8:00 AM 2 hours | Room 225-AB
P-01 | **Papers: Ocular Disease #1**
ALCON LOGO | Moderator: Anthony A. Cavallerano, OD, FAAO

8:00 AM. **VETERANS AFFAIRS CLINICAL PATHWAY FOR A TELERETINAL MODEL FOR DIABETIC RETINOPATHY (120531)**
Anthony A. Cavallerano, OD, FAAO, Gerald J. Selvin, OD, FAAO, Baharak Asefzadeh, OD, MS, FAAO, Paul A. Marescalchi, OD, FAAO, Douglas Rett, OD, Veterans Health Administration

RESULTS: The VA Teleretinal clinical pathway was successfully integrated at the network level. In over 4000 patients, levels of DR, diabetic macular edema, and eye disorders not associated with diabetes were identified. Patients with significant DR or other significant ocular findings were prioritized for prompt comprehensive evaluation and treatment. Patients with no diabetic eye disease but other significant findings were identified for prompt referral. Patients with normal digital retinal examination had follow-up eye care scheduled accordingly. A significant increase in the percent of patients examined for DR was achieved.
PURPOSE: To present a six-year follow-up of a network VA Teleretinal Imaging Program and to characterize ocular findings in diabetic patients employing a digital retinal imaging/telemedicine platform.
METHODS: Patients were scheduled via the VA internal consult mechanism and imaged using the Topcon nonmydriatic camera by a certified ophthalmic imager. Certified readers at the Jamaica Plain Campus of the VA Boston Health Care System graded the images. Findings were entered into the CPRS and are available to local VA and remote providers.
CONCLUSIONS: The VA Teleretinal Model facilitates screening for DR, offers added value by identifying a substantial number of non-DR related ocular findings, and provides the foundation for ongoing research to expand the platform to screen for other sight-threatening conditions in the VA population.
ADDITIONAL COMMENTS: Educational, training and certification, and ongoing competency support for this program is provided by the VA Office of Telehealth Services Store and Forward National Training Center in Boston.

8:15 AM. **EXPANDING A VETERANS HEALTH ADMINISTRATION DIABETES TELERETINAL IMAGING PLATFORM TO SCREEN FOR OPTIC NERVE AND MACULAR DISORDERS (120551)**
Anthony A. Cavallerano, OD, FAAO, Gerald J. Selvin, OD, FAAO, Robert W. Morris, OD, FAAO, Baharak Asefzadeh, OD, MS, FAAO, Paul A. Marescalchi, OD, FAAO, Veterans Health Administration

RESULTS: The comprehensive optic nerve and macula template embedded in the diabetes screening model proved to be sufficiently sensitive to identify and report on disorders of the optic nerve and macula, including markers considered to be specific to glaucoma and age-related macular degeneration.
PURPOSE: To develop a standardized clinical pathway to report on optic nerve and

macular disorders within a diabetic population being evaluated for diabetic retinopathy using a mature teleretinal imaging platform.
METHODS: Through consensus of provider workgroups a template with specific optic nerve and macula indicators was developed for use in a mature diabetic retinopathy screening program. Images of diabetic patients scheduled for retinal screening were reviewed by certified readers at the Jamaica Plain Campus of the VA Boston Health Care System to evaluate for diabetic retinopathy. Additionally, using the newly deployed comprehensive template, optic nerve and macular findings were recorded by the readers.
CONCLUSIONS: The standardized approach for reporting nondiabetic macular and optic nerve disorders within a diabetic population proved to be a successful first step in creating a validated pathway for screening for optic nerve and macular disorders in a nondiabetic population.
ADDITIONAL COMMENTS: Educational, training and certification, and ongoing competency support for this program is provided by the VA Office of Telehealth Services Store and Forward National Training Center in Boston.

8:30 AM. **VALIDATION OF NON-MYDRIATIC DIGITAL RETINAL IMAGING FOR DETECTION OF AGE-RELATED MACULAR DEGENERATION (120958)**
Kyla Smith, OD, Baharak Asefzadeh, OD, MS, FAAO, Anthony A. Cavallerano, OD, FAAO, Boston VA Healthcare System

RESULTS: For non-mydriatic images, the agreement between R1 and the RS was 0.76 while that between R2 and RS was 0.85.For the mydriatic images, agreement between R1 and RS was 0.78 while that between R2 and RS was 0.83.Intra-reader agreement between non-mydriatic and mydriatic images was 0.98 for R1 and 0.95 for R2.For non-mydriatic images, the agreement between R1 and R2 was 0.92.For mydriatic images, agreement between R1 and R2 was 0.91.For the non-mydriatic images, the agreement between R1 and the RS was 0.83 while that between R2 and RS was 0.60.For the mydriatic images, agreement between R1 and RS was 0.85 while that between R2 and RS was 0.64.Intra-reader agreement between non-mydriatic and mydriatic images was 1.0 for R1 and 0.83 for R2.For non-mydriatic images, the agreement between R1 and R2 was 0.69.For mydriatic images, agreement between R1 and R2 was 0.76.
PURPOSE: Age-related macular degeneration (AMD) is the leading cause of irreversible blindness in Americans over age 55.In the VA healthcare system,digital retinal imaging (DRI) has proven an accurate and cost-effective alternative to live exams for detection of diabetic retinopathy and shows initial promise as a detection tool for AMD.The objective of this pilot study is to evaluate the sensitivity and specificity of non-mydriatic DRI for detection of AMD compared to live examination.
METHODS: A total of 47 participants with or without AMD were recruited.Mean age of subjects was 74+/-9 years.All subjects completed non-mydriatic and mydriatic DRI and were evaluated by a retina specialist(RS) post dilation.Images were graded by 2 masked readers (Reader 1(R1) and Reader 2(R2)) who used a diagnostic template and standard images assess level of AMD and presence or absence of choroidal neovascular membrane (CNVM).The AMD levels of the right eye were compared to the RS live exam findings; the data were also evaluated for inter- and intra-observer agreement for mydriatic and non-mydriatic images.

CONCLUSIONS: Non-mydriatic DRI may be a viable screening tool for the detection of AMD.

8:45 AM. **DIABETIC MACULAR EDEMA ASSOCIATED WITH HARD EXUDATES: GENDER-SPECIFIC MANIFESTATIONS (120354)**
Taras V. Litvin, OD, FAAO, Glen Y. Ozawa, OD, Jorge Cuadros, OD, Tracy Wang, BS, University of California Berkeley, Matthew Muller, MS, MBA, Aeon Imaging

RESULTS: Patients had greater central macular thickness on the OCT thickness maps if they had either focal edema or exudates < 500 microns from the fovea on OCT scans ($p<0.0001$, 0.0021, respectively). Males had greater central macular thickness in every comparison, e.g. focal edema or exudate on OCT scans ($p = 0.0002$, 0.006, respectively). Cases from the color photos were more likely to have exudates or focal edema on OCT and more diffuse central thickness ($p = 0.0222$) than controls, but the significantly greater thickness found in males ($p = 0.0099$) influenced the quantitative analyses. HE < 1500 microns from the fovea in color photos had a sensitivity of 92% and specificity of 65% for edema.
PURPOSE: To investigate the gender-specific manifestation of diabetic macular edema associated with hard exudates (HE).
METHODS: 937 adult diabetic patients were imaged with Canon CR6-45NM and iVue OCT at four different Alameda County Medical Center ambulatory clinics - part of the EyePACS diabetic retinopathy screening network. Canon images were evaluated by a certified grader for HE. The focal edema and HE on OCT were indicated in the 7 higher resolution scans via blind grading by 2 optometrists, and the closest distance from the fovea computed. 74 eyes of 74 patients were selected as cases based on the presence of HE located within 1 disc diameter of the fovea in the color photos and that could be imaged in the central area on OCT scans. 74 control eyes of 74 age-, gender-, and race/ethnicity-matched patients had no HE or retinopathy that would generate a referral. The mean age of the patients was 53.7 years, 50% were females. ANOVA, linear regression, and Chi Square were used to compare the HE on color photos, the focal OCT data, and the diffuse retinal thickening automatically computed from the OCT data.
CONCLUSIONS: Focal edema, exudates, and increased central macular thickness with OCT are common in patients who have HE in color fundus photos. Normative OCT values, in general, may require analyses for gender.

9:00 AM. **MEASURING RETINAL LIPOFUSCIN WITH AUTOFLUORESCENCE IMAGING (120734)**
John R. Hayes, PhD, Pacific University College of Optometry

RESULTS: opt student Topcon AF photos were evaluated by 2 judges (Between judge Background reliability R2=.88; lipofuscin R2=.98). Consistency of two consecutive Topcon photos was high (R2=.85 and R2=.91 for background & lipofuscin). There was a consistent bias of one judge rating the points higher than the other judge (Mn=2.5;p<.01). Validity was demonstrated with the computer model by showing a significant expected relationship between age and lipofuscin accumulation (R2=.14 in restricted age range 22-35yrs); Correlation between baseline values and 4 months later (R2=.90) and baseline

values and 9 months later (R2=.80); and detection of an order effect between two consecutive pictures (p<.005) confirming a light bulb heating effect noted with fluorescent paper. Similar effects were found with the Heidelberg, noting both significant age (p=.048) and picture order (p=.026) effects.
PURPOSE: Measuring lipofuscin in the retinal pigment epithelium has been a challenging and complex endeavor. We propose two simple procedures using either human analysts or a computer. We tested our approach on autofluorescent (AF) photos taken by a Topcon fundus camera with Spaide filters and a Heidelberg Spectralis with Blue peak AF.
METHODS: The human analysis consisted of examining photos using the GLIM open source graphics program. Using the threshold function, analysts determined both the gray scale point at which the major vessels could be first identified with no break and the grayscale point at which the minor vessels could be fully detected. The threshold image at the second point revealed the bright lipofuscin ring around the macula. These points were then identified on the histogram of the grayscale image which yielded mean luminance between two identified points (background luminance) and the mean for the pixels from higher point to the top of the distribution (assumed lipofuscin luminance). An R computer program used a two distribution mixture model (mix function; mixdist library).
CONCLUSIONS: We noted both our methods were sensitive, reliable, and valid on both the Topcon and Heidelberg cameras.

9:15 AM. **RETINAL LIPOFUSCIN ACCUMULATION FROM LIGHT EXPOSURE AND THE POTENTIAL ROLE OF BLUE LIGHT FILTERS (120425)**
David K. Glabe, OD, MS, John R. Hayes, PhD, Pacific University College of Optometry

RESULTS: Baseline LF differed significantly across groups (Gray scale 0-255; Non-opt 49.4, 02.4SE; 1st yr 40.8, 2.28SE; 2nd yr 48.0, 3.0SE, p=.027), but not when controlling for background vessel luminance (means = 45.4, 46.5, 44.4, respectively). LF measures of unfiltered eyes at 8 mo were not significantly different (Non-opt 76.5, 2.73SE; 1st yr 68.2, 2.6SE, 2nd yr 72.7, 2.8SE). Considering only optometry students and both eyes, 2nd yr images were more autofluorescent than 1st yrs (difference = 10.8 p=.042). Inter-eye difference was primarily seen in 2nd yr eyes (difference unfiltered vs filtered = 4.7, p=.002) rather than 1st yr (difference = .78, p= .64).
PURPOSE: Previous reports suggest that excess light exposure may increase retinal lipofuscin (LF). Yellow filters have been shown to reduce oxidation of LF components. We tested two hypotheses: 1) Do optometry students accumulate more LF than similarly aged students? 2) Does a yellow filter influence LF accumulation?
METHODS: The sample consisted of 54 non-optometry students (Mean age=27, 4.1SD; 62% Female), 62 1st yr optometry students (Mean age = 27, SD = 4.8; 51% female, avg light exposure time 204 min (105SD)), and 39 2nd yr optometry students (Mean age = 26, 3.8SD, avg exposure 344 min (179SD)). Fundus autofluorescence (AF) images were taken at baseline, 8 mo, and 20 mo. LF was indirectly measured from luminance of AF photos.
CONCLUSIONS: We showed a significant relationship between LF and age. Our

hypothesis that LF increased with light exposure was not supported. While there was a trend toward a decrease in LF in optometry students relative to control, differences were not significant. For 2nd yr students, there was a greater decrease in the non-filtered eye. Our results are more consistent with LF oxidation than accumulation. We conclude that there is low likelihood of damage to students from increased retinal light exposure while practicing ophthalmic procedures. However, we revealed intriguing trends that suggest further investigation in a more rigorous experimental environment is worthwhile.

9:30 AM. **CLINICAL UTILITY OF PANORAMIC AUTOFLUORESCENCE IN PATIENTS WITH REDUCED VA (120266)**

Sarah MacIver, OD, FAAO, University of Waterloo School of Optometry and Vision Science, Samantha Slotnick, OD, FAAO, Sherry J. Bass, OD, FAAO, Jerome Sherman, OD, FAAO, State University of New York (SUNY) College of Optometry

RESULTS: 61 of the 100 PAF images reviewed had AF abnormalities: 18(29.5%) were AC, 10(16.4%) were AP, and 33(54.1%) were ACP. 5 patients had AP in 1 eye with ACP in the fellow eye. Of the 61 abnormal PAF images: (a)54(88.5%) did not match the corresponding color optomap image. (b)48(78.7%) had symmetric patterns OD and OS. Bilateral bull's-eye maculopathy was discovered in 12 of the 61 images. SDOCT confirmed RPE defects in the posterior pole in all AC and ACP eyes.
PURPOSE: Fundus Autofluorescence (AF) is an indicator of retinal pigment epithelium (RPE) activity, with Hypo-AF indicating RPE cell loss, and hyper-AF RPE stress. Panoramic AF (PAF) imaging with Optos 200Tx captures a 200 degree image in a minimally invasive, time-effective, manner. This study utilizes PAF in patients with reduced visual acuity (VA) (a) to determine whether PAF images correspond with color optomap® images and (b) to determine the scope and symmetry of retinal abnormalities.
METHODS: A retrospective review of 100 PAF and color optomap images from 50 patients with reduced VA or unusual visual symptoms was conducted in an ocular disease clinic. The images were categorized as normal (N) or abnormal, further designated by location: Abnormal centrally (AC), abnormal peripherally (AP), or abnormal centrally & peripherally (ACP). The images were analyzed for (a) PAF/color optomap correspondence and (b) OD/OS PAF pattern symmetry. Spectral domain optical coherence tomography (SDOCT) was used to confirm retinal abnormalities in all cases.
CONCLUSIONS: 1)PAF is a fast, non-invasive procedure that can detect outer retinal pathology in patients with vision defects. 2)ACP abnormalities are more common than AC or AP defects. Isolated AP may precede ACP. 3)PAF reveals abnormalities that may be invisible to fundus ophthalmoscopy, fundus photography or other imaging modalities. 4) PAF abnormalities are more extensive than color images when the changes are in the outer retina. 5)PAF may be used in early detection of bull's-eye maculopathy. 6)SDOCT of the outer retina confirms RPE involvement in areas of hyper/hypo AF.

9:45 AM. **CHANGES IN NEURO-RETINAL AND VISION FUNCTION AFTER OCCURRENCE OF DIABETIC MACULAR EDEMA: A PILOT STUDY (120369)**

Kavita Prashant Dhamdhere, MD, University of California Berkeley, Wendy Harrison, OD, PhD, FAAO, Midwestern University Arizona College of Optometry, Marcus Bearse, PhD, Marilyn Schneck, PhD, Shirin Barez, MD, University of California Berkeley

RESULTS: All subjects had DME at V1, resolving in 8 eyes at V2. CV appeared unaffected in the T1DM group but 4 of the T2DM subjects had high color confusion scores (CCS) at V1 that worsened at V2. mfERG IT did not worsen from V1 to V2 in either group. mfERG AMP was reduced from V1 to V2 only in the T2DM group ($p<0.0001$) in both retinal locations with or without DME. VA, LCVA and CS remained unchanged from V1 to V2 ($p>0.43$; $p>0.36$ and $p>0.16$). No changes were observed in total retinal thickness and retinal nerve fiber layer thickness ($p>0.58$ and $p>0.82$).
PURPOSE: The multifocal electroretinogram (mfERG) is a sensitive predictor of diabetic macular edema (DME) in at-risk patients. However, it is unclear how vision function continues to change after DME develops. Here we study changes in neuro-retinal and vision function after DME is established.
METHODS: One eye of 12 patients with DME was included and was studied when DME developed (V1) and 6 to 12 months later (V2). There were 7 patients with type 2 diabetes (T2DM) and 5 with type 1 diabetes (T1DM). The mean ages were 58.6±7.6 and 34.1±8.9 yrs and DM durations of 13.8±6.2 and 25.6±7.4 yrs, respectively. All subjects had poor DM control (HbA1c≥8.2) and moderate to severe retinopathy (DR) and DME at V1, and DR and/or DME at V2. Fundus photos, visual acuity (VA), low contrast VA (LCVA), mfERG (VERIS 5.2), contrast sensitivity (CS), color vision (CV), OCT retinal thickness (Cirrus) and HbA1c were obtained at both visits. mfERG implicit time (IT) and amplitude (AMP) were converted to Z-scores, and grouped into 35 zones. Differences between V1 and V2 were evaluated.
CONCLUSIONS: Progression or regression of DME does not appear to have major effects on vision function (VA, LCVA and CS). In T2DM patients, mfERG AMP worsens over time in established edema regardless of status or location of edema. In patients with T2DM who have abnormal CCS at the time of DME development, color vision continues to worsen over time.