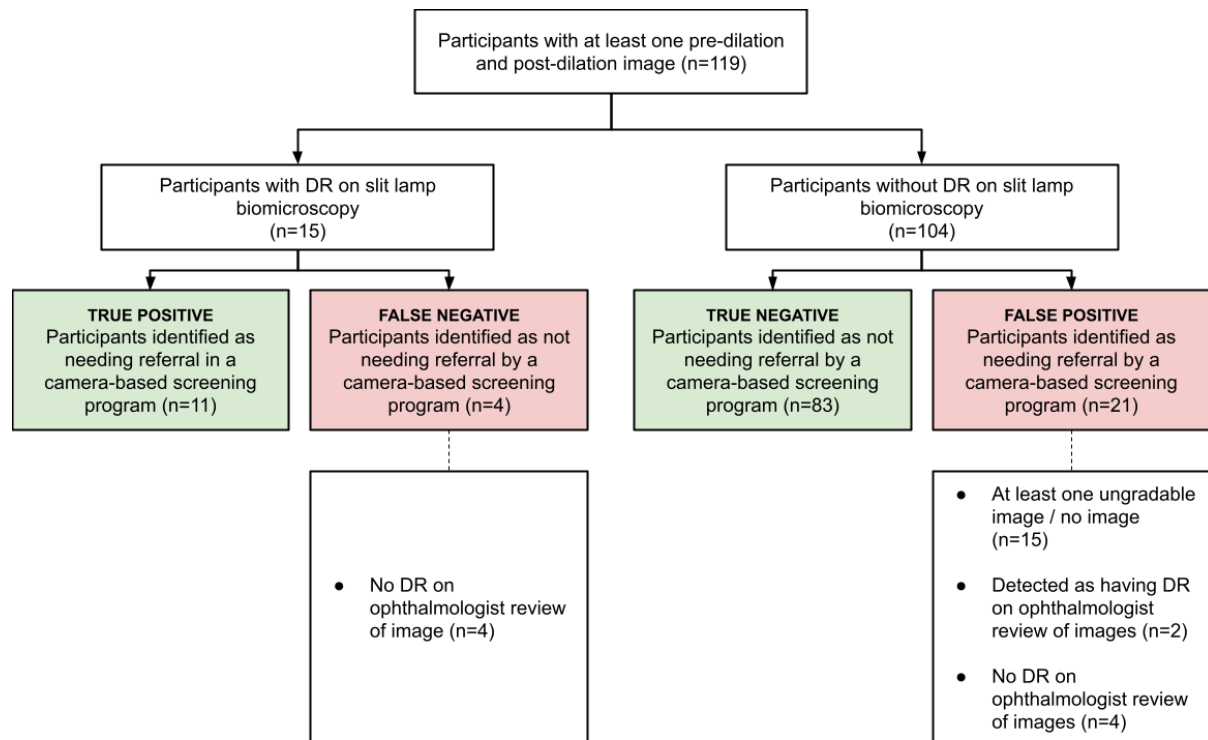
**Table S2 Odds of ungradable eyes captured by each subgroup of image capturer, before and after dilation**

| Predictor                         | Pre-dilated eyes    |          |     | Post-dilated eyes   |          |
|-----------------------------------|---------------------|----------|-----|---------------------|----------|
|                                   | Odds Ratio (95% CI) | p-value  |     | Odds Ratio (95% CI) | p-value  |
| Participant characteristic        |                     |          |     |                     |          |
| Age (per year increase)           | 1.1 (1.0–1.2)       | 0.004    | **  | 1.1 (1.0–1.3)       | 0.114    |
| Female (ref: male)                | 0.4 (0.1–1.5)       | 0.157    |     | 1.9 (0.2–14.8)      | 0.56     |
| Cataract (ref: no cataract)       | 4.8 (0.8–30.6)      | 0.094    |     | 2.1 (0.2–24.6)      | 0.559    |
| Poor visual acuity (ref: good VA) | 1.9 (0.6–6.3)       | 0.305    |     | 4.6 (0.6–37.7)      | 0.154    |
| Image capturer characteristic     |                     |          |     |                     |          |
| Female (ref: male)                | 0.6 (0.2–2.3)       | 0.447    |     | 1.0 (0.1–7.8)       | 0.154    |
| Medical student                   |                     |          |     | 1.9 (0.0–89.8)      | 0.753    |
| (ref: medical graduate)           | 2.1 (0.3–13.6)      | 0.453    |     |                     |          |
| Non-medical graduate              |                     |          |     | 1.0 (0.0–0.0)       | -        |
| (ref: medical graduate)           | 1.0                 | -        |     |                     |          |
| Constant                          | 0.0 (0.0–0.0)       | 0.001    | *** | 0.0 (0.0–0.1)       | 0.014    |
|                                   |                     |          |     |                     | *        |
| Random effects                    |                     |          |     |                     |          |
| Level                             | Variance (SE)       | 95% CI   |     | Variance (SE)       | 95% CI   |
| Cluster-level variance            | 6.3 (3.3)           | 2.2–17.8 |     | 9.4 (49.5)          | 1.8–49.5 |
| (individual)                      |                     |          |     |                     |          |

**Table S3 Diagnostic test accuracy of camera in detecting referable DR using alternate protocols**

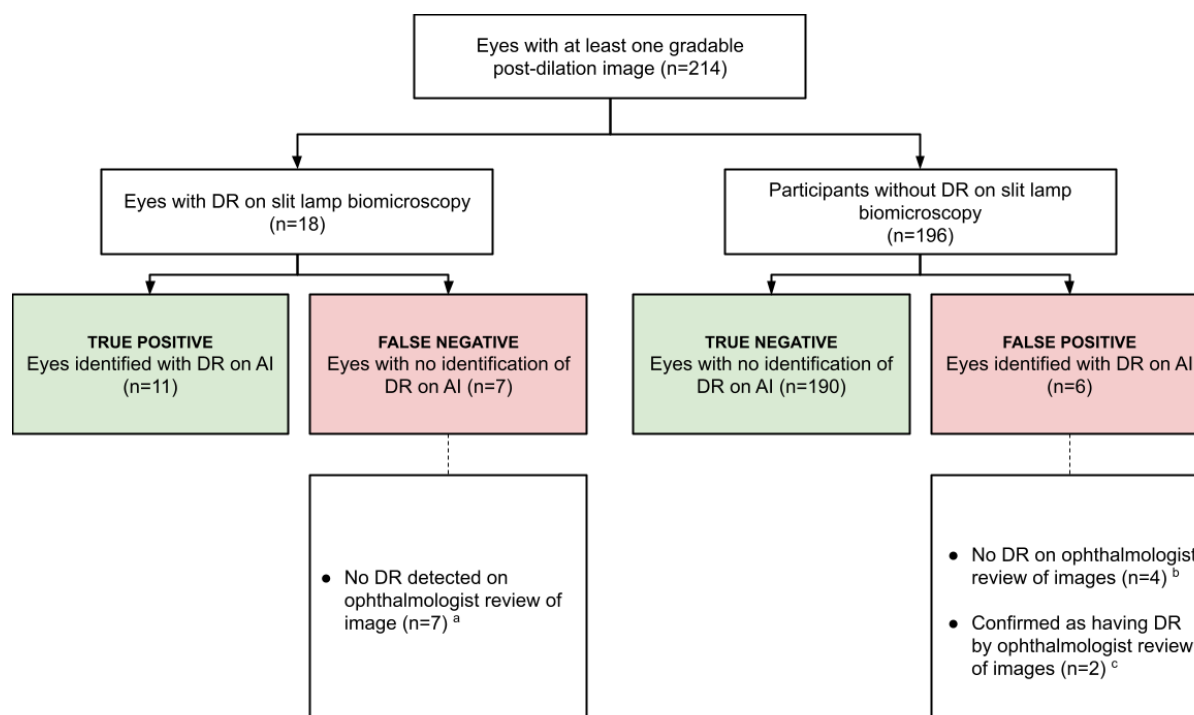
| <b>Performance in:</b>                                                                                                                            | <b>Reference standard</b>                | <b>Sensitivity</b>  | <b>Specificity</b>  | <b>AUC</b>          |
|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---------------------|---------------------|---------------------|
| Identifying eyes with referable DR, analysing gradable images                                                                                     | Ophthalmologist review of retinal images | 90.0<br>(55.5–99.7) | 96.1<br>(92.4–98.3) | 0.93<br>(0.83–1.00) |
| Identifying individuals who require a referral, where all individuals with at least one ungradable eye are referred, based on pre-mydratic images | Ophthalmologist slit lamp biomicroscopy  | 66.7<br>(38.4–88.2) | 52.9<br>(42.8–62.8) | 0.60<br>(0.47–0.73) |

**Fig. S1 Flowchart of DR classification by camera-based screening versus slit-lamp biomicroscopy**



*Notes:* Of the individuals with false positives, 15 had at least one ungradable image or no image, which means they would need referral for further evaluation in a camera-based screening program.

**Fig. S2 Flowchart of DR classification by AI software versus slit-lamp biomicroscopy of eyes with at least one gradable post-dilation image**



*Notes:*

<sup>a</sup> Images are blurred, likely due to cataracts (n=6) and poor focus (n=1), which may have obscured DR changes seen on slit lamp biomicroscopy.

<sup>b</sup> AI may have detected drusen as a feature of DR, as well as hypopigmentation on an area which was a small optic cup (n=1); hypopigmented spot present but not a typical feature of DR with no other features of DR seen (n=1); AI may have picked up the fovea as a hemorrhagic area because of an adjoining hypopigmented area (n=1); hazy image likely because of cataract and lashes in the image may have produced artefact which is picked up by the AI, with other clearer images of the same eye not showing any features of DR (n=1).

<sup>c</sup> Hemorrhage in retinal image seen in a less common location, nasal to the disc, which would have been missed in slit lamp biomicroscopy (n=1); clear dot hemorrhage is present in retinal image (n=1).