Centre for Eye Health

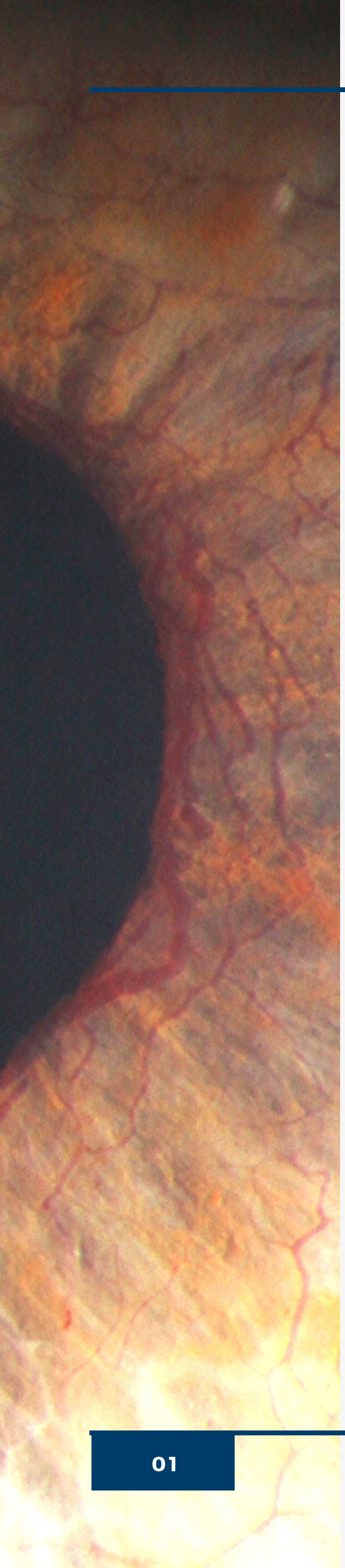
2019

YEAR IN REVIEW

UNSW SYDNEY

Guide Dogs NSW/ACT

Sight lost, freedom found.



EXECUTIVE SUMMARY

2019 was both a challenging and exceptionally rewarding year for the CFEH team. It was a year that saw the successful culmination of many years of foundation work in the areas of both clinical services and original research. This year we celebrated 10 years of CFEH operations. Over this 10 year period, in excess of 60 000 patients appointments have been undertaken.

As 2019 draws to a close, Guide Dogs NSW/ACT and CFEH are making the final preparations needed for the opening of a new collaborative hub in Parramatta - the Cameron Centre. This hub will open in early 2020 and offer an integrated approach to patient care, encompassing diagnostic, management and rehabilitation services.

This location will provide a new geographical population access to CFEH services, an important evolution when you consider that a large proportion of those in this catchment area come from a lower socio-economic background. CFEH will also be participating in the Community Eye Care (C-Eye-C) program, working with Westmead Hospital ophthalmologists to reduce the public hospital waiting list, thereby allowing those requiring treatment to be seen in a more timely manner.

A third key component of this venture is the establishment of a collaborative low vision clinic whereby functional visual assessment will help to inform visual solutions for those patients with significant vision loss. This will be the first clinic where Guide Dogs and CFEH will be working together to positively impact the lives of people with vision impairment and represents a great step forward for both organisations.

While clinical services are the cornerstone of CFEH operations, research and education activities are equally important in the drive towards achieving the Centre's vision: a reduction in the incidence of preventable blindness.

2019 was a very successful year in the area of research with the awarding of two NHMRC grants totalling $1.1 million to CFEH-based staff. The funds will advance the work of both Dr Lisa Nivison-Smith who is looking at outer retinal changes in macular degeneration and the ongoing work into structure and function led by Prof Michael Kalloniatis and Dr Barbara Zangerl.

The research team also had several papers published in high impact journals, received invitations to present at several prestigious international conferences and also secured a patent for a novel new method of detecting eye disease.

The education team also had great success with high-profile speaking invitations both nationally and internationally.

So after a successful 2019, preparations are now in place for the controlled expansion of the Centre and procedures have been refined to increase operational efficiencies. The prognosis for 2020 is bright and the CFEH team ready to adapt and take on any challenge that may arise.

It is indeed a team to be proud of.

MICHAEL KALLONIATIS
ON BEHALF OF THE CFEH EXECUTIVE TEAM

STRATEGIC FRAMEWORK

VISION

To reduce the incidence of preventable vision loss.

CORE SERVICES

1. Advanced imaging and diagnostics service for early detection of eye disease.
2. Disease management services for specific conditions.
3. Expert clinical recommendations and advice on eye imaging and visual system diagnosis. Where appropriate, CFEH optometrists consult with ophthalmologists from South Eastern Sydney Local Health District for interpretation of test results and to determine suitable management of patients.
4. Provision of clinicial services within a public hospital, working with hospital based ophthalmologists in a collaborative stratified care model.
5. Provision of education and raising awareness of eye disease.

STRATEGIC GOALS 2018-2023

1. To provide a triage service for public hospital ophthalmology allowing earlier access to advanced eye imaging, diagnostic services and disease management (in collaboration with ophthalmology).
2. To provide collaborative care with ophthalmology for those with stable conditions.
3. To ensure we remain a growing and financially sustainable organisation.
4. Plan and develop new clinical hubs that include integrated GDN/CFEH client services to deliver a holistic client-centric approach.
5. To enhance credibility through research and publications and to demonstrate clinical expertise through education.

CFEH CLINICAL SERVICES

MICHAEL YAPP

During 2019, 10,615 patient patient referrals were received by the Centre (Kensington and Sutherland Hospital satellite clinic combined). This represents an increase of 3% on 2018.

This increase in patient numbers was made possible by ongoing refinements to and expansion of the services offered by the CFEH clinic in line with the strategic goals previously identified.

#1 TO PROVIDE A TRIAGE SERVICE FOR PUBLIC HOSPITAL OPHTHALMOLOGY

PRINCE OF WALES HOSPITAL (POWH)

1**. Reduction of Wait Times:** The non-urgent POWH referral triage clinic continued operation in 2019 in conjunction with an onsite specialist from POWH ophthalmology. This clinic was developed to assess patients referred to POWH whose referred condition was assessed as being non-urgent. Results suggest that this clinic and associated processes has halved the waiting time for appointments at the hospital.

This clinic was wound up towards the latter part of 2019 having achieved its primary aim and is in the final stages of being converted into a new model whereby patients are assessed independently by CFEH optometrists with remote ophthalmology review. This will assist with increasing patient throughput and enabling Medicare billing.

2**. Transfer of stable patients**: Patients with stable glaucoma are being transferred from POWH care to CFEH. This transfer option has now been expanded to include a wide range of conditions to further improve the utilisation of public resources and ensure that the right person is seen at the right place at the right time.

SUTHERLAND HOSPITAL

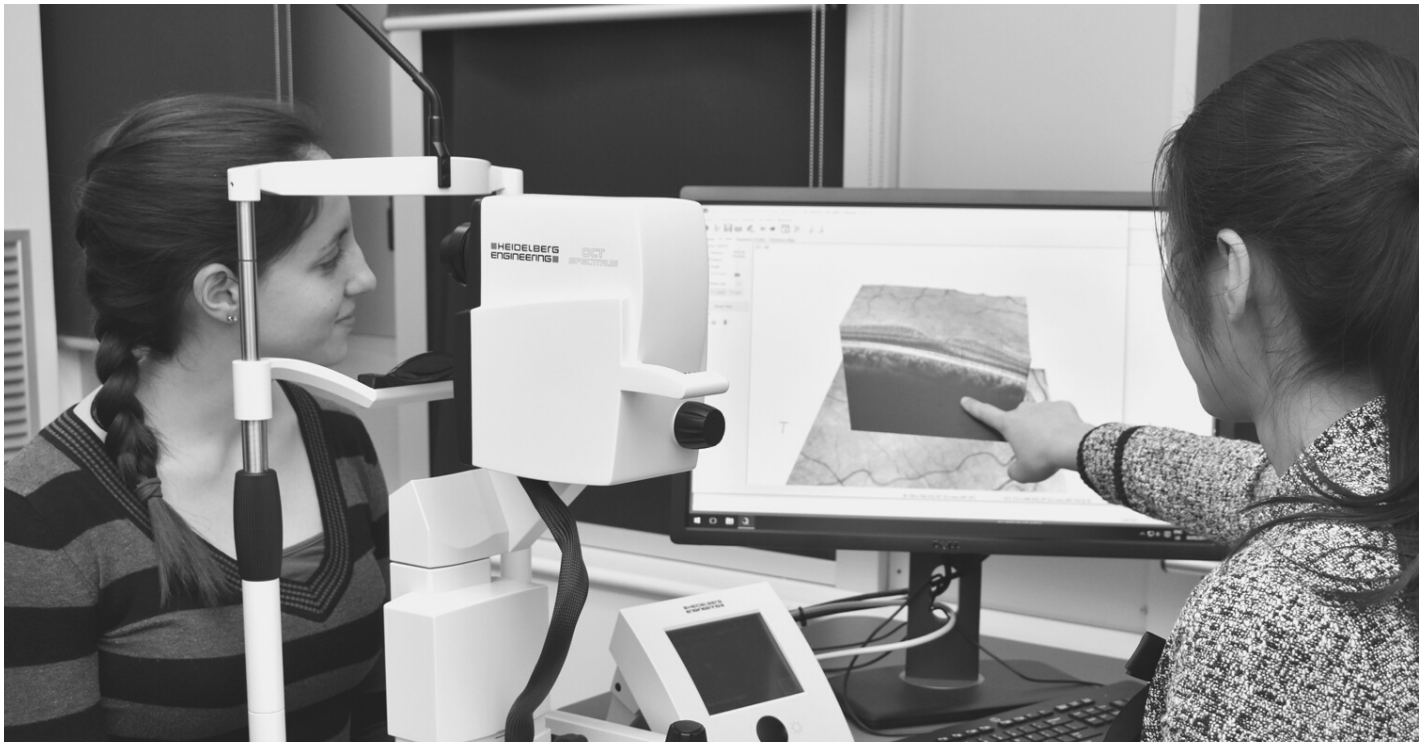
1**. At Risk Patients:** The collaboration with Sutherland hospital has expanded to include working with HealthOne to further assist with providing eye care to at risk population groups. This has included several clinic sessions specifically aimed at providing comprehensive eye examinations for Aboriginal and Torres Strait Islanders from the area as well as patients with mental health issues.

2. **Diabetic Retinopathy:** While referral numbers have not grown as initially anticipated, the clinic continues to identify and arrange treatment for a significant number of patients at high risk of sight loss from Diabetic retinopathy that would otherwise not have sought eye care. This is through a combination of the collaboration with ophthalmology, endocrinology and the physical setting of the clinic within the hospital.

3. Future Expansion: Negotiations are continuing with Hospital management with the goal of expanding the service to include cataract and glaucoma assessments for the benefit of the local population as well as to assist in improving the clinic's long term financial viability.

WESTMEAD HOSPITAL

Reducing Wait Times: Westmead hospital services a very large geographical area including a large number of regions with a low socioeconomic profile. The eye clinic at Westmead is the largest in NSW and consequently has a long waiting list. An MoU with Westmead hospital was signed in 2019 to work within the C-Eye-C program to address this problem with the collaboration set to commence with the opening of the Cameron Centre in early 2020.



#2: TO PROVIDE COLLABORATIVE CARE WITH OPHTHALMOLOGY FOR THOSE WITH STABLE CONDITIONS

MANAGEMENT REFERRALS

Over the last 10 years, CFEH's main model of care has centered on assisting community optometrists in the early detection of eye disease, in particular for glaucoma, macular disease and diabetic retinopathy. The mainstay of the CFEH operational model involves sending results and recommendations from the examination to the referring practitioner for them to discuss with the patient as appropriate (assessment referral option).

The success of the glaucoma management clinic (GMC) which was established in 2016, was the Centre's first step in the collaborative management of stable, chronic eye disease with ophthalmology. During 2019 this framework was expanded to allow optometrists the option of referring other non-acute retinal conditions for management. Where appropriate, remote review of a patient's results by an ophthalmologist is undertaken. This option helps time-poor practitioners enhance the patient journey, make the most of CFEH's expertise and collaboration with ophthalmology and also offers patients an accessible and time-efficient alternative to the public health system.

NARROW ANGLE SUITES

Optometrists regularly see patients that are at risk of angle closure glaucoma, a potentially acute, blinding condition. Many practitioners are not comfortable performing gonioscopy - a test to help determine if prophylactic treatment is needed. As a result, a referral option specifically for this condition was introduced and has had a significant uptake by referrers. CFEH clinicians use gonioscopy and anterior eye imaging technologies (including optical coherence tomography and ultrasound biomicroscopy) to thoroughly evaluate the angle. Where appropriate, remote review by ophthalmology is possible. This clinic has led to published research on the topic which is assisting with future management practices as well as allowing for Medicare rebates.

#3: TO ENSURE WE REMAIN A GROWING AND FINANCIALLY RESPONSIBLE ORGANIZATION

REFINING GLAUCOMA MANAGEMENT (GMC) REFERRAL PROCESSES

To ensure that the time and expertise of the ophthalmologist is best utilised, the criteria used for patient selection has been refined. This has led to the introduction of a supplementary clinical testing protocol prior to deciding if an appointment in this clinic is needed. Ongoing analysis of the outcomes of these processes has the potential to lead to improvements in the management of glaucoma throughout the Australian health care system.

The glaucoma management (GMC) clinic continues to show long term financial viability with Medicare income covering 153% of the associated personnel costs in 2019.

"TESTS ONLY" REFERRALS

Performing imaging alone without providing an opinion on diagnosis and management is not covered by Medicare. While this option of 'test only' referrals has been available since the Centre's inception and is continuing for ophthalmology referrals, to assist with moving towards a more financially sustainable long term model and enable better interpretation of results, this option was phased out towards the end of 2019.

PROCESS REFINEMENT

CFEH continues to be a dynamic organisation with changes to existing processes occurring regularly throughout the year. The collaboration with final year optometric students in the clinic as well as improvements in scheduling of patients and report writing templates are examples of some of the refinements throughout the year leading to increased efficiency within the clinic.

#4: PLAN AND DEVELOP NEW CLINICAL HUBS THAT INCLUDE INTEGRATED GDN/CFEH CLIENT SERVICES TO DELIVER A HOLISTIC CLIENT-CENTRIC APPROACH

THE CAMERON CENTRE

Throughout the latter part of 2019 preparations continued for the opening of the Cameron Centre at Parramatta where Guide Dogs NSW/ACT (GDN) and CFEH services will be co-located. It is also the location of the first CFEH/GDN collaborative care clinic.

The assessment and management services currently available at Kensington and at Sutherland Hospital will be offered at Parramatta. However, there will also be an additional full-scope low vision service available, provided in collaboration with GDN. This model will allow the two organisations to work together and utilise their respective strengths to facilitate the best outcomes for low vision patients referred to the clinic.

In addition to these core services, CFEH is joining the Community Eye Care (C-Eye-C) program - a service delivery model which aims to improve access to appropriate management for people with diabetic retinopathy and/or glaucoma to prevent avoidable vision loss and blindness. Under this program, patient care will be shared between the Centre and Westmead Hospital Ophthalmology.

At the end of 2019 practical preparations for the Cameron Centre were on track with the IT setup complete and imaging and optometric equipment due to be installed in early January.

An announcement of the imminent venture was made to CFEH referrers in December 2019 with positive feedback. Clear communication with key stakeholders was essential from the outset to avoid misconceptions or misunderstandings.

TRANSFER OF PATIENTS WITH VISION LOSS FROM POWH

Towards the end of 2019, a process has been commenced to transfer patients under the care of POWH eye clinic that have vision loss to CFEH through the existing pathways. CFEH is currently developing and refining a protocol to assess patients' visual function and needs to assist with subsequent referrals to Guide Dogs services as appropriate.

This model is set to be replicated to some degree at the Cameron Centre with Westmead and refined for both locations throughout 2020.

CLINICAL SERVICES : OUTPUTS

DAVID MURRAY

	2017	2018	2019	2019 BUDGET	% OF BUDGET
PATIENT NUMBERS +					
REFERRALS	7937	9540	10615	9740	109%
APPOINTMENTS	7372	9455	9729	8927	109%
ACTIVE REFERRERS	755	710	793	N/A	N/A
OPHTHALMOLOGY CONSULTS	3209	4361	4361	N/A	N/A
TURNAROUND TIMES (WEEKS)					
REFERRAL TURNAROUND	5.5	3.9	4.4	4.0	110%
BOOKING TURNAROUND	3.5	2.4	2.6	3.0	87%
PERSONNEL COST RECOVERY					
GLAUCOMA MANAGEMENT CLINIC	97%	126%	153%	N/A	N/A

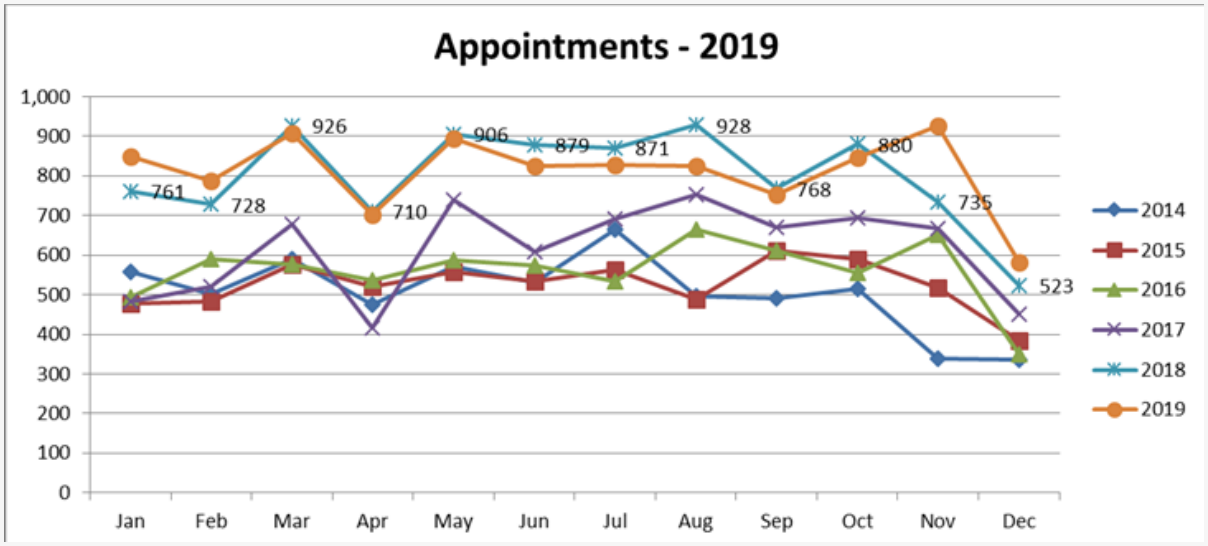


Figure 1: CFEH appointment numbers by month shown over time.

+ Figures are based on the calendar year (1st January 2019 - 31st December 2019)

CFEH OPERATIONS

The Centre is continually seeking to improve and refine processes for the benefit of both clients and referrers. The three key areas of change and improvement in 2019 are below:

IMPLEMENTATION OF NEW INTIATIVES

During 2019, CFEH was first in the eye-care industry to integrate with My Health Record in order to help improve the quality of patient care for people with eye disease and those at risk of developing eye disease or vision loss.

The new CFEH website was launched in 2019 with an integrated online referral form that has made the process of referring a patient very easy. The use of this form has seen excellent uptake with 1789 online referrals received to date. Concurrently, CFEH also started receiving referrals through Oculo, making it easier for large corporate practices to refer patients and receive reports. These changes were all administered efficiently in a timely manner by the Client Services team.

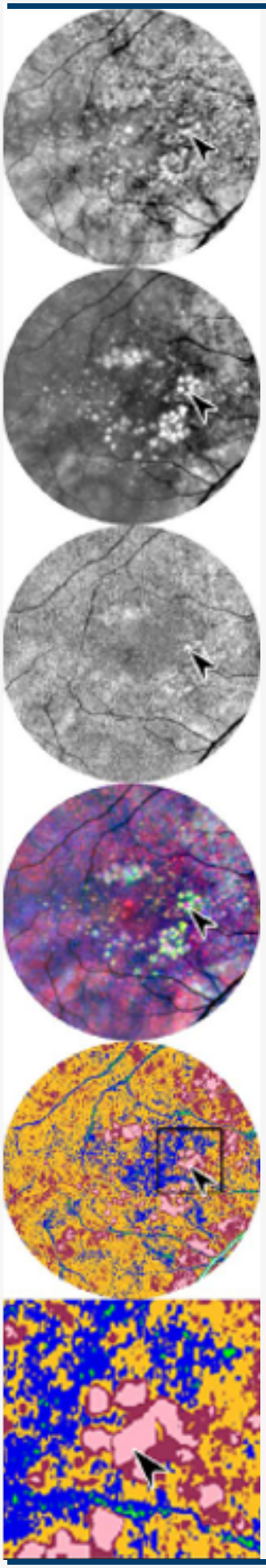
IMPROVING EFFICIENCIES

In an initiative designed to improve the efficiency of the CFEH clinic, the appointment structure for the General Clinic was refined, increasing the number of patients seen each day.

When the Big W chain of optometry stores closed in 2019, the Client Services team undertook an initiative to ensure these patients were not lost to follow-up. A letter was sent to each patient informing them that the practice had closed and asked them to nominate a new optometrist who their future reports could be sent to.

MARKETING AND COMMUNICATIONS

In 2019, a new Marketing and Communications Coordinator was employed and tasked with both raising the profile of the Centre and its achievements, as well as improving communications with referrers. In 2019 this greatly helped the Centre communicate key changes to referrers, including the change away from offering "tests only", the launch of a new online referral form and the establishment of a Retina Clinic for patients with chronic retinal disease.



CFEH RESEARCH

PROFESSOR MICHAEL KALLONIATIS

2019 was a busy and productive year for the CFEH research team. Highlights included the following:

- Dr Lisa Nivison-Smith was awarded a 5 year NHMRC investigator grant to continue her research into retinal remodeling in age-related macular degeneration (total value $625 000).

- Prof Michael Kalloniatis and Dr Barbara Zangerl are CFEH-based investigators on an NHMRC Ideas grant with co-investigators Dr David Alonso-Caneiro (QUT) and Assoc Prof Sieu Khuu (SOVS, UNSW). The 3 year grant will allow the team to further their research into linking structure with visual function.

- Prof Michael Kalloniatis, Assoc Prof Sieu Khuu and Dr Noha El Saleem successfully applied for a patent covering a novel method they developed for the early detection of ocular disease such as glaucoma.

- The CFEH research team has had 17 papers accepted or published this year, many of which were in high impact journals. For a full list of publications, refer to Appendix A.

- The CFEH research team was also invited to present their findings at several prestigious international conferences including the American Academy of Optometry meeting (Orlando), the Association for Research in Vision and Ophthalmology meeting (Vancouver), the World Glaucoma Congress (Melbourne) and the Asia-Pacific Conference on Vision (Osaka). A full list of presentations can be found in Appendix B.

- PhD Candidate Agnes Choi successfully completed her studies. Agnes looked at the role of visual function and optical imaging in age-related macular degeneration (AMD), aiming to link clinical measures of visual function to different stages of AMD. She was supervised by Prof Michael Kalloniatis, Dr Lisa Nivison-Smith and Assoc Prof Sieu Khuu.

Ongoing CFEH research projects include the following:

- Using advanced imaging technologies in early detection and management of eye disease
- Developing new clinical tests and refining existing tests to improve early detection of eye disease
- Using pattern recognition to develop automated methods to assess clinical data
- Developing new referral pathways to create efficiencies in public health ophthalmology services
- Assessing the effectiveness of collaborative patient management paradigms

CFEH EDUCATION

MICHELE CLEWETT

UNSW SCHOOL OF OPTOMETRY AND VISION SCIENCE CONTRACT TEACHING (BSC, MCLIN OPTOM)

In 2019 the CFEH education team developed a new course for third year undergraduate students covering the pathophysiology and clinical presentation of ocular disease - Disease Processes of the Eye 2 (OPTM3205). This course replaces the previous ocular disease course and this year had 120 students enrolled with 184 expected in 2020. UNSW contract teaching continues to be a cost neutral activity for the Centre.

The Centre secured a digital uplift grant to enhance this course in 2020 through the development of engaging online educational resources that complement face-to-face teaching. This includes $10,000 towards covering CFEH staff costs, $20,000 towards outsourced development support and a UNSW project manager to support the CFEH educational team. Work on the uplift started in late December.

Throughout 2019, CFEH also hosted every Masters of Clinical Optometry student for a 6 week rotation. As in previous years, this rotation rated very highly in student feedback, particularly with regards to the amount learnt about both imaging and ocular disease. The full feedback summary is included in Appendix E.

BOUTIQUE GLAUCOMA TRAINING COURSE

In April 2019, the Centre hosted 2 optometrists and one nurse practitioner from Yishun Health Campus, Singapore for a glaucoma training course specifically developed to meet the operational needs of a new collaborative care clinic this group are tasked with running.

Prior to their arrival, the participants were required to complete an online training component to ensure they had a solid understanding of glaucoma diagnosis and management. Once at the Centre, participants undertook a 5 week intensive practical program to refine their clinical and diagnostic skills in the area of glaucoma.

Feedback from both the participants and CFEH staff involved in the program was extremely positive.

PROVISION OF CONTINUING PROFESSIONAL EDUCATION (CPD)

1. CFEH Online Education

During 2019, the Centre presented 10 live webinars, available through a paid annual program subscription. Throughout the year there was a significant increase in subscriber numbers for this program with 146 members in November 2019 compared with 89 at the same time in 2018 (a 64% increase).

2. Collaboration with Optometry Australia

In 2019, two CFEH webinars were selected to be broadcast nationally by Optometry Australia. These were available to all members and reached a combined total of 1000 optometrists.

In further collaborations with Optometry Australia, the CFEH education team developed two interactive, adaptive learning modules that will be hosted on the Association's new educational website - the Institute of Excellence. These modules utilise the latest development tools for online education and were developed using the guiding principles of good educational design and current learning theory.

This collaboration will continue in 2020, providing a valuable income source to support the Centre's educational endeavours and increasing the reach of these resources.

3. Collaboration with the New Zealand Optometrists Association (NZAO)

In 2019 the NZAO financed a subscription to the CFEH Education learning portal for all members. As a result of this agreement, 2019 course completions by New Zealand members increased from 317 in 2018 to 432 in 2019 (37% increase). Two CFEH presenters, Dr Jack Phu and Dr Angelica Ly were also invited to be keynote speakers at the 2019 NZAO conference in Napier. Feedback from attendees of both the lectures and workshops was outstanding.

4. Collaboration with Guide Dogs NSW/ACT

In collaboration with Guide Dogs, the CFEH education team presented a series of workshops throughout rural NSW during 2019. These were greeted with great enthusiasm by attendees and offered a chance to raise the awareness of Guide Dogs services with the local optometrists.

5. Invited National and International Presentations

In 2019 both Michael Yapp and Jack Phu were invited to present lectures at the American Academy of Optometry annual conference in Orlando. One of the talks given by Michael Yapp was chosen as one of the top lectures from the 2019 meeting and a summary of his lecture will feature in the Heart of America Conference in Kansas City (February 2020).

Several CFEH senior educators were also invited to speak at conferences around Australia throughout 2019, which is testament to their ever-growing reputation as leaders in the field of optometry. A full list of CFEH lectures and workshops for 2019 can be found in Appendix C.

6. CFEH 10 Year Celebration CPD Event

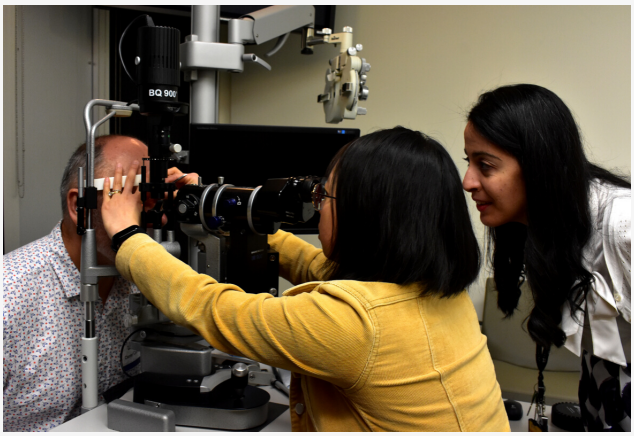
The final CPD event of the year was the CFEH 10 year celebration CPD event in November. CFEH educators ran a series of workshops and didactic lectures were presented by senior CFEH staff and affiliated ophthalmologists. This event, and in particular the workshops, received extremely positive feedback from all who attended.

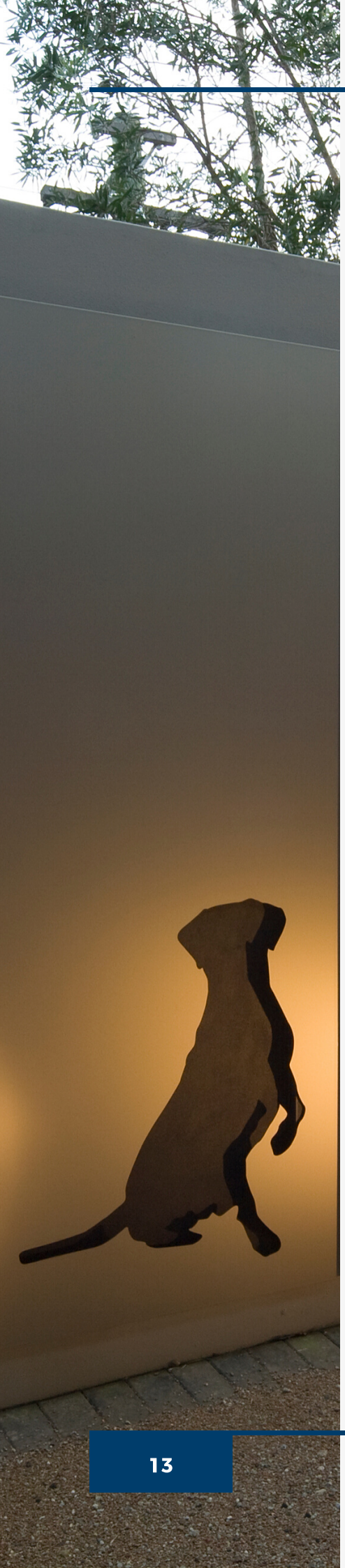
CFEH 10 YEAR CELEBRATION EVENT

In November 2019 the Centre celebrated 10 years of successful operation and collaboration. To mark the occasion, a celebratory event was held at the Centre that was attended by referrers, Guide Dogs NSW/ACT donors, former staff members, media representatives and key stakeholders from Guide Dogs, UNSW, Optometry Australia and Prince of Wales Hospital Ophthalmology,

The event featured both continuing education workshops and lectures as well as a celebratory lunch and cake. Speeches were given by Centre Director Prof Michael Kalloniatis, Barry Stephen (CFEH and Guide Dogs Boards), Professor Simon Killcross (UNSW Acting Deputy Dean Education, Faculty of Science) and Prof Lisa Keay (Head of the School of Optometry and Vision Science, UNSW), and the event was compered by Andrew McKinnon (CEO Optometry NSW/ACT).

This celebration gave all stakeholders the chance to reflect on the significant changes and advances made at the Centre in the space of just one decade. Evolution and change will continue as CFEH moves to work more closely with Guide Dogs and all present at the celebration were united in their optimism about the future. It is important to acknowledge however, that none of the achievements presented in this document and indeed those of the previous 9 years of operation would have been possible without the generous financial support and vision of Guide Dogs NSW/ACT.





KEY COLLABORATIONS

The Centre for eye Health has always worked collaboratively with key industry stakeholders with great success. In the immediate future, the opening of the Cameron Centre will herald a new era of collaboration and a closer relationship between ***Guide Dogs*** and CFEH, bringing many potential opportunities and leveraging of synergies between the organisations.

Throughout the last 10 years the Centre has also grown key collaborative relationships with other organisations, such as those with Prince of Wales Ophthalmology and Sutherland Hospital, as outlined previously in this document. There are many other noteworthy alliances however, both developed and developing. These include:

- ***School of Optometry and Vision Science (SOVS, UNSW):*** CFEH continued to provide undergraduate teaching in 2019 through delivery of a third year ocular disease/pathophysiology course as well as hosting a 6 week clinical rotation for every final year student. Centre staff also work collaboratively to provide lectures or tutorials on request for other courses in the OPTM/VISN course and conduct collaborative research projects with SOVS staff as appropriate.

- ***Big Picture Medical:*** CFEH is planning to work with BPM, the School of Optometry and Vision Science at UNSW and the Department of Machine Learning at University of Adelaide to develop a point-of-care optometry platform that utilises artificial intelligence to reduce misdiagnoses and unnecessary referrals.

- ***Community Eye Care Program (C-Eye-C)*:** CFEH has been developing referral pathways with Westmead Hospital as planning progresses for CFEH to join the existing C-Eye-C program. This aims to reduce public hospital waiting times, allowing patients in most need to access ophthalmology services in a more timely manner.

- ***Brien Holden Vision Institute consortium (includes Australian College of Optometry, Optometry Australia and Aboriginal Health Council of South Australia)* :** CFEH developed an online educational module to instruct general practitioners in diabetic retinopathy screening. This module was developed as part of a federal government program to install retinal cameras into remote areas of Australia. This program is scheduled to be completed at the end of June 2020.

- ***Optometry Australia (OA):*** CFEH was contracted to develop a series of literature reviews to inform Optometry Australia decision making as part of their 20/40 strategy in 2019. Additionally, as previously mentioned, the Centre's clinicians were active contributors to OA-led continuing education.

- ***Optometry NSW/ACT:*** Dr Angelica Ly and Michael Yapp have been elected to serve on the Council of Optometry NSW/ACT.

- ***Glaucoma Australia (GA):*** Dr Jack Phu represents CFEH on the Glaucoma sub-committee. All GMC patients with a glaucoma diagnosis are given the opportunity to sign up as a member of GA.

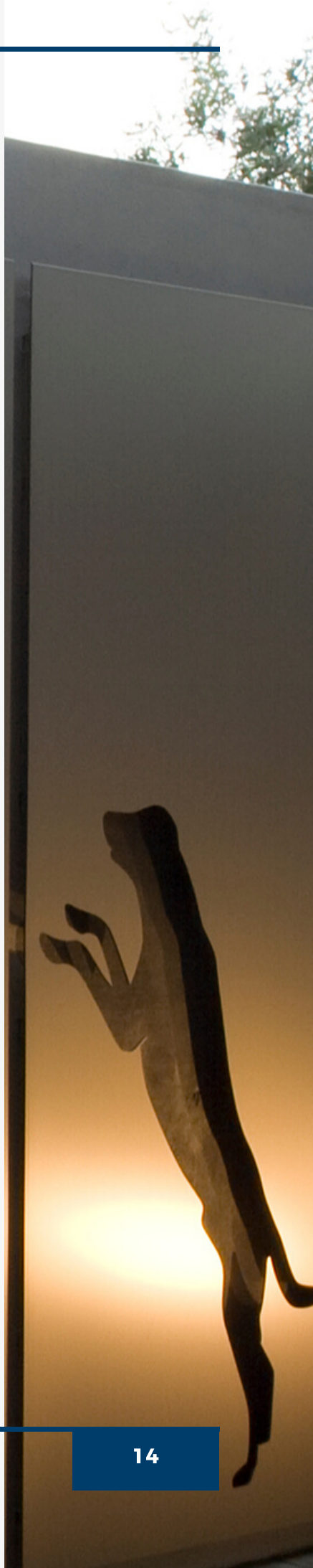
- ***Macular Disease Foundation (MDF):*** CFEH is working with the MDF to improve outcomes for patients with macular disease. All patients with macular disease are given the opportunity to sign up as a member of the MDF.

- ***Australian Health Alliance (AHRA):*** Prof Michael Kalloniatis was on a national steering committee to develop a national system to improve health pathways.

- **Sydney Partnership for Health Education and Research and Enterprise (SPHERE)**: Prof Michael Kalloniatis sits on the council and the Centre is one of the founding institutions of this partnership.

- ***Vision 2020 - Early Intervention and Prevention:*** David Murray sits on this committee.

- ***Western NSW Eye Health Project:*** This project aims to develop a coherent system of coordinated eye health services in Western NSW LHD with a focus on Aboriginal eye care. David Murray sits on this committee.



THE FUTURE

At the end of 2019, the Centre is preparing for significant expansion of services and increased collaboration with Guide Dogs NSW/ACT at the Cameron Centre. At the same time, the Centre is joining the C-Eye-C program, allowing the growth of further collaborative relationships with public hospital ophthalmology.

It is a busy time also in the research space with two large NHMRC grants awarded late in the year, providing resources to further the Centre's work into the early detection of eye disease, potentially improving outcomes for patients with eye disease on a global scale.

Another exciting area of CFEH evolution is into the world of artificial intelligence in partnership with Big Picture Medical. This project aims to use machine learning to improve diagnostic accuracy, thereby reducing unnecessary referrals and minimising misdiagnoses. We await the outcome of a large Cooperative Research Centre Project Grant to be announced in early 2020.

It is a time of great change, but also of great opportunity.

APPENDIX A: 2019 PUBLICATIONS

PEER-REVIEWED PUBLICATIONS PUBLISHED IN 2019

1. LY,A; PHU,J; KATALINIC,P; KALLONIATIS,M. An Evidence-Based Approach to the Routine Use of Optical Coherence Tomography. *Clinical and Experimental Optometry* 2019:102(3):242-259.
2. PHU,J; KALLONIATIS,M; WANG,H; KHUU,S. Optimising the Structure-Function Relationship at the Locus of Deficit in Retinal Disease. *Frontiers in Neuroscience* 2019 Vol 13:306.
3. TONG,J; PHU,J; KHUU,S; YOSHIOKA,N; CHOI,A; NIVISON-SMITH,L; MARC, RE; JONES,BW; PFEIFFER,RL; KALLONIATIS,M; ZANGERL,B. Development of a spatial model of age-related change in the macular ganglion cell layer to predict function from structural changes. *American Journal of Ophthalmology*. 2019:208:166-177.
4. TRINH,M; KALLONIATIS,M; NIVISON-SMITH,L. Vascular Changes in Intermediate Age-Related Macular Degeneration Quantified Using Optical Coherence Tomography Angiography. *Translational Vision Science & Technology* 2019:Vol.8, 20.
5. PHU,J; WANG,H; KHUU,S; ZANGERL,B; HENNESSY,MP, MASSELOS,K; KALLONIATIS,M. Anterior Chamber Angle Evaluation Using Gonioscopy in a Collaborative Care Glaucoma Clinic: Consistency and Agreement Amongst Clinicians. *Optometry and Vision Science*. 2019;96(10):751-760.
6. CHOI,A; NIVISON-SMITH,L; PHU,J; ZANGERL,B; KHUU,S; JONES,BW; PFEIFFER,R; MARC,RE; KALLONIATIS,M. Contrast Sensitivity Isocontours of the Central Visual Field and their Utility in Assessing Age-Related Macular Degeneration. *Scientific Reports* 9 2019 11603.
7. PHU,J; WANG,H; KHOU,V; ZHANG,S; KALLONIATIS,M. Remote Grading of the Anterior Chamber Angle Using Goniophotographs and Optical Coherence Tomography: Implications for Telemedicine or Virtual Clinics. *Translational Vision Science & Technology* 2019:Vol.8(16).
8. PHU,J; KHUU,S; AGAR,A; KALLONIATIS,M. Clinical Evaluation of SITA-Faster Compared to SITA-Standard in Normal Subjects, Glaucoma Suspects and Glaucoma Patients. *American Journal of Ophthalmology* 2019 Vol 208:251-264.
9. LY,A; BANH,J; LUU,P; HUANG,J. YAPP,M; ZANGERL,B. Interocular asymmetry of the Superonasal Retinal Nerve Fibre Layer Thickness and Blood Vessel Diameter in Healthy Subjects. *PLOS ONE* 14(12): e0226728.
10. LAURITZEN,JS; SIGULINSKY,CL; ANDERSON, JR; KALLONIATIS,M; NELSON,NT; EMRICH,DP; RAPP,C; MCCARTHY,N; KERZNER,E; MEYER,M; JONES,BW; MARC,RE. Rod-Cone Crossover Connectome of Mammalian bipolar cells. *Journal of Comparative Neurology* 2019;527(1):87-116.
11. HART,K; ABBOTT,C; LY,A; KALFF,S. LEK,JJ; MILSTON,R; PAGE,G; ROBERTSON,B; AYTON,L. Optometry Australia's Chairside Reference for the Diagnosis and Management of Age-Related Macular Degeneration. *Clinical and Experimental Optometry* doi:10.1111/cxo.12964.

PAPERS PUBLISHED ONLINE AHEAD OF PRINT IN 2019

1. PHU,J; HENNESSY,M; SPARGO,M; DANCE,S; KALLONIATIS,M. A Collaborative Care Pathway for Patients with Suspected Angle Closure Glaucoma Spectrum Disease. *Clinical and Experimental Optometry*. Epub 2019 May 23.
2. TONG,J; PHU,J; KALLONIATIS,M; ZANGERL,B. Modelling Changes in Corneal Parameters With Age: implications for Corneal Disease Detection. *American Journal of Ophthalmology* 2020 Jan;209:117-131. Epub 2019 Aug 27.
3. WANG,H; LY,A; YAPP,M; ASSAAD,N; KALLONIATIS,M. Multimodal imaging characteristics of congenital grouped hyper- and hypo-pigmented fundus lesions. *Clinical and Experimental Optometry* Epub 2019 Nov 25.
4. HUANG,J; YAPP,M; HENNESSY,M; LY,A; MASSELOS,K; AGAR,A; KALLONIATIS,M; ZANGERL,B. Impact of referral refinement on management of glaucoma suspects in Australia. *Clinical and Experimental Optometry*. 2019 Dec 18.

PAPERS ACCEPTED FOR PUBLICATION IN 2020

1. HUANG,J; PHU,J; KALLONIATIS,M; ZANGERL,B. Determining Significant Elevation of Applanation Intraocular Pressure Using Icare HOME Tonometry. *Optometry and Vision Science*. Accepted October 2019.
2. TRINH,M; TONG,J; YOSHIOKA,N; ZANGERL,B; KALLONIATIS,M; NIVISON-SMITH,L. Macula Ganglion Cell Thickness Changes Display Location-Specific Variation Patterns in Intermediate Age-Related Macular Degeneration. *Investigative Ophthlamology and Vision Science*. Accepted November 2019.

PUBLISHED PATENT

KALLONIATIS,M; KHUU,S; SALEEM,N AI. Methods and Systems for Diagnosis of Ocular Disease. US patent 10,390,695.

Abstract: An aspect of the present invention provides a method for early detection of ocular disease such as glaucoma in a subject. The method comprises the steps of: successively applying a plurality of test stimuli at different eccentricities to the subject's retina, wherein each of the test stimuli is adjusted for differences in spatial or temporal summation resulting from application of the test stimuli; determining visual field capability loss of the subject in response to each of the plurality of test stimuli; and diagnosing ocular disease int he subject if the subject's visual field capability loss in response to each of the test stimuli is substantially equal.

NON-PEER-REVIEWED PUBLICATIONS

1. HUANG,J; ZANGERL,B. Intraocular Pressure Phasing and Glaucoma. Mivision Education 2019.
2. KALLONIATIS,M. Centre for Eye Health Celebrates 10 Years. Mivision December 2019.
3. LY,A; XU,P. DRUSEN: Your Mnemonic for Managing AMD. Mivision May 2019.
4. LY,A. Confessions of a Clinician: Tips for Managing AMD. Pharma March 2019.
5. NIVISON-SMITH,L; ZHANG,S. Branded or Generic: Which Eye Drops do you Choose? Mivision January 2019.
6. NIVISON-SMITH,L. Beyond the Macula: Peripheral Changes in Patients with AMD. Pharma June 2019.
7. PHU,J. Glaucoma Management for Optometrists in 2019: Are the NHMRC Guidelines Still Useful? Parma March 2019.
8. TOBIAS,R; JACOME,G. Acute Symptomatic PVD: Dilate and Re-Examine 6 Weeks On? Mivision July 2019.
9. WONG,E; HUANG,J. Monocular Glaucoma Trials: Weighing Up the Evidence. Mivision March 2019.
10. XU,P; WANG,H. Cataract Surgery and AMD Progression: Are They Associated? Mivision May 2019.
11. XU,P. Not Quite as it Seems: How to Differentiate Macular Dystrophy From AMD. Pharma June 2019.

APPENDIX B: 2019 PRESENTATIONS (RESEARCH)

University of New South Wales (UNSW)

1. PHU,J. Vaegan Seminar: Application of Psychophysical Principles for Optomising Ocular Structure-Function Relationships.
2. TONG,J; WANG,H. Vaegan Seminar: Development of Novel Structural and Functional Analysis Techniques to Improve the Structure-Function Relationship in Posterior Eye Disease.
3. NIVISON-SMITH. Becoming a Vision Scientist - Girls in STEM Outreach Day

Department of Optometry and Vision Science, University of Melbourne

1. NIVISON-SMITH, L. Using Advanced Ocular Imaging to Better Understand Structural Changes in the Inner Retina in Early AMD

CONFERENCE ABSTRACTS 2019

American Academy of Optometry (Orlando)

1. PHU,J. Evidence-Based Practice in Angle Closure Spectrum Disease: Gonioscopy and Multimodal Imaging.
2. PHU,J. A Feature Agnostic Based Glaucoma Diagnosis From OCT Images With Deep Learning Technique.
3. PHU,J; ASSAAD,N. Can Anterior Segment Optical Coherence Tomography Describe Gonioscopic Features as a Continuum of Change? Implications for the Clinic and Artificial Intelligence.
4. WANG,H. Structure-Function Correlations Using a Novel Method for Quantification of Vitreomacular Interface Distortions: Application in a Spectrum of Epiretinal Membrane.

The Association for Research in Vision and Ophthalmology (Vancouver)

1. NIVISON-SMITH,L; TRINH,M; Kalloniatis,M. Quantity and Morphology of Inner Retinal Vasculature is Reduced in Intermediate Age-Related Macular Degeneration. Investigative Ophthalmology & Visual Science 60(9), 3443-3443.
2. TONG,J; PHU,J; KALLONIATIS,M; ZANGERL,B. Refining Models Characterising Age-Related Changes in the Human Cornea. Investigative Ophthalmology & Visual Science 60(9) 4232-4232.
3. PHU,J; TONG,J; ZANGERL,B; HENNESSY,M; LE,JL; Kalloniatis. Central and Paracentral Anterior Chamber Depth for Diagnosis of Angle Closure Spectrum Disease. Investigative Ophthalmology & Visual Science 60(9), 5565-5565.
4. ZANGERL,B; TONG,J; ALONSO-CANEIRO,D; YOSHIOKA,N; KALLONIATIS,M. Clustered and Spatial Alignment of Ganglion Cell Structure and Function Delivers Near Perfect Correlation Enabling Prediction of Visual Function. Investigative Ophthalmology & Visual Science 60(9) 6139-6139.
5. LY,A; NIVISON-SMITH,L; KALLONIATIS,M. Pattern Recognition for the Distinction of Drusen From Reticular Pseudodrusen. Investigative Ophthalmology & Visual Science 60(9) 174-174

WORLD GLAUCOMA CONGRESS (Melbourne)

1. PHU,J; KHUU,S; KALLONIATIS,M. Comparison of SITA-Faster and SITA-Standard in a Clinical Cohort of normal Subjects, Glaucoma Suspects and Patients with Glaucoma. Abstract no P-FS-043.
2. HUANG,J; PHU,J; KHUU,S; HENNESSY,M; KALLONIATIS,M; ZANGERL,B. Cluster Analysis of Longtitudinal Visucal Fields Identifies Patterns of Progression in Glaucoma Patients.

ASIA PACIFIC CONFERENCE ON VISION (Osaka)

1. LUU,W; ZANGERL,B. KALLONIATIS,M; KIM,J. Effects of Display Compensation, Speed and Stereopsls on Motion Perception in an Immersive Virtual Environment Viewed on a Head-Mounted Display (HMD). I-Perception 10 86-86.

APPENDIX C: 2019 PRESENTATIONS (EDUCATION)

World Glaucoma Congress (Sydney)

1. YAPP,M. Maximising Functionality and Minimising Disability in the Advanced Glaucoma Patient

American Academy of Optometry (Orlando)

1. YAPP,M. The Choroid: Vascular, Inflammatory and Tumours
2. YAPP,M. When OCT is Not Enough
3. PHU,J. Visual Fields in 2019: Still Relevant in Your Clinical Practice?
4. PHU,J. Evidence-Based Practice in Angle Closure Spectrum Disease: Gonioscopy and Multimodal Imaging.

Optometry Australia (National Webinar)

1. KATALINIC,P; Xu,P; YAPP,M; PHU,J; Ly,A. 5 Papers That Will Change How You Practice Optometry
2. CHU,C; YAPP,M. CFEH Top Cases of 2019
3. LY,A. The Past, Present and Future of Imaging in AMD

N**ZAO Annual Conference**

1. LY, A. Stretched to Breaking Point: Retinal Complications of myopia
2. LY,A. How to Detect Progression in AMD.
3. LY,A. Workshop: Multimodal Imaging in macular Disease
4. PHU,J. White-on-White vs Matrix and Other Forms of Perimetry: The Future of Visual Fields
5. PHU,J. Update of Angle Closure Spectrum Disease
6. PHU,J. Workshop: Glaucoma Peer Review Session

North Queensland Vision

1. KALLONIATIS,M. Interesting Glaucoma Cases: Beware the Mimickers
2. KALLONIATIS,M. Collaborative Glaucoma Care, Patient Outcomes and the Future

School of Optometry and Vision Science (UNSW)

1. LY,A. New Graduate Address - Professional Development
2. PHU,J. Webinar: Clinical Scenarios in glaucoma - Perspectives From a Co-Management Clinic.

Graduate School of Medicine (University of Wollongong)

1. KHOU,V. Common Signs and Symptoms but Uncommon Diagnoses

Optometry NSW/ACT

1. YAPP,M; WONG,E; JACOME,G; LY,A. Super Sunday: Rapid Fire on Ultra Wide Imaging.
2. PHU,J. ECONA: Co-management

Young Optometrists

1. YAPP,M. CPD Trivia night

Rural Allied Health and Medical Society

1. KATALINIC,P. Diabetes Case Studies

HCF Eyecare

1. LY,A. Back to Basics: How to Interpret OCT

School of Optometry and Vision Science, University of Auckland, NZ

1. KALLONIATIS,M. Interpreting Visual Fields and Optical Coherence Tomography in Clinical Practice
2. KALLONIATIS,M. Practical workshop

New Zealand National Eye Centre, University of Auckland

1. KALLONIATIS,M. Optimising Models to Predict Function from Structural Data

Kensington Combined Probus

1. KALLONIATIS,M. Diabetes and the Eye

Guide Dogs NSW/ACT Rural Workshops:
New Perspectives in Optic Nerve and Macular Diagnosis and Management

1. KATALINIC,P; XU,P. - Canberra
2. KATALINIC,P; XU,P - Newcastle
3. PHU,J. - Dubbo
4. PHU,J; XU,P - Wollongong
5. YAPP,M. - Port Macquarie
6. YAPP,M - Coffs Harbour
7. YAPP,M. - Lismore
8. YAPP,M - Albury
9. YAPP,M - Tamworth

CFEH 10 year Celebration CPD Event

1. PHU,J; LY,A; MARKOULLI,M. Advanced Clinical Skills workshop (narrow angles, dry eye and advanced diagnosis skills)
2. KATALINIC,P; JACOME,G; MOORE,L; TONG,J; WANG,H; YAPP,M. Back to Basics: OCT Interpretation workshop
3. HENNESSY,M; YAPP,M. Collaborative Care
4. SPARGO,M. Update on Paediatric Ophthalmology
5. ASSAAD,N. Diabetic Retinopathy Update
6. LY,A. Update on AMD
7. PHU,J. There and Back Again - The Evolution of Pre-Perimetric Glaucoma Over the Last 10 years

CFEH Webinar Series (2019)

1. YAPP,M. Ocular Complications of Sleep Disorders
2. PHU,J. Paradigm Shifts in Therapeutic Management of Glaucoma
3. LESLIE,S. Neuro-Optometric Rehabilitation
4. KANG,P. Atropine: Analysing the Evidence
5. Xu, P. Optometrist's Guide to Inherited Retinal Degenerations
6. LY,A. Artificial Intelligence - Friend or Foe?
7. YAPP,M; MOORE,L. Online workshop: Case Studies
8. CARNT,N. Management of Microbial Keratitis
9. KATALINIC,P; WONG,E. Neovascularisation Unravelled

APPENDIX D: CFEH GRANT SUCCESS (2019)

NHMRC IDEAS GRANT

1. **$476,764 over 3 years**
   Title: Predicting visual function from structural data in health and ocular disease
   Lead Investigator: Prof Michael Kalloniatis
   Co-investigators: Barbara Zangerl, David Alonso-Caneiro (QUT), Siew Khuu (SOVS, UNSW)
   Description of grant: To fund the continuing research into retinal structure and function of Dr Zangerl and Dr Kalloniatis

NHMRC INVESTIGATOR GRANT

1. **$628,690 over 5 years**
   Lead investigator: Dr Lisa Nivison-Smith
   Description of grant: The grant is to support research using advanced imaging to better understand the early stages of Age related macular degeneration which can facilitate better early detection, diagnosis and management.

UNSW RESEARCH INFRASTRUCTURE SCHEME

1. **$11 050** to purchase Spectralis Spectral Domain Optical Coherence Tomography (SD-OCT) High Magnification Module (a high-resolution lens and software package to be fitted to the Centre's existing Spectralis SD-OCT.
   Lead investigator: Dr Lisa Nivison-Smith
   Co-investigators: Michael Kalloniatis, Barbara Zangerl, Angelica Ly, Jack Phu, Michael Yapp, Sieu Khuu, Nayuta Yoshioka, Juno Kim, Pauline Kang, Maitreyee Roy, Minas Coroneo, Arthur Ho, Mohit Shivdasani

2. **$70 000** for Installation and validation of a polarisation-sensitive optical coherence tomographer (PS-OCT)
   Lead Investigator: Dr Barbara Zangerl
   Co-investigators: Jack Phu, Sieu Khuu, Angelica Ly, Maria Markoulli, Ashish Agar, Michael Hennessy, Pauline Kang, Minas Coroneo, Michael Kalloniatis, Maitreyee Roy

UNSW DIGITAL UPLIFT GRANT

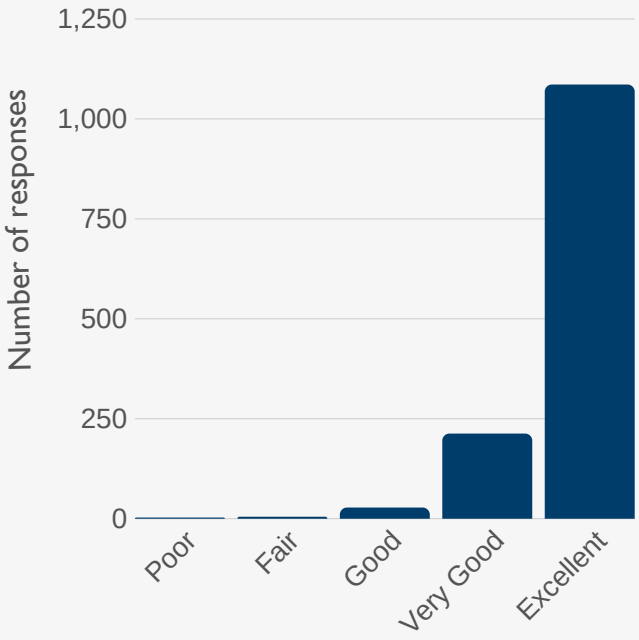
1. **$10 000 to cover CFEH costs, $20 000 computer science services, A dedicated project manager from PVCe**
   Course: OPTM3205 Disease Processes of the Eye 2
   Convenor: Michele Clewett

APPENDIX E: CLIENT FEEDBACK: CFEH CLINICAL SERVICES

Client feedback is used to identify potential areas of improvement in both clinical services and CFEH operations.

As can be seen from the graph, feedback is consistently positive. Some quotes from the 2019 feedback forms are re-produced below.

One area that was identified in 2019 as problematic were the directions to find the Centre. As a result of this feedback, these were updated so that they were clearer.



EXAMPLES OF FEEDBACK FROM OUR CLIENTS

Every conceivable test was carried out. I was confident that if I had a problem it would be found.

Excellent service, professionalism, modern equipment, friendly staff.

Excellent doctor who explained things really well and was easy to understand.

Outstanding care, equipment, experts in eye health have given me a great deal of time and information on my condition.

All tests were delivered with an explanation I could understand!

Staff very professional and caring.

I was most impressed with your service and equipment - thankyou.

Very well organised from start to end of eye test. Everybody was very helpful and friendly and everything was clearly explained.

Thanks to the friendly, considerate and efficient staff. What might have been a worrying experience was in fact quite interesting and almost fun!

APPENDIX F: STUDENT FEEDBACK: 5TH YEAR CLINICAL ROTATION

	2014 n=78	2015 n=65	2016 n=40	2017 n=45	2018 N=67	2019 N=66	Average
Non cognitive factors							
1. The CFEH clinical rotations helped motivate me to learn	4.5	4.7	4.9	4.5	4.6	4.5	4.6
2. The hands-on CFEH clinical rotations was useful in helping me improve my clinical confidence and understanding of testing protocols	4.4	4.8	4.9	4.6	4.6	4.7	4.7
Assessment methods							
3. I received helpful feedback on how I was going in the CFEH clinical rotations	4.1	4.3	4.7	4	4.1	4.2	4.2
4. I found writing the CFEH Patient summary reports helpful	4.2	4.5	4.6	4.2	4.0	3.6	4.2
Teaching methodologies							
5. The tutorials held during the rotation were useful both for clinical knowledge and the CFEH rotations themselves	-	4.7	5	4.7	4.8	4.7	4.8
6. The course materials provided for the CFEH clinical rotations were useful (podcasts, PBLs etcetera)	4.4	4.8	5	4.7	4.8	4.6	4.7
7. The CFEH teaching staff showed an interest in the needs of the students	4.7	4.6	4.8	4.3	4.4	4.4	4.5
8. I found the CFEH clinical update presentations useful (Tuesday lunchtime)	4.4	4.5	4.8	4.3	4.3	4.3	4.4
9. The volume of work in the CFEH clinical rotations was appropriate	3.2	4	4.4	3.8	4.0	3.9	3.9
Learning outcomes							
10. The CFEH clinical rotations was useful in helping me improve my differential diagnostic capabilities	4.3	4.7	4.9	4.4	4.5	4.6	4.6
11. The CFEH clinical rotations improved my knowledge and understanding of the role and interpretation of ocular imaging and other diagnostic tests	4.7	4.9	4.9	4.7	4.8	4.7	4.8
12. The CFEH clinical rotations helped deepen my understanding of ocular disease diagnosis and management	4.3	4.8	4.9	4.5	4.6	4.7	4.6
13. I had a clear understanding of what was expected of me in the CFEH clinical rotations	4.3	4.5	4.6	4.4	4.3	4.4	4.4
Satisfaction							
14. Overall, I was satisfied with the quality of the CFEH clinical rotations	4.4	4.8	4.9	4.6	4.6	4.6	4.7
15. Overall, I was satisfied with experience provided during the CFEH clinical rotations	4.5	4.8	5	4.5	4.6	4.7	4.7
Average score over all aspects	4.3	4.6	4.8	4.4	4.5	4.4	4.5

Note: each question has a maximum of 5 points

CFEH TEAM MEMBERS

LEADERSHIP TEAM

MICHAEL YAPP
HEAD OF CLINICAL OPERATIONS AND TEACHING

PROF. MICHAEL KALLONIATIS
CENTRE DIRECTOR

DAVID MURRAY
EXECUTIVE OFFICER

CFEH CLINICAL TEAM

- Dr Agnes Choi
- Dr Angelica Ly
- Carol Chu
- Elizabeth Wong
- Gonzalo Jacome
- Henrietta Wang
- Dr Jack Phu
- Janelle Tong
- Lindsay Moore
- Meri Galoyan
- Paula Katalinic
- Pauline Xu
- Rebecca Tobias
- Sophia Zhang

CFEH EDUCATION TEAM

- Michele Clewett
- Karin Mavromatis

CFEH RESEARCH TEAM

- Dr Barbara Zangerl
- Dr Lisa Nivison-Smith
- Jessie Huang (PhD candidate)
- Vincent Khou (PhD candidate)
- Wilson Luu (PhD candidate)
- Matt Trinh (PhD candidate)
- Sean Sivieng
- Judy Nam

CONSULTANT OPHTHALMOLOGISTS

- Dr Ashish Agar
- Dr Esra Sanli
- Dr Jenna Besley
- Dr Katherine Masselos
- Dr Nagi Assaad
- A/Prof Michael Hennessy
- Dr Matt Spargo
- Dr Sam Dance
- Dr Warren Apel

OPERATIONS TEAM

- Alexandra Prenc-Sadler
- Annie Tran
- Antigone Kordas
- Arveen Venzon
- Ashleigh Neville
- Demetra Nicolaou
- Emily Conrecode
- Jeanne Saw
- Joanne Collier
- Kayleigh Dowdeswell
- Madeleine Collier
- Natalia Croft
- Natalie Borstein
- Ran Lin

Centre for Eye Health

Rupert Myers Building South Wing
Barker St Gate 14
The University of New South Wales
Kensington NSW 2052

Sutherland Hospital
The Kingsway
Caringbah NSW 2229

Phone: (02) 8115 0700
email: enquiries@cfeh.com.au

UNSW SYDNEY

Guide Dogs NSW/ACT
Sight lost, freedom found.