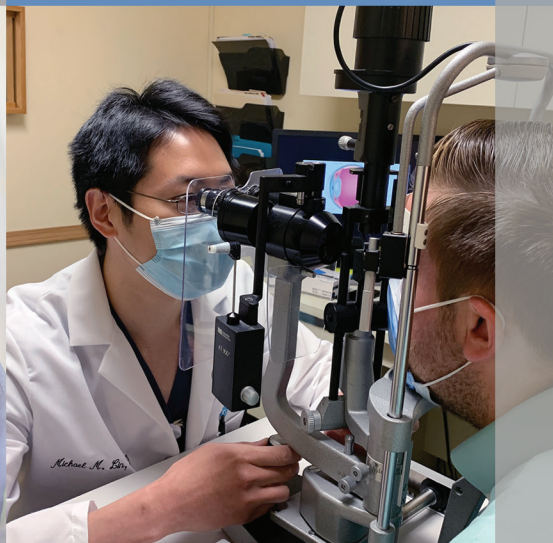
Quality and Outcomes

Department of Ophthalmology | 2020



MASSACHUSETTS
EYE AND EAR

Photo by Garyfallia Pagonis.

Table of Contents

Leading the way in making outcomes data publicly available

Dear Colleagues in Healthcare,

Thank you for reading the 2020 edition of the Mass Eye and Ear Quality and Outcomes Report for the Department of Ophthalmology. Like for all of you, this year presented unprecedented challenges for our clinical and hospital staff brought on by the COVID-19 pandemic. We are especially proud of how all of our teams responded and put patient care and safety at the forefront of all of their actions.

Mass Eye and Ear is proud to be a specialty academic medical center within the Mass General Brigham system. Formerly known as Partners HealthCare, the new system name complements our work on behalf of our patients and strengthens the alignment of all of our hospitals.

Since 2010, Mass Eye and Ear has been a leader in the development and implementation of outcomes measures for the field of Ophthalmology, and we have consistently reported on these measures in our Quality and Outcomes annual report. By publicly reporting our quality measures and outcomes, we are holding ourselves accountable for providing the best care for our patients as well as identifying areas for improvement. Further, by defining and sharing a variety of outcomes from our subspecialty divisions, we hope to help determine some of the universal standards that should be reported widely throughout our discipline, and to provide patients with these insights while seeking life-altering care. With telemedicine increasing due to the pandemic, it is critically important to continue this work tracking patient outcomes. We hope that we empower more ophthalmology institutions and providers to join us in this effort to engage in transparent public reporting.

This eleventh edition includes patient outcomes data through 2019, and reflects the meticulous work of many contributors. We thank Dr. Joan W. Miller, Chief of Ophthalmology at Mass Eye and Ear and Massachusetts General Hospital, Ophthalmologist-in-Chief at Brigham and Women's Hospital, and Chair of Ophthalmology at Harvard Medical School, for her leadership in setting the national standard in ophthalmology outcomes reporting. We also thank Dr. Alice Lorch, Chief Quality Officer for Ophthalmology, for her devotion to spearheading this project, and Dr. Matthew Gardiner, Associate Director of Quality for Ophthalmology, for his advisory role. We are also grateful to all of the clinicians, technicians, nurses and staff members at Mass Eye and Ear, who provide the highest quality care to our patients each and every day. For more information on the Mass Eye and Ear Quality and Outcomes Program and to view an electronic copy of this report, please visit our website at **MassEyeAndEar.org/about/quality**

John Fernandez
President, Massachusetts Eye and Ear

About the Quality and Outcomes Program

Photo by Garyfallia Pagonis.

This past year, we have been inspired by the fortitude and dedication of our fellow ophthalmologists across the country and world, with many working far outside their comfort levels. COVID-19 has presented many unexpected challenges for all of us, and through it all, the field of medicine has responded with resiliency, compassion, and creativity.

Mass Eye and Ear continued to provide quality eye care for those in need throughout the pandemic. While all elective and non-urgent cases were postponed for several months in the spring, as of August 2020, the hospital returned to full volume of surgical and clinical care with precautions to keep all of our patients and employees safe. We have also added new models for providing care; patients are now offered virtual visits and hybrid visits, which combine remote imaging with video conferencing. These virtual approaches allow for shorter in-person interactions and enable clinicians to meet patient care needs while following social distancing protocols.

As we navigate changes in healthcare and the world around us, Mass Eye and Ear remains focused on the experience, as well as the care and outcomes of our patients. In 2019, we launched a hospital-wide, multi-year initiative called "All About You," which puts the patient at the center of every decision. This initiative has components of patient access, patient communication, clinic operations, and staff engagement, as well as provider compensation and incentives. We believe that this initiative, combined with our Quality and Outcomes Program, will ensure that we provide the best care and experience for our patients.

Despite the considerable attention that we have devoted to the treatment and prevention of COVID-19, we remain committed to monitoring outcomes for all of the care we provide. We have remained attentive to the mission of our Quality and Outcomes Program, which focuses on outcomes, provider excellence, clinical incidents response, and process improvement. We continue to look critically at the outcomes metrics that we have chosen for each subspecialty to ensure that they are clinically relevant; to this end, changes to our metrics for this year can be found in the Appendix. This book includes outcomes from 2019;

it is published almost a year later to allow for collection of outcomes up to six months after a surgery or treatment. Therefore these data do not reflect the impact of COVID-19 on ophthalmic care; we will analyze this in next year's publication.

We are increasingly looking at all of our outcomes not only annually in this book, but also in real-time. Therefore, we are able to provide these data to clinicians at the individual level, with the belief that transparency and accountability will improve the care we provide. We hope that this body of work will not only push our own system and our own clinicians to improve at Mass Eye and Ear, but also establish benchmarks within ophthalmology so that, as a profession, we all work to achieve the best patient outcomes possible.

We cannot address healthcare outcomes in ophthalmology this year without drawing attention to the way in which, as a global community, our eyes have been opened more widely to the systemic racial and social inequities within our society. It has become very clear that these inequities affect health outcomes. We recognize the need to do more to understand and combat this problem. Moving forward, we will start analyzing outcomes by race, ethnicity, and other socio-economic determinants when possible so that we can understand healthcare disparities in our own care.

This year has been difficult for the world and for us. However, it has forced us to recommit to our most deeply held value—to provide the very best quality of care to every patient who walks through our doors (or now enters our Zoom screens.) We have been proud to work among the Mass Eye and Ear clinicians, who dedicate themselves to this each day, despite the personal and professional strains this year has posed.

We want to thank research assistants Colleen Szypko and Thong Ta for their work on this year's book. As we look to the future, we are excited by the prospect of expanding this work. We hope that you find this information useful, and we welcome your comments and feedback.

Joan W. Miller

Joan W. Miller, MD
David Glendenning Cogan Professor of Ophthalmology and Chair,
Department of Ophthalmology, Harvard Medical School
Chief of Ophthalmology, Massachusetts Eye and Ear,
Massachusetts General Hospital
Ophthalmologist-in-Chief, Brigham and Women's Hospital

Alice Lorch

Alice Lorch, MD, MPH
Assistant Professor of Ophthalmology
Director of Ophthalmology Residency Training Program,
Harvard Medical School
Associate Chief for Quality, Department of Ophthalmology,
Massachusetts Eye and Ear

Ophthalmology Clinical Leadership in Quality: 2020

Joan W. Miller, MD
David Glendenning Cogan Professor of Ophthalmology,
Chair, Department of Ophthalmology, Harvard Medical School
Chief of Ophthalmology, Massachusetts Eye and Ear,
Massachusetts General Hospital
Ophthalmologist-in-Chief, Brigham and Women's Hospital

Debra Rogers, MSM
Senior Vice President for Ophthalmology and Ambulatory Services,
Massachusetts Eye and Ear

Matthew Gardiner, MD
Assistant Professor of Ophthalmology, Harvard Medical School
Associate Chief for Clinical Affairs, Department of Ophthalmology,
Massachusetts Eye and Ear
Associate Director of Quality, Department of Ophthalmology,
Massachusetts Eye and Ear
Director, Ophthalmology Emergency, Consult, and Hospitalist Services

Alice Lorch, MD, MPH
Assistant Professor of Ophthalmology
Director of Ophthalmology Residency Training Program,
Harvard Medical School
Associate Chief for Quality, Department of Ophthalmology,
Massachusetts Eye and Ear

Aalok Agarwala, MD, MBA
Assistant Professor of Anesthesia, Harvard Medical School
Chief Medical Officer, Massachusetts Eye and Ear

Eileen Lowell, BSN, RN, MM
Senior Vice President of Patient Care Services, Chief Nursing Officer,
Massachusetts Eye and Ear

About Massachusetts Eye and Ear

Founded in 1824, Mass Eye and Ear is a preeminent acute care hospital dedicated to caring for disorders of the eyes, ears, nose, throat, head, and neck. Our dedicated staff provides primary and subspecialty care and serves as a referral center for inpatient and outpatient medical and surgical care.

Mass Eye and Ear is the leading authority in its specialties throughout the Northeast and is a resource globally for advances in healthcare. As the primary academic medical center for Harvard Ophthalmology, the hub of its research and teaching facilities, Mass Eye and Ear encourages multidisciplinary and interdisciplinary pursuits across patient care, research, and education. Seminal contributions to these three mission-critical areas span nearly 200 years and have shaped the hospital's reputation and success as a national and global center of excellence.

Pivotal to our clinical quality efforts is the use of Mass General Brigham eCare, a highly integrated health information system. Mass General Brigham eCare is utilized by a large segment of Harvard Medical School's network of hospitals and affiliates, facilitating quick and easy communication amongst referring physicians and Mass Eye and Ear's consulting ophthalmologists, otolaryngologists, and radiologists.

2019 Ophthalmology and Otolaryngology Hospital Statistics

(January 1 – December 31, 2019)

Patient Volume

All services at Mass Eye and Ear locations.

Outpatient Services*	547,648
Ambulatory Surgery Services	32,371
Inpatient Surgical Services^	990
Emergency Department Services	21,388
Discharges	1,206
Beds	41
Overall Operating Revenue#	$454,247,723

*All clinic visits, Ambulatory Surgery Services, Emergency Department Services, and Discharges
^Includes community-based physicians
#All sites, clinical and non-clinical

Clinical Locations

Boston - 243 Charles St.*
Boston - Longwood*
Boston - Emerson Place
Braintree
Bridgewater
Concord
Duxbury
Foxborough*
Harwich
Malden*
Mashpee
Medford
Milton
Newton
Plainville*
Providence*
Quincy
Stoneham*
Waltham*
Wellesley
Weymouth

*Denotes locations with ophthalmology services.

For more information, visit MassEyeAndEar.org/Locations

Mass Eye and Ear Ophthalmology Department

At Harvard Ophthalmology/Mass Eye and Ear, we have nearly two centuries of experience in developing innovative approaches to treating eye disease and reducing blindness worldwide. We founded subspecialty training in the areas of cornea, retina, and glaucoma, and have pioneered tools and treatments for numerous diseases and conditions, ranging from retinal detachment to age-related macular degeneration to corneal scarring. Our patient-centered core values focus on delivering the highest quality of care through education, innovation, and service excellence.

We Are:

- The primary teaching hospital of the Harvard Ophthalmology
- Home to Berman-Gund Laboratory for the Study of Retinal Degenerations, Howe Laboratory, and Schepens Eye Research Institute of Mass Eye and Ear
- Accelerating research and discovery through our Harvard Ophthalmology multidisciplinary institutes and subspecialty-based centers of excellence:

  Age-Related Macular Degeneration Center of Excellence
  Cornea Center of Excellence
  Diabetic Eye Disease Center of Excellence
  Glaucoma Center of Excellence
  Infectious Disease Institute
  Mobility Enhancement & Vision Rehabilitation Center of Excellence
  Ocular Genomics Institute
  Ocular Oncology Center of Excellence
  Ocular Regenerative Medicine Institute

Clinical Affiliations

Massachusetts General Hospital (MGH)

- Mass Eye and Ear clinicians provide comprehensive and subspecialty care to MGH patients in outpatient, inpatient consultation, surgical, and emergency care settings. Our 24/7 Emergency Department is a regional resource for urgent care and trauma, and our clinicians collaborate in the care of patients with ocular cancers and burns.
- Mass Eye and Ear's dedicated Same-Day Service triages urgent and emergent eye concerns of MGH patients as a more affordable and efficient alternative to Emergency Department care.

Academic Affiliations and Partners

Harvard Medical School
Massachusetts General Hospital
Brigham and Women's Hospital
Boston Children's Hospital
Beth Israel Deaconess Medical Center
VA Boston Healthcare System
VA Maine Healthcare System
Cambridge Health Alliance
Aravind Eye Hospital, Madurai, India
LV Prasad Eye Institute, Hyderabad, India
Shanghai Eye and ENT Hospital: Fudan University, Shanghai, China

Brigham and Women's Hospital (BWH) and Brigham and Women's Faulkner Hospital (BWFH)

- Mass Eye and Ear ophthalmologists provide comprehensive and subspecialty care and inpatient consultations to BWH and BWFH patients, including 24/7 emergency eye care and trauma coverage.
- BWH and BWFH patients also receive the full range of ophthalmic care, including dedicated Same-Day Service, urgent consultation, and evaluations and surgery at Mass Eye and Ear-Longwood, staffed by Mass Eye and Ear clinicians.

Children's Hospital Ophthalmology Foundation (CHOF)

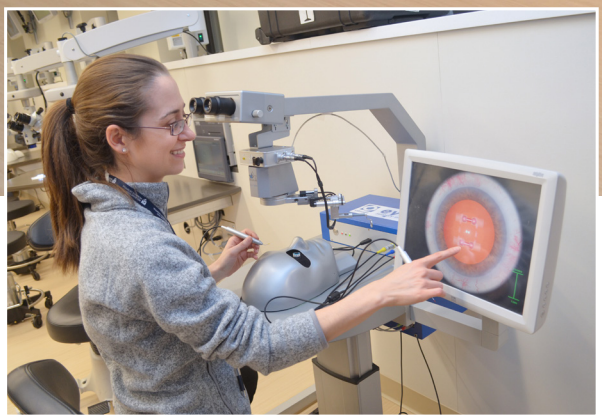
- CHOF clinicians staff the comprehensive pediatric ophthalmology and adult strabismus service at Mass Eye and Ear and Mass General Hospital.
- Mass Eye and Ear ophthalmologists provide subspecialty care in glaucoma, cornea, and pediatric retina surgery in partnership with CHOF.

Ophthalmology Resources at Mass Eye and Ear

- Highly skilled teams provide a full spectrum of primary and subspecialty ophthalmic care.
- Our dedicated eye Emergency Department is available 24/7.
- The de Gunzburg Retinal Imaging Suite offers state-of-the-art spectral domain optical coherence tomography (OCT), OCT angiography, swept source OCT, fluorescein angiography, and indocyanine green angiography.
- Our Inherited Retinal Disorders Service performs evaluations of patients referred for diagnosis, prognosis, genetic counseling, and treatment of retinal degenerative disorders.
- The Ocular Melanoma Center, a premier referral center for the diagnosis and treatment of eye tumors, draws patients from around the world.
- The Morse Laser Center provides advanced laser procedures using state-of-the-art refractive, glaucoma, retinal, and anterior segment lasers.
- The Ocular Surface Imaging Center enables rapid corneal imaging.
- The David Glendenning Cogan Laboratory of Ophthalmic Pathology provides enhanced diagnostic services in conjunction with the MGH Surgical Pathology Service.
- The Mass Eye and Ear Infectious Disease Institute houses a repository of all cases of infections after all procedures performed at Mass Eye and Ear or at any of its affiliates.
- Our expanding Optometry Service provides screening and vision care in the context of ophthalmic practice.
- The Contact Lens Service specializes in therapeutic lens fittings, bandage contact lenses, and specialty contact lenses.

For more information about the Mass Eye and Ear Quality and Outcomes Program or the Department of Ophthalmology, please visit our website at www.MassEyeAndEar.org.

Photos by Garyfallia Pagonis.



Ophthalmology resident training in the Samuel and Nancy Jo Altschuler Ophthalmology Surgical Training Laboratory.

- The Mass Eye and Ear Radiology Department houses a dedicated MRI/CT imaging suite.
- Our dedicated Social Work and Discharge Planning Department provides information, counseling, and referral services to patients and their families.
- The International Program helps patients with appointments, transportation, accommodations, and language translation.
- The Altschuler Surgical Training Laboratory serves as a cornerstone of the surgical training program at Harvard Ophthalmology/Mass Eye and Ear, and houses state-of-the-art surgical equipment, training machines for vitreoretinal and cataract surgery, a proctor station with a plasma screen, and other technological improvements.
- The Howe Library houses one of the most extensive ophthalmology research collections in the world. The library also collaborates with institutes, including the Francis A. Countway Library of Medicine at Harvard Medical School, the National Library of Medicine, and Association of Vision Science Libraries.

Mass Eye and Ear Ophthalmology Associates Key Statistics

(January 1–December 31, 2019)

Subspecialty	Patient Visits
Outpatient Ophthalmology Encounters	
Comprehensive Ophthalmology and Cataract Consultation	54,541
Trauma	837
Cornea	23,237
Optometry	12,336
Ophthalmic Plastic and Reconstructive Surgery	9,902
Glaucoma	27,164
Immunology and Uveitis	6,103
Inherited Retinal Disorders	1,355
Neuro-Ophthalmology	6,624
Retina	49,343
Vision Rehabilitation	1,204
Total Outpatient Ophthalmology Visits	192,646
Emergency Department Visits	
Total Ophthalmology Visits	17,794
Surgical Procedures	
Total Ophthalmology Surgeries*	13,630
Total Ophthalmology Laser Procedures*	3,971
Refractive Procedures*	680
Total Intravitreal Injections	19,372
Total Ophthalmology Procedures	37,653

*Includes community-based physicians

Data reported throughout the book for 2010 to 2019 represent calendar years. The 2009 data represent 12-month results as noted.

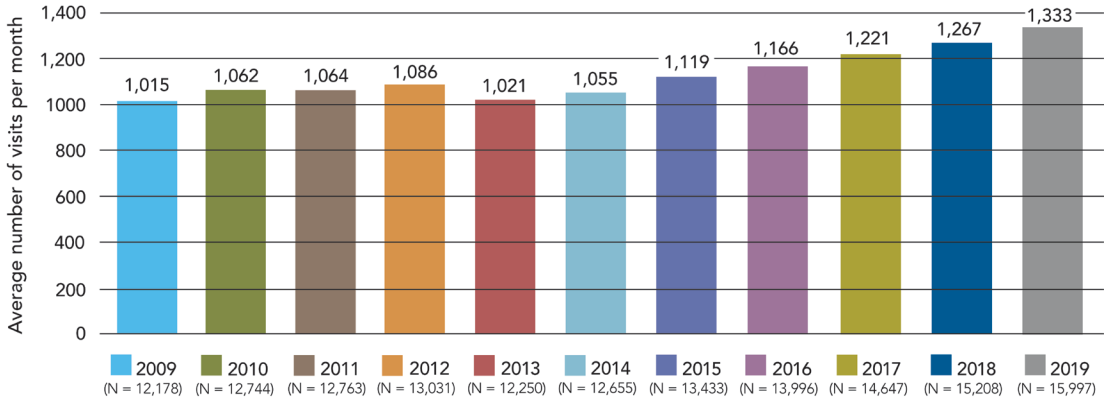
All benchmarks reported reflect the most recent values in literature.

Emergency Department

The Emergency Department at Mass Eye and Ear provides 24/7 urgent ophthalmic care for the local community and for patients who are referred to Mass Eye and Ear from throughout the region. The department works closely with the Mass General Emergency Department to co-manage and coordinate care for patients with ophthalmic problems.

Ophthalmology Emergency Visits

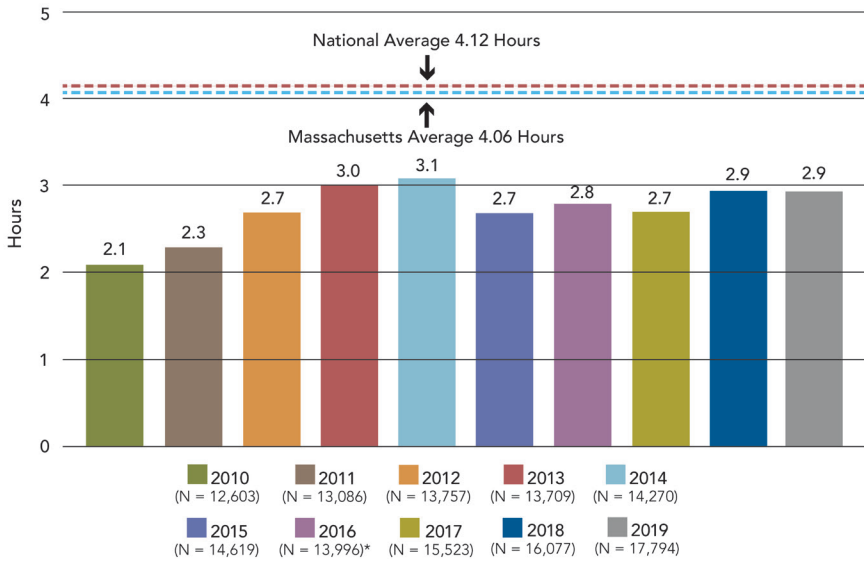
This bar graph shows the average number of Ophthalmology initial encounters seen monthly by the Mass Eye and Ear Emergency Department across the last 11 calendar years.



Ophthalmology Visit Times

The average Ophthalmology visit time in the Mass Eye and Ear Emergency Department for calendar year 2019 was 2.9 hours. The visit time is defined as the total time from when the patient walked into Mass Eye and Ear's Emergency Department to when the patient left the Emergency Department. Visit times over three standard deviations from the raw mean were considered outliers and were excluded from the final analysis due to suspicion of poor documentation in those cases. According to the 2010 Press Ganey Emergency Department Pulse Report, patients across the United States spent an average of four hours and seven minutes (4.12 hours) per emergency department visit. The Massachusetts state average visit time was 4.06 hours.

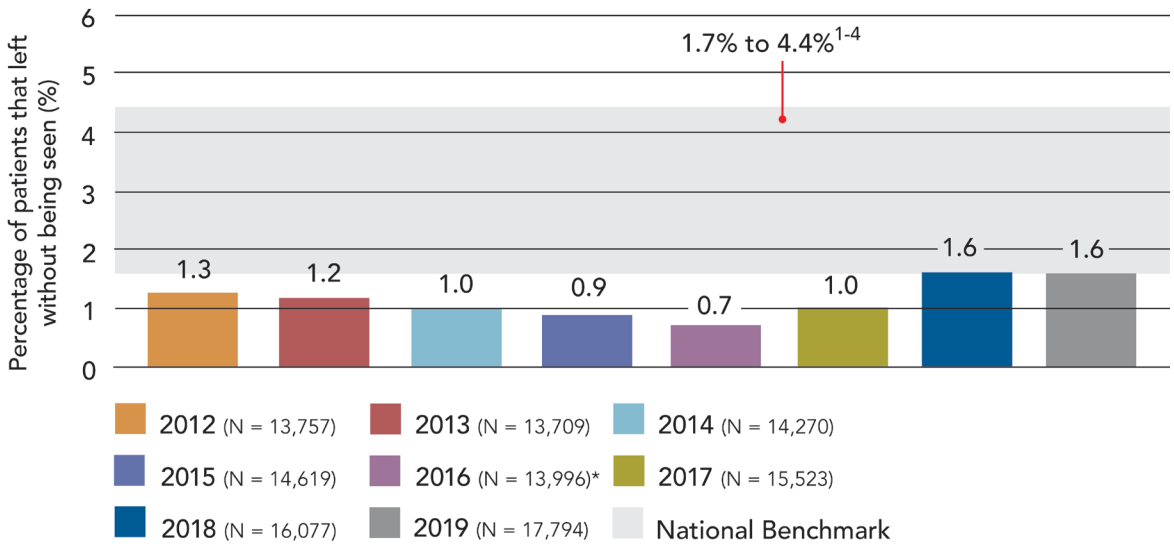
For the past 10 years, the average ophthalmology visit time in the Mass Eye and Ear Emergency Department was lower than the average national and state visit times.



*For calendar year 2016, the graphed data depicts only initial encounters.

Ophthalmology "Left Without Being Seen" (LWBS) Rate

"Left without being seen" (LWBS) refers to patients who present to an emergency department but leave before being seen by a physician. The Mass Eye and Ear Emergency Department reported a LWBS rate of 1.6% (287 patients for all 17,794 initial and follow-up ophthalmic emergency encounters) in calendar year 2019. According to a 2009 report by the Society for Academic Emergency Medicine, the national LWBS rate is 1.7%.[1] LWBS rates vary greatly between hospitals; a review of the literature suggests a national range of 1.7% to 4.4%.[1-4]



*Data reported for calendar year 2016 depicted only initial encounters. All other calendar years included all ophthalmic emergency visits (initial and follow-up visits).

The Mass Eye and Ear Emergency Department has a lower LWBS rate compared to national benchmarks.

The Emergency Department bounceback rate in calendar year 2019 was 11.2%. This rate serves as an approximation of the rate at which patients come back to the ED within one week of initial exam.*

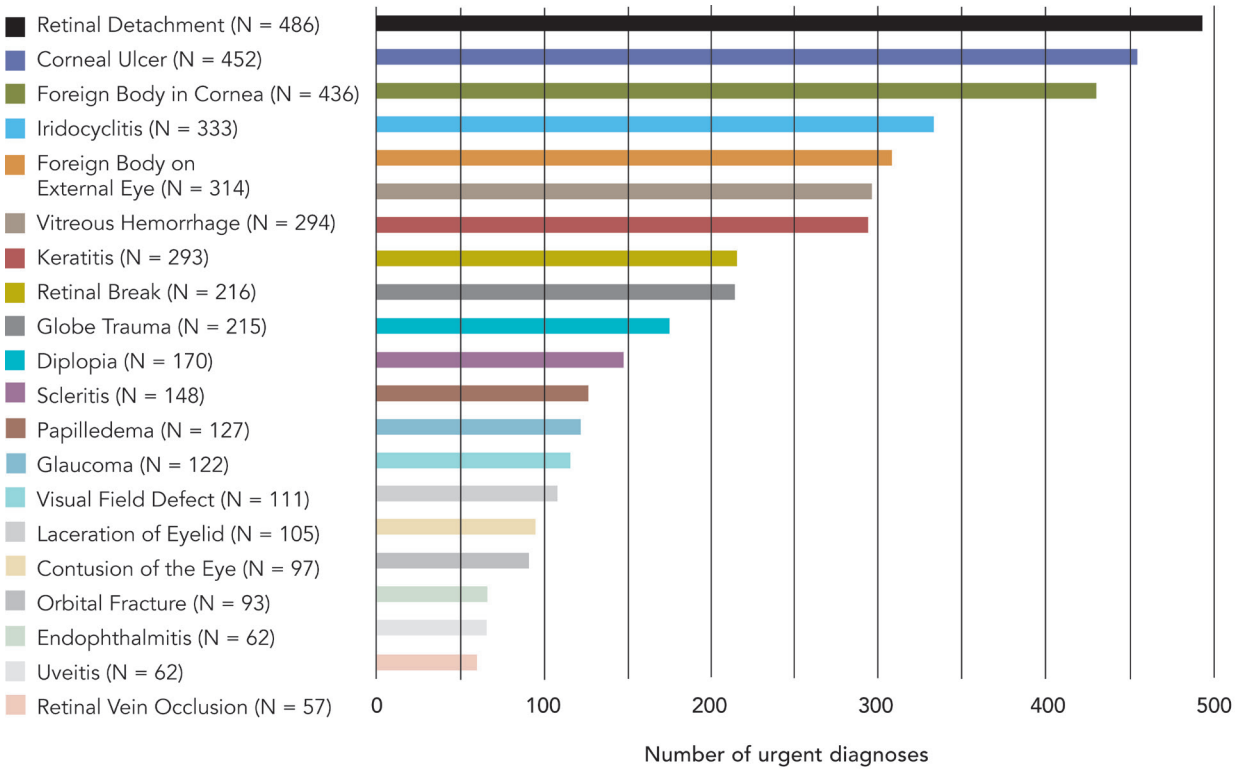
* This is calculated as the number of ED follow-up visits (n = 1,797) divided by the number of initial visits (n = 15,997). Visits are general designated as follow-up if they occur within one week of a prior visit. Of note, given limits of a calendar year, not all numerator patients may be included in the denominator.

References: [1]Pham JC, Ho GK, Hill PM, et al. National study of patient, visit and hospital characteristics associated with leaving an emergency department without being seen: predicting LWBS. Acad Emerg Med 2009; 16(10): 949–955. [2]Hsia RY, Asch SM, Weiss RE, et al. Hospital determinants of emergency department left without being seen rates. Ann Emerg Med 2011; 58(1): 24-32.e3. [3]Handel DA, Fu R, Daya M, et al. The use of scripting at triage and its impact on elopements. Acad Emerg Med 2010; 17(5): 495-500. [4]Li DR, Brennan JJ, Kreshak AA, et al. Patients who leave the emergency department without being seen and their follow-up behavior: a retrospective descriptive analysis. J Emerg Med 2019; 57(1): 106-113.

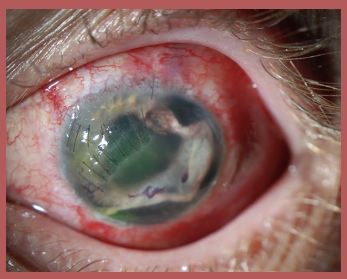
Distribution of Top-20 Urgent Ophthalmology Diagnoses

During calendar year 2019, there were 15,997 ophthalmic emergency initial encounters to the Mass Eye and Ear Emergency Department. The top-20 urgent diagnoses represented 4,193 (26.2%) of the total Emergency Department initial encounters and are depicted below and ranked according to their frequency.

The top-five most frequent diagnoses include retinal detachment, corneal ulcer, corneal foreign body, iridocyclitis, and foreign body on the external eye.



Eye Trauma Surgery



The Eye Trauma Service at Mass Eye and Ear provides high-quality and successful surgical care for patients with open globe injuries from throughout New England.

Postoperative appearance after initial repair of a complex corneal laceration with extensive iris involvement.

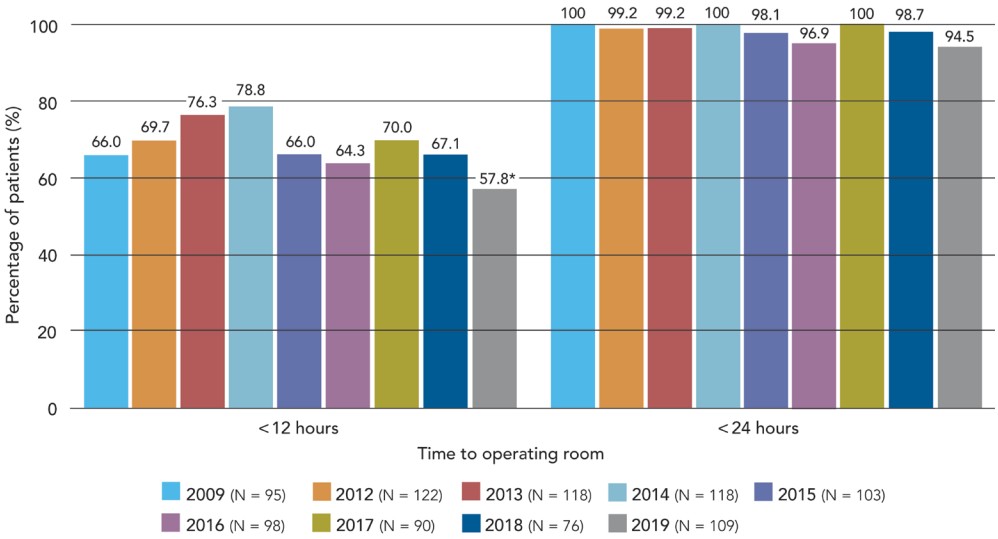
Photo courtesy of Alice Lorch, MD, MPH

Time to Surgical Repair for Open Globe Injuries

During calendar year 2019, 121 open globe injuries requiring repair presented to the Eye Trauma Service. There were an additional seven cases where an exploration was performed and no repair was needed. Of the 121 repaired injuries, nine cases involving intraocular foreign bodies in the posterior segment were repaired by the Retina Service and two dehisced penetrating keratoplasties were repaired by the Cornea Service; these were not included in the analysis but are also repaired within 24 hours of injury when possible. One hundred ten eyes of 109 patients suffered open globe injuries that required urgent surgical repair by the Eye Trauma Service. Of these 109 patients, 103 (94.5%) were taken to the (OR) operating room within 24 hours of arrival at Mass Eye and Ear. Sixty-three of the 109 patients (57.8%) were taken to the operating room in under 12 hours. Six patients were taken to the operating room more than 24 hours after admission. Five of these delays were due to need for general anesthesia clearance for a high level of medical complexity; four were related to active bleeds in the trauma patient that required stabilization before surgery, and one was due to active cardiac issues.

The mean time from presentation at the Emergency Department to arrival in the operating room was 11.3 hours (range: 0.8 to 52.85 hours).

Multiple studies suggest the benefit of repairing open globe injuries within 12-24 hours after injury, in particular for the prevention of endophthalmitis.[1-2]



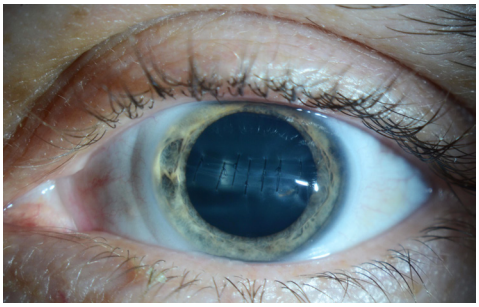
In calendar year 2019, the Trauma Service repaired 94.5% of presenting open globe injuries within 24 hours after presentation to Mass Eye and Ear. This rate is similar to prior years.

*With a significance level of p value = 0.05, we did not find any statistically significant difference between time to surgical repair (<12 hours) in 2018 and 2019 (p = 0.20)

References: [1]Thompson, WS, Parver, LM, Enger, CL, et al. Infectious endophthalmitis after penetrating injuries with retained intraocular foreign bodies. Ophthalmology 1993; 100(10): 1468-1474. [2] Cebulla, CM, Flynn Jr, HW. Endophthalmitis after open globe injuries. Am J Ophthalmol. 2009; 147(4): 567-568

Final Visual Acuity and Ocular Trauma Score

Patients who undergo open globe repair in the Mass Eye and Ear Trauma Service often do not return for follow-up within the four to six month postoperative period in which we historically collected data on median visual acuity outcomes; this can be due to factors such as distant home location and patient's perceived satisfactory recovery. Therefore, starting with 2018 outcomes, we changed our methodology for looking at outcomes of trauma surgery. This analysis now consists of final visual acuity for all patients with a minimum of one week of follow-up as a function of their respective ocular trauma score (OTS).



Postoperative left eye following an open globe injury and repair.

Photo courtesy of Grayson W. Armstrong, MD, MPH

OTS, a commonly used predictor in ocular trauma management, categorizes patients by the severity of open globe injury. This score accounts for the patient's visual acuity at presentation and other preoperative findings, such as the mechanism of the open globe injury and the presence or absence of relative afferent pupillary defect. To calculate a patient's score, all the raw points corresponding to the presenting variables are added; the final sum corresponds to the OTS. A higher ocular trauma score predicts a better visual outcome.[1]

Variables	Raw Points
Initial vision	
NLP	60
LP/HM	70
1/200-19/200	80
20/200-20/50	90
≥20/40	100
Rupture	-23
Endophthalmitis	-17
Perforating injury	-14
Retinal detachment	-11
Afferent pupillary defect	-10

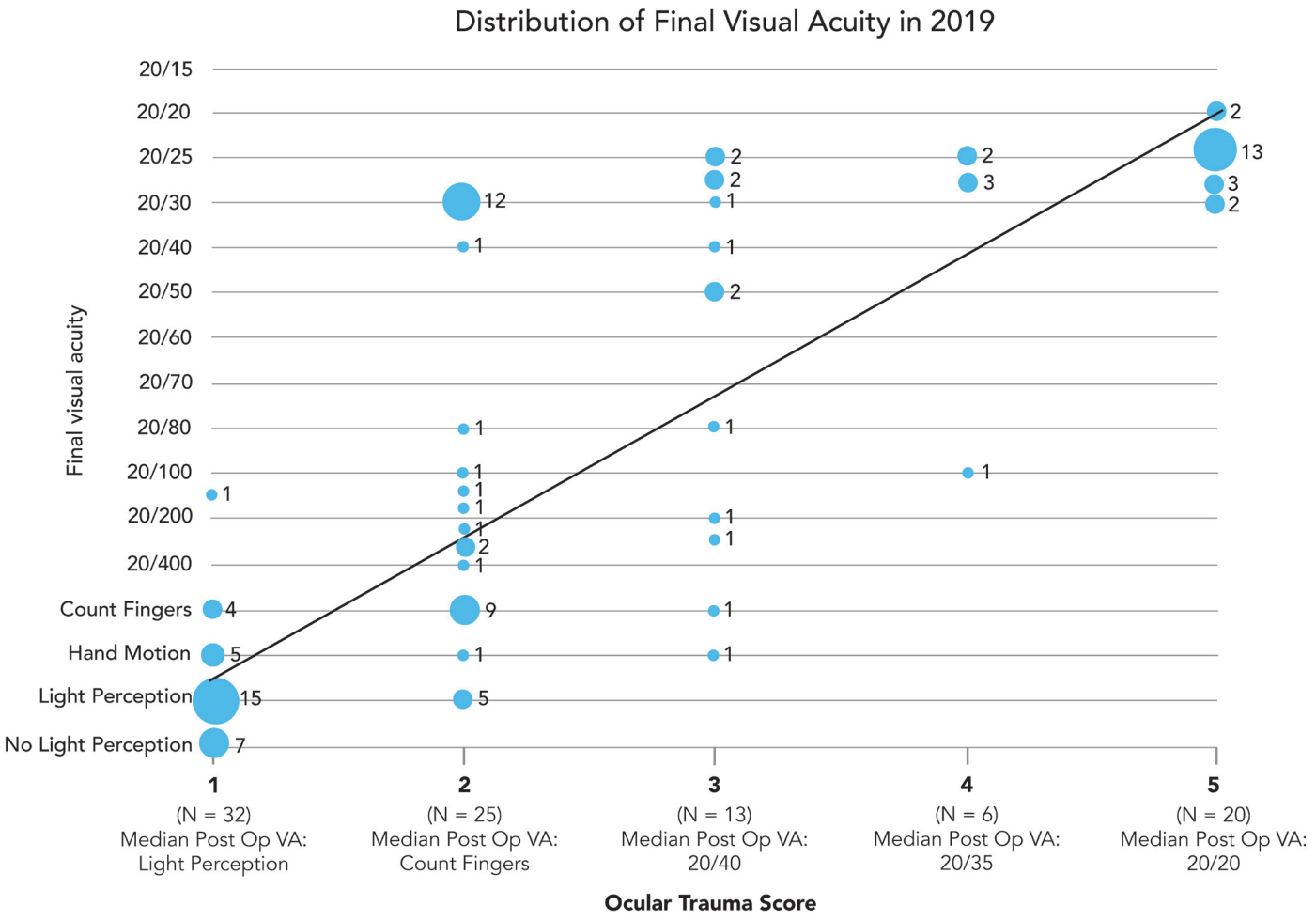
Sum of Raw Points	OTS
0-44	1
45-65	2
66-80	3
81-91	4
92-100	5

For design purposes, these tables have been adapted from their original publication.[1]

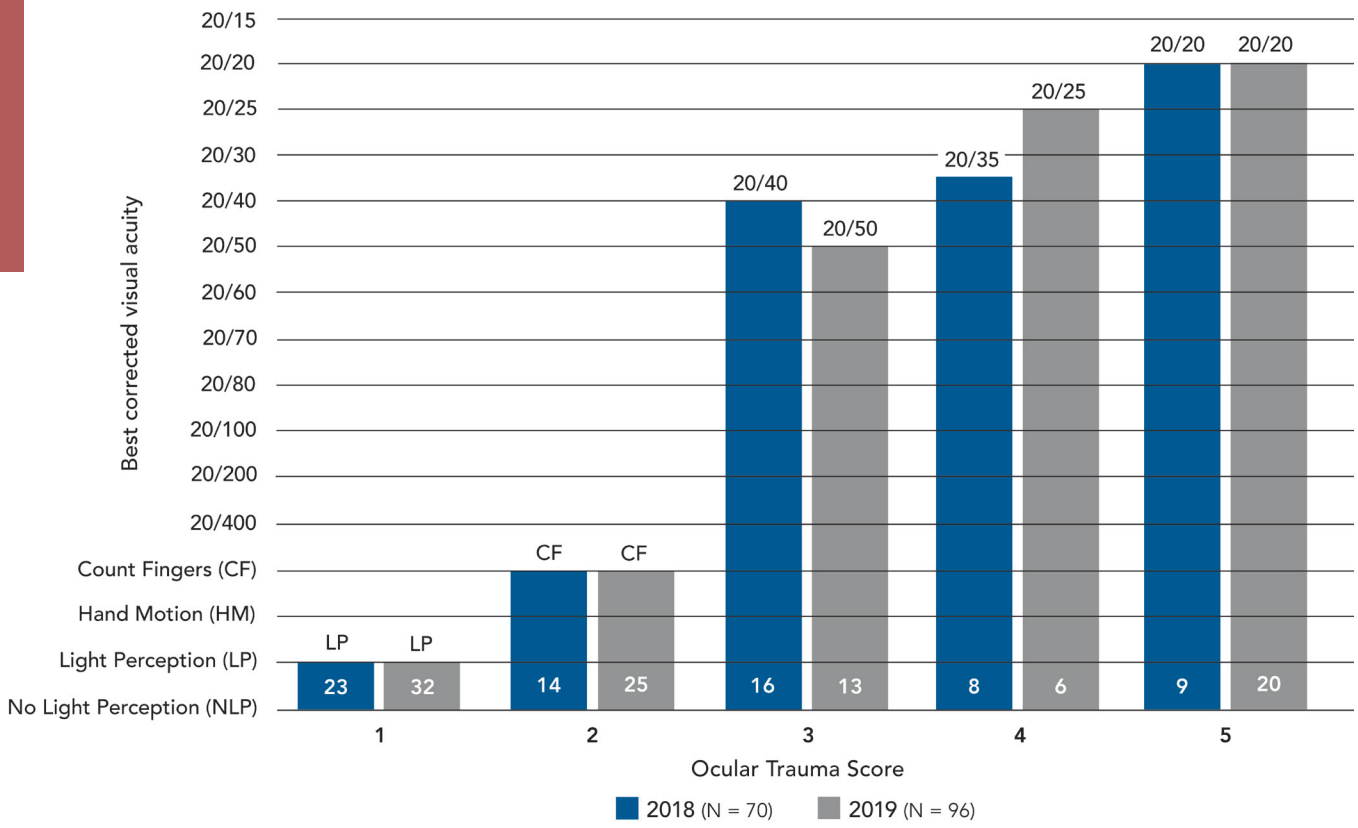
Reference: [1]Kuhn F, Maisiak R, Mann L, et al. The Ocular Trauma Score (OTS). Ophthalmol Clin N Am 2002; 15: 163-165

Final Visual Acuity and Ocular Trauma Score

During the 2019 calendar year, 110 eyes of 109 patients had an open globe injury repaired by the Mass Eye and Ear Trauma Service. Of these, 96 eyes had a recorded visual acuity at presentation and at least one week of follow-up at Mass Eye and Ear. The most recent visual acuity in the one week to six months window following surgery was recorded for each patient. Of the 57 eyes that presented with extensive injuries to the globe (OTS 1 or 2), 21.1% (12/57 eyes) had a final visual acuity of 20/400 or better. Of the remaining 39 patients that presented with ocular trauma scores 3 to 5, 84.6% (33/39 eyes) had final visual acuities ranging from 20/50 to 20/15.



Median Postoperative Vision



The numbers in white represent the number of patients for that OTS for their respective years.

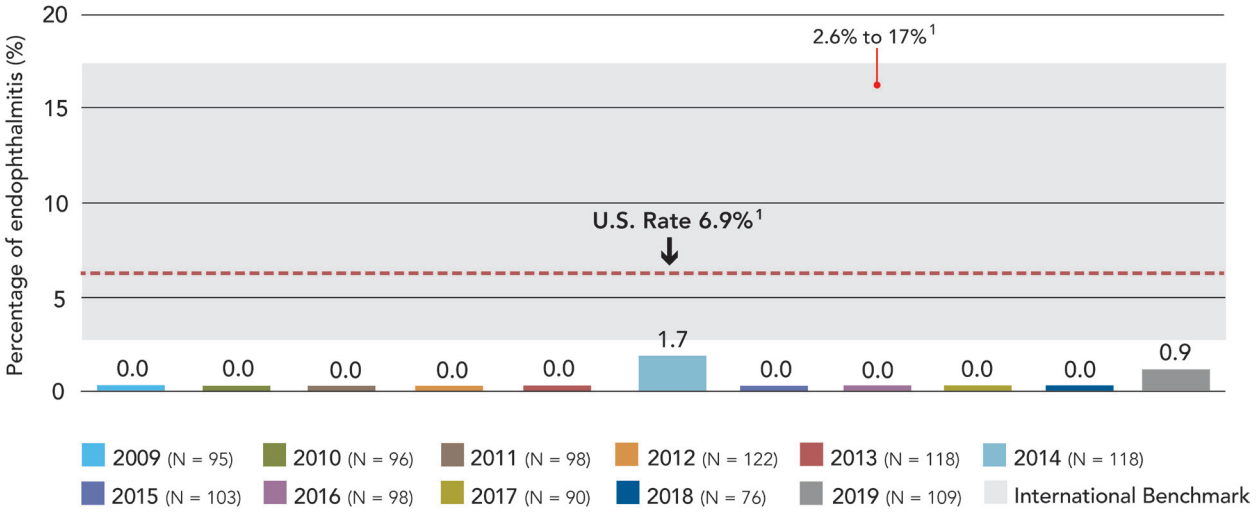
Rates of Endophthalmitis After Open Globe Repair

During calendar year 2019, 110 eyes of 109 patients underwent open globe repair by the Eye Trauma Service. Of these 109 patients, 1 (0.9%) developed endophthalmitis postoperatively. Similar results were reported since 2009.

In this case, the patient presented to the Emergency Department with a zone I open globe injury and an intraocular foreign body fewer than 24 hours after injury. The patient underwent open globe repair and removal of the intraocular foreign body and intraocular injection of moxifloxacin. After the surgery, the patient was noted to have worsening inflammation and a progressive corneal infiltrate that was treated with numerous intrastromal corneal, intracameral, and intravitreal anti-fungal injections. Four days after initial repair, the patient underwent a lensectomy. Cornea, vitreous, and anterior chamber cultures were collected five days later in the setting of new fibrin and hypopyon formation, which was concerning for endophthalmitis. Corneal culture grew *Scedosporium apiospermum*, an opportunistic filamentous fungus, vitreous culture showed a few cells on the Gram stain, and anterior chamber culture had no growth. Although vision on presentation had been light perception, the vision at the end of nine months was 20/500 after a subsequent anterior chamber washout, two therapeutic penetrating keratoplasties, and a pars plana vitrectomy.

The standard Mass Eye and Ear protocol for eye trauma (i.e., surgical repair by a dedicated trauma team and 48 hours of intravenous antibiotics) is associated with post-traumatic endophthalmitis rates far below international benchmarks. A review of the literature suggests that endophthalmitis rates associated with open globe injuries range worldwide from 2.6% to 17%. The United States National Eye Trauma Registry has reported an endophthalmitis rate of 6.9% after open globe repair.[1]

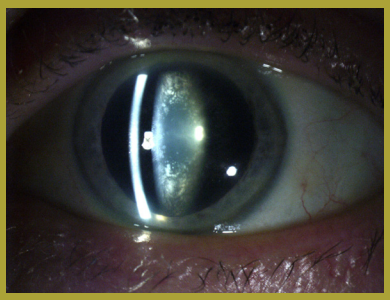
A published study of our antibiotic protocol for open globe injuries included 675 open globe injuries treated at Mass Eye and Ear from January 2000 to July 2007. Intravenous vancomycin and ceftazidime were started on admission and stopped after 48 hours for all patients. Patients were discharged on topical antibiotics, corticosteroids, and cycloplegics. Of these 675 eyes, 558 had at least 30 days of follow-up (mean, 11 months). The overall rate of endophthalmitis was 0.9% (5/558 cases).[1] Based on the Mass Eye and Ear experience and the low percentage of cases with endophthalmitis, we recommend that institutions adopt a standardized protocol for treating open globe injuries and consider the use of prophylactic systemic antibiotics.[1]



Reference: [1]Andreoli CM, Andreoli MT, Kloek CE, et al. Low rate of endophthalmitis in a large series of open globe injuries. Am J Ophthalmol 2009; 147(4): 601-608.

Cataract Surgery

The Comprehensive Ophthalmology and Cataract Consultation Service at Mass Eye and Ear provides a full spectrum of integrated patient care, including annual and diabetic eye exams, prescriptions for eyeglasses, management of a variety of chronic eye problems, surgical intervention, and subspecialty referrals for advanced care. The most common surgery performed at Mass Eye and Ear is cataract extraction with intraocular lens implantation.

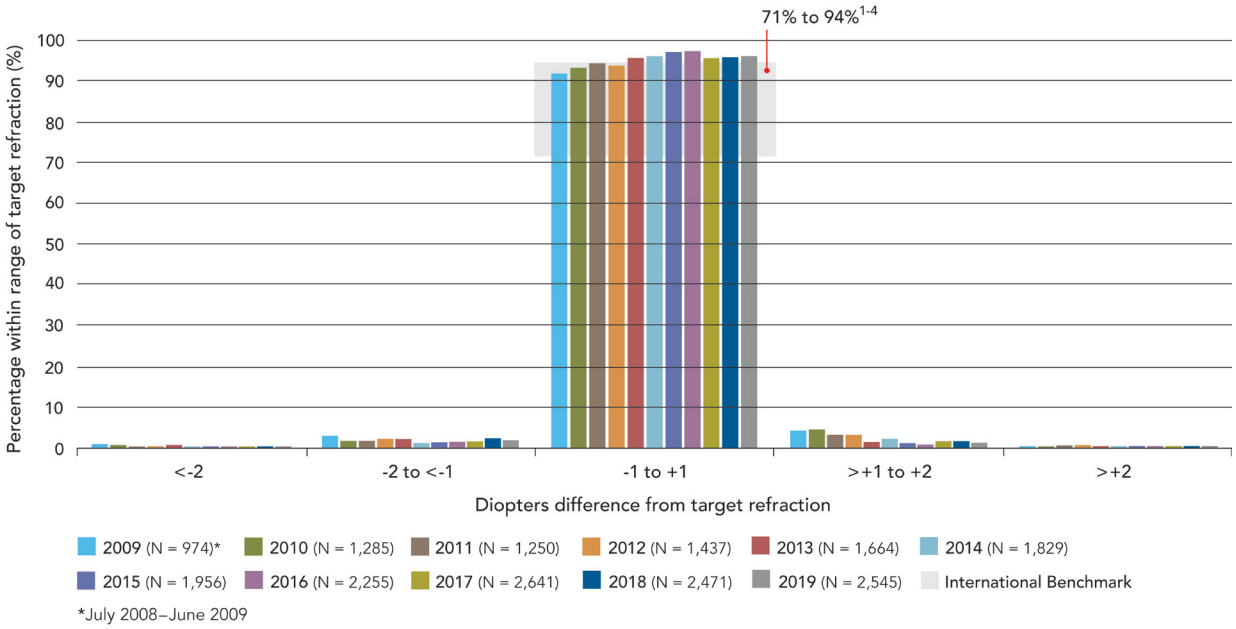


Preoperative photo of combined congenital and nuclear sclerotic cataract.

Photo courtesy of Alice Lorch, MD, MPH

Achieving Target Refraction (Spherical Equivalent)

During the 2019 calendar year, the Comprehensive Ophthalmology and Cataract Consultation Service performed cataract surgery on 2,940 eyes. This chart depicts the results of the 2,545 eyes with follow-up data available between three weeks and three months postoperatively. Of these 2,545 eyes, 96.1% (2,445/2,545 eyes) achieved within one diopter of target refraction, and 79.2% (2,015/2,545 eyes) achieved within 0.5 diopter of target refraction after cataract surgery.



For the past 11 years, the Comprehensive Ophthalmology and Cataract Consultation Service has consistently met or exceeded international benchmarks for successful cataract surgery.

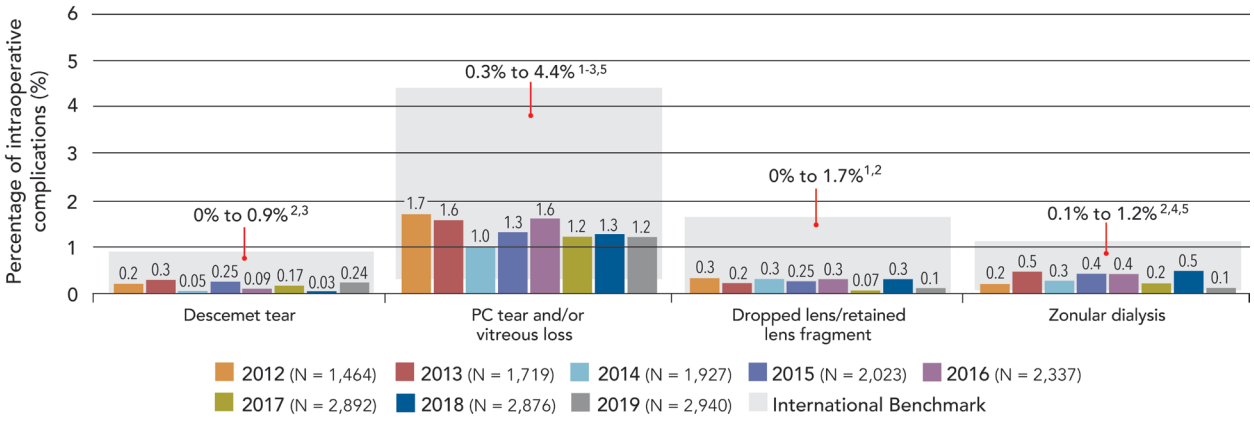
In the calendar year 2019, the Comprehensive Ophthalmology and Cataract Consultation Service performed cataract surgery on 2,940 eyes.

References: [1]Kugelberg M, Lundström M. Factors related to the degree of success in achieving target refraction in cataract surgery: Swedish National Cataract Register study. J Cataract and Refract Surg 2008; 34(11): 1935-1939. [2]Cole Eye Institute. Outcomes 2012. [3]Lum F, Shein O, Schachat AP, et al. Initial two years of experience with the AAO National Eyecare Outcomes Network (NEON) cataract surgery database. Ophthalmology 2000; 107(4): 691-697. [4]Simon SS, Chee YE, Haddadin RI, et al. Achieving target refraction after cataract surgery. Ophthalmology 2014; 121(2): 440-444.

Intraoperative Complication Rates

Of the 2,940 cataract surgeries performed by the Comprehensive Ophthalmology and Cataract Consultation Service during the 2019 calendar year at all surgical locations, 47 (1.6%) had intraoperative complications. These results are displayed in the graph below.

In addition, there were no cases of endophthalmitis after cataract surgery in calendar year 2019.



Mass Eye and Ear 2019 Intraoperative Complication Rates

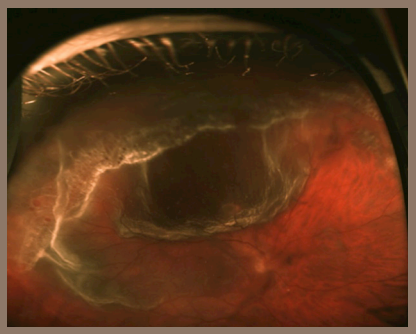
Complication	N (%)
Descemet tear	7 (0.24)
Posterior capsule (PC) tear and/or vitreous loss	35 (1.2)
Dropped lens/retained lens fragment	3 (0.1)
Zonular dialysis	4 (0.1)
Endophthalmitis	0 (0.0)

Year	Overall Complication Rate (%)
2012	2.5
2013	2.6
2014	1.7
2015	1.8
2016	1.9
2017	1.6
2018	1.7
2019	1.6

The Mass Eye and Ear Comprehensive Ophthalmology and Cataract Consultation Service has some of the lowest intraoperative complication rates compared to international benchmarks.

References: [1]Greenberg PB, Tseng VL, Wu WC, et al. Prevalence and predictors of ocular complications associated with cataract surgery in United States veterans. Ophthalmology 2011; 118(3): 507-514. [2]Haripriya A, Chang DF, Reena M, et al. Complication rates of phacoemulsification and manual small-incision cataract surgery at Aravind Eye Hospital. J Cataract Refract Surg 2012; 38(8): 1360-1369. [3]Pingree MF, Crandall AS, Olson RJ. Cataract surgery complications in 1 year at an academic institution. J Cataract Refract Surg 1999; 25(5): 705-708. [4]Ng DT, Rowe NA, Francis IC, et al. Intraoperative complications of 1000 phacoemulsification procedures: a prospective study. J Cataract Refract Surg 1998; 24(10): 1390-1395. [5]McKellar MJ, Elder MJ. The early complications of cataract surgery: is routine review of patients 1 week after cataract extraction necessary? Ophthalmology 2001; 108(5): 930-935.

Retina Surgery

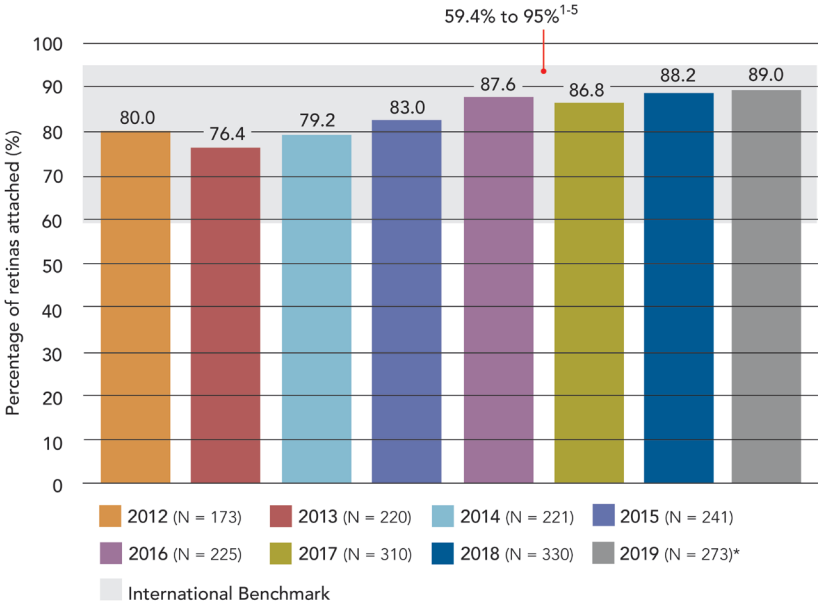


The Retina Service at Mass Eye and Ear is one of the largest subspecialty groups of its kind in the country. Our clinicians are highly skilled at diagnosing and treating a full range of ocular conditions, including macular degeneration, diabetic retinopathy, retinal detachments, ocular tumors, intraocular infections, and severe ocular injuries.

Preoperative retinal detachment with extensive lattice and holes.
Photo courtesy of John B. Miller, MD

Single Surgery Reattachment Rate for Primary Rhegmatogenous Retinal Detachment

Primary rhegmatogenous retinal detachment (RRD) is one of the most common retinal conditions requiring surgical repair by the Mass Eye and Ear Retina Service. The Retina Service repairs RRDs with pneumatic retinopexy, pars plana vitrectomy, and/or scleral buckle surgery.



*The decrease in the number of included surgeries is due in part to an increasing number of complex cases managed by the Retina Service in addition to an increase in cases with insufficient follow-up due to COVID-19.

During calendar year 2019, the Mass Eye and Ear Retina Service performed a total of 1,738 procedures, of which 946 were for retinal detachments (RDs). From these 946 cases, the following were excluded: chronic RDs of greater than one month duration; exudative and tractional RDs; RDs associated with proliferative vitreoretinopathy, macular holes, or trauma; prior pars plana vitrectomy; patients less than 18 years of age; cases associated with Marfan's or Stickler's syndrome; and cases with insufficient follow-up. After exclusion criteria were applied, 273 uncomplicated primary RRD surgeries remained for the following analysis. Single surgery reattachment rate, defined as an attached retina three months to five months postoperatively, was 89.0% (or 243 of 273 eyes). Similar results were reported for calendar years 2012 to 2018.

Benchmarks were determined from a literature review of studies that reported single surgery reattachment rates for at least two of the three surgical techniques in this analysis (i.e., pneumatic retinopexy, pars plana vitrectomy, and/or scleral buckle).

Of the 273 included procedures for retinal detachments, 22 were pneumatic retinopexies. Of these, 72.7% had an attached retina after one surgery, and 100% had an attached retina after multiple surgeries. Of the remaining 251 procedures, which include scleral buckles and pars plana vitrectomies, 90.4% had an attached retina after one surgery, and 97.6% had an attached retina after multiple surgeries.

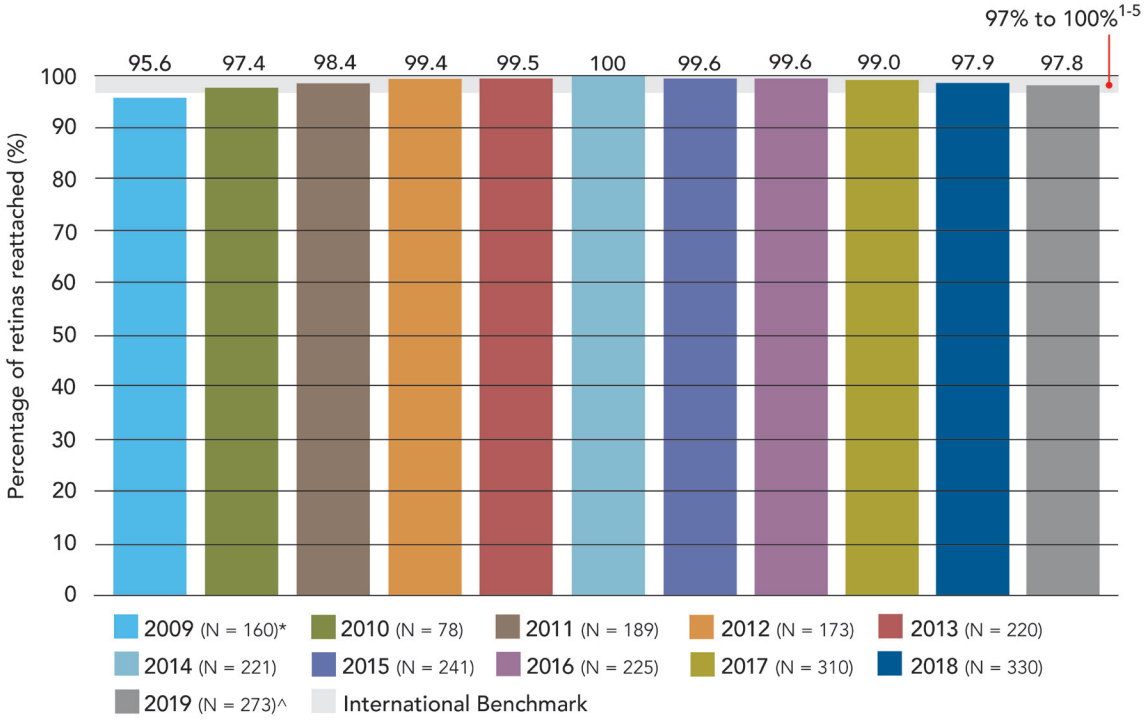
In the calendar year 2019, the Retina Service performed 946 retinal detachment surgeries, 100 macular hole repair surgeries, and 19,372 intravitreal injections.

References: [1]Soni C, Hainsworth DP, Almony A. Surgical management of rhegmatogenous retinal detachment: a meta-analysis of randomized controlled trials. Ophthalmology 2013; 120(7): 1440-1447. [2]Feltgen N, Heimann H, Hoerauf H, et al. Scleral buckling versus primary vitrectomy in rhegmatogenous retinal detachment study (SPR study): Risk assessment of anatomical outcome. SPR study report no.7. Acta Ophthalmol 2013: 91(3): 282-287. [3]Adelman RA, Parnes AJ, Ducournau D; European Vitreo-Retinal Society (EVRS) Retinal Detachment Study Group. Strategy for the management of uncomplicated retinal detachments: the European Vitreo-Retinal Society retinal detachment study report 1. Ophthalmology 2013; 120(9): 1804-1808. [4]Sodhi A, Leung LS, Do DV, et al. Recent trends in the management of rhegmatogenous retinal detachment. Surv Ophthalmol 2008; 53(1): 50-67. [5]Day S, Grossman DS, Mruthyunjaya P, et al. One-year outcomes after retinal detachment surgery among medicare beneficiaries. Am J Ophthalmol 2010; 150(3): 338-345.

Final Retinal Reattachment Rate for Primary Rhegmatogenous Retinal Detachment

During calendar year 2019, 273 uncomplicated primary RRD surgeries were analyzed to determine the final retinal reattachment rate.

Retinal reattachment was successfully achieved at a rate of 97.8% (267/273 eyes). This reattachment rate reflects eyes that had one or more surgeries, which may have included pars plana vitrectomy, scleral buckle, and pneumatic retinopexy. These 273 eyes had at least three months of follow-up from the date of the last surgery; data were collected from visits closest to three but up to five months postoperatively. The smaller number of cases in calendar year 2010 may be attributable to more stringent follow-up criteria of having at least five months follow-up data.



*March 2008–February 2009

^The decrease in the number of included surgeries is due in part to an increasing number of complex cases managed by the Retina Service in addition to an increase in cases with insufficient follow-up due to COVID-19.

With a 97.8% reattachment rate for primary RRD repair after one or more surgeries, the Mass Eye and Ear Retina Service continues to maintain high success rates for this procedure. For the past nine years, the Retina Service has consistently met international benchmarks of 97% to 100% for successful RRD repair.[1-5]

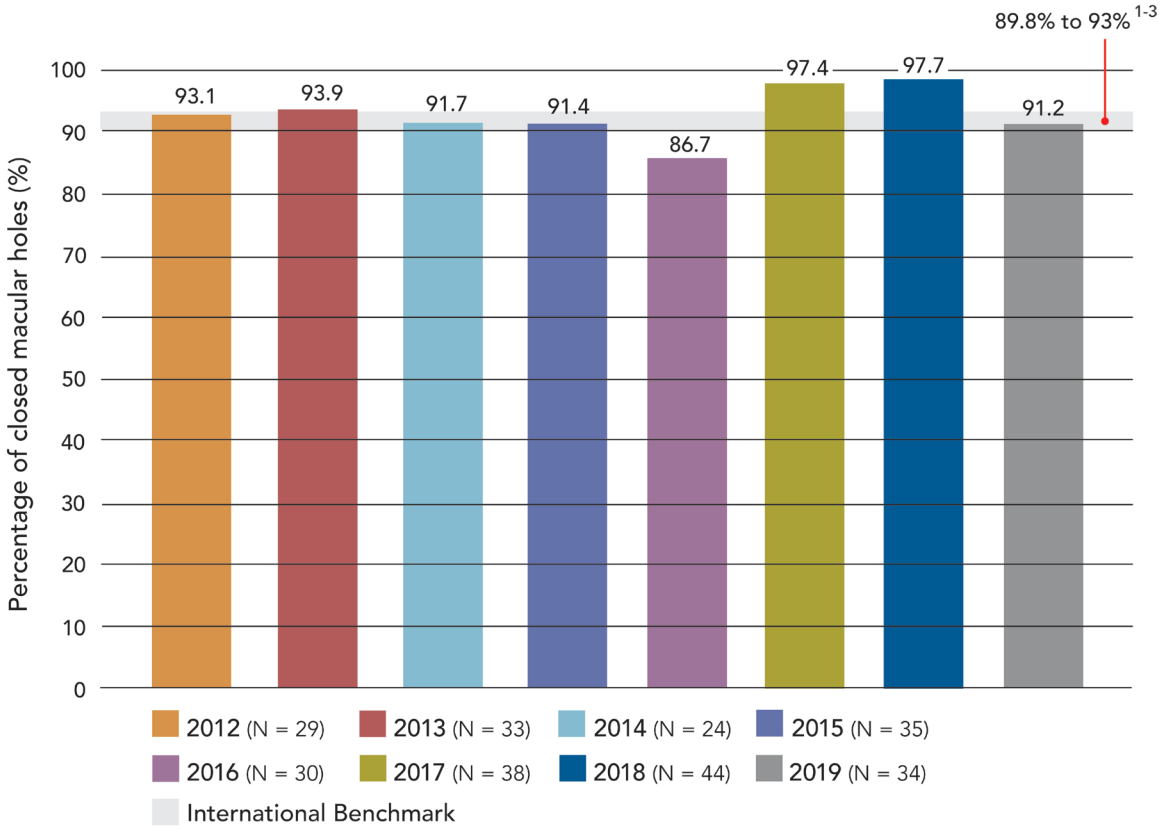
Follow-up from previous year: Of the seven cases in 2018 that were detached at the time of analysis, three patients elected not to undergo further surgeries. One patient continued their care with a retina specialist closer to home. The remaining three patients' retinas were attached after two, two, and three surgeries, respectively.

References: [1]Han DP, Mohsin NC, Guse CE, et al. Comparison of pneumatic retinopexy and scleral buckling in the management of primary rhegmatogenous retinal detachment. Southern Wisconsin Pneumatic Retinopexy Study Group. Am J Ophthalmol 1998; 126(5): 658-668. [2]Avitabile T, Bartolotta G, Torrisi B, et al. A randomized prospective study of rhegmatogenous retinal detachment cases treated with cryopexy versus frequency-doubled Nd:YAG laser-retinopexy during episcleral surgery. Retina 2004; 24(6), 878-882. [3]Azad RV, Chanana B, Sharma YR, et al. Primary vitrectomy versus conventional retinal detachment surgery in phakic rhegmatogenous retinal detachment. Acta Ophthalmol Scand 2007; 85(5): 540-545. [4]Sullivan PM, Luff AJ, Aylward GW. Results of primary retinal reattachment surgery: a prospective audit. Eye 1997; 11(Pt6): 869-871. [5]Day S, Grossman DS, Mruthyunjaya P, et al. One-year outcomes after retinal detachment surgery among medicare beneficiaries. Am J Ophthalmol 2010; 150(3): 338-345.

Macular Hole Surgery: Single Surgery Success Rate at Three Months

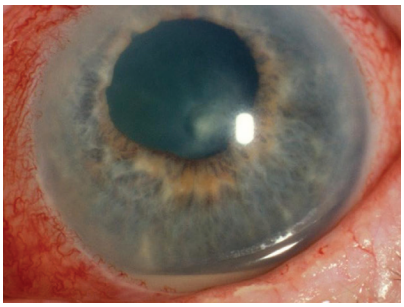
During calendar year 2019, the Mass Eye and Ear Retina Service performed 100 macular hole surgeries. Of these 100 macular hole surgeries, the following were excluded: macular holes associated with RRD or trauma, holes with a history of prior pars plana vitrectomy, macular holes of greater than six months duration, and cases without follow-up within three to five months. After exclusion criteria were applied, a total of 34 primary macular hole surgeries on 34 eyes (which included pars plana vitrectomy, membrane peel, and gas tamponade) were included in the following analysis.

Of the 34 eyes, 31 (91.2%) achieved surgical success with a single operation. Success was defined as any primary macular hole that was fully closed on an exam between three and five months following their first surgery. A review of the literature suggests that single surgery success rates for macular hole surgery range from 89.8% to 93.0%.[1-3] Of the 34 eyes included for analysis in calendar year 2019, 97.1% (33/34 eyes) achieved surgical success after one or two surgeries.



References: [1]Wu D, Ho LY, Lai M, et al. Surgical outcomes of idiopathic macular hole repair with limited postoperative positioning. Retina 2011; 31 (3): 609-611. [2]Smiddy WE, Feuer W, Cordahi G. Internal limiting membrane peeling in macular hole surgery. Ophthalmology 2001; 108(8): 1471-1478. [3]Guillaubey A, Malvitte L, Lafontaine PO, et al. Comparison of face-down and seated position after idiopathic macular hole surgery: a randomized clinical trial. Am J Ophthalmol 2008; 146(1): 128-134.

Rates of Endophthalmitis After Intravitreal Injection



Endophthalmitis of the right eye.
Photo courtesy of Lucy H. Young, MD, PhD, FACS

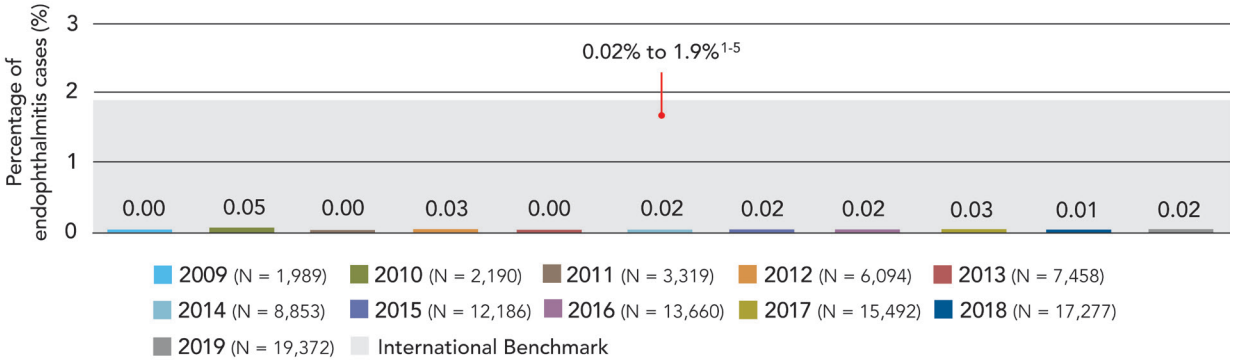
During the 2019 calendar year, the Mass Eye and Ear Retina Service performed 19,372 intravitreal injections (IVIs). Of these, four cases of infectious endophthalmitis (0.02%) were identified after IVI.

In the first case, the patient with a three-year history of central retinal vein occlusion on frequent (approximately monthly) injections presented six days after IVI with a visual acuity of 20/20 (pre-IVI vision was 20/20), ocular pain, and anterior chamber and vitreous cells. The patient underwent a vitreous tap with injection of vancomycin and ceftazidime on the same day. The culture grew very rare *Staphylococcus epidermidis*. The patient's best corrected visual acuity was 20/40 at 15 days post-treatment and 20/15 at four months post-treatment.

In the second case, the patient presented three days after IVI with visual acuity of light perception (pre-IVI vision was count fingers at one foot due to a submacular hemorrhage) and floaters. The patient underwent a pars plana vitrectomy, vitreous tap, and anterior chamber washout with injection of vancomycin, amikacin, and dexamethasone. The culture grew *Streptococcus anginosus*. The patient's best corrected visual acuity was no light perception at six months post-treatment.

In the third case, the patient presented three days after IVI with a visual acuity of hand motion (pre-IVI vision was 20/50), ocular pain and inflammation, high intraocular pressure, posterior synechiae, and anterior chamber cells. The patient underwent a vitreous tap and injection of intravitreal vancomycin and ceftazidime on the same day. The culture grew *Stapohylococcus epidermidis*. The patient's best corrected visual acuity was 20/50 at four months post-treatment.

In the fourth case, the patient presented 20 days after IVI with a visual acuity of 20/200 (pre-IVI vision was 20/25), ocular pain, and anterior chamber and vitreous cells. The patient underwent an anterior chamber and vitreous tap and injection of intravitreal vancomycin and ceftazidime on the same day. The culture had no growth. The patient's best corrected visual acuity was 20/40 at one month post treatment.



Acute endophthalmitis is a rare potential complication of intravitreal injections. Mass Eye and Ear's rates of endophthalmitis after intravitreal injection are low compared to international benchmarks. Beyond treating our own patients, Mass Eye and Ear receives referrals from outside sources for treatment of endophthalmitis.

The endophthalmitis rate for calendar year 2019 is similar to the overall rate for the past 11 calendar years (i.e. period from January 1, 2009 to December 31, 2019), where the overall rate of endophthalmitis after intravitreal injection was 0.02% (20 of 107,890 injections).

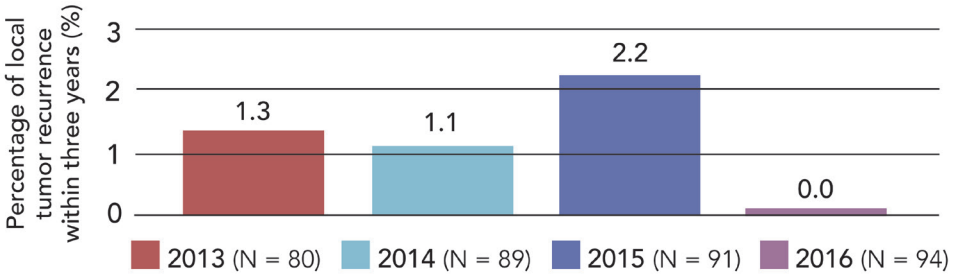
References: [1]Bhavsar AR, Googe JM Jr, Stockdale CR, et al. Risk of endophthalmitis after intravitreal drug injection when topical antibiotics are not required: the diabetic retinopathy clinical research network laser-ranibizumab-triamcinolone clinical trials. Arch Ophthalmol 2009; 127(12): 1581-1583. [2]Englander M, Chen TC, Paschalis EI, et al. Intravitreal injections at the Massachusetts Eye and Ear Infirmary: analysis of treatment indications and postinjection endophthalmitis rates. Br J Ophthalmol 2013; 97(4): 460-465. [3]Fileta JB, Scott IU, Flynn HW Jr. Meta-analysis of infectious endophthalmitis after intravitreal injection of anti-vascular endothelial growth factor agents. Ophthalmic Surg Lasers Imaging Retina 2014; 45(2): 143-149. [4]VanderBeek BL, Bonaffini SG, Ma L. Association of compounded bevacizumab with postinjection endophthalmitis. JAMA Ophthalmol 2015; 133(10): 1159-1164. [5]Dossarps D, Bron AM, Koehrer P, et al. Endophthalmitis after intravitreal injections: incidence, presentation, management, and visual outcome. Am J Ophthalmol 2015; 160(1): 17-25.

Management of Intraocular Tumors: Tumor Recurrence After Proton Therapy

The Ocular Melanoma Center at Mass Eye and Ear is an international referral center for the diagnosis and treatment of eye neoplasms.

Uveal melanoma can be treated effectively with proton beam irradiation, achieving local control of the tumor in most cases, and preserving visual function in many patients. The Ocular Melanoma Center closely examines the recurrence rate at three years following treatment, and as such 2016 results are presented below.

Ninety-nine patients were diagnosed with uveal melanoma (UM) in calendar year 2016. Enucleation was performed in three cases, and 96 patients received proton beam irradiation. Ninety-four of these 96 patients returned for at least one follow-up visit and 67% (63/94 cases) had three or more years (defined as a follow-up visit at 33 months or later) of follow-up. Median follow-up time was 38.8 months. All patients were recurrence-free through their last follow-up examination. Of note, two patients in the cohort had been previously treated elsewhere with transpupillary thermotherapy or photodynamic therapy for probable small melanomas and one patient had previously been treated with I-25 plaque radiotherapy for choroidal melanoma.

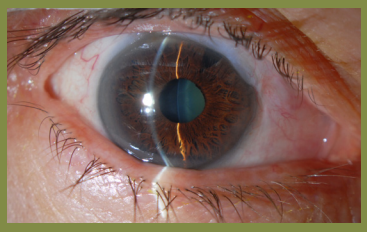


Proton beam irradiation was developed at Mass Eye and Ear in conjunction with a team of radiotherapists from Massachusetts General Hospital. In 1975, the first proton beam irradiation treatment was administered to a Mass Eye and Ear patient with intraocular malignant melanoma.[1]

Reference: [1]Gragoudas ES, Egan KM, Seddon JM, et al. Intraocular recurrence of uveal melanoma after proton beam irradiation. Ophthalmology 1992, 99: 760-766.

Glaucoma Surgery

The Mass Eye and Ear Glaucoma Consultation Service provides the full-spectrum of care—ranging from medical therapy and traditional surgery to the latest minimally invasive glaucoma surgeries (MIGS)—for patients of all ages. Our specialists treat patients with all forms and stages of glaucoma, including those with advanced disease, and are often referred complicated cases.



Postoperative glaucomatous right eye following trabeculectomy surgery. Note the formed bleb at 2 o'clock.

Photo courtesy of Teresa Chen, MD

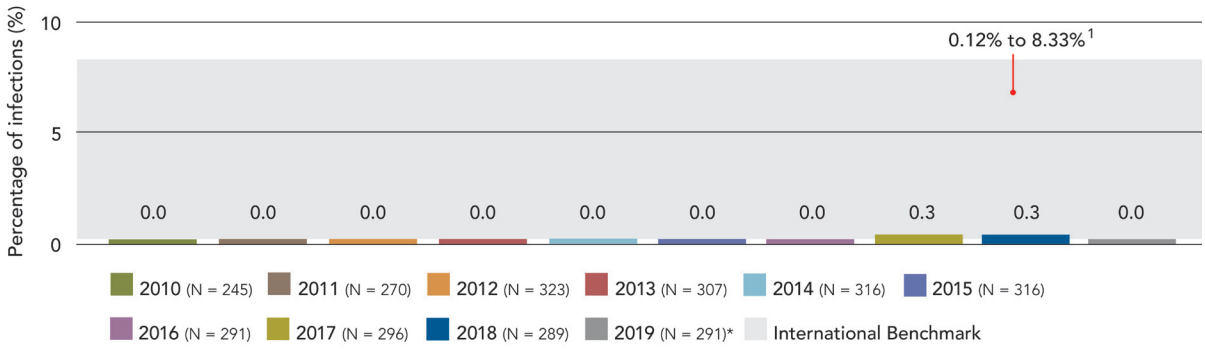
Trabeculectomy and Tube Shunt 30-Day Infection Rates

The most common incisional surgeries performed at all surgical locations by the Mass Eye and Ear Glaucoma Consultation Service are trabeculectomy and tube shunt surgery.

During the 2019 calendar year, the Glaucoma Consultation Service performed a total of 303 trabeculectomy and tube shunt surgeries on adults. These surgeries included trabeculectomy (with or without previous scarring) on 97 eyes, and tube shunt surgeries (primary or revision) on 206 eyes. Of these, six cases were combined with other procedures, such as partial thickness keratoplasty or keratoprosthesis surgery. Of note, six pediatric cases, defined as patients younger than 18 years old, performed by specialists within the Glaucoma Service were excluded from all analyses.

A review of the literature suggests that trabeculectomy and tube shunt infection rates range from 0.12% to 8.33% internationally depending, in part, on the length of follow-up.[1]

During calendar year 2019, there were no cases of endophthalmitis within 30 days of surgery in the Glaucoma Consultation Service.



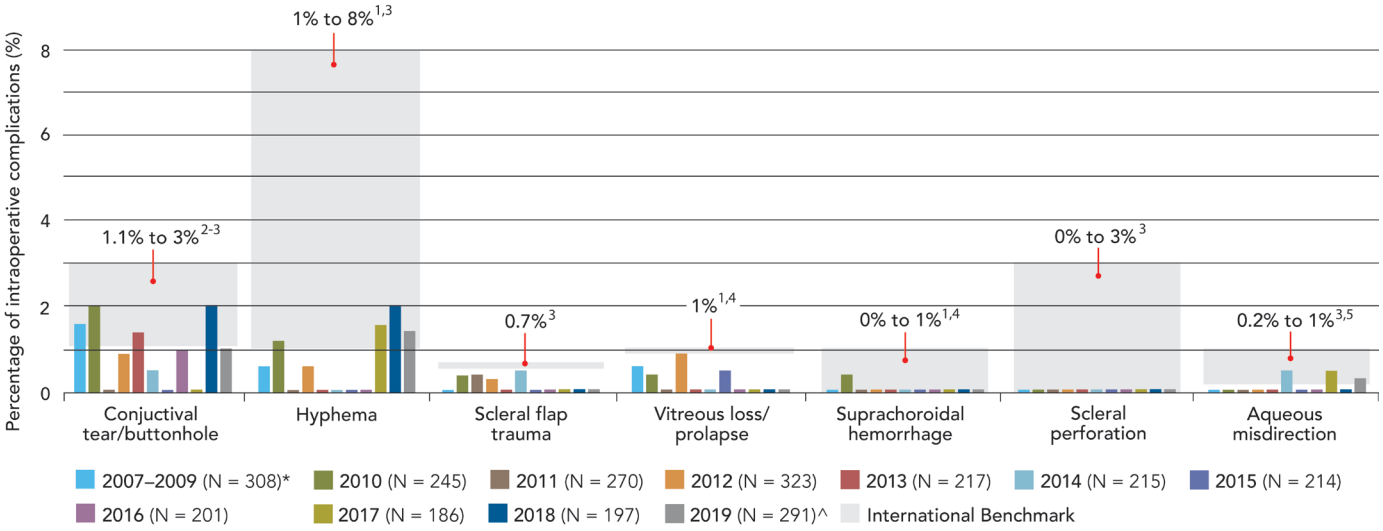
*Glaucoma surgeries combined with cataract surgery and ExPRESS shunt were included in the analysis.

In the calendar year 2019, the Glaucoma Service performed 97 trabeculectomies and 206 tube shunt surgeries.

Reference: [1]Ang GS, Varga Z, Shaarawy T. Postoperative infection in penetrating versus non-penetrating glaucoma surgery. Br J Ophthalmol 2010; 94(12): 1571-1576.

Trabeculectomy and Glaucoma Tube Shunt Surgery: Intraoperative Complications

During the 2019 calendar year, 303 trabeculectomy surgeries and glaucoma tube shunt surgeries were performed by the Glaucoma Consultation Service. Six cases that were combined with other procedures (i.e. keratoplasty surgery, secondary lens implantation, or keratoprosthesis surgery) and six pediatric cases, defined as patients younger than 18 years old, were excluded, which left 291 cases for analysis. Of these, 97.2% (283/291 cases) of patients had no intraoperative complications. For trabeculectomy and glaucoma tube shunt surgery, similar results were reported from calendar year 2010 to 2018.



**July 2007–June 2009*
^Glaucoma surgeries combined with cataract surgery and ExPRESS shunt were included in the analysis.

Minimally Invasive Glaucoma Surgery (MIGS) represents a fast-growing field within the subspecialty of glaucoma and refers to surgical interventions, often entailing the implantation of new devices, for patients with uncontrolled eye pressure. MIGS has become a rapidly adopted alternative to existing, more invasive glaucoma surgeries such as trabeculectomy and tube shunt surgery. Due to the fast-paced growth of the field, long-term data regarding safety and outcomes is limited. To address this, Mass Eye and Ear has created a data repository program to track outcomes of all patients undergoing MIGS procedures, ensuring that patients receive cutting-edge treatments that are also safe and effective.

Mass Eye and Ear 2019 Complication Rates:

Conjunctival tear/buttonhole: **1.0%**
Hyphema: **1.4%**
Scleral flap trauma: **0%**
Vitreous loss (vitreous prolapse): **0%**
Suprachoroidal hemorrhage: **1.0%**
Scleral perforation: **0%**
Aqueous misdirection: **0.3%**

The 294 Cases evaluated included:

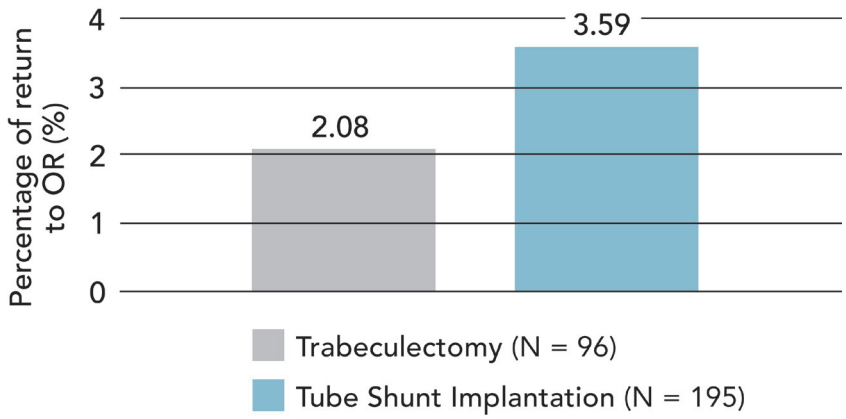
81 trabeculectomies without scarring
15 trabeculectomies with previous scarring
158 primary tube surgeries
37 tube revisions

References: [1]Barton K, Gedde SJ, Budenz DL, et al. Ahmed Baerveldt Comparison Study Group. The Ahmed Baerveldt Comparison Study methodology, baseline patient characteristics, and intraoperative complications. Ophthalmology 2011; 118(3): 435-442. [2]Jampel HD, Musch DC, Gillespie BW, et al. Perioperative complications of trabeculectomy in the Collaborative Initial Glaucoma Treatment Study (CIGTS). Am J Ophthalmol 2005; 140(1): 16-22. [3]Gedde SJ, Herndon LW, Brandt JD, et al. Surgical complications in the Tube Versus Trabeculectomy Study during the first year of follow-up. Am J Ophthalmol 2007; 143(1): 23-31. [4]Christakis PG, Tsai JC, Zurakowski D, et al. The Ahmed Versus Baerveldt study: design, baseline patient characteristics, and intraoperative complications. Ophthalmology 2011; 118(11): 2172-2179. 5Kirwan JF, Lockwood AJ, Shah P, et al. Trabeculectomy in the 21st century: a multicenter analysis. Ophthalmology 2013; 120(12): 2532-2539.

Trabeculectomy and Tube Shunt Surgery Return to Operating Room Within One Month

Trabeculectomies and tube shunt implantations are the gold standard procedures for glaucoma patients who require surgical intervention. The Glaucoma Consultation Service performed 303 trabeculectomy and tube shunt surgeries in calendar year 2019, which included 97 trabeculectomies and 206 tube shunts. In this analysis, surgeries that were combined with secondary lens implantation or keratoprosthesis procedures and patients younger than 18 years old were excluded. Cases combined with cataract surgery and ExPRESS shunts were included. After the exclusion criteria were applied, 96 trabeculectomies and 195 tube shunt surgeries remained for analysis. Return to the operating room (OR) rates were calculated at one month following surgery. Reoperations were defined as cases requiring further revision surgery for any surgically related reason (i.e. bleb leak, further intraocular pressure lowering).

Of the 96 trabeculectomies, 2.08% of cases returned to the OR within one month (2/96 cases). Of the 195 tube shunt surgeries, 3.59% of cases returned to the OR within one month (7/195 cases). To the best of our knowledge, published data on one-month reoperation rates are lacking; therefore, our reported rates will help to establish new benchmarks.

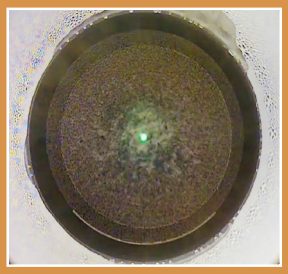


Mass Eye and Ear Return to OR Rate by Reason:

Persistent bleb leak: **0.34% (1/291)**
Kissing choroidals: **0.69% (2/291)**
Suprachoroidal hemorrhage: **0.34% (1/291)**
Aqueous misdirection: **0.34% (1/291)**
Tube plate exposure: **0.69% (2/291)**
Tube occlusion/malposition: **0.69% (2/291)**

The Mass Eye and Ear Glaucoma Consultation Service reports low return to OR rates within the first month after surgery.

Refractive Surgery (Laser Vision Correction)



The Mass Eye and Ear Cornea and Refractive Surgery Service provides the most advanced forms of refractive procedures, ranging from laser-assisted in situ keratomileusis (LASIK) and photorefractive keratectomy (PRK) to small incision lenticule extraction (SMILE) and implantable lenses.

Gas pattern after completion of the laser passes of SMILE.

Photo courtesy of Kathryn M. Hatch, MD

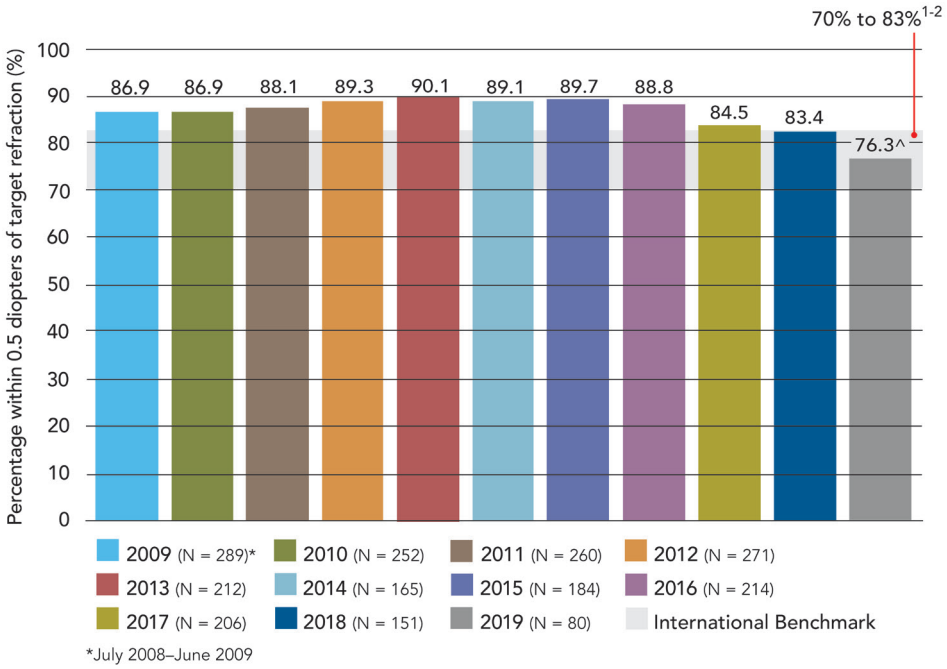
LASIK for Myopia and Myopic Astigmatism: Achieving Target Refraction (Spherical Equivalent)

During the 2019 calendar year, 127 eyes had LASIK surgery for myopia. Of the 80 eyes that had follow-up data available between one and three months postoperatively, 76.3% (61/80 eyes) achieved within 0.5 diopter of target refraction. Patients with astigmatism (ranging from -0.25 to -5.25 diopters) were included in the analysis.

Benchmark data from U.S. Food and Drug Administration (FDA) trials of LASIK for myopia showed that 71.6% of eyes resulted in a refractive error within 0.5 diopters of the intended target correction.[1] Further review of the literature suggests that after LASIK surgery for myopia, approximately 70% to 83% of eyes achieve within 0.5 diopters of the intended target correction.[1-2] Downward trend in outcome in 2020 may be related to lower denominator of patients. Testing revealed no statistical significance for this change, with $p<0.05$ (see footnote).

The overall LASIK success rate for achieving within 0.5 diopters of target refraction for myopia and hyperopia combined in 2019 was 74.2% (66/89 eyes).

In the calendar year 2019, the Refractive Service performed LASIK on 153 eyes and SMILE on 118 eyes.



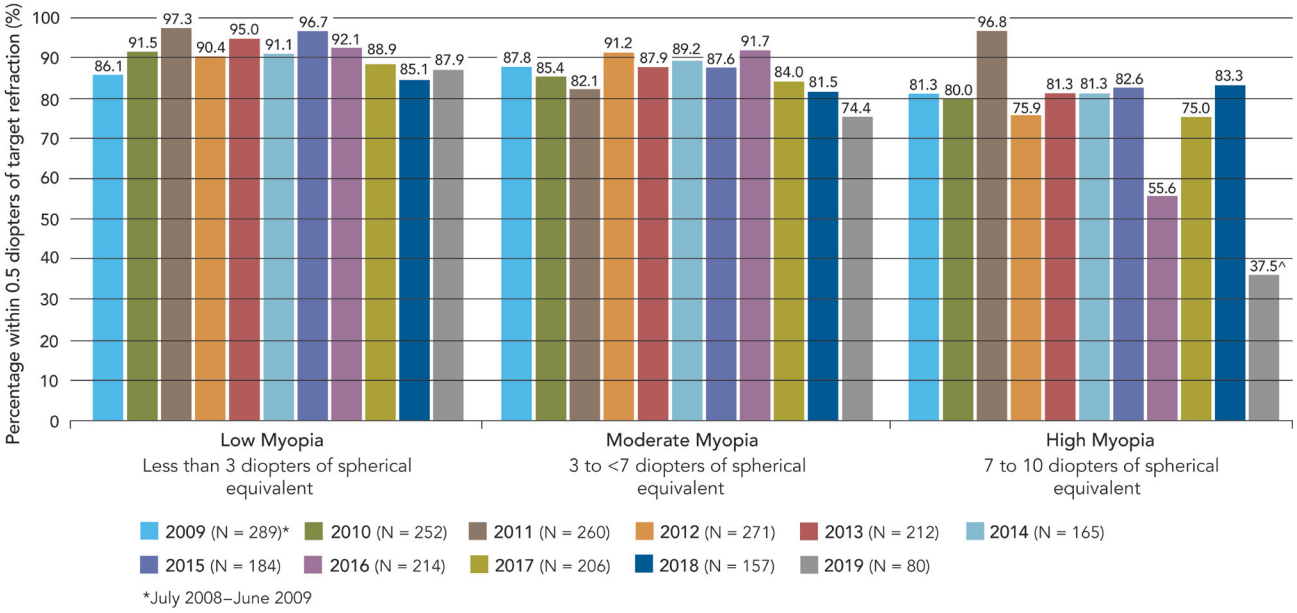
*July 2008–June 2009

^ With a significance level of p value = 0.05, we did not find any statistically significant difference between the percentage within 0.5 diopters of target refraction after LASIK for myopia in 2018 and 2019 (p = 0.19).

References: [1]Bailey MD, Zadnick K. Outcomes of LASIK for myopia with FDA-approved lasers. Cornea 2007; 26(3), 246–254. [2] Yuen LH, Chan WK, Koh J, et al. A 10-year prospective audit of LASIK outcomes for myopia in 37,932 eyes at a single institution in Asia. Ophthalmology 2010; 117(6): 1236–1244.

LASIK for Different Degrees of Myopia and Myopic Astigmatism: Achieving Target Refraction (Spherical Equivalent)

In calendar year 2019, 127 eyes had LASIK surgery for myopia. Of these, 80 eyes had between one and three months follow-up data available for analysis. The success rates based on the degree of myopia are illustrated here. LASIK for low myopia was performed on 33 eyes, and of these, 87.9% (29/33 eyes) were successful (achieved within 0.5 diopters of target refraction at their follow-up). For the 39 eyes with moderate myopia, 74.4% (29/39 eyes) were successful; and for the eight eyes with high myopia, 37.5% (3/8 eyes) achieved within 0.5 diopters of target refraction at one month follow-up. Similar results were reported for low myopia for calendar years 2010 to 2018. Downward trend in outcome in 2020 may be related to lower denominator of patients. Testing revealed no statistical significance for this change, with p<0.05 (see footnote).



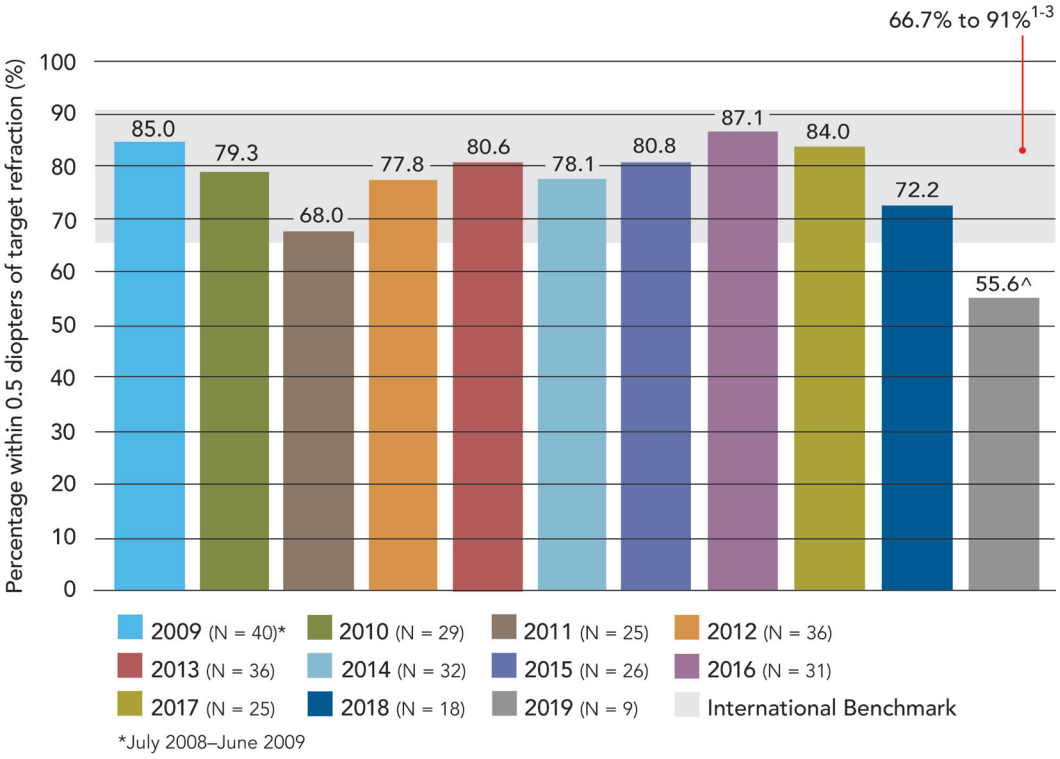
^ With a significance level of p value = 0.5, we did not find any statistically significant difference between the percentage within 0.5 diopters of target refraction in 2018 and 2019 (p = 0.062).

The Mass Eye and Ear Cornea and Refractive Surgery Service continues to maintain a high overall success rate for LASIK surgery for myopia.

LASIK for Hyperopia and Hyperopic Astigmatism: Achieving Target Refraction (Spherical Equivalent)

Of the 26 eyes that had LASIK surgery for hyperopia during the 2019 calendar year, nine had between three and six months of follow-up data available for analysis. The overall 2019 LASIK success rate for achieving within 0.5 diopters of target refraction was 55.6% (5/9 eyes) for hyperopia. Patients with astigmatism (ranging from -0.25 to -1.75 diopters) were included in the analysis.

A review of the literature suggests that the success rate for achieving within 0.5 diopters of the intended target correction after LASIK for hyperopia ranges between 66.7% and 91%.[1-3] Downward trend in outcome in 2020 may be related to lower denominator of patients. Testing revealed no statistical significance for this change, with $p<0.05$ (see footnote).



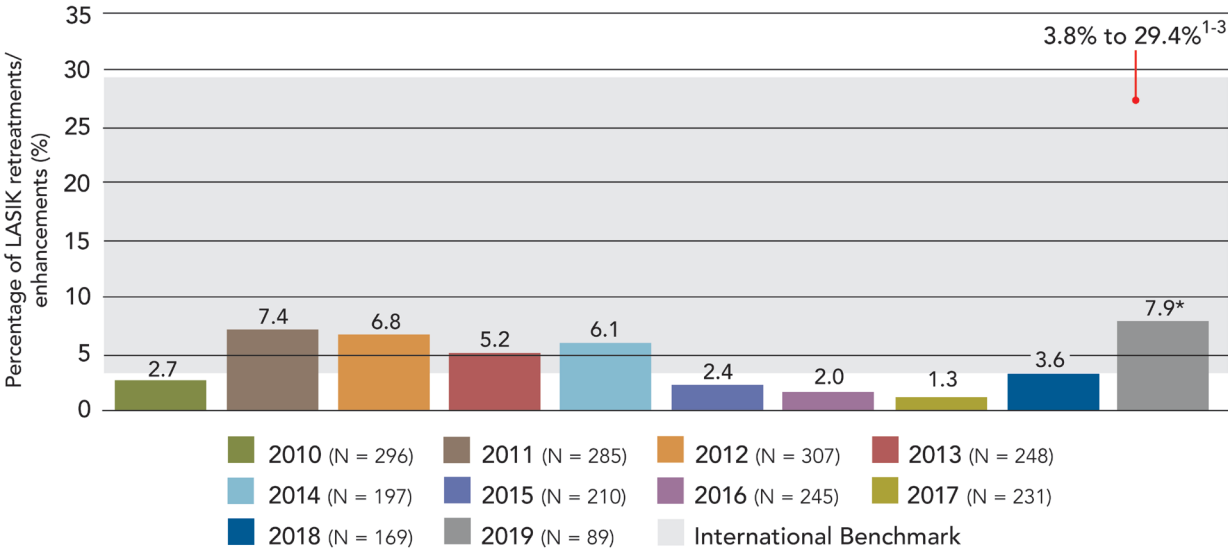
^ With a significance level of p value = 0.05, we did not find any statistically significant difference between the percentage within 0.5 diopters of target refraction in 2018 and 2019 (p = 0.42)

References: [1]Alió JL, El Aswad A, Vega-Estrada A, et al. Laser in situ keratomileusis for high hyperopia (>5.0 diopters) using optimized aspheric profiles: efficacy and safety. J Cataract Refract Surg 2013; 39(4): 519-527. [2]Keir NJ, Simpson T, Hutchings N, et al. Outcomes of wavefront-guided laser in situ keratomileusis for hyperopia. J Cataract Refract Surg 2011; 37(5): 886-893. [3]Cole Eye Institute. Outcomes 2012.

LASIK: Enhancement/Retreatment Rates at Six Months Follow-up

During the 2019 calendar year, 89 of the 153 eyes that had LASIK surgery had sufficient follow-up data for analysis. Sufficient follow-up was defined as data available between one and three months for myopia and between three and six months for hyperopia. Of these 89 eyes, 7.9% (7/89 eyes) had an enhancement/retreatment procedure within six months of surgery. Similar results have been reported since calendar year 2010 when data collection for enhancement/retreatment rates began.

LASIK retreatment rates of between 3.8% and 29.4% have been reported in the literature.[1-3] Upward trend in outcome in 2020 may be related to lower denominator of patients. Testing revealed no statistical significance for this change, with $p<0.05$ (see footnote).



* With a significance level of p value = 0.05, we did not find any statistically significant difference between the enhancement and retreatment rate in 2018 and 2019 (p = 0.132)

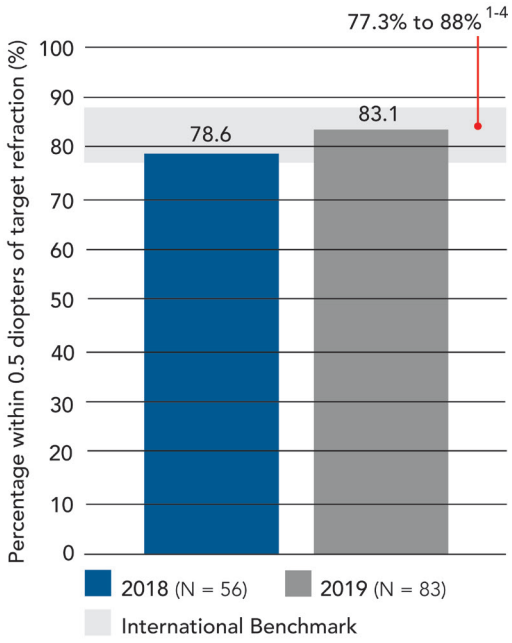
For the past 10 years, the Mass Eye and Ear Cornea and Refractive Surgery Service has maintained low enhancement/retreatment rates when compared to international benchmarks.

References: [1]Bragheeth MA, Fares U, Dua HS. Re-treatment after laser in situ keratomileusis for correction of myopia and myopic astigmatism. Br J Ophthalmol 2008; 92(11): 1506-1511. [2]Yuen LH, Chan WK, Koh J, et al. A 10-year prospective audit of LASIK outcomes for myopia in 37,932 eyes at a single institution in Asia. Ophthalmology 2010; 117(6): 1236-1244. [3]Alió JL, El Aswad A, Vega-Estrada A, et al. Laser in situ keratomileusis for high hyperopia (>5.0 diopters) using optimized aspheric profiles: efficacy and safety. J Cataract Refract Surg 2013; 39(4): 519-527.

SMILE for Myopia and Myopic Astigmatism: Achieving Target Refraction (Spherical Equivalent)

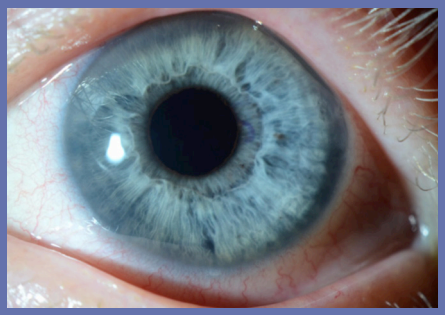
During the 2019 calendar year, 118 eyes had small incision lenticule extraction (SMILE) surgery for myopia. Of the 83 eyes that had between one and three months of follow-up data available for analysis, 83.1% (69/83 eyes) achieved within 0.5 diopter of target refraction. Patients with astigmatism (ranging from -0.25 to -4.25 diopters) were included in the analysis.

SMILE is an FDA-approved procedure for the treatment of spherical myopia and myopic astigmatism. SMILE uses the latest laser technology to gently create a thin, contact lens-shaped layer just beneath the surface of the eye. This lenticule is then removed through a tiny opening. The adoption of SMILE is growing as a minimally invasive technology that allows for a rapid visual recovery, reduced risk of dry eye, and no postoperative restrictions.



References: [1]Sekundo W, Kunert KS, Blum M. Small incision corneal refractive surgery using the small incision lenticule extraction (SMILE) procedure for the correction of myopia and myopic astigmatism: results of a 6 months prospective study. Br J Ophthalmol 2011; 95(3): 335-339. [2]Vestergaard AH, Grauslund J, Ivarsen AR, et al. Efficacy, safety, predictability, contrast sensitivity, and aberrations after femtosecond laser lenticule extraction. J Cataract Refract Surg 2014; 40(3): 403-11. [3]Kanellopoulos AJ. Topography-guided LASIK versus small incision lenticule extraction (SMILE) for myopia and myopic astigmatism: a randomized, prospective, contralateral eye study. J Refract Surg 2017; 33(5): 306-312. [4]Kamiya K, Takahashi M, Nakamura T, et al. A multicenter study on early outcomes of small-incision lenticule extraction for myopia. Sci Re 2019; 9(1): 4067.

Cornea Surgery



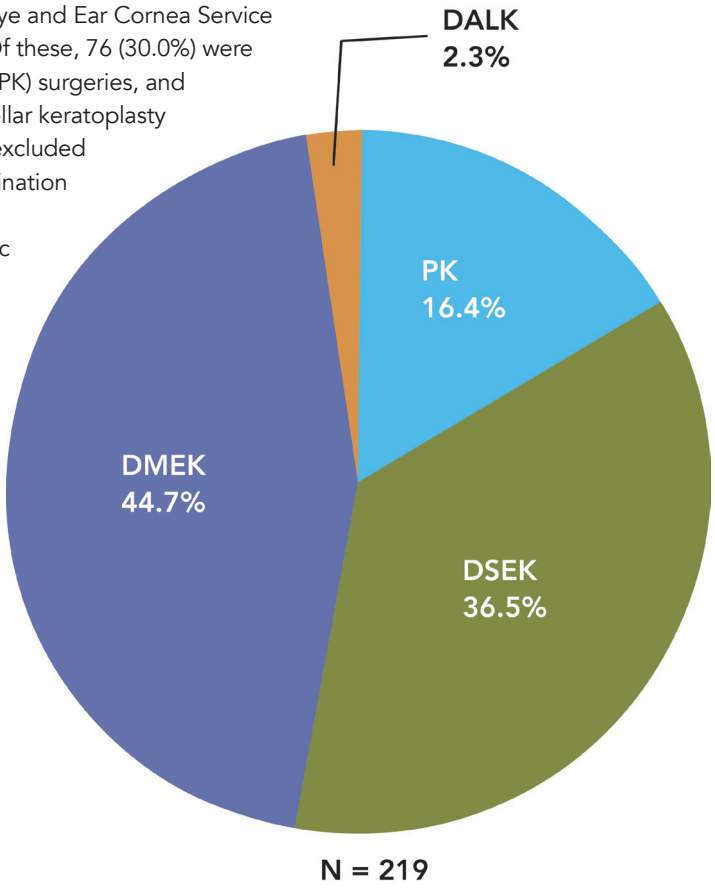
The Mass Eye and Ear Cornea Service is highly skilled at correcting a variety of corneal disorders that disrupt vision. When appropriate, our clinicians perform more advanced lamellar procedures over penetrating keratoplasties in order to limit scarring and improve graft results.

Postoperative left eye following DMEK surgery with a faint S stamp denoting correct graft orientation.

Photo courtesy of Ula V. Jurkunas, MD

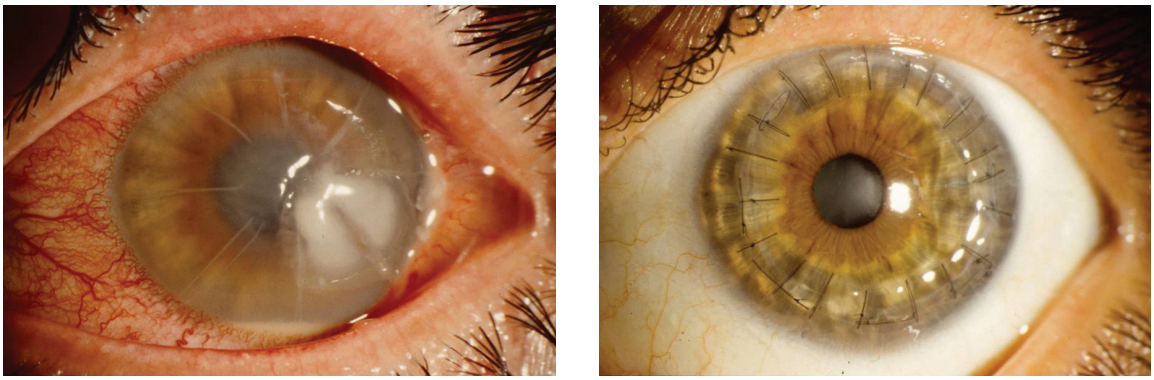
Distribution of Full-Thickness and Partial-Thickness Keratoplasty

During the 2019 calendar year, the Mass Eye and Ear Cornea Service performed 259 keratoplasty procedures. Of these, 76 (30.0%) were full-thickness, or penetrating keratoplasty (PK) surgeries, and 183 (70.0%) were partial-thickness, or lamellar keratoplasty surgeries. The below distribution analysis excluded 17 PK procedures that were done in combination with retinal, glaucoma, or keratoprosthesis (KPro) procedures, as well as 23 therapeutic PK procedures done for active corneal infections or non-healing ulcers. This left 36 PKs for inclusion in the distribution analysis compared to 183 partial-thickness transplants. The subdivision of lamellar keratoplasty procedures was 80 Descemet's stripping endothelial keratoplasties (DSEKs), 98 Descemet's membrane endothelial keratoplasties (DMEKs), and five deep anterior lamellar keratoplasties (DALKs).

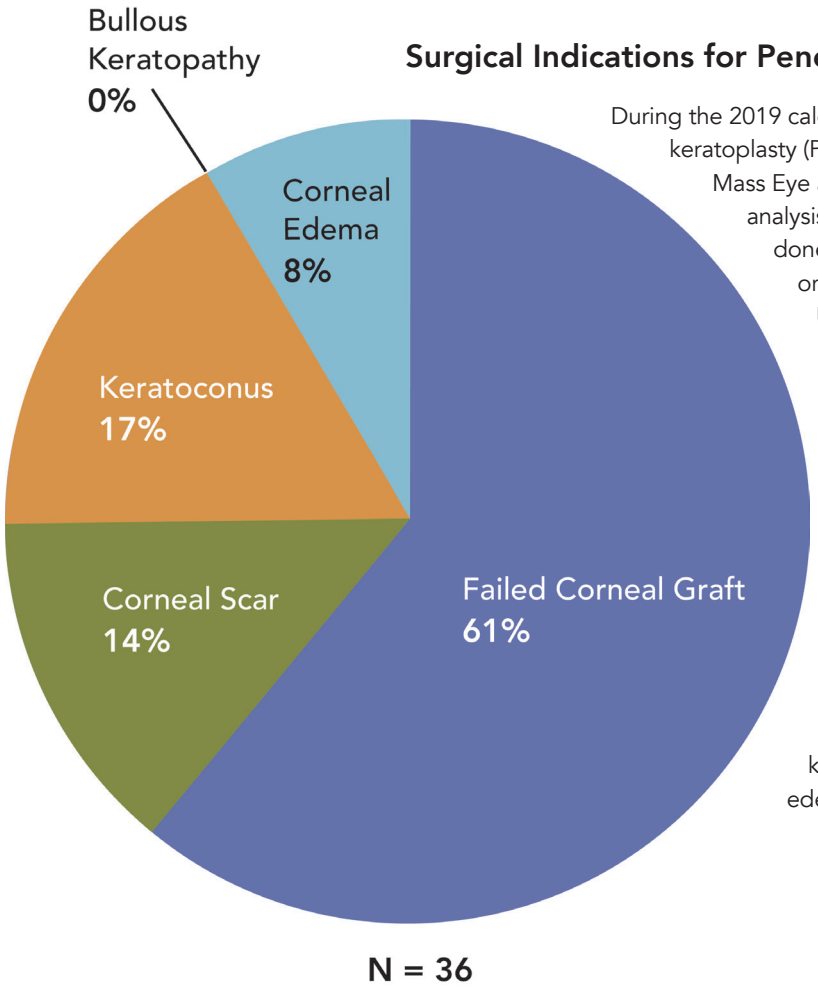


The Mass Eye and Ear Cornea Service has faculty who specialize in pediatric keratoplasty cases. In calendar year 2019, the service performed five pediatric keratoplasty procedures, which have not been included in the analysis.

Penetrating Keratoplasty



Preoperative and postoperative right eye that underwent PK for Pseudomonas keratitis in a prior radial keratotomy incision.
Photos courtesy of James Chodosh, MD, MPH



Surgical Indications for Penetrating Keratoplasty (PK)

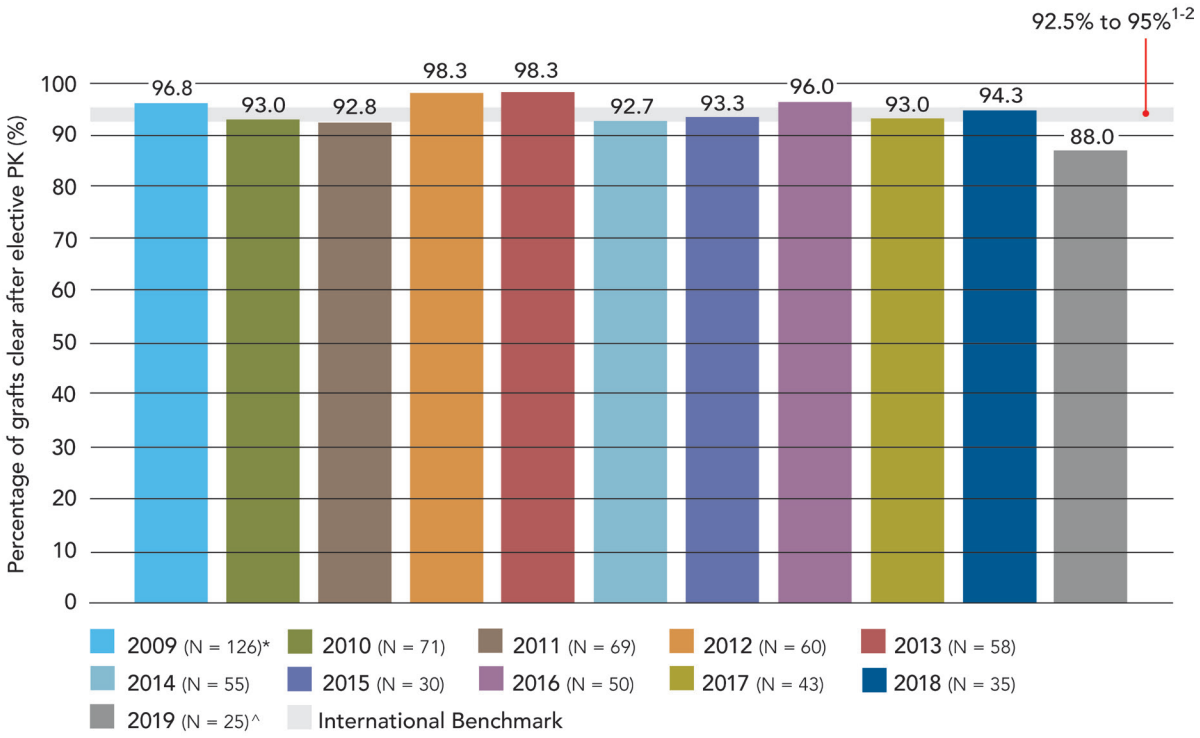
During the 2019 calendar year, 76 full-thickness penetrating keratoplasty (PK) procedures were performed by the Mass Eye and Ear Cornea Service. The current analysis includes only elective PKs that were not done in combination with retinal, glaucoma, or keratoprosthesis (KPro) procedures. Using these exclusion criteria, 36 (47.4% cases) elective PKs remained for analysis for calendar year 2019. These 36 elective PKs included both first-time grafts in uninflamed host beds, as well as PKs performed in eyes at high risk of rejection, including eyes with extensive corneal neovascularization and/or a previous failed corneal graft.

Indications for elective PKs included failed corneal graft (22/36 cases, 61.1%), corneal scar (5/36 cases, 13.9%), keratoconus (6/36 cases, 16.7%), bullous keratopathy (0/36 cases, 0%), and corneal edema (3/36 cases, 8.3%).

In the calendar year 2019, the Cornea Service performed 259 keratoplasty surgeries, 79 full or penetrating keratoplasties and 183 partial thickness keratoplasties.

Clear Corneal Grafts After Penetrating Keratoplasty (PK) Surgery

Of the 25 elective PKs with sufficient follow-up for analysis*, 22 (88.0%) achieved surgical success, which is defined as a graft at three to five months follow-up with minimal to no clinical edema and with sufficient clarity to permit the examiner to have an unencumbered view of the interior of the eye, including iris details. Downward trend in outcome in 2020 may be related to lower denominator of patients. Testing revealed no statistical significance for this change, with $p<0.05$.



*11 PKs were excluded from this analysis due to insufficient follow-up

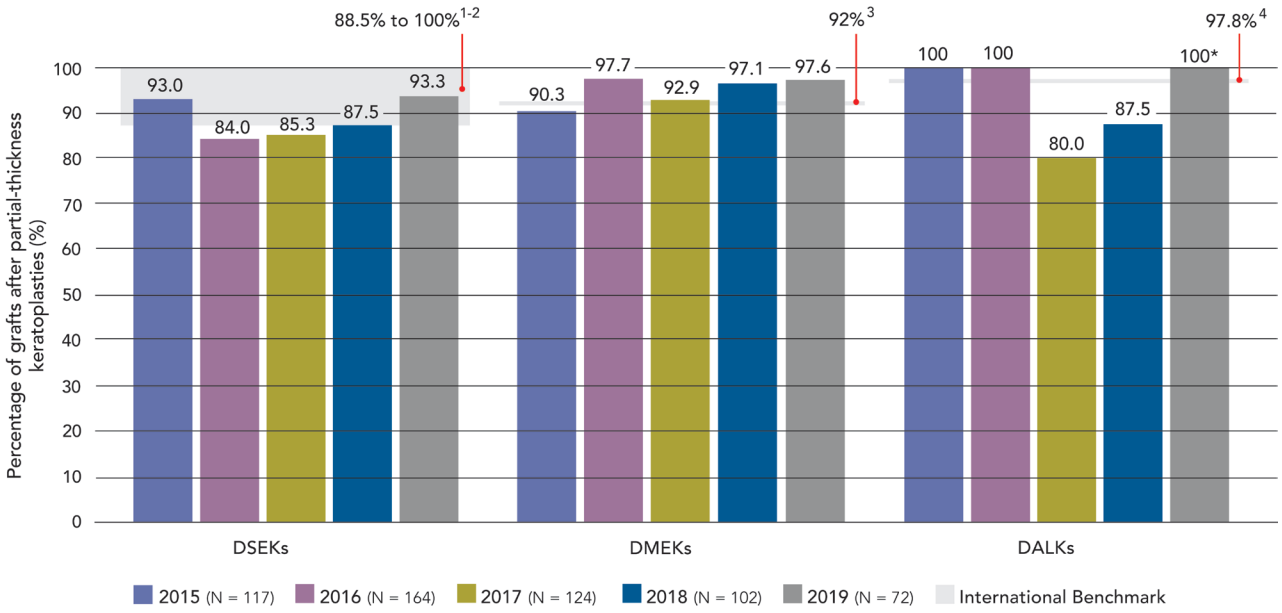
^ With a significance level of p value = 0.05, we did not find any statistically significant difference between the rate of clear corneal grafts after PK surgeries in 2018 and 2019.

Mass Eye and Ear PK surgery success rates are comparable to international benchmarks.[1-2]

References: [1]Vail A, Gore SM, Bradley BA, et al. Corneal graft survival and visual outcome. A multicenter study. Corneal transplant follow-up study collaborators. Ophthalmology 1994; 101(1): 120-127. [2]Price MO, Thompson RW Jr, Price FW Jr. Risk factors for various causes of failure in initial corneal grafts. Arch Ophthalmol 2003; 121(8): 1087-1092.

Clear Corneal Grafts After Partial-Thickness Keratoplasty Surgery

Of 183 partial-thickness keratoplasties performed in calendar year 2019 by the Mass Eye and Ear Cornea Service, 72 were elective procedures, not done in combination with retinal or glaucoma procedures, with at least three months of follow-up data, and as such, were included in the analysis. These 72 procedures included 30 Descemet's stripping endothelial keratoplasties (DSEKs), 41 Descemet's membrane endothelial keratoplasties (DMEKs), and one deep anterior lamellar keratoplasty (DALK). Of these 72 procedures, 69 (95.8%) achieved surgical success, which is defined as a graft at three to five months follow-up with minimal to no clinical edema and with sufficient clarity to permit the examiner to have an unencumbered view of the interior of the eye, including iris details. When the data were subdivided by lamellar graft type, DMEK and DSEK graft success rates were similar compared to previous years.



*With a significance level of p value = 0.05, we did not find any statistically significant difference between clear corneal graft after a DALK procedure in 2018 and 2019 (p = 1.0)

References: [1]Basak SK. Descemet stripping and endothelial keratoplasty in endothelial dysfunctions: three-month results in 75 eyes. Indian J Ophthalmol 2008 56(4): 291-296. [2]Koenig SB, Covert DJ. Early results of small-incision Descemet's stripping and automated endothelial keratoplasty. Ophthalmology 2007; 114(2): 221-226. [3]Price MO, Giebel AW, Fairchild KM, et al. Descemet's membrane endothelial keratoplasty: prospective multicenter study of visual and refractive outcomes and endothelial survival. Ophthalmology 2009; 116(12): 2361-2368. [4]Jones MN, Armitage WJ, Ayliffe W, et al. Penetrating and deep anterior lamellar keratoplasty for keratoconus: a comparison of graft outcomes in the United Kingdom. Invest Ophthalmol Vis Sci 2009; 50(12): 5625-5629.

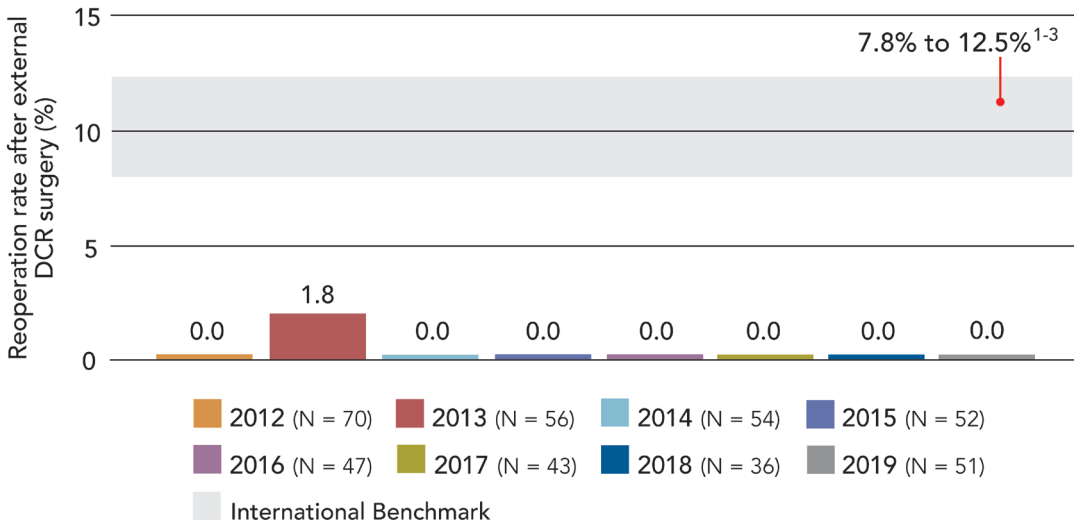
Oculoplastic Surgery

The Mass Eye and Ear Ophthalmic Plastic Surgery Service performs a high volume of specialized treatments and surgeries to address facial and orbital disease and trauma.

Oculoplastic Surgery: Reoperation Rate for Primary External Dacryocystorhinostomy (Ex-DCR) Surgery at Six Months Follow-up

During the 2019 calendar year, the Mass Eye and Ear Ophthalmic Plastic Surgery Service performed Ex-DCR procedures on 58 eyes of 47 patients. Three eyes of three patients were excluded for pre-existing ocular conditions (benign tumors and post-traumatic lacrimal obstruction). Full exclusion criteria for pre-existing ocular conditions include granulomatosis with polyangiitis, sarcoidosis, cancer (e.g. lymphoma), benign tumors, post-traumatic lacrimal obstruction, and congenital cases. Four eyes of four patients were excluded because of a history of prior lacrimal surgery. This analysis includes the remaining 51 eyes of 40 patients who underwent primary Ex-DCR in 2019 for primary acquired nasolacrimal duct obstruction (PANDO). Of these eyes, none (0%) required a second procedure within six months in order to achieve surgical success. Similar results were reported for calendar years 2012, 2014, 2015, 2016, 2017, and 2018 during which time there were no reoperations within six months of primary Ex-DCR.

Ex-DCR is a common surgical method for PANDO. A review of the literature suggests that 7.8% to 12.5% of patients require reoperation following primary external DCR for PANDO.[1-3]

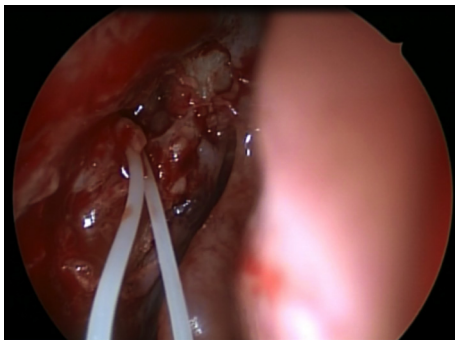


For the past seven years, the Mass Eye and Ear Ophthalmic Plastic Surgery Service has maintained a low reoperation rate for Ex-DCR surgeries compared to international benchmarks.

In the calendar year 2019, the Oculoplastic Service performed Ex-DCRs on 58 eyes, En-DCRs on 58 eyes, and upper lid surgeries on 885 eyelids.

References: [1]Dolman PJ. Comparison of external dacryocystorhinostomy with nonlaser endonasal dacryocystorhinostomy. Ophthalmology 2003; 110(1): 78-84. [2]Karim R, Ghabrial R, Lynch TF, et al. A comparison of external and endoscopic endonasal dacryocystorhinostomy for acquired nasolacrimal duct obstruction. Clin Ophthalmol 2011; 5: 979-989. [3]Ben Simon GJ, Joseph J, Lee S, et al. External versus endoscopic dacryocystorhinostomy for acquired nasolacrimal duct obstruction in a tertiary referral center. Ophthalmology 2005; 112(8): 1463-1468.

Reoperation Rate for Primary Endoscopic Dacryocystorhinostomy (En-DCR) Surgery at Six Months Follow-up

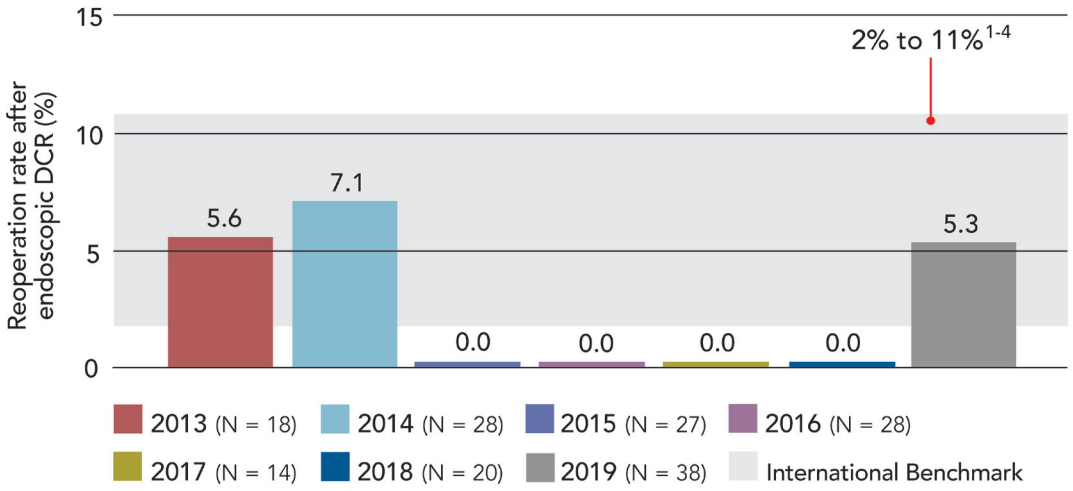


Intraoperative endoscopic view of En-DCR ostium with silicone stent in position.

Photo courtesy of Daniel R. Lefebvre, MD, FACS

During the 2019 calendar year, the Mass Eye and Ear Ophthalmic Plastic Surgery Service performed En-DCR procedures on 58 eyes of 48 patients. Four eyes of four patients were excluded for pre-existing lacrimal conditions (benign tumors and post-traumatic lacrimal obstruction). Full exclusion criteria for pre-existing lacrimal conditions include granulomatosis with polyangiitis, sarcoidosis, cancer (e.g. lymphoma), benign tumors, post-traumatic lacrimal obstruction, and congenital obstruction. Sixteen eyes of 13 patients also were excluded because of a history of prior lacrimal surgery. This analysis includes the remaining 38 eyes of 32 patients (one patient had bilateral lacrimal surgery where one eye was included and the other was excluded) who underwent primary En-DCR in 2019 for primary acquired nasolacrimal duct obstruction (PANDO). Two of these 38 eyes (5.3%) required a second procedure within six months to achieve surgical success.

A review of the literature suggests that 2% to 11% of patients who undergo primary En-DCR for PANDO require a revision.[1-4]

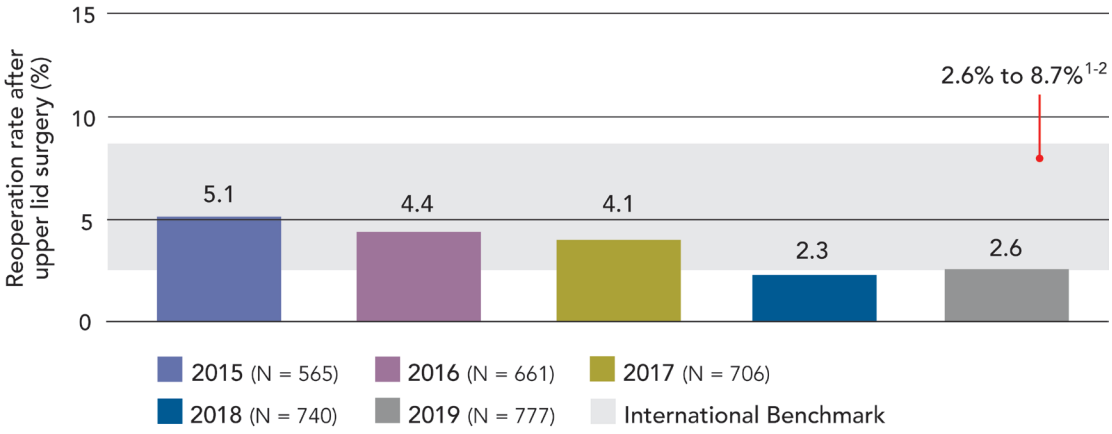


References: [1]Dolman PJ. Comparison of external dacryocystorhinostomy with nonlaser endonasal dacryocystorhinostomy. *Ophthalmology* 2003; 110(1): 78-84. [2]Ben Simon GJ, Joseph J, Lee S, et al. External versus endoscopic dacryocystorhinostomy for acquired nasolacrimal duct obstruction in a tertiary referral center. *Ophthalmology* 2005; 112(8): 1463-1468. [3]Moore WMH, Bentley CR, Olver JM. Functional and anatomic results after two types of endoscopic endonasal dacryocystorhinostomy: surgical and holmium laser. *Ophthalmology* 2002; 109(8): 1575-1582. [4]Codère F, Denton P, Corona J. Endonasal dacryocystorhinostomy: a modified technique with preservation of the nasal and lacrimal mucosa. *Ophthal Plast Reconstr Surg* 2010; 26(3): 161-164.

Reoperation Rate for Upper-Lid Surgeries at Six Months Follow-up

During the 2019 calendar year, the Mass Eye and Ear Ophthalmic Plastic Surgery Service performed upper blepharoplasty and/or ptosis repair surgeries on 885 eyelids in 500 patients. These upper lid surgeries included cosmetic eyelid surgery and functional eyelid surgery including in patients with other medical conditions, such as neurogenic ptosis, myogenic ptosis, congenital ptosis, and thyroid eye disease. Of these 885 lids, 108 were excluded from analysis because they had undergone prior lid surgeries in the past; these included blepharoplasty, ptosis repair or lid surgeries in the setting of tumor removal or orbital decompression. This left 777 lids for the following analysis. Of these 777 lids, only 2.6% (20/777 lids) required a second procedure within six months in order to achieve surgical success.

A review of the literature suggests that reoperation rates after eyelid surgery range from 2.6% to 8.7%.[1-2]



The Mass Eye and Ear Ophthalmic Plastic Surgery Service has maintained a low reoperation rate for upper eyelid surgeries compared to international benchmarks.

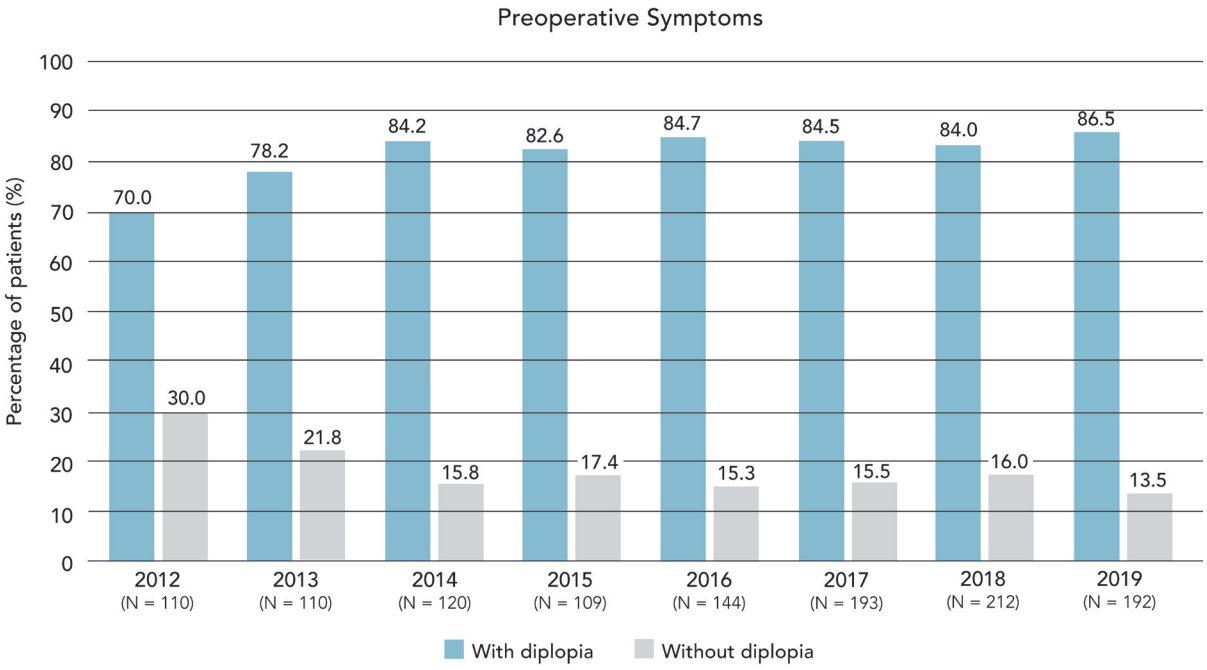
References: [1]Scoppettuolo E, Chadha V, Bunce C, et al. British Oculoplastic Surgery Society (BOPSS) National Ptosis Survey. Br J Ophthalmol 2008; 92(8): 1134–1138. [2]Melicher J, Nerad JA. Chapter 29: Ptosis surgery failure and reoperation. In: Cohen AJ, Weinberg DA, eds. Evaluation and management of blepharoptosis. New York: Springer; 2011, 269-274.

Adult Strabismus Service

The Adult Strabismus Service at Mass Eye and Ear provides comprehensive diagnoses and treatments (to agree with diagnoses) for adults with strabismus. Treatment can include prism therapy, Botox® injections, or strabismus surgery. The service is one of the few in the country that performs strabismus surgery specifically in adults and is distinct from the Mass Eye and Ear Pediatric Ophthalmology and Strabismus Service, which is affiliated with Boston Children's Hospital.

Preoperative Symptoms in Adult Strabismus Surgery Patients

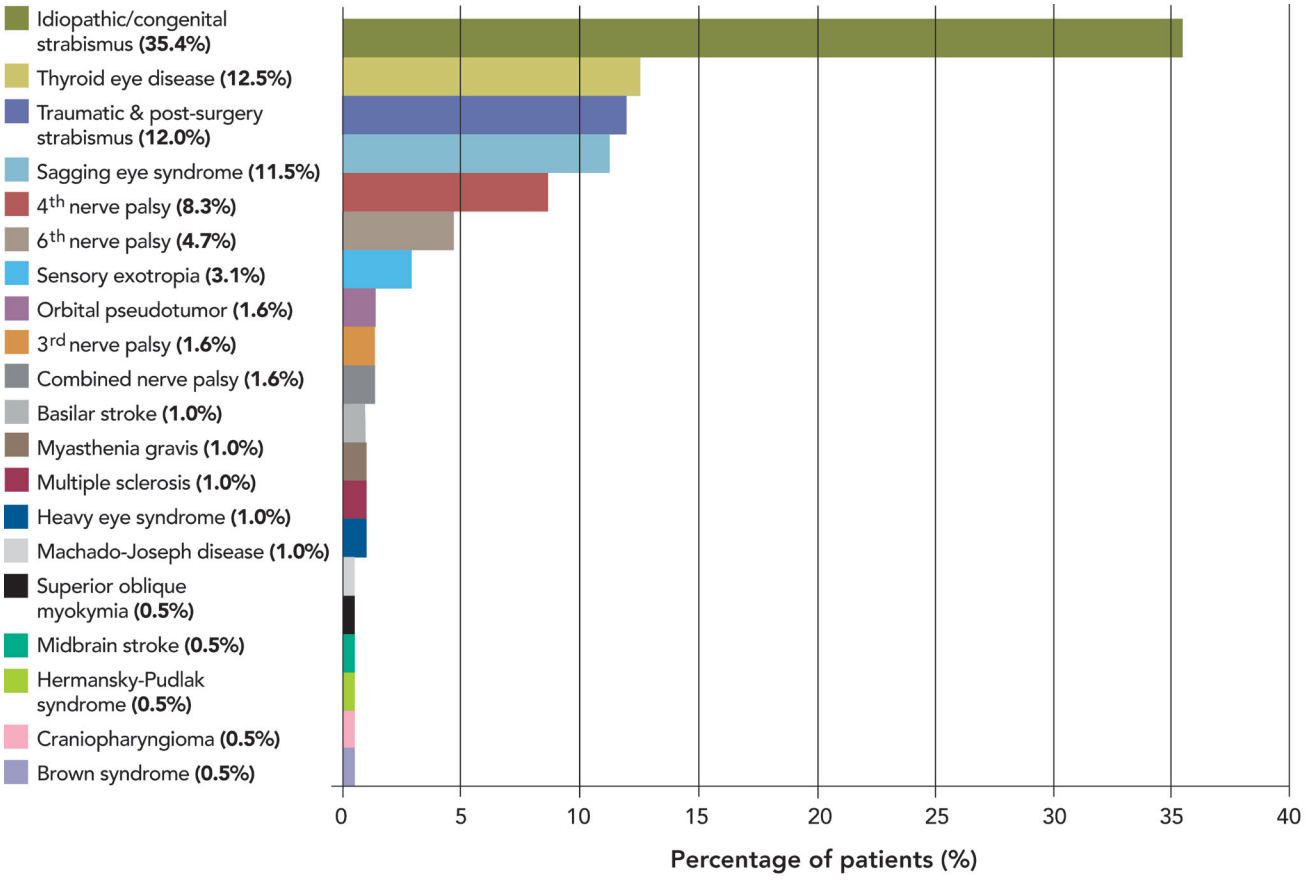
During the 2019 calendar year, the Mass Eye and Ear Adult Strabismus Service performed strabismus surgery on 192 patients. The majority of patients (86.5% or 166/192 patients) had diplopia pre-operatively, while 13.5%, or 26/192 patients, did not have diplopia. Diplopia was also a common pre-operative symptom in prior calendar years, as shown below.



Diplopia is one of the most common indications for surgical intervention at the Mass Eye and Ear Adult Strabismus Service.

Underlying Etiologies Associated with Adult Strabismus Surgery

Of the 192 strabismus surgery cases performed in calendar year 2019, the most common etiology was idiopathic or congenital strabismus (35.4% or 68 patients). Thyroid eye disease was the second most common cause (12.5% or 24 patients). Other etiologies included traumatic and post-surgical strabismus (12.0% or 23 patients), sagging eye syndrome (11.5% or 22 patients), 6th nerve palsy (8.3% or 16 patients), 4th nerve palsy (4.7% or 9 patients), sensory exotropia (3.1% or 6 patients), orbital pseudotumor (1.6% or 3 patients), 3rd nerve palsy (1.6% or 3 patients), and combined nerve palsies (1.6% or 3 patients). The remaining etiologies (7.5% or 15 patients) were basilar stroke, myasthenia gravis, multiple sclerosis, heavy eye syndrome, myokymia, midbrain stroke, Machado-Joseph disease, Hermansky-Pudlak Syndrome, craniopharyngioma, and Brown syndrome.



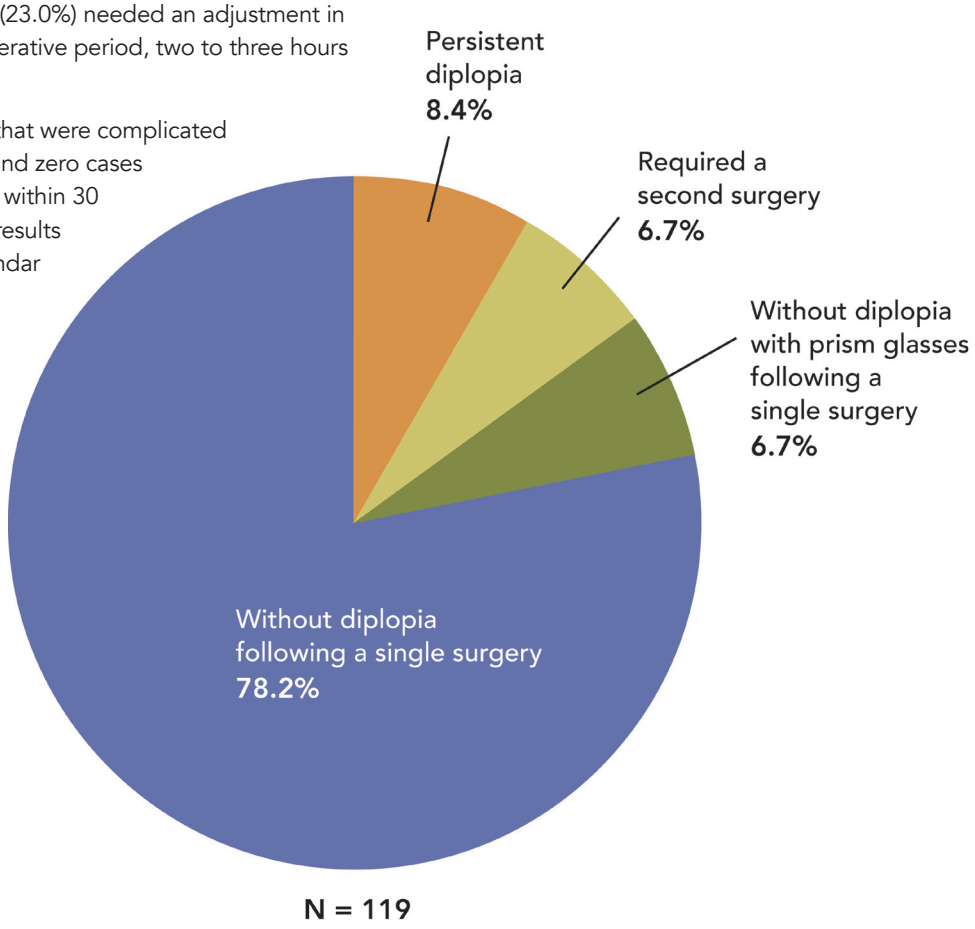
The most common indications for adult strabismus surgery in the Adult Strabismus Service were idiopathic/congenital strabismus, traumatic and post-surgery strabismus, thyroid eye disease, and sagging eye syndrome.

Success Rates for Adult Strabismus Surgery at Six Months Follow-up

In calendar year 2019, 166 of 192 patients (86.5%) had diplopia prior to their surgery. Of these 166 patients, 119 had between one and six months follow-up data available, and therefore, were included in the following analysis. Postoperatively, 93 of 119 patients (78.2%) were without diplopia in primary position or had a deviation less than six prism diopters after a single surgery that did not require prism glasses at their six-month follow-up appointment. Eight of 119 patients (6.7%) who had diplopia after surgery were without diplopia in primary position with prism glasses. Eight of 119 patients (6.7%) required a second surgery that was performed within six months. The remaining 10 of 119 patients (8.4%) had persistent diplopia at their follow-up appointment closest to six months.

Of the 192 patients who had strabismus surgery, 178 patients (92.7%) had the adjustable suture technique and 14 patients (7.3%) had a non-adjustable procedure. Of the 178 patients who underwent an adjustable procedure, 41 patients (23.0%) needed an adjustment in the immediate post-operative period, two to three hours following surgery.

There were zero cases that were complicated by scleral perforation, and zero cases developed an infection within 30 days of surgery. These results are the same as in calendar years 2012 to 2018.



After a single strabismus surgery in the Adult Strabismus Service, 78.2% of patients were without diplopia in primary position and 6.7% were without diplopia in primary position with prism glasses.

Neuro-Ophthalmology Service

The Neuro-Ophthalmology Service at Mass Eye and Ear diagnoses and treats a wide variety of disorders that affect the cranial nerves and orbit, many of which require advanced imaging.

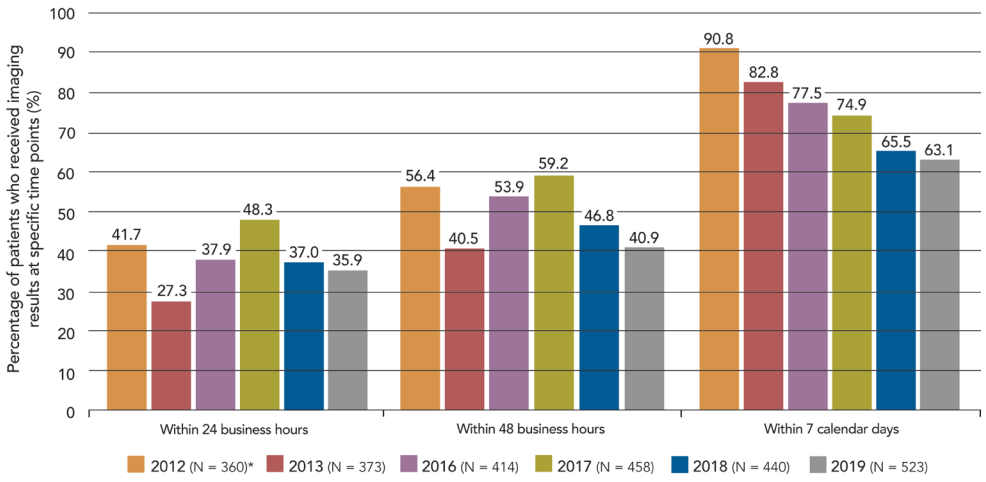
Providing Imaging Results to Patients

During calendar year 2019, the Mass Eye and Ear Neuro-Ophthalmology Service ordered and performed 523 outpatient neuroimaging scans (MRI and CT scans). Follow-up rates reflect the length of time from when the scan was performed to when the ordering physician was able to successfully reach the patient (not necessarily the first call to the patient).

Of the 523 imaging studies included in the 2019 analysis, scan follow-up rates were as follows: 188 scans (35.9%) were reviewed with the patient within one business day, 214 (40.9%) within two business days, 330 (63.1%) within seven calendar days, 386 (73.8%) within 14 calendar days, and 426 (81.5%) within one month.

To the best of our knowledge, there are no Ophthalmology studies that report the percentage of patients who receive imaging results at specified time points. The Veterans Health Administration published guidelines in 2009 stating that all test results should be given to patients within 14 calendar days after the test results are made available to the physician. Similar guidelines have been published in the European community.[1-3]

Of the 523 scans that were ordered by a physician in the Neuro-Ophthalmology Service and also completed at Mass Eye and Ear in 2019, 482 scans (92.2%) had documentation of when the patient was notified of the test results. Similar results were reported for calendar years 2012, 2013, 2016, 2017, and 2018 during which time 96.7% (348/360 scans), 94.9% (354/373 scans), 98.1% (406/414 scans), 92.8% (425/458 scans), 92.3% (406/440 scans), respectively, of scans had documentation of follow-up with the patient. A review of the literature revealed that physicians document their follow-up with patients for 64.3% to 100% of scans ordered.[4-5]



*Additional scans were identified for calendar year 2012 that were not reported in the previous publication. Inclusion of these cases changed the rate of follow-up within 24 hours from 150/348 scans (43.1%) to 150/360 scans (41.7%); follow-up within 48 hours from 203/348 scans (58.3%) to 203/360 scans (56.4%); and within seven days from 327/348 scans (94%) to 327/360 scans (90.8%).

The Mass Eye and Ear Neuro-Ophthalmology Service strives for favorable rates of follow-up for results of outpatient imaging studies. It is difficult to determine whether the decreased rate of results reporting to patients within seven calendar days over the past four years is truly representative of clinical care or due to difficulty with documentation in the electronic medical record. As a result, efforts are in place to both emphasize to providers the importance of this communication as well as improve ease of accurate documentation within the system.

References: [1]Singh H, Vij MS. Eight recommendations for policies for communicating abnormal test results. Jt Comm J Qual Saf 2010; 36(5): 226-232. [2]Sittig D, Singh H. Improving test result follow-up through electronic health records requires more than just an alert. J Gen Intern Med 2012; 27(10): 1235-1237. [3]Rosenberg RD, Haneuse SJ, Geller BM, et al. Timeliness of follow-up after abnormal screening mammogram: variability of facilities. Radiology 2011; 261(2): 404-413. [4]Callen JL, Westbrook JI, Georgiou A, et al. Failure to follow-up test results for ambulatory patients: a systematic review. J Gen Intern Med 2012; 27(10): 1334-1348. 5Casalino LP, Dunham D, Chin MH, et al. Frequency of failure to inform patients of clinically significant outpatient test results. Arch Intern Med 2009; 169(12): 1123-1129.

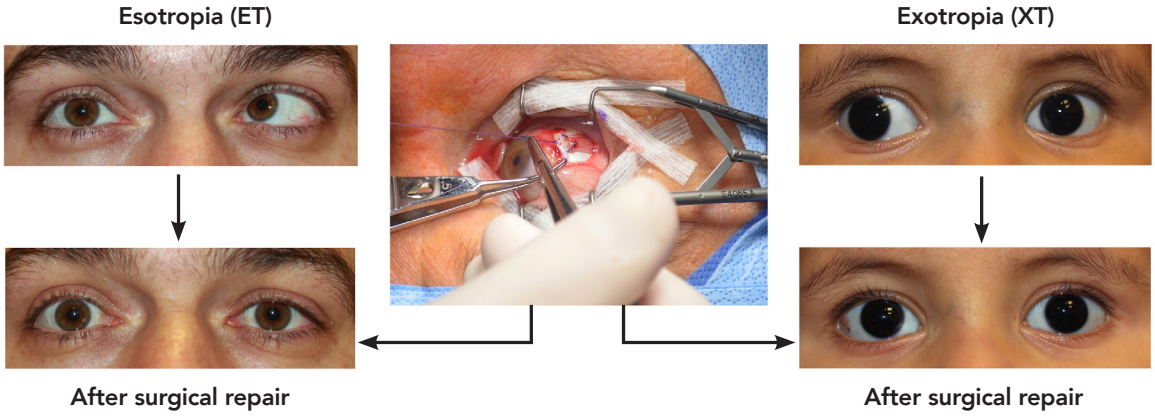
Pediatric and Adult Strabismus Surgery: Goal-Determined Outcomes

Ophthalmologists with joint appointments at Children's Hospital Ophthalmology Foundation and the Mass Eye and Ear Pediatric Ophthalmology and Strabismus Service offer subspecialized medical and surgical care for the full spectrum of pediatric ophthalmic disorders, including strabismus, cataract, glaucoma, oculoplastic surgery, neuro-ophthalmology, ocular trauma, ocular oncology, inherited retinal degenerations, and vitreoretinal surgery in addition to adult strabismus. This service is distinct from the Mass Eye and Ear Adult Strabismus Service, for which results are presented on earlier pages.

Strabismus surgery is the most commonly performed ophthalmic procedure in children, and is also performed on adults with new or previously existing misalignment. Recession and resection procedures are often performed for horizontal misalignment; other approaches include tuck, loop myopexy, myectomy, tenotomy, and transposition.

Since the desired surgical outcome depends on the primary indication for surgery, the department designed a goal-determined methodology to assess surgical outcomes.[1,2] The analysis shown below includes all patients treated for horizontal strabismus without exclusion, and therefore facilitates stratification based on the presence or absence of risk factors (ophthalmic or systemic) that might impact results. The reported outcomes include procedures performed at Harvard Ophthalmology affiliates by ophthalmologists with joint appointments at Children's Hospital Ophthalmology Foundation and the Mass Eye and Ear Pediatric Ophthalmology and Strabismus Service. Procedures reported by the Adult Neuro-Ophthalmology Service are not included in this analysis.

Pediatric and Adult Strabismus Surgery

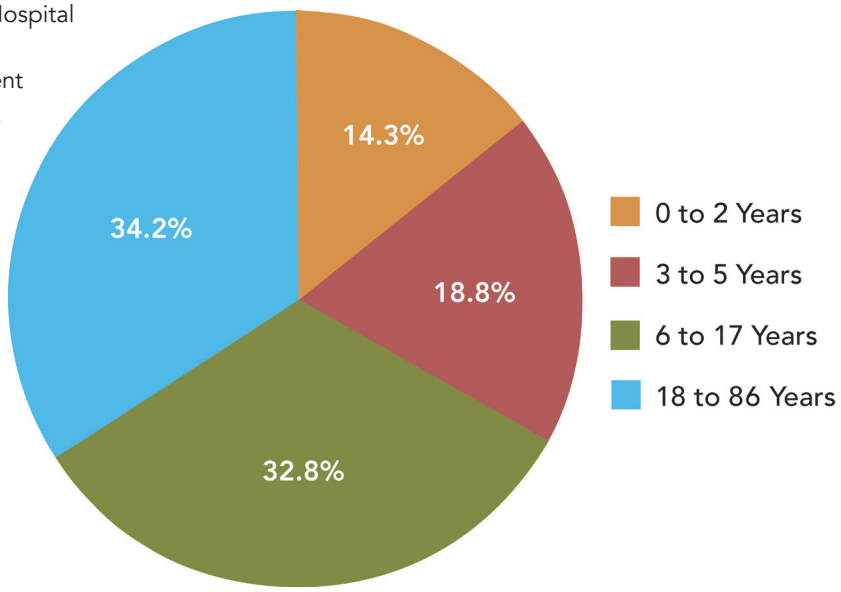


Preoperative and postoperative photos courtesy of Boston Children's Hospital, archive of ophthalmology department. Intraoperative photo courtesy of Garyfallia Pagonis.

References: [1]Ehrenberg M, Nihalani BR, Melvin P, Cain CE, Hunter DG, Dagi LR. Goal-determined metrics to assess outcomes of esotropia surgery. J AAPOS 2014; 18(3): 211-216. [2]Chang YH, Melvin P, Dagi LR. Goal-determined metrics to assess outcomes of exotropia surgery. J AAPOS 2015; 19: 304-310.

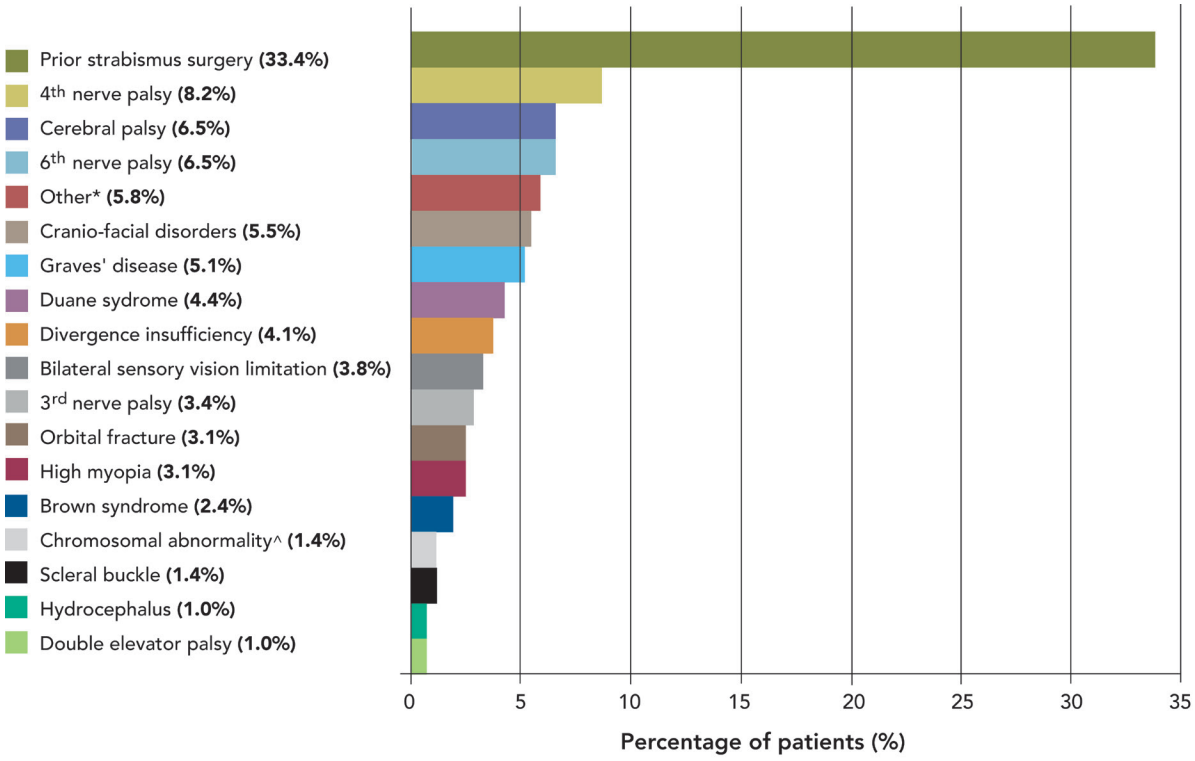
Distribution of Strabismus Patients by Age

The Strabismus Service at Children's Hospital Ophthalmology Foundation offers comprehensive evaluation and treatment for children and adults with strabismus. A total of 650 strabismus surgeries were performed in 2019, with patients ranging from eight months to 83 years of age.



Distribution of Risk Factors in Strabismus Patients

Of the 650 strabismus surgeries performed in 2019, a total of 310 patients presented with associated risk factors. The most common risk factors were prior strabismus surgery (33.4%), 4th nerve palsy (8.2%), and 6th nerve palsy (6.5%).

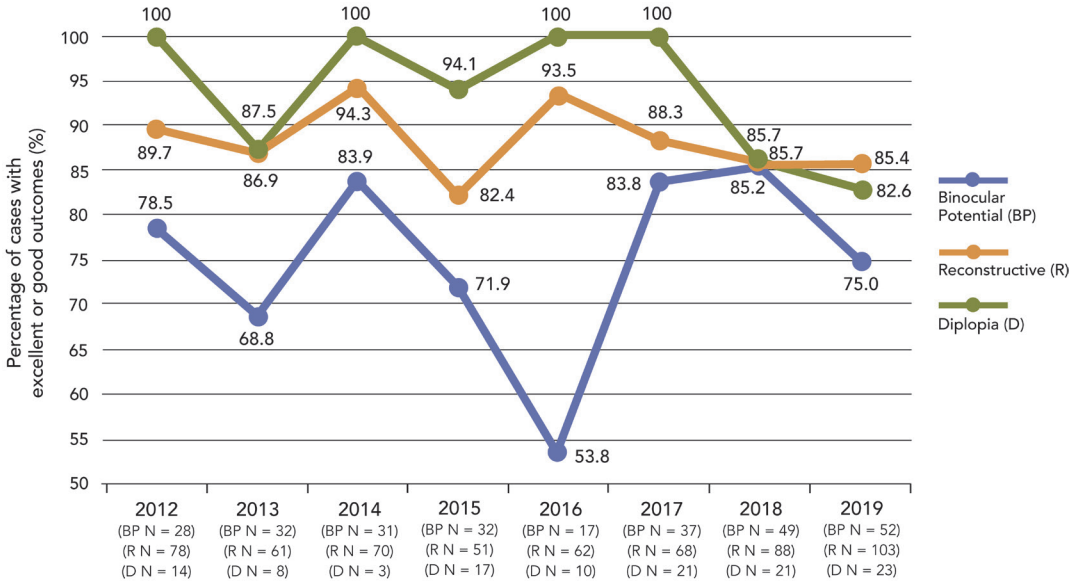


*Includes autism, retinopathy of prematurity, and optic nerve neuropathy

^Includes Down syndrome

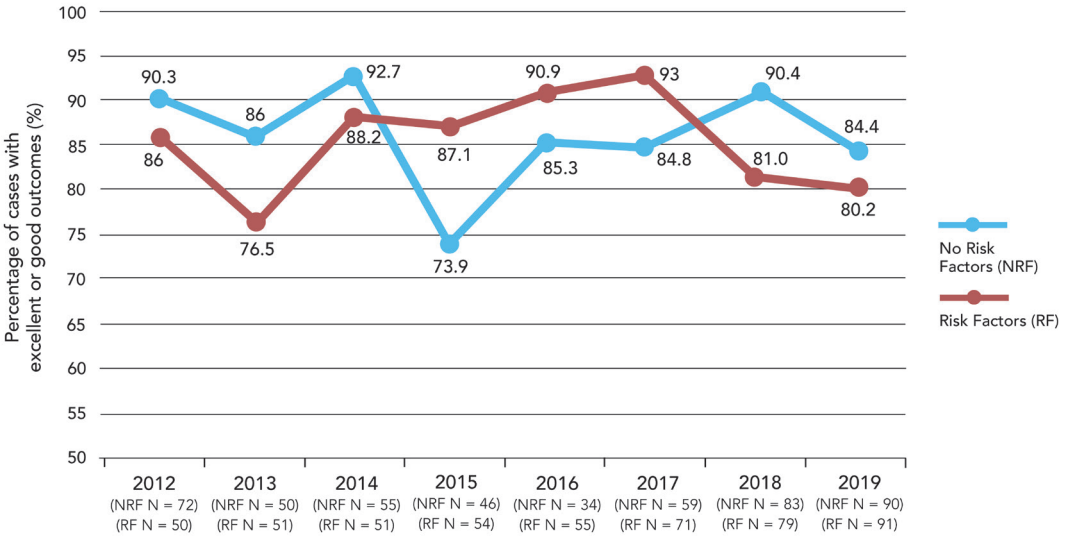
Exotropia Outcomes Stratified by Goal

In 2019, 181 patients with exotropia underwent strabismus surgery. Of these, 52 patients had surgery to restore binocular vision (binocular potential), 103 patients had reconstructive surgery for normalizing eye contact (reconstructive), and 23 patients had surgery to eliminate double vision (diplopia). The success rates (excellent or good outcome) were 75%, 85.4%, and 82.6%, respectively. Three surgeries complicated by risk factors were performed to resolve torticollis, and they have been excluded from this analysis due to the small number.



Exotropia Outcomes Stratified by Risk Factors

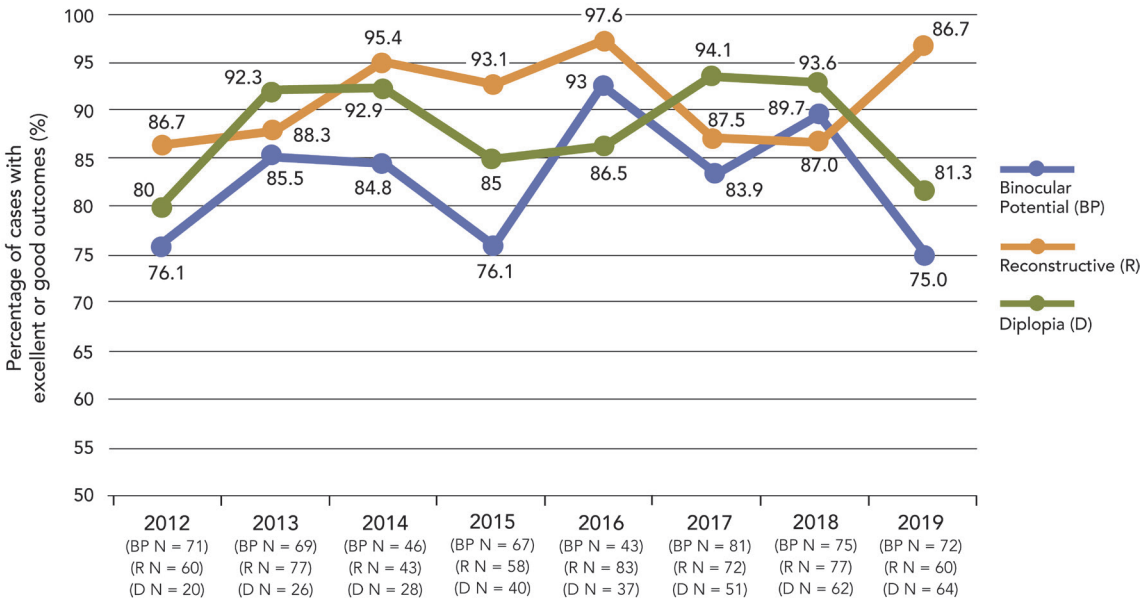
Of the 181 patients with exotropia, 91 patients had associated risk factors, and 90 patients had no associated risk factors. Risk factors include the following: bilateral vision limitation (e.g. albinism), conditions resulting in hyper- or hypotonia, craniosynostosis or craniofacial anomalies, 3rd nerve palsy, 4th nerve palsy, prior strabismus surgery, Duane syndrome, prior surgery for retinal detachment, Graves' orbitopathy, antecedent orbital trauma with or without orbital fracture, congenital fibrosis of the extraocular muscles, and simultaneous surgery for nystagmus or vertical strabismus. In the presence of these complicating conditions, 80% of strabismus surgeries for exotropia with an above risk factor had an excellent or good outcome, as defined by the metrics published by Chang et al.[1]



Reference: [1]Chang YH, Melvin P, Dagi LR. Goal-determined metrics to assess outcomes of exotropia surgery. J AAPOS 2015; 19: 304-310.

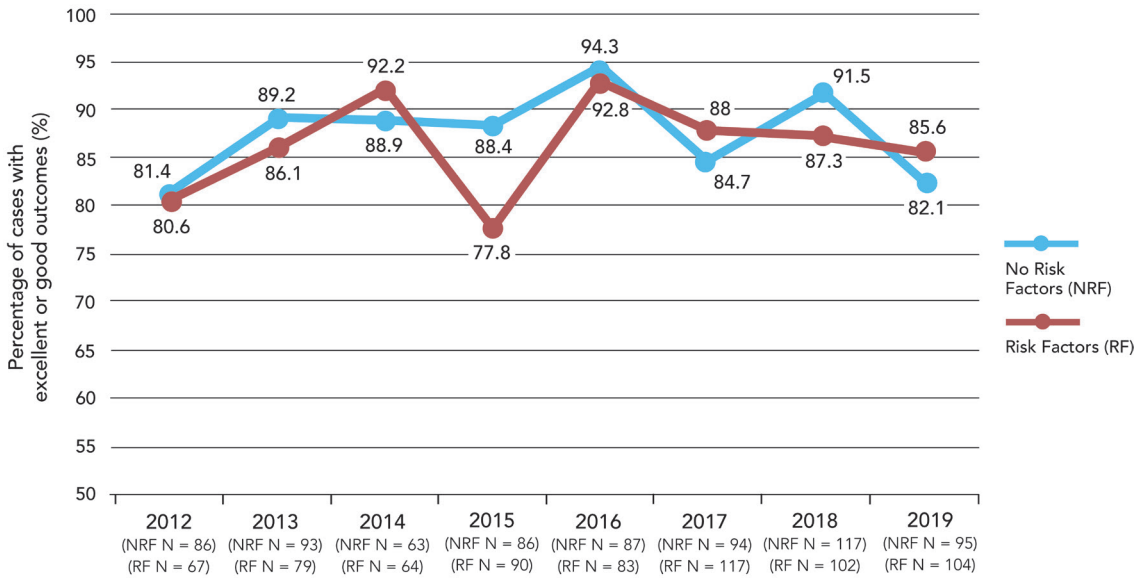
Esotropia Outcomes Stratified by Goal

In 2019, 199 patients with esotropia underwent strabismus surgery. Of these, 72 patients had surgery to restore binocular vision (binocular potential), 60 patients had reconstructive surgery for normalizing eye contact, and 64 patients had surgery to eliminate double vision (diplopia). The success rates (excellent or good outcome) were 75%, 96.7% and 81.3%, respectively. Three surgeries performed to resolve torticollis, which were complicated, have been excluded from this analysis due to the small number.



Esotropia Outcomes Stratified by Risk Factors

Of the 199 patients with esotropia, 104 patients had associated risk factors, and 95 patients had no associated risk factors. Despite these complicating conditions, 85.6% of strabismus surgeries for esotropia with an above risk factor had excellent or good outcomes as defined by the metrics published by Ehrenberg et al.[1]

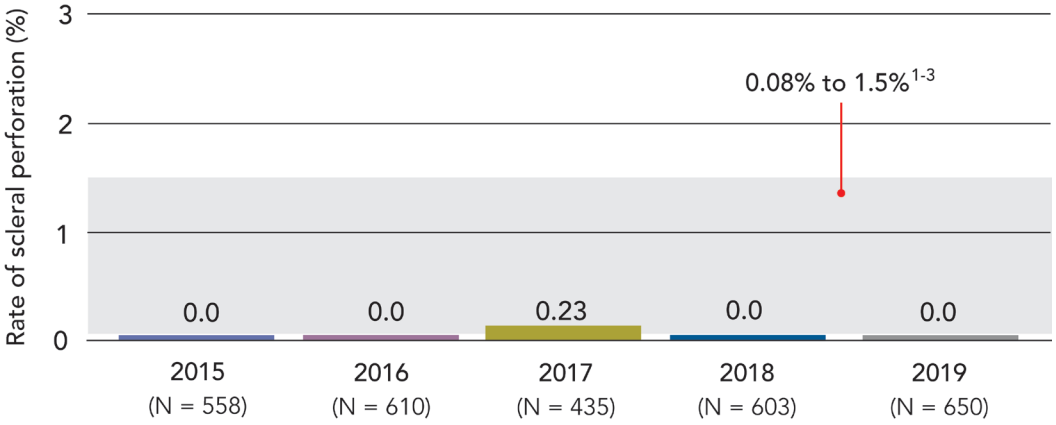


Reference: [1]Ehrenberg M, Nihalani BR, Melvin P, Cain CE, Hunter DG, Dagi LR. Goal-determined metrics to assess outcomes of esotropia surgery. J AAPOS 2014; 18(3): 211-216.

Scleral Perforation During Strabismus Surgery

Scleral perforation is a major complication of strabismus surgery, typically occurring during the reattachment of an eye muscle to the globe. An associated retinal hole can give rise to retinal detachment in some cases.

Of the 650 strabismus procedures performed in 2019, there were no cases of scleral perforation.



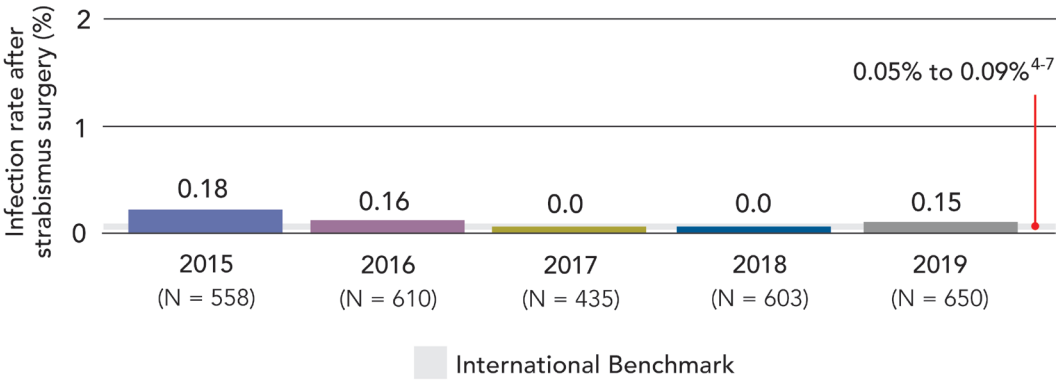
References: [1]Bradbury JA. What information can we give to the patient about the risks of strabismus surgery. Eye (Lond) 2015; 29(2): 252-257. [2]Awad AH, Mullaney PB, Al-Hazmi A, et al. Recognized globe perforation during strabismus surgery: incidence, risk factors, and sequelae. J AAPOS 2000; 4(3): 150-153. [3]Morris RJ, Rosen PH, Fells P. Incidence of inadvertent globe perforation during strabismus surgery. Br J Ophthalmol 1990; 74(8): 490-493.

Infection Within 30 Days After Surgery

Intra- or extraocular surgery may be complicated by postoperative infection. The types of infection after strabismus surgery that were included in this analysis were endophthalmitis, sub-Tenon's space abscess, subconjunctival abscess, and cellulitis.

Of the 650 strabismus surgery procedures performed in calendar year 2019, there was one case of postoperative pre-septal cellulitis. In calendar years 2015 and 2016, one of 558 procedures was complicated by a postoperative pre-septal cellulitis, and one of 610 procedures was complicated by postoperative pyomyositis of an extraocular muscle, respectively.

There were no postoperative infections for pediatric cataract and ptosis surgery procedures in calendar year 2019, which has been consistent since reporting began in 2013.[8-11]



References: [4]Ing MR. Infection following strabismus surgery. J Ophthalmic Nurs Technol 1991; 10(5): 211-214. [5]Bradbury JA. What information can we give to the patient about the risk of strabismus surgery. Eye (Lond) 2015; 29(2): 252-257. [6]Brenner C, Ashwin M, Smith D, et al. Sub-Tenon's space abscess after strabismus surgery. J AAPOS 2009; 13(2): 198-199. [7]Bradbury JA, Taylor RH. Severe complications of strabismus surgery. J AAPOS 2013; 17(1): 59-63. [8]Haripriya A, Chang DF, Reena M, et al. Complication rates of phacoemulsification and manual small-incision cataract surgery at Aravind Eye Hospital. J Cataract Refract Surg 2012; 38(8): 1360-1369. [9]Sharma N, Pushker N, Dada T, et al. Complications of pediatric cataract surgery and intraocular lens implantation. J Cataract Refract Surg 1999; 25(12): 1585-1588. [10]Pandey SK, Wilson ME, Trivedi RH, et al. Pediatric cataract surgery and intraocular lens implantation: current techniques, complications, and management. Int Ophthalmol Clin 2001; 41(3): 175-196. [11]Lee EW, Holtebeck AC, Harrison AR. Infection rates in outpatient eyelid surgery. Ophthal Plast Reconstr Surg 2009; 25(2): 109-110.

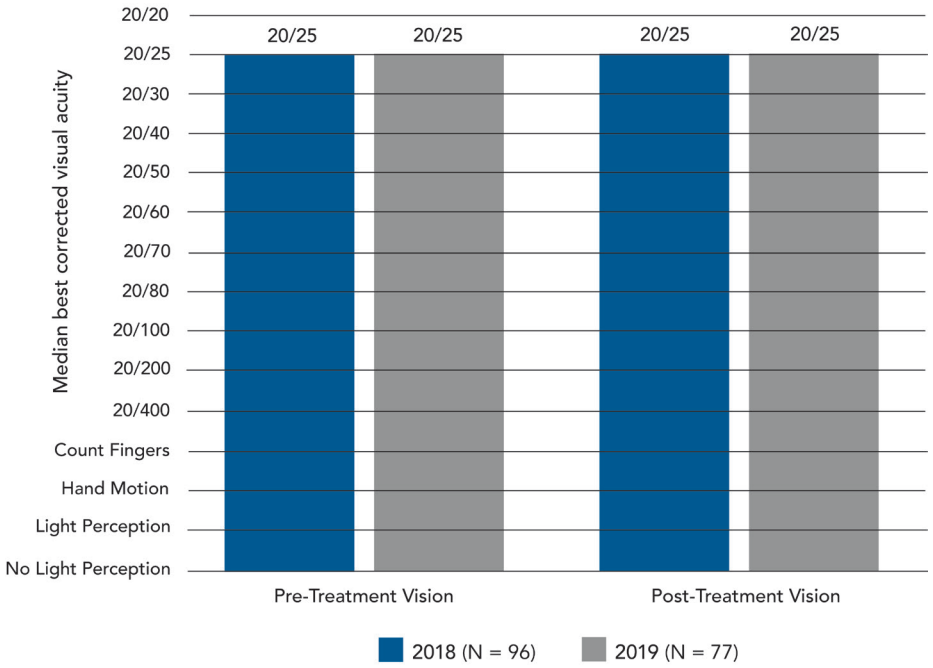
Ocular Immunology and Uveitis Service

Treatment for uveitis and other ocular inflammatory conditions requires a multidisciplinary approach that involves internal medicine and ophthalmology. At the Mass Eye and Ear Ocular Immunology and Uveitis Service, patients are treated with a range of therapies, including eye drops, prescription NSAIDs, and systemic immunosuppressive medications.

Median Post-Treatment Vision for Acute Anterior Uveitis

During calendar year 2019, 329 patients presented with acute anterior uveitis to the Mass Eye and Ear Emergency Department (ED). Of these 329 patients, 77 had a follow-up within one month of their ED visit at the Mass Eye and Ear Ocular Immunology and Uveitis Service. In general, patients with uveitis with perceived higher acuity in the ED are referred to the Uveitis Service; other patients with uveitis are followed by the Comprehensive Ophthalmology Service.

The nationally established IRIS measure for acute anterior uveitis (IRIS51) by the American Academy of Ophthalmology (updated 1/2020) defines treatment success as achievement of best corrected visual acuity of 20/20 or better or back to baseline within 90 days of treatment. The majority of patients who presented to our ED were new and as such did not have a baseline vision. Therefore, instead, visual acuity was recorded for those 77 patients at presentation to the ED and compared to their visual acuity at their post-treatment follow-up visit closest to three months. Ninety-five eyes of 77 patients were included in the following analysis. The median pre-treatment vision (vision at presentation) and the median post-treatment vision was 20/25. Of the 77 patients, 54 (70.1%) had a visual acuity of 20/25 or better at their three month follow-up visit.



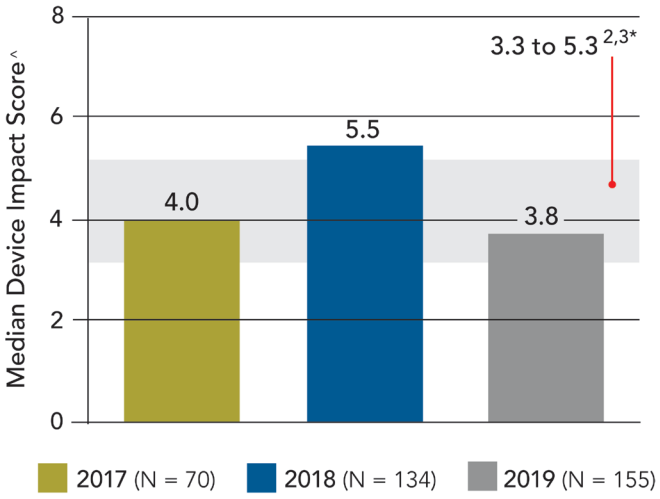
Vision Rehabilitation Service

The Mass Eye and Ear Vision Rehabilitation Service offers multidisciplinary, comprehensive, and personalized treatment for patients with low vision. Interventions address patient safety, continued participation in activities despite vision loss, psychosocial adjustment to low vision, and difficulties with reading and activities of daily living.

Psychosocial Impact of Assistive Devices Scale

Psychosocial impact of assistive device scales (PIADS)[1] have been the primary quality outcome measure for the Vision Rehabilitation Service since 2017. It consists of 26 items of a few words or less (i.e. "competence," "happiness," "independence," "embarrassment") that fall into three broader categories in which the patient is asked to rate their vision assistive device as decreasing (0 to -3) or increasing (0 to +3) that term. The combined scores in each category are then summed to give a total score ranging from -9 to +9, with 0 being no impact, 9 being maximum positive impact, and -9 being maximum negative impact. Over the past 20 years, the PIADS has gained favor in various fields of rehabilitation research and clinical practice. It is easy to administer and does not require pre- and post-rehabilitation administration.

During calendar year 2019, 155 patients both reported using a device and took part in the PIADS questionnaire looking at the impact of a prescribed assistive device (i.e. spectacle-mounted or hand-held magnifying device). The median scores are shown in the graph.



^0 = No Impact, 9 = Maximum Positive Impact

*Benchmark values are based on studies limited to CCTV device users. Our data includes all devices.

The median visual acuity of patients tested with a device in 2019 was 20/100 at distance and 20/125 (2.5M) at near. Over the past three years, there have been statistically significant differences in impact scores for different devices ($p<0.001$) with the highest being telescopes (6.6), hand-held electronic magnifiers (6.0), and smartphone/tablet devices (5.5). The top three devices most frequently reported by patients as being their most useful in 2019 were hand-held magnifiers, smartphones/tablets, and magnifier reading glasses. There were no differences in impact scores based on primary ophthalmic diagnosis ($p=0.38$).

Image of a patient using a vision assistive device that magnifies text on a page.

Photo by Pierce Harman.

References: [1]Jutai J, Day H. Psychosocial impact of assistive devices scale (PIADS). Technol Disabil 2002; 14: 107-111. [2]Huber J, Jutai J, Strong G, Plotkin A. The psychosocial Impact of closed-circuit televisions on persons with age-related macular degeneration. J Vis Impair Blind 2008; 102: 690-701. [3]Strong G, Jutai J, Bevers P, Hartley M, Plotkin A. The psychosocial impact of closed-circuit television (CCTV) low vision aids. Vis Impair Res 2003; 5: 179-190.

Photo by Garyfallia Pagonis.

Ophthalmology Medical Staff and Practice Locations

Ophthalmology Central Referral and Appointments

617-573-3202

Comprehensive Ophthalmology and Cataract Consultation

617-573-3202
Service Director: Sherleen H. Chen, MD
Grayson Armstrong, MD, MPH
Sheila Borboli-Gerogiannis, MD
Stacey C. Brauner, MD
Han-Ying Peggy Chang, MD
Elizabeth Fortin, MD
Matthew F. Gardiner, MD
Scott H. Greenstein, MD
Kristine Tan Lo, MD
Alice C. Lorch, MD, MPH
Zhonghui (Katie) Luo, MD, PhD
Brendan McCarthy, MD
George N. Papaliodis, MD
Jane G. Schweitzer, MD
Christian E. Song, MD
Aisha S. Traish, MD
Ryan A. Vasan, MD
Daniel M. Vu, MD
Silas L. Wang, MD

Cornea and External Disease

617-573-3938
Service Director: Reza Dana, MD, MSc, MPH
Associate Service Director:
James Chodosh, MD, MPH
Sheila Borboli-Gerogiannis, MD
Han-Yin Peggy Chang, MD
Joseph B. Ciolino, MD
Emma C. Davies, MD
Claes H. Dohlman, MD, PhD
Thomas Dohlman, MD
Kathryn M. Hatch, MD
Deborah S. Jacobs, MD, MS
Ula V. Jurkunas, MD
Zhonghui (Katie) Luo, MD, PhD
Roberto Pineda II, MD
Hajirah N. Saeed, MD
Aisha S. Traish, MD
Nandini Venkateswaran, MD
Jia Yin, MD, PhD, MPH

Ophthalmology Emergency, Consult, and Hospitalist Services

617-573-3431
Service Director: Matthew F. Gardiner, MD
Jo-Ann E. Haney-Tilton, MD
John H. Kempen, MD, MPH, MHS, PhD
Jane Schweitzer, MD
Aisha S. Traish, MD
Prashant Yadav, MD

Eye Trauma Appointments

617-573-3022
Service Director:
Grayson Armstrong, MD, MPH (AY20)

Glaucoma

617-573-3670
Service Director:
David S. Friedman, MD, PhD, MPH
Michael V. Boland, MD, PhD
Teresa C. Chen, MD
Cynthia L. Grosskreutz, MD, PhD
Michael M. Lin, MD
Milica Margeta, MD, PhD
Courtney L. Ondeck, MD, MPhil
Lucy Q. Shen, MD
David A. Solá-Del Valle, MD
Allison R. Soneru, MD
Daniel Vu, MD
Janey L. Wiggs, MD, PhD
Nazlee Zebardast, MD, MSc

Neuro-Ophthalmology

617-573-3412
Service Director: Joseph F. Rizzo III, MD
Dean M. Cestari, MD
Bart K. Chwalisz, MD
Elizabeth Fortin, MD
Eric D. Gaier, MD, PhD
John W. Gittinger, Jr., MD
Robert M. Mallery, MD

Adult Strabismus

(Mass Eye and Ear)

617-573-3412
Service Director: Dean M. Cestari, MD

Ophthalmology Medical Staff and Practice Locations (continued)

Ocular Oncology

617-573-3202
Mary E. Aronow, MD
Han-Ying Peggy Chang, MD
Thaddeus P. Dryja, MD
Suzanne K. Freitag, MD
Evangelos S. Gragoudas, MD
Ivana K. Kim, MD
Nahyoung Grace Lee, MD
Daniel R. Lefebvre, MD
Shizuo Mukai, MD
Natalie Wolkow, MD, PhD
Michael K. Yoon, MD

Ophthalmic Pathology

617-573-3319
Service Director: Anna Stagner, MD
Thaddeus P. Dryja, MD
Natalie Wolkow, MD, PhD

Ophthalmic Plastic Surgery

617-573-5550
Service Director: Suzanne K. Freitag, MD
Lynette Johns, OD
Nahyoung Grace Lee, MD
Daniel R. Lefebvre, MD
Natalie Wolkow, MD, PhD
Michael K. Yoon, MD

Optometry/Contact Lens

617-573-3185
Service Director: Amy C. Watts, OD
Mark M. Bernardo, OD
Shannon M. Bligdon, OD
Haley D. Italia, OD
Yan Jiang, OD, PhD
Lynette K. Johns, OD
Charles D. Leahy, OD, MS
Patrick Lee, OD
Brittney J. Mazza, OD
Michelle J. Sandler, OD
Amy F. Scally, OD
Karen L. Zar, OD
Xiaohong Zhou, OD, PhD

Pediatric Ophthalmology and Adult Strabismus

(an on-site collaboration with Children's Hospital Ophthalmology Foundation)

617-355-6401
Ophthalmologist-in-Chief, Boston Children's Hospital:
David G. Hunter, MD, PhD
Service Director, Mass Eye and Ear:
Melanie A. Kazlas, MD and Dean Cestari, MD
Maan S. Alkharashi, MD
Anna Maria Baglieri, OD
Kimberley W. Chan, OD
Linda R. Dagi, MD
Alexandra Elliott, MD
Anne Fulton, MD
Bharti Gangwani, MD
Eric D. Gaier, MD, PhD
Efren Gonzalez, MD
Carolyn Graeber, MD
Joseph Griffith, MD
Gena Heidary, MD, PhD
Suzanne Johnston, MD, MPH
Anna Kirillova, OD
Danielle Ledoux, MD
Jason Mantagos, MD
Kathryn Miller, OD
Preeti Mokka, OD
Eric Moulton, OD, PhD
Robert Petersen, MD
Aparna Raghuram, OD, PhD
Hajirah Saeed, MD
Michelle J. Sandler, OD
Ankoor S. Shah, MD, PhD
Lois Smith, MD, PhD
Aisha Traish, MD
Deborah Vanderveen, MD
Mary C. Whitman, MD, PhD
Emily Wiecek, OD, PhD
Carolyn S. Wu, MD, PhD

continued on page 54

Ophthalmology Medical Staff and Practice Locations (continued)

Refractive Surgery

1-833-LASER-99
Service Director: Kathryn M. Hatch, MD
Emma C. Davies, MD
Ula V. Jurkunas, MD
Zhonghui (Katie) Luo, MD, PhD
Roberto Pineda II, MD
Hajirah N. Saeed, MD
Christian E. Song, MD
Nandini Venkateswaran, MD
Jia Yin, MD, PhD, MPH

Retina

617-573-3288
Service Director: Dean Eliott, MD
Associate Director: Demetrios G. Vavvas, MD, PhD
Mary E. Aronow, MD
Jason I. Comander, MD, PhD
Evangelos S. Gragoudas, MD
Rachel Huckfeldt, MD, PhD
Deeba Husain, MD
Ivana K. Kim, MD
Leo A. Kim, MD, PhD
Magdalena G. Krzystolik, MD
Jan A. Kylstra, MD
Joan W. Miller, MD
John B. Miller, MD
Shizuo Mukai, MD
Nimesh Patel, MD
Lucia Sobrin, MD, MPH
Lucy H. Y. Young, MD, PhD

Inherited Retinal Disorders

617-573-3621
Service Director: Eric A. Pierce, MD, PhD
Associate Director: Jason I. Comander, MD, PhD
Rachel Huckfeldt, MD, PhD

Uveitis and Immunology

617-573-3591
Service Director: George N. Papaliodis, MD
Nicholas J. Butler, MD
Reza Dana, MD, MSc, MPH
John H. Kempen, MD, PhD, MHS, MPH
Lucia Sobrin, MD, MPH
Lucy H.Y. Young, MD, PhD

Vision Rehabilitation

617-573-4177
Service Director: Amy Watts, OD
Calliope J. Galatis, OD
Kevin E. Houston, OD, MSc
Patrick Lee, OD
Lotfi B. Merabet, OD, PhD, MPH

Practice Locations

Mass Eye and Ear, Main Campus
243 Charles Street, Boston, MA 02114
617-573-3202

Mass Eye and Ear, Foxborough
22 Patriot Place, Foxborough, MA 02035
617-573-3202
Site Director: Amy Watts, OD

Mass Eye and Ear, Longwood
800 Huntington Avenue, Boston, MA 02115
617-398-2947
Site Director: Sheila Borboli-Gerogiannis, MD

Mass Eye and Ear, Malden
578 Main Street, Suite 102
Malden, MA 02148
781-321-6544
Site Director: Ryan Vasan, MD

Mass Eye and Ear, Plainville
30 Man Mar Drive, Suite 2
Plainville, MA 02762
508-695-9550
Site Director: Magdalena Krzystolik, MD

Mass Eye and Ear, Providence
One Randall Square, Suite 203
Providence, RI 02904
401-453-4600
Site Director: Magdalena Krzystolik, MD

Mass Eye and Ear, Stoneham
1 Montvale Avenue, Stoneham, MA 02180
781-279-4418
Site Director: Han-Ying Peggy Chang, MD
Director of Mass Eye and Ear
Retina Consultants: Deeba Husain, MD

Mass Eye and Ear, Waltham
1601 Trapelo Road, Reservoir Place, Suite 184
Waltham, MA 02451
781-890-1023
Site Director: Kathryn M. Hatch, MD

Contributors

Joshua Agranat
Christopher Andreoli
Grayson Armstrong
Jennifer Aspesi
Olamide Awosanya
Sandra Baptista
Syritta Barrows
Linda Belkner
Sheila Borboli-Gerogiannis
Stacey Brauner
Dean Cestari
Peggy Chang
Kathleen Charbonnier
Sherleen Chen
Teresa Chen
Liza Cohen
Marcio Correa
Kevin D'hooge
Linda Dagi
Mohammad Dahrouj
Reza Dana
Emma Davies
Mary DeFazio
Jose Diaz
Anne-Marie Donnelly
Erin Duggan
Marlene Durand
Dean Eliott
Lisa Endo
Elizabeth Fortin
Suzanne Freitag
David Friedman
Matthew Gardiner
Deborah Gass
Evangelos Gragoudas
Scott Greenstein
Kathryn Hatch
Kathleen Holmes
Kevin Houston
Wen Hu
David Hunter
Ryan Jaslow
Karen Jeng-Miller
Ula Jurkunas
Melanie Kazlas
Mary Kennedy
Ivana Kim
Anne Marie Lane
Daniel Lefebvre
Olga Levy
Patricia Li
Michael Lin
Wendy Liu
Kristine Lo
Katie Luo
Milica Margeta
Christina Marko
Jonathan Mazzone
Brendan McCarthy
Shannon McDonough
Fran McDonald
Matthew McKay
John Miller
Anne Murphy
Sheelagh Nelis-Swain
Victoria North
George Papaliodis
Tatyana Pearson
Corinne Powers
Michael Price
Janet Razulis
Edith Reshef
Mike Ricci
Debbie Rich
Joseph Rizzo III
Rosa Rojas
Lizzy Rossin
Ankoor Shah
Damon Singletary
JuDana Smith
Lucia Sobrin
Christian Song
Jennifer Street
Marisa Tieger
Lisa Tom
Dave Tosatti
Aisha Traish
Debra Trocchi
Ryan Vasan
Ann Vinton
Huy Vu Nguyen
Silas Wang
Yvonne Wang
Amy Watts
Julia Wong
Amy Yuan

Research fellows:
Colleen Szypko
Thong Ta

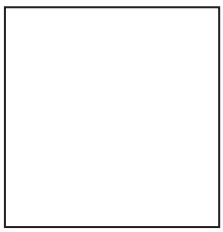
Graphic Design by:
Garyfallia Pagonis

Appendix

Service	Description of Change Compared to Prior Years
TRAUMA SERVICE	
Median Postoperative Vision	Removed to combine with Ocular Trauma Score
GLAUCOMA SERVICE	
Trabeculectomy and Tube Shunt Infection Rates	Updated metrics to reflect infection rates within 30 days of procedure
Mitomycin C Trabeculectomy Reoperation Rates at One Month and Six Months	Removed in favor of new outcome measure
Glaucoma Laser Surgery: Intraocular Pressure (IOP) Spikes	Removed in favor of new outcome measure

Photo by Garyfallia Pagonis.

MASSACHUSETTS
EYE AND EAR



MASSACHUSETTS
EYE AND EAR

243 Charles Street, Boston, MA 02114-3096
617-523-7900 | 617-523-5498 (T.D.D.)
MassEyeAndEar.org