

Implementing cognitive assessment and RetiSpec retinal screening in community-based settings: Enhancing early detection of Alzheimer's disease

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BACKGROUND

- Canada faces a critical need to increase screening rates for Alzheimer's disease (AD) given anticipated new treatments for AD. In Ontario, primary care providers (PCPs) are the gatekeepers to medical care; however, primary care settings are not equipped to effectively assess cognition resulting in significant under-diagnosis of AD¹.
- Current AD diagnostic solutions, such as positron emission tomography scans and cerebrospinal fluid analysis, are impractical for scalable and accessible early detection.
- The launch of new AD therapies in 2023 has led to an urgent and unmet need for accessible diagnostics.
- Research shows that retinal hyperspectral imaging can detect AD biomarkers given its shared developmental/ biological similarities to the brain.^{2,3} RetiSpec's Artificial Intelligence (AI)-based retinal imaging solution may enable an affordable and non-invasive way to enhance real-time clinical decision support at the point-of-care.

To address the raising need for AD screening, novel settings should be explored as an opportunity to enable actionable information for healthcare providers as well as a pathway to accelerate access to disease-modifying AD treatments.

METHODS

- An observational study assessed the feasibility of a novel, community-based settings to increase rates of cognitive assessment (conducted by Alzheimer Society of Toronto [AST] social workers) and RetiSpec's AI-based eye test to detect biologic signatures of AD. Eligible participants were adults ages ≥55 years with self-reported memory concerns.
 - Aim 1: to leverage accessible community-based settings to increase the baseline rate of cognitive assessments
 - Aim 2: to increase awareness of brain health for adults with memory complaints in optometry settings and to translate this awareness into additional cognitive and biomarker assessment
 - Aim 3: to evaluate risks, benefits, facilitators, and barriers of these settings to increase rates of AD screening
- Dual entry screening:** local Alzheimer Society chapter for cognitive assessment or optometry clinics for a RetiSpec scan, plus a brief survey on scan experience (Figure 1)
- Cognitive assessments:** included Boston Naming Test (BNT) and Montreal Cognitive Assessment (MoCA), or Mini-Mental State Examination (MMSE) plus Clock Drawing Test (CDT), as per education level. Results were shared with the participant's PCP or study-appointed Nurse Practitioner (NP) and a visit to discuss results was facilitated.
- RetiSpec scan:** participants were seated comfortably at a RetiSpec Retinal Imaging System comprised of a commercially available standard fundus camera (Topcon TRC-NW8) and hyperspectral sensor (Cubert FirefEYE 185) (Figure 2). Bilateral retinal images were acquired over ~10 mins. Dilation drops were administered (per standard clinic practices) for adequate pupil size to ensure high quality imaging.
- RetiSpec AI analysis:** ensemble convolutional neural network model of 3D spectral-spatial architecture that scrutinized multiple retinal regions (Figure 2)
- Utilization focused evaluation⁴:** to explore the risks, benefits, facilitators, and barriers to these settings from the perspective of frontline providers
- All study activities took place in Toronto, Ontario, Canada over a 9-month period

RESULTS

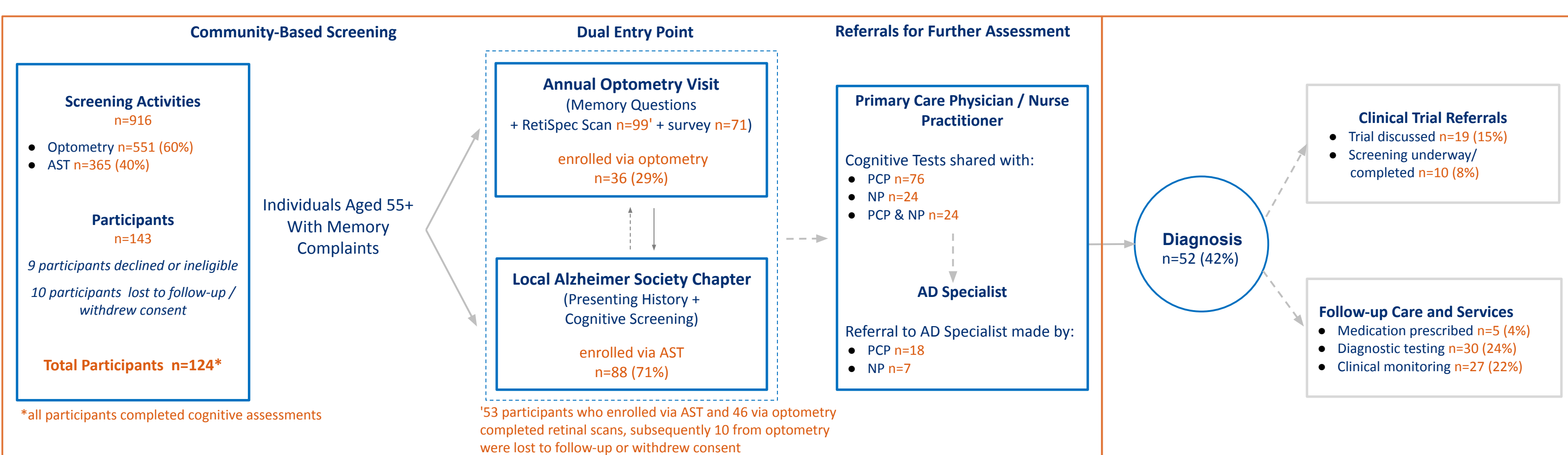


Figure 1: Clinical Workflow of Study

- Cognitive testing and retinal scans integrated well into existing clinical workflows where n=916 individuals were screened (Figure 1)
 - Endpoint 1:** Met endpoint with 13.8 cognitive tests/month during study compared to 1.8 tests/month in the 12-month pre-study period (667% increase)
 - Endpoint 2:** Met endpoint with 29% of cognitive test referrals originating from optometry compared to the study target of 10% (99/134 participants underwent a retinal scan; 74%)
- Exploratory Aim (Endpoint 3):**
 - Benefits: access to screening in comfortable settings, reduced stigma, early detection, patient concerns addressed
 - Risks: delays or missed connections for follow-up care, surprising patients with AD screening out of context
 - Facilitators: accessible settings for screening, effective training for staff, clear communication pathways with primary care, cost-free screening, Nurse Practitioner closed primary care gaps and enabled timely follow-up
 - Barriers: stigma, PCP unresponsive to patient concerns, communication challenges between care partners
- Most enrollees with a memory concern were found to have signs of cognitive impairment (n=65; 52%) (Table 2)
- Individuals enrolled through optometry settings showed slightly better cognitive results than those entering through the Alzheimer Society (mean MoCA and BNT scores: 25.0±3.2 and 13.8±1.7 vs 24.5±4.0 and 13.1±2.1, respectively)
- 89% of participants discussed their cognitive assessment results with a clinician; 38% participants consulted the study-appointed NP

RESULTS (con't)

- Necessary changes were made to participant's clinical care (Figure 1):
 - New AD-specific diagnosis was given (n=52; 42%)
 - Referral to AD specialist (n=25; 20%)
 - Medication prescribed (n=5; 4%), diagnostic testing (n=30; 24%), clinical monitoring (n=27, 22%), or clinical trial referrals (n=29; 23%) were offered
- 38% of enrolled were from minority groups (including Black, Asian, Latino, Hispanic, Armenian, & Mixed-Race Ethnicities) (Table 1)
- Results from the RetiSpec survey were highly favorable, with positive experiences, willingness to repeat particularly if the cost was covered and unanimous interest in sharing scan results with PCP (Table 3)

Table 1: Participant Demographic Characteristics

Point of Entry:	Optometry N (%)	Alzheimer Society N (%)	Total N (%)
Total # of Participants	36 (29.03)	88 (70.97)	124 (100)
Age Mean (SD) (Range)	72.08 (6.42) (55-87)	75.17 (6.53) (55-89)	74.26 (6.99) (55-89)
Sex			
Male	14 (11.29)	31 (25.00)	45 (36.29)
Female	22 (17.74)	57 (45.97)	79 (63.71)
Ethnicity			
Caucasian	20 (16.13)	55 (44.35)	75 (60.48)
Black	0	7 (5.65)	7 (5.65)
Hispanic	0	2 (1.61)	2 (1.61)
Asian (East, South, Southeast, West/Arab)	11 (8.87)	10 (8.07)	21 (16.89)
Mixed Race	1 (0.81)	7 (5.65)	8 (6.45)
Other	2 (1.61)	7 (5.65)	9 (7.26)
Did not disclose	2 (1.61)	0	2 (1.61)
Highest Level of Education			
Some high school or less	1 (0.81)	4 (3.23)	5 (4.03)
High school graduate or GED	5 (4.03)	7 (5.65)	12 (9.68)
Some college, associate's degree or technical training	6 (4.84)	23 (18.55)	29 (23.39)
University or college graduate (Bachelor's degree)	11 (8.87)	32 (25.81)	43 (34.68)
Graduate school degree (Master's, professional, doctorate)	13 (10.48)	22 (17.74)	35 (28.23)
Employment Status			
Working full or part time (paid)	10 (8.06)	15 (12.10)	25 (20.16)
Retired or not currently employed	26 (20.97)	72 (58.06)	98 (79.03)
Homemaker	0	1 (0.81)	1 (0.81)
Marital Status			
Single, Dating or Never Married	3 (2.42)	23 (18.55)	26 (20.97)
Married or Common Law	22 (17.74)	44 (35.48)	66 (53.23)
Separated or Divorced	5 (4.03)	10 (8.06)	15 (12.10)
Widowed	6 (4.84)	11 (8.87)	17 (13.71)

Table 2: Study Instruments

Point of Entry:	Optometry N (%)	Alzheimer Society N (%)	Total N (%)
RetiSpec Assessments	46	53	99
Predicted positive	28 (28.28)	37 (37.37)	45 (45.46)
Predicted negative	18 (18.18)	16 (16.16)	34 (34.34)
RetiSpec Score Mean (SD) (Range)	0.55 [0.15] (0.36-0.83)	0.59 [0.15] (0.36-0.90)	0.57 [0.15] (0.36-0.90)
MoCA Assessments	36	82	118
MoCA Score Mean (SD) (Range)	24.97 [3.21] (17-30)	24.5 [3.95] (14-30)	24.65 [3.79] (14-30)
Normal Cognition	18 (15.25)	40 (33.90)	58 (49.15)
Mild Cognitive Impairment	18 (15.25)	35 (29.66)	53 (44.92)
Moderate Cognitive Impairment	0	7 (5.93)	7 (5.93)
MMSE Assessments	0	6	6
MMSE Score Mean (SD) (Range)	0	18.67 [5.72] (12-26)	18.67 [5.72] (12-26)
Normal Cognition	0	1 (16.67)	1 (16.67)
Mild / Early Impairment	0	1 (16.67)	1 (16.67)
Moderate Impairment	0	4 (66.67)	4 (66.67)
CDT Assessments	0	6	6
CDT Score Mean (SD) (Range)	0	1.17 [1.17] (0-3)	1.17 [1.17] (0-3)
BNT Assessments	0	36	36
BNT Score Mean (SD) (Range)	13.81 [1.66] (8-15)	13.08 [2.10] (5-15)	13.3 [2.00] (5-15)

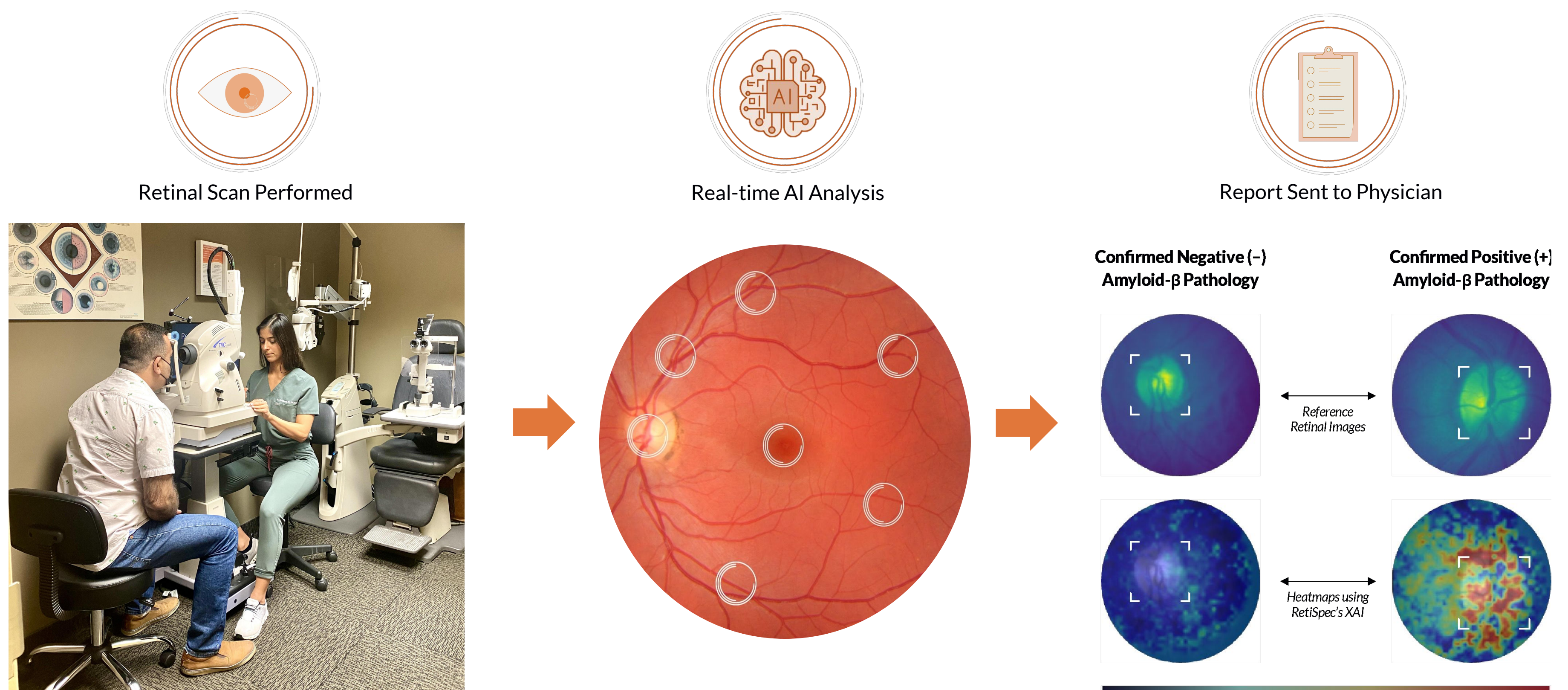


Figure 2: RetiSpec's AI-based Retinal Imaging Solution - system set-up (left), followed by AI analysis (center) and reporting (right)

SUMMARY & CONCLUSIONS

Initiating community-based AD screening facilitated needed cognitive assessments leading to meaningful clinical support (specialist referrals, new diagnoses and follow-on care/services) which would have otherwise been missed or delayed.

Screening in a multicultural city achieved an ethnically diverse population, supporting generalizable results.

Participants reported the RetiSpec scan experience to be positive and would repeat it again. High interest in sharing RetiSpec scan results with their PCP demonstrates that brain health is top of mind for many individuals.

Utilizing community-based settings, including optometry clinics and Alzheimer's Society social workers, demonstrates a promising approach to AD screening. Technology to evaluate amyloid status that leverages existing imaging infrastructure, including RetiSpec's AI-based eye exam, may offer a pragmatic, affordable, and scalable way to increase AD screening rates via optometry settings.

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Table 3: Participant Feedback from RetiSpec Scan^{*}

Questions	Average Score [*]
The RetiSpec scan was difficult to do	4.1
Was initially nervous/afraid to do the RetiSpec scan	4.8
The duration of the RetiSpec scan was longer than expected	2.8
The duration of the RetiSpec scan was reasonable	4.5
The RetiSpec scan was comfortable for the eyes	4.8
The RetiSpec seating position and posture were comfortable	4.8
Level of satisfaction with the RetiSpec scan experience	4.8
Willingness to undergo a RetiSpec scan again	4.8
Willingness to undergo RetiSpec scan if covered by OHIP	4.8
Interested in providing RetiSpec scan results to clinician	4.8

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For more info on RetiSpec's technology:

