

THE 8TH ASIA PACIFIC TELE-OPHTHALMOLOGY SOCIETY SYMPOSIUM

ABSTRACT BOOK



远程眼科 TELEOPHTHALMOLOGY 立足中国 布局全球 FROM CHINA TO THE WORLD

Tele-Outpatient Service





远程门诊

Tele-Consultation 远程看诊

Real-Time Tele-Examination 实时远程检查

Tele-Diagnosis 远程诊断

Tele-Spectacle Prescriptions 远程验配

Tele-Followups 远程复查

Tele-Teaching 远程教学

Tele-Emergency Service 远程急诊

Tele-Spectacle 远程验配 Prescriptions



Orthokeratology, Red Light Therapy



Tele-Optometry



Tele-OCT



远程眼底相机 Tele-Fundus Camera



Tele-Mydriasis



Tele-A/B-Scans



远程角膜地形图 Tele-Corneal Topography





Tele-Optical Biometry

Based in China, Liuliu Pei is actively recruiting partners from around the world to build a global tele-ophthalmology platform. Join us today.

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Real-Time Tele-Examination

实时远程检查





远程数码裂隙灯

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FOREWORD

From Congress President & Scientific Program Chair



Dear Friends & Colleagues,

On behalf of Rajavithi Hospital and the Department of Medical Services of the Ministry of Health of Thailand, I would like to offer you a warm welcome to the 8th Asia Pacific Tele-Ophthalmology Society (APTOS) Symposium! It is a great honor for us to host APTOS 2023 in Pattaya, Thailand, in which the theme 'Vision for All with Digital Health' will be deliberated at great length. We are also proud to host the first-ever hackathon in ophthalmology where AI engineers, data scientists and ophthalmologists alike will gather in Pattaya to compete for the APTOS Big Data Cup. With our signature AI workshops and a scientific program that covers all grounds in artificial intelligence (AI) and teleophthalmology, we are confident that APTOS 2023 will be an excellent platform for fruitful exchange and mutual growth.

We can almost say for sure that the adoption of AI in ophthalmology and tele-ophthalmology is unstoppable. Moreover, generative AI is leading this revolution by uncovering new aspects and possibilities. Our next generations of AI will very soon become not only AI-ready, but also AI-native. On the other hand, the WHO World Report on Vision recommends eye care as an integral part of universal health coverage. The first UN General Assembly resolution on eye health has adopted "Vision for Everyone by the Year 2030" to achieve the Sustainable Development Goals (SDGs). One of the key strategies to achieve the SDGs is the application of digital health. It is high time that we laid down some ground rules for better governance and responsible development. APTOS 2023 is for sure the best occasion for such deliberation.

Last but not least, we would like to thank all our chairs, speakers and presenters who share the same vision with us to believe in the potential of digital health including AI and tele-ophthalmology to be the gamechanger in the delivery of ophthalmic care and service. Thank you for envisioning with us the future in which there will be vision for all with digital health.

I hope you will enjoy APTOS 2023 and our hospitality in Pattaya, the beautiful coastal city of Thailand.

Yours sincerely,

Paisan RUAMVIBOONSUK, MD Congress President & Scientific Program Chair APTOS 2023

FOREWORD AND WELCOME MESSAGES

WELCOME MESSAGE

From President, Asia Pacific Tele-Ophthalmology Society



Dear Friends & Colleagues,

Welcome to the 8th Asia Pacific Tele-Ophthalmology Society (APTOS) Symposium! APTOS 2023, aptly themed "Vision for All with Digital Health," is our first physical, face-to-face meeting after the pandemic. I just can't wait to meet you all in person again along the beautiful coastline of Pattaya!

Who could have imagined that it took us 3 whole years to return to normal? Who could have imagined that ChatGPT became mega-popular in just a matter of weeks? We never know what is going to be the next unicorn, but we can be certain that worldwide adoption of AI in almost all walks of life is just a matter of time. It is always in interesting times, which are usually times of trouble, that our society makes room for innovations and alternative solutions. Telemedicine-based consultations soon became the solution in times of lockdowns. AI will soon become an important aide to both the ophthalmologists and the tele-ophthalmologists. At APTOS 2023, the impact and the potential of tele-ophthalmology and its enabling technologies, including AI products and home use devices, will be explored and deliberated at great length. Both speakers and presenters will shed light on their research findings and the latest developments in AI and tele-ophthalmology.

This year, we take pride in organizing **the first-ever hackathon in ophthalmology**. I would like to thank Prof Paisan Ruamviboonsuk and his team from Rajavithi Hospital for their dedication to make this happen. As you may recall, APTOS was probably the first to organize a big data competition in ophthalmology back in 2019 and we are also the first to make available to all our datasets through credentialled access. We are committed to removing all the barriers on your way to becoming AI-ready and AI-native and look forward to your joining the community of **APTOSIANS**, where interdisciplinary collaboration is fostered and friendships built.

The future of digital ophthalmology and eye care is all ours. APTOS is more than happy to drive the change so that we can achieve **vision for all with digital health**. I very much hope that you will enjoy the talks and the presentations we put together at APTOS 2023 and the hospitality of our host.

Yours sincerely,

Mingguang HE, MD, PhD President, Asia Pacific Tele-Ophthalmology Society

FOREWORD AND WELCOME MESSAGES

WELCOME MESSAGE

From Secretary-General, Asia Pacific Tele-Ophthalmology Society



Dear Friends and Colleagues,

Welcome to APTOS 2023, the 8th Asia Pacific Tele-Ophthalmology Society Symposium, hosted by Thailand!

Globally, we are facing ageing and growing populations. With lifestyle changes added to the mix, all making for a predicted significant increase in the burden of vision impairment. This burden is not shared evenly, with at risk populations disproportionally living in low- and middle-income countries. So, it is timely to have **'Vision for All with Digital Health'** as the theme for our congress and I look forward to the discussions on real world opportunities for digital eye health to reach underserved populations and truly make a difference.

I hope you will find the congress stimulating and enjoyable and good luck to all participants joining the APTOS Big Data competition and Hackathon.

Yours sincerely,

Andreas **MUELLER**, PhD, MPH Secretary-General, Asia Pacific Tele-Ophthalmology Society



Asia-Pacific Tele-Ophthalmology Society

(APTOS)



Founded by a group of outstanding tele-ophthalmology specialists in the Asia-Pacific region in May 2016, the Asia Pacific Tele-Ophthalmology Society (APTOS) aims to bring together clinicians, researchers, technicians, institutes and organizations to form an alliance that promotes communication, exchange and collaboration in tele-ophthalmology. It provides a platform on which eye care or tele-medical professionals can share knowledge and collaborate to deliver efficient, accessible and quality universal eye care throughout the region.

Contact us:

APTOS Secretariat

c/o State Key Laboratory (Ophthalmology) Zhongshan Ophthalmic Center, Sun Yat-Sen University 1/F, No. 7 Jinsui Road Zhujiang New Town, Tianhe District Guangzhou, Guangdong, P.R. China

Webiste: www.asiateleophth.org

Email: secretariat@asiateleophth.org

CO-HOST



DEPARTMENT OF MEDICAL SERVICES

Department of Medical Services,

Thai Ministry of Public Health



The Department of Medical Services (DMS), Ministry of Public Health of Thailand takes charge of technical development on medical treatment and physical rehabilitation by conducting studies, research, model development and knowledge management and technology transfer activities; strengthening medical knowledge and skills of healthcare professionals; providing specialized healthcare services or tertiary care for sophisticated conditions that shall meet relevant standards and people's satisfaction. The duties and power of DMS include the following:

- 1. Conducting reviews, analyses, research studies, model development, knowledge management and transfer of appropriate medical and specialized medical technologies; acting as a medical reference center; collaborating and coordinating with other relevant agencies within and outside the country.
- 2. Determining, certifying and developing medical quality standards.
- 3. Transferring medical and specialized medical knowledge and technologies to other public and private health service providers.
- 4. Conducting medical technology assessment of health service providers at all levels to determine their appropriateness and cost effectiveness.
- 5. Providing referral service for patients who may require highly specialized tertiary care or specific medical treatment.
- 6. Assisting in the capacity development of healthcare professionals in public and private health service providers in clinical treatment, medical rehabilitation and other related fields.
- 7. Formulating policy recommendations to improve medical service standards.
- 8. Enhancing operational systems and mechanisms to meet the legal requirements of the Department.
- 9. Performing any other duties as stipulated by laws or delegated by the Ministry of Public Health or the Cabinet.

Contact us: Department of Medical Service Ministry of Public Health, Thailand 88/23 Tivanon Road, Nonthaburi 11000 Tel: 0-2590-6000 Fax: 0-2591-8253 Website: www.dms.go.th/ Email : Saraban@dms.mail.go.th / inter.health@dms.mail.go.th

CO-HOST



Rajavithi Hospital



Established on 16 April 1951, Rajavithi Hospital was initially the first special hospital for women and children in Thailand. Reliable and well-known to the public for its capable team of management professionals and medical doctors, it is where the first successful operation to separate Siamese twins (Wandee and Sriwan) was conducted to our great pride. On 2 May 1976, the hospital was renamed from "Women's Hospital" to "Rajavithi Hospital" and the role of the hospital was changed ever since to provide general healthcare services for all patients nationwide.

Nowadays, Rajavithi Hospital is a modern, fully-equipped institution with a staff of dedicated medical professionals who are ready to serve. As the largest hospital in the network of the Thai Ministry of Public Health, Rajavithi Hospital has a strong reputation for excellence and aspires to become a leading institute in the academic arena internationally.

Contact us:

2, Phayathai Road, Ratchathewi District, Bangkok 10400, Thailand Website: www.rajavithi.go.th Email : webmaster@rajavithi.go.th

CO-HOST



Rajavithi Hospital Foundation



Rajavithi Hospital Foundation was founded in 1980 and registered as a Licensed entity in 1981. Our main objectives include helping needy patients, promoting hospital activities for treatment and research for patients' benefits. Rajavithi Hospital was graciously supported by the Princess Mother Charity Fund.

From 1992 to 2010, Rajavithi Hospital Foundation received 10,300,000 Baht under her royal wish "...to carefully provide for the maximum benefits to distressed patients..." Since its inception, the foundation has spent over US\$11 million on patients' benefits so that needy patients can have a better quality of life.

Contact us:

2, Phayathai Road, Ratchathewi District, Bangkok 10400, Thailand Website: www.rajavithi.go.th/eng/_foundation.php Email : ihc@rajavithi.go.th

ORGANIZING COMMITTEE

Honorary Advisors

Amporn BENJAPONPITAK, MD, MRC Psych (Director-General, Department of Medical Services, Ministry of Public Health)

Nutthapong WONGWIWAT, MD (Deputy Director-General, Department of Medical Services, Ministry of Public Health)

Jinda ROJANAMATIN, MD (Director, Rajavithi Hospital)

Boonsong WANICHWECHARUNGREUNG, MD (Chair, Department of Ophthalmology, Rajavithi Hospital)

Congress President & Scientific Program Chair Paisan RUAMVIBOONSUK, MD

Congress Secretary Somporn CHANTRA, MD

Onsite Registration Worakorn THIANTHAT, MD Kornkamol ANNOPAWONG, MD

Conference Venue & Audio-Visual Teeravee HONGYOK, MD Nattawadee ARAMTIANTAMRONG, MD

Social Program Peranut CHOTCOMWONGSE, MD Rattiya PORNCHAISUREE, MD Nattawat KHIEOKHOEN, MD Parinee KHEMCHOKNATEE, MD Supaporn SRITHAWATPONG, MD

Speaker Coordinators

Somporn CHANTRA, MD Nattapon POKAWATTANA, MD Pareena CHAITANUWONG, MD Nucharee PARIVISUTT, MD

Program Book Mongkol TADARATI, MD

Scientific Program Coordinators Pornlada SUNLAKAVISET, MD Atchara AUMPORNPRUT, MD

Sponsorship

Nitee RATPRASATPORN, MD Jirawut LIMWATTANAYINGYONG, MD Sukhum SILPA-ARCHA, MD

Big Data Competition & Hackathon Peranut CHOTCOMWONGSE, MD

Danli SHI Weiyi ZHANG Guankai PENG

APTOS Secretariat Florence CHUNG Bill WONG



Vision for ALL with Digital Health

SCIENTIFIC PROGRAM COMMITTEE & FACULTY



Paisan RUAMVIBOONSUK (Thailand)



Mingguang HE (Hong Kong)

Invited Speakers				
Pakinee AIMMANEE (Thailand)	Lama AL-ASWAD (U.S.)	Mitchell BRINKS (U.S.)	Peter CAMPBELL (U.S.)	
Paul CHAN	Robert CHANG	Carol CHEUNG	Malvina EYDELMAN	
(U.S.)	(U.S.)	(Hong Kong)	(U.S.)	







THE APTOS COUNCIL

Office Bearers



President Minguang HE (Australia)



Vice President Kim RAMASAMY (India)



Assistant Secretary-General Ryo KAWASAKI (Japan)





Vice-President Paisan RUAMVIBOONSUK (Thailand)

Secretary-General

Andreas MUELLER

(Australia)



Treasurer Carol CHEUNG (Hong Kong)

Council Members



Wei HE (China)



Gavin TAN (Singapore)





Raba THAPA (Nepal)

Hanruo LIU

(China)



Ching-Yao TSAI (Taiwan)

Padmaja RANI

(India)

(Korea)

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Ningli WANG (China)



Sangchul YOON



PROGRAM AT A GLANCE

PROGRAM OVERVIEW & SCIENTIFIC SESSIONS

Date: December 2, 2023 (Saturday)

Time: 08:00 – 17:30 (GMT+7) Head of State Chamber, 2/F, Royal Cliff Grand Hotel, Pattaya, Thailand

08:00 - 09:15	Symposium 1: ChatGPT, Generative AI & Large Language Models in Ophthalmology & Healthcare
09:15 - 10:15	Opening Session
10:15 - 10:30	Coffee Break
10:30 - 12:00	Symposium 2: Vision for All with Digital Eye Care: From Code to Clinical Care
12:00 - 13:00	Free Paper Session 1: Artificial Intelligence
13:00 - 13:45	Jin Yu Medical Sponsored Lunch Symposium: Development & Applications of Tele- Ophthalmology in China
13:45 – 15:30	Symposium 3: Combating Disparities in Eye Care
15:30 - 15:45	Coffee Break
15:45 – 17:30	Symposium 4: The Latest of AI in Ophthalmology 1: Classification and Screening
17:30 - 21:00	Attendee Get-Together

Date: December 3, 2023 (Sunday) Time: 08:00 – 17:45 (GMT+7) Head of State Chamber, 2/F, Royal Cliff Grand Hotel, Pattaya, Thailand

08:00 - 09:30	Symposium 5: International Research Collaboration in Digital Eye Health
09:30 - 10:45	Symposium 6: Governance of AI in Ophthalmology
10:45 - 11:00	Coffee Break
11:00 - 13:00	Symposium 7: The Latest of AI in Ophthalmology 2: Segmentation & Prediction
13:00 – 13:45	Lunch Break & Poster Session
13:45 – 15:30	Symposium 8: Lessons Learnt from Real-World Teleophthalmology
15:30 – 15:45	Coffee Break
15:45 – 16:45	Free Paper Session 2: Tele-Ophthalmology
16:45 – 17:45	Closing Remarks & Prize Presentation for APTOS Hackathon 2023

CONGRESS INFORMATION

GENERAL INFORMATION

Name of Event

The 8th Asia Pacific Tele-Ophthalmology Society Symposium (APTOS 2023)

<u>Venue</u>

Royal Cliff Grand Hotel 353 Phra Tamnuk Road, Pattaya, Chonburi, Thailand 20150

<u>Time</u>

December 2, 2023: 08:00 – 17:30 (GMT+7) December 3, 2023: 08:00 – 17:45 (GMT+7)

Registration Counter & Delegate Bag Collection

Location: **Dec 1:** Lobby, Royal Cliff Beach Hotel **Dec 2 – 3:** Pre-Function Area, Head of State Chamber, 2/F, Royal Cliff Grand Hotel

On-Site Payment

On-site payment with cash and credit card can be made at the registration and payment counter.

Delegate Bag Pick Up – Registration Counter

Delegates can collect their delegate bags at the registration counter.

Coffee Breaks & Lunch

Coffee and refreshments are served between sessions in the morning and in the afternoon. Lunch is inclusive in the registration and served in Head of State Chamber, 2/F, Royal Cliff Grand Hotel.

Policies

No Smoking Policy

Smoking is strictly prohibited in all session rooms, meeting and exhibition areas. Your cooperation is appreciated.

Photographing in Exhibition Hall

Attendees wishing to photograph or videotape an exhibit must obtain permission from the relevant company beforehand.

Photographing or Videotaping for Scientific Sessions

Photographing and/or videotaping during any of the Scientific Sessions are strictly prohibited. (Permission must be obtained in advance by media representatives.)

Re-Issue of Delegate Badge

Reissuing of delegate badges will be available at the Registration. Badges are non-transferable. An administration fee of USD20 may be incurred for re-issuing a delegate badge.



Scan the QR code for the online abstract book.

Speaker Ready Room/Preview Room – Jomtian 9

Opening Hours:

Date	Time
December 1, 2023	1500-1730
December 2, 2023	0730-1730
December 3, 2023	0730-1730

E-Poster & Video Platform – Pre-Function Area

Delegates can visit the E-poster and Video Platform located in the Exhibition Area.

FLOOR PLAN

8 9



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CONGRESS INFORMATION

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CONGRESS INFORMATION

SOCIAL PROGRAM

Presidential Dinner

Date:December 1, 2023Time:17:15 - 20:00 (GMT+7)Venue:Sky Gallery, Pattaya, Thailand

Attendee Get-Together

Date:December 2, 2023Time:17:30 – 21:00 (GMT+7)Venue:Royal Opal Theatre, 1/F, Royal Cliff Beach Hotel, Pattaya, ThailandFormat:Buffet Dinner

AI WORKSHOPS

We will be conducting **AI workshops** online as a pre-meeting of APTOS 2023 on December 1. Details are given as follows:

Date: December 1, 2023 (Friday)
Time: 15:00 – 16:00 (GMT+7)
Venue: Jomtian 8, 2/F, Royal Cliff Grand Hotel, Pattaya, Thailand



CORPORATE PARTNERS





BIG DATA COMPETITION & HACKATHON

The Asia Pacific Tele-Ophthalmology Society is organizing its 3rd Big Data Competition with the support from the Department of Medical Services of the Thai Ministry of Public Health and Tianchi, a subsidiary of Alibaba Group. This year, we will focus on report generation from fundus fluorescein angiography (FFA) images of over 1,700 patients with different eye conditions.

Description:

Fundus fluorescein angiography (FFA) is an invasive diagnostic procedure that helps to assess the anatomy, physiology, and pathology of retinal and choroidal circulation. It aids in the diagnosis of various ocular pathologies and contributes to decision-making when planning the management of ocular pathology.

In this synchronous competition, you'll build a machine learning model to generate comprehensive angiography reports for patients with eye diseases. You'll work with **over 50,000 FFA images** collected in hospital settings to identify different vascular lesions, anomalies, blood flow patterns and to ultimately generate an accurate report, which is a time-consuming and knowledge-intensive task for the physician. If successful, you will help ophthalmologists save tremendous time that can otherwise be spent on improving the quality of patient care.

Timeline:

- October 21, 2023 Launch of Competition & APTOS Hackathon 2023 Registration Opens
- October 24, 2023 Accepting Submissions
- November 15, 2023 Entry Deadline & Team Merger Deadline
- November 26, 2023 Preliminary Round Submission Deadline & APTOS Hackathon 2023 Registration Deadline
- December 1, 2023 APTOS 2023 Hackathon & Final Submission Deadline (Only participants taking part in the Hackathon in Pattaya are eligible to receive the prize money.)
- December 2, 2023 Submission of Codes by the top 5 finalists
- December 3, 2023 Prize Presentation

APTOS Hackathon 2023:

Date: December 1, 2023
Time: 09:00 – 19:00 (GMT+7)
Venue: Jomtian 10, 2/F, Royal Cliff Grand Hotel, Pattaya, Thailand

Cash Prizes:

Participants in the APTOS Hackathon 2023 with the best scores on the private leaderboard are eligible to receive:

- 1st Place **US\$10,000**
- 2nd Place US\$5,000

COMPETITION & AWARDS

Acknowledgment:

We thank Rajavathi Hospital for providing the images for the 3rd APTOS Big Data Competition and the Department of Medical Services of the Ministry of Public Health of Thailand for their support to make the Competition and the Hackathon happen.





We are also grateful towards Alibaba Cloud and Tianchi, our sole sponsors that provide us with the technical support necessary for the Competition to take place.

C-J Alibaba Cloud | TIANCHI 天池

YOUNG INNOVATOR TRAVEL GRANTS

Every year, the Asia Pacific Tele-Ophthalmology Society offers up to 3 travel grants for outstanding presenters and young innovators to attend its annual symposium. Priority is given to young innovators who are aged 40 or below, come from a developing country, whose presentations (free paper or poster) have been accepted by the Scientific Program Committee and who have never received the APTOS Young Innovator Travel Grant.



Masahiro AKADA, MD Japan



Md. Sajidul H. TANJIL, MBBS, MPH Bangladesh



Zhen Ling TEO, MBBS, FRCOphth Singapore

DEC 2, 2023 (SAT)

ARTIFICIAL INTELLIGENCE

ChatGPT, Generative AI & Large Language Models in Ophthalmology & Healthcare

08:00 - 09:15 Venue: Head of State Chamber Chair(s): Robert CHANG, Mingguang HE, Paisan RUAMVIBOONSUK

08:00 Large Language Models in **Ophthalmology: Promise or Fluke?** Yih-Chung THAM 08:15 Med-PaLM to Generate Answers to **Medical Questions** Yun LIU 08:30 How Large Language Models will Transform Clinical Care Robert CHANG 08:45 Future-Proofing Patient-Centred **Ophthalmology Service Delivery** Olivia LI 09:00 Artificial Intelligence Generated Content (AIGC) in Medical Health Chao HE 09:15 Panel Discussion: How to Make Use of ChatGPT in Healthcare

The Latest of AI in Ophthalmology 1: Classification and Screening

15:45 - 17:30 Venue: Head of State Chamber Chair(s): Somkiat **ASAWAPHUREEKORN**, Carol **CHEUNG**, Andrzej **GRZYBOWSKI**

15:45 Deep Learning for Prediction of DR Progression Richa TIWARI 16:00 Technological Innovations to Improve the Diagnostic Evaluation of Infectious Keratitis Travis REDD 16:15 Deep Learning for Discriminating Infectious Keratitis Passara JONGKHAJORNPONG 16:30 Updates on Deep Learning for Oculomics: Can it be Used in Clinical Practice? Carol CHEUNG 16:45 AI-Assisted Telemedicine Screening for Diabetic Retinopathy in Taiwan Yi-Ting **HSIEH**

17:00 AI for CMVR Screening, the Next Step Wipada LAOVIROJJANAKUL 17:15 Panel Discussion: What's next for eye screening with AI?

DIGITAL HEALTH

Opening Session

09:15 - 10:15 Venue: Head of State Chamber *Chair(s): Mingguang HE, Paisan RUAMVIBOONSUK*

09:15 Opening Remarks 09:35 Keynote Lecture 1: Digital Eye Health – Key to Enhancing Eye Care Ravilla THULASIRAJ 09:55 Keynote Lecture 2: Vision for All by the Year 2030 with Digital Eye Care Paisan RUAMVIBOONSUK

Vision for All with Digital Eye Care: From Code to Clinical Care

10:30 - 12:00 Venue: Head of State Chamber *Chair(s): Rajiv RAMAN, Vitoon RUANGSUKSRIWONG, Sangchul YOON*

10:30 Prevention of Blindness from Thailand's National Eye Service Plan Vitoon RUANGSUKSRIWONG 10:45 Translating Big Data & Al into Better Healthcare Delivery Kang ZHANG 11:00 Digital Twin Olivia LI 11:15 Digital Screening for Strabismus Supaporn TENGTRISORN 11:30 Creating a Digitally Enabled Patient Centric Health Delivery Model of Care in Eye Care and Getting Ready for Telehealth 2.0 Amit MATHUR 11:45 Panel Discussion: How to Integrate Digital Care into Clinical Care

Combating Disparities in Eye Care

13:45 - 15:30 Venue: Head of State Chamber Chair(s): Paul CHAN, Mitchell BRINKS, Warapat WONGSAWAT

13:45 Artificial Intelligence to Reduce Ocular **Health Disparities** J. Peter CAMPBELL 14:00 Addressing Health Equity and Implementation of AI Screening: Perspectives from the American Academy of Ophthalmology Paul CHAN 14:15 A Cost-Effectiveness Analysis of **Combined Population-Based Screening for** Multiple Blindness-Causing Eye Diseases in China Hanruo LIU 14:30 Using Health Policy Evidence Gaps for Sustainability – A Case Study in the U.S. Mitchell BRINKS 14:45 Adoption of WHO Eye Care Competency Framework in Thailand Warapat WONGSAWAT 15:00 Combined AI Model for Diabetic Retinopathy and Glaucoma Screening in Thailand

Nida WONGCHAISUWAT

15:15 Panel Discussion: Can we achieve 'vision for all' by the year 2030?

DEC 3, 2023 (SUN)

ARTIFICIAL INTELLIGENCE

Governance of AI in Ophthalmology

09:30 - 10:45 Venue: Head of State Chamber *Moderator(s): Malvina* **EYDELMAN**, *Sak* **SENGKHOONTHOD**

09:30 Overview of AI Governance Sak SENGKHOONTHOD 09:45 EU and AI Approval for Ophthalmology Andrzej GRZYBOWSKI 10:00 Approval of AI in Ophthalmology in the US Malvina EYDELMAN 10:15 Data Protection with Federated Machine Learning Zhen Ling **TEO** 10:30 **Panel Discussion: Will AI create inequity in ophthalmic care**?

The Latest of AI in Ophthalmology 2: Segmentation & Prediction

11:00 - 13:00 Venue: Head of State Chamber *Moderator(s): Pitipol CHOOPONG, Haotian LIN, T.Y. Alvin LIU*

11:00 Effect of Image Segmentation to Performance of Common Macular Diseases using Deep Learning on OCT Natsuda KAOTHANTHONG 11:15 Predicting Imminent Conversion to Neovascular AMD Using Multimodal Data and **Ensemble Machine Learning** T.Y. Alvin LIU 11:30 Predictive Utility of Deep Learning in Diabetic Retinopathy Care: Translating into **Clinical Practice** Rajiv RAMAN 11:45 Real-World, Retina Clinic Application of AI for OCT Segmentation Boris STANZEL 12:00 Early Detection of Visual Impairment in Young Children Using a Smartphone-Based **Deep Learning System** Haotian LIN 12:15 Computer-Aided Systems in Automatic **Detection of Eye Diseases** Pakinee AIMMANEE 12:30 AI-Based Retinal Image Assessment for Cardiovascular Disease Prediction: Huge Potentials, but more Challenges in Japan Ryo KAWASAKI 12:45 Panel Discussion: What's next for disease prediction with AI?

Closing Session & Prize Presentation of the APTOS Hackathon 2023

16:45 - 17:45 Venue: Head of State Chamber *Chair(s): Mingguang HE, Paisan RUAMVIBOONSUK*

16:45 TBC Reza ZADEH 17:00 Overview of the Competition

SCIENTIFIC PROGRAM SCHEDULE

Paisan RUAMVIBOONSUK 17:15 Champion's Share & Tell TBC 17:30 Closing Remarks

DIGITAL HEALTH

International Research Collaboration in Digital Eye Health

08:00 - 09:30 Venue: Head of State Chamber *Chair(s): Prut HANUTSAHA, John PRAKASH, Gavin TAN*

08:00 Collaboration in the Metaverse Steven HOUSTON III 08:15 Strengthening International Research Collaboration for Improving Digital Health in the Mobile World John PRAKASH 08:30 Federated Learning for Multicenter **Collaboration in Ophthalmology** Jayashree KALPATHY-CRAMER 08:45 Developing Systems and Platforms for International Collaboration in Digital Health Gavin TAN 09:00 Digital Health Solutions in Eye Care, International Collaborative Initiatives and Expanding Horizons: Experience from a Tertiary Care Academic Institution in India Radhika TANDON 09:15 Panel Discussion: Challenges in International Research in Ophthalmology

TELE-OPHTHALMOLOGY

Lessons Learnt from Real-World Teleophthalmology

13:45 - 15:30 Venue: Head of State Chamber Chair(s): Lama AL-ASWAD, Teeravee HONGYOK, Padmaja RANI

13:45 Lessons learned from Aravind Eye Hospital Kim RAMASAMY 14:00 AI-Based Eye Care through Tele-Ophthalmology Yogesan KANAGASINGAM 14:15 AI-Assisted Telemedicine Screening for Age-Related Macular Degeneration in Taiwan Tsui-Kang HSU 14:30 Lessons learned from LV Prasad Eye

Institute Padmaja RANI

14:45 Lessons learned from the USA Lama AL-ASWAD

15:00 Teleophthalmology Unit Brings Comprehensive Eye Care to Rural India Sheila JOHN

15:15 Panel Discussion: Is tele-medicine a main stream practice in healthcare and ophthalmic care now?

SUBMITTED PROGRAM- FREE PAPERS

DEC 2, 2023 (SAT)

ARTIFICIAL INTELLIGENCE

12:00 - 13:00 Venue: Head of State Chamber *Chair(s): Ryo KAWASAKI, Raba THAPA*

12:00 Automatic Report Interpretation and Clinical Evaluation for Fundus Fluorescein Angiography Images of Diabetic Retinopathy Patients by Artificial Intelligence Kai JIN

12:08 Objective Evaluation of Intrascleral Fixation Procedures using Stretchable Strain Sensors: A Machine Learning Approach Masahiro AKADA

12:16 Translation of Color Fundus Photography into Fluorescein Angiography using Deep Learning

Danli SHI 12:24 Enhancing Ultra-Wide-Field Fundus Images: Deep Learning-Based Eyelash Artifact Removal

Weiyi **ZHANG**

12:32 Improving Retinal Disease Detection Training for Non-Experts with Stable Diffusion-Generated Images: Matching AI Performance in Less than 60 Minutes

Hitoshi TABUCHI

12:40 Multiple Ocular disease Detection using Deep Learning

Amod **NAYAK**

12:48 Electrodiagnostic Signs of Carpal Tunnel Syndrome in Ocular Pseudoexfoliation Syndrome Nader NASSIRI

DEC 3, 2023 (SUN)

TELE-OPHTHALMOLOGY

15:45 - 16:45 Venue: Head of State Chamber *Chair(s): Mingguang HE, Paisan RUAMVIBOONSUK*

15:45 Clinical and Economic Impact of Teleophthalmology-Based Vision Center in Managing Ocular Disorders in Rural Northern Bangladesh Md. Sajidul HUQ 15:53 Advancements in Teleophthalmology in the Context of Glaucoma Piyush JAIN 16:01 Teleophthalmology at a Primary and Tertiary Eye Care Network from India: **Environmental and Economic Impact** Padmaja RANI 16:09 Reading Ability Improvements Following Magnification Device Training via Telerehabilitation versus In-Office Visits for **Visually Impaired Patients** Ava BITTNER 16:16 Validation of the Diagnosis by Teleophthalmologists and Vision Centre Technicians in Patients Diagnosed with **Posterior Segment Disease** Vijay ANTONY 16:25 Comparing the Clinical Outcome of Transepithelial and Conventional Photorefractive Keratectomy in Correction of Moderate Myopia: A Randomized Case Control Study Nader NASSIRI 16:25 Effect of Subconjunctival Bevacizumab Injection on the Outcome of Ahmed Glaucoma Valve Implantation: A Randomized Control

Trial Nader **NASSIRI**

SUBMITTED PROGRAM- E-POSTER

ARTIFICIAL INTELLIGENCE

Development and Future of Artificial Intelligence and Telemedicine in Ophthalmic Applications *First Author: Lijun YUN Co-Author(s): Xiaokun WU*

Analysis of an Al-Based Diabetic Retinopathy Screening: A Comprehensive Study First Author: Md Sajidul HUQ Co-Author(s): Khairul ISLAM, Rokhsana SHOMA, Md Mahmudul ISLAM

Accuracy of Medios Artificial Intelligence Aided Fundus Photography in Detecting Diabetic Retinopathy among Filipino Patients with Type 2 Diabetes Mellitus Being Seen by Endocrine Specialty Clinics First Author: Precious UNTALAN Co-Author(s): Maria CRUZ, Oliver DAMPIL, Niccolo AGUSTIN

Federated Machine Learning in Healthcare: A Systematic Review on Clinical Applications and Technical Architecture First Author: Zhen Ling TEO Co-Author(s): Daniel TING

Relationship between Research Impact and Open Access in Ophthalmic Artificial Intelligence Publications

First Author: Victoria **VOUGHT** Co-Author(s): Rita **VOUGHT**, Haris **WASEEM**, Bernard **SZIRTH**, Albert **KHOURI**

Few-Shot Learning for Detection of Pythium Insidiosum Keratitis

First Author: Passara JONGKHAJORNPONG Co-Author(s): Ratchainant THAMMASUDJARIT, Onsiri THANATHANEE, Orapin ANUTARAPONGPAN, Theerapong KRAJAEJUN

Development of an Artificial Intelligence System to Identify Diabetic Retinopathy: A Case Study in a Low Resource Setting First Author: Malinda **DE SILVA** Co-Author(s): Kasun **RANASINGHE**, Poorna **FERNANDO**, Harsha **JAYAKODY**

Prediction of Treatment Response in Center-Involved Diabetic Macular Edema Using a Deep Learning Approach Based on Optical Coherence Tomography

First Author: Thanaporn **KRITFUANGFOO** Co-Author(s): Sipat **TRIUKOSE**, Tharikarn **SUJIRAKUL**

Offline AI Deployed on a Portable and Cost-Effective Fundus Camera Innovating Diabetic Retinopathy, Glaucoma, and AMD Screening First Author: Divya **RAO**

Co-Author(s): Venkatesh **SWATI**, Manavi SINDAL, Prabu BHASKARAN, Anand RAJENDRAN, Aditya MAITRAY, Kavita **S**, Shruti R, Kalpa NEGILONI, Florian SAVOY, Shreya BHANDARY, Maanasi MAHALINGAM, Vighnesh MJ

Knowledge and Attitude of Ophthalmic Physicians in Bangladesh toward Artificial Intelligence in Ophthalmology First Author: Md Sajidul HUQ Co-Author(s): Khairul ISLAM, Md Faruck HUSSAIN

OCT Image Interpretation Using Deep Learning and Explainable AI

First Author: Amod NAYAK

Co-Author(s): Minakhi **GHOSH**, Mustuffa **KHAN**, Girish **SOMVANSHI**, Pradeep **WALIA**, Pallabi **PAUL**

ICGA-GPT: Report Generation and Question Answering for Indocyanine Green Angiography Images

First Author: Ziwei **ZHAO** Co-Author(s): Xiaolan **CHEN**, Weiyi **ZHANG**, Pusheng **XU**, Yingfeng **ZHENG**, Danli **SHI**, Mingguang **HE**

Integrating Multi-Modal Ophthalmic Images: A New Frontier in Predicting Cardiovascular Disease Risks

First Author: Fan **SONG** Co-Author(s): Weiyi **ZHANG**, Danli **SHI**

Translation of Color Fundus Photography into High-Resolution Indocyanine Green Angiography Image Using Deep Learning for Age-Related Macular Degeneration Screening First Author: Ruoyu CHEN

Co-Author(s): Weiyi **ZHANG**, Fan **SONG**, Yingfeng **ZHENG**, Honghua **YU**, Dan **CAO**, Danli **SHI**, Mingguang **HE** **Program in Nepal** *First Author: Raba THAPA*

Association of Genetic Risk Score for Intraocular Pressure and Incident Dementia First Author: Wenyi HU Co-Author(s): Zhuoting ZHU, Mingguang HE

CORNEA

Remote Surgical Wetlab Training for Cornea Fellows in a Multi-Tier Hospital Network in India First Author: Kavya CHANDRAN Co-Author(s): Karthikesh ANCHE, Padmaja RANI, Pravin VADDAVALLI

CATARACT

Classification of Cataract Based on Swept Source Image on IOL 700 and Comparison with Slip Lamp LOCS Classification of Lens Opacification – a Pilot Study First Author: Sharat HEGDE Co-Author(s): Vrinda VISWANATHAN

Diagnostic Performance of Smartphone Anterior Eye Photography with Remote Ophthalmologist Review Versus In-Person Ophthalmologist Exams First Author: Vijay ANTONY Co-Author(s): Rengaraj VENKATESH, Jordan

SHUFF, Kunal PARIKH, Nakul SHEKHAWAT, Kamini REDDY

CLINCAL & EPIDEMIOLOGIC RESEARCH

Accelerometer-Measured Daily Behaviours that Medicate the Association between Refractive Status and Depressive Disorder First Author: Zijing DU Co-Author(s): Xiayin ZHANG, Ting SU, Ying FANG, Honghua YU

Prevalence and Associated Factors of Diabetic Retinopathy among People with Diabetes Screened Using Fundus Photography at a Community Diabetic Retinopathy Screening

GENERAL OPHTHALMOLOGY

Comparative Study of Changes of Corneal Curvatures and Uncorrected Distance Visual Acuity Prior to and after Corneal Collagen Crosslinking: 1-Year Results First Author: Nader NASSIRI Co-Author(s): Kourosh SHEIBANI, Sara KAVOUSNEZHAD

A Case Report of Optic Neuritis Following Second COVID-19 Vaccination

First Author: Edward **SAXTON** Co-Author(s): Binita **PANCHASARA**, Susan **SARANGAPANI**

Real-World Validation of the R Eye Library for Big-Data Analysis of Free Text EMR Visual Acuity Data *First Author: Michael MAHR*

GLAUCOMA

Surgical Management of Glaucoma in Fuchs Uveitis Syndrome: Trabeculectomy or Ahmed

Glaucoma Valve

First Author: Nader **NASSIRI** Co-Author(s): Kourosh **SHEIBANI**, Sara **KAVOUSNEZHAD**

The Long-Term Outcome of Ahmed Glaucoma Valve Insertion in Neovascular Glaucoma First Author: Nader NASSIRI

Co-Author(s): Kourosh **SHEIBANI**, Sara **KAVOUSNEZHAD**

The Effect of Early Post Trabeculectomy Bleb Leakage on Surgical Outcome: A Prospective Cohort Study First Author: Nader NASSIRI Co-Author(s): Maryam YADGARI, Kourosh SHEIBANI, Sara KAVOUSNEZHAD

The Effect of Hypertensive Phase on the Long-Term Outcomes of Ahmed Glaucoma Valve (AGV) Implantation

First Author: Nader **NASSIRI** Co-Author(s): Maryam **YADGARI**, Kourosh **SHEIBANI**, Sara **KAVOUSNEZHAD**

The Role of Primary Needle Revision after Ahmed Glaucoma Valve (AGV) Implantation First Author: Nader NASSIRI Co-Author(s): Maryam YADGARI, Kourosh SHEIBANI, Sara KAVOUSNEZHAD

An Automated, Offline, Fundus Image-Based Artificial Intelligence Tool in Screening Different Severity of Glaucoma First Author: Divya RAO Co-Author(s): Sirisha SENTHIL, Chandrasekar GARUDADRI, Florian SAVOY, Kalpa NEGILONI, Shreya BHANDARY, Raghava CHARY

Eye Drop Nitarsudil in Advanced Glaucoma on Maximum Tolerated Medical Therapy During COVID-19 Pandemic First Author: Saurabh HARAL Co-Author(s): VS GUPTA

OCULAR IMAGING

Retinal Vessel Calibers and Mortality Risk: Evidence from UK Biobank Study *First Author: Mayinuer* **YUSUFU** *Co-Author(s): Xianwen* **SHANG**, Danli **SHI**, *Mingguang* **HE**

RETINA & VITREOUS

Retinopathy of Prematurity among the Neonates in a Multi-Specialty Eye Hospital of Northern Bangladesh First Author: Md Sajidul HUQ Co-Author(s): Md Mahmudul ISLAM

Cultural Retinal Vein Occlusion in a Young Adult Secondary to Dehydration and Overexertion *First Author: Edward SAXTON Co-Author(s): Aaron YEUNG*

The Control Study of Deep Learning – Retinal Pigment Epithelium Segmentation for the Most Popular Optical Coherence Tomography Device First Author: Daisuke NAGASATO Co-Author(s): Hitoshi TABUCHI, Mao TANABE

TELE-OPHTHALMOLOGY

Telemedicine during COVID Era: Experience from a Tertiary Eye Care Centre in North India *First Author: Neha KUMARI Co-Author(s): Karthikeyan MAHALINGAM, Radhika TANDON*

Real-World Applications of a Smartphone-Based VA Test (WHOeyes) with Automatic Distance Calibration

First Author: Yi **WU** Co-Author(s): Stuart **KEEL**, Vera **CARNEIRO**, Shiran **ZHANG**, Wei **WANG**, Xiaotung **HAN**, Mingguang **HE**

Pre- and Post-COVID Longitudinal OCT-B Foveal Analysis in Patients with Type 1 Diabetes Mellitus *First Author: Victoria VOUGHT Co-Author(s): Rita VOUGHT, Bernard SZIRTH, Albert KHOURI*

Tele-Robotic Consultations in Vision-Threatening Diseases in Community-Based Events *First Author: Victoria VOUGHT Co-Author(s): Rita VOUGHT, Bernard SZIRTH, Albert KHOURI*

Inclusion of Anterior Segments Imaging in Detecting Ocular Conditions in Remote Community-Based Screenings First Author: Rita VOUGHT Co-Author(s): Victoria VOUGHT, Bernard SZIRTH, Albert KHOURI

Gender Differences in Tele-Ophthalmology Article Authorship First Author: Rita VOUGHT

Co-Author(s): Victoria VOUGHT, Bernard SZIRTH, Albert KHOURI

Impact of an Integrated Care Delivery Model Connecting Diabetic and the Eye Clinics to Deliver Care for Diabetic Retinopathy via Tele-Ophthalmology First Author: Malinda DE SILVA Co-Author(s): Rohana MARASINGHE

Designing a Care Delivery Model to Use Tele-Ophthalmology for Sri Lankan Context First Author: Malinda DE SILVA Co-Author(s): Rohana MARASINGHE, Aruna FERNANDO

Training of the Screeners for Tele-Glaucoma Program in Malaysia: A Pilot Study First Author: Jemaima Che HAMZAH Co-Author(s): Xiao Hui WEE, Mohd HAIROL, Mohd RAHMAN, Rona NASARUDDIN

No-Code Automated Machine Learning for Referable Diabetic Retinopathy Image **Classification from Ultrawide Field Retinal Images in a Philippine Tertiary Hospital** *First Author: Leandro ARCENA Co-Author(s): Paolo SILVA*

Digital Cataract Service: An Inevitable Revolution?

First Author: Meriam **ISLAM** Co-Author(s): Pei-Fen **LIN**

FREE PAPERS

ARTIFICIAL INTELLIGENCE

Dec 2, 2023 (Saturday), 12:00 – 13:00 Venue: Head of State Chamber Automatic Report Interpretation and Clinical Evaluation for Fundus Fluorescein Angiography Images of Diabetic Retinopathy Patients by Artificial Intelligence *First Author: Kai JIN*

Purpose: Fundus fluorescein angiography (FFA) is an important technique to evaluate diabetic retinopathy (DR) and other retinal diseases. The interpretation of FFA images is complex and time-consuming, and the ability of diagnosis is uneven among different ophthalmologists. The aim of the study is to develop a clinically usable multi-level classification deep learning model for FFA images, including pre-diagnosis assessment and lesion classification. Methods: A total of 15,599 FFA images of 1558 eyes from 845 patients diagnosed with diabetic retinopathy (DR) were collected and annotated. Three convolutional neural network (CNN) models were trained to generate the label of image quality, location, laterality of eye, phase and 5 lesions. Performance of the models was evaluated by accuracy, F-1 score, the area under the curve (AUC) and human-machine comparison. The images with false positive and false negative results were analyzed in detail. Results: Compared with LeNet-5 and VGG16. ResNet18 got the best result, achieving an accuracy of 80.79%-93.34% for pre-diagnosis assessment and an accuracy of 63.67%-88.88% for lesion detection. The human-machine comparison showed that the CNN had similar accuracy with junior ophthalmologists. The false positive and false negative analysis indicated a direction of improvement.

Conclusions: This is the first study to do automated standardized labeling on FFA images. Our model is able to be applied in clinical practice, and will make great contributions to the development of intelligent diagnosis of FFA images.

Dec 2, 2023 (Saturday), 12:00 – 13:00 Venue: Head of State Chamber Objective Evaluation of Intrascleral Fixation Procedures using Stretchable Strain Sensors: A Machine Learning Approach First Author: Masahiro AKADA Co-Author(s): Hitoshi TABUCHI

Purpose: Intrascleral fixation, essential for complex intraocular lens fixation due to

inadequate lens capsule support, lacks a quantitative method for data gathering and assessment. This study aimed to objectively evaluate this procedure by analyzing hand motion waveforms, obtained using a stretchable strain sensor, during an operation on an anterior segment model eye Methods: We attached a stretchable strain sensor C-STRETCH (Bando Chemical, Kobe, Japan) to all ten fingers and performed intrascleral fixation using the Yamane method on an model eye. Waveforms of both hands during the procedure were obtained 96 times by five professionals including doctors and orthoptists in our hospital (three experienced, two beginners). From the waveform data of hand movements obtained, we extracted the steps of inserting the leading loop of the intraocular lens into the 30G needle (Step 1) and inserting the rear loop (Step 2). Each step waveform length was standardized and dimension reduction was carried out by feature extraction. We performed a classification of the five surgeons and a binary classification of experienced/beginners using LightGBM. The evaluation index was the overall accuracy rate in K-Fold Cross Validation (K=3). **Results:** The accuracy rate for Step 1 was 0.719

(69/96) for surgeon classification and 0.865 (83/96) for binary classification, and the accuracy rate for Step 2 was 0.698 (67/96) for surgeon classification and 0.750 (72/96) for binary classification.

binary classification. **Conclusions:** The use of machine learning for motion analysis demonstrated characteristics for each surgeon. The potential for objective evaluation of surgical skills using a model eye and hand sensor was suggested.

Dec 2, 2023 (Saturday), 12:00 – 13:00 Venue: Head of State Chamber Translation of Color Fundus Photography into Fluorescein Angiography using Deep Learning *First Author: Danli SHI*

First Author: Danli **SHI** Co-Author(s): Weiyi **ZHANG**, Mingguang **HE**

Purpose: To develop and validate a deeplearning model that can transform CF into corresponding venous and late-phase FFA images.

Methods: We developed and validated a deeplearning model using 66,014 paired images of CF and FFA from venous and late phases in a tertiary center. The model was trained to transform CF into corresponding venous and late-phase FFA images. The translated FFA images' quality was evaluated quantitatively by common image generation metrics, and subjectively by two clinical experts on 100 CF-FFA paired images, rated on a five-point scale. The realisticity of the global image, anatomical landmarks (macula, optic disc, and vessels), and lesions were considered. We used 50 sets each from internal and external CF-FFA tests for evaluation.

Results: The quantitative metrics of MAE, PSNR, SSIM, and FID were 111.46, 21.07, 0.61, and 46.28 for venous-phase FFA, and 123.07, 22.11, 0.65, and 32.72 for late-phase FFA. The subjective quality scores ranged from 1.37–2.60 on a five-point scale (1 refers to real FFA). Both experts reported similar quality scores with substantial agreement (all kappas > 0.8). **Conclusions:** The CF-to-FFA framework produced realistic FFA images. Moreover, adding the translated FFA images on top of CF improved the accuracy of DR screening. These results suggest that CF-to-FFA translation could be used as a surrogate method when FFA examination is not feasible.

Dec 2, 2023 (Saturday), 12:00 – 13:00 Venue: Head of State Chamber Enhancing Ultra-Wide-Field Fundus Images: Deep Learning-Based Eyelash Artifact Removal

First Author: Weiyi **ZHANG** Co-Author(s): Danli **SHI**, Mingguang **HE**

Purpose: Fundus photography aids in diagnosing ocular and systemic conditions. Ultra-Wide-Field (UWF) fundus imaging captures a larger retinal field of view but is hindered by eyelash artifacts. This study aims to develop deep learning methods to remove eyelash artifacts from UWF fundus images while preserving high resolution and clinical details. Methods: We used a dataset of 16,938 UWF images. First, annotated eyelashes in 30 images were used for Dual Super-Resolution Learning (DSRL) network segmentation training. Images were categorized as "eyelash-obscured" or "non-obscured" according to the segmentation masks. Subsequently, synthetic eyelashes were added to "non-obscured" images by image processing methods, creating paired datasets. Finally, an image-to-image translation model was trained using generative adversarial networks to remove eyelash obstructions. We validated the model on the eyelash-free vs. synthetic eyelash-obscured image pairs by assessing metrics (MAE, PSNR, SSIM, and MS-SSIM), and tested the model on a subset of real eyelash-obscured images

Results: The dataset was divided into "eyelashobscured" (12,278 images) and "non-obscured" (4,660 images) after our classification. Validation metrics were MAE=80.43, PSNR=37.74, SSIM=0.9324, and MS-SSIM=0.9513. Visual analysis confirmed that our approach effectively removed eyelash artifacts and maintained high resolution while preserving ocular structures, vessels, and lesions.

Conclusions: Our novel deep learning approach successfully removes eyelash artifacts from UWF fundus images, enhancing clinical

utility by providing clearer and accurate images for analysis and diagnosis. This method holds great potential for improving the diagnosis of ocular and systemic conditions.

Dec 2, 2023 (Saturday), 12:00 – 13:00 Venue: Head of State Chamber Improving Retinal Disease Detection Training for Non-Experts with Stable Diffusion-Generated Images: Matching AI Performance in Less than 60 Minutes First Author: Hitoshi TABUCHI Co-Author(s): Justin ENGELMANN, Fumiatsu MAEDA, Ryo NISHIKAWA, Toshihiko NAGASAWA, Tomofusa YAMAUCH, Mao

TANABE, Masahiro AKADA, Yasuyuki NAKAE, Yoshiaki KIUCHI, Miguel BERNABEU

Purpose: The purpose of this study was to evaluate the effectiveness of a synthetic imagebased teaching method, supported by Artificial Intelligence (AI), for improving the diagnostic capabilities of non-experts.

Methods: We designed a web-based training course incorporating 600 synthetic images created by Stable Diffusion. These images included representations of normal retinae and five types of retinal diseases, fine-tuned based on 6,285 ultra-widefield (UWF) retinal images. The training method was tested on 161 trainee orthoptists. Each student undertook a diagnostic test involving six types of images before and after the training course. This prepost comparison was used to assess the efficacy of the training method.

Results: On average, the students completed the course in just 53 minutes and demonstrated significant improvements in their diagnostic accuracy. For UWF images, student accuracy increased from 43.6% to 74.1% (p<0.0001 by paired-t test), nearly matching the diagnostic accuracy of the state-of-art Al model (73.3%). Interestingly, for standard field (SF) images, which were untrained by both students and Al, student accuracy rose from 42.7% to 68.7% (p<0.0001 by paired-t test), surpassing the accuracy of the state-of-art Al model (40%). **Conclusions:** Our synthetic image-based teaching method, aided by Al, demonstrated its efficiency in a notably short timeframe. The results underscore the human superiority in adaptability to changes in imaging modalities compared to Al models. These findings emphasize the positive potential of Al to contribute to a human-centered approach in medicine, particularly in providing an efficient training platform and enhancing essential skills in medical image interpretation.

Dec 2, 2023 (Saturday), 12:00 – 13:00 Venue: Head of State Chamber Multiple Ocular disease Detection using

ABSTRACTS- FREE PAPERS

Deep Learning

First Author: Amod NAYAK Co-Author(s): Minakhi GHOSH, Pradeep WALIA, Mustaffa KHAN, Abhik MAITY, Sagarnil DAS

Purpose: To detect multiple ocular diseases using deep learning in a single fundus image to make patient encounters more comprehensive. Methods: EfficientNetV2 a powerful deep learning architecture designed for multi-task learning applications was able to detect multiple diseases by using multiple heads for prediction of diseases from fundus images. The model, featuring a visual attention convolutional neural network (CNN), was uniquely structured with multiple detection heads. These distinct heads were used for multiple functions: predicting a wide range of disease pathologies, discerning grades of diabetic retinopathy (DR), and executing binary classification of disease presence or absence **Results:** This study presents a novel approach in predicting 19 diseases. The diseases and sensitivity achieved are, Hemorrhage(89%), Microaneurysm(80%) Hard Exudates(88%), Diabetic Macular Edema (86%) Soft Exudates(87%), Intra-Retinal Microvascular Abnormalities (IRMA) (81%), Laser (88) Neovascularization on Disc (NVD)(84%), Neovascularization on Disc (NVD)(84%), Neovascularization Elsewhere (NVE) (86%) Fibrous Proliferation of Disc (FPD) (84%), Fibrous Proliferation Elsewhere (FPE) (83%) Vitreous Hemorrhage (80%), Pre-retinal Hemorrhage (80%), Drusen (86%), Myopic Degeneration(80%), Papilledema (86%), Macular Hole (88%), Glaucoma (80%), Epiretinal Membrane (ERM)(82%). Conclusions: A comprehensive even

Conclusions: A comprehensive eye examination for detecting multiple diseases utilizing machine learning indicative of various eye diseases from a single eye exam could help change the way eye screening is done.. This comprehensive approach can aid in early detection and improve treatment outcomes.

OCULAR IMAGING

Dec 2, 2023 (Saturday), 12:00 – 13:00 Venue: Head of State Chamber Electrodiagnostic Signs of Carpal Tunnel Syndrome in Ocular Pseudoexfoliation Syndrome

First Author: Nader NASSIRI Co-Author(s): Maryam YADGARI, Kourosh SHEIBANI, Šara KAVOUSNEZHAD, Afshin KARIMZADEH, Mansoor SHAHRIARI **Purpose:** To assess the occurrence and severity of electrodiagnostic signs of carpal tunnel syndrome (ED-CTS) in patients with ocular pseudoexfoliation (PEX) and compare them with normal subjects.

Methods: A cross-sectional study with comparison group was designed and 60 patients with PEX were recruited from May 2019 to February 2021, and the findings were compared with 59 healthy subjects. All patients underwent complete ophthalmologic examination and nerve conduction velocity test at the median nerve was used to assess the occurrence and severity of ED-CTS in both hands.

Results: The mean age of participants was 59.8 \pm 4.5 years. Occurrence of ED-CTS was 38.3% in PEX patients and 20.3% in control subjects (P = 0.025). There was also a significant difference in the severity and presence of asymptomatic CTS (P < 0.05). Adjusting other variables, including; age and sex, having severe ED-CTS showed a 3.07fold higher chance in the PEX group (P = 0.005).

Conclusions: According to our finding, it seems there is a direct association between PEX and the occurrence, as well as severity of ED-CTS.

TELE- OPHTHALMOLOGY Dec 3, 2023 (Sunday), 15:45 – 16:45 Venue: Online via Zoom Clinical and Economic Impact of Teleophthalmology-Based Vision Center in Managing Ocular Disorders in Rural Northern Bangladesh First Author: Md. Sajidul HUQ Co-Author(s): Khairul ISLAM, Rokhsana SHOMA

Purpose: This study aimed to find out the clinical and economic impact of teleophthalmology-based Vision Centers (VC) in the management of various ocular disorders in rural northern Bangladesh.

Methods: It was a retrospective study of rural patients who attended the teleophthalmologybased vision center of an eye hospital from January 2023 to April 2023. Data were collected and analyzed to assess demographic characteristics, different ocular cases that were treated at the VC, surgeries advised and accepted, those referred to the base hospital (BH), and the costs of treatment. **Results:** A total of 1,184 patients were included in the analysis. The age distribution showed that the majority of patients belonged to the 41-60 years age group (42.1%). Among the

patients, 75.2% were new cases seeking ophthalmic care and 56.3% were female. 22.6% were follow-up patients who had previously undergone surgery at the base hospital. In addition, 10.6% of the patients included in the analysis were referred to the base hospital for sub-specialty services. Refractive error (33.0%) was the most commonly diagnosed condition, followed by Cataract (23.9%). Among those advised, 42.0% accepted cataract surgery. The VC provided a substantial cost-saving opportunity, with patients saving approximately BDT 1300 (USD 12) by attending the VC for medical service instead of the base hospital. Conclusions: Teleophthalmology-based Vision Centers offer a cost-effective alternative, enabling patients to save significantly on healthcare expenses. The findings underscore the importance of expanding and promoting telemedicine initiatives, particularly in resourceconstrained settings, to enhance eye care services and improve overall public health outcomes.

Dec 3, 2023 (Sunday), 15:45 – 16:45 Venue: Online via Zoom Teleophthalmology at a Primary and Tertiary Eye Care Network from India: Environmental and Economic Impact *First Author: Padmaja RANI*

Purpose: To evaluate the environmental and economic impact of teleophthalmological services provided by a primary (rural) and tertiary (urban) eyecare network in India. Methods: This prospective study utilized a random sampling method, and administered an environmental and economic impact assessment questionnaire. The study included 324 (primary: 173; tertiary:151) patients who received teleconsultations from July to September 2022. The primary network (rural) used a colour-coded triage system (Green: eye conditions managed by teleconsult alone; yellow: semi-urgent referral within one week to a month, red: urgent referral within a day to a week). The tertiary network (urban) included new and follow-up patients. The environmental impact was assessed by estimating the potential CO2 emissions saved by avoiding travel for various transport modes. Economic impact measured by the potential cost savings from direct (travel) and indirect (food and wages lost) expenses spent by yellow and red referrals (primary) and the first-visit expenses of followüp (tertiary) patients.

Results: The primary rural network saved 2.89 kg CO2/person and 80 km/person. the tertiary urban network saved 176.6 kg CO2/person and 1666 km/person. The potential cost savings on travel expenses were INR 19,970 (\$250) for the primary (average: INR 370 (\$4.6) per patient) and INR 546,700 (\$6,834) for the tertiary network (average: INR 9427 (\$118) per patient).

Indirect costs (food and wages) were reduced, with savings of INR 29100 (\$364) for the primary and INR 246,900 (\$3,086) for the tertiary network.

Conclusions: The study findings indicate that teleophthalmology services have significant environmental and economic benefits in primary and tertiary eyecare systems.

Dec 3, 2023 (Sunday), 15:45 – 16:45 Venue: Online via Zoom Reading Ability Improvements Following Magnification Device Training via Telerehabilitation versus In-Office Visits for Visually Impaired Patients *First Author: Ava BITTNER*

Purpose: An evidence basis is lacking but needed for the efficacy of training for magnification devices remotely via telerehabilitation versus in-office sessions to enhance reading ability in visually-impaired individuals.

Methods: A multicenter trial randomized 61 visually-impaired adults to telerehabilitation or in-office (control) training 1-4-months after dispensing new portable electronic or optical magnifiers. Telerehabilitation included loaner equipment for Zoom videoconferencing with remote control access software to connect visually-impaired patients at home to vision rehabilitation providers. We assessed changes in a patient-reported outcome measure, the Activity Inventory, using Rasch analysis to estimate reading ability in dimensionless log odds units (logits)(0.14-logit change corresponds to ability change expected from a 1-line visual acuity change).

Results: Significant mean improvements in reading ability from 1-4-months were the same for each randomized group; i.e., 0.4-logits for both telerehabilitation (n=29; 95% CI 0.08, 0.73; P=.015) and in-office training (n=18; 95% Cl 0.005, 0.80; P=.047). Participants who were not proficient with the magnifier initially and needed a second telerehabilitation session had significantly greater odds of being older (OR=1.08; 95% Cl 1.02,1.14; P=.007) or not a college graduate (OR=32.7; 95% Cl 1.87,573; P=.02), and were less likely to read 0.0-0.1logMAR text size with their magnifier initially (chi2=8.96; P=.003), but 71% of participants gained at least 0.1 log unit in reading acuity at the second telerehabilitation session. **Conclusions:** Telerehabilitation with accommodations for accessibility to conduct magnifier training sessions can serve as another viable, efficacious means (versus in-office) for rendering vision rehabilitation services to enhance access to care and patient outcomes for reading.

ABSTRACTS- FREE PAPERS

Dec 3, 2023 (Sunday), 15:45 – 16:45 Venue: Online via Zoom Validation of the Diagnosis by Teleophthalmologists and Vision Centre Technicians in Patients Diagnosed with Posterior Segment Disease First Author: Vijay ANTONY Co-Author(s): Srinivasan KAVITHA, Annamalai ODAIYAPPAN, Rengaraj VENKATESH

Purpose: To assess the diagnostic accuracy of tele-ophthalmologist (TO), vision centre technician (VCT) in patients with posterior segment disease compared to the base hospital (BH) diagnosis by specialists and to assess the effectiveness of counselling using the patient's own fundus photograph.

Methods: A cluster randomized control study was designed where 350 new patients attended the 10 Vision Centres (VC) suspected to have any posterior segment disease by TO & VCT are recruited. For referral to base hospital, one arm had counselling by showing their own fundus photograph and another arm had conventional oral counselling. Among those who visited BH, final diagnosis was compared with that made by TO, VCT and level of agreement were analysed. We compared the BH visit response rate between the two arms and assessed the barriers in uptake of services among the non-compliant patients. Results: The overall full agreement of TO and VCT with the BH diagnoses was 60.9% and 54.6%. High percentage of full agreement was seen in glaucoma diagnoses (TO-76.7%, VCT-76.7%) followed by neuro-ophthalmology (TO– 76%, VCT–72%) and retinal diagnoses (TO–68.5%, VCT–58.9%). 66.8% patient has attended the base hospital in image-based counselling arm vs 63.7% in conventional oral counselling arm (p=0.245). Major barriers for non-compliance include poor awareness about the disease, lack of an accompanying person and financial constraints.

Conclusions: Tele-ophthalmology provides a very good support in screening and referring the patients with posterior segment disease. Image-based counselling was not superior to conventional counselling.

Dec 3, 2023 (Sunday), 15:45 – 16:45 Venue: Online via Zoom Comparing the Clinical Outcome of Transepithelial and Conventional Photorefractive Keratectomy in Correction of Moderate Myopia: A Randomized Case Control Study

Control Study First Author: Nader NASSIRI Co-Author(s): Kourosh SHEIBANI, Sara KAVOUSNEZHAD

Purpose: To compare the clinical outcome of one-step transepithelial photorefractive keratectomy (tPRK) and conventional photorefractive keratectomy (PRK).

Methods: Consecutive patients with moderate myopia were randomly assigned to be operated either with tPRK or the conventional PRK method. The one-step tPRK and conventional PRK were both performed using the Schwind Amaris excimer laser system. Outcome measures included patients' one and three months post surgical uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), sphere, cylinder, spherical equivalent (SE), intraocular pressure, haze, contrast sensitivity, pain and discomfort. **Results:** In total 120 eyes from 60 consecutive patients were evaluated from May to December 2020. The mean UCVA, BCVA or SE did not show a statistically significant difference one and three months postoperatively. The mean haze among patients undergoing tPRK was significantly lower than the PRK group one month postoperatively (p < 0.001), but no difference was observed three months postoperatively. Patients undergoing tPRK was postoperatively. Patients undergoing tPRK experienced less pain (p = 0.027) and discomfort (p < 0.001) one day postoperatively. There was no difference between the two groups regarding postoperative intraocular pressure and contrast sensitivity. **Conclusions:** Our study results suggest that the tPRK method is associated with less early postoperative pain and discomfort at day one and corneal haze at one month postoperatively compared to the conventional PRK method.

Dec 3, 2023 (Sunday), 15:45 – 16:45 Venue: Online via Zoom Effect of Subconjunctival Bevacizumab Injection on the Outcome of Ahmed Glaucoma Valve Implantation: A Randomized Control Trial

First Author: Nader NASSIRI Co-Author(s): Marmam YADGARI, Kourosh SHEIBANI, Sara KAVOUSNEZHAD

Purpose: To evaluate the efficacy and safety of subconjunctival Bevacizumab injection adjunctive to AGV implantation. **Methods:** In 25 eyes, conventional AGV surgery (group 1) and in 25 eyes AGV surgery with subconjunctival Bevacizumab (group 2) was performed by block randomization. The primary outcome measure was surgical success. Outcome measures were compared at postoperative month 3, 6 and 12. **Results:** The mean age of patients was 58.76 ± 12.11 and 51.36 ± 15.44 years in group 1 and 2 respectively (P = 0.06). Mean intraocular pressure (IOP) at baseline was 24.88 ± 7.62 mmHg in group 1 and 27.52 ± 8.57 mmHg in group 2 which decreased to 15.4 ± 4.4 mmHg in group 1 and 13.42 ± 2.9 mmHg in group 2 (P < 0.00) at last follow up. The cumulative success according to criterion A and B was 77.8%, 72.2% in group 1 and 89.5% in group 2, respectively, at the end of follow-up.

ABSTRACTS- FREE PAPERS

Bevacizumab adjunctive to AGV implantation leads to higher success rate compared with AGV alone in one year follow-up.

E-POSTERS

ARTIFICIAL INTELLIGENCE

Development and Future of Artificial Intelligence and Telemedicine in Ophthalmic Applications

First Author: Lijun **YUN** Co-Author(s): Xiaokun **WU**

Purpose: With the development of science and technology, artificial intelligence has made major breakthroughs. So how to improve human ability and efficiency in screening eye diseases through artificial intelligence, and finally realize a "human-computer coexistence" society?

Methods: First, establish a grassroots eye health service center, so that patients do not have to spend a lot of energy on going to the hospital. Second, promote portable eye examination instruments, and the grass-roots service center can help patients check well, eliminating the process of going to the hospital for examination. Third, establish an artificial intelligence analysis system. After the grassroots service center does a good examination, the system will automatically analyze the eye development of the patient and extract the condition of an important part of the patient. Fourth, consult with remote experts. If the system screens out that the patient has an eye disease, you can directly connect to the remote expert, and the expert will give advice or solutions. Mild diseases can be treated by yourself, and serious diseases can be referred to the hospital for treatment. **Results:** As a result, the efficiency of screening

Results: As a result, the efficiency of screening for eye diseases has been greatly improved, and people's eye health has been well monitored and guaranteed. **Conclusions:** Therefore, the future development of ophthalmology is inseparable from artificial intelligence and telemedicine! As opto-optic practitioners, we should work hard to learn the latest technology to make a contribution to the optotech industry!

Analysis of an AI-Based Diabetic Retinopathy Screening: A Comprehensive Study

First Author: Md Sajidul **HUQ** Co-Author(s): Khairul **ISLAM**, Rokhsana **SHOMA**, Md Mahmudul **ISLAM**

Purpose: This study presents a comprehensive analysis of an artificial intelligence (AI)-based diabetic retinopathy (DR) screening program implemented in a specialized eye hospital in northern Bangladesh. The study also aims to assess the acceptability of the respondents towards this innovative technology. **Methods:** This prospective study was conducted in the outpatient department from October 2022 to May 2023. The study included diagnosed diabetic patients aged 18 years and above who visited the hospital for eye checkups. The IDx-DR was used for DR screening, an Al diagnostic system that autonomously diagnoses patients for diabetic retinopathy and macular edema based on ETDRS level 35 or higher. A questionnaire was used to collect demographic data, medical history, and assess their acceptance and willingness towards Albased screening.

Results: A total of 2142 diabetic patients underwent AI-based DR screening. The mean age was 50.80±10.35 years. The AI diagnosis resulted in a positive finding for 28.4% of the respondents, while 68.9% and 28.4% received negative and insufficient results, respectively. The analysis unveiled statistically significant associations between AI diagnosis results and various factors, including sex

results and various factors, including sex (p=0.001), education level (p=0.04), occupation (p=<0.001), age (p=<0.001), and duration of DM (p=<0.001). A significant majority of the participants expressed satisfaction (81.9%) and high satisfaction (18.1%) with the AI-assisted DR screening service.

Conclusions: Al-based screening for diabetic retinopathy can assist healthcare providers in managing the increasing number of patients. Early detection and intervention can significantly impact disease outcomes. Future developments of Al systems based on portable devices will enhance the accessibility of DR screening services.

Accuracy of Medios Artificial Intelligence Aided Fundus Photography in Detecting Diabetic Retinopathy among Filipino Patients with Type 2 Diabetes Mellitus Being Seen by Endocrine Specialty Clinics

First Author: Precious **UNTALAN** Co-Author(s): Maria **CRUZ**, Oliver **DAMPIL**, Niccolo **AGUSTIN**

Purpose: The study aimed to strengthen the referral system and aid in the decrease of Diabetic Retinopathy (DR) visual morbidity. The main objective of this study was to determine the accuracy of Medios Artificial Intelligence (AI) in DR screening.

Methods: Adult patients with type 2 diabetes mellitus aged 18-80 years old being seen at the private endocrine clinics were included. Fundus photographs with the Remedio FOP (Remidio Innovative Solutions Pvt. Ltd) obtained by the

nurse including all three fields of view i.e. posterior pole, nasal field, and superotemporal field. Images taken were analyzed for presence of diabetic retinopathy (DR) by the retina specialists separately who were masked to the interpretation of the Remidio FOP. Disagreement in the presence of retinopathy between the two retina specialists were mediated by a 3rd retina specialist. **Results:** The overall diagnostic accuracy of Medios Al in detecting DR is 82.69%, with 95% CI the Al had a sensitivity and specificity of 73.68% and 83.74%, respectively.

Conclusions: The Medios AI showed an acceptable diagnostic accuracy when used as a screening tool in detecting DR among patients with Type 2 Diabetes as it is relatively inexpensive, safe and easily performed and can potentially shorten lead time from screening to ophthalmology referral and intervention.

Federated Machine Learning in Healthcare: A Systematic Review on Clinical Applications and Technical Architecture *First Author: Zhen Ling TEO*

Co-Author(s): Daniel **TING**

Purpose: Federated learning (FL) is a distributed machine learning framework that is gaining traction in view of increasing health data privacy protection needs.

Methods: We conducted a systematic review of FL applications in healthcare. We identified relevant articles published in PubMed, Medline, Web of Science, Scopus, Embase, Institute of Electrical and Electronics Engineers Xplore, ArXiv, Springerlink, CINAHL and Google Scholar, up to June 13, 2022 in English. Critical review of these articles included data and imaging modalities, technical architecture, levels of collaboration, clinical specialties, application settings and regulatory authority involvement for intellectual property management.

Results: A total of 13,726 articles were evaluated with 280 articles included in the final analysis. Majority of articles were of research proof-of-concept settings and only 9.3% were studies with real-life application of FL. Amongst those with real-life application, the number of participating sites ranged from 2 to 314 with international and regional collaboration frequent. FL was used in many clinical specialties with radiology being the most common. FL was robust to a variety of data types with medical images being the most common at 32.8% followed by clinical data and electronic medical records (20.8%) and Internet of Things (10.9%). Majority of studies used neural network (77.4%), horizontal data partitioning (90.1%) and a centralised communication architecture (89.0%). 29.8% of studies included privacy mechanisms including blockchain (8.7%).

Conclusions: We provide a comprehensive review of FL in healthcare and highlight the need to address barriers to clinical translation and to assess its real-world impact in this new digital data driven healthcare scene.

Relationship between Research Impact and Open Access in Ophthalmic Artificial Intelligence Publications

First Author: Victoria VOUGHT Co-Author(s): Rita VOUGHT, Haris WASEEM, Bernard SZIRTH, Albert KHOURI

Purpose: Artificial intelligence development within ophthalmology has been a rapidly growing topic of interest. Understanding the impact of manuscripts published in this field can provide insight into research trends. Tools such as relative citation ratio (RCR) and field citation ratio (FCR) may be used to quantify this impact. In this study, we utilize the impact of Open Access on article influence within ophthalmic artificial intelligence, a rapidly growing topic of study.

Methods: A search on the Dimensions Database using the criteria of "Artificial Intelligence" AND "Ophthalmology" in the title/abstract published from 2018-2022 was completed. Article information, including year of publication, number of citations, RCR, and FCR were queried. Publication type, open access or closed, was recorded.

Results: Five-hundred sixty manuscripts suited our criteria. Each article had an average of 15 citations, and 65.5% were published Open Access. There was an increasing trend in the number of publications from 2018 to 2022 (from 12 available in 2018 to 186 in 2022). In articles published Open Access, the average number of citations (p<0.001), RCR (p=0.049), and FCR (p<0.001) were significantly higher than articles that were not published Open

Access.

Conclusions: We provide a comprehensive review of FL in healthcare and highlight the need to address barriers to clinical translation and to assess its real-world impact in this new digital data driven healthcare scene.

Few-Shot Learning for Detection of Pythium Insidiosum Keratitis

First Author: Passara JONGKHAJORNPONG Co-Author(s): Ratchainant THAMMASUDJARIT, Onsiri THANATHANEE, Orapin ANUTARAPONGPAN, Theerapong KRAJAEJUN

Purpose: Pythium keratitis (PK) is a rare visionthreatening corneal infection caused by a parasitic aquatic oomycete named P. insidiosum. Delayed diagnosis of PK substantially leads to blindness and eye loss. Clinical characteristics of PK are overlapped with fungal keratitis (FK) making the diagnosis becomes challenging. This study proposed the few-shot learning (FSL) method to overcome the limitation of large sample size required for deep learning (Convolution Neural Network) in the application of early discrimination between PK and FK.

Methods: A total of 66 anterior segment images retrospectively was acquired from 17 patients with PK and 37 patients with FK. These images were split into 3 sets (train: validation: test ratio 50:25:25) and were used to develop the model. FSL (2-way, 4-shot) was employed to classify a given image to be either PK or FK. Performance of the model was evaluated using precision (positive predictive value), sensitivity (recall), accuracy, and F1 score (the harmonic mean of precision and recall).

Results: Our proposed model showed favorable results though the number of training samples was small. The model performance in precision, recall, accuracy and F1 score were 0.583, 1.000, 0.706, and 0.737 respectively. Four photos of FK in the test set were misclassified as PK, while no PK photos was misclassified. **Conclusions:** FSL is a promising technique which can be applied to develop prediction model for a rare disease with limited number of samples. High sensitivity of our model indicates the opportunity to adopt the model as a screening tool for PK detection.

Development of an Artificial Intelligence System to Identify Diabetic Retinopathy: A Case Study in a Low Resource Setting First Author: Malinda DE SILVA Co-Author(s): Kasun RANASINGHE, Poorna FERNANDO, Harsha JAYAKODY

Purpose: Diabetic retinopathy (DR) poses a significant disease burden worldwide, leading to vision impairment and blindness. However, in low resource settings, coverage of DR screening and effective management faces barriers which includes lack of resources and limited access to screening. This study explored the feasibility of developing an artificial intelligence (AI) system with free and open-source material to screen and grade retinal images for DR as an aid to overburdened DR screening programs. Methods: The team comprised of Health informaticians and Software engineers. EfficientNet, a pretrained convoluted neural network (CNN) was adopted for machine learning. Free and open resource frameworks, TensorFlow and Keras were used while Google Colabs - free access, served as a feasible development environment mitigating the computational limitations encountered in low resource settings. Lack of training data is a cardinal challenge, which was leveraged upon publicly available labelled image-sets of diabetic retinopathy from keggle.com. Iterative training of the neural network was performed. **Results:** Following initial training, the system demonstrated 2% accuracy. Finetuning the training algorithm improved the accuracy to 78% in one week and 94.5% in 2 months. A portal to demonstrate the functionality of the system was developed in https://ophthaden.com.

Conclusions: It is feasible to use free and open-source resources to develop an AI system to grade and screen DR ensuring frugality which is favorable to low resource settings. Curated high quality image sets are needed while emphasizing the model, activation functions and optimizers for continuous improvement of this AI system.

Prediction of Treatment Response in Center-Involved Diabetic Macular Edema Using a Deep Learning Approach Based on Optical Coherence Tomography

First Author: Thanaporn **KRITFUANGFOO** Co-Author(s): Sipat **TRIUKOSE**, Tharikarn **SUJIRAKUL**

Purpose: This study aims to develop a deep learning (DL) model for predicting treatment response in center-involved diabetic macular edema (ci-DME) following anti-vascular endothelial growth factor injections, using optical coherence tomography (OCT) images. Methods: We included 1,000 OCT images of ci-DME patients. Radial scans through the fovea were extracted from the initial OCT images taken before treatment initiation. These patients were then categorized into a "response group" (Central subfield thickness (CST) improvement > 10%) and a "nonresponse group" (CST change \leq 10%) after three monthly bevacizumab injections. The EfficientNet BO network was employed for model development, using 90% of the dataset for training and the remaining 10% for evaluation. Model construction involved dividing the 900 OCT images into two subsets: 550 for the response group and 350 for the nonresponse group, used for training the model.

Results: Our DL approach, based on OCT, demonstrated promising predictive power, achieving an accuracy of 75% in forecasting treatment response among patients with ci-DME who received bevacizumab injections. These results provide valuable insights into the potential of DL techniques for predicting treatment response in ci-DME cases. Moreover, this model has the potential to be applied in identifying cases within the non-responsive group, where early switching to alternative drugs might lead to more substantial benefits. Conclusions: This study presents a DL approach utilizing OCT images to predict treatment response in ci-DME patients. These findings are significant for personalized treatment choices in ci-DME, emphasizing the need for more extensive information and larger datasets to fine-tune and validate the DL model.

Offline AI Deployed on a Portable and Cost-Effective Fundus Camera Innovating Diabetic Retinopathy, Glaucoma, and AMD Screening First Author: Divya RAO

Co-Author(s): Venkatesh SWATI, Manavi SINDAL, Prabu BHASKARAN, Anand

RAJENDRAN, Aditya MAITRAY, Kavita S, Shruti R, Kalpa NEGILONI, Florian SAVOY, Shreya BHANDARY, Maanasi MAHALINGAM, Vighnesh MJ

Purpose: This study presents the diagnostic performance of a novel, offline AI system integrated into a smartphone-based fundus camera to screen for DR, Glaucoma and AMD. Methods: In this prospective study conducted at three different study centres, performance of three distinct AI systems for screening referable forms of DR(moderate NPDR and worse, DME), Glaucoma(Glaucoma and disc suspects), and AMD(intermediate and worse) was validated independently in respective clinics. The study device is a validated smartphone-based nonmydriatic fundus camera. Each Al system was validated against reference standard (gold standard) appropriate for the condition using pre-defined criteria by specialists. Results: The DR AI system validated in 233 patients demonstrated sensitivity and specificity of 95.56% (95% CI 84.85% to 99.46%) and 77.66%(95% CI 71.03% to 83.40%) respectively to detect referable DR. Among false positives, 50% had mild NPDR. The Glaucoma AI system validated in 215 patients showed sensitivity and specificity of 85.9% (95% CI 79.3% - 91.1%) and 97.0%(95% Cl89.5 - 99.6%) respectively to detect referable glaucoma. Among false negatives, 71%(n=15) were disc suspects and 29%(n=6) had glaucoma. The interim results of the AMD AI system on 414 eyes(221 patients) showed a sensitivity for intermediate AMD of 87.84% and advanced AMD of 90.91%. The sensitivity and specificity for any AMD were 84.55% and 84.52% respectively.

Conclusions: The novel, offline AI integrated on a portable fundus camera demonstrated robust performance in screening for sight-threatening ocular conditions including DR, Glaucoma and AMD. This combination tool can potentially enhance accessibility, affordability, and effectiveness.

Knowledge and Attitude of Ophthalmic Physicians in Bangladesh toward Artificial Intelligence in Ophthalmology First Author: Md Sajidul HUQ Co-Author(s): Khairul ISLAM, Md Faruck HUSSAIN

Purpose: To assess the knowledge and attitude of Ophthalmic Physicians toward application of artificial intelligence in ophthalmology. Methods: Ophthalmic Physicians were invited to participate in the study through an online survey form distributed via email. The form collected knowledge and attitude-related information, including demographic information of the doctors. Participants were asked about their familiarity with AI applications and awareness of AI algorithms for ophthalmic imaging analysis. Knowledge and attitude towards AI was assessed using a Likert scale based on responses to a set of 10 questions. Participants' scores regarding knowledge and attitude were calculated as a percentage and categorized accordingly.

Results: A total of 72 Ophthalmic Physicians participated in the survey. Of these, 75.0% were younger than 40 years, and the same percentage were male. The majority of participants (62.8%) practiced in private hospitals. The survey revealed that 58.3% of participants were somewhat familiar with Al applications, and 66.7% were aware of AI algorithms for ophthalmic imaging analysis. Approximately half of the participants had read a few research papers on AI in ophthalmology (50%) and attended a few AI-focused events (33.3%). Among the participants, 60 (83.3%) respondents demonstrated good knowledge. Attitudes towards AI varied, with 37.5% having a positive outlook, 45.8% expressing a neutral view, and 16.7% holding a negative perspective. Conclusions: The study highlights the mixed attitudes and varying levels of familiarity among physicians regarding AI in ophthalmology. To effectively harness the benefits of AI, targeted educational initiatives and ongoing discussions are essential to address concerns and ensure successful integration into ophthalmic practice.

OCT Image Interpretation Using Deep Learning and Explainable AI First Author: Amod NAYAK

Co-Author(s): Minakhi GHOSH, Mustuffa KHAN, Girish SOMVANSHI, Pradeep WALIA, Pallabi PAUL

Purpose: Retinal disease classification plays a vital role in early detection and treatment of ocular pathologies. Our primary objective is to develop a robust and accurate model capable of classifying retinal diseases into distinct

categories, such as Normal, Drusen, DME, CNV, AMD, CSR, DR, and MH, Each of these categories represents a unique retinal pathology with specific clinical implications. Methods: Our methodology builds upon a pretrained EfficientNet architecture, initially trained on chest X-rays, and fine-tunes it on a diverse OCT dataset encompassing eight distinct classes, including Normal, Drusen, DME, CNV, AMD, CSR, DR, and MH. To enhance interpretability, we introduce a channel-based attention mechanism, enabling the model to focus on salient image regions. Additionally, we employ Grad-CAM to generate heatmaps, facilitating explainable AI and providing visual insights into the model's decision-process. **Results:** Extensive validation against a comprehensive test set demonstrates outstanding performance, we achieved sensitivity with a sensitivity of 99.8% and specificity of 99.2%. Our approach holds significant potential for clinical applications, empowering accurate diagnosis and timely intervention for retinal diseases. This study presents a novel approach in predicting 8 Ocular diseases from OCT images. The diseases and sensitivity achieved are, Normal (99%), Drusen (98.2%), DME (98.1), CNV (98.4%), AMD (98.9%), CSR (98.6%), DR (98.2%), and MH (98.7%). Conclusions: Using AI for detecting specific diseases like drusen and macular holes in the field of ophthalmology is a promising application. Al algorithms can analyse medical images like retinal scans to identify these conditions accurately and assist healthcare professionals in early diagnosis and treatment.

ICGA-GPT: Report Generation and Question Answering for Indocyanine Green Angiography Images

First Author: Ziwei **ZHAO** Co-Author(s): Xiaolan **CHEN**, Weiyi **ZHANG**, Pusheng **XU**, Yingfeng **ZHENG**, Danli **SHI**, Mingguang **HE**

Purpose: Indocyanine green angiography (ICGA) is vital for diagnosing chorioretinal diseases, but its interpretation and patient communication require extensive expertise and time-consuming efforts. We aim to develop a bilingual ICGA report generation and question answering (QA) system.

Methods: Our dataset comprised 213,129 ICGA

images from 2,919 participants. The system comprised two stages: image-text alignment for report generation by a multimodal transformer architecture, and large language model (LLM)-based QA with ICGA text reports and human-input questions. Performance was assessed using both qualitative metrics (including BLEU, CIDEr, ROUGE-L, SPICE, accuracy, sensitivity, specificity, precision, and F1-score) and subjective evaluation by three experienced ophthalmologists using five-point scales (5 refers to high quality).

Results: We produced 8,757 ICGA reports covering 39 disease-related conditions after bilingual translation (66.7% English, 33.3% Chinese). The ICGA-GPT model's report generation performance was evaluated with BLEU scores (1-4) of 0.48, 0.44, 0.40, and 0.37, CIDEr of 0.82, ROUGE of 0.41, and SPICE of 0.18. For disease-based metrics, the average specificity, accuracy, precision, sensitivity, and F1 score were 0.98, 0.94, 0.70, 0.68, and 0.64, respectively. Assessing the quality of 50 images (100 reports), three ophthalmologists achieved substantial agreement (kappa=0.723 for completeness, kappa=0.738 for accuracy), yielding scores from 3.2 to 3.55. In an interactive OA scenario involving 100 generated answers, the ophthalmologists provided scores of 4.24, 4.22, and 4.10, displaying good consistency (kappa=0.779).

Conclusions: This pioneering study introduces the ICGA-GPT model for report generation and interactive QA for the first time, underscoring the potential of LLMs in assisting with automatic ICGA image interpretation.

Integrating Multi-Modal Ophthalmic Images: A New Frontier in Predicting Cardiovascular Disease Risks

First Author: Fan **SONG** Co-Author(s): Weiyi **ZHANG**, Danli **SHI**

Purpose: Cardiovascular diseases (CVD) pose a substantial global health burden, emphasizing the importance of early and accurate risk assessment for the implementation of effective prevention and intervention strategies. Our aim was to develop a non-invasive and cost-effective DL (deep learning) model that utilizes multi-modal ophthalmic images to predict CVD risk.

Methods: We create a multi-modal DL model

for CVD risk prediction by integrating ophthalmic modalities and processing them into regression-based CVD risk scores (multi-CVD). We utilized data from Lingtou dataset and calculate WHO-CVD risk score as ground truth. A total of 201,742 retinal photographs (including macula and optic images) and slit lamp images (including cornea, upper eyelid, and lower eyelid images) from 4,752 participants were included to develop the DL model. The predictive performances of multi-CVD using different image modalities were compared using regression metrics.

Results: Different modalities and input images yielded varying levels of performance in terms of R2-Score (coefficient of determination), MAE (mean absolute error), correlation coefficient, and MSE (mean squared error). As the number of multi-modal images used as input increased from 1 to 9, there was a consistent improvement in overall performance across all metrics.

Conclusions: This is the first study to predict CVD risk by integrating information from five kinds of ophthalmic images. In the context of multi-modal CVD risk prediction, increasing the number of images improved predictive accuracy and yielded comparable results to the WHO-CVD score. The study demonstrated the potential of our non-invasive and cost-effective DL model to be applied in large-scale screening for CVD risk.

Translation of Color Fundus Photography into High-Resolution Indocyanine Green Angiography Image Using Deep Learning for Age-Related Macular Degeneration Screening

First Author: Ruoyu **CHEN** Co-Author(s): Weiyi **ZHANG**, Fan **SONG**, Yingfeng **ZHENG**, Honghua **YU**, Dan **CAO**, Danli **SHI**, Mingguang **HE**

Purpose: Federated learning (FL) is a distributed machine learning framework that is gaining traction in view of increasing health data privacy protection needs. **Methods:** We conducted a systematic review of FL applications in healthcare. We identified

FL applications in healthcare. We identified relevant articles published in PubMed, Medline, Web of Science, Scopus, Embase, Institute of Electrical and Electronics Engineers Xplore, ArXiv, Springerlink, CINAHL and Google

Scholar, up to June 13, 2022 in English. Critical review of these articles included data and imaging modalities, technical architecture, levels of collaboration, clinical specialties, application settings and regulatory authority involvement for intellectual property management.

Results: A total of 13.726 articles were evaluated with 280 articles included in the final analysis. Majority of articles were of research proof-of-concept settings and only 9.3% were studies with real-life application of FL. Amongst those with real-life application, the number of participating sites ranged from 2 to 314 with international and regional collaboration frequent. FL was used in many clinical specialties with radiology being the most common. FL was robust to a variety of data types with medical images being the most common at 32.8% followed by clinical data and electronic medical records (20.8%) and Internet of Things (10.9%). Majority of studies used neural network (77.4%), horizontal data partitioning (90.1%) and a centralised communication architecture (89.0%). 29.8% of studies included privacy mechanisms including blockchain (8.7%).

Conclusions: We provide a comprehensive review of FL in healthcare and highlight the need to address barriers to clinical translation and to assess its real-world impact in this new digital data driven healthcare scene.

CATARACT

Classification of Cataract Based on Swept Source Image on IOL 700 and Comparison with Slip Lamp LOCS Classification of Lens Opacification – a Pilot Study First Author: Sharat HEGDE Co-Author(s): Vrinda VISWANATHAN

Purpose: To grade the lens images obtained in iol master 700 into mature cataract , nuclear sclerosis and posterior subcapsular cataract To compare the grading of cataract obtained by above method with the LOCS classification. **Methods:** 360 patients with cataract were subjected to *IOLmaster* 700 scan. Swept source lens images were obtained, observed and categorised into mature cataract, nuclear sclerosis and posterior subcapsular cataract based on the derived parameters. The observation was later correlated with the LOCS grading on slit lamp.

Results: 6 parameters for mature cataract , 4 parameters for nuclear sclerosis and 3 parameters for posterior subcapsular cataract were found to be statistically significant (p<0.05). A strong correlation was found between the grading based on the IOL master 700 image and the slit lamp grading based on LOCS classification.

Conclusions: Proposing classification of cataract based on swept source image of lens on IOL master 700. The outcome of this study could be used in the automated grading of cataract using artificial intelligence in IOL master 700.

Diagnostic Performance of Smartphone Anterior Eye Photography with Remote Ophthalmologist Review Versus In-Person Ophthalmologist Exams

First Author: Vijay **ANTONY** Co-Author(s): Rengaraj **VENKATESH**, Jordan **SHUFF**, Kunal **PARIKH**, Nakul **SHEKHAWAT**, Kamini **REDDY**

Purpose: To evaluate the diagnostic performance of community health worker (CHW)-led smartphone photography paired with remote ophthalmologist review versus traditional in-person ophthalmologist eye camp (EC) exams in a rural South Indian population. **Methods:** Traditional in-person

ophthalmologist EC exams consisted of Snellen visual acuity (VA), pen light exam, and anterior segment diagnosis for each eye. Smartphone screening consisted of Snellen VA, CHW-led smartphone photography and questionnaire, image transfer, and asynchronous remote ophthalmologist (RO) review and diagnosis for each eye. All images were diagnosed by three ROs. Images with differing diagnoses were assigned a consensus RO diagnosis via a Delphi panel of all ROs. Sensitivity, specificity, and kappa statistic were measured for each diagnostic class comparing smartphone screenings versus EC exams.

Results: From August 2022-June 2023, 19 EC screenings were held across five South Indian regions. 2067 eyes of 1065 participants underwent screening and met eligibility criteria.

The median age was 60 years (IQR: 54-67 years). 57.84% of participants were female. Lens categories assessed included mature cataract (N=146, sensitivity 71.9%, specificity 97.5%, kappa statistic 67.9%), immature cataract (N=1068, sensitivity 78.8%, specificity 93.0%, kappa 71.4%), clear crystalline lens (N=329, sensitivity 88.1%, specificity 89.1%, kappa 65.2%), pseudophakia (N=487, sensitivity 96.5%, specificity 97.5%, kappa 92.5%), and aphakia (N=5).

Conclusions: Compared to in-person EC ophthalmologist exams, CHW-led screening using a novel smartphone platform and asynchronous ophthalmologist review demonstrated good diagnostic accuracy for cataract and lens status. The platform has potential to expand access to anterior eye disease screenings in low-resource settings.

CLINCAL & EPIDEMIOLOGIC RESEARCH

Accelerometer-Measured Daily Behaviours that Medicate the Association between Refractive Status and Depressive Disorder First Author: Zijing DU Co-Author(s): Xiayin ZHANG, Ting SU, Ying FANG, Honghua YU

Purpose: To identify the accelerometermeasured daily behaviors that mediate the association of refractive status with depressive disorders and advance understanding of the differences in accelerometer-measured daily behaviors in depression.

Methods: Participants with baseline MSE and accelerometer measurements from the UK Biobank were included. Refractive status was categorized as hyperopia and non-hyperopia. Four daily behaviors including moderate to vigorous physical activity (MVPA), light physical activity (LPA), sedentary, and sleep were recorded between 2013 and 2015. Depression cases were identified through hospital records and questionnaires over a 10-year follow-up. Results: For all 21,135 individuals, every 0.5 diopters (D) increase in MSE was associated with a 6% higher risk of depressive disorders, with hyperopia participants at higher risk than non-hyperopia participants (OR = 1.13, 95% CI = 1.05–1.22). MVPA and sleep time were

significantly associated with depressive disorders, with ORs of 0.006 and 3.81 (P values<0.05), respectively. MSE showed significant correlations with four daily behaviors. The effects of MVPA and sleep duration on MSE and depressive disorders varied across different time periods within 24 hours. Mediation analyses highlighted that MVPA and sleep duration partly mediated the association between MSE and depressive disorders. MVPA time significantly moderated the association between moderate to high hyperopia and depression, with a mediation ratio of 12.0%.

Conclusions: Among middle-aged and older adults with higher MSE, particularly with hyperopia, physical activity and sleep time mediated significant differences in depressive disorders. These findings support interventions aimed at increasing morning and evening MVPA while reducing daytime sleep to improve mental health in this population.

Prevalence and Associated Factors of Diabetic Retinopathy among People with Diabetes Screened Using Fundus Photography at a Community Diabetic Retinopathy Screening Program in Nepal *First Author: Raba THAPA*

Purpose: This study aimed to assess the prevalence and associated factors of diabetic retinopathy (DR) and vision threatening DR (VTDR) among people with diabetes screened using fundus photography in Nepal. Methods: This is a retrospective study among patients with diabetes presented for DR screening using fundus photography from 2013 to 2019. Detailed demographics, duration of diabetes, medical history, visual acuity, and grading of DR on fundus photography were analyzed. DR was graded using early treatment diabetic retinopathy study criteria. Results: Total of 25,196 patients with diabetes were enrolled with mean age was 54.15 years (S.D:12.94 years) ranging from 6 years to 97 years. Type 1 and type 2 diabetes comprised of 451 people (1.79%) and 24,747 (98.21%) respectively. DR prevalence was 19.3% (95% Confidence Interval (CI): 18.8% - 19.7%). DR prevalence in type 1 and type 2 diabetes was 15.5% (95% CI: 12.5% - 18.6%) and 19.3% (CI: 18.8% - 19.8%) respectively. Clinically significant

macular edema (CSME) was found in 5.9% (95% Cl: 5.6%-6.2%) and VTDR in 7.9% (95% Cl: 7.7%-8.3%). In multivariate analysis, duration of diabetes, diabetic foot, diabetic neuropathy, agriculture occupation, those under oral hypoglycaemic agents or insulin or both as compared to those under diet only, and presenting visual acuity >0.3 LogMAR were significantly associated with DR and VTDR. **Conclusions:** Prevalence and associated factors for DR and VTDR were similar to other DR screening program in the region. Emphasis on wider coverage of DR screening could help for timely detection and treatment of STDR to avoid irreversible blindness.

Association of Genetic Risk Score for Intraocular Pressure and Incident Dementia First Author: Wenyi HU Co-Author(s): Zhuoting ZHU, Mingguang HE

Purpose: To investigate the association between genetically determined intraocular pressure (IOP) and the risk of incident dementia.

Methods: The UK Biobank study enrolled over 500.000 individuals aged 40–69 years across the United Kingdom. Blood samples were taken from the participants during the baseline assessment and were used for whole-genome genotyping. A genetic risk score (GRS) for IOP was generated based on 112 loci associated with intraocular pressure which were predictive of primary open-angle glaucoma. The incident dementia cases were determined by the UK Biobank algorithm integrating sources of primary care, hospital admissions, and death registries. Multivariable Cox regression models were applied to examine the association between IOP GRS and the risk of developing future dementia.

Results: Among a total of 486,924 participants, 6,282 participants developed dementia during the median (interquartile range) follow-up of 12.1(11.4 to 12.9) years. After adjusting for multiple confounding factors (including age, gender, ethnicity, education, socioeconomic status, smoking status, physical activity, diabetes, hypertension, family history of dementia, APOE ε 4 and depression), the GRS for IOP was significantly associated with an increased risk of developing dementia (HR=1.04, 95% CI: 1.00-1.07, P=0.025).

Compared to the individuals with a GRS in the lowest decile, participants with a GRS in the 10th decile demonstrated 15% increased risk of developing dementia (HR=1.15, 95% Cl: 1.02-1.31, P=0.025). There was a significant linear trend between the IOP GRS and incident dementia risk (Ptrend=0.037). **Conclusions:** Genetically determined increase in IOP was associated with a higher risk of developing future dementia.

CORNEA

Remote Surgical Wetlab Training for Cornea Fellows in a Multi-Tier Hospital Network in India

First Author: Kavya CHANDRAN Co-Author(s): Karthikesh ANCHE, Padmaja RANI, Pravin VADDAVALLI

Purpose: To describe the efficacy and feasibility of a low cost, innovative remote wet lab model for corneal surgical training in a multi-tier hospital network in southern and eastern India. Methods: A descriptive study of remote corneal suturing wet lab training for cornea fellows in a multi-tier hospital network spanning across four tertiary centres (TC) and 26 secondary centres (SC). Cornea fellows in their second year of training in SC were engaged in remote penetrating keratoplasty (PK) suturing training from the TC. A pre wet lab virtual lecture was conducted for 18 fellows in SC on suturing technique in PK followed by a live demonstration from the TC on a research grade cornea which was relayed via Zoom.Fellows were instructed to set up relay from their respective SC. A dual feed relay was set up including a direct feed from side scope of the operating microscope (Zeiss Lumera) using a in house manufactured mobile phone adaptor device 'FOCUS' and an external video feed from laptop HD camera kept at a distance of 1 metre from the operating desk. The video screens were monitored by the trainer at the TC. Real time feedback was provided to the fellows and modifications in suturing were made. Results: A pre and post wet lab survey conducted for showed a significant

improvement in understanding surgical technique in suturing.

Conclusions: A low-cost innovative educational system to engage fellows in remote locations, obviating the need to travel to TC is an effective method to ensure continuous skill transfer and surgical training.

GENERAL OPHTHALMOLOGY

Comparative Study of Changes of Corneal Curvatures and Uncorrected Distance Visual Acuity Prior to and after Corneal Collagen Crosslinking: 1-Year Results First Author: Nader NASSIRI Co-Author(s): Kourosh SHEIBANI, Sara KAVOUSNEZHAD

Purpose: To evaluate the effect of CXL on corneal topographic and uncorrected distance visual acuity (UDVA) by Oculus Pentacam in the 15-30-year-old population.

Methods: In this descriptive-analytic study, we enrolled 38 eyes of 27 patients suffering from progressive keratoconus who were candidates for CXL. UDVA and the anterior and posterior corneal curvatures assessed prior to and 12 months after CXL. Data were analyzed by the paired t test and p < 0.05 was considered significant.

Results: One year after the CXL, mean UDVA significantly improved 0.1 \pm 0.25 logarithm of the minimal angle of resolution (p = 0.012). Changes for steep keratometry values, flat keratometry, and mean keratometry on the anterior corneal surface were statistically significant (all p < 0.005). However, the difference observed in maximum keratometry and astigmatism was not significant (p = 0.421 and p = 0.745, respectively). After 12 months, all four keratometry values on the posterior corneal surface had increased significantly (p < 0.005), while no significant change observed in astigmatism (p = 0.303).

Conclusions: Corneal collagen crosslinking has been revealed as an effective and minimally invasive intervention for the treatment of progressive keratoconus that can improve UDVA.

A Case Report of Optic Neuritis Following Second COVID-19 Vaccination

First Author: Edward **SAXTON** Co-Author(s): Binita **PANCHASARA**, Susan **SARANGAPANI**

Purpose: This case highlights potential consequences of the COVID-19 vaccine that can have considerable implications with regards to quality of life.

Methods: A 28-year-old woman presented to the eve casualty with a one-week history of reduced visual acuity in the right eye associated with pain on adduction and a right-sided headache. In clinic, prior to the onset of her visual symptoms, she received the second dose of The Moderna COVID-19 (mRNA-1273) vaccine which itself induced a flu-like syndrome that resolved within a few days. The best corrected visual acuity was 6/15 in the right eye and 6/6 in the left eye with a relative afferent pupillary defect in the right eye. Results: The patient had a multitude of investigations performed. A full panel of blood tests were taken including an immunologic screen. All results were normal or not detected other than a positive JC Virus result and Varicella Zoster IgG Antibody positive. MRI scans revealed lesions disseminated in space and time. She was found to fit the McDonald Criteria for Multiple Sclerosis and was commenced on disease-modifying therapy. Conclusions: The mRNA vaccines have thus far demonstrated a reasonable safety profile with The Moderna COVID-19 (mRNA-1273) vaccine being effective in around 94% of recipients. However, demyelinating events have been identified to occur following COVID-19 vaccinations. In this case we have found that The Moderna mRNA-1273 vaccine could have contributed to the development of optic neuritis following a second dose of the vaccine.

Real-World Validation of the R Eye Library for Big-Data Analysis of Free Text EMR Visual Acuity Data *First Author: Michael MAHR*

Purpose: To report on the real-world use of the R eye package for automated, algorithmic analysis of free text electronic medical record visual acuity data.

Methods: EPIC uncorrected and best corrected

distance visual acuity measurement free text entries for patients 21-90 days after undergoing cataract surgery were imported into RStudio. Using the eye package (https://cran.r-

project.org/web/packages/eye/vignettes/eye.ht ml) raw entries were converted to standard Snellen and ETDRS visual acuities.

Results: For a total of 29,231 free text electronic medical record visual acuity entries (14,615 right and 14,616 left) 24,624 (84%) [right 12,116: 82%, left 12,518: 86%], were successfully converted to standardized Snellen or ETDRS visual acuities for further algorithmic analysis. Entries with expanded textual descriptions suggestive of relatively poorer subjective vision were more likely to fail the automated conversion process.

Conclusions: With large scale, real world electronic medical record visual acuity data, the R eye package can convert 84% of "unclean" free text entries to standardized results suitable for additional algorithmic processing. Failed conversions suggest that there may be a bias towards discarding unconvertible, relatively worse visual acuities.

GLAUCOMA

Surgical Management of Glaucoma in Fuchs Uveitis Syndrome: Trabeculectomy or Ahmed Glaucoma Valve

First Author: Nader NASSIRI Co-Author(s): Kourosh SHEIBANI, Sara KAVOUSNEZHAD

Purpose: To evaluate the outcome of trabeculectomy versus Ahmed glaucoma valve (AGV) surgery in patients with Fuchs uveitis Syndrome (FUS).

Methods: Twenty-eight eyes with uncontrolled glaucoma and at least 6 months of follow-up were enrolled. In 16 eyes trabeculectomy and in 12 eyes AGV implant were performed. The primary outcome measure was surgical success defined as 5 < intraocular pressure (IOP) \leq 21 mmHg (criterion A) and 5 < IOP \leq 16 mmHg (criterion B), with at least 20% reduction in IOP, either with no medication (complete success) or with no more than preoperative medications (qualified success). The sum of complete and

qualified success was defined as cumulative success.

Results: In the AGV group, mean IOP was 31.41 \pm 6.76 at baseline that changed to 22.41 \pm 5.09 at last visit (P = 0.005). According to criterion A, cumulative success rates were 100% and 91% at 6 months and 76% and 9% at 36 months in the trabeculectomy and the AGV group, respectively. Cumulative success rates at 6 months were 93% and 58% and 65% and 7% at 36 months according to criterion B in the trabeculectomy and the AGV group. respectively. Kaplan-Meier survival analysis revealed a significant association between surgical method and cumulative success rate over 36 months (based on criteria A: P = 0.02, and based on criteria B: P = 0.007). Conclusions: The success rate of trabeculectomy was higher than AGV in the surgical management of glaucoma in FUS during a medium-term follow-up.

The Long-Term Outcome of Ahmed Glaucoma Valve Insertion in Neovascular Glaucoma

First Author: Nader **NASSIRI** Co-Author(s): Kourosh **SHEIBANI**, Sara **KAVOUSNEZHAD**

Purpose: To evaluate the efficacy of Ahmed glaucoma valve (AGV) implantation for neovascular glaucoma (NVG), in short, intermediate, and long term follow ups. Methods: The present study was a retrospective review of 23 eyes of 23 patients with NVG who underwent AGV implantation at Imam Hussein Medical Center, Tehran, Iran, between January 2008 and March 2017. Pre and post operative intraocular pressure (IOP), visual acuity, surgical success rate, number of medications, and complications were recorded. The primary outcome was surgical success defined in terms of $5 \le IOP \le 21$ mmHg and at least 20% reduction in IOP without glaucoma medication (complete success), or with medications (qualified success). The sum of complete success and qualified success was reported as cumulative success.

Results: The mean follow up period was 4.69 years (range, 2-10 years). The mean IOP was significantly lower compared to preoperative mean at each postoperative visit up to three years (P < 0.001). The cumulative surgical

success rate at 1 year, 2 years and 3 years were 91.3 %, 82.6 %, 78.3 % respectively. The mean number of drugs needed to control IOP was significantly lower compared to preoperative mean at each postoperative visit up to three years.

Conclusions: Our results suggest that AGV implantation is a useful method for controlling neovascular glaucoma (NVG), in short, intermediate, and long term follow ups.

The Effect of Early Post Trabeculectomy Bleb Leakage on Surgical Outcome: A Prospective Cohort Study

First Author: Nader NASSIRI Co-Author(s): Maryam YADGARI, Kourosh SHEIBANI, Sara KAVOUSNEZHAD

Purpose: To evaluate the effect of early posttrabeculectomy bleb leakage on the trabeculectomy surgery outcomes and success rate.

Methods: The present prospective cohort study was conducted on 203 eyes of 203 patients who underwent trabeculectomy at Torfeh and Imam Hosein medical centers, Tehran, Iran, between 2016 and 2021. Patients were divided in two groups: those patients with early bleb leakage (during the first month postoperative) and those without bleb leakage. The success rate of surgery was compared 12, 18, and 24 months after surgery in the two groups. The average intraocular pressure (IOP) and the need for medications in patients 1, 3, 6, 9, 12, 18, and 24 months after the trabeculectomy were also compared.

Results: Bleb leakage was detected in 33 eyes during the first month after trabeculectomy (16.3%). The mean decrease in IOP in the group with leakage was significantly lower than in the patients without the leakage in 1,6,9,12,18 and 24 months after surgery (p<0.05). The need for anti glaucoma medication was significantly higher among patients with bleb leakage 3 months (p=0.04(and 9 months) p=0.047(after surgery (p<0.05). The success rate 12, 18 and 24 months after surgery, was significantly lower in the group with the leakage than the group without the leakage.

Conclusions: Our study results suggest that early post-trabeculectomy bleb leakage has a negative effect on the surgery success rates.

Also, IOP reduction was lower in patients with early leakage.

The Effect of Hypertensive Phase on the Long-Term Outcomes of Ahmed Glaucoma Valve (AGV) Implantation

First Author: Nader **NASSIRI** Co-Author(s): Maryam **YADGARI**, Kourosh **SHEIBANI**, Sara **KAVOUSNEZHAD**

Purpose: To investigate the long-term effect of hypertensive phase (HP) on the clinical outcomes of Ahmed glaucoma valve (AGV) implantation.

Methods: The records of patients with different etiologies of glaucoma who underwent AGV implantation with at least 3 years of follow-up were retrospectively reviewed. HP was defined as the IOP > 21 mm Hg during the first three months after surgery. The main outcome measure was cumulative success defined as $5 < IOP \le 21$ mmHg and 20% reduction from the baseline with or without IOP lowering medications. Results that do not achieve cumulative success or undergo glaucoma reoperation during the follow-up period are considered failures. The secondary outcome measures were intraocular pressure (IOP) and the number of glaucoma medications. Results: A total of 120 patients (28 patients of HP, 92 patients without HP) with an average age (\pm SD) of 48.9 \pm 19.6 years and a mean follow-up of 4.5 ± 1.4 years were enrolled. The mean duration of survival was 5.3 ± 0.5 years in HP which was significantly shorter than 6.4 ± 0.2 years in non-HP (log rank = 4.2, P = 0.04). Mean IOP and number of IOP lowering agents were higher in postoperative visits at 1,2, 3, and 4 years in HP patients compared with non-HP (all Ps < 0.01). Higher baseline IOP was significantly associated with higher rates of surgical failure. **Conclusions:** In the long-term follow-up, the duration of survival was significantly longer in the non-HP group. In the non-HP group, the failure rate was significantly lower than the HP group.

The Role of Primary Needle Revision after Ahmed Glaucoma Valve (AGV) Implantation *First Author: Nader* **NASSIRI**

Co-Author(s): Maryam YADGARI, Kourosh SHEIBANI, Sara KAVOUSNEZHAD

Purpose: To evaluate the efficacy and safety of primary needle revision after Ahmed Glaucoma Valve (AGV) implantation in comparison with glaucoma medication use.

Methods: In this interventional case series, 23 eves of 23 patients who underwent AGV implantation were enrolled. Needle revision was performed when the intraocular pressure was higher than the target pressure before glaucoma medications. Using a 30-gauge needle, the Tenon's capsule over the plate was incised and the bleb was reformed. Patients were examined on a postoperative day one, weekly (for four weeks), and every 1–3 months. Two criteria were used to define cumulative success as a minimum 20% reduction in IOP and $5 < IOP \le 21 \text{ mmHg}$ (Criteria A) or $5 < IOP \le$ 18 mmHg (Criteria B) without (Complete success) or with (Qualified success) glaucoma medication.

Results: The mean age of patients was 53.8 ± 12.4 years. The mean number of primary needle revision was 2.2 ± 1.6 (1–6). One year postoperatively, the cumulative success rate was 91.4% and 86.9% based on Criteria A and B, respectively. The mean of preoperative IOP was 28.26 ± 8.86 mmHg, reaching 13.78 ± 3.54 mmHg at the end of the one-year follow-up (P < 0.001). The mean preoperative medication significantly decreased from a median of 4 at baseline to 2 after the one-year follow-up (P < 0.001). One patient experienced leakage over the plate, which was successfully treated via conservative management.

Conclusions: Our results showed that primary needle revision is a safe and effective method for controlling IOP after AGV implantation resulting in lower need for medication.

An Automated, Offline, Fundus Image-Based Artificial Intelligence Tool in Screening Different Severity of Glaucoma

First Author: Divya **RAO** Co-Author(s): Sirisha **SENTHIL**, Chandrasekar **GARUDADRI**, Florian **SAVOY**, Kalpa **NEGILONI**, Shreya **BHANDARY**, Raghava **CHARY**

Purpose: Evaluate the performance of a novel Al system deployed on a smartphone-based fundus camera to detect referable glaucoma with different severity grading against glaucoma specialists' diagnosis. **Methods:** A prospective study was conducted in glaucoma clinic of a tertiary eye hospital. One disc-centered image per eye was captured using the study device(validated, portable nonmydriatic fundus camera). The diagnostic ability of the Al tool to detect referable glaucoma against a final diagnosis made by a specialist following a thorough glaucoma workup(clinical assessment, SD-OCT, HVF) was evaluated. The severity of glaucoma was classified based on the visual field mean deviation using Hoddap–Parrish–Anderson criteria.

Results: We included 213 participants (Mean age:55±15 years (18,88)). The glaucoma specialist diagnosed 129 subjects as confirmed Glaucoma, 34-disc suspects and 50-noglaucoma. At a patient level (worse eye diagnosis), the automated AI system with fundus images alone achieved an accuracy of 89.7%, sensitivity of 89.57%(95%CI-83.8-93.8) and specificity of 90%(95%CI-78.2-96.7) for referable glaucoma. The 17 false negatives included 8-disc suspects and 9-confirmed glaucoma (2-Mild, 3-Moderate and 4-Advanced glaucoma). Sensitivity of Al for detecting mild(n=22), moderate(n=31) and advanced glaucoma(n=76) on fundus images alone when compared to a specialist (full glaucoma work-up diagnosis) was 90.91%(95%CI-70.84-98.8), 90.3%(95%CI:74.3-97.96), and 94.7%(95%CI:87.1-98.6) respectively. **Conclusions:** The fundus image-based offline Al tool shows promising performance in detecting referable glaucoma with better accuracy in detecting advanced glaucoma followed by moderate and early glaucoma. This solution can make glaucoma screening accessible even at remote locations in absence of glaucoma specialist.

Eye Drop Nitarsudil in Advanced Glaucoma on Maximum Tolerated Medical Therapy During COVID-19 Pandemic First Author: Saurabh HARAL Co-Author(s): VS GUPTA

Purpose: To elucidate the use of Nitarsudil in advanced glaucoma on maximally tolerated medical therapy who could not be offered the option of surgery due to Covid19. **Methods:** Only patients with primary open angle glaucoma (POAG), who had a cup-disc

ratio (CDR) of 0.9 or a near total cupping on maximum tolerated medical therapy for at least 4 weeks and whose target IOP was not meet were included. Total 30 patients were enrolled.Patients were started on E/D Nitarsudil OD and followed up at 1, 2, 4 weeks and then every 6 months for their BCVA, IOP, disc changes, perimetry, and OCT-RNFL. Results: Mean pre-treatment IOP on five drugs was 18.1 ± 1.1 mm Hg (range 14 to 22mmHg) on maximally tolerated medical therapy. At 1 week follow-up, mean post-treatment IOP was 15.4 ± 1.5 mm Hg (range 12 to 18mmHg) and at 2 week follow-up, mean post-treatment IOP was 12.3 ± 1.6 mmHg (range 10 to 16mmHg). Thus, target IOP \leq 12mmHg was attained in 28 patients at 2 weeks. This target IOP was maintained throughout the 6 months of followup period. Of the 2 patients who could not meet target IOP, 1 patient needed rearrangement of their fixed-drugcombinations to achieve target IOP at 4 weeks. The second patient required unfixing of all fixed-drug-combinations to achieve target IOP at maximally tolerated medical therapy at 6 weeks.

Conclusions: Nitarsudil not only provides a better IOP control but also has a high safety profile even when started as an add-on drug to already-existing yet inadequate maximally tolerated medical therapy.

(AVR). After removing variables with more than 30% missing values and feature selection with the Least Absolute Shrinkage and Selection Operator method, 45 variables were included in the final analysis. We used multivariate Cox regression models to assess their associations with mortality risk after adjusting for demographic, socioeconomic, and health and lifestyle-related factors.

Results: The analysis showed that while the CRAE and CRVE are commonly used retinal vascular features in studies exploring systemic health, they did not show a significant association with mortality risk. AVR equivalent showed a significate negative association with a hazard ratio of 0.96 (95% confidential interval: 0.925 - 0.996, p=0.028) with mortality risk after adjusting for age, sex, ethnicity, education, and social deprivation index. In addition, our study showed that wider retinal vessels, both arterial and veinous, are associated with higher mortality risk in the fully adjusted model. **Conclusions:** The observed associations suggest that AVR may be a more reliable indicator for all-cause mortality compared with CRAE and CRVE. In addition, wider retinal vessels may indicate poorer systemic health and increased mortality risk. Further research is warranted to elucidate underlying mechanisms and to explore the utility of these measurements in clinical practice.

OCULAR IMAGING

Retinal Vessel Calibers and Mortality Risk: Evidence from UK Biobank Study First Author: Mayinuer YUSUFU Co-Author(s): Xianwen SHANG, Danli SHI, Mingguang HE

Purpose: To investigate the associations between retinal vessel calibers and mortality risk.

Methods: We used retinal images from the UK Biobank study and extracted 83 caliber-related measurements, including both the measurement variance of the calibers, the central tendency and distribution of these measurements, as well as Central Retinal Arteriolar Equivalent (CRAE), Central Retinal Venular Equivalent (CRVE), Arteriovenous Ratio

RETINA & VITREOUS

Retinopathy of Prematurity among the Neonates in a Multi-Specialty Eye Hospital of Northern Bangladesh First Author: Md Sajidul HUQ

Co-Author(s): Md Mahmudul ISLAM

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Purpose: To determine the incidence and risk factors for developing retinopathy of prematurity among neonates attending an eye hospital for ROP screening.

Methods: It was a retrospective, record-based study of neonates who were screened for ROP in the ROP clinic of an eye hospital between February 2022 and July 2022. Data collected for each neonate included their gestational age, gender, birth weight, past medical history, ROP

screening findings and treatment advised. ROP screening was done by indirect ophthalmoscope and ROP was classified as stage I-V, APROP and Plus disease. Results: Forty-seven newborn infants were evaluated. Mean Birth Weight: 1707.55 ± 453.46 g and Mean Gestational Age: 32.66 ± 2.28 weeks. 14 babies 28 eyes (29.85%) were found to have ROP (18 eyes 19.1% Stage II, 6 eyes 6.4% Stage III, 4 eyes 4.3% APROP, 8 eyes 8.2% plus disease). All of them had BW \leq 2000 g and gestational age ≤ 35 weeks. In regard to treatment, 8 (8.5%) eyes were advised for laser, 6 (6.4%) for Anti-VEGF and rest of them for follow-up. ROP was significantly associated with history of blood transfusion (P = < 0.001), supplementary oxygen administration (P = 0.01) and birth weight (P = 0.03).

Conclusions: Considering the high incidence of ROP in this region, effective screening and timely intervention is needed to prevent the progression of ROP. It is also important to follow strict oxygen therapy guidelines and transfusion practices in the NICU to decrease the incidence of ROP.

Central Retinal Vein Occlusion in a Young Adult Secondary to Dehydration and Overexertion

First Author: Edward **SAXTON** Co-Author(s): Aaron **YEUNG**

Purpose: This case report highlights that dehydration and overexertion in young adults poses a risk to developing Central Retinal Vein Occlusion (CRVO).

Methods: A fit and well 20-year-old male presented to the clinic with reduced vision in the left eye and was found to have CRVO. His visual acuity was recorded as 6/6 in the right eye and 6/9 in the left eye. Prior to the onset of his visual symptoms, he was visiting a family member overseas during the height of the summer season where temperatures were high. He was over-exerting himself at the gym using heavier weights. We suspect that the combination of dehydration and overexertion caused the subsequent development of CRVO. **Results:** The patient was investigated extensively. Blood tests were normal apart from a low serum ACE (15) which we suspect is insignificant. MRI brain revealed no structural cause or inflammatory cause for left CRVO.

Carotid doppler did not reveal any evidence of stenosis or atherosclerosis. OCT taken at time of left eye demonstrated some macula swelling. On three-months follow up, his vision had resolved to normal and his clinical exam demonstrated almost complete resolution of the retina.

Conclusions: CRVO affects patient in an older age group with age, smoking, and cardiovascular risk factors being associated risks. Our case further highlights that both dehydration and overexertion is are risk factors for younger patients developing CRVO.

The Control Study of Deep Learning – Retinal Pigment Epithelium Segmentation for the Most Popular Optical Coherence Tomography Device First Author: Daisuke NAGASATO Co-Author(s): Hitoshi TABUCHI, Mao TANABE

Purpose: This study aimed to develop and evaluate an artificial intelligence (AI) assisted method designed to enhance the visualization of the retinal pigment epithelium (RPE) in optical coherence tomography (OCT) images for patients with age-related macular degeneration (AMD), diabetic retinopathy (DR), epiretinal membrane (ERM), branch retinal vein occlusion (BRVO), and even in normal eyes. Methods: OCT images from 88 patients with AMD were utilized, with the RPE area and choroid-scleral boundary identified. Following this, mask images were created using image processing software (200 for AMD; 100 each for DR, BRVO, ERM, and Normal). The Pyramid Scene Parsing Network (PSPNet) integrated with ResNet-50 was used to train the Al model. Its performance was then compared to conventional methods for OCT image analysis across a variety of retinal diseases and normal eyes. RPE identification accuracy was gauged using Mean Absolute Error (MAE). **Results:** The Al-assisted method significantly outperformed traditional methods in all groups, exhibiting lower MAEs (AMD, 2.18 vs. 4.79; DR, 1.69 vs. 3.17; ERM, 1.50 vs. 2.67; BRVO, 1.86 vs. 2.98; Normal, 1.59 vs. 2.28, all P<0.001). Specifically, the AI method was highly efficient in identifying the distinctive right-angled elevations seen in AMD and displayed superior RPE visualization.

Conclusions: The study affirms the potential of an Al-aided method in enhancing RPE visualization in OCT images, particularly notable in AMD cases. The Al's ability to precisely and automatically outline the RPE presents a significant leap in OCT's everyday clinical efficiency, suggesting potential advancements in the management of retinal diseases.

TELE-OPHTHALMOLOGY

Telemedicine during COVID Era: Experience from a Tertiary Eye Care Centre in North India

First Author: Neha **KUMARI** Co-Author(s): Karthikeyan **MAHALINGAM**, Radhika **TANDON**

Purpose: Coronavirus pandemic has turned the world upside down. India has confirmed 44,994,097 cases till present (28, June, 2023) accounting for 5.86% cases worldwide. Highly contagious coronavirus waves have diverted healthcare mainly to patients suffering from COVID-19. To address the needs of other patients' telemedicine service was introduced. Apart from helping patients, facility also reduced the number of patients visiting the hospital thus exposure to infection. Through this article we are sharing our 2 year experience with telemedicine in ophthalmology at the tertiary eye care centre during COVID-19. Methods: A cross-sectional observational study was conducted. A voice or video call was made depending on feasibility to the patients who got an online appointment for telemedicine. Data was collected and analyzed in terms of successful and unsuccessful calls and causes for the same.

Results: During this period of 2 years (April, 2020 to April, 2022) 16,911 patients took appointment for telemedicine service. Age of patients ranged from 1 day to 85 years with a mean age of 37.68 years. The majority of the patients (14,221, 84.09%) were registered for general OPD services and the rest for specialty clinics. Telemedicine was successful in 59.78% patients and unsuccessful in 40.22% patients, with most common cause for failure being calls not picked/not reachable (32.37%). 778 patients

requiring urgent ophthalmic care were asked to visit the emergency service.

Conclusions: Although a physical visit can never be replaced by any other modality but, in a pandemic-like situations telemedicine is an approachable option.

Real-World Applications of a Smartphone-Based VA Test (WHOeyes) with Automatic Distance Calibration

First Author: Yi **WU** Co-Author(s): Stuart **KEEL**, Vera **CARNEIRO**, Shiran **ZHANG**, Wei **WANG**, Xiaotung **HAN**, Mingguang **HE**

Purpose: To develop and validate a smartphone-based visual acuity (VA) test with an automatic distance calibration (ADC) function called WHOeyes.

Methods: OCT images from 88 patients with AMD were utilized, with the RPE area and choroid-scleral boundary identified. Following this, mask images were created using image processing software (200 for AMD; 100 each for DR, BRVO, ERM, and Normal). The Pyramid Scene Parsing Network (PSPNet) integrated with ResNet-50 was used to train the AI model. Its performance was then compared to conventional methods for OCT image analysis across a variety of retinal diseases and normal eyes. RPE identification accuracy was gauged using Mean Absolute Error (MAE). **Results:** The AI-assisted method significantly

outperformed traditional methods in all groups, exhibiting lower MAEs (AMD, 2.18 vs. 4.79; DR, 1.69 vs. 3.17; ERM, 1.50 vs. 2.67; BRVO, 1.86 vs. 2.98; Normal, 1.59 vs. 2.28, all P<0.001). Specifically, the AI method was highly efficient in identifying the distinctive right-angled elevations seen in AMD and displayed superior RPE visualization.

Conclusions: The study affirms the potential of an Al-aided method in enhancing RPE visualization in OCT images, particularly notable in AMD cases. The Al's ability to precisely and automatically outline the RPE presents a significant leap in OCT's everyday clinical efficiency, suggesting potential advancements in the management of retinal diseases.

Pre- and Post-COVID Longitudinal OCT-B Foveal Analysis in Patients with Type 1 Diabetes Mellitus

First Author: Victoria VOUGHT Co-Author(s): Rita VOUGHT, Bernard SZIRTH, Albert KHOURI

Purpose: Patients with Type I Diabetes Mellitus (T1DM) are advised to attend yearly retinal exams to screen for retinal changes that may occur as a result of poorly controlled glucose levels. The purpose of this study was to evaluate the relationship of years with T1DM and foveal thickness using trend analysis software in patients who receive annual retinal screenings.

Methods: Twenty patients (60% female, average age 25 and 19 years T1DM) were imaged yearly in 2016-2022 using Optical Coherence Tomography B (OCT-B). Imaging was not performed in 2020-2021 due to the pandemic. Foveal thickness, parafoveal thickness, and Early Treatment Diabetic Retinopathy Study (ETDRS) fovea were recorded annually. OptovueTM trend analysis software used linear regression to analyze yearly changes compared to a baseline of no change (slope=0). Patients were stratified by controlled (A1C \leq 7) or uncontrolled (A1C \geq 7) blood glucose. Paired T-tests were used to evaluate statistical significance.

Results: As of 2022, all patients used a continuous glucose monitor, and two patients did not have a pump. Patients with A1C \leq 7 (p<0.01) and A1C>7 (p=0.03) had significant increases in foveal thickness compared their baselines. However, patients with A1C \leq 7 had mild increases in parafoveal thickness (0.09%/year, p=0.62) and EDTRS (0.185%/year, p=0.28) compared to baseline. Patients with A1C>7 saw significant increases in parafoveal thickness (1.07%/year, p=0.00067) and EDTRS (1.04%/year, p=0.00083).

Conclusions: Patients with uncontrolled blood glucose had greater foveal deterioration as compared to patients with controlled blood glucose. This highlights the importance of OCT imaging alongside patient education in annual screenings of T1DM patients.

Tele-Robotic Consultations in Vision-Threatening Diseases in Community-Based Events

First Author: Victoria **VOUGHT** Co-Author(s): Rita **VOUGHT**, Bernard **SZIRTH**, Albert **KHOURI**

Purpose: Tele-robotic consultations can be utilized in community programs to increase the accessibility of ophthalmic care. Especially in medically-underserved populations, the rate of undiagnosed vision-threatening diseases, such as glaucoma, age-related macular degeneration (AMD), and diabetic retinopathy may be higher than the average population. In this study, we surveyed individuals to evaluate their comfort with tele-robotic consultations in a community screening setting.

Methods: An ocular screening for visionthreatening diseases was conducted at a community health fair. Individuals were imaged using a TopconTM Maestro 1, a dual OCT Fundus Photography unit. Images were transferred to an offsite certified telemedicine grader using a HIPAA compliant network. The telemedicine grader consulted with the patient regarding their findings using the Double 2 Robot TM, and subspecialty referrals were made as needed. Following the visit, patients completed a survey about their experience. **Results:** Eleven individuals (average 64.7 years old, 54.5% female) were imaged. One individual was referred for AMD (9%), and one for glaucoma (9%). Three individuals were counseled on blood pressure medication adherence for hypertensive retinopathy. Of these patients, only 50% attended a health fair before, and 20% had previously attended a community vision screening. Following the telerobotic consultation, all individuals would be open to a similar interaction in the future, as well as recommend a community fair eye screenina.

Conclusions: We observed a high level of comfort with tele-robotic consultations in our community-based eye screening post COVID-19. Similar telemedicine applications may be deployed in the future to continue increasing access to ophthalmic care.

Inclusion of Anterior Segments Imaging in Detecting Ocular Conditions in Remote Community-Based Screenings First Author: Rita VOUGHT

Co-Author(s): Victoria VOUGHT, Bernard SZIRTH, Albert KHOURI

Purpose: Community screenings constitute critical outreach in many underserved communities. Analysis of the referrals and need in these communities is important for the continued adaptation and tailoring of these services. The objective of this study was to analyze referrals generated from anterior segment imaging in community screenings targeted at underserved populations. Methods: Six urban remote community screenings were conducted in 2022. A CanonTM CR-2 Plus AF retinal camera was used to capture anterior segment images of each patient. Referrals to an academic medical center were generated by an onsite telemedicine grader for cataracts, dry eye, and pterygium removal. Alongside patient counseling, direct contact was established with a community liaison for appointment scheduling and charity care.

Results: In total, 122 patients (average age 59, 59% female) were evaluated. Two percent identified as Asian, 4% African American, 33% Hispanic, and 64% Caucasian. Referable findings were observed in 26% of patients. Twenty-two percent of patients were referred for cataracts: 20 patients had a 2+ cataract and six patients had a 3 or 3+ cataract. Additionally, 5% of patients were referred for dry eye and 4% were referred for pterygium removal.

Conclusions: With the incorporation of anterior segment imaging in our community screenings, we observed that a significant portion of patients (26%) had referable findings for cataracts, dry eye, or pterygium removal. Our outreach underscores the need for continued ophthalmic outreach in communities lacking access to eye care.

Gender Differences in Tele-Ophthalmology Article Authorship

First Author: Rita **VOUGHT** Co-Author(s): Victoria **VOUGHT**, Bernard **SZIRTH**, Albert **KHOURI**

Purpose: Gender disparities exist across multiple medical disciplines, including ophthalmology. Scholars are often evaluated using their research impact, such as through relative citation ratio (RCR) and field citation ratio (FCR). These parameters may be used to determine advancement opportunities.

Therefore, the objective of this study was to identify gender differences in Teleophthalmology publishing using RCR and FCR. Methods: A search was conducted in June 2023 on the Dimensions AI Database with the key terms "Tele-Ophthalmology" OR "Teleophthalmology", and results were filtered to include articles published from 2018 to 2022. The RCR and FCR, and Open Access status were noted for each article. The number of authors and gender of the corresponding author was also recorded. Mann-Whitney U tests were utilized to determine statistical significance. **Results:** Four hundred thirty-two articles were analyzed. Manuscripts had an average of six authors per manuscript. Of these articles, 67.5% of corresponding authors were male while 32.5% were female. Articles with female corresponding authors had an average RCR of 2.5 and FCR of 5.8, while those with male corresponding authors had an average RCR of 2.4 and FCR of 7.4. No significant differences were observed in RCR (p=0.75), FCR (p=0.55), or Open Access publishing (p=0.21) by gender. **Conclusions:** Despite similar levels of research impact, significant disparities exist in authorship by gender in Teleophthalmology publishing, with over twice as many male corresponding authors than female. There is significant room for improvement to improve equal opportunity access to publishing opportunities for women in Teleophthalmology.

Impact of an Integrated Care Delivery Model Connecting Diabetic and the Eye Clinics to Deliver Care for Diabetic Retinopathy via Tele-Ophthalmology *First Author: Malinda DE SILVA*

Co-Author(s): Rohana **MARASINGHE**

Purpose: Global diabetic retinopathy (DR) prevalence is a growing concern, accounting for 4% of blindness worldwide. Screening coverage remains at 60% due to various factors. To address this, we developed a local teleophthalmology platform to connect clinics and evaluate outcomes. **Methods:** Action-based research was conducted at a tertiary care hospital with an

established DR screening process. Requirements were gathered through interviews and existing teleophthalmology models. The platform facilitated upload of



retinal images after capture, remark the grading, referral to a specialist opinion and informed patient history. Patient factors were compared between samples screened with and without teleophthalmology.

Results: 40 patients each were screened with and without teleophthalmology. Patients using the platform experienced reduced visits (p=0.001), waiting time (p<0.017), and higher satisfaction (p<0.002). Number of visits lessened for the patients, reducing the cost incurred.

Conclusions: Teleophthalmology adoption improves waiting time, visits, and satisfaction. This effective and feasible model can integrate with established clinical setups for managing diabetic retinopathy.

Designing a Care Delivery Model to Use Tele-Ophthalmology for Sri Lankan Context First Author: Malinda DE SILVA Co-Author(s): Rohana MARASINGHE, Aruna FERNANDO

Purpose: The ophthalmic disease burden poses a global challenge, with teleophthalmology emerging as a digital health intervention to bridge gaps in care delivery. The objective of this study was to propose a tailored teleophthalmology model for the local context. Methods: The study was conducted in three phases using a mixed method. Thematic analysis on the searched literature identified 5 key components of a teleophthalmology model in low-resource settings. During phase 2, expertise of 10 ophthalmologists were obtained to refine the components and achieve consensus on the designed teleophthalmology model. A user acceptance study was conducted among the primary care physicians after demonstration of the model using a validated Unified Theory of Acceptance and Use of Technology (UTAUT) guestionnaire. Results: Discovered components of the model were disease contexts, type of care, telemedicine principles, necessary technologies, and contact points. The panelists achieved consensus on the teleophthalmology model. It was favorably acceptance by primary care physicians. Regression analysis revealed linear correlation between all independent variables and Behavioral intention, while effort expectancy was the strongest predictor.

Conclusions: The teleophthalmology model tailored for Sri Lanka recognized digital health records and Artificial intelligence as important features while disregarding mobile applications. Reinforcing UTAUT constructs would improve acceptance of teleophthalmology among primary care physicians. Policy direction, prototyping, stakeholder consensus, and use of standardizing equipment are recommended prior to implanting this model.

Training of the Screeners for Tele-Glaucoma Program in Malaysia: A Pilot Study First Author: Jemaima Che HAMZAH Co-Author(s): Xiao Hui WEE, Mohd HAIROL, Mohd RAHMAN, Rona NASARUDDIN

Purpose: Glaucoma is a progressive optic neuropathy which can cause blindness if left untreated. Teleglaucoma screening program can be one of the strategies to reduce the risk of visual impairment and blindness. One component of a successful screening program is the training of the personnel before performing the actual screening. This crosssectional study reported the results on the effectiveness of a training workshop for the teleglaucoma screening program. Methods: Fourteen eye care providers participated in a one-day training workshop at Hospital Canselor Tuanku Muhriz, Universiti Kebangsaan Malaysia Medical Centre. Prior to this, the eye care providers were required to attend online teaching on introduction to glaucoma, history taking, pupillary light examination, oblique flashlight test, visual acuity test, intraocular pressure measurement, fundus examination using non-mydriatic fundus camera and management of glaucoma two weeks before the workshop. Six trainers were involved in this workshop. After the training session, the participants undertook a practical competency assessment. Self-assessment questionnaire regarding their knowledge and basic skills in glaucoma screening were administered to the participants pre and post workshop.

Results: All the participants achieved more than 70% for the practical competency assessment. There was a significant improvement in the self-assessment of the participants' skills (p=0.01 for the visual acuity test and p=0.003 for the rest of the skills) after the workshop.

Conclusions: This training workshop enabled the eye care providers to acquire and enhance their skills in screening glaucoma. The improvement in their self-assessment rating post-workshop will also improve their confidence in performing glaucoma screening in the future.

No-Code Automated Machine Learning for Referable Diabetic Retinopathy Image Classification from Ultrawide Field Retinal Images in a Philippine Tertiary Hospital First Author: Leandro ARCENA Co-Author(s): Paolo SILVA

Purpose: To create and determine the diagnostic performance of a machine learning model for detection of referable diabetic retinopathy (refDR) in ultrawide field (UWF) retinal images from a Philippine eye center. Methods: A Google AutoML Vision model was trained using 2,000 UWF images with 50/50 ratio of refDR/non-refDR. Images were labeled according to diabetic retinopathy (DR) severity grading based on the Early Treatment Diabetic Retinopathy Study (ETDRS); refDR was defined as moderate nonproliferative DR (NPDR) or worse. A ratio of 8-1-1 for training was used as per Google AutoML's requirements; 80% training, 10% validation, 10% testing. Published UWF image sets were used for external testing (N=225 images, N=256 images). Sensitivity and specificity (Sn/Sp) for refDR were calculated as per US FDA performance requirements of 0.85/0.825 Sn/Sp.

Results: Area under precision-recall curve was 0.998. Sn/Sp from external testing were 0.88/0.83 (CI 95% 0.80-0.94/0.74-0.89) and 0.83/0.80 (CI 95% 0.74-0.89/0.72-0.86). Positive/negative predictive values were 0.81/0.89 (CI 95% 0.73-0.89/0.82-0.94) and 0.75/0.86 (CI 95% 0.66-0.83/0.79- 0.91). **Conclusions:** The utility and validity of deep learning algorithms continues to be heavily studied in ophthalmology. However, there are no commercially available AI systems for ultrawide field (UWF) retinal images. The pilot performance of the custom AutoML model constructed in this study in the diagnosis of referable DR approaches US FDA requirements, indicating wide potential in clinical applications.

Digital Cataract Service: An Inevitable Revolution? First Author: Meriam ISLAM

Co-Author(s): Pei-Fen LIN

Purpose: To demonstrate the viability of digital innovation in the form of a digital cataract service (DCS) in a tertiary referral centre (Moorfields Eye Hospital, London, UK). **Methods:** Traditional face to face (F2F) assessment for cataract was replaced with remote consultation via a tele-ophthalmology service using "Attend Anywhere" in February 2021 and remains ongoing to date. A traditional case mix was reflected in our cohort. We evaluated the patient journey time, patient experience and complication rate for this patient group.

Results: The average age was 74 years. Complexity scoring between the virtual clinic and F2F traditional clinic was comparable. We demonstrated a 93% conversion rate from attendance to surgical listing. The patient journey was reduced from 4 hours to 1 hour 20 minutes. 177 patients have been through this pathway and thus far the complication rate is low [Post op inflammation/CMO 4%] with nil endophthalmitis, and 96% reporting an improvement in vision postoperatively. Patients were satisfied with this care with 95% approving, 57% preferring it to standard F2F, and 9.7% preferring F2F.

Conclusions: We recognise that digital innovation in the cataract service is an inevitability to the future of our health service and an asset, and find that there is minimal digital exclusion in our patient mix and patients are innovative. The benefits are clear in the form of ease of access for patients, efficiency of resources for clinician and hospital services alike and outcomes are comparable with standard care, proving safe cafe and a satisfactory service to patients.

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³ Actual image size is 7.1MP
 ⁴ Courtesy: Tsuskazaki Hospital, Japan

⁵ Images A-C: Courtesy of Tsukazaki Hospital, Hyogo, Japan. Images D-F: Courtesy of Hanemoto Eye Clinic, Japan

⁶ Courtesy: Ophthalmology Department. Manchester Royal Eye Hospital @2023 TOPCON CORPORATION I AP000137A-1

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