

419 Glaucoma - screening, risk factors, and outcomes

Wednesday, May 07, 2014 8:30 AM–10:15 AM

Exhibit/Poster Hall SA Poster Session

Program #/Board # Range: 4266–4319/B0034–B0087

Organizing Section: Clinical/Epidemiologic Research

Program Number: 4266 **Poster Board Number:** B0034

Presentation Time: 8:30 AM–10:15 AM

Comparison of the Diagnosis of Glaucoma in a Retail-Based Telemedicine Model

Lindsay A. Rhodes, Gerald McGwin, Carrie E. Huisinigh, Cynthia Owsley, Christopher A. Girkin. Ophthalmology, The University of Alabama at Birmingham, Birmingham, AL.

Purpose: With an expected doubling of the glaucoma patient population by 2020 and with the majority of glaucoma specialists located in urban centers, patients with a glaucoma-associated diagnosis (GAD) may have difficulty accessing a glaucoma specialist. Telemedicine can be used to help bridge this gap. One critical aspect of a successful telemedicine program is establishing a channel of communication between subspecialists and optometrists that will facilitate diagnosis of GAD patients. The purpose of this analysis is to evaluate a fellowship-trained glaucoma specialist's assessment of a community-based optometrist's GADs.

Methods: Using a demonstration telemedicine program entitled Eye Care Quality and Accessibility Improvement in the Community (EQUALITY), based in two Walmart Vision Center clinics staffed by primary care optometrists (OD), patients were enrolled when they met any of the following at-risk criteria for glaucoma: African Americans or Hispanics ≥ 40 years, whites ≥ 50 years, persons of any age or race/ethnicity with diabetes, and/or family history of glaucoma; those with a pre-existing diagnosis of glaucoma were also enrolled. Following a comprehensive dilated exam with complete optic nerve head imaging (Cirrus SDOCT, 24-2 SITA perimetry, and stereophotography), the OD recorded a diagnosis and sent the exam and imaging data electronically to the glaucoma specialist (MD), who made an independent diagnosis. The OD and MD diagnoses were then compared.

Results: A total of 352 patients are currently enrolled in the EQUALITY program with a total of 61 patients having a GAD per the OD. The correspondence between the MD and OD was 75%, kappa= 0.57 (95% CI 0.40-0.75) and 67%, kappa= 0.45 (95% CI 0.30-0.63) for the right and left eyes, respectively.

Conclusions: There was moderate agreement between the optometrist and glaucoma specialist for the diagnostic category of GAD. Telemedicine-based approaches may reduce variability in care delivery, particularly for patients who have difficulty accessing face-to-face visits with a subspecialist.

Commercial Relationships: **Lindsay A. Rhodes**, None; **Gerald McGwin**, None; **Carrie E. Huisinigh**, None; **Cynthia Owsley**, None; **Christopher A. Girkin**, Carl Zeiss Meditec (F), Heidelberg Engineering (F)

Support: Centers for Disease Control and Prevention Cooperative Agreement 1U58DP004061, Research to Prevent Blindness, EyeSight Foundation of Alabama

Program Number: 4267 **Poster Board Number:** B0035

Presentation Time: 8:30 AM–10:15 AM

Evaluation of Non-Mydriatic Optic Disc Photography Grading in a Community-Based Glaucoma Detection Program in Philadelphia

Emily A. Bond, Timothy Sullivan, Michael Waisbourd, Wanda D. Hu, Sonya Shah, Jeanne Molineaux, Harjeet Sembhi, Lisa A. Hark, L Jay Katz. Glaucoma Research Center, Wills Eye Hospital, Philadelphia, PA.

Purpose: To determine the intra- and interobserver reproducibility of non-mydriatic, monoscopic optic disc photo grading and to determine the sensitivity and specificity of optic disc photos in diagnosing patients with glaucoma and glaucoma suspects, in a large, community-based, CDC-funded, glaucoma detection program.

Methods: As part of the detection program, patients underwent slit-lamp examination by an ophthalmologist, who then graded each patient's optic discs using two methods: cup-to-disc (CD) ratio and Disc Damage Likelihood Scale (DDLS). Following an automated visual-field test, patients were diagnosed as having "glaucoma," "glaucoma suspect," or "no glaucoma". Non-mydriatic, monoscopic optic disc photographs were then taken by an ocular technician using the Volk Pictor fundus camera (Volk Optical Inc, Mentor, Ohio), a novel, portable digital imaging device. On a different day, in a masked fashion, the same examiner and a second observer graded the disc photos and determined a diagnostic impression based only on the disc photos. For disc grading, intra-class correlations for intra- and interobserver reproducibility were calculated for both CD ratio and DDLS. Sensitivity and specificity of the disc photos' diagnostic impression were also determined.

Results: One thousand one hundred and eight patients (1108) were examined between 1/3/13 - 11/8/13. Of those, patients were randomly selected according to three groups of diagnoses: "glaucoma" (n=36), "glaucoma suspect" (n=50), and "no glaucoma" (N=33). For CD ratio, the intraobserver agreement was 0.71 and the interobserver agreement, 0.69. For DDLS, the intraobserver agreement was 0.65 and the interobserver agreement, 0.67. The sensitivity of diagnosing glaucoma or glaucoma suspect based on disc photos alone was 66% and the specificity was 85%.

Conclusions: Non-mydriatic, monoscopic disc photos had little value as a screening technique for glaucoma, with moderate intra- and interobserver disc grading reproducibility. Possible reasons include a high percentage of patients with significant cataracts that were examined, as well as the photography technique through small pupils, both of which reduced the quality of the images and made interpretation more challenging for the reviewer

Commercial Relationships: **Emily A. Bond**, None; **Timothy Sullivan**, None; **Michael Waisbourd**, None; **Wanda D. Hu**, None; **Sonya Shah**, None; **Jeanne Molineaux**, None; **Harjeet Sembhi**, None; **Lisa A. Hark**, None; **L Jay Katz**, Aerie Pharm. (C), Aerie Pharm. (F), Alcon (C), Alcon (R), Allergan (C), Allergan (F), Allergan (R), Bausch & Lomb (C), Bausch & Lomb (F), Glaukos (C), Glaukos (I), Inotek (C), Lumenis (R), Merck (F), Merck (R), Sensimed AG (C), Sucampo (C)

Support: CDC Grant 1U58DP004060-02

Program Number: 4268 **Poster Board Number:** B0036

Presentation Time: 8:30 AM–10:15 AM

Glaucoma Awareness of Primary Care Providers

Kelly Ma, Manishi Desai. Ophthalmology, Boston Medical Center, Boston, MA.

Purpose: Glaucoma is the second cause of legal blindness in the United States and the leading cause of legal blindness in African-Americans.¹ Given the asymptomatic nature of the disease, over half

of these patients present late to the ophthalmologist with already significant and irreversible vision loss.² Primary care providers are often the gateway in connecting patients to ophthalmologists. Thus, the purpose of this study is to assess primary care provider ability to recognize disease risk factors, presentation, and clinical course.

Methods: Attending and resident primary care physicians were surveyed at Boston Medical Center using a web-based survey that included eight basic questions assessing their knowledge of the screening and management of patients with glaucoma.

Results: 28 primary care physicians completed the survey, 13 of which are attending physicians and 15 resident physicians. The two groups performed comparably, with attending physicians scoring 50.5% correctly, and resident physicians scoring 54.3% correctly. Nearly all physicians surveyed correctly identified known risk factors of glaucoma and understood chronic and progressive nature of disease; few were versed in treatment options and systemic side effects of glaucoma medications. Of note, 96% of the physicians sampled believe they do not have adequate knowledge of glaucoma to recognize patients at risk and to appropriately counsel patients.

Conclusions: Our results indicate a possible lack of understanding of basic glaucoma concepts in primary care physicians. It becomes therefore clear that improved education and awareness may aid in more effective screening and timely referral of patients with glaucomatous disease.

References:

1. Weston BC, Aliabadi Z, White GL. Glaucoma—review for the vigilant clinician. *Clinician Reviews*. 2000;10:59-74.
2. American Academy of Ophthalmology, Glaucoma Panel. Primary open-angle glaucoma. Preferred practice pattern. San Francisco: American Academy of Ophthalmology, 2000:1-36.

Commercial Relationships: Kelly Ma, None; Manishi Desai, None

Program Number: 4269 **Poster Board Number:** B0037

Presentation Time: 8:30 AM–10:15 AM

Improving Access to Eye Care Among High-Risk Persons for Glaucoma in Philadelphia

Lisa A. Hark¹, L Jay Katz¹, George L. Spaeth¹, Jonathan S. Myers¹, Michael Waisbourd¹, Harjeet Sembhi¹, Jeffrey D. Henderer².

¹Research, Wills Eye Hospital, Philadelphia, PA; ²Ophthalmology, Temple University School of Medicine, Philadelphia, PA.

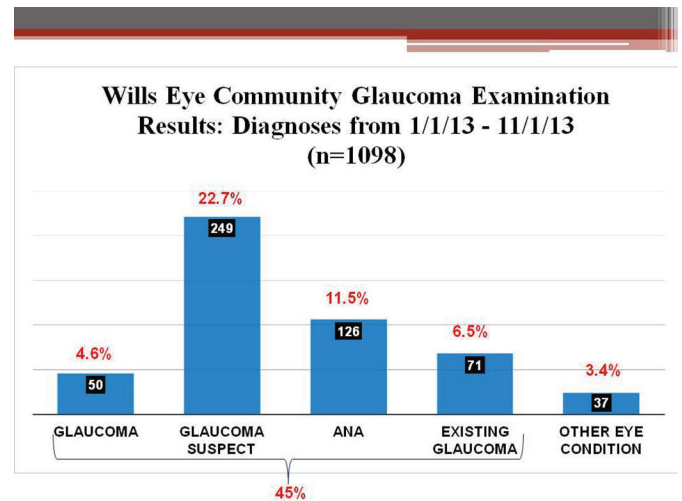
Purpose: Wills Eye Glaucoma Research Center, in cooperation with the CDC, is conducting a 2-year demonstration project to implement a community-based intervention to improve detection and follow-up eye care of individuals at high-risk for glaucoma. The project aims to 1) identify adults in underserved communities in Philadelphia most vulnerable to glaucoma (African Americans >age 50 and adults >age 60), 2) provide on-site workshops about glaucoma, 3) perform 2,000 eye exams to detect glaucoma, and 4) provide on-site treatment, follow-up, and referrals in individuals diagnosed with glaucoma, glaucoma suspect, or anatomically narrow angle.

Methods: A team of ocular technicians, health educators, and glaucoma specialists conduct exams which include 1) ocular, medical and family history of glaucoma 2) visual acuity 3) pupil exam 4) biomicroscopy of the anterior segment, 5) intraocular pressure 6) gonioscopy 7) undilated optic nerve evaluation by indirect biomicroscopy and 8) visual field testing. A total of 50 community sites, such as senior centers, community centers, housing buildings, and faith-based organizations are partnering with Wills Eye to recruit patients and conduct these exams.

Results: From January 1, 2013 to November 1, 2013, 1098 patients have been examined. Race/ethnicity data: 65% African American, 15% White, 14% Asian, and 5% Hispanic/Latino. Fifty patients (4.6%) have been diagnosed with glaucoma, 249 (22.7%)

as glaucoma suspect, 126 (11.5%) with anatomical narrow angle, 71 (6.5%) with existing glaucoma, and 37 (3.4%) with other eye conditions. Individuals diagnosed with glaucoma who require treatment are recommended for selective laser trabeculoplasty (SLT), laser peripheral iridotomy (LPI), or medication. Eight individuals have completed SLT treatment and 52 have completed LPI treatment at the community site. Eighty percent of patients have scheduled follow-up appointments in the community setting and 75% of those have attended these follow-up appointments.

Conclusions: This project clearly demonstrates how a community-based intervention can improve access, detection, management, treatment, and follow-up eye care of individuals at high-risk for glaucoma. The long-term impact of this CDC-funded project aims to reduce disability, ocular health disparities, and the economic burden from vision loss due to glaucoma.



Commercial Relationships: Lisa A. Hark, None; L Jay Katz, Aerie Pharm (C), Aerie Pharm (F), Alcon (C), Allergan (C), Allergan (F), Bausch & Lomb (C), Bausch & Lomb (F), Glaukos (C), Glaukos (I), Inotek (C), Lumenis (C), Merck (C), Merck (F), Sensimed AG (C), Sucampo (C); **George L. Spaeth**, None; **Jonathan S. Myers**, Alcon (C), Alcon (F), Allergan (C), Allergan (F), Aquesys (F), Aton Pharma, Inc (C), Diopsys, Inc. (F), Glaukos (F), Haag Streit (C), Inotek (F), Merck (F), Sucampo Pharma Americas (C); **Michael Waisbourd**, None; **Harjeet Sembhi**, None; **Jeffrey D. Henderer**, None
Support: Centers for Disease Control and Prevention U58DP004060-02

Program Number: 4270 **Poster Board Number:** B0038

Presentation Time: 8:30 AM–10:15 AM

The Impact of Multimedia Education on Uptake of Comprehensive Eye Examination in Rural Southern China: A Randomized, Controlled Trial

Aihua Dan¹, Ling Jin¹, Mingguang He¹, Nathan G. Congdon^{1,2}.

¹State Key Laboratory of Ophthalmology and Division of Preventive Ophthalmology, Zhongshan Ophthalmic Center, Guangzhou, China; ²Beijing China Contact, ORBIS International, NY, NY.

Purpose: Initially asymptomatic diseases such as glaucoma and diabetic retinopathy are becoming rapidly more prevalent in China, and focus group studies suggest that patients may not understand the need for or accept the comprehensive eye examination (CEE) needed to detect these conditions. We sought to identify rate of acceptance of exams in the CREST rural Chinese hospital network, and to evaluate an educational intervention promoting these exams using a randomized controlled design.

Methods: Patients aged ≥ 40 years who had never had a CEE were recruited from 54 routine clinic sessions (27 intervention, 27 control) conducted by seven rural county-level hospitals in Guangdong, China. Prior to the exam, all subjects answered 20-items questionnaires, and were informed the cost of the examination. At intervention sessions, subjects were also shown a video demonstrating the value of CEE via patient stories, and completed the knowledge questionnaire again after watching the video. Patients refusing the CEE were asked why. Trial outcomes were acceptance of CEE (Primary outcome) and knowledge scores.

Results: Subjects in the intervention group were more likely than controls to wear glasses ($P=0.01$), but the groups did not otherwise differ in 20 baseline characteristics. Among 241 intervention patients and 218 controls, CEE was accepted by 73% of intervention patients and 72% of controls ($P>0.50$). Predictors of acceptance included having been diagnosed with a systemic illness ($P = 0.009$), the offer of a free exam ($P = 0.005$) and rural residence ($P = 0.01$) though acceptance did not differ significantly between study groups ($P > 0.60$) when adjusting for these. Power to have detected 20% difference in acceptance between study groups was 96%, adjusting for clustering within clinic sessions. At baseline 74.7% ($n=180$) of patients could not answer a single question on the knowledge test correctly. After viewing the video, knowledge scores increased significantly ($P < 0.001$), but scores were not associated ($P = 0.40$) with acceptance of CEE.

Conclusions: Though our intervention did not increase acceptance of examinations, acceptance of low-cost CEE was high in this setting despite very low levels of knowledge about eye disease. Offering low cost exams may be sufficient to reach the majority of patients without need for educational interventions.

Commercial Relationships: Aihua Dan, None; Ling Jin, None; Mingguang He, None; Nathan G. Congdon, None
Support: ORBIS, ZOC, WDF, Thousand Man Plan
Clinical Trial: NCT01743781

Program Number: 4271 **Poster Board Number:** B0039

Presentation Time: 8:30 AM–10:15 AM

Higher than Expected Prevalence of Glaucoma in Community Centered Practice

Majda Hadziahmetovic, Kelly Williamson, Amanda Y. Lehman, Jessica M. Ackert. Ophthalmology, Drexel University College of Medicine, Philadelphia, PA.

Purpose: To report a higher than expected prevalence of glaucoma at Drexel Eye Physicians, located in center city Philadelphia, which serves predominately indigent and ethnically diverse population. We will also review the epidemiology of different types of glaucoma and identify risk factors for the observed increase in diagnosis.

Methods: Retrospective chart review examining diagnosis codes of all new patients seen at Drexel Eye Physicians. Diagnosis codes of open angle glaucoma (365.11), open angle with borderline findings high risk and low risk (365.01, 365.05), acute angle closure (365.22), and anatomic narrow angles (365.02) were included. 5800 gender, age and race/ethnicity diverse beneficiaries were examined. Patients were diagnosed as glaucoma suspects or with open angle glaucoma based on standardized criteria by those used by the Rotterdam Study and Foster and associates. Anatomical narrow angles (ANA) were diagnosed by gonioscopy findings of trabecular obstruction by the peripheral iris in conjunction with OCT imaging of anterior segment showing narrow anterior chamber angles.

Results: Our preliminary data show a prevalence of diagnosis codes associated with at-risk patients for glaucoma of 22.13%, substantially higher than previous reports. Broken down by year, prevalence's of 19.5%, 20.2% and 26.35% for 2011, 2012 and 2013 respectively

were observed. 16.8% of patients were classified as glaucoma with borderline findings, the majority of which were subsequently diagnosed with OAG. Anatomic narrow angles were observed in 2.7% of all new patients and comprised 12% of glaucoma diagnosis codes.

Conclusions: Our preliminary data show a significantly higher than expected prevalence of glaucoma related disease. Findings from our study emphasize that estimates of glaucoma prevalence may be higher than previously reported. A lower socioeconomic status seems to be a marker for a higher risk of developing glaucoma, though further study is needed to identify the factors behind this finding.
Commercial Relationships: Majda Hadziahmetovic, None; Kelly Williamson, None; Amanda Y. Lehman, None; Jessica M. Ackert, None

Program Number: 4272 **Poster Board Number:** B0040

Presentation Time: 8:30 AM–10:15 AM

Prevalence and Clinical Associations of 4 Glaucomatous Disc Types in Japanese Open Angle Glaucoma Patients Determined in Population-based Setting

Aiko Iwase¹, Yasuaki Kuwayama², Tetsuya Yamamoto³, Shoichi Sawaguchi⁴, Makoto Araie⁵. ¹Tajimi Iwase Eye Clinic, Tajimi, Japan; ²Fukushima Eye Clinic, Osaka, Japan; ³Ophthalmology, Gifu University Graduate School of Medicine, Gifu, Japan; ⁴Ophthalmology, University of Ryukyus Faculty of Medicine, Nishihara-cho, Japan; ⁵Kanto Central Hospital of the Mutual Aid Association of Public School Teachers, Tokyo, Japan.

Purpose: 4 disc types in open angle glaucoma (OAG), focal glaucomatous (FG), myopic glaucomatous (MG), general enlargement (GE), senile sclerotic (SS) types, associated with different clinical associations were reported. Prevalence and clinical associations of these 4 disc types have been studied in hospital-based settings, but rarely in less biased population-based settings. The purpose of this study is to report prevalence and clinical associations of the 4 glaucomatous disc types in Japanese OAG patients found in 2 Japanese population-based studies.

Methods: In 2 population-based studies in Japan, Tajimi Study (Iwase et al. Ophthalmology, 2004) and Kumejima Study (Sawaguchi et al, Ophthalmology, 2012), a total of 273 patients were diagnosed as having definite OAG according to the same International Society for Geometric and Epidemiological Ophthalmology criteria. Among them, disc photos with 30-degree visual angle with acceptable quality was obtained in 270 patients at least in one eye, which were examined by 4 independent masked investigators (IA, YK, TY, MA). Discs were classified into FG, MG, GE, SS, mixed appearance and unclassifiable and only discs where judgment by the 4 unanimously agreed upon were adopted

Results: Among 270 right eyes examined, 90 (33.3%), 11 (4.1%), 48 (17.8%) and 5 (1.9%) were classified in to FG, MG, GE and SS disc type, respectively. Prevalence of MG and SS type disc was much lower than those reported in hospital-based studies in Japan (e.g., Nakazawa et al. J Glaucoma, 2012). FG type disc was more likely to be previously diagnosed ($P=0.039$) and smaller disc size ($P=0.000$); MG type disc was associated with younger age ($P=0.036$), higher myopic power ($P=.000$) and larger PPA-beta area ($P=0.040$); GE type disc was associated with higher prevalence of PPA-beta ($P=0.037$). Other systemic or ocular factors including blood pressure, intraocular pressure, central corneal thickness or mean deviation value showed no significant inter-group difference. Analysis of the left eyes yielded essentially the same results.

Conclusions: Prevalence and clinical associations of FG, MG, GE and SS disc types in Japanese OAG patients were described in general population. Prevalence of MG and SS disc type was

much lower than those reported in hospital-based studies in Japan. Association of some ocular factors with each glaucomatous disc type was found.

Commercial Relationships: Aiko Iwase, Alcon (R), Carl Zeiss-Meditec (R), Kowa (C), Otsuka (R), Pfizer (R), Santen (R), Senju (R), Topcon (R); Yasuaki Kuwayama, Alcon (R), Kowa (C), MSD (R), Otsuka (R), Pfizer (C), Santen (R); Tetsuya Yamamoto, Alcon (R), Hoya (F), Kowa (C), MSD (R), Otsuka (C), Pfizer (C), Sanen (R), Senju (C); Shoichi Sawaguchi, Alcon (R), MSD (R), Pfizer (R), Santen (R); Makoto Araie, Alcon (C), Allergan (C), Bausch&Lomb (C), Carl Zeiss-Meditec (R), Kowa (C), MSD (R), Nitten (R), Otsuka (R), Pfizer (C), Santen (C), Senju (C), Topcon (C)

Support: the Japan National Society for the Prevention of Blindness

Program Number: 4273 **Poster Board Number:** B0041

Presentation Time: 8:30 AM–10:15 AM

Prevalence of disc hemorrhages and its risk factors in an urban South Korean population, Kangbuk Samsung Cohort Study

HanSeok Park¹, Seong Hee Shim¹, Joon Mo Kim¹, Chungkwon Yoo², Jeong Hun Bae¹. ¹Ophthalmology, Sungkyunkwan University College of Medicine, Kangbuk Samsung Hospital, Seoul, Republic of Korea; ²Ophthalmology, Korea University College of Medicine, Seoul, Republic of Korea.

Purpose: This study was performed to estimate the prevalence of disc hemorrhages (DHs) and evaluate its related risk factors in an urban South Korean population.

Methods: The study design was prospective cohort study from the Health Screening Center of Kangbuk Samsung Hospital. Subjects who underwent health screening from August 2012 to July 2013 were enrolled in this study and all subjects agreed to participate in the cohort study. All of the fundus photographs were reviewed by two ophthalmologic doctors (HSP and SHS) first and were confirmed by two glaucoma specialists and one retina specialist (JMK, JGY, JHB). In addition to fundus photographs, systemic examinations, sociodemographics and behavioral characteristics questionnaires were administered to each subjects. Eyes with disc hemorrhage were assigned according to whether or not accompanied by retinal nerve fiber layer (RNFL) defects. Disc hemorrhages were divided into four types according to the proximal location (lamina cribrosa, cup margin, disc rim, and peripapillary types) as well as the quadrant location (inferotemporal, superotemporal, inferonasal, and superonasal).

Results: Fundus photographs were available for 328,054 eyes of 164,027/169,209 (96.94%) subjects with an age of 20+ years. The prevalence of disc hemorrhages was 226/164,027 (0.14%; 95% confidence interval (CI): 0.12-0.16) per subject and 233/328,054 (0.07%; 95% CI: 0.06-0.08) per eye. Logistic regression analyses indicated that disc hemorrhages were associated with coincident RNFL defects ($p < 0.001$), older age ($p = 0.001$). A significantly higher proportion (48.0%) of disc rim-type DH was found in the DH with RNFL defects than in the DH without RNFL defects group (23.4%; $P < 0.001$). Eyes with disc rim-type DH were 5.4 times more likely to be accompanied by RNFL defects than were eyes with peripapillary-type DH (95% CI: 2.74-10.64; $P < 0.001$).

Conclusions: The prevalence of DHs was 0.14% in South Korean aged 20+ years. With RNFL defects and older age were associated with higher prevalence of DHs. Disc rim-type DH was significantly more common in eyes with RNFL defects than without RNFL defects.

Table 1 Characteristics of 226 subjects with DHs and 163,801 subjects without DHs

	Disc hemorrhage (+) (n=226)	Disc hemorrhage (-) (n=163,801)	P-value
Gender (men/women)	151/75	93,407/70,394	0.003*
Age (years)	44.68 ± 8.97	40.55 ± 8.51	<0.001†
IOP range (mmHg)	15.47 ± 3.05	15.01 ± 2.95	0.021†
RNFL defects	139/226 (61.5%)	3,333/163,801 (2.0%)	<0.001*
Glaucoma history	38/226 (16.8%)	1,441/163,801 (0.9%)	<0.001*
Diabetes	12/214 (5.6%)	4,878/155,082 (3.1%)	0.039*
Hypertension	33/212 (15.6%)	14,460/154,910 (9.3%)	0.002*
Hyperlipidemia	44/207 (21.3%)	22,759/150,016 (15.2%)	0.015*
Smoking history	93/190 (48.9%)	61,171/144,022 (42.5%)	0.155*
Alcoholic history	186/208 (89.4%)	144,205/154,449 (93.4%)	0.022*
Aspirin use	5/226 (2.2%)	3,118/163,801 (1.9%)	0.734*
Systolic blood pressure (mmHg)	110.99 ± 14.52	107.18 ± 12.95	<0.001†
Diastolic blood pressure (mmHg)	72.90 ± 11.27	70.06 ± 10.24	<0.001†
Glucose	97.85 ± 13.38	95.52 ± 14.68	0.017†
Hemoglobin A1c	5.68 ± 0.42	5.63 ± 0.47	0.095†
BUN	13.15 ± 3.46	12.78 ± 3.22	0.081†
Creatinine	0.93 ± 0.19	0.88 ± 0.21	<0.001†
Triglyceride	121.04 ± 91.25	113.37 ± 77.46	0.137†
HDL cholesterol	56.96 ± 14.56	57.51 ± 14.70	0.579†
LDL cholesterol	125.31 ± 31.12	120.77 ± 31.86	0.033†
BMI	23.38 ± 3.20	23.33 ± 3.26	0.815†
Waist circumference	82.67 ± 8.93	81.94 ± 9.71	0.263†

DH, disc hemorrhage; IOP, intraocular pressure; RNFL, retinal nerve fiber layer; BUN, blood urea nitrogen;

HDL, high density lipoprotein; LDL, low density lipoprotein; BMI, body mass index

*Chi-square test

†Student's t-test

Continuous values are presented as the mean ± standard deviation

Table 2 Multivariate logistic regression analysis of systemic and ocular variables

Risk factor	P-value	Odds ratio	95% Confidence interval	
Gender	0.295			
IOP range (mmHg)	0.943			
RNFL defects	<0.001	62.93	46.49	85.17
Diabetes	0.749			
Smoking history	0.780			
Alcoholic history	0.179			
Systolic blood pressure (mmHg)	0.099			
BUN	0.996			
Creatinine	0.247			
LDL cholesterol	0.287			
Age group (prevalence of DH, %)	0.007			
20-29 (0.03%)		1.00		
30-39 (0.08%)	0.135	2.94	0.71	12.15
40-49 (0.18%)	0.028	4.83	1.18	19.72
50-59 (0.20%)	0.048	4.31	1.02	18.31
60-69 (0.27%)	0.041	5.22	1.07	25.50
70+ (0.56%)	0.005	13.51	2.17	84.03

IOP, intraocular pressure; RNFL, retinal nerve fiber layer; BUN, blood urea nitrogen; LDL, low density lipoprotein; DH, disc hemorrhage

Variables with $P < 0.1$ on univariate analysis were included in a multivariate regression

Commercial Relationships: HanSeok Park, None; Seong Hee Shim, None; Joon Mo Kim, None; Chungkwon Yoo, None; Jeong Hun Bae, None

Program Number: 4274 **Poster Board Number:** B0042

Presentation Time: 8:30 AM–10:15 AM

Determinants of Undetected Glaucoma in an Asian Community: The Singapore Epidemiology of Eye Disease (SEED) Study

Jacqueline Chua¹, Baskaran Mani^{1,2}, Jiemin Liao^{1,2}, Yingfeng Zheng¹, Tien Y. Wong^{1,2}, Tin Aung^{1,2}, Ching-Yu Cheng^{1,2}. ¹Singapore Eye Research Institute, Singapore National Eye Centre, Singapore, Singapore; ²Department of Ophthalmology, Yong Loo Lin School of Medicine, National University of Singapore and National University Health System, Singapore, Singapore.

Purpose: To examine factors influencing undetected glaucoma across three major ethnic groups - Chinese, Malays and Indians - in Singapore.

Methods: The Singapore Epidemiology of Eye Disease (SEED) Study examined a total of 10,033 persons (75.7% response rate), comprising 3,353 Chinese, 3,280 Malays and 3,400 Indians aged 40-80 years. An age-stratified random sample of people residing in south-western Singapore was selected from a national database. Subjects were invited for a structured interview and a standardized comprehensive eye examination, including visual field assessment, based on the same study protocol. Subjects with previously undiagnosed glaucoma (i.e., not answering “yes” to previously being

ARVO 2014 Annual Meeting Abstracts

told by a doctor of having glaucoma) were identified after the eye examination.

Results: A total of 361 subjects were diagnosed as having glaucoma. Of them, 286 (79.2%) were unaware of having glaucoma. In the multiple regression analysis, subjects who were unaware of having glaucoma were younger (odds ratio [OR], 1.32, per 5 year, $p=0.001$) and more likely to be Malay (OR 4.38, $p<0.001$); had lower education levels (OR 2.08, $p=0.036$) and less regular eye checks (OR 4.48, $p<0.001$), were less likely to wear glasses (OR 2.87, $p=0.014$), and less likely to have undergone cataract surgery (OR 4.10, $p<0.001$), compared to those who were aware of their condition.

Conclusions: Our study provides population-based data in an Asian community showing that among persons with glaucoma, a large proportion is undetected. Factors associated with undetected glaucoma were younger age, Malay ethnicity, lower education, and under-utilization of eye care resources. This has implications for public health activities to improve glaucoma awareness in these high-risk groups. Tailored ophthalmic services at primary health care level targeted to high risk groups may be warranted.

Commercial Relationships: Jacqueline Chua, None; Baskaran Mani, None; Jiemin Liao, None; Yingfeng Zheng, None; Tien Y. Wong, None; Tin Aung, None; Ching-Yu Cheng, None

Support: National Medical Research Council Grant 0796/2003; Biomedical Research Council Grant 08/1/35/19/550, Singapore

Program Number: 4275 **Poster Board Number:** B0043

Presentation Time: 8:30 AM–10:15 AM

The prevalence of primary open angle glaucoma among sickle cell patients in the Bronx

Alessa Crossan, Shlomit Sandler, Wen-Jeng (Melissa) Yao.

Ophthalmology, Montefiore Medical Center, Bronx, NY.

Purpose: Little in the literature links sickle cell disease with an increased prevalence of open angle glaucoma, despite shared ischemic pathophysiology. Our study attempts to determine the prevalence of glaucoma in patients with sickle cell disease in an inner city population and to identify whether these patients have greater prevalence of glaucoma than non sickle cell patients.

Methods: A retrospective chart review of patients seen at Montefiore Ophthalmology Department between 2003 and 2013 was done using Clinical Looking Glass, an electronic medical record that records all clinical encounters at Montefiore. Using ICD-9 codes, patients with sickle cell disease or SC disease were identified. Of these sickle cell disease patients, those with primary open angle glaucoma were extracted by ICD-9 code. The charts of the patients identified with both sickle cell disease and primary open angle glaucoma were reviewed, to identify patients with actual glaucomatous visual field loss.

Results: We identified 375 unique patients seen by our eye department from 2003

to 2013 with sickle cell disease; of these, 52 patients also carried a glaucoma related ICD code. Of the 52 patients, 17 were identified as glaucoma suspects due to increased cup to disc ratio and had at least one Humphrey visual field that was completely full and reliable. Nineteen patients were identified as glaucoma suspects based on cup to disc ratio but never followed up for a visual field. Four patients had at least one HVF that could have been indicative of glaucomatous field loss. Our calculated prevalence of glaucoma in this sickle cell population was 1.1%; the average age of these 52 patients was 28.

Conclusions: In our inner city population with numerous African American patients,

we identified 52 patients with sickle cell or SC disease and primary open angle glaucoma. Four patients had increased cup to disc as well as one HVF that could be indicative of glaucomatous field loss,

giving a prevalence of 1.1%. This is lower than historically quoted rates in the Baltimore and Barbados eye studies, possibly secondary to the younger age of our sickle cell patients compared to usual glaucoma patients. Further study is necessary to clarify whether the ischemic changes of sickle cell disease have any association with increased prevalence of POAG.

Commercial Relationships: Alessa Crossan, None; Shlomit Sandler, None; Wen-Jeng (Melissa) Yao, None

Program Number: 4276 **Poster Board Number:** B0044

Presentation Time: 8:30 AM–10:15 AM

Prevalence and risk factors of glaucoma in myopic subjects attending a corneal refractive surgery clinic in Hong Kong

Sayantan Biswas, Vishal Jhanji, Gilda Lai, Christopher K. Leung.
Ophthalmology and Visual Sciences, The Chinese University of Hong Kong, Hong Kong, Hong Kong.

Purpose: While glaucoma remains a relative contraindication to corneal refractive surgery, diagnosing glaucoma in myopic eyes can be challenging and the prevalence of glaucoma in myopic subjects undertaking corneal refractive surgery is unknown. This study aimed to estimate the prevalence of glaucoma in a consecutive series of myopic subjects attending the corneal refractive clinic for corneal refractive surgery in Hong Kong.

Methods: 302 eyes of 152 consecutive myopic subjects (mean -6.49 D; range -2.38 to -14.88 D) attending the corneal refractive clinic from October 2012 to November 2013 underwent a complete ophthalmic examination. Visual field (C40 screening test, Humphrey Field Analyzer II), RNFL imaging (Cirrus HD-OCT) and stereoscopic optic disc photography were performed. Eyes with ≥ 1 abnormal location in the screening test had 24-2 threshold testing. Glaucoma was defined when there was glaucomatous optic disc configuration together with OCT confirmed RNFL thinning and repeatable visual field defects. Pre-perimetric glaucoma was defined as above but with absence of visual field defects. Risk factors associated with glaucoma were computed with logistic regression analysis.

Results: The mean age, IOP, refractive error, axial length and CCT of the 152 myopic subjects were 34.0 ± 8.8 years, 13.3 ± 2.3 mmHg, -6.60 ± 2.27 D, 26.04 ± 1.15 mm and 553.7 ± 32.6 μ m, respectively. 5 eyes (4 subjects) and 9 eyes (6 subjects) had primary open-angle glaucoma and pre-perimetric open-angle glaucoma, respectively. None of the patients had IOP ≥ 21 mmHg. The glaucomatous eyes had significantly smaller average RNFL thickness (78.92 ± 9.24 μ m vs. 90.16 ± 8.01 , $p<0.001$) and CCT (533.35 ± 34.45 vs. 555.75 ± 29.22 μ m, $p<0.001$) and more myopic (-8.33 ± 2.76 vs. -6.40 ± 2.31 D) compared with the non-glaucomatous eyes. Older age, higher myopia, thinner CCT, greater vertical cup-disc ratio and thinner RNFL thickness were associated with a higher risk of developing glaucoma ($p \leq 0.042$).

Conclusions: The prevalence of glaucoma among myopic subjects attending the corneal refractive clinic was 6.6% in which 2.6% had confirmed visual field loss. The relatively high prevalence of glaucoma in such a young age group (34 years) suggests the need of a more vigilant approach in the diagnostic evaluation of individuals seeking for refractive surgical correction.

Commercial Relationships: Sayantan Biswas, None; Vishal Jhanji, None; Gilda Lai, None; Christopher K. Leung, Carl Zeiss Meditec (F)

Program Number: 4277 **Poster Board Number:** B0045

Presentation Time: 8:30 AM–10:15 AM

Surgical Outcomes of Trabeculectomy in Patients with Glaucoma Over 80 Years of Age

Fulya Duman^{1,2}, Michael Waisbourd², Bruno M. Faria^{3,2}, Victoria Addis², Michael Hsieh², Feyzahan Ekici², Lisa A. Hark², George L. Spaeth². ¹Ophthalmology, Antalya Ataturk State Hospital, Antalya, Turkey; ²Glaucoma, Wills Eye Institute, Philadelphia, PA; ³Ophthalmology, University of Sao Paulo, Sao Paulo, Brazil.

Purpose: To compare the surgical outcomes of trabeculectomy performed in elderly patients (>80 years) with those of younger controls.

Methods: We retrospectively reviewed the charts of patients who underwent trabeculectomy from 1/1/2009 through 4/31/2011 at the Wills Eye Hospital. Patients over 80 years of age were compared with younger controls. Outcome measures included intraocular pressure (IOP), visual acuity, number of glaucoma medications, surgical complications and surgical failure. Surgical failure was defined as IOP >21 mmHg, <20% reduction below baseline IOP, IOP <5 mmHg, reoperation for glaucoma, or loss of light perception. In addition, the number of missed post-operative visits was documented.

Results: Eighty-six eyes of patients over 80 years of age (81–94) were compared with 86 eyes of younger controls (22–79). Mean follow-up time was 23.9±8.0 and 25.1±8.0 months for each group, respectively. Failure rate was 31.3% in the elderly group, compared with 29.5% in the control group (P=0.98). Post-operative complications were similar between the groups (P=0.25). Elderly patients were less likely to return for their follow-up appointments (P=0.04).

Conclusions: The surgical outcomes of trabeculectomy in patients older than 80 years of age were similar to those of younger controls. Taking into consideration their general health condition and life expectancy, elderly patients with glaucoma may benefit from surgery in order to preserve their visual function. Appointment reminders and patient navigators may help improve follow-up adherence.

Commercial Relationships: Fulya Duman, None; Michael Waisbourd, None; Bruno M. Faria, None; Victoria Addis, None; Michael Hsieh, None; Feyzahan Ekici, None; Lisa A. Hark, None; George L. Spaeth, None

Program Number: 4278 **Poster Board Number:** B0046

Presentation Time: 8:30 AM–10:15 AM

Number of People Blind or Visually Impaired or by Glaucoma Worldwide and in World Regions 1990 – 2010

Rupert Bourne¹, Jost B. Jonas², Seth R. Flaxman³, Jill Keeffe⁴, Janet Leasher⁵, Kovin S. Naidoo⁶, Konrad Pesudovs⁷, Tien Y. Wong⁸, Serge Resnikoff⁹, Hugh R. Taylor¹⁰. ¹Vision & Eye Research Unit, Anglia Ruskin University, Cambridge, United Kingdom; ²Department of Ophthalmology, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany; ³School of Computer Science & Heinz College, Carnegie Mellon University, Pittsburgh, PA; ⁴Department of Ophthalmology, University of Melbourne, Melbourne, VIC, Australia; ⁵Nova Southeastern University, Fort Lauderdale, FL; ⁶Vision Research Institute, University of Kwazulu-Natal, Durban, South Africa; ⁷NHMRC Centre for Clinical Eye Research, Flinders University, Adelaide, SA, Australia; ⁸Singapore Eye Research Institute, Singapore, Singapore; ⁹Brien Holden Vision Institute, Sydney, NSW, Australia; ¹⁰Melbourne School of Population and Global Health, University of Melbourne, Melbourne, VIC, Australia.

Purpose: To estimate the number of people visually impaired or blind due to glaucoma.

Methods: A systematic review for the Global Burden of Diseases (GBD) Study 2010 and an ongoing literature search (to 2012) resulted

in 243 population-based eye surveys. These data were used to estimate the global burden of moderate and severe vision impairment (MSVI; presenting visual acuity <6/18, ≥3/60) and blindness (presenting visual acuity <3/60). 66 of these studies specified the proportion attributable to glaucoma. We used the DisMod-MR of the GBD to calculate fraction of vision impairment due to glaucoma.

Results: In 2010, out of overall 32.4 million blind and 191 million vision impaired, 2.1 million (95% Uncertainty Interval (UI):1.9,2.6) people were blind, and 4.2 million (95% UI:3.7,5.8) million were visually impaired due to glaucoma. Glaucoma caused worldwide 6.6% (95% UI:5.9,7.9) of all blindness in 2010 and 2.2% (95% UI:2.0,2.8) of all MSVI. These figures were lower in regions with younger populations (<5% in South Asia) than in high-income regions with relatively old populations (>10%). From 1990 to 2010, the number of blind or visually impaired due to glaucoma increased by 0.8 million (95%UI:0.7, 1.1) or 62% and by 2.3 million (95%UI:2.1,3.5) or 83%, respectively. Age-standardized global prevalence of glaucoma related blindness and MSVI in adults aged 50+ years decreased from 0.2% (95% UI:0.1,0.2) in 1990 to 0.1% (95% UI:0.1,0.2) in 2010, and increased from 0.2% (95%UI:0.2,0.3) to 0.3% (95% UI:0.2,0.4), respectively. The percentage of global blindness and MSVI caused by glaucoma increased between 1990 and 2010 from 4.4% (4.0,5.1) to 6.6%, and from 1.2% (1.1,1.5) to 2.2% (2.0, 2.8), respectively. Age-standardized prevalence of glaucoma related blindness and MSVI did not differ markedly between world regions nor between women (0.1% (95% UI:0.1,0.2) and 0.3% (95% UI:0.2,0.4), respectively) and men (0.1% (95% UI:0.1,0.2) and 0.3% (95% UI:0.3,0.4), respectively).

Conclusions: In 2010, 2.1 million people were blind and 4.2 million people were visually impaired due to glaucoma, with an increase by 0.8 million and 2.3 million for the number of blind and visually impaired, respectively, from 1990 to 2010. One out of 15 blind people was blind due to glaucoma, and one out of 45 visually impaired people was visually impaired due to glaucoma. These data highlight the increasing global burden of glaucoma.

Commercial Relationships: Rupert Bourne, None; Jost B. Jonas, None; Seth R. Flaxman, None; Jill Keeffe, None; Janet Leasher, None; Kovin S. Naidoo, None; Konrad Pesudovs, None; Tien Y. Wong, None; Serge Resnikoff, None; Hugh R. Taylor, None
Support: Bill & Melinda Gates Foundation, Fight for Sight, Fred Hollows Foundation and the Brien Holden Vision Institute.

Program Number: 4279 **Poster Board Number:** B0047

Presentation Time: 8:30 AM–10:15 AM

The Relationship between Intraocular Pressure and the Peripapillary Retinal Nerve Fiber Layer Thickness in Chinese Americans without Eye Disease: The Chinese American Eye Study

Thasarat S. Vajaranant, Shaung Wu, Chunyi Hsu, Mina Torres, Rohit Varma. UIC, Ophthalmology and Visual Sciences, Illinois Eye and Ear Infirmary, Chicago, IL.

Purpose: To explore the relationship between intraocular pressure (IOP) on the peripapillary retinal nerve fiber layer (pRNFL) thickness in Chinese Americans without any evidence of eye disease.

Methods: We analyzed data from the CHES, the first population-based study of 4582 Chinese-Americans aged 50 years and older in Monterey Park, California. The participants completed a comprehensive eye exam including measurements of the pRNFL thickness by the Cirrus SD-OCT. Participants with glaucoma, age-related macular degeneration, diabetic retinopathy, and high myopia (> 6 diopters) were excluded from this analysis. One eye from each participant was randomly selected for this analysis. Linear regression models were used to determine the relationship of age,

sex, hypertension, diabetes, axial length (AL), spherical equivalent, IOP, central corneal thickness, and ocular perfusion pressure on the pRNFL thickness.

Results: The final analysis included one eye of 3961 participants with a mean age of 61.5 ± 8.9 years (63.8% females). In this cohort, the mean IOP was 15.2 ± 2.9 mmHg, and the mean global pRNFL thickness was 94.6 ± 13.2 μ m. Thinner pRNFL was associated with older age ($p < .0001$); being male ($p = 0.01$); having hypertension ($p = 0.04$); having type 2 diabetes ($p < .0001$); longer AL ($p < .0001$); more myopic refractive error ($p < .0001$); and higher IOP ($p < .0001$). For every decade of older age, the pRNFL is thinner by 3.5 μ m (95% confidence interval (CI), 3.0-4.0 μ m). With every 10-mmHg-increase in IOP, the pRNFL is thinner by 2.7 μ m (95% CI, 1.5-4.0).

Conclusions: Our findings represent the first epidemiologic analyses of the pRNFL thickness in the Chinese Americans without eye disease. Given that higher IOP was associated with thinner pRNFL, IOP may need to be taken into account when assessing the pRNFL thickness for diagnosis and follow-up of glaucoma.

Commercial Relationships: Thasarat S. Vajaranant, None; Shaung Wu, None; Chunyi Hsu, None; Mina Torres, None; Rohit Varma, None

Support: NIH/NEI K23EY022949-01 (PI: Vajaranant), NIH/NEI U10EY017337-05 (PI: Varma); and Research to Prevent Blindness, NY

Program Number: 4280 **Poster Board Number:** B0048

Presentation Time: 8:30 AM–10:15 AM

Volumetric Assessment of the Cornea, Anterior Chamber and Iris using Swept-Source Optical Coherence Topography in Pigment Dispersion Syndrome and Normal eyes

Christopher C. Teng^{1,3}, Ruojin Ren¹, Mugen Liu¹, Gustavo V. De Moraes^{3,1}, Lam Lu¹, Sung Chul Park^{1,2}, Jeffrey M. Liebmann^{3,1}, Robert Ritch^{1,2}. ¹Ophthalmology, Moise and Chella Safra Advanced Ocular Imaging Laboratory, Einhorn Clinical Research Center, The New York Eye and Ear Infirmary, New York, NY; ²Ophthalmology, New York Medical College, New York, NY; ³Ophthalmology, NYU School of Medicine, New York, NY.

Purpose: To compare cornea, anterior chamber and iris volumes between normal and pigment dispersion syndrome (PDS) eyes using swept-source optical coherence tomography (SS-OCT).

Methods: Volumetric radial scans of the cornea, anterior chamber and iris were performed using SS-OCT (Casia SS-1000; Tomey, Nagoya, Japan) in ambient light. Total, superior, inferior, nasal, and temporal quadrant volumes (mm³) were calculated for the cornea, anterior chamber, and iris in normal and pigment dispersion syndrome eyes, using the built-in software.

Results: 20 PDS eyes (10 patients; mean age, 42.6 ± 11.7 years) and 16 normal eyes (11 patients; mean age, 38.4 ± 12.0 years) were included. Compared to normal eyes, PDS eyes had greater total cornea volume (147.7 ± 10.1 vs 133.5 ± 11.3 , $p < 0.01$) and greater total anterior chamber volume (239.5 ± 28.9 vs 179.3 ± 35.1 , $p < 0.01$). There was no difference in total iris volume (44.4 ± 4.7 vs 45.1 ± 4.5 , $p = 0.67$) between the two groups. In PDS eyes, the superior quadrant cornea volume (34.0) (mm³) was less than the nasal (36.7), temporal (37.5) and inferior (39.5) quadrant volumes ($p < 0.01$); but there was no difference in the anterior chamber volume ($p = 0.5$) and iris volume ($p = 0.06$) between the four quadrants. In normal eyes, the superior quadrant cornea volume (29.6) (mm³) was less than the nasal (33.9), temporal (35.3) and inferior (35.2) quadrant volumes ($p < 0.01$); the superior quadrant anterior chamber volume (41.5) was also less than the nasal (42.8), temporal (46.8), and inferior (48.2) quadrant volumes, ($p = 0.04$); and the superior iris volume (11.7) was greater

than the nasal (10.8), temporal (11.2) and inferior (11.4) quadrant volumes ($p = 0.05$).

Conclusions: Cornea and anterior chamber volumes are greater in PDS eyes compared to normal eyes. Differences in anterior chamber and iris volume may become less pronounced in PDS. Imaging the cornea, anterior chamber and iris using SS-OCT may be beneficial to help better understand the pathophysiology of PDS.

Commercial Relationships: Christopher C. Teng, None; Ruojin Ren, None; Mugen Liu, None; Gustavo V. De Moraes, None; Lam Lu, None; Sung Chul Park, None; Jeffrey M. Liebmann, Alcon, Inc. (C), Allergan, Inc. (C), Bausch & Lomb, Inc. (C), Carl Zeiss Meditech, Inc. (C), Diopysis, Inc. (C), Heidelberg Engineering, GmbH (C), Merz Pharmaceuticals, Inc. (C), National Institutes of Health (F), New York Glaucoma Research Institute (F), Optovue, Inc. (C), Quark Pharmaceuticals, Inc. (C), Reichert, Inc. (C), Sensimed, Inc. (C), Topcon, Inc. (C), Valeant Pharmaceuticals, Inc. (C); Robert Ritch, None

Support: Corrinne Graber Research Fund of the New York Glaucoma Research Institute, James Cox Chambers Research Fund of the New York Eye and Ear Infirmary, and Peter Crowley Research Fund of the New York Eye and Ear Infirmary

Program Number: 4281 **Poster Board Number:** B0049

Presentation Time: 8:30 AM–10:15 AM

Incidence of glaucoma suspects in the Afro-Caribbean population of South Florida

Adam Aldahan¹, Christine Bokman¹, Patrick Staropoli¹, Arash Sayari¹, Richard K. Lee². ¹University of Miami Miller School of Medicine, Miami, FL; ²Bascom Palmer Eye Institute, Miami, FL.

Purpose: To determine the incidence of glaucoma suspects in the Afro-Caribbean population of South Florida at community screenings.

Methods: This is a retrospective chart review from October 2011 to October 2013. A total of 939 unique patient charts were reviewed from 5 separate health screenings held at the Center for Haitian Studies within the Little Haiti district in Miami, Florida. Measurements of intraocular eye pressure (IOP), cup-to-disc ratio, and visual acuity (VA) were performed on all patients. Glaucoma suspects were defined as having either an IOP of 24 mm Hg or greater or a cup-to-disc ratio of 0.6 or greater in either eye. The incidence of glaucoma suspects was calculated as well as the severity of pathology based upon IOP, cup-to-disc ratio, and visual acuity.

Results: During 2011-2013, a total of 331 patients were newly identified as glaucoma suspects in the Afro-Caribbean community of South Florida during community screenings. The incidence of a glaucoma suspect diagnosis was 35.3%. Among patients diagnosed as glaucoma suspects, the median IOP was 22.0 mmHg (SD 19-25), the median cup-to-disc ratio was 0.60 (SD 0.4-0.8), and the median logMAR VA was 0.22 (SD 0.20-0.24, Snellen equivalent 20/30). Overall, the median age of patients diagnosed as glaucoma suspects was 56 years.

Conclusions: Community health screenings alone have led to an increase in the number of people diagnosed with glaucoma. The incidence and severity of optic nerve cupping and ocular hypertension in the Afro-Caribbean population of South Florida is very high even though the median visual acuity of these patients is close to normal. Our experience in the clinic shows that patients with glaucoma from the Haitian population are among the highest with the greatest level of blindness at the youngest ages. The data from these community screenings suggests the Afro-Caribbean population is a high-risk population for glaucoma in line with our impression in our clinics. Further follow-up will determine the incidence and severity of glaucoma.

Commercial Relationships: Adam Aldahan, None; Christine Bokman, None; Patrick Staropoli, None; Arash Sayari, None; Richard K. Lee, None

Program Number: 4282 **Poster Board Number:** B0050
Presentation Time: 8:30 AM–10:15 AM
Serum Ferritin as a Predictor of Glaucoma in the South Korean Population

Sophie Shuaichun Lin¹, Sophia Y. Wang¹, Chungkwon Yoo², Kuldev Singh³, Shan C. Lin¹. ¹Ophthalmology, UCSF, San Francisco, CA; ²Ophthalmology, Korea University College of Medicine, Seoul, Republic of Korea; ³Ophthalmology, Stanford University, Stanford, CA.

Purpose: We investigated the association between serum ferritin level and the likelihood of a glaucoma diagnosis.

Methods: Data were included from 15,932 participants in the 2010-2011 Korean National Health and Nutrition Examination Survey, a cross-sectional population study. Data pertaining to the serum ferritin level was aggregated and divided into quartiles. Demographic, comorbidity, and health-related behavior information was obtained via interview. The definition of glaucoma was based upon criteria established by the International Society for Geographical and Epidemiological Ophthalmology. (ISGEO)

Results: Participants whose serum ferritin level was greater than 62 ng/ml had significantly higher odds of a glaucoma diagnosis when compared to those with a level less than 30 ng/ml, after adjustment for potential confounders (odds ratio [OR] 1.19, 95% confidence interval [CI] 0.806-1.758 for levels 31-61 ng/ml; OR 1.608, 95% CI 1.115-2.319 for levels 62-112 ng/ml; OR 1.892, 95% CI 1.279-2.800 for levels 113-3018 ng/ml).

Conclusions: A higher serum ferritin level was associated with greater odds of glaucoma in a representative sample of the South Korean population. These findings confirm earlier work regarding the potential adverse role of iron in glaucoma pathogenesis.

Commercial Relationships: Sophie Shuaichun Lin, None; Sophia Y. Wang, None; Chungkwon Yoo, None; Kuldev Singh, None; Shan C. Lin, None

Program Number: 4283 **Poster Board Number:** B0051
Presentation Time: 8:30 AM–10:15 AM
High Risk Pseudoexfoliative Families Identified in the Utah Population Database

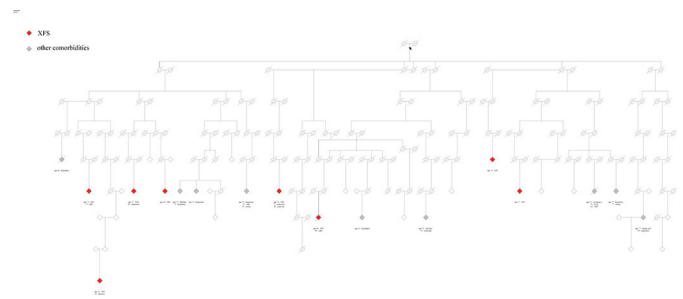
Barbara Wirostko¹, Steven Christiansen¹, Debra Schaumberg¹, Karen Curtin². ¹Moran Eye Center, University of Utah, Salt lake city, UT; ²Dept. of Medicine and Huntsman Cancer Institute, University of Utah, Salt lake city, UT.

Purpose: Pseudoexfoliation (XFS) is a systemic disease and a frequent cause of glaucoma. The Lysyl oxidase-like 1 (LOXL1) gene is associated with XFS, but XFS-associated common variants in LOXL1 are present in >80% of individuals without XFS, suggesting involvement of additional genes and/or risk factors. The purpose of this study was to use the University of Utah Healthcare (UUHC) patient population and the Utah Population Database (UPDB) to identify families with of XFS to further investigate the genetic underpinnings and epidemiology of XFS.

Methods: To identify patients diagnosed with XFS, we analyzed UUHC records comprised of ~236,000 individuals and 1.1 million patient visits from 1996-2013 that link to Utah Population Data Base (UPDB) genealogies. We verified ICD-9 coded XFS cases by medical record review. We estimated the prevalence of XFS in the UUHC population, and identified families with excess risk of XFS using a familial standardized incidence ratio (FSIR) approach.

Results: We identified 1901 patients with ICD-9-coded XFS (365.52 and 366.11). Of 540 charts reviewed to date 90.7% were confirmed. The prevalence of XFS in the UUHC system was 0.8% based on age at diagnosis. Prevalence increased with age from 0.6% for 55-64 y, 2.2% for 65-74 y, and 3.0% for 75 y and older (Ptrend=0.0001). We identified 200 families with a significant excess of XFS (FSIRs P<0.0001 to P=0.008). The population attributable risk (PAR) for genetic effects was 10.0% (95%CI 1.0%-17.0%). Within these families, atrial fibrillation, HTN, and other cardiovascular diseases appear to co-segregate vs. UUHC patients in families with no XFS (OR=1.24, 95%CI 1.01-1.54; P=0.04).

Conclusions: The prevalence of XFS in the UUHC system was consistent with other studies in Caucasian populations. Using the UPDB, we identified the largest known set of high-risk XFS pedigrees. This set of 200 families supports a genetic inheritance of XFS (overall FSIR P=0.02), and association with several comorbidities. This large number of high-risk XFS families provides a resource for further investigation of the genetics and epidemiology of XFS.



a Utah family with Pseudoexfoliation

Commercial Relationships: Barbara Wirostko, None; Steven Christiansen, None; Debra Schaumberg, None; Karen Curtin, None

Support: Department of Ophthalmology & Visual Sciences, University of Utah and Moran Center for Translational Medicine (G Hageman, PI) and Pedigree & Population Resource (funded by the Huntsman Cancer Foundation) for its role in the ongoing collection, maintenance and support of the Utah Population Database (UPDB). Supported in part by an Unrestricted Grant from Research to Prevent Blindness, Inc., New York, NY, to the Department of Ophthalmology & Visual Sciences, Moran Eye Center, University of Utah.

Clinical Trial: RGE_00000017; IRB_00010201

Program Number: 4284 **Poster Board Number:** B0052
Presentation Time: 8:30 AM–10:15 AM
Calibration of OCT Measurements across Multiple Device Generations Using a Measurement Error Structural Equation Model

Richard A. Bilonick^{1,2}, Yun Ling^{1,2}, Hiroshi Ishikawa^{1,3}, Gadi Wollstein¹, Xuejiao Yang¹, Joel S. Schuman^{1,3}. ¹UPMC Eye Center, Eye and Ear Institute, Ophthalmology and Visual Science Research Center, Department of Ophthalmology, University of Pittsburgh School of Medicine, Pittsburgh, PA; ²Department of Biostatistics, University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA; ³Department of Bioengineering, Swanson School of Engineering, University of Pittsburgh, Pittsburgh, PA.

Purpose: Retinal nerve fiber layer (RNFL) thickness measurements made by different generations of OCT potentially differ both systematically (bias) and in terms of imprecision (random error). The goal was to assess simultaneously the systematic differences among prototype OCT, OCT 1&2, Stratus, and Cirrus devices, and their corresponding imprecision standard deviations. Using the resulting

calibration equations, consistent longitudinal thickness profiles were created for time periods as long as 17 years.

Methods: Global mean RNFL thickness measurements had been made so that some eyes were measured by both prototype OCT and OCT 1&2 (22 eyes), some were measured by both OCT 1&2 and Stratus (156 eyes), and others measured on both Stratus and Cirrus (92 eyes). No eye was measured simultaneously by more than 2 devices. A common factor structural equation model (SEM) was used to describe the measurement error. The unknown true thickness was represented as a latent variable. Two models were fit to the data: 1) simple model without image quality (IQ), and 2) enhanced model using IQ. Figure 1 shows the corresponding path diagrams. Model parameters were estimated using full information maximum likelihood (R language and environment for statistical computing with OpenMx package).

Results: Both simple and enhanced models showed similar scale parameter estimates with Cirrus and prototype showing smaller, and OCT 1&2 showing larger, scale parameters compared to Stratus. The larger the scale parameter, the smaller the measurement unit. Resulting calibration equations are shown in Listing 1. IQ had substantial and statistically significant effects when included in the enhanced model but with little impact on the device imprecision (except for OCT 1&2). As shown in Listing 1, device imprecision, after appropriate adjustment for scale differences was substantially higher for prototype and substantially lower for Cirrus.

Conclusions: Changes in device construction can impact the relative accuracy and precision of the resulting measurements, making it problematic for detecting overall trends in RNFL thickness over time. These problems can be alleviated to the extent that appropriate calibration techniques can be used to remove device artifacts due to systematic error. Calibration, however, has no effect on differences between devices in terms of imprecision.

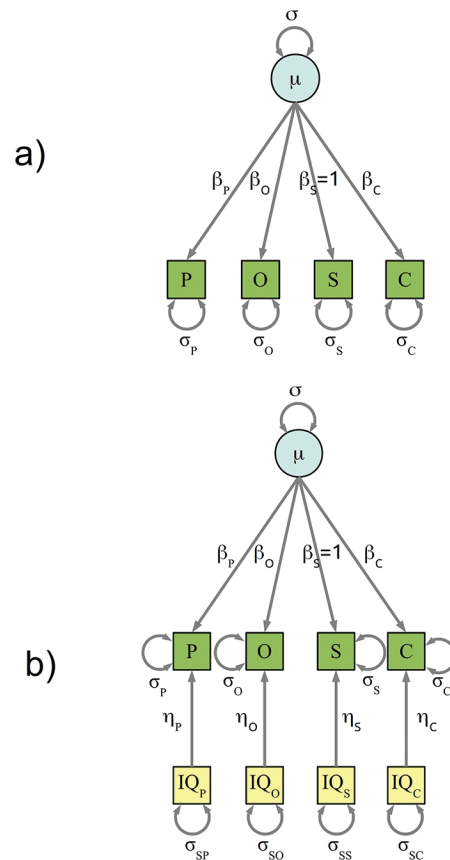


Figure 1. Path diagrams for a) simple calibration model, and b) enhanced model with image quality information (IQ). Prototype, OCT 1&2, Stratus, and Cirrus measurements denoted by P, O, S, and C, respectively; true values by μ , factor loadings by β ; standard deviations by σ ; and, image quality effects by η .

$$S = -9.761 + [1.778 IQ_S - 3.850 IQ_C] + 1.391 C$$

$$S = -15.149 + 1.242 C$$

$$S = 48.850 + [1.778 IQ_S - 1.185 IQ_O] + 0.852 O$$

$$S = -4.119 + 0.900 O$$

$$S = 59.128 + [1.778 IQ_S - 2.076 IQ_P] + 1.070 P$$

$$S = -12.689 + 1.018 P$$

Imprecision SD Based on Enhanced Model

	Lower	Estimate	Upper
Prototype	10.428	19.499	NA
OCT 1&2	0.080	1.587	9.187
Stratus	0.100	7.090	7.946
Cirrus	0.129	0.440	9.341

Imprecision SD Based on Simple Model

	Lower	Estimate	Upper
Prototype	8.795	18.310	NA
OCT 1&2	2.415	5.619	11.454
Stratus	0.100	6.817	7.935
Cirrus	0.117	0.125	8.766

Listing 1. Measurement error SEM calibration equations converting Cirrus (C), OCT 1 and 2 (O), and Prototype (P) to Stratus (S) units. Enhanced equations include image quality (IQ). Tables show 95% confidence intervals for the scale-adjusted imprecision SDs.

Commercial Relationships: Richard A. Bilonick, None; Yun Ling, None; Hiroshi Ishikawa, None; Gadi Wollstein, None; Xuejiao Yang, None; Joel S. Schuman, Zeiss (P)

Support: NIH R01-EY013178, P30-EY008098, R01-EY011289; Eye and Ear Foundation (Pittsburgh, PA); Research to Prevent Blindness (New York, NY)

Program Number: 4285 **Poster Board Number:** B0053

Presentation Time: 8:30 AM–10:15 AM

Relation between time spent outdoors and exfoliation glaucoma or exfoliation glaucoma suspect

Jae H. Kang¹, Janey L. Wiggs², Louis R. Pasquale^{1,2}. ¹Department of Medicine, Brigham and Women, Boston, MA; ²Glaucoma Service, Massachusetts Eye and Ear, Boston, MA.

Purpose: Higher UV exposure and residence at latitudes far from the equator has been linked to higher prevalence of exfoliation glaucoma (EG) or exfoliation glaucoma suspect (EGS). To date, the etiologic timing of UV exposure and its inter-relationship with residence has not been evaluated.

Methods: We conducted a cohort study in the United States using data from Nurses' Health Study (NHS) and the Health Professionals Follow-up Study (HPFS) from 1980 (NHS) / 1986 (HPFS) to 2010. Biennial questionnaires were mailed to participants for follow-up. Participants were eligible to contribute person-time if they were 60+ years of age, free of glaucoma, had no history of cataract surgery history, reported eye exams and completed questions about the average hours/week spent outdoors in direct sunlight at the middle of the day for work or recreation purposes in the summer months at 3 life periods: high school to age 24 years, age 25-35 years, and age 36-59 years (questions were asked in 2006 in NHS and 2008 in HPFS); a total of 48,721 NHS women and 17,324 HPFS men contributed person-time. Incident EG/EGS cases (232 women and 32 men) were identified with biennial questionnaires and subsequently confirmed with medical records. Cohort-specific multivariable-adjusted rate ratios (MVRs) and 95% confidence intervals (CIs) from Cox proportional hazards models for EG/EGS were estimated and then pooled with meta-analysis.

Results: Although no association was observed with greater time spent outdoors in summer months in the ages of 25-35 years or 36-59 years (p for linear trend or p-trends >0.15), we observed greater risks of EG/EGS with greater time spent outdoors in high school to age 24 years: the pooled MVR for ≥11 hours per week compared with ≤1 hour per week spent outdoors was 2.04 (95% CI = 1.10, 3.77; p-trend=0.001). In the NHS, we observed that the association with greater time spent outdoors from high school to age 24 years was stronger in those residing in the same period in the southern tier (where the relative risk of EG/EGS is lower than in the northern tier; p for interaction = 0.05).

Conclusions: In this US study, greater time spent outdoors during the summer in young adulthood, particularly among those residing in the southern geographical tier, was associated with a greater risk of EG/EGS, supporting a etiologic role of ocular UV exposure on EG/EGS risk.

Commercial Relationships: Jae H. Kang, None; Janey L. Wiggs, None; Louis R. Pasquale, None

Support: NIH Grants P01 CA87969, UM1 CA167552, EY09611, EY020928 and EY015473

Program Number: 4286 **Poster Board Number:** B0054

Presentation Time: 8:30 AM–10:15 AM

10-year incidence and risk factors of localized retina nerve fiber layer defect in adult Chinese: the Beijing Eye Study

Jianjun Li. Beijing Institute of Ophthalmology, Beijing, China.

Purpose: To describe the 10-year incidence of localized retina nerve fiber layer (RNFL) defects and its risk factors in adult Chinese.

Methods: The Beijing Eye Study is a population-based, cohort study, which included 4439 subjects (40 years and older) of Beijing China in 2001 as baseline survey, and was re-conducted in 2011 with 2695 subjects (aged 50 years and older) participating (66.4% of the survivors). Participants underwent retinal photography and localized RNFL defects were evaluated by one trained ophthalmologists. Localized RNFL defects were defined as wedge-shaped defects running towards the optic disc. The eyes with localized RNFL defects 10 years ago and their ranges of defect enlarged during the 10 years were included. In addition, its associated risk factors were obtained from clinical examination and questionnaires.

Results: The incident localized retina nerve fiber layer defects were detected in 114/2422 persons (mean±SE, 4.7%±0.2%) and 139/4867 eyes (2.9%±0.2%). In multivariate analysis, the incidence of localized RNFL defect were significantly associated with the rural region residency (P=0.007; OR=1.98; 95% CI:1.20, 3.23), lower cognitive function score (P=0.009; OR=1.06; 95% CI:1.02, 1.12),

ARVO 2014 Annual Meeting Abstracts

had more often hypertension (P=0.015; OR=1.69; 95% CI:1.11, 2.56), diabetes (P=0.001; OR=2.34; 95% CI:1.42, 3.84), diabetic retinopathy (P=0.024; OR=3.10; 95% CI:1.16, 8.28), cerebral infarction or hemorrhages (P=0.000; OR=2.95; 95% CI:1.42, 6.14) and glaucoma (P=0.000; OR=46.62; 95% CI:24.49, 88.74), not significantly associated with intraocular pressure (p=0.324), systolic blood pressure (P=0.892), diastolic blood pressure (P=0.262) and body mass index (BMI) (P=0.142).

Conclusions: The 10-year incidence of localized RNFL defects in 40 years old or more Chinese is 4.7%±0.2%. It is associated with the rural region residency, lower cognitive function score, hypertension history, diabetes history, diabetic retinopathy, cerebral infarction or hemorrhages and glaucoma.

Commercial Relationships: Jianjun Li, None

Program Number: 4287 **Poster Board Number:** B0055

Presentation Time: 8:30 AM–10:15 AM

Intraocular pressure: Association with blood pressure lowering medication and seasonal variations in the Gutenberg Health Study

Rene Hoehn^{1,5}, Alireza Mirshahi¹, Andreas Schulz¹, Philipp Wild², Karl J. Lackner³, Maria Blettner⁴, Norbert Pfeiffer¹. ¹Ophthalmology, University Medical Center Mainz, Mainz, Germany; ²Internal Medicine 2, University Medical Center Mainz, Mainz, Germany; ³Clinical Chemistry and Laboratory Medicine, University Medical Center Mainz, Mainz, Germany; ⁴Institute of Medical Biostatistics, Epidemiology and Informatics, University Medical Center Mainz, Mainz, Germany; ⁵Ophthalmology, Klinik Pallas, Olten, Switzerland.

Purpose: To determine associations between intraocular pressure and blood pressure lowering medication, cardiovascular diseases and seasons in an adult European cohort.

Methods: The Gutenberg Health Study (GHS) is a population-based, prospective, observational cohort study in the Rhine-Main Region in mid-western Germany with a total of 15,010 participants. Their age range was 35–74 years at enrollment. Participants underwent a standardized protocol including a non-contact tonometry, central corneal thickness measurement and a thorough general examination focused on cardiovascular parameters. Antihypertensives were assessed according to the Anatomical Therapeutic Chemical (ATC) Classification System (C02 - C04, C07 - C09). Participants with missing IOP values, topical IOP-lowering medication, or previous ocular surgery including corneal laser treatment were excluded. Thus, 13,529 participants were included in the analysis. Association analyses with antihypertensives and cardiovascular diseases were performed using a linear regression adjusted by central corneal thickness in ATC groups and a stepwise linear regression model, respectively.

Results: The overall mean IOP (±standard deviation) was 14.2 ±2.8 mm Hg. Higher IOP showed a weak association with the intake of renin-angiotensin system blockers (0.26 mm Hg; P<.0001), but no association was found with beta-blockers, diuretics, peripheral vasodilators, calcium antagonists or other antihypertensives. Higher IOP was associated with diabetes (β= 0.32, P<.001), smoking (β= 0.5, P<.001), and serum cholesterol (β= 0.005, P=0.0021). We found no association between IOP and myocardial infarction, chronic heart failure, peripheral arterial disease, coronary artery disease, atrial fibrillation or stroke. IOP was higher in the winter (14.5 ±2.8 mm Hg) than in the fall (14.2 ±2.7 mm Hg), spring and summer (14.1 ±2.7 mm Hg respectively). The monthly mean IOP was lower from May to October (13.9 – 14.1 mm Hg) than from November to April (14.4 – 14.6 mm Hg).

Conclusions: A positive, but clinically not relevant association was identified between IOP and renin-angiotensin system inhibitors. No

association was found with other antihypertensives, in particular not with systemic beta-blocking agents, or cardiovascular diseases. We confirmed seasonal variations in IOP distribution, namely higher mean values between November and April.

Commercial Relationships: Rene Hoehn, None; Alireza Mirshahi, None; Andreas Schulz, None; Philipp Wild, None; Karl J. Lackner, None; Maria Blettner, None; Norbert Pfeiffer, None

Program Number: 4288 **Poster Board Number:** B0056

Presentation Time: 8:30 AM–10:15 AM

The Prevalence of Co-Morbid Retinal Disease in Patients with Glaucoma at an Academic Medical Center

Joseph Griffith^{1,2}, Jeffrey L. Goldberg^{3,2}. ¹Ophthalmology, Cole Eye Institute, Cleveland Clinic, Cleveland, OH; ²Ophthalmology, Bascom Palmer Eye Institute, University of Miami School of Medicine, Miami, FL; ³Ophthalmology, Shiley Eye Center, UC San Diego, San Diego, CA.

Purpose: Patients with various retinal diseases and patients who have undergone retinal procedures and surgeries have an increased risk of developing ocular hypertension and glaucoma. Little is known about the epidemiology of co-morbid retinal diseases in glaucoma patients. This study evaluates the prevalence of retinal co-morbidities in a population of glaucoma patients.

Methods: A longitudinal, retrospective study was conducted using international classification of disease (ICD-9) billing records from 2003-2010 at an academic medical center. Patients were classified as having primary open-angle glaucoma (POAG), low tension open-angle glaucoma (NTG), pigmentary open-angle glaucoma (PG), chronic angle-closure glaucoma (CACG) or pseudoexfoliation glaucoma (PXG) if they had at least three clinic visits over two years with the same ICD-9 code. Patients were classified as having a retinal co-morbidity if they had two visits with the same retina code. Variables were analyzed with the Independent T-Test, χ^2 Test or Fisher's Exact Test.

Results: 5,154 patients had glaucoma, and 14.8% of these patients had a retinal co-morbidity. The prevalence of co-morbid retinal disease was higher with POAG patients (15.7%) than NTG (10.1%), PXG (10.1%) and PG (3.7%) (P< 0.05). 202 patients had diabetic retinopathy with POAG patients (4.5%) having a higher prevalence than CACG (1.4%) and PXG (0.6%) (P<0.001). 128 patients had a retinal vascular occlusion. There were no differences in the prevalence of retinal vascular occlusion or retinal vein occlusion between glaucoma types. 297 patients had macular degeneration with POAG (2.0%) and PXG patients (2.9%) having a higher prevalence of nonexudative macular degeneration than CACG (0%) (P<0.01). Patients with comorbid retinal disease had a higher prevalence of blindness and low vision than patients without comorbid retinal disease (1.97% vs 1.02%, P=0.02).

Conclusions: The high prevalence of co-morbid retinal disease and the nearly two-fold increase in blindness and low vision in this population demonstrate the need for ophthalmologists to determine if patients have multiple etiologies for their vision loss. The higher prevalence of co-morbid retinal disease, diabetic retinopathy and nonexudative macular degeneration in POAG patients may reflect common pathophysiologic processes that warrant further investigation.

Commercial Relationships: Joseph Griffith, None; Jeffrey L. Goldberg, None

Support: National Eye Institute (P30s EY022589 and EY014801). Research to Prevent Blindness, Inc.

Program Number: 4289 **Poster Board Number:** B0057

Presentation Time: 8:30 AM–10:15 AM

The Prevalence of Glaucoma Patients Undergoing Hemodialysis in An Inner City Population

Wen-Jeng (Melissa) Yao, Alessa Crossan, Michelle A. Sato. Visual Science, Montefiore Medical Center / Albert Einstein Medical College, Bronx, NY.

Purpose: Decreased ocular perfusion pressure and increased intraocular pressure are well-known risk factors that cause glaucoma and its progression. Recent studies have shown that hemodialysis decreases ocular perfusion pressure and increases intraocular pressure. The purpose of this study is to determine and compare the prevalence of hemodialysis in patients with glaucoma to those with cataracts.

Methods: Methods: Clinical Looking Glass (CLG) is an electronic medical record that captures all clinical interactions at Montefiore Medical Center. CLG was used to identify, via CPT code and ICD-9 codes, patients who have had hemodialysis and glaucoma, glaucoma only, hemodialysis and cataracts, and cataracts only. The prevalence of glaucoma or cataract patients on hemodialysis was then calculated. Demographic data, including age, gender, and race, were also included in our analysis.

Results: Results: We identified 5,942 patients with a diagnosis of open angle glaucoma and 19,951 patients with a diagnosis of age related cataracts at our eye center. Three percent of the glaucoma patients were found to be on hemodialysis, versus 1.9% of patients with cataracts. The difference between those two cohorts was statistically significant ($p < 0.00000001$). More African Americans were identified in the glaucoma group than the cataract group (60% in the glaucoma group vs. 46% in the cataract group).

Conclusions: Conclusions: In this urban cross-sectional study, we have shown that the prevalence of hemodialysis in glaucoma patients was 3%. There is a statistically significant higher prevalence of hemodialysis in patients with glaucoma when compared to patients with cataracts. Since hemodialysis may cause changes in ocular perfusion pressure and intraocular pressure that can lead to glaucoma progression, eye care providers may need to be vigilant in monitoring for glaucoma progression in those patients who are undergoing hemodialysis.

Commercial Relationships: Wen-Jeng (Melissa) Yao, None; Alessa Crossan, None; Michelle A. Sato, None

Program Number: 4290 **Poster Board Number:** B0058

Presentation Time: 8:30 AM–10:15 AM

Competing risk analysis reveals unique determinants for primary open angle glaucoma subtypes defined by pattern of visual field loss

Louis R. Pasquale¹, Stephanie Loomis¹, Janey L. Wiggs¹, Bernard Rosner², Jae H. Kang². ¹Ophthalmology, Mass Eye & Ear Infirmary, Boston, MA; ²Medicine, Brigham and Women's Hospital, Boston, MA.

Purpose: We explored whether the risk factor profile for POAG differed when the disease was divided into cases with either incident paracentral or incident peripheral visual field (VF) loss.

Methods: We used competing risks analysis to identify unique risk factors for POAG with paracentral VF loss or POAG with peripheral VF loss. We used updated prospective data from 79,191 women in the Nurses Health Study (NHS) and 43,311 men in the Health Professionals Follow-up Study (HPFS). We identified 974 incident POAG cases in the NHS (1980-2010) and 425 incident POAG cases in the HPFS (1986-2010). We confirmed that cases had reproducible VF loss on reliable tests and defined VF subtype based on the earliest abnormal VF. We considered the following risk factors in competing

risk analyses: gender, African-heritage, family history of glaucoma, body mass index (BMI), hypertension, diabetes mellitus, physical activity, smoking, caffeine intake, and alcohol intake. We used the forward selection approach, where we sequentially identified the factor that showed the most significant differences in associations with POAG subtypes (iteration threshold for testing was $p < 0.1$) Backward selection approach was also used for sensitivity analysis. **Results:** Risk factors with similar significant associations with the POAG subtypes were family history of glaucoma, African-heritage and greater caffeine consumption. An adverse risk factor for POAG with peripheral VF loss but not paracentral VF loss was diabetes (HR=1.35 [95% CI: 1.05-1.72] for peripheral vs. HR=0.86 [95% CI: 0.58-1.28] for paracentral). These HRs for diabetes were significantly different from one another ($p=0.02$). Risk factors that were more strongly inversely associated with POAG with paracentral VF loss were 10-kg/m² increments of BMI (HR=0.79 [95% CI: 0.64-0.98] for paracentral vs. HR=0.99 [95% CI: 0.85-1.15] for peripheral) and 10 pack-year increases in smoking (HR=0.89 [95% CI: 0.85-0.95] for paracentral vs. HR=0.97 [95% CI: 0.94-1.01] for peripheral). The relation between smoking ($p=0.01$), but not BMI ($p=0.09$), and the POAG subtypes were significantly different from one another. Results were similar with a backward selection approach.

Conclusions: These data show unique risk factor profiles for POAG subtypes indicating that POAG is a heterogeneous condition.

Commercial Relationships: Louis R. Pasquale, None; Stephanie Loomis, None; Janey L. Wiggs, None; Bernard Rosner, None; Jae H. Kang, None

Support: NEI RO1 EY 015473

Program Number: 4291 **Poster Board Number:** B0059

Presentation Time: 8:30 AM–10:15 AM

Is Primary Angle Closure (PAC) Glaucoma (G) Rare in the UK? - Prevalence Rates from a Glaucoma Clinic in the UK

Saurabh Goyal^{1,2}, Maria Mousou², Anita Arora^{1,2}. ¹Ophthalmology, St. Thomas' Hospital, London, United Kingdom; ²Ophthalmology, Queen Mary, Sidcup, United Kingdom.

Purpose: Recent estimates for PACG prevalence in the general population (0.4% in those over 40 years old) are 2-4 times higher than previous estimates (0.1-0.25%). One study from West London (published 2006) reported that 4.2% of all their glaucoma patients were PAC related.

The purpose of this study was to determine the prevalence of PACS (suspects)/ PAC/ PACG in all glaucoma patients seen in a glaucoma clinic in Kent over a period of one year.

Methods: All new and existing patients in a glaucoma clinic between May 2010 and April 2011 had full glaucoma phenotyping including peripheral limbal chamber depth estimation and high magnification gonioscopy by a new glaucoma consultant. Patient demographics, diagnosis and treatment were retrospectively reviewed for patients with PACS/PAC/PACG.

Results: 3016 patients were assessed over 125 clinic sessions in one year. Of these 320 were found to have PAC/ PACS/ PACG, with a prevalence of 10.6%. Female to male ratio was 1.3:1 with ages ranging from 50 to 94 years. More than 95% were Caucasians (5 Indians, 4 Far East Asian, 2 Afro Caribbean and 1 Middle Eastern). Majority (73%) of these patients were not previously known to have angle closure.

Conclusions: We found a higher prevalence of angle closure in our glaucoma clinic in a predominantly Caucasian Population in line with recent higher population estimates but with a relatively smaller female predominance. Given that angle closure is more blinding and treatment is different to primary open angle glaucoma this

calls for further studies and increased awareness among eye care professionals.

Commercial Relationships: Saurabh Goyal, None; Maria Moutsou, None; Anita Arora, None

Program Number: 4292 **Poster Board Number:** B0060

Presentation Time: 8:30 AM–10:15 AM

Is Incidence of Optic Disc Hemorrhages Related to Seasonal Changes?

Jiah Kim, Jin Wook Jeoung, Young Kook Kim, Hyuk Jin Choi, Ki Ho Park, Dong Myung Kim. Ophthalmology, Seoul National University of Hospital, Seoul, Republic of Korea.

Purpose: Seasonal variation in the incidence of cerebrovascular diseases has been reported in many studies. There is evidence of an increase in the incidence of cerebrovascular diseases during the colder autumn and winter and decrease during the warmer summer. Since optic nerve has a direct connection to brain, we investigated seasonal variation in the incidence of optic disc hemorrhages (DHs).

Methods: This study included 343,747 eyes of 88,889 subjects who participated in a standardized health screening (including noncontact tonometry and fundus photography) at The Healthcare Gangnam Center of Seoul National University Hospital during the period from January 2004 to December 2012. Two experienced ophthalmologists, who were masked to the subject's information, independently evaluated fundus photographs to check for the presence of optic DHs. DHs were classified as lamina cribrosa-, cup margin-, disc rim-, or peripapillary-type DH according to its proximal location. Incidence rates per 100 eyes and 95% confidence interval (CI) were calculated by gender, age, and DH subtypes for spring, summer, autumn, and winter.

Results: The estimated incidence of optic DHs was 0.11 per 100 eyes (95% CI, 0.10 to 0.12). Among the seasons, the DH incidence was highest in the autumn (0.12 per 100 eyes; 95% CI, 0.10 to 0.15). Among DH subtypes, winter incidence was low for cup margin type-DH (odds ratio (OR) 0.408 versus spring group; 95% CI, 0.198 to 0.838) and winter incidence was highest for disc rim type-DH (OR 2.144 versus spring group; 95% CI, 1.205 to 3.816).

Conclusions: The estimated incidence of optic DHs was 0.11 per 100 eyes. DH incidence appears to be highest in the autumn season. The seasonal effect on DH incidence needs further investigation in different population samples.

Commercial Relationships: Jiah Kim, None; Jin Wook Jeoung, None; Young Kook Kim, None; Hyuk Jin Choi, None; Ki Ho Park, None; Dong Myung Kim, None

Program Number: 4293 **Poster Board Number:** B0061

Presentation Time: 8:30 AM–10:15 AM

Exfoliation syndrome and primary open angle glaucoma are not associated with hearing loss in an Icelandic older adult case-control study

Fridbert Jonasson¹, Geir Tryggvason², Gudny Eiriksdottir³, Mary Frances Cotch⁴, Tamara B. Harris⁵, Lenore J. Launer⁵, Chuang-Ming Li⁶, Howard J. Hoffman⁶, Vilmondur Gudnason³, Hannes Petersen⁷.

¹Faculty of Medicine / Department of Ophthalmology, University of Iceland / Landspítali, Reykjavik, Iceland; ²Department of Otolaryngology – Head and Neck surgery, Oslo University Hospital, Oslo, Norway; ³Icelandic Heart Association, Kopavogur, Iceland; ⁴National Eye Institute, National Institutes of Health, Bethesda, MD; ⁵National Institute on Aging, National Institutes of Health, Bethesda, MD; ⁶National Institute on Deafness and Other Communication Disorders, National Institutes of Health, Bethesda, Bethesda, MD; ⁷Department of Otolaryngology – Head and Neck Surgery, Landspítali University Hospital, Reykjavik, Iceland.

Purpose: To determine if older adults with exfoliation syndrome (XFS), exfoliation glaucoma (XFG) or primary open angle glaucoma (POAG) are more hearing impaired than control subjects.

Methods: Individuals who participated in the Reykjavik Eye and Reykjavik Glaucoma studies and the Age Gene Environment Susceptibility (AGES) Reykjavik Study were eligible. Case status (XFS/XFG or POAG) was determined from the Reykjavik Eye studies augmented by information from AGES. Exfoliation syndrome was detected on retroilluminated fundus images and confirmed on slit-lamp examination. Exfoliation glaucoma and primary open angle glaucoma were diagnosed after repeated visual field testing and fundus photography of the optic nerve head. The remaining subjects were controls, none of whom had evidence of XFS/XFG or POAG. Otoscopy was performed and hearing thresholds obtained at 0.5, 1, 2, 3, 4, 6 and 8 kHz. Hearing outcomes were better ear pure-tone average (PTA) of all thresholds and the WHO-recommended four-frequency PTA (0.5, 1, 2, and 4 kHz). Multivariable logistic regression was used to test for differences in hearing between cases and controls, while controlling for age, sex, education, general health, chronic conditions (diabetes, hypertension), lifestyle (cigarette smoking, alcohol use), noise exposure, and ear-related conditions (ear infections, ear operations, and tinnitus).

Results: There were 167 subjects with XFS/XFG (mean age 77.2 years), 100 subjects having POAG (mean age 77.8 years) and 128 controls (mean age 76.7 years). The male/female ratio for XFS/XFG was 1:2.3, for POAG 1:1.8 and 1:1.2 for controls, and the prevalence of hearing aid use was 17.4%, 22.2% and 14.8%, respectively. The prevalence of glaucoma in XFS subjects was 47%. Multivariable logistic regression results indicated there were no significant differences in hearing impairment between either of the two case groups and controls. Factors independently associated with hearing impairment were age, sex, fair/poor health, noise exposure, and history of ear infections.

Conclusions: Older adults with exfoliation syndrome, exfoliation glaucoma or primary open angle glaucoma did not have more hearing impairment than controls. Older adults with XFS or POAG do not require referral for audiological workup by their ophthalmologist.

Commercial Relationships: Fridbert Jonasson, None; Geir Tryggvason, None; Gudny Eiriksdottir, None; Mary Frances Cotch, None; Tamara B. Harris, None; Lenore J. Launer, None; Chuang-Ming Li, None; Howard J. Hoffman, None; Vilmondur Gudnason, None; Hannes Petersen, None

Support: National Institutes of Health (Intramural Research Program of the National Institute on Ageing and the National Eye Institute, Z01-EY00401 National Institutes of Health contract number N01-AG-1-2100), the IHA, the Icelandic Parliament, and the University of Iceland Research Fund

Program Number: 4294 **Poster Board Number:** B0062

Presentation Time: 8:30 AM–10:15 AM

Longitudinal Changes of Angle Configuration in Primary Angle Closure Suspects:

the Zhongshan Angle Closure Prevention Trial

Yuzhen Jiang^{1,2}, Mingguang He^{2,1}, David S. Friedman^{3,5}, Tin Aung⁴, Paul J. Foster^{4,6}. ¹UCL Institute of Ophthalmology & Moorfields Eye Hospital, London, United Kingdom; ²State Key Laboratory, Zhongshan Ophthalmic Centre, Guangzhou, China; ³Dana Center for Preventive Ophthalmology, Wilmer Eye Institute, Baltimore, MD; ⁴Singapore Eye Research Institute & Singapore National Eye Center, Singapore, Singapore; ⁵Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD; ⁶NIHR Biomedical Research Centre at Moorfields Eye Hospital, London, United Kingdom.

Purpose: To determine longitudinal changes in angle configuration in eyes of primary angle closure suspects (PACS) treated by laser peripheral iridotomy (LPI) and in untreated fellow eyes.

Methods: Urban citizens aged 50 to 70 years identified as primary angle closure suspects were enrolled for a randomized controlled clinical trial. Each participant was treated by LPI in one randomly selected eye, with the fellow eye serving as a control. Angle width was assessed in a masked fashion using gonioscopy and anterior segment optical coherence tomography (AS-OCT) before and at 2 weeks, 6 months and 18 months after LPI.

Results: No significant difference was found in baseline measures of angle configuration between treated and untreated eyes. At 2 weeks after LPI, the drainage angle on gonioscopy widened from a mean of 13.49 degrees at baseline to a mean of 25.72 degrees in treated eyes, which was also confirmed by significant increases in all AS-OCT angle width measures ($P < 0.001$ for all variables). Between 2 weeks and 18 months following LPI, a significant decrease in angle width was observed over time in treated eyes ($P < 0.001$ for all variables), although the change over the first 5.5 months was not statistically significant ($P = 0.07-1.00$). In untreated eyes, angle width consistently decreased across all follow-up visits after LPI, with a more rapid longitudinal decrease compared to treated eyes (P values for all variables ≤ 0.01). The annual rate of change in angle width was equivalent to 1.17 degrees/year (95% CI: 0.75 degrees/year, 1.60 degrees/year) in treated eyes, and 1.64 degrees/year (95% CI: 1.32 degrees/year, 1.95 degrees/year) in untreated eyes ($P < 0.001$).

Conclusions: Angle width of treated eyes increased markedly after LPI, remained stable for 6 months, and then decreased significantly by the 18th month following LPI. Untreated eyes experienced a more consistent and rapid decrease in angle width over the same time period.

Commercial Relationships: Yuzhen Jiang, None; Mingguang He, None; David S. Friedman, None; Tin Aung, None; Paul J. Foster, None

Support: The study was supported by Fight for Sight (UK) and the Sun Yat-sen University 5010 Project Fund (China). Dr Yuzhen Jiang receives additional support from the British Council for Prevention of Blindness PhD Scholarship and UCL Overseas Research Scholarship for conducting research related to the ZAP Trial.

Clinical Trial: ISRCTN45213099

Program Number: 4295 **Poster Board Number:** B0063

Presentation Time: 8:30 AM–10:15 AM

Epidemiology and risk factors of progression in primary open-angle glaucoma : a retrospective study of 280 eyes

Léa Benoudis¹, Sahbi Rouissi¹, Julie Espenan¹, Iness Loukil², Amel Jeddi Blouza², Martial Mercie¹, Nicolas Leveziel¹, Michèle Boissonnot¹. ¹Ophthalmology, University Medical Hospital of Poitiers, Poitiers, France; ²Ophthalmology, University Medical Hospital of La Rabta, Tunis, Tunisia.

Purpose: To assess the epidemiological profile of patients with Primary Open-Angle Glaucoma (POAG) and determine the predictive factors of its progression, in order to screen subjects at risk.

Methods: A retrospective study was carried out among 280 eyes of 140 patients with POAG followed at the Ophthalmology Department of University Hospital La Rabta in Tunisia, between 1998 and 2009. After an analysis of their epidemiological profile, eyes were split into two groups: G1 or progression of glaucoma (92 eyes), and G2 or stabilization (188 eyes). Analysed factors of progression were: systemic risk factors, factors related to glaucoma optic neuropathy, other ocular risk factors, and those related to treatment.

Results: The epidemiological characteristics of our patients were high blood pressure (42.9%), diabetes (37.1%), familial history of glaucoma (52.2%), and coronaropathy (17.1%).

Ocular parameters were myopia (32.9%), pseudophakic (22.9%), pachymetry $< 530 \mu\text{m}$ (24.2%), ocular hypertension (24.3%), and exfoliation (28.6%).

The progression rate of POAG was 32.9%. In univariate analysis, our results concerning factors for glaucoma progression were: initial visual acuity $< 0.5 \log\text{MAR}$ (Odds Ratio (OR) OR=3.2; $p=0.003$), long-term fluctuation of intra ocular pressure (IOP) ($p=0.003$), pachymetry $< 505 \mu\text{m}$ (OR=10.83; $p=0.005$), noncompliance with therapeutics (OR=7.26; $p=0.011$), peak in IOP $> 23 \text{ mmHg}$ (OR=4.5; $p=0.02$), beta-blockers ($p=0.034$), bitherapy (OR=3; $p=0.03$), initial IOP $> 25 \text{ mmHg}$ (OR=5.25; $p=0.04$), initial cup-to-disc ratio $> 5/10$ (OR=3.23; $p=0.07$), Mean Defect (MD) $< -8.2 \text{ dB}$ (OR=4.8; $p=0.07$), short-term fluctuation of IOP ($p=0.07$) and exfoliation (OR=2.84; $p=0.053$).

In multivariate analyses, all factors were interdependent.

Conclusions: These data confirm the complex character of the POAG, either in its epidemiological characteristics or in its progression factors. They point out that the only control of intraocular pressure is not sufficient to guarantee its stabilization. Similar to glaucoma international studies, we found out that numerous parameters are also significant risk factors for progression, mainly low initial visual acuity, long-term IOP fluctuation, thin pachymetry and noncompliance.

POAG stabilization is based on identifying high-risk populations to provide them adequate care.

Commercial Relationships: Léa Benoudis, None; Sahbi Rouissi, None; Julie Espenan, None; Iness Loukil, None; Amel Jeddi Blouza, None; Martial Mercie, None; Nicolas Leveziel, None; Michèle Boissonnot, None

Program Number: 4296 **Poster Board Number:** B0064

Presentation Time: 8:30 AM–10:15 AM

Comparison of Anterior Chamber Angle Width Determinants in Different Ethnic Groups

Roland Y. Lee¹, Diego T. Barbosa¹, Brian Chon², Mingguang He³, Shan C. Lin¹. ¹Ophthalmology, University of California, San Francisco, San Francisco, CA; ²Ophthalmology, Duke University, Durham, NC; ³Ophthalmology, Zhongshan Ophthalmic Center, Sun Yat-sen University, Guangzhou, China.

Purpose: To evaluate determinants of anterior chamber angle width in Caucasian, African, Hispanic, and Chinese subjects.

Methods: Anterior segment optical coherence tomography images captured before and after LPI were analyzed to determine trabecular-iris space area (TISA750); angle opening distance (AOD750); anterior chamber area (ACA); anterior chamber volume (ACV); anterior chamber width (ACW); lens vault (LV); iris thickness (IT750); and iris area (IArea). Comparisons of ACA, ACV, ACW, LV, IT750, and IArea were made between ethnic groups for subjects with only narrow angles, only open angles, and both narrow and open angles. Multivariate linear regression models were used to investigate the association of TISA750 and AOD750 with ACA, ACV, ACW, LV, IT750 and IArea.

Results: Data from 157 Caucasian, 73 African, 62 Hispanic, and 124 Chinese subjects were analyzed. Ethnic differences among narrow angle subjects were observed in ACA, ACV, ACW, LV, and IT750, while ethnic differences among open angle subjects were observed in ACV, ACW, LV, IT750, and IArea (all $P < 0.05$). Merging both narrow angle and open angle subjects together showed ethnic differences in ACA, ACV, ACW, LV, IT750, and IArea (all $P < 0.05$). In all four ethnic groups, ACA, ACV, ACW, LV, IT750 and IArea

ARVO 2014 Annual Meeting Abstracts

were significant predictors of variance in both TISA750 and AOD750 (all $P < 0.05$). ACA, ACV, and ACW were the strongest determinants of both TISA750 and AOD750 across all ethnicities.

Conclusions: Despite ethnic differences in ACA, ACV, ACW, LV, IT750 and IArea, these six anterior segment biometric parameters feature as significant determinants of anterior chamber angle width in all four ethnic groups.

Commercial Relationships: Roland Y. Lee, None; Diego T. Barbosa, None; Brian Chon, None; Mingguang He, None; Shan C. Lin, None

Support: This study was supported by NIH-NEI EY002162 – Core Grant for Vision Research, Research to Prevent Blindness, and That Man May See, Inc.

Program Number: 4297 **Poster Board Number:** B0065

Presentation Time: 8:30 AM–10:15 AM

Age, intraocular pressure and glaucoma risk

Sigrídur Oskarsdóttir, Boel Bengtsson, Anders Heijl. Clinical Sciences, Ophthalmology, Lund University, Malmö, Sweden.

Purpose: To analyze the combined influence of IOP and age on the risk of undetected glaucoma.

Methods: A large population screening investigation was performed in Sweden in the years 1992–1997 in order to identify patients with undetected glaucoma for possible inclusion in the Early Manifest Glaucoma Trial. All residents 55 to 79 years of age in the city of Malmö ($n=275,000$) were invited, with the exception of those who had visited the Malmö University Ophthalmology department within one year prior to the screening. Visual acuity and intraocular pressure were measured, one monoscopic colour photograph of the optic disc was obtained in each eye, and family history was recorded. Subjects with suspect glaucoma or a positive family history were referred for one or more follow-up visits in order to establish or reject a diagnosis of glaucoma. The full eye examinations included visual field testing using the Humphrey 24-2 Full-Threshold program. We calculated the risk of undetected glaucoma per eye in groups combining intraocular pressure (IOP) (5 mmHg intervals) and age (5 year intervals).

Results: The total number of subjects screened were 32,918 (77.5% of those invited). We found 545 eyes in 406 subjects with previously undiagnosed glaucomatous eyes. The risk of undetected glaucoma per eye increased linearly with age from 0.41% in the youngest age group (55–59 years), to 1.93% in the oldest age group (75–79 years). The risk increased exponentially with IOP from 0.19% at IOP 10–14 mmHg to 57.14 mmHg at IOP >35mmHg. In most IOP groups risk increased with increasing age. Thus in the 10–14 mmHg IOP group from 0.11% to 0.49% and in the 25–29 mmHg group from 4.55% to 18.18% in the youngest and oldest age groups, respectively.

Conclusions: IOP influences glaucoma risk more than age. The risk increased exponentially with higher IOP and linearly with older age. Combining age and IOP gives better risk estimates than looking at each factor separately.

Commercial Relationships: Sigrídur Oskarsdóttir, None; Boel Bengtsson, None; Anders Heijl, None

Program Number: 4298 **Poster Board Number:** B0066

Presentation Time: 8:30 AM–10:15 AM

Importance of primary open angle glaucoma and its relation with socioeconomic conditions

Juan Manuel Elizondo Camacho, Maria Garcia Ibarra, Jesus Jimenez-Roman, Luis Zarate. Glaucoma, Asociacion Para Evitar la Ceguera en México, Mexico city, Mexico.

Purpose: To establish the level of knowledge about the disease that patients with Primary Open Angle Glaucoma have, and to determine

if it correlates with severity, family history, scholarship, monthly income and years of diagnosis.

Methods: It was a prospective, transversal and observational study. We applied a general knowledge questionnaire about glaucoma to patients with Primary Open Angle Glaucoma and classified them according to visual field damage considering the mean deviation (Hodapp Parrish criteria). We analyzed the variables with non parametric statistics using the Wilcoxon test to identify differences amongst the groups.

Results: We studied 142 patients, 76% were female and 24% male, with a mean age of 68.91 ± 11.94 years. Nineteen percent had an acceptable score, defining this as 6 or higher. Sixty two patients (43.66%) had mild damage in the visual field, 38 (26.76%) moderate damage and 42 (30%) severe damage. We found no difference between the groups in the total score obtained in the following studied variables: severity, scholarship, monthly income and years of diagnosis. We only found that patients with family history obtained a better grade, and this difference was statistically significant. This means that a patient that has a family member with glaucoma knows the disease better.

Conclusions: Only 20% of patients have an acceptable knowledge about their disease. There is no correlation between severity, scholarship, monthly income and years of diagnosis of the disease with the knowledge about glaucoma, but there is a positive relationship with family history.

Commercial Relationships: Juan Manuel Elizondo Camacho, None; Maria Garcia Ibarra, None; Jesus Jimenez-Roman, None; Luis Zarate, None

Program Number: 4299 **Poster Board Number:** B0067

Presentation Time: 8:30 AM–10:15 AM

Risk Factors for Primary Open-Angle Glaucoma in Nigeria: Results of the Nigeria National Survey of Blindness and Visual Impairment

Fatima Kyari^{1,2}, Clare Gilbert¹, Tunde Peto³. ¹Clinical Research Department, London School of Hygiene and Tropical Medicine, London, United Kingdom; ²Department of Ophthalmology, College of Health Sciences, University of Abuja, Abuja, Nigeria; ³NIHR Biomedical Research Centre at Moorfields Eye Hospital and UCL Institute of Ophthalmology, London, United Kingdom.

Purpose: To explore risk factors for primary open-angle glaucoma (POAG) among adults aged ≥ 40 years in Nigeria.

The glaucoma-specific blindness prevalence in Nigeria (0.7%, 95%CI 0.55–0.88%) among those aged ≥ 40 years is one of the highest ever reported.

Methods: Population-based survey of a nationally representative sample. 13,591 participants aged >40 years had logMAR visual acuity (VA) measurement, FDT visual field testing, autorefractometry, A-scan biometry and optic disc assessment. Values for defining glaucoma using ISGEO levels of evidence i.e. vertical cup:disc ratio (VCDR), disc asymmetry and intraocular pressure (IOP) were derived from a systematically sampled normative subset of 1 in 7 participants. All in the normative sample and participants with VA $<20/40$ or suspicious optic discs had detailed examination including slit-lamp ocular biomicroscopy, Goldmann applanation tonometry, Van Herick's angle estimation, gonioscopy, dilated funduscopy and fundus photography. Disc images were graded by Moorfields Eye Hospital Reading Centre. Glaucoma defining values were applied to the whole sample to identify participants with POAG. The following sociodemographic, systemic and ocular factors were assessed in univariate and multivariate analyses, taking account of the cluster design: age, gender, ethnic group and literacy; urban/rural residence; hypertension, blood glucose and body mass index (BMI); IOP, axial

length and mean ocular perfusion pressure (MOPP), using standard/published definitions and categories.

Results: 96% of 13,591 participants had data on VCDR in at least one eye. 462 participants were classified as cases of POAG according to ISGEO's 3 levels of evidence; with open angles. In univariate analyses the following were associated with POAG: increasing age, male gender, Ibo and Ijaw ethnic groups, being illiterate, longer ocular axial length, higher IOP, lower MOPP, any hypertension and greater severity of hypertension, low BMI and being underweight. In multivariate analysis, increasing age and higher IOPs were the only independent risk factors for POAG.

Conclusions: Risk factors for POAG in Nigeria are similar to those reported in other black populations in Africa and USA. This large, national survey does not identify subgroups of the population at significantly higher risk of POAG, which limits focused public health approaches for early detection.

Commercial Relationships: Fatima Kyari, None; Clare Gilbert, None; Tunde Peto, None

Support: Fred Hollows Foundation: PhD scholarship for FK

Program Number: 4300 **Poster Board Number:** B0068

Presentation Time: 8:30 AM–10:15 AM

CLINICAL PROFILES OF GLAUCOMATOUS PATIENTS WITH HIGH- AND LOW-TENSION OPTIC DISC HEMORRHAGES

Flávio S. Lopes^{1,2}, Daniela L. Junqueira², Luis G. Biteli^{1,2}, Syril Dorairaj³, Tiago S. Prata^{1,2}. ¹Department of Ophthalmology and Visual Sciences, Paulista School of Medicina, Federal University of São Paulo, São Paulo, Brazil; ²Glaucoma Service, Hospital Medicina dos Olhos, Osasco, Brazil; ³Mayo Clinic, Jacksonville, FL.

Purpose: We sought to characterize distinct clinical subtypes of glaucomatous patients with high (HTDH) and low-tension optic disc hemorrhages (LTDH).

Methods: In this prospective study, we enrolled consecutive glaucomatous patients, examined between January–November 2013. Glaucoma was defined as glaucomatous optic neuropathy and reproducible visual field defects (all patients with previous experience in VF testing [≥ 3 exams]). Disc photographs of all patients were evaluated for the presence of DH by two glaucoma specialists. Eyes with diabetic retinopathy, vascular occlusive disease, recent history of posterior vitreous detachment, and any ocular disease other than glaucoma were excluded. Patients were classified as HTDH if presenting with an intraocular pressure (IOP) ≥ 16 mmHg at the time of DH detection. Those with an IOP < 16 mmHg were classified as LTDH. Clinical and ocular data from the time of DH detection were collected and compared between patients with HTDH and LTDH. Whenever both eyes were eligible, one was randomly selected for analysis.

Results: A total of 40 patients were included (HTDH=15 eyes; LTDH=25 eyes). Patients with LTDH were more often women than those with HTDH (84% vs 40%; $p < 0.01$). Eyes with LTDH had lower visual field index values (80% vs 93%) and a higher frequency of paracentral field involvement (83% vs 40%) than those with HTDH ($p \leq 0.04$). Although the LTDH patient group had thicker corneas (mean difference of 19.8 μ m) and a higher prevalence of Asian descendants (32% vs 7%) compared to the HTDH patient group, this difference did not reach statistical significance ($p = 0.11$). The most common optic disc phenotypes in eyes with LTDH and HTDH were the focal (39%) and the generalized cup enlargement (43%), respectively. No significant differences were found regarding age, number of medications, DHs location, and recurrences ($p \geq 0.16$).

Conclusions: There are significant differences between patients with HTDH and LTDH. Patients developing DHs with treated IOPs in the

low teens (< 16 mmHg) are most frequently women with focal rim loss, and present with more advanced and central visual field defects than those with higher IOPs. Race and corneal thickness also seem to differ between these two clinical subtypes. We believe these findings add to the clinical management of these patients, and that special care should be taken regarding optic disc evaluation to those with the LTDH subtype.

Commercial Relationships: Flávio S. Lopes, None; Daniela L. Junqueira, None; Luis G. Biteli, None; Syril Dorairaj, None; Tiago S. Prata, None

Program Number: 4301 **Poster Board Number:** B0069

Presentation Time: 8:30 AM–10:15 AM

The Visual Field Index (VFI) - Correlation with Mean Deviation (MD) and Visual Disability Parameters in Advanced Glaucoma

Sybil Dorairaj¹, Cornelius Nasser², Yaniv Barkana². ¹Ophthalmology, Glaucoma Service, Mayo Clinic, Jacksonville, FL; ²Ophthalmology, Glaucoma Service, Assaf Harofe Medical Center, Zerifin, Israel.

Purpose: Visual field index (VFI) is a recently introduced summary parameter. Before it is widely adapted, it needs to be further characterized and compared with familiar indices used in glaucoma management, specifically mean deviation (MD). To characterize VFI in cases of advanced glaucoma by comparing it to MD and criteria of blindness according to the US Social Security and World Health Organization (WHO).

Methods: Visual fields of glaucoma patients with MD worse than -12 dB were prospectively included. VFI was compared to MD and criteria of blindness.

Results: Visual fields of 66 eyes of 54 patients were included. MD ranged from -12.15 to -31.4, VFI ranged from 0% to 76%. These parameters exhibited excellent correlation with $R^2 = 0.96$. VFI corresponding to MD of -15, -20, -22, and -25 was 55%, 40%, 35%, and 24% respectively. Correlation between VFI and the widest remaining central visual field diameter was only demonstrated in the later, more severe, stages of glaucoma.

Conclusions: VFI was found to be in excellent correlation with MD across the spectrum of glaucomatous visual loss. However, its "intuitive" presentation may underestimate the visual loss. We recommend that clinicians aim to keep VFI above 50–60% for the remainder of the patient's lifetime in order to preserve functional vision.

Commercial Relationships: Sybil Dorairaj, None; Cornelius Nasser, None; Yaniv Barkana, None

Program Number: 4302 **Poster Board Number:** B0070

Presentation Time: 8:30 AM–10:15 AM

Glaucomatous disease in patients with normal pressure hydrocephalus

Kyle Kovacs^{1,3}, Steven Sparr^{2,3}, Assumpta Madu^{1,3}. ¹Ophthalmology, Montefiore Medical Center, Bronx, NY; ²Neurology, Montefiore Medical Center, Bronx, NY; ³Albert Einstein College of Medicine, Bronx, NY.

Purpose: To delineate the possible relationship between glaucoma and normal pressure hydrocephalus (NPH) based on disease prevalence, uncovering an underlying susceptibility of neural pathways to compressive damage intrinsic to the extracellular matrix, cytoskeleton, or impediment of axonal transport. Given an underlying discrepancy in the susceptibility of their neuronal pathways to pressure, then there should be elevated rates of such diseases as well as worse disease severity in this target population.

Methods: This IRB-approved study was a retrospective analysis of all patients diagnosed with NPH at a major medical center between January 1997 and November 2013. Using an electronic research tool,

Clinical Looking Glass (CLG), all patients with an ICD-9 coded diagnosis of NPH were identified and then confirmed upon chart review looking at neuroimaging, lumbar puncture results, and clinical notes. Two age-matched control groups were generated by searching CLG for: 1) patients who received a diagnosis of hydrocephalus based on ICD-9 codes, and 2) patients who had neuroimaging performed (MRI or CT scan) whose reports indicated evidence of dilated ventricles (but no NPH diagnosis). Using ICD-9 codes all three groups were searched for patients who received a diagnosis of glaucoma, constricting the diagnoses to include only open-angle variants. Chi-square tests were used to compare disease rates between groups.

Results: There were 182 patients with NPH identified, of which 24 were also held glaucoma diagnoses (13.2%). In the age-matched hydrocephalus group, 7.1% of patients were diagnosed with glaucoma ($p=0.056$). In the age-matched dilated ventricle group 9.9% of patients were diagnosed with glaucoma ($p=0.32$). The average ages in years for the three groups were 73.3 ± 13.2 , 73.8 ± 11.9 , and 72.8 ± 15.4 , respectively.

Conclusions: There is a trend of elevated rates of glaucoma in patients with NPH compared with control groups, with the comparison of the hydrocephalus group to the NPH group showing near statistical significance. This appears to indicate an underlying susceptibility of neurons to barometric insult in this patient population. Further comparison of disease severity between these patient groups needs to be assessed.

Commercial Relationships: Kyle Kovacs, None; Steven Sparr, None; Assumpta Madu, None

Program Number: 4303 **Poster Board Number:** B0071

Presentation Time: 8:30 AM–10:15 AM

Pupil Analysis in African-Americans with Long Anterior Lens Zonules

Daniel K. Roberts^{1,5}, Yongyi Yang^{2,3}, Ana Lukic³, Jacob T. Wilensky⁴, Miles Wernick^{2,3}. ¹Clinical Education, Illinois College of Optometry, Chicago, IL; ²Department of Electrical and Computer Engineering, Illinois Institute of Technology, Chicago, IL; ³Predictek, Inc., Chicago, IL; ⁴Department of Ophthalmology and Visual Sciences, University of Illinois at Chicago, Chicago, IL; ⁵Division of Epidemiology and Biostatistics, University of Illinois at Chicago, Chicago, IL.

Purpose: Long anterior zonules (LAZ), which are characterized by zonular fibers that extend more central than usual on the anterior lens capsule, could be a risk factor for open- and narrow-angle glaucoma. Studies so far have shown LAZ to be associated with female gender, older age, hyperopia, shorter axial length, remnants of the tunica vasculosa lentis, and pigment dispersion. We investigated the hypothesis that LAZ are also more likely to have mild dyscoria, possibly due to chronic irido-zonular rubbing, concentrated mainly in the pupillary region.

Methods: We reviewed a near infrared iris transillumination (NIRit) database that contained a variety of subjects and selected LAZ and normal eyes for comparison. All eyes had been previously imaged using a modified digital camera (COOLPIX 950, Nikon Corp, Tokyo, Japan) to photograph the iris while it was illuminated with visible and infrared light via a standard ophthalmic transilluminator directed against the inferior eyelid. Pupil contour lines were created using an automated computer algorithm, and measures of pupil shape were calculated, including pupil roundness (PR), pupil ovalness (PO), pupil circularity index (PCI), pupil size (PS), and pupil eccentricity (PE). Regression analyses were used to assess pupil feature differences between LAZ and normal eyes. Because African-

American females comprised the vast majority of LAZ eyes in the database, only this subject group was included in the analysis.

Results: There were 41 LAZ females with a mean age = 68.3 years +/- 11.8 years (44-92 years) and 72 normals with a mean age = 45.0 years +/- 13.7 years (18-75 years). Controlling for age and pupil size (PS), LAZ right eyes showed PO measures ($P=0.001$), PR measures ($P=0.002$), and PCI measures ($P=0.001$) that were significantly different from normal right eyes. PE measures were marginally significantly different ($P=0.03$).

Conclusions: In addition to signs previously described, the clinical features of LAZ eyes may also include pupil dyscoria. This may be helpful toward the emerging understanding of the LAZ clinical trait.

Commercial Relationships: Daniel K. Roberts, Predictek, Inc. (P); Yongyi Yang, Predictek, Inc. (P); Ana Lukic, Predictek, Inc. (P); Jacob T. Wilensky, None; Miles Wernick, Predictek, Inc. (P)
Support: NIH Grants K23 EY0181883 and SBIR EY015604

Program Number: 4304 **Poster Board Number:** B0072

Presentation Time: 8:30 AM–10:15 AM

A Multivariate Mixed Effects Model for Visual Field and RNFL Thickness Measurements

Yun Ling^{1,2}, Richard A. Bilonick^{1,2}, Gadi Wollstein¹, Hiroshi Ishikawa^{1,3}, Larry Kagemann^{1,3}, Igor I. Bussell¹, Xuejiao Yang¹, Joel S. Schuman^{1,3}. ¹UPMC Eye Center, Eye and Ear Institute, Ophthalmology and Visual Science Research Center, Department of Ophthalmology, University of Pittsburgh School of Medicine, Pittsburgh, PA; ²Department of Biostatistics, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, PA; ³Department of Bioengineering, Swanson School of Engineering, University of Pittsburgh, Pittsburgh, PA.

Purpose: Simultaneously model multiple repeatedly measured values such as visual field mean deviation (MD), pattern standard deviation (PSD), visual field index (VFI), and optical coherence tomography RNFL in order to study the joint relationships between the parameters at one time point and the relationships between their rates of change.

Methods: The model was applied on a longitudinal cohort to evaluate age-related changes. Total 1046 observations on 174 eyes (87 subjects) were analyzed. We simultaneously modeled MD, PSD, VFI, and overall RNFL as a function of follow-up (years, FY), adjusted for signal strength (SS) and baseline age (BLAGE). Multivariate linear mixed effect (MLME) model was used. Random effects and residuals are each assumed to follow a multivariate normal distribution with mean 0 and a 4x4 covariance matrix.

For comparison, we also modeled MD, PSD, VFI and RNFL individually. Parameter estimates of both models are shown in Table 1. SAS PROC MIXED was used to fit the model.

Results: Estimates of the most important and relevant functions of the model parameters are shown in Table 1. Standard errors (SE) for the parameter estimates from joint model are smaller than those from individual models. Covariance and correlation matrices are shown in Table 2 (random effects) and 3 (residuals). The joint model was: MD = -0.6341 - 0.00237*BLAGE + 0.08406*SS + 0.003167*FY
PSD = 1.2106 + 0.003743*BLAGE + 0.04136*SS + 0.02180*FY
VFI = 99.5545 - 0.00574*BLAGE + 0.03657*SS - 0.04457*FY
RNFL = 95.2683 - 0.2495*BLAGE + 2.2271*SS + 0.1097*FY

Conclusions: The joint modeling approach had the following results. We 1) Obtained the correlations among different outcomes at same measurement time (Table 2). MD and VFI values at same time point were moderately correlated, while PSD and VFI were more strongly negatively correlated. RNFL was almost not correlated with MD, PSD and VFI. 2) Obtained the correlation among the rates of change (slope) between different outcomes (Table 3). The slope of MD and VFI was moderately positively correlated, i.e., the higher the

MD slope, the higher VFI slope. The slope of PSD and VFI were highly negatively correlated, i.e., changing in opposite directions. 3) Obtained smaller SE's (and thus higher test power) for the parameter estimates compared to the univariate models. 4) Obtained a more realistic appraisal of the diverse impacts of the predictors since we took into account the correlation between the outcomes.

Parameter	Joint Est	Joint SE	Ind Est	Ind SE
β_{10} (int, MD)	-0.6341	0.5171	-0.3360	0.5485
β_{11} (bsage, MD)	-0.00237	0.005780	-0.003377	0.006652
β_{12} (SS, MD)	0.08406	0.04016	0.05979	0.04101
β_{13} (Fu, MD)	0.003167	0.02321	0.003517	0.02491
β_{20} (int, PSD)	1.2106	0.1843	1.2218	0.1847
β_{21} (bsage, PSD)	0.003743	0.002073	0.003616	0.002079
β_{22} (SS, PSD)	0.004136	0.01423	0.003604	0.01426
β_{23} (Fu, PSD)	0.02180	0.008543	0.02218	0.008578
β_{30} (int, VFI)	99.5545	0.4005	99.7827	0.4501
β_{31} (bsage, VFI)	-0.00574	0.004466	-0.00686	0.00498
β_{32} (SS, VFI)	0.03657	0.03092	0.0128	0.0346
β_{33} (Fu, VFI)	-0.04457	0.01810	-0.0416	0.0196
β_{40} (int, RNFL)	95.2683	2.7757	95.2099	2.7794
β_{41} (bsage, RNFL)	-0.2495	0.03463	-0.2490	0.0346
β_{42} (SS, RNFL)	2.2271	0.2019	2.2320	0.2020
β_{43} (Fu, RNFL)	0.1097	0.2211	0.1034	0.2210

Table 1. Comparison of the parameters estimation between joint modeling and individually modeling. The standard errors (SE) for joint modeling are noticeably less than the SE's for individually modeling. But generally the direction and significance or non-significance of the effects in both models do not change.

$$\Sigma = \begin{pmatrix} \epsilon_1(MD) & \epsilon_2(PSD) & \epsilon_3(VFI) & \epsilon_4(RNFL) \\ \epsilon_1 & \epsilon_2 & \epsilon_3 & \epsilon_4 \\ \epsilon_2 & \epsilon_1 & \epsilon_3 & \epsilon_4 \\ \epsilon_3 & \epsilon_3 & \epsilon_2 & \epsilon_1 \\ \epsilon_4 & \epsilon_4 & \epsilon_4 & \epsilon_3 \end{pmatrix} \text{corr}(\Sigma) = \begin{pmatrix} \epsilon_1(MD) & \epsilon_2(PSD) & \epsilon_3(VFI) & \epsilon_4(RNFL) \\ \epsilon_1 & \epsilon_2 & \epsilon_3 & \epsilon_4 \\ \epsilon_2 & \epsilon_1 & \epsilon_3 & \epsilon_4 \\ \epsilon_3 & \epsilon_3 & \epsilon_2 & \epsilon_1 \\ \epsilon_4 & \epsilon_4 & \epsilon_4 & \epsilon_3 \end{pmatrix}$$

Table 2. The estimated residual variance-covariance matrix, and its corresponding correlation matrix. These two matrices indicate the covariances and correlations between different parameters at one time point. We can see that MD and VFI values at one time point are moderately positively correlated ($\rho_{13}=0.4529$), while PSD and VFI values at one time point are more strongly negatively correlated ($\rho_{23}=-0.6979$). When MD is large, the VFI is possibly large; When PSD is large, there is high probability that VFI will be small.

$$\hat{\Sigma} = \begin{pmatrix} b_{11}(MD) & b_{21}(PSD) & b_{31}(VFI) & b_{41}(RNFL) \\ b_{11} & b_{21} & b_{31} & b_{41} \\ b_{21} & b_{11} & b_{31} & b_{41} \\ b_{31} & b_{31} & b_{21} & b_{11} \\ b_{41} & b_{41} & b_{41} & b_{31} \end{pmatrix} \text{corr}(\hat{\Sigma}) = \begin{pmatrix} b_{11}(MD) & b_{21}(PSD) & b_{31}(VFI) & b_{41}(RNFL) \\ b_{11} & b_{21} & b_{31} & b_{41} \\ b_{21} & b_{11} & b_{31} & b_{41} \\ b_{31} & b_{31} & b_{21} & b_{11} \\ b_{41} & b_{41} & b_{41} & b_{31} \end{pmatrix}$$

Table 3. The estimated variance-covariance matrix and its corresponding correlation matrix for the rates of change (per year) of the four parameters. These two matrices indicate the covariances and correlations between the rates of change ("slope") of the four parameters. We can see that the slopes of MD and VFI are moderately positively correlated ($\rho_{13}=0.6262$), which means the higher the MD slope, the higher the VFI slopes. While the slopes of PSD and VFI are highly negatively correlated ($\rho_{23}=-0.8861$), indicating that the higher the PSD slope, the lower the VFI slope.

Commercial Relationships: Yun Ling, None; Richard A. Bilonick, None; Gadi Wollstein, None; Hiroshi Ishikawa, None; Larry Kagemann, None; Igor I. Bussel, None; Xuejiao Yang, None; Joel S. Schuman, Zeiss (P)
Support: NIH R01-EY013178, P30-EY008098; Eye and Ear Foundation (Pittsburgh, PA); Research to Prevent Blindness (New York, NY).

Program Number: 4305 **Poster Board Number:** B0073
Presentation Time: 8:30 AM–10:15 AM
Artificial Neural Network Approach for Differentiating Open-Angle Glaucoma

Yoo Kyung Song, Samin Hong, Ein Oh, Tae Keun Yoo, Gong Je Seong. Department of Ophthalmology, Yonsei Univ College of Medicine, Seoul, Republic of Korea.
Purpose: Visual field test for open-angle glaucoma (OAG) and glaucoma suspect (GS) has been a major workload of hospital eye services. The objective of this study was to select patients who should receive periodic visual field test due to clinically significant optic nerve damage in order to increase the effectiveness of treating OAG. To achieve the best performance in differentiating OAG from GS without visual field test, we used an artificial neural network (ANN).
Methods: We investigated Fifth Korean National Health and Nutrition Examination Survey for OAG prediction models. In this cross-sectional study, 386 participants, who underwent visual field test using frequency doubling technology, were included in the study population. For risk prediction model development, the association between clinical features and OAG was examined by multivariate logistic regression (LR) and ANN.
Results: Among 386 participants from the study population, 94 subjects had OAG. The predictors selected by LR included sex, age, menopause, duration of hypertension, myopic spherical equivalent,

intraocular pressure, vertical cup-disc ratio, temporal superior RNFL defect, and temporal inferior RNFL defect. The ANN model was the best discriminator between OAG and glaucoma suspect with an AUC of 0.890. This model predicted OAG with an accuracy of 84.0%, a sensitivity of 78.3%, and a specificity of 85.9%.

Conclusions: To our knowledge, this is the first study to develop the mathematical models for OAG risk prediction among patients with suspected glaucoma using population-based health records. ANN might be cost-effective screening tools identifying OAG among patients with suspected glaucoma. The machine learning technique using ANN can contribute to the advancement of clinical decision-making tools with a good discriminative ability for OAG.

Commercial Relationships: Yoo Kyung Song, None; Samin Hong, None; Ein Oh, None; Tae Keun Yoo, None; Gong Je Seong, None

Program Number: 4306 **Poster Board Number:** B0074
Presentation Time: 8:30 AM–10:15 AM
Residential History and Solar Exposure in Relation to Exfoliation Syndrome in the United States and Israel

Aliya Jiwanil¹, Tzukit Zehavi-Dorin², Arow Majd², Stephanie Loomis^{1,3}, Jae H. Kang³, Janey L. Wiggs¹, Hani Levkovitch-Verbin², Louis R. Pasquale^{1,3}. ¹Ophthalmology, Massachusetts Eye and Ear Infirmary, Boston, MA; ²Ophthalmology, Goldschleger Eye Institute, The Chaim Sheba Medical Center, Tel Aviv University, Tel Hashomer, Israel; ³Medicine, Brigham and Women's Hospital, Boston, MA.
Purpose: To assess the relation between residential history, solar exposure and risk of exfoliation syndrome (ES).

Methods: We conducted a prospective, cross-sectional observational, case-control study at 2 clinical centers: Massachusetts Eye & Ear Infirmary in the United States (US) and the Goldschleger Eye Institute in Israel. Cases demonstrated exfoliation precipitates in at least one eye with or without glaucoma while controls lacked these precipitates on dilated fundus exam. Masked interviewers administered validated residential and solar exposure questionnaires to assess exposure from birth to age 60 in subjects from the US (118 cases, 106 controls) and Israel (67 cases, 72 controls). We developed logistic regression models to estimate the multivariate odds ratio (MV OR) and 95% confidence intervals (CI) of ES at each site separately and pooled the results with meta-analysis.

Results: After adjusting for multiple covariates including age and gender, each degree of weighted lifetime average latitude spent away from the equator was associated with an 11% increased risk of ES (pooled MV OR=1.11, 95% CI: 1.05-1.17; p=0004). After adjustment for lifetime residential history and other covariates, every extra hour per week spent outdoors was associated with a 3% increased risk of ES (pooled MV OR=1.03, 95% CI: 1.00-1.06; p=0.04). For every 1% of time in the summer between 10am and 4pm that sunglasses were worn, the risk of ES decreased by 2% (MV OR=0.98, 95% CI: 0.97-0.99) at the US site but these results were not reproduced at the Israeli site (MV OR=1.00, 95% CI: 0.99-1.01; p=0.98); however, data from both sites were statistically heterogeneous (p for heterogeneity=0.005) and could not be pooled. History of work over either water or over snow was associated with increased risk of ES (MV OR=3.86 (95% CI: 1.36-10.9) in the US even after controlling for weighted lifetime average latitude, sunglass wear and lifetime average number of hours spent outside per week. Too few people in Israel had comparable occupations for analysis. In no model was brimmed hat wear associated with ES risk.

Conclusions: These data suggest that solar exposure contributes to ES. Furthermore, the stronger association with work over snow or water in conjunction with the absence of protection from brimmed hats suggests that light rays incident off reflective surfaces is critical for the development of ES.

Commercial Relationships: Aliya Jiwani, None; Tzukit Zehavi-Dorin, None; Arow Majd, None; Stephanie Loomis, None; Jae H. Kang, None; Janey L. Wiggs, None; Hani Levkovitch-Verbin, None; Louis R. Pasquale, None

Support: Arthur Ashley Foundation; NIH Grant EY020928 and EY015473; Physician Scientist Award from Research to Prevent Blindness and a Harvard Medical School Ophthalmology Scholar Award support Dr. Pasquale; Doris Duke Clinical Research Fellowship supported Aliya Jiwani.

Program Number: 4307 **Poster Board Number:** B0075

Presentation Time: 8:30 AM–10:15 AM

Glaucoma severity and participation in diverse social roles: Does visual field loss matter?

Yelin Yang¹, Graham E. Trope², Yvonne M. Buys³, Elizabeth Badley⁴, Monique Gignac⁴, Yaping Jin^{2,3}. ¹Faculty of Medicine, University of Ottawa, Ottawa, ON, Canada; ²Department of Ophthalmology and Vision Sciences, University of Toronto, Toronto, ON, Canada; ³Dalla Lana School of Public Health, University of Toronto, Toronto, ON, Canada; ⁴Health Care and Outcomes Research, Toronto Western Research Institute, Toronto, ON, Canada.

Purpose: To assess the association between glaucoma severity and individual's participation in diverse social roles.

Methods: Individuals with definite glaucoma, aged 50+ and attending 2 glaucoma clinics were enrolled. They were classified into one of three groups based on visual field loss in the better eye: mild (Mean Deviation (MD) >-6dB), moderate (MD -6dB to -12dB) and severe (MD <-12dB). Those with visual acuity in the better eye <20/50 were excluded to minimize effects caused by reduced visual acuity. Standardized telephone interviews were used to collect information. The validated Social Role Participation Questionnaire was used to assess respondent's view on salience (i.e. importance), difficulty and satisfaction in participating in 11 social role domains. Differences between groups were examined using univariate and multivariate analyses.

Results: 108 participants (54% female) were included: 60 mild, 23 moderate and 25 severe. The mean age was 68±10 for mild, 73±8 for moderate, and 73±8 for severe (p=0.04). Visual field loss involving both superior and inferior fields was seen in 47% of mild, 96% of moderate and 100% of severe.

Except for attending school and having a paid job, the remaining 9 examined social role domains were rated as important/very important by participants in all 3 groups (p>0.05). Compared to those with mild glaucoma, individuals with severe glaucoma reported more difficulties participating in community/religious/cultural events (p=0.02), travelling (p<0.01) and relationships with family members other than spouse or children (p=0.02). The least satisfied social involvement was travelling, reported by individuals with severe glaucoma.

Globally those who were female (p<0.05), had a partner (p<0.05) or had greater social support (p<0.05) considered participation in all aspects of life more important. Individuals with severe glaucoma stated more difficulties when considering all things together compared to mild and moderate groups (p=0.02). Those with higher levels of income (p<0.05) had higher satisfaction with the social roles involved.

Conclusions: Individuals with varying severity of glaucomatous visual field loss all rate participation in diverse social roles as important. Those with severe visual field loss however experience more difficulty with community events, travelling and relationships. They are also least satisfied with these involvements.

Commercial Relationships: Yelin Yang, None; Graham E. Trope, None; Yvonne M. Buys, None; Elizabeth Badley, None; Monique Gignac, None; Yaping Jin, None

Support: CNIB and the Glaucoma Research Society of Canada

Program Number: 4308 **Poster Board Number:** B0076

Presentation Time: 8:30 AM–10:15 AM

Quality of life evaluation of the geriatric population with glaucoma in Costa Rica

Marisse Masis¹, Beatriz Quesada². ¹Universidad de Costa Rica, San José, Costa Rica; ²Universidad de Costa Rica, San Jose, Costa Rica.

Purpose: To evaluate quality of life in geriatric population with glaucoma using the spanish translation of the Glaucoma Quality of Life (GQL-15) and its correlation with visual field damage, visual acuity and demographic factors.

Methods: A cross-sectional, prospective study, using survey questionnaires applied by an interviewer correlated with demographic and clinical data from the health file.

The SPSS was used for statistical analysis

Results: From 100 patients of ages between 64 and 95 years, 70% were female and 30% were male. The mean GQL-15 value was 25. 81±10, being the most referred symptom glare and dark adaptation parameters (11.14 ± 4.3), followed by peripheral vision (9.6 ± 4.4), central and near vision (3.67±1.6), and least was outdoor mobility (1.39 ± 1.01). There was as well a relation between severe glaucomatous damage in the visual field which wasnt related with the visual acuity.

There was no relation between age, sex, IOP, numbers of drugs used or quality of life

Conclusions: The spanish version of the GQL-15 applied to the geriatric population with glaucoma in Costa Rica shows that the difference in severity of the visual field damage is statistically significant between the different groups and is directly proportional with a decrease in the quality of life. The results are not reproducible using visual acuity only.

Using the GLQ-15 adapted to Latin American population may be a useful tool to detect patients with a high-risk for visual field damage, and to evaluate the quality of life in this vulnerable population.

Commercial Relationships: Marisse Masis, None; Beatriz Quesada, None

Program Number: 4309 **Poster Board Number:** B0077

Presentation Time: 8:30 AM–10:15 AM

Quality of life (QoL) in patients (pts) with primary open-angle glaucoma (POAG). An Italian multicenter observational study

Luciano Quaranta¹, Luisa Frevola², Luigi Varano³, Paolo Frezzottti⁴, Gemma C. Rossi⁵, Luciana Carmassi⁶, Teresa Rolle⁷, Luisa

Delcassi¹, Irene C. Floriani². ¹Department of Medical and Surgical Specialties, Radiological Sciences and Public Health, University of Brescia, Brescia, Italy; ²Oncology, IRCCS - Istituto di Ricerche Farmacologiche Mario Negri, Milan, Italy; ³Ophthalmology, University of Catanzaro, Catanzaro, Italy; ⁴Ophthalmology, University of Siena, Siena, Italy; ⁵Ophthalmology, University of Pavia, Pavia, Italy; ⁶Ophthalmology, Istituto Auxologico Italiano, Milan, Italy; ⁷Clin Physiopathol-Section of Optalmology, University of Turin, Turin, Italy.

Purpose: As a chronic and progressive condition, glaucoma can hardly affect QoL. Distress caused by diagnosis, increasing problems with daily activities from visual dysfunction and adverse reactions to glaucoma therapies are only some of the more frequently reported concerns. This study was aimed at evaluating QoL in a large cohort of POAG pts and at assessing the association between glaucoma-related QoL and socio-demographic and clinical characteristics.

Methods: Italian multicenter observational study. Pts already diagnosed or at first diagnosis underwent a comprehensive ocular examination in which QoL was assessed using the Italian validated versions of National Eye Institute Visual Function Questionnaire (NEI-VFQ-25), which measures dimensions of self-reported vision-targeted health status, and Glaucoma Symptom Scale (GSS) Questionnaire, a glaucoma specific tool. Only newly diagnosed pts were asked to enter a 1-year longitudinal phase with two subsequent questionnaire administrations.

Results: From March 2012 to July 2013, out of 3225 pts enrolled at 21 centres 3171 were eligible, whereas less than 2% were excluded due to QoL questionnaire unavailability. 99% pts were caucasian, 50% were female, mean age was 66.9 years (SD 12.2). Most pts (73%) were married, and only 17% lived alone. 93% had a previous POAG diagnosis from a median time of 8 years and 95% pts had a bilateral eye involvement. Mean values of mean defect (MD), of pattern standard deviation (PSD) and visual field index (VFI) were -6.19 dB (SD 6.24), 4.62 dB (SD 3.34) and 84.9 (SD 19.1), respectively. As for QoL, overall mean total score of NEI-VFQ-25 and GSS questionnaires were 86.9 (SD 11.9) and 74.9 (SD 19.2), respectively. PSD>2.5 dB, MD <-2 dB, (VFI) <90% and longer time from diagnosis negatively affect QoL as assessed by both questionnaires. Female sex has a lower total score of GSS, while older pts have a lower NEI-VFQ-25 total score. Glaucoma treatment seems to have no impact on QoL.

Conclusions: This is a large-scale, not-for-profit study providing a reliable description of current Italian situation. Considering that the maximum total score value for both questionnaires is 100, results suggest an overall good QoL. More refined analyses are being conducted to examine in depth pts profiles and questionnaire sub-scales. Longitudinal phase on 207 pts is still ongoing.

Commercial Relationships: Luciano Quaranta, None; Luisa Frevola, None; Luigi Varano, None; Paolo Frezzotti, None; Gemma C. Rossi, None; Luciana Carmassi, None; Teresa Rolle, None; Luisa Delcassi, None; Irene C. Floriani, None
Clinical Trial: NCT01742104

Program Number: 4310 **Poster Board Number:** B0078
Presentation Time: 8:30 AM–10:15 AM

Eye Health Education: How Do Patients Want To Learn?
Lakshmi Swamy, Sandra S. Stinnett, Jullia A. Rosdahl.
Ophthalmology, Duke University, Durham, NC.

Purpose: To understand the learning preferences of ophthalmology patients.

Methods: Results from a survey of ophthalmology patients were analyzed for education preferences and how these correlate with race, age, and ophthalmic topics of interest.

A voluntary and anonymous survey was offered to all patients visiting the Duke Eye Center during the month of May 2012. A total of 611 patients (7.9% of total patients) completed the survey. The survey collected the respondents' age, race, eye health topic preferences, and educational media preferences. The age and racial proportions of the survey group were compared to that of all Duke Eye Center patients during the same time period (a total of 7715 patients).

Results: The age and racial distribution of all Duke Eye Center patients was similar to that of the self-reported demographics of the survey group.

Patients preferred to learn about eye health from one-on-one sessions with providers as well as from printed materials and websites recommended by providers. Patients currently learning from their provider were older (average age 59), and patients learning from the internet (average age 49) and family and friends (average age 51) were younger. Patients interested in cataracts, glaucoma, macular

degeneration, and dry eye were older; patients interested in double vision and glasses were younger. There were racial differences among topic preferences, with black patients most interested in glaucoma (46% of all black respondents), diabetic retinopathy (31%), and cataracts (28%), and white patients most interested in cataracts (22%), glaucoma (22%), and macular degeneration (19%). P was less than 0.05% for all comparison groups.

Conclusions: Ophthalmology patients preferred personalized education: one-on-one with their provider or a health educator, and materials (printed and electronic) recommended by their provider. Age-related topics were more popular with older patients, and diseases with racial risk factors were more popular with high risk racial groups.

Practice implication: Patients value printed materials and websites recommended for them by their providers.

Commercial Relationships: Lakshmi Swamy, None; Sandra S. Stinnett, None; Jullia A. Rosdahl, None
Support: NEI K12 career development award

Program Number: 4311 **Poster Board Number:** B0079

Presentation Time: 8:30 AM–10:15 AM

Cost of care associated with Childhood Glaucoma: 4 year study
Linda Y. Huang, Lekha Ravindraraj, Albert S. Khouri. Institute of Ophthalmology and Visual Science, Rutgers New Jersey Medical School, Newark, NJ.

Purpose: Currently, there are few studies on cost of care of childhood glaucoma. Our aim is to evaluate costs associated with childhood glaucoma upon diagnosis and during first 4 years of care.

Methods: Records of patients (pt) with primary congenital glaucoma (PCG) or secondary glaucoma (SG) who presented over a 15 year period to New Jersey Medical School were reviewed. Data was collected yearly after initial diagnosis; pts with at least 4 year follow up were included in the study. Best estimate at direct costs was based on total number of exams under anesthesia (EUA); surgical interventions including glaucoma procedures, cataract extractions, pars plana vitrectomies, or penetrating keratoplasties; all office and emergency department visits related to the patient's glaucoma; and medications used. Hospital and physicians' fees were converted to costs using the Healthcare Cost and Utilization Project charge to cost ratio of 0.65. Annual cost of medications was based on prior cost analysis. Indirect costs from productivity loss were ascertained by measuring caregivers' missed work days, based on an 8 hour workday and average hourly wages plus benefits for civilian workers in the US (\$29.18 per hour for all US companies).

Results: A total of 23 out of 60 pts diagnosed with childhood glaucoma met inclusion criteria. These consisted of 10 pts (19 eyes) with PCG, and 13 pts (20 eyes) with SG. Mean age at presentation was 41.1 months (from birth to 216 months) and 35.1 months (from birth to 240 months) in the PCG and SG groups respectively. Mean direct costs per pt in each group each year is included in Table 1. The only significant decrease was costs of surgical interventions between year 1 and year 2 (p<0.05). Costs of medications averaged \$564.16 per pt per year. Models for calculating indirect costs of childhood glaucoma and visual impairment are not well-established. Average work days missed per pt per year was 8.39, averaging about \$1,958.87 of lost wages per pt per year.

Conclusions: Childhood glaucomas pose a significant economic burden on care givers and the healthcare system. This burden was highest the first year after diagnosis, especially in cost of surgical intervention, but persisted during the 4 years included in this study. Direct costs are significant in the first years of the disease, however longer follow up is needed to evaluate the impact of indirect costs.

Direct Costs of Childhood Glaucoma (dollars per patient)					
		year 1	year 2	year 3	year 4
EUA	PCG	19410.30	10451.70	9954.00	5972.40
	SG	12251.08	5742.69	5359.85	1914.23
Surgical Interventions	PCG	8936.99	1151.22	3231.80	4575.90
	SG	8070.56	2160.34	1139.29	2949.28
Medications	PCG	548.74	598.42	717.37	649.15
	SG	333.24	487.21	570.00	641.29
Visits	PCG	6648.85	924.30	3081.00	2464.80
	SG	9113.65	2772.90	924.30	1540.50
Total	PCG	52731.39	15339.52	23199.17	22462.05
	SG	40799.89	14116.03	9550.68	11076.56
Total Combined		93531.28	29455.55	32749.85	33538.61

Table 1

Commercial Relationships: Linda Y. Huang, None; Lekha Ravindraraj, None; Albert S. Khouri, None

Program Number: 4312 **Poster Board Number:** B0080

Presentation Time: 8:30 AM–10:15 AM

Cost-Effectiveness of Trabeculectomy with Mitomycin C versus Baerveldt Tube Shunt in the Treatment of Glaucoma: A Markov Microsimulation

Richard I. Kaplan, Lama A. Al-Aswad, George A. Cioffi, Dana M. Blumberg. Harkness Eye Institute, Columbia University Medical Center, New York, NY.

Purpose: The Tube versus Trabeculectomy Trial showed that the increasingly popular tube-shunt procedures may be similarly effective in lowering IOP with lower rates of failure and reoperation when compared to trabeculectomy¹. While the TVT study demonstrated clinical effectiveness of both procedures, evidence on cost-effectiveness is limited. This study sought to compare the cost-effectiveness of trabeculectomy with mitomycin C to Baerveldt 350-mm² implant.

Methods: Using Markov modeling, the cost effectiveness of the procedures was evaluated from a societal perspective. A comprehensive literature review was conducted to identify clinically relevant probabilities of health states for each procedure including rates of success, number of supplemental medications, rates of severe complications and associated visual outcomes. Costs were identified from Medicare CPT/APC reimbursement codes and Red Book medication costs. Patient derived utilities were based on both visual field and visual acuity outcomes and represented by Quality Adjusted Life Years (QALYs). The hypothetical societal limit to resources was included using the willingness to pay threshold per QALY gained (WTP). Costs and utilities were discounted at 3% per year. Uncertainty was assessed using deterministic sensitivity analyses.

Results: Using a five years time horizon, trabeculectomy was less costly (\$8881 versus \$11811) than tube insertion. Patient related utility was slightly more favorable in the tube group than trabeculectomy group (3.49 QALYs versus 3.43 QALYs). This resulted in a cost effectiveness ratio of \$2592/QALY for trabeculectomy and \$3384/QALY for tube insertion. Assuming a WTP of \$50,000, trabeculectomy is the preferred option. However, if WTP is \$100,000, the tube shunt is preferred. The model was sensitive to rates of failure for each procedure but was robust

relative to incidence of complications and generic versus branded medications.

Conclusions: Trabeculectomy provides a more cost effective option than Baerveldt tube shunt for the management of glaucoma. However, Baerveldt does provide slightly higher patient utility at five years and is the preferred option if the willingness to pay threshold is \$100,000 per QALY gained. Future head to head clinical trials should consider costs and visual field outcomes in addition to more traditional glaucoma measures.

Commercial Relationships: Richard I. Kaplan, None; Lama A. Al-Aswad, None; George A. Cioffi, None; Dana M. Blumberg, None

Program Number: 4313 **Poster Board Number:** B0081

Presentation Time: 8:30 AM–10:15 AM

Glaucoma Patients' awareness and approval of "gifts" to ophthalmologists from pharmaceutical companies

Ritu Shah, Ruchir Tewari, Divya Singh, Dewang Angmo, Reetika Sharma, Tanuj Dada. RP centre of ophthalmic sciences, New Delhi, India.

Purpose: To determine the awareness, attitude and approval of glaucoma patients on chronic topical ocular hypotensive medications towards "gifts" that pharmaceutical companies give to treating ophthalmologists

Methods: This was a cross sectional study including patients from the glaucoma services of a university hospital, who were on topical ocularhypotensive medical therapy for a period of 6 months or more. A resident doctor using a standard questionnaire directly interviewed a

total of 88 patients aged 18 yrs of age or above. The questions included demographic data and issues on awareness, attitude and approval of different gift items (drug samples, office items, personal gifts, travel expenses, social events etc) provided to physicians by pharmaceutical companies

Results: Of the 88 participants, 19 (21.6%) were females and 69 (78.4%) were males. Age of the patients was between 18 years and 77 years with a mean age of 47.2 ± 0.5 yrs. Only 58 (65.9%) patients were aware that doctors received gifts from pharmaceutical industry representatives. Forty five (51.1%) patients approved of their physicians receiving gifts in any form. The approval rates for different gift items as given by the patients were - drug samples 62 patients (70.4%), pens 62 patients (70.4%), diary 58 patients (65.9%), calendars 58 patients (65.9%), medical books/ journals/ study material 57 patients (64.7%), domestic conference expenses 31 patients (35.22%), food items 30 patients (34.09%), toiletries 26 patients (29.54%), foreign conference trips 25 patients (28.40%), music CDs 25 patients (28.40%), movie outings/ picnics 22 patients (25%), music players 20 patients (22.7%), mobile phone recharge 19 patients (21.6%), dinners/parties 17 patients (19.3%)

Conclusions: Nearly half of glaucoma patients did not approve of the gifts given by pharmaceutical companies to the ophthalmologists. Eye drop samples, stationary items and study material related to ophthalmology had a high approval rate, while less than one third of patients approved conference expenses or any other personal gift items. This is an important ethical consideration when treating ophthalmologists are offered gifts by medical representatives, especially since the patient may indirectly bear the cost burden of these gifts.

Commercial Relationships: Ritu Shah, None; Ruchir Tewari, None; Divya Singh, None; Dewang Angmo, None; Reetika Sharma, None; Tanuj Dada, None

Program Number: 4314 Poster Board Number: B0082

Presentation Time: 8:30 AM–10:15 AM

Systemic Medication and Intraocular Pressure in a British Population: The EPIC-Norfolk Eye Study

Anthony P. Khawaja¹, Michelle P. Chan², David C. Broadway³, David F. Garway-Heath⁴, Robert N. Luben¹, Jennifer L. Yip¹, Shabina Hayat¹, Kay-Tee Khaw¹, Paul J. Foster^{2,4}. ¹Department of Public Health and Primary Care, Institute of Public Health, University of Cambridge, London, United Kingdom; ²Division of Genetics and Epidemiology, UCL Institute of Ophthalmology, London, United Kingdom; ³Department of Ophthalmology, Norfolk & Norwich University Hospital, Norwich, United Kingdom; ⁴NIHR Biomedical Research Centre, Moorfields Eye Hospital NHS Foundation Trust and UCL Institute of Ophthalmology, London, United Kingdom.

Purpose: To determine the association between systemic medication use and intraocular pressure (IOP) in a population of older British men and women.

Methods: The EPIC-Norfolk Eye Study is a cross-sectional population-based study in the UK. IOP was measured using the Ocular Response Analyser. Three readings were taken per eye and the single best value of the Goldmann-correlated IOP considered. Participants were asked to bring their medication and related documentation to the examination, and these were recorded by a research nurse. The medication classes examined in the current analysis were α -blockers, angiotensin converting enzyme inhibitors (ACEI), angiotensin receptor blockers (ARB), β -blockers, calcium channel blockers (CCB), diabetic medication, diuretics, nitrates, statins, aspirin and other non-steroidal anti-inflammatory drugs (NSAID). We excluded participants with a history of glaucoma therapy or IOP asymmetry between eyes of >5 mmHg. We examined associations between medication use and mean IOP of both eyes using linear regression models adjusted for age, sex and body mass index. We further adjusted for other medication use, one at a time, to determine if associations were independent of other concurrent medication use.

Results: There were complete data from 7093 participants with a mean age of 68 years (range 48–92); 56% were women. The figure presents the associations between medication use and IOP. Use of systemic β -blockers (-1.04 mmHg, 95% CI [-1.30, -0.79], $p < 0.001$) and nitrates (-1.04 mmHg, 95% CI [-1.51, -0.58], $p < 0.001$) were associated with lower IOP. Use of diabetic medication was associated with higher IOP (0.44 mmHg, 95% CI [0.02, 0.85], $p = 0.038$). The observed associations between statin or aspirin use with IOP were no longer significant following adjustment for β -blocker use (Table).

Conclusions: This is the first population-based study to have demonstrated and quantified clinically significant differences in IOP among participants using systemic β -blockers or nitrates. The study findings may have implications for the management of glaucoma patients with co-morbidity, and may provide insight into the pathophysiological processes underlying IOP.

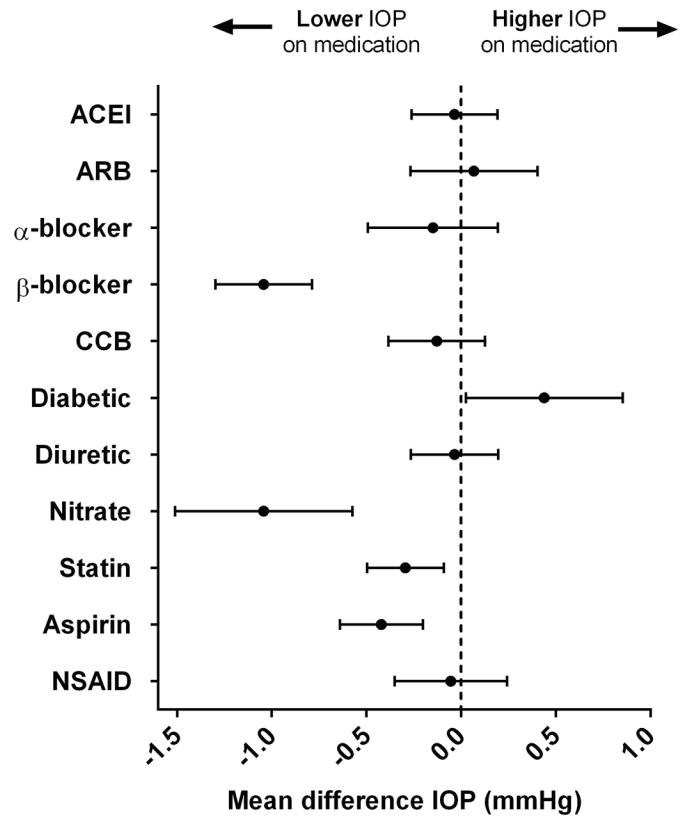


Figure: β coefficients with 95% CI. Adjusted for age, sex and body mass index.

	β	95% CI	p-value
Nitrates	-0.69	(-1.17, -0.21)	0.005
Statins	-0.11	(-0.31, 0.10)	0.31
Diabetic	0.52	(0.11, 0.93)	0.014
Aspirin	-0.21	(-0.43, 0.02)	0.07

Table: Results from regression models further adjusted for systemic β -blocker use.

Commercial Relationships: Anthony P. Khawaja, None; Michelle P. Chan, None; David C. Broadway, None; David F. Garway-Heath, None; Robert N. Luben, None; Jennifer L. Yip, None; Shabina Hayat, None; Kay-Tee Khaw, None; Paul J. Foster, None
Support: Wellcome Trust (094791/Z/10/Z), Medical Research Council (G0401527), Cancer Research UK (C864/A8257), Research into Ageing (262)

Program Number: 4315 **Poster Board Number:** B0083

Presentation Time: 8:30 AM–10:15 AM

Utilization of Various Glaucoma Surgeries and Procedures in Medicare Beneficiaries from 1995 to 2011

Karun Arora, Alan L. Robin, Kevin Corcoran, Suzanne Corcoran, Pradeep Y. Ramulu. Ophthalmology, Johns Hopkins Univ School of Med, Baltimore, MD.

Purpose: To evaluate how procedural treatments for glaucoma have changed between 1995 and 2011.

Methods: Medicare fee-for-service data claims between 1995-2011 were analyzed to determine the number of penetrating surgeries and laser procedures performed for glaucoma in the Medicare population for each calendar year.

Results: Trabeculectomies in eyes without previous scarring decreased 50% from 51,690 in 1995 to 25,758 in 2003, and dropped a further 49% to 13,077 in 2011. Trabeculectomies in eyes with scarring ranged between 10,366 and 13,604 between 1995-2003, but then decreased 44% from 11,018 to 6,117 from 2003-11. The number of aqueous shunting devices placed rose 185% from 2,728 in 1995 to 7,788 in 2003, and increased a further 43% to 11,111 in 2011. Total cytophotocoagulation procedures increased 179% from 3,264 in 1995 to 9,106 in 2003, and increased a further 50% to 13,657 in 2011. The number of transscleral cytophotocoagulations decreased 46% from 5,978 to 3,231 between 2005-11; concurrently, the number of endoscopic cytophotocoagulations increased 94% from 5,383 to 10,426 between 2005-11. The number of laser trabeculoplasties decreased 57%, from a high of 151,244 in 1995 to a low of 75,647 in 2001. From 2001-05, the number of trabeculoplasties more than doubled (176,476 in 2005), but since then the number of trabeculoplasties has decreased 16% (148,052 in 2011). The number of laser iridotomies has stayed fairly consistent between 1995-2011, increasing 14% over this period and ranging from 63,701 to 85,426. Canaloplasties increased 858% from 161 in 2007 to 1,543 in 2011, while express shunts increased 113% from 2,718 in 2009 to 5,788 in 2011.

Conclusions: Glaucoma procedures demonstrating a significant overall increase in volume in recent years include canaloplasty, express shunt implantation, aqueous drainage device surgery, and endoscopic cyclophotocoagulation. Trabeculectomy numbers show a continued long-term downward trend in utilization. After a decline in use between 1995-2001, laser trabeculoplasty increased more than twofold from 2001-05, but has since declined again marginally. The continued movement away from trabeculectomy and towards other IOP-lowering procedures highlights the need for clinical trials comparing the efficacy of these procedures.

Commercial Relationships: Karun Arora, None; Alan L. Robin, None; Kevin Corcoran, None; Suzanne Corcoran, None; Pradeep Y. Ramulu, None

Program Number: 4316 **Poster Board Number:** B0084

Presentation Time: 8:30 AM–10:15 AM

Bleb related infections: Clinical characteristics, risk factors and outcomes in an Asian population

Zhu Li Yap¹, You Chuen Chin³, Judy Ku^{1,4}, Tat Keong Chan^{1,2}, Shamira Perera^{1,2}. ¹Ophthalmology, Singapore National Eye Centre, Singapore, Singapore; ²Ophthalmology, Singapore Eye Research Institute, Singapore, Singapore; ³Medicine, National University of Singapore, Singapore, Singapore; ⁴Ophthalmology, City Eye Centre, Brisbane, QLD, Australia.

Purpose: Our study seeks to verify the hypothesis that blebitis precedes and leads to bleb related endophthalmitis (BRE) if left untreated

Methods: Patient notes were identified for review from January 1996 – July 2013. Identification was done via the center's long standing endophthalmitis audit, glaucoma department bleb-related infection (BRI) audit and microbiology laboratory database identifying all conjunctival swabs taken from blebs. Blebitis was defined as anterior segment inflammation with mucopurulent material in or around the bleb, usually with anterior chamber cells but no hypopyon. Hypopyon or vitreous inflammation was termed BRE

Results: The mean age of all subjects (n=39) was 68.4 with a preponderance of men (74.4%) and Chinese (74.4%). BRE patients were approximately 9 years older than blebitis patients. Majority of subjects had POAG (n=28, 71.8%) with 18(46.2%) subjects having a co-existing eye condition. Diabetes was shown to be a prominent risk factor for BRE compared to blebitis (p=0.047). From similar pre-infective IOP levels of around 12mmHg, IOP dropped in blebitis but doubled with BRE (p=0.002). However, 2 weeks post treatment, IOPs in both groups returned to pre-infective levels. Increasing vascularity of the bleb conferred some risk towards the more severe infection (p=0.004); subjects with blebitis more often had an avascular bleb (84.6%) while those with BRE trended towards a moderately vascular bleb (42.9%). 50% of all our patients had no growth from conjunctival culture. Streptococcus species were the most frequently isolated microbe (15.4%), followed by Haemophilus influenzae (12.8%) and coagulase-negative Staphylococcus (10.2%). The distribution of causative micro-organisms between the blebitis and BRE groups was very similar, implying that no particular micro-organism has a propensity to greater pathogenicity and progression to BRE

Conclusions: We found diabetes to be a prominent risk factor for BRE. Uniquely our IOP results highlight the divergent courses of each disease and may reflect the added inflammatory load in BRE. The lowering of the IOP at infection with blebitis likely represents objective evidence of subclinical leaks or bleb sweating- a feature which is consistent with the avascular bleb morphology noted too. Microbiological analysis of isolates implies that blebitis and BRE have a shared infective aetiology, upon which altered immunity predisposes towards BRE

Commercial Relationships: Zhu Li Yap, None; You Chuen Chin, None; Judy Ku, None; Tat Keong Chan, None; Shamira Perera, None

Program Number: 4317 **Poster Board Number:** B0085

Presentation Time: 8:30 AM–10:15 AM

Surgical Outcomes in Patients with Primary Congenital Glaucoma

Alejandra Hernandez-Oteyza, Antonio Remolina, Cristina Isida Llerandi, Hector Bello Lopez Portillo, Jesus Jimenez-Roman. Glaucoma, Asoc para Evitar la Ceguera en Mexico, Mexico City, Mexico.

Purpose: To evaluate the surgical results of Primary Congenital Glaucoma at our hospital, and to identify how many procedures are needed to control this disease's progression.

Hypothesis: Patients with Primary Congenital Glaucoma require more than one surgical procedure to achieve intraocular pressure (IOP) control

Methods: We reviewed the files of all patients with Primary Congenital Glaucoma that attended the Glaucoma Service at the Asociación para Evitar la Ceguera en México, from April 1997 to January 2012, and identified which surgical procedures were performed, how many surgeries were needed, and the results of each technique, as reflected on the IOP control.

Results: We reviewed the files of 80 patients (160 eyes); 48 patients were males and 32 females, with a mean age at diagnosis of 9.9

months (range 3 days to 108 months). At the time of diagnosis the mean IOP was 21.68 mmHg.

One hundred and twenty three eyes required surgical management. Goniotomy was the most common initial procedure (73 eyes) followed by trabeculectomy (34 eyes), trabeculo-trabeculectomy (7 eyes) and Ahmed Valve implant (5 eyes). In total, 249 procedures in 123 eyes were done (2.02 procedures per eye).

The mean follow-up period was 34.95 months (1 month to 114 months). The mean final IOP was 16.3 mmHg.

Conclusions: Goniotomy is the most common procedure made in patients with Primary Congenital Glaucoma. Most patients require more than one surgical procedure to obtain an adequate IOP and attempt to control the disease's progression.

Commercial Relationships: **Alejandra Hernandez-Oteyza**, None; **Antonio Remolina**, None; **Cristina Isida Llerandi**, None; **Hector Bello Lopez Portillo**, None; **Jesus Jimenez-Roman**, None

Program Number: 4318 **Poster Board Number:** B0086

Presentation Time: 8:30 AM–10:15 AM

THE MACCABI GLAUCOMA STUDY- TREATMENT PATTERNS AND PERSISTENCE WITH GLAUCOMA THERAPY IN A LARGE ISRAELI HEALTH MAINTENANCE ORGANIZATION

Hani Levkovitch-Verbin^{1,2}, Varda Shalev¹, Nir Zigman¹, Gabriel Chodick¹, Inbal Goldschtein¹. ¹Ophthalmology, Maccabi Health Services, Tel-Aviv, Israel; ²Ophthalmology, Goldschleger Eye Institute, Tel-Hashomer, Israel.

Purpose: To characterize adherence and persistence to glaucoma medications among glaucoma patients in Israel

Methods: This is a population-based retrospective cohort study, conducted using the electronic medical databases of Maccabi Healthcare Services (MHS), a 2 million member health maintenance organization in Israel. All MHS newly diagnosed glaucoma patients who purchased at least one anti-glaucoma medication were included. Collected data included demographics, baseline intraocular pressure, diagnosis, prescribed and dispensed anti-glaucoma medications, and caregiver characteristics. Adherence was analyzed by proportion of days covered by drugs during follow up time, ignoring overlaps due to overuse and simultaneous combination of several types of eye drops.

Results: We identified a total of 5,934 incident definite glaucoma patients, who were diagnosed between 2003 and 2010 and purchased at least one anti-glaucoma medication. The mean medical coverage was 58%. Thirteen percent were non-adherent with therapy (covered less than 20% of the follow up time), and only 25% exhibited high adherence (covered at least 80% of the follow-up period). Medical coverage was affected significantly by patient age, gender, socioeconomic status, diagnosis and IOP at baseline. Patients with angle closure and low tension glaucoma were less persistent than those with open angle and exfoliation glaucoma. Medical coverage was also affected by class of drug.

Conclusions: Every Israeli citizen is covered by a governmental supported health insurance. Nevertheless, this study confirms that adherence and persistence with ocular hypotensive medications is less than ideal among Israeli glaucoma patients. Both patients and caregiver characteristics affect adherence.

Commercial Relationships: **Hani Levkovitch-Verbin**, None; **Varda Shalev**, None; **Nir Zigman**, None; **Gabriel Chodick**, None; **Inbal Goldschtein**, None

Program Number: 4319 **Poster Board Number:** B0087

Presentation Time: 8:30 AM–10:15 AM

Continuous use of Sartan Drugs Significantly Reduces Development of Primary Open Angle Glaucoma

John Scichilone, John Kuchtey, Rachel W. Kuchtey. Vanderbilt Eye Institute, Vanderbilt University, Nashville, TN.

Purpose: Sartan drugs are typically prescribed to treat a number of common diseases, such as hypertension and heart disease. Previous studies have shown the beneficial effect of Sartan drugs on reducing intraocular pressure and retinal ganglion cell death. Here, we test the hypothesis that Sartan drugs reduce primary open angle glaucoma (POAG) by exploring a large database of de-identified electronic medical records at Vanderbilt University Medical Center.

Methods: Synthetic Derivative (SD), a database containing clinical information of > 2.2 million unique individuals who received care at Vanderbilt Medical Center was used to identify individuals for this study. Subjects who were 65 years or older as of August, 2008 with more than 1 clinic note during the study period (August, 2008 - August, 2013) were included. Subjects with a possible diagnosis of glaucoma, defined by any of the 44 glaucoma-related ICD 9 codes, were excluded. Cases were defined as individuals with at least one year of continuous Sartan drug exposure during the study period. Controls were defined as individuals with no Sartan drug exposure. POAG development during the study period was defined by the ICD9 code 365.11. Primary analysis reviewed data from all patients, and secondary analysis subdivided the group based on race. Fisher's exact test was used to determine significance.

Results: Patient data was obtained from 13,700 Cases and 88,598 Controls. Of the total Cases, 115 patients (0.75%) developed POAG during the study period. In contrast, 1,611 Controls (1.82%) developed POAG, which is significantly higher than for Cases ($p < 0.0001$). Subgroup analysis showed a lower rate of POAG development in Caucasians compared to African Americans. In Caucasians, Cases consisted of 12,550 individuals, where 85 of these individuals (0.69%) developed POAG, which is significantly lower compared to the 1,337 (1.61%) individuals of the 82,879 Caucasian Controls ($p < 0.0001$). Of the African American Cases ($n = 1,150$), 20 patients (1.39%) developed POAG, significantly lower than the 274 patients (4.79%) of African American Controls ($n = 5,719$) ($p < 0.0001$).

Conclusions: In all comparisons, patients who had taken Sartan drugs continuously for at least a year had a lower diagnostic rate of POAG compared to those who had not taken any Sartan drugs. Further prospective study to prove the beneficial effect of Sartan drugs in reducing glaucoma, is warranted.

Commercial Relationships: **John Scichilone**, None; **John Kuchtey**, None; **Rachel W. Kuchtey**, None

Support: NEI Grant EY020894 (RWK); P30EY008126; Research to Prevent Blindness (Departmental Challenge grant to Vanderbilt Eye Institute and Career Development Grant to RWK) and American Glaucoma Society (RWK).