Measuring Outcomes Promotes Quality Improvement
Measuring and understanding outcomes of medical treatments promotes quality improvement. Cleveland Clinic has created a series of Outcomes books similar to this one for its clinical institutes. Designed for a physician audience, the Outcomes books contain a summary of many of our surgical and medical treatments, with a focus on outcomes data and a review of new technologies and innovations.

The Outcomes books are not a comprehensive analysis of all treatments provided at Cleveland Clinic, and omission of a particular treatment does not necessarily mean we do not offer that treatment. When there are no recognized clinical outcome measures for a specific treatment, we may report process measures associated with improved outcomes. When process measures are unavailable, we may report volume measures; a relationship has been demonstrated between volume and improved outcomes for many treatments, particularly those involving surgical and procedural techniques.

In addition to these institute-based books of clinical outcomes, Cleveland Clinic supports transparent public reporting of healthcare quality data. The following reports are available to the public:

- Joint Commission Performance Measurement Initiative (qualitycheck.org)
- Centers for Medicare and Medicaid Services (CMS) Hospital Compare (HospitalCompare.hhs.gov), and Physician Compare (medicare.gov/PhysicianCompare)
- Cleveland Clinic Quality Performance Report (clevelandclinic.org/QPR)

Our commitment to transparent reporting of accurate, timely information about patient care reflects Cleveland Clinic’s culture of continuous improvement and may help referring physicians make informed decisions.

We hope you find these data valuable, and we invite your feedback. Please send your comments and questions via email to:
OutcomesBooksFeedback@ccf.org or scan here.

To view all of our Outcomes books, please visit clevelandclinic.org/outcomes.
Dear Colleague:

Welcome to this 2014 Cleveland Clinic Outcomes book. Every year, we publish Outcomes books for 14 clinical institutes with multiple specialty services. These publications are unique in healthcare. Each one provides an overview of medical or surgical trends, innovations, and clinical data for a particular specialty over the past year. We are pleased to make this information available.

Cleveland Clinic uses data to manage outcomes across the full continuum of care. Our unique organizational structure contributes to our success. Patient services at Cleveland Clinic are delivered through institutes, and each institute is based on a single disease or organ system. Institutes combine medical and surgical services, along with research and education, under unified leadership. Institutes define quality benchmarks for their specialty services and report on longitudinal progress.

All Cleveland Clinic Outcomes books are available in print and online. Additional data are available through our online Quality Performance Report (clevelandclinic.org/QPR). The site offers process measure, outcome measure, and patient experience data in advance of national and state public reporting sites.

Our practice of releasing annual outcomes books has become increasingly relevant as healthcare transforms from a volume-based to a value-based system. We appreciate your interest and hope you find this information useful and informative.

Sincerely,

Delos M. Cosgrove, MD
CEO and President
Dear Colleagues,

I am pleased to share 2014 Outcomes from the Cole Eye Institute. Cleveland Clinic was the first large academic medical center to prospectively collect and report outcomes data. Thanks to the commitment of countless individuals and strong physician leaders, this process has become central to our quality of care.

2014 was another record year, as Cole Eye Institute:

- Evaluated more patients and performed more surgeries than in any previous year
- Launched many new clinical trials and basic research initiatives involving inherited retinal diseases, regenerative medicine, imaging, intraoperative optical coherence tomography (OCT), developmental angiogenesis, and infectious keratitis
- Completed rollout of the electronic medical record to all regional satellites, integrating not only records but also all images across the enterprise
- Had staff members continue to serve as editors-in-chief or on editorial boards for every major ophthalmology publication
- Received 500 applications to our highly ranked residency program, with exceptional matches
- Completed the inaugural yearlong surgical education course for first-year residents in our new, leading-edge surgical education laboratory
- Welcomed a new retina specialist, cornea specialist, pediatric ophthalmologist, oculoplastics specialist, and general ophthalmologist

Cole Eye Institute is one of the nation’s largest academic clinical ophthalmology practices. As we grow, we remain committed to improving efficiency, reducing costs, and providing superb, value-based care.

We welcome your feedback, questions, and ideas for collaboration. Please contact me via email at OutcomesBooksFeedback@ccf.org and reference the Cole Eye Institute book in your message.

Sincerely,

Daniel F. Martin, MD
Chairman, Cole Eye Institute
Cleveland Clinic Cole Eye Institute is a leader in ophthalmologic care today and is committed to innovative basic, clinical, and translational research designed to transform ophthalmologic care tomorrow. Cleveland Clinic’s ophthalmology program is ranked No. 7 in the country in the U.S. News & World Report “Best Hospitals” survey (2014-2015), the top ranking in Ohio.

Cole Eye Institute’s staff of 45 ophthalmologists and researchers is composed almost entirely of subspecialists in cornea and external disease; glaucoma; keratorefractive surgery; neuro-ophthalmology; oculoplastics and orbital surgery; ophthalmic oncology; pediatric ophthalmology and adult strabismus; and vitreoretinal care. Comprehensive general ophthalmologists round out the program, which also includes optometrists.

Cole Eye Institute has advanced research laboratories and a leading-edge training facility at Cleveland Clinic’s main campus, where patient care is also offered. Cole Eye Institute’s staff also provides primary, secondary, and tertiary services for patients of all ages at a growing number of family health centers and specialty centers across Northeast Ohio.

### 2014 Cole Eye Institute Key Statistics

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Clinic Visits</td>
<td>177,812</td>
</tr>
<tr>
<td>Total Surgeries</td>
<td>8220</td>
</tr>
<tr>
<td>Total Surgical Procedures (surgeries in operating rooms and all outpatient procedures)</td>
<td>10,220</td>
</tr>
<tr>
<td>Total Laser Procedures</td>
<td>2040</td>
</tr>
<tr>
<td>Annual Research Funding Level</td>
<td>$11,532,698 (including $4,743,369 from federal sources)</td>
</tr>
</tbody>
</table>
Cataract surgery is the most commonly performed surgical procedure in ophthalmology and thus represents a significant proportion of the surgical caseload performed at Cleveland Clinic Cole Eye Institute. In 2014, a total of 3024 cataract extraction procedures were performed, and outcomes were tracked on 2702 of these procedures.

Intraoperative complications during cataract surgery were uncommon, occurring in only 0.8% of patients. The most common complication was a capsular tear, reported in 0.26% of patients, most of whom ended up with excellent vision.

### Intraoperative Complications (N = 2702)

<table>
<thead>
<tr>
<th>Complication</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>99.22%</td>
</tr>
<tr>
<td>Posterior capsule tear</td>
<td>0.26%</td>
</tr>
<tr>
<td>Vitreous loss</td>
<td>0.19%</td>
</tr>
<tr>
<td>Iris trauma</td>
<td>0.15%</td>
</tr>
<tr>
<td>Retained lens</td>
<td>0.07%</td>
</tr>
<tr>
<td>Zonular dialysis</td>
<td>0.07%</td>
</tr>
<tr>
<td>Choroidal hemorrhage</td>
<td>0.04%</td>
</tr>
</tbody>
</table>
Postoperative complications were also rare, occurring in 1.2% of patients operated on at main campus and who had follow-up appointments from 1 to 12 months after surgery. These included cystoid macular edema (0.58%), acute endophthalmitis (0.41%), intraocular pressure greater than 30 mm Hg (0.16%), and unexpected refractive outcome (0.08%).

**Postoperative Complications (N = 1215)**
January – December 2014

- **None**: 98.77%
- **Complications**: 1.23%
  - 0.58% Cystoid macular edema
  - 0.41% Acute endophthalmitis
  - 0.16% Intraocular pressure > 30 mm Hg
  - 0.08% Unexpected refractive outcome
One of the goals of cataract surgery is improving visual acuity, which is accomplished for the vast majority of patients at Cole Eye Institute. Visual acuity, as measured by the ETDRS (Early Treatment Diabetic Retinopathy Study) protocol, was tracked for 839 patients who came back for follow-up after 1 to 12 months. There was a \( \geq 15 \) letter improvement in ETDRS protocol refraction visual acuity in 43.27% of these patients, and 46.60% had a < 15 letter improvement. The remaining 10.13% had no change or a decrease from baseline status.

**ETDRS Vision Improvement**

October 2011 – September 2012  
January 2013 – December 2013  
January 2014 – December 2014

<table>
<thead>
<tr>
<th>Vision Improvement</th>
<th>2011 – 12</th>
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<th>2014</th>
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<tr>
<td>No Change or Worse</td>
<td>36</td>
<td>160</td>
<td>85</td>
</tr>
<tr>
<td>1 – 14 Letters Improvement</td>
<td>332</td>
<td>370</td>
<td>391</td>
</tr>
<tr>
<td>( \geq 15 ) Letters Improvement</td>
<td>265</td>
<td>363</td>
<td>363</td>
</tr>
</tbody>
</table>
Because Cole Eye Institute is a tertiary care center, patients referred for surgery often have multiple, simultaneous eye diseases that can influence visual potential and limit the ability to predict precise refractive outcome. These comorbidities may explain the limited visual improvement in some patients. Among patients undergoing cataract surgery at the institute in 2014, comorbidities affecting the retina or cornea were most common, followed by glaucoma and uveitis.

**Ocular Comorbidities (N = 2702)**

2014

76.46% None

23.54% Complications

- 11.88% Vitreoretinal conditions
- 5.07% Corneal conditions
- 4.92% Glaucoma
- 0.63% Uveitis
- 1.04% Other

**Difference Between Actual and Target Refractive Error (N = 565)**

2014

Most patients achieved a refractive outcome following cataract surgery that was near the anticipated target. Despite the large number of patients with other conditions that can influence the refractive outcome, or the accuracy in measuring the final refractive error, 93% of patients achieved a final spherical equivalent refractive error within 1 diopter of the expected result.
Cornea Surgery

Corneal transplant surgeons at Cleveland Clinic’s Cole Eye Institute perform state-of-the-art procedures for numerous conditions that distort or cloud the normally transparent cornea. Traditional full-thickness procedures, also known as penetrating keratoplasties (PK), made up the majority of the grafts performed 6 years ago. Today, Cole Eye Institute surgeons are contributing to the advancement of lamellar corneal transplant procedures in which only the diseased portion of the cornea is replaced. Using a procedure called Descemet’s stripping automated endothelial keratoplasty (DSAEK), surgeons selectively transplant the endothelium for conditions such as pseudophakic bullous keratopathy and Fuchs endothelial dystrophy. These patients experience faster visual recovery and more stable and predictable refractive outcomes than do patients treated with traditional PK. During 2014, 46 PKs and 132 DSAEKs were performed. This is consistent with an international trend toward less invasive corneal transplant procedures for endothelial disease.

Cole Eye Institute has also started offering Descemet membrane endothelial keratoplasty (DMEK), a procedure that involves placement of an even thinner graft than with DSAEK. Corneal transplant surgeons at the institute have integrated intraoperative optical coherence tomography into their approach to lamellar transplant surgeries such as DSAEK and deep anterior lamellar keratoplasty (DALK) to better identify surgical endpoints in real time and to study the effect of enhanced intraoperative visualization on postoperative outcomes. Eye surgeons across the institute are participating in a comprehensive prospective study of this technology in a variety of applications.

After DSAEK or DMEK, 95% of grafts remained clear at 3 to 12 months. For PK patients, 93% of grafts remained clear at 3 to 12 months. Institute surgeons also performed DALK for corneal scars and keratoconus; in this procedure, the recipient’s anterior cornea is replaced but the patient’s healthy endothelium is retained, eliminating the risk of endothelial rejection.

Highly specialized transplants are performed in smaller numbers for uncommon sight-threatening corneal conditions. For end-stage corneal disease in patients who were not candidates for other forms of transplantation, synthetic corneas (Boston keratoprostheses) were implanted to allow them to regain their visual function.
The mean improvement in ETDRS visual acuity score in DSAEK patients was 29.30 letters, corresponding to an improvement of over 5 lines of visual acuity. PK patients had worse preoperative vision than DSAEK patients and gained a mean of 35.60 letters, equivalent to 7 lines of visual acuity. N = patients who completed 3 to 12 months of follow-up after DSAEK or PK.

The only intraoperative complication was a case of vitreous prolapse with intraocular lens dislocation.

At 3 to 12 months, the postoperative complication rate was 8%. These included 7 graft failures, 5 episodes of graft rejection, and 1 case each of epithelial defect, epithelial downgrowth, and wound dehiscence upon suture removal.

ETDRS = Early Treatment Diabetic Retinopathy Study

Change in Visual Acuity by Procedure

Mean ETDRS Visual Acuity Score

<table>
<thead>
<tr>
<th>Type of Procedure</th>
<th>Preop</th>
<th>Postop</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSAEK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PK</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 85

ETDRS = Early Treatment Diabetic Retinopathy Study
Glaucoma Surgery

Glaucoma is the second most common cause of irreversible blindness in the United States, after age-related macular degeneration. While visual loss from glaucoma cannot be reversed, adequate control of intraocular pressure (IOP) can halt or slow the progressive loss of vision. The key to preserving vision in glaucoma is early detection and good IOP control. The goal of glaucoma surgery is to preserve the current level of vision.

Glaucoma surgery usually does not improve visual acuity unless combined with cataract surgery. Glaucoma can be managed with eye drops, laser treatment, or surgery. Medications can help patients avoid the need for laser treatment or surgery, but medications, usually in the form of eye drops, entail long-term cost and some potential for local and systemic side effects. Laser treatment for glaucoma is generally quick, safe, and convenient, but in many patients it has only a relatively small effect in reducing IOP and the effect may wear off over time. For some patients, surgery to control IOP, and prevent glaucoma progression, is the best option.

With a recent trend toward minimally invasive glaucoma surgery, the institute has started to offer 2 new procedures (iStent® trabecular microbypass and canaloplasty) in carefully selected cases. Outcomes of these cases will be reported in the future.
**Volume of Glaucoma Surgeries**

October 2011 – September 2012
January 2013 – December 2013
January 2014 – December 2014

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**Surgeries (%)**

![Bar graph showing the percentage of surgeries by type and year.]

- **Trabeculectomy**
- **Glaucoma Implant**
- **Revision of Trabeculectomy**
- **Revision of Glaucoma Implant**
- **Other**

### Type of Surgery

During 2014, 97 trabeculectomies and 115 glaucoma implant surgeries were performed at Cole Eye Institute. As shown in the graph, in prior years, trabeculectomies were performed more frequently than glaucoma implant surgery. The reversal of the trend was influenced in part by the recently published results from the TVT (Tube versus Trabeculectomy) study, which showed that glaucoma implant surgery was as effective as trabeculectomy with fewer complications.

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**Reference**

In patients treated at the institute during 2014, trabeculectomy reduced IOP from a mean of 26.9 mm Hg to 15.5 mm Hg, and glaucoma implant surgery reduced IOP from a mean of 28.4 mm Hg to 17.7 mm Hg. A normal range of IOP is approximately 10 mm Hg to 21 mm Hg. N = number of patients who returned for a follow-up visit and had IOP measured.

The mean level of visual acuity, as measured with ETDRS visual acuity charts, improved slightly after glaucoma surgery. N = number of patients who returned for a follow-up visit and had visual acuity measured. Higher number indicates better vision.
Intraoperative Complications (N = 316)
2014

- 1.2% Complications:
  - 0.6% Conjunctival buttonhole
  - 0.3% Scleral perforation
  - 0.3% Hyphema

- 98.8% None

Postoperative Complications at 3- to 12-Month Follow-Up (N = 316)
2014

- 6.3% Complications:
  - 2.8% Bleb leak/hypotony (IOP < 5 mm Hg)
  - 1.3% Needle bleb revision
  - 0.3% Choroidal hemorrhage
  - 0.3% Aqueous misdirection
  - 0.3% Flat chamber
  - 1.3% Other

- 93.7% None

The total postoperative complication rate was 6.3%, which included bleb leak and/or hypotony (IOP < 5 mm Hg), needle bleb revision, choroidal hemorrhage, aqueous misdirection, and flat chamber. N = number of patients who returned for a follow-up visit.
The mean incidence of uveal melanoma in the United States is 5.1 per million, with most cases (97.8%) occurring in the white population. Increasingly, uveal melanoma patients are being treated by radiation.

Several outcome measures can be considered when assessing treatment benefits of plaque radiation therapy. These include tumor specific mortality, local tumor control, globe salvage rate, and vision preservation. The recurrence rates following brachytherapy with plaque radiation therapy range from 10% to 15% in the published studies in the United States. Because the outcome events of interest are likely to occur after the first year following primary therapy, Cole Eye Institute is in the process of conducting a comprehensive 10-year outcomes study.
The number of uveal melanoma surgeries performed at Cleveland Clinic has risen dramatically from 2007 to 2014.

For patients with uveal melanoma who were treated with radiation in 2013, the freedom from recurrence was 100% at 1 year.
Oculoplastic surgery outcomes were divided into 3 categories: eyelid surgery, lacrimal surgery, and orbital surgery. A total of 1169 oculoplastic surgeries were performed at Cleveland Clinic Cole Eye Institute in 2014. Eyelid surgery outcome measures included postoperative complications and eyelid symmetry.

There were 631 eyelid, 162 lacrimal, and 69 orbital procedures performed during this period. The remaining 307 procedures represent eyelid lesions and other local procedures. No intraoperative complications were reported, and the postoperative outcomes are displayed below.
Postoperative eyelid symmetry was excellent in 75% of cases and good in the remaining 25%. Excellent and good eyelid symmetries were defined by a marginal reflex distance within 0.5 mm and 1.0 mm of the desired position, respectively. This graph excludes 28 patients for whom follow-up was not available.

Lacrimal Surgery Outcomes (N = 148)

This graph excludes 14 patients for whom follow-up was not available.
Surgeons at Cole Eye Institute use 2 laser platforms: the WaveLight® Refractive Suite: Allegretto Wave® Eye-Q and FS200 Femto Laser, and the VISX™ Star S4 and Intralase Femtosecond Laser. Outcomes are subdivided based on the type of surgery and the patient's preoperative refractive status (mild/moderate myopia [0 to -7.00 diopters (D)], high myopia [> -7.00 D], and hyperopia [0 to +6.00 D]). Both the type and magnitude of refractive error can affect the likelihood that uncorrected visual acuity (UCVA) of 20/20 or better will be achieved. Another important metric in assessing laser vision correction outcomes is the proportion of patients whose final refractive error falls within ± 0.5 D of the intended result.

This section documents outcomes for laser in situ keratomileusis (LASIK) with a femtosecond laser (FS200) flap (FemtoLASIK) and photorefractive keratectomy (PRK) (i.e., surface ablation) using the wavefront optimized (WFO) ablation profile of the WaveLight Allegretto Wave Eye-Q excimer laser along with the VISX Star S4 platform, which is all-inclusive of customized and standard ablation profiles. Outcomes are reported as the percentages of eyes with UCVA of 20/20 or 20/25, eyes with an exceptional outcome (UCVA of 20/15 or better), and eyes with UCVA meeting the requirements for driving without glasses (20/40 or better). This analysis includes the outcomes of 442 eyes treated in 2014 with the WaveLight platform and 180 eyes treated with the VISX platform.

Overall, the optimized platform of the WaveLight laser showed superior results to that of the VISX Star S4 in most categories. The VISX platform, however, represents both customized and standard treatments with a different subgroup of surgeons, and this may play a role in the difference in outcomes between the 2 platforms. The breakdown of PRK eyes to low/moderate myopia vs high myopia reveals excellent vision in the high myopic PRK subgroup which, although not statistically significant, shows better visual results than the high myopia LASIK group.
Following FemtoLASIK to treat low to moderate myopia, 93% (69%) of eyes achieved UCVA of 20/20 or better and 97% (86%) achieved 20/25 or better. The refractive accuracy in achieving these excellent visual outcomes is 95% (71%) within ± 0.5 D of the desired target. UCVA of 20/40 or better (legal driving vision) was achieved in 99% (94%) of eyes, and 70% (28%) had an exceptional visual outcome of 20/15 or better. VISX platform results are shown in parentheses.
Following FemtoLASIK to treat high myopia, 75% (62%) of eyes achieved UCVA of 20/20 or better and 86% (72%) achieved 20/25 or better. The refractive accuracy in achieving these excellent visual outcomes is 82% (62%) within ± 0.5 D of the desired target. UCVA of 20/40 or better (legal driving vision) was achieved in 97% (86%) of eyes, and 48% (14%) had an exceptional visual result of 20/15 or better. VISX platform results are shown in parentheses.
For FemtoLASIK in hyperopic eyes, where a precise refractive outcome is known to be more difficult to achieve, 74% (70%) of eyes still achieved UCVA of at least 20/20 and 96% (90%) achieved 20/25 or better. The refractive accuracy in achieving these visual outcomes is 74% (70%) within ± 0.5 D of the target outcome. UCVA of 20/40 or better (legal driving vision) was achieved in all eyes, and 26% (30%) achieved an exceptional visual result of 20/15 or better. VISX platform results are shown in parentheses.
Distance-Only PRK Surface Ablation for Low to Moderate Myopia (0 to -7 D Sphere With Cylinder < 3 D) (N = 94)

Following PRK to treat low to moderate myopia, 89% (63%) of eyes achieved UCVA of 20/20 or better and 94% (79%) achieved 20/25 or better. The refractive accuracy in achieving these excellent visual outcomes is 91% (63%) within ± 0.5 D of the desired target. UCVA of 20/40 or better (legal driving vision) was achieved in 99% (96%) of eyes, and 70% (33%) had an exceptional visual result of 20/15 or better. VISX platform results are shown in parentheses.

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Percentages are cumulative.
Following PRK to treat high myopia, 80% (67%) of eyes achieved UCVA of 20/20 or better and 90% (89%) achieved 20/25 or better. The refractive accuracy in achieving these excellent visual outcomes is 70% (67%) within ± 0.5 D of the desired target. UCVA of 20/40 or better (legal driving vision) was achieved in 100% (89%) of eyes, and 50% (22%) had an exceptional visual result of 20/15 or better. VISX platform results are shown in parentheses.
Cole Eye Institute considers the outcome of surgery for strabismus in adults to be good if there is: (1) disappearance of diplopia and/or anomalous head position in primary position of gaze or (2) in the absence of diplopia or anomalous head position, a constant deviation of less than 10 prism diopters (D). In children, a good outcome is defined as: (1) a constant deviation of less than 10 prism D in primary position or (2) the disappearance of anomalous head position for those in whom the surgery was done for that purpose, such as patients with a fourth nerve palsy, Brown syndrome, or Duane syndrome. The results here reflect reviews of follow-up visits during the period between January and December 2014. Hence, follow-up data for some patients are not included here, nor are long-term outcomes.

During 2014, 320 strabismus procedures were performed by 5 surgeons; 188 procedures were performed on children and 132 on adults (defined as age 16 years or older).
Adult Strabismus Cases (N = 132)
2014

Surgeries (%)

Diagnosis

- Esotropia
- Exotropia
- 4th Nerve Palsy
- 6th Nerve Palsy
- Hypertropia
- Thyroid Eye Disease
- 3rd Nerve Palsy
- Duane Syndrome
- Orbital Floor Fracture

This graph excludes 10 patients for whom follow-up was not available.

Adult Strabismus Outcomes (N = 122)
2014

24% Poor − Over- or undercorrected

76% Good − Ocular alignment within 10 prism D of orthotropia if no diplopia, and/or diplopia disappeared and/or anomalous head position resolved

This graph excludes 10 patients for whom follow-up was not available.
### Pediatric Strabismus Cases (N = 188)

#### 2014

**Surgeries (%)**

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Surgeries (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esotropia</td>
<td>50</td>
</tr>
<tr>
<td>Exotropia</td>
<td>40</td>
</tr>
<tr>
<td>Dissociated Vertical Deviations</td>
<td>10</td>
</tr>
<tr>
<td>4th Nerve Palsy</td>
<td>10</td>
</tr>
<tr>
<td>6th Nerve Palsy</td>
<td>10</td>
</tr>
<tr>
<td>Nystagmus</td>
<td>10</td>
</tr>
<tr>
<td>Duane Syndrome</td>
<td>10</td>
</tr>
<tr>
<td>Hypertropia</td>
<td>10</td>
</tr>
<tr>
<td>Brown Syndrome</td>
<td>10</td>
</tr>
</tbody>
</table>

### Pediatric Strabismus Outcomes (N = 187)

#### 2014

- **21%** Poor — Over- or undercorrected
- **79%** Good — Constant deviation < 10 prism D in primary position and/or anomalous head position resolved

This graph excludes 1 patient for whom follow-up was not available.
The Vitreoretinal Department at Cleveland Clinic’s Cole Eye Institute has assembled a dedicated surgical team of surgeons, nurses, and skilled technicians to deliver world-class care for its patients. This team has developed several new surgical procedures that are now used worldwide to treat conditions such as retinal detachment, diabetic macular edema, diabetic traction retinal detachments, and myopic macular holes, and for microincision surgery and pediatric retinal surgery. Members of the team have also helped develop the next generation of vitreoretinal surgical devices including microincision surgical instruments and techniques. Finally, the Ophthalmic Imaging Center at Cole Eye Institute is a leader in the new field of intraoperative optical coherence tomography, developing new uses for this pioneering technology.

In 2014, the team performed 823 surgical procedures. Outcomes were tracked on 604 of these procedures. As in previous years, this analysis excludes emergency cases, situations in which ETDRS (Early Treatment Diabetic Retinopathy Study) protocol visual acuity testing could not be performed at baseline, and patients who received postoperative care at another facility.

The vitreoretinal team performed 57 surgeries to close a macular hole for which detailed efficacy outcomes were available. Anatomic closure of the macular hole was achieved in 96.5% of cases. Vision improved ≥ 3 ETDRS lines in 67% of cases, with an average improvement in vision of + 17.8 ETDRS letters, or ≥ 3 lines.

Another common macular procedure was removal of an epiretinal membrane, with detailed efficacy outcomes available in 122 cases. The mean visual acuity improvement after membrane peeling surgery was + 12.2 ETDRS letters, with 27% of patients having a ≥ 3 line gain in vision.

Primary rhegmatogenous retinal detachments with scleral buckle are common, and primary retinal detachment repair was performed in 45 patients. In 98.5% of cases, the retina was reattached with 1 surgery. The mean change in vision after primary retinal detachment repair was an improvement of + 15.5 ETDRS letters, with an improvement in vision of ≥ 3 lines in 51% of cases.

Cole Eye Institute is a tertiary care facility and the vitreoretinal team is called on by patients and other physicians to assist in difficult cases. This is especially true with cases of giant retinal tears and complicated retinal detachments that have proliferative vitreoretinopathy (PVR); these patients are often referred to the institute after previous vitreoretinal surgeries at other hospitals. Detailed efficacy outcomes for these types of surgery are available for 240 patients in 2014. Although most patients had a previous retinal surgery, the reattachment rate in these complicated patients was 86.25%. Thirty-three patients had to go back to the operating room after complicated retinal repair. The average improvement in vision after PVR retinal detachment repair was + 15.8 ETDRS letters. A ≥ 3 line improvement in vision occurred in 40% of cases, while a ≥ 3 line loss in vision occurred in 7.7% of cases.
Vision Improvement by Procedure (N = 351)

Preoperative and postoperative ETDRS visual acuity was available for 351 patients, whose outcomes are shown in the graph above.

Intraoperative Complications (N = 604)

An analysis of intraoperative complications for all surgical procedures revealed no complications in 95% of cases. Suture microincision sclerotomy was the most common intraoperative complication, recorded in 3.6% of cases.
An analysis of postoperative complications in patients who had follow-up of at least 3 to 12 months revealed that 95.5% of cases did not have any postoperative complications. The most prevalent postoperative complications were vitreous hemorrhage (1.5%), retinal detachment following surgery (1.5%), and dislocated lens (0.5%). Other complications included hypotony, open macular hole, intraocular pressure spike > 30 mm Hg, and retained perfluoro-n-octane.
Cleveland Clinic is dedicated to delivering excellent clinical outcomes surrounded by the best possible experience for patients and their families. Reported patient experiences are shared with caregivers and used to identify opportunities to improve care. Cleveland Clinic’s Office of Patient Experience supports caregivers through education and guidance to help them deliver consistent, patient-centered care.

**Outpatient Office Visit Survey — Cole Eye Institute**

**CG-CAHPS Assessment**<sup>a</sup>

2013 – 2014

<table>
<thead>
<tr>
<th>Percent Best Response</th>
<th>2013 (N = 4074)</th>
<th>2014 (N = 6859)</th>
<th>CG-CAHPS 2013 database average (all practices)&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appointment Access (% Always)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>80</td>
<td>78</td>
<td>90</td>
</tr>
<tr>
<td>Doctor Communication (% Yes, Definitely)&lt;sup&gt;d&lt;/sup&gt;</td>
<td>90</td>
<td>85</td>
<td>85</td>
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<tr>
<td>Doctor Rating (% 9 or 10) 0 – 10 Scale</td>
<td>90</td>
<td>92</td>
<td>92</td>
</tr>
<tr>
<td>Clerical Staff (% Yes, Definitely)&lt;sup&gt;d&lt;/sup&gt;</td>
<td>90</td>
<td>89</td>
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<td>Test Results Communication (% Yes)&lt;sup&gt;e&lt;/sup&gt;</td>
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</tbody>
</table>

<sup>a</sup>In 2013, Cleveland Clinic began administering the Clinician and Group Practice Consumer Assessment of Healthcare Providers and Systems surveys (CG-CAHPS), standardized instruments developed by the Agency for Healthcare Research and Quality and supported by the Centers for Medicare & Medicaid Services for use in the physician office setting to measure patients’ perspectives of outpatient care.

<sup>b</sup>Based on results submitted to the CG-CAHPS database from 2172 medical practices in 2013.

<sup>c</sup>Response options: Always, Usually, Sometimes, Never

<sup>d</sup>Response options: Yes, definitely; Yes, somewhat; No

<sup>e</sup>Response options: Yes, No

Source: Press Ganey, a national hospital survey vendor
Cleveland Clinic is developing and implementing new models of care that focus on “Patients First” and aim to deliver on the Institute of Medicine goal of Safe, Timely, Effective, Efficient, Equitable, Patient-centered care. Creating new models of Value-Based Care is a strategic priority for Cleveland Clinic. As care delivery shifts from fee-for-service to a population health and bundled payment delivery system, Cleveland Clinic is focused on concurrently improving patient safety, outcomes, and experience.

What does this new model of care look like?

The Cleveland Clinic Integrated Care Model (CCICM) is a value-based model of care, designed to improve outcomes while reducing cost. It is designed to deliver value in both population health and specialty care.

- The patient remains at the heart of the CCICM.
- The blue band represents the care system, which is a seamless pathway that patients move along as they receive care in different settings. The care system represents integration of care across the continuum.
- Critical competencies are required to build this new care system. Cleveland Clinic is creating disease- and condition-specific care paths for a variety of procedures and chronic diseases. Another facet is implementing comprehensive care coordination for high-risk patients to prevent unnecessary hospitalizations and emergency department visits. Efforts include managing transitions in care, optimizing access and flow for patients through the CCICM, and developing novel tactics to engage patients and caregivers in this work.
- Measuring performance around quality, safety, utilization, cost, appropriateness of care, and patient and caregiver experience is an essential component of this work.
Using Cornea Modeling to Assess Ectasia Risk in Refractive Surgery Patients

Ectasia, a structural weakening of the cornea, is an important cause of vision loss that can occur naturally or as a complication of refractive surgery. Computational corneal modeling, which simulates how an eye will respond to refractive surgery, is now being studied at Cleveland Clinic’s Cole Eye Institute as a way to improve ectasia risk prediction. Computational corneal modeling begins with images collected during the standard refractive surgery screening exam, but then uses these data in a novel way to simulate the effects of structural loading and surgery in that eye. This personalized approach aims to assign a risk factor to each eye for each patient, thus giving physicians a more specific and sensitive ectasia risk prediction tool with the ultimate goal of improving patient outcomes.

Lacrimal Drainage Manometer

US Patent 8,932,231 was issued on Jan. 13, 2015, for the Lacrimal Drainage Manometer. Current office-based procedures provide only qualitative measures to assess the patency of the nasolacrimal drainage system. However, the Lacrimal Drainage Manometer measures the fluid resistance during injection. A pressure sensor between the 2 luer fittings works by comparing the pressure on the small element to external atmospheric pressure. A linear resistor receives feedback from the parallel plunger arm, allowing the calculation of flow rate based on location of the syringe gasket. An LCD display shows the pressure, piston position, and fluid resistance. A USB connector allows modifications to the circuitry’s program and serves as a charging port for the electronics within the device.
Advancing the Application of Intraoperative Optical Coherence Tomography in Ophthalmic Surgery

In 2014, Cleveland Clinic’s Cole Eye Institute initiated the DISCOVER study to examine the role of microscope-integrated intraoperative optical coherence tomography (OCT) in ophthalmic surgery. The DISCOVER study is evaluating 3 different intraoperative OCT systems: the Cole Eye Integrated System, the Zeiss RESCAN™ 700, and the Bioptigen Integrated System. Cole Eye Institute was the first institution in the United States to use the Zeiss system and the first to use the Bioptigen system for retinal imaging. Cole Eye Institute also employed this technology with heads-up display feedback to facilitate Descemet membrane endothelial keratoplasty corneal transplant surgery, which allowed for rapid and accurate orientation of donor tissue in all cases with no primary graft failures. Preliminary results from the DISCOVER study suggest that utilizing image-guided feedback may provide surgeons with high-value information that can guide surgical decision-making.

Depictions of air infusion progression during Descemet membrane endothelial keratoplasty surgery with en face views and spectral-domain optical coherence tomography (SD-OCT) images. The left column (A, C, E, and G) shows en face views. The right column (B, D, F, and H) shows the accompanying SD-OCT images from the en face views, which depict graft localization and the progression of graft apposition during air infusion. The white arrows indicate presence of interface fluid, and the yellow arrows indicate complete graft attachment to host tissue.
Contact Information

Cole Eye Institute
Appointments
216.444.2020 or
800.223.2273, ext. 42020

Cole Eye Institute
Referrals
216.444.2030 or
800.223.2273, ext. 42030

On the Web at clevelandclinic.org/eye

Staff Listing
For a complete listing of Cleveland Clinic’s Cole Eye Institute staff, please visit clevelandclinic.org/staff.

Publications
Cole Eye Institute staff authored 199 publications in 2014.
For a complete list, go to clevelandclinic.org/outcomes.

Locations
For a complete listing of Cole Eye Institute locations, please visit clevelandclinic.org/eye.
**Additional Contact Information**

**General Patient Referral**
24/7 hospital transfers or physician consults
800.553.5056

**General Information**
216.444.2200

**Hospital Patient Information**
216.444.2000

**General Patient Appointments**
216.444.2273 or 800.223.2273

**Referring Physician Center and Hotline**
855REFER.123 (855.733.3712)
Or email refdr@ccf.org or visit clevelandclinic.org/refer123

**Request for Medical Records**
216.444.2640 or 800.223.2273, ext. 42640

**Same-Day Appointments**
216.444.CARE (2273)

**Global Patient Services/International Center**
Complimentary assistance for international patients and families
001.216.444.8184 or visit clevelandclinic.org/gps

**Medical Concierge**
Complimentary assistance for out-of-state patients and families
800.223.2273, ext. 55580, or email medicalconcierge@ccf.org

**Cleveland Clinic Abu Dhabi**
clevelandclinicabudhabi.ae

**Cleveland Clinic Canada**
888.507.6885

**Cleveland Clinic Florida**
866.293.7866

**Cleveland Clinic Nevada**
702.483.6000

For address corrections or changes, please call
800.890.2467
Overview

Cleveland Clinic is an academic medical center offering patient care services supported by research and education in a nonprofit group practice setting. More than 3200 Cleveland Clinic staff physicians and scientists in 130 medical specialties and subspecialties care for more than 5.9 million patients across the system, performing more than 192,000 surgeries and conducting more than 497,000 emergency department visits. Patients come to Cleveland Clinic from all 50 states and more than 147 nations.

Cleveland Clinic is an integrated healthcare delivery system with local, national, and international reach. The main campus in midtown Cleveland, Ohio, has a 1400-bed hospital, outpatient clinic, specialty institutes, labs, classrooms, and research facilities in 42 buildings on 165 acres. Cleveland Clinic’s CMS case-mix index is the second highest in the nation. Cleveland Clinic encompasses more than 90 northern Ohio outpatient locations, including 18 full-service family health centers, 8 regional hospitals, an affiliate hospital, and a rehabilitation hospital for children. Cleveland Clinic also includes Cleveland Clinic Florida; Cleveland Clinic Nevada, which includes the Lou Ruvo Center for Brain Health in Las Vegas, and urology and nephrology services; Cleveland Clinic Canada; and Sheikh Khalifa Medical City (management contract). Cleveland Clinic Abu Dhabi is a full-service hospital and outpatient center in the United Arab Emirates (UAE), which began offering services in spring 2015. Cleveland Clinic is the second-largest employer in Ohio, with more than 42,500 employees. It generates $12.6 billion of economic activity a year.

Cleveland Clinic Global Solutions supports physician education, training and consulting, and patient services around the world through offices in Canada, China, the Dominican Republic, El Salvador, Guatemala, Honduras, Panama, Peru, Saudi Arabia, Turkey, UAE, and the United Kingdom.

The Cleveland Clinic Model

Cleveland Clinic was founded in 1921 by 4 physicians who had served in World War I and hoped to replicate the organizational efficiency of military medicine. The organization has grown through the years by adhering to the model set forth by the founders. All Cleveland Clinic staff physicians receive a straight salary with no bonuses or other financial incentives. The hospital and physicians share a financial interest in controlling costs, and profits are reinvested in research and education.

The Cleveland Clinic health system began to grow in 1987 with the founding of Cleveland Clinic Florida and expanded in the 1990s with the development of 18 family health centers across Northeast Ohio. Fairview Hospital, Hillcrest Hospital, and 6 other regional hospitals have joined Cleveland Clinic over the past 2 decades, offering Cleveland Clinic institute services in heart and neurological care, physical rehabilitation, and more. Clinical and support services were reorganized into 27 patient-centered institutes beginning in 2007. Institutes combine medical and surgical specialists for specific diseases or organ systems under unified leadership and in a shared location to provide optimal team care for every patient. Institutes work with the Office of Patient Experience to give every patient the best outcome and experience.

A Clinically Integrated Network

Cleveland Clinic is committed to providing value-based care, and it has grown the Cleveland Clinic Quality Alliance into the nation’s second-largest and Northeast Ohio’s largest clinically integrated network. The network comprises more than 5400 physician members, both employed and independent physicians from the community. Led by its physician members, the Quality Alliance strives to improve quality and consistency of care; reduce costs and increase efficiency; and provide access to expertise, data, and experience.
Cleveland Clinic Lerner College of Medicine

Lerner College of Medicine is known for its small class sizes, unique curriculum, and full-tuition scholarships for all students. Each new class accepts 32 students who are preparing to be physician investigators. Cleveland Clinic is building a multidisciplinary Health Education Campus as the new home of the Case Western Reserve University (CWRU) School of Medicine and Cleveland Clinic’s Lerner College of Medicine, as well as the CWRU School of Dental Medicine, the Frances Payne Bolton School of Nursing, and physician assistant and allied health training programs.

Graduate Medical Education

In 2014, nearly 1800 residents and fellows trained at Cleveland Clinic and Cleveland Clinic Florida, which is part of a continuing upward trend.

U.S. News & World Report Ranking

Cleveland Clinic is consistently ranked among the top hospitals in America by U.S. News & World Report. It is ranked No. 1 in urology and has ranked No. 1 in heart care and heart surgery since 1995. In 2014, 4 of its programs were ranked No. 2 in the nation: diabetes and endocrinology, gastroenterology and GI surgery, nephrology, and rheumatology.

For more information about Cleveland Clinic, please visit clevelandclinic.org.

Cleveland Clinic Physician Ratings

At Cleveland Clinic, we believe in transparency. We also believe in the positive influence of the physician-patient relationship on healthcare outcomes. To continue to meet the highest standards of patient satisfaction, we now publish Cleveland Clinic physician ratings, based on nationally recognized Press Ganey patient satisfaction surveys, online at clevelandclinic.org/staff.
Resources

Referring Physician Center and Hotline
Call 24/7 for access to medical services or to schedule patient appointments: 855.REFER.123 (855.733.3712), email refdr@ccf.org, or go to clevelandclinic.org/Refer123. The free Cleveland Clinic Physician Referral App, available for mobile devices, gives you 1-click access. Available at the App Store or Google Play.

Remote Consults
Anybody anywhere can get an online second opinion from a Cleveland Clinic specialist through our MyConsult service. For more information, go to clevelandclinic.org/myconsult, email eclevelandclinic.org, or call 800.223.2273, ext. 43223.

Request Medical Records
216.444.2640 or 800.223.2273, ext. 42640

Track Your Patients’ Care Online
Cleveland Clinic offers an array of secure online services that allow referring physicians to monitor their patients’ treatment while under Cleveland Clinic care, as well as access test results, medications, and treatment plans. my.clevelandclinic.org/online-services

DrConnect (online access to patients’ treatment progress while under referred care): 877.224.7367; drconnect@ccf.org

MyPractice Community (affordable electronic medical records system for physicians in private practice): 866.320.4573

eRadiology (teleradiology consultation provided nationwide by board-certified radiologists with specialty training, within 24 hours or stat): 216.986.2915; starimaging@ccf.org

Medical Records Online
Patients can view portions of their medical record, receive diagnostic images and test results, make appointments, and renew prescriptions through MyChart, a secure online portal. All new Cleveland Clinic patients are automatically registered for MyChart. clevelandclinic.org/mychart

Critical Care Transport Worldwide
Cleveland Clinic’s fleet of ground and air transport vehicles is ready to transfer patients at any level of acuity anywhere on earth. Specially trained crews provide Cleveland Clinic care protocols from first contact. To arrange a transfer for STEMI (ST-elevation myocardial infarction), acute stroke, ICH (intracerebral hemorrhage), SAH (subarachnoid hemorrhage), or aortic syndrome, call 877.379.CODE (2633). For all other critical care transfers, call 216.444.8302 or 800.553.5056.

CME Opportunities: Live and Online
Cleveland Clinic’s Center for Continuing Education operates the largest CME program in the country. Live courses are offered in Cleveland and cities around the nation and the world. The center’s website (ccfcme.org) is an educational resource for healthcare providers and the public. It has a calendar of upcoming courses, online programs on topics in 30 areas, and the award-winning virtual textbook of medicine, The Disease Management Project.

Clinical Trials
Cleveland Clinic is running more than 2100 clinical trials at any given time for conditions including breast and liver cancer, coronary artery disease, heart failure, epilepsy, Parkinson disease, chronic obstructive pulmonary disease, asthma, high blood pressure, diabetes, depression, and eating disorders. Cancer Clinical Trials is a mobile app that provides information on the more than 100 active clinical trials available to cancer patients at Cleveland Clinic. clevelandclinic.org/cancertrialapp.
**Healthcare Executive Education**

Cleveland Clinic has programs to teach people from outside the organization how it operates a major medical center. The Executive Visitors’ Program is an intensive 3-day behind-the-scenes view of the Cleveland Clinic organization for the busy executive. The Samson Global Leadership Academy is a 2-week immersion in challenges of leadership, management, and innovation taught by Cleveland Clinic leaders, administrators, and clinicians. Curriculum includes coaching and a personalized 3-year leadership development plan. Learn more at clevelandclinic.org/executiveeducation.

**Consult QD Physician Blog**

A singular blog for physicians and healthcare professionals from Cleveland Clinic. Discover the latest research insights, innovations, treatment trends, and more for all specialties. Join the conversation: consultqd.clevelandclinic.org.

**Social Media**

Cleveland Clinic uses social media to help caregivers everywhere provide better patient care. Millions of people currently like, friend, or link to Cleveland Clinic social media — including leaders in medicine.

Facebook for Medical Professionals  
[facebook.com/CMEclevelandclinic](http://facebook.com/CMEclevelandclinic)

Follow us on Twitter  
[@cleclinicMD](https://twitter.com/cleclinicMD)

Connect with us on LinkedIn  
[Clevelandclinic.org/Mdlinkedin](https://www.linkedin.com)