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 data on patient volumes and outcomes 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)
- Ohio Department of Health (ohiohospitalcompare.ohio.gov)
- 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 our Outcomes books, please visit Cleveland Clinic’s Quality and Patient Safety Institute website at clevelandclinic.org/outcomes.
Dear Colleague:

Welcome to this 2013 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 a summary 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 around 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 reports has received favorable notice from colleagues and healthcare observers. We appreciate your interest and hope you find this information useful and informative.

Sincerely,

Delos M. Cosgrove, MD
CEO and President
what’s inside

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we’ll remove you from the hard copy mailing list
and email you when next year’s books are online.
This is our eighth Outcomes book, and much has changed since we started. The process is an iterative one, requiring the dedicated efforts of people committed full time to the project, as well as strong physician leadership.

Collecting and reporting outcomes has become central to the quality of care that we provide and an integral part of the business of ophthalmology at Cole Eye Institute. A major advance in the quality of our data stems from the improvement of our electronic medical record. Under the direction of Rishi Singh, MD, Cole Eye Institute has invested considerable resources to rebuild Epic for ophthalmology, transforming it from a simple patient-care tool to a powerful, searchable database that will inform our Outcomes efforts like never before.

The year 2013 was a record one for Cole Eye Institute on many levels:

• Our clinical and surgical volumes were at an all-time high.
• Our research efforts were bolstered by more than $10 million in new grants to support the Cole Eye Institute Ophthalmic Imaging Center.
• Our educational mission was greatly enhanced with the opening of Louise Timken Microsurgical Education Laboratory in July. This sophisticated facility represents our commitment to becoming the premier surgical education training program for residents and fellows in the United States.

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

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 care tomorrow. Cleveland Clinic’s ophthalmology program is ranked No. 7 in the country in the 2013 U.S. News & World Report “Best Hospitals” survey, 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 location, where patient care is offered. Cole Eye Institute staff also provide primary, secondary and tertiary services for patients of all ages at a growing number of family health centers and specialty centers across Northeast Ohio.

### 2013 Cole Eye Institute Key Statistics

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Clinic Visits</td>
<td>189,999</td>
</tr>
<tr>
<td>Total Surgeries</td>
<td>8247</td>
</tr>
<tr>
<td>Total Surgical Procedures (surgeries in operating rooms and all outpatient procedures)</td>
<td>10,143</td>
</tr>
<tr>
<td>Total Laser Procedures</td>
<td>2042</td>
</tr>
<tr>
<td>Annual Research Funding Level (including $5,891,222 from federal sources)</td>
<td>$10,175,282</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. From January through December 2013, a total of 2879 cataract extraction procedures were performed and outcomes were tracked on 2564 of these procedures.

Intraoperative complications during cataract surgery were uncommon, occurring in only 1.3% of patients. The most common complication was a posterior capsular tear, reported in 0.59% of patients, most of whom ended up with excellent vision.

Complications During Cataract Surgery (N = 2564)

<table>
<thead>
<tr>
<th>Complication</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>98.7%</td>
</tr>
<tr>
<td>Complications</td>
<td>1.3%</td>
</tr>
<tr>
<td>Posterior Capsule Tear</td>
<td>0.59%</td>
</tr>
<tr>
<td>Vitreous Loss</td>
<td>0.39%</td>
</tr>
<tr>
<td>Iris Trauma</td>
<td>0.16%</td>
</tr>
<tr>
<td>Retained Lens</td>
<td>0.12%</td>
</tr>
<tr>
<td>Zonular Dialysis</td>
<td>0.04%</td>
</tr>
<tr>
<td>Anterior Capsule Tear</td>
<td>0.04%</td>
</tr>
</tbody>
</table>
Postoperative complications were also rare, occurring in less than 1% of patients who returned for up to 12 months of follow-up. These included unexpected refractive outcome (0.45%), acute postoperative endophthalmitis (0.34%), and retained lens fragments (0.11%).

**Postoperative Complications (N = 893)**

2013

- **0.9%** Complications
  - 0.45% Unexpected Refractive Outcome
  - 0.34% Acute Endophthalmitis
  - 0.11% Retained Lens Fragments

99.1% None
One of the goals of cataract surgery is to improve 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 893 patients who came back for up to 12 months of follow-up. There was a $\geq 15$ letter improvement in 40.65% of these patients, and 41.43% had a $< 15$ letter improvement. The remaining 17.92% had no change or a decrease from baseline status.

**ETDRS Vision Improvement**

**October 2010 – December 2013**

<table>
<thead>
<tr>
<th>Vision Improvement</th>
<th>2010 – 11\textsuperscript{a}</th>
<th>2011 – 12\textsuperscript{b}</th>
<th>2013\textsuperscript{c}</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Change or Worse</td>
<td>27</td>
<td>36</td>
<td>160</td>
</tr>
<tr>
<td>1 – 14 Letters Improvement</td>
<td>379</td>
<td>332</td>
<td>370</td>
</tr>
<tr>
<td>$\geq 15$ Letters Improvement</td>
<td>301</td>
<td>265</td>
<td>363</td>
</tr>
</tbody>
</table>

\textsuperscript{a} October 2010 – September 2011  
\textsuperscript{b} October 2011 – September 2012  
\textsuperscript{c} January 2013 – December 2013

The overall improvement in vision was seen in patients with a cataract condition; some also may have had other disorders of the eye, such as glaucoma, retinal disease, or anterior segment disease. A significant number of the institute’s cataract patients have multiple clinical morbidities that may explain the limited visual improvement in some patients.
About a year and a half ago, Cole Eye Institute surgeons began using a new technology, femtosecond laser-assisted cataract surgery, and the data for 2013 have been analyzed. The majority of patients (90.87%) achieved a final spherical equivalent refractive error within 1 diopter of the expected result. The femtosecond laser is used to treat corneal astigmatism as well as to perform elements of the cataract procedure with computer precision. As the number of patients undergoing this procedure increases, the institute will be able to provide data with regard to its effectiveness in treating astigmatism as well as comparing overall results with conventional surgery.

**Difference Between Actual and Target Refractive Error for Femtosecond Laser Patients (N = 263)**

2013

<table>
<thead>
<tr>
<th>Diopters</th>
<th>Patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; -2</td>
<td>9</td>
</tr>
<tr>
<td>-2 to -1</td>
<td>26</td>
</tr>
<tr>
<td>-1 to 0</td>
<td>41</td>
</tr>
<tr>
<td>0 to +1</td>
<td>26</td>
</tr>
<tr>
<td>+1 to +2</td>
<td>5</td>
</tr>
<tr>
<td>&gt; +2</td>
<td>0</td>
</tr>
</tbody>
</table>
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 5 years ago. Today, Cole Eye Institute surgeons are contributing to the development of cutting-edge 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. From January through December 2013, 60 PKs and 109 DSAEKs were performed. This greater number of DSAEKs is in contrast to 2008 and 2009, when equivalent numbers of PKs and DSAEKs were performed; this reflects an international trend toward less invasive corneal transplant procedures for endothelial disease.

Corneal transplant surgeons at Cole Eye 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, 98% of grafts remained clear at 3 to 12 months. For PK patients, 90% 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.
Cornea Surgery

Intraoperative Complications (N = 180)

2013

99.4% None

0.6% Vitreous Prolapse (With Combined Cataract Extraction)

The only intraoperative complication was a case of vitreous prolapse that occurred when combined with cataract extraction.

Postoperative Complications (N = 180)

2013

92.2% None

7.8% Complications:

- 4.4% Graft Rejection Episode
- 1.1% Corneal Ulcer
- 1.1% Graft Failure
- 0.6% Persistent Epithelial Defect
- 0.6% Retained Descemet's Membrane

At 3 to 12 months, the postoperative complication rate was 7.8%. These included eight episodes of graft rejection, two patients with corneal ulcers, two patients with graft failure, and a case each of persistent epithelial defect and retained Descemet’s membrane.
Changes in visual acuity by the type of corneal transplant procedure are shown in the graph. For patients who completed 3 to 12 months of follow-up, the mean improvement in ETDRS visual acuity score in DSAEK patients was 28.30 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 38.12 letters, equivalent to 7 lines of visual acuity.

ETDRS = Early Treatment Diabetic Retinopathy Study
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 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 hence glaucoma progression, is the best option.

Trabeculectomy is the most frequently performed glaucoma surgical procedure in the United States. For patients who have difficult-to-control glaucoma or who have had previous eye surgery or trauma, a glaucoma implant (glaucoma drainage device) is used instead. From January 2006 through December 2013, 2212 glaucoma surgeries were performed at Cleveland Clinic's Cole Eye Institute. These included 1086 trabeculectomies, 829 glaucoma implants, and 203 revisions of previous glaucoma surgeries.

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

October 2010 – September 2011
October 2011 – September 2012
January 2013 – December 2013

Surgeries (%)

<table>
<thead>
<tr>
<th>Type of Surgery</th>
<th>2010–11 (N = 313)</th>
<th>2011–12 (N = 276)</th>
<th>2013 (N = 317)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trabeculectomy</td>
<td>45</td>
<td>35</td>
<td>30</td>
</tr>
<tr>
<td>Glaucoma Implant</td>
<td>25</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Revision of Trabeculectomy</td>
<td>10</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Revision of Glaucoma Implant</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

During the 12-month period of January to December 2013, 113 trabeculectomies and 135 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\(^1\) from the TVT (Tube vs. Trabeculectomy) study, which showed that glaucoma implant surgery was as effective as trabeculectomy with fewer complications.

References

In patients treated at the institute during 2013, trabeculectomy reduced IOP from a mean of 22.2 mm Hg to 14.9 mm Hg, and glaucoma implant surgery reduced IOP from a mean of 26.4 mm Hg to 16.0 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 on 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.
Postoperative Complications at 3- to 12-Month Follow-up (N = 317)

No intraoperative complications were observed. The total postoperative complication rate was 4.1%, which included hypotony (IOP < 5 mm Hg), bleb leaks, vitreous blocking tube, and exposed glaucoma implant graft. 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.

Methods of Treatment for Uveal Melanoma (N = 95)
2013
- 33% Enucleation
- 67% Plaque Brachytherapy
The number of uveal melanoma surgeries performed at Cleveland Clinic has more than doubled in 7 years, from 45 in 2007 to 95 in 2013.

For patients with uveal melanoma who were treated with radiation in 2012, the freedom from recurrence was 100% at 1 year.
Oculoplastic surgery outcomes were divided into three categories: eyelid surgery, lacrimal surgery, and orbital surgery. A total of 1132 oculoplastic surgeries were performed at Cleveland Clinic Cole Eye Institute from January through December 2013. Eyelid surgery outcome measures included postoperative complications and eyelid symmetry.

There were 597 eyelid, 168 lacrimal, and 63 orbital procedures performed during this period. The remaining 304 procedures represent eyelid lesions and other local procedures. No intraoperative complications were reported, and the postoperative complications are shown below.

### Distribution of Oculoplastic Surgeries (N = 1132)

<table>
<thead>
<tr>
<th>Procedure Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orbital</td>
<td>5.6%</td>
</tr>
<tr>
<td>Lacrimal</td>
<td>14.8%</td>
</tr>
<tr>
<td>Other Local Procedures</td>
<td>26.9%</td>
</tr>
<tr>
<td>Eyelid</td>
<td>52.7%</td>
</tr>
</tbody>
</table>

### Postoperative Complications — Eyelid Surgery (N = 597)

<table>
<thead>
<tr>
<th>Complication</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocular Symptoms</td>
<td>3.0%</td>
</tr>
<tr>
<td>Need Reoperation</td>
<td>0.2%</td>
</tr>
<tr>
<td>Asymmetry</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

A total of 597 eyelid surgeries were performed during this period. The postoperative complication rate was 3.4%, including ocular symptoms (such as tearing, painful eye, irritation, inflammation, and lagophthalmos) in 3%, asymmetry in 0.2%, and the need for reoperation in 0.2% of cases.
Postoperative eyelid symmetry was excellent in 73% of cases and good in the remaining 27%. 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.
Surgeons at Cole Eye Institute use two laser platforms; one is the WaveLight® Refractive Suite: Allegretto Wave Eye-Q and FS200 Femto Laser; the other is 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 20/16 or better), and eyes with UCVA meeting the requirements for driving without glasses (20/40 or better). This analysis includes the outcomes of 426 eyes treated in 2013 with the WaveLight platform and 223 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.
Following FemtoLASIK to treat low to moderate myopia, 96% (91%) of eyes achieved UCVA of 20/20 or better and 99% (94%) achieved 20/25 or better. The refractive accuracy in achieving these excellent visual outcomes is 98% (84%) within ± 0.50 D of the desired target. UCVA of 20/40 or better (legal driving vision) was achieved in 100% (99%) of eyes, and 74% (46%) of eyes had an exceptional visual outcome of 20/16 or better. VISX platform results are shown in parentheses.
Following FemtoLASIK to treat high myopia, 86% (54%) of eyes achieved UCVA of 20/20 or better and 96% (68%) achieved 20/25 or better. The refractive accuracy in achieving these excellent visual outcomes is 88% (61%) within ± 0.50 D of the desired target. UCVA of 20/40 or better (legal driving vision) was achieved in 98% (93%) of eyes, and 52% (11%) had an exceptional visual result of 20/16 or better. VISX platform results are shown in parentheses.
Distance-Only LASIK for Hyperopia (N = 47)

2013

For FemtoLASIK in hyperopic eyes, where a precise refractive outcome is known to be more difficult to achieve, 59% (47%) of eyes still achieved UCVA of at least 20/20 and 81% (60%) achieved 20/25 or better. The refractive accuracy in achieving these visual outcomes is 84% (60%) within ± 0.5 D of the target outcome. UCVA of 20/40 or better (legal driving vision) was achieved in 97% (93%) of eyes, and 22% (20%) of eyes achieved an exceptional result with an uncorrected visual acuity of 20/16 or better. VISX platform results are shown in parentheses.
Following PRK to treat low to moderate myopia, 87% (93%) of eyes achieved UCVA of 20/20 or better and 98% (97%) achieved 20/25 or better. The refractive accuracy in achieving these excellent visual outcomes is 96% (83%) within ±0.50 D of the desired target. All eyes achieved UCVA of 20/40 or better (legal driving vision), and 58% (59%) had an exceptional visual result of 20/16 or better. VISX platform results are shown in parentheses.
Distance-Only PRK Surface Ablation for High Myopia (> -7 D Sphere With Cylinder < 3 D) (N = 25)

2013

<table>
<thead>
<tr>
<th>Percentage</th>
<th>± 0.5D</th>
<th>20/16</th>
<th>20/20</th>
<th>20/25</th>
<th>20/40</th>
</tr>
</thead>
<tbody>
<tr>
<td>73% (40%)</td>
<td>27%</td>
<td>73%</td>
<td>60%</td>
<td>60%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Visual Acuity&lt;sup&gt;a&lt;/sup&gt;</th>
<th>0%</th>
<th>60%</th>
<th>93%</th>
<th>100%</th>
</tr>
</thead>
</table>

<sup>a</sup>Percentages are cumulative.

Following PRK to treat high myopia, 73% (60%) of eyes achieved UCVA of 20/20 or better and 93% (60%) achieved 20/25 or better. The refractive accuracy in achieving these excellent visual outcomes is 73% (40%) within ±0.50 D of the desired target. All eyes achieved UCVA of 20/40 or better (legal driving vision), and 27% (0%) had an exceptional visual result of 20/16 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 in 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 from January to December 2013. Hence, follow-up data for some patients are not included here, nor are long-term outcomes.

During 2013, 219 strabismus procedures were performed by four surgeons; 125 procedures were performed on children and 94 on adults (defined as age 16 years or older).
Adult Strabismus Cases (N = 94)

2013

Adult Strabismus Outcomes (N = 91)

2013

This graph excludes three patients for whom follow-up is not available. Complexity of strabismus cases in adults and a large number of reoperations in this age group possibly account for the observed success rate. In the future, data will be analyzed by complexity, primary vs. reoperations, and combination of vertical and horizontal misalignment.
Pediatric Strabismus Cases (N = 125)

2013

Surgeries (%)

- Esotropia
- Exotropia
- Dissociated Vertical Deviations
- 4th Nerve Palsy
- 6th Nerve Palsy
- Nystagmus
- Duane Syndrome
- Hypertropia

Diagnosis

Pediatric Strabismus Outcomes (N = 122)

2013

- 26% Poor – Over- or undercorrected
- 74% Good – Constant deviation < 10 prism D in primary position and/or anomalous head position resolved

This graph excludes three patients for whom follow-up is not available.
Vitreoretinal Surgery

The Vitreoretinal Department at Cleveland Clinic 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 2013, the team performed 799 surgical procedures. Outcomes were tracked on 633 of these procedures. As in previous years, this analysis excludes emergency cases, situations in which ETDRS (Early Treatment Diabetic Retinopathy Study) protocol visual acuity could not be performed at baseline, and patients who received postoperative care at another facility.

The vitreoretinal team performed 65 surgeries to close a macular hole for which detailed efficacy outcomes were available. Anatomic closure of the macular hole was achieved in 96.9% of cases. Vision improved ≥ 3 ETDRS lines in 64% of cases, with an average improvement in vision of + 17.5 ETDRS letters, or ≥ 3 lines.

Another common macular procedure was removal of an epiretinal membrane, with detailed efficacy outcomes available in 92 cases. The mean visual acuity improvement after membrane peeling surgery was + 11.6 ETDRS letters, with 25% of patients having a ≥ 3 line gain in vision.

Primary rhegmatogenous retinal detachments are common, and primary retinal detachment repair was performed in 34 patients. In 82.4% of cases, the retina was reattached with one surgery. The mean change in vision after primary retinal detachment repair was an improvement of + 15.2 ETDRS letters, with an improvement in vision of ≥ 3 lines in 50% of cases.
Preoperative and postoperative ETDRS visual acuity was available for 180 patients, whose outcomes are shown in the graph below.

### Vision Improvement by Procedure (N = 180)

**2013**

<table>
<thead>
<tr>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ -15</td>
</tr>
<tr>
<td>-14 to -5</td>
</tr>
<tr>
<td>-4 to +4</td>
</tr>
<tr>
<td>+5 to +14</td>
</tr>
<tr>
<td>≥ +15</td>
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</tbody>
</table>

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 274 patients in 2013. Although most patients had a previous retinal surgery, the reattachment rate in these complicated patients was 90.8%. Twenty-five patients had to go back to the operating room after complicated retinal repair. The average improvement in vision after PVR retinal detachment repair was +15.6 ETDRS letters. A ≥ 3 line improvement in vision occurred in 38% of cases, while a ≥ 3 line loss in vision occurred in 5.2% of cases.
An analysis of intraoperative complications for all surgical procedures revealed no complications in 93.4% of cases. Suture microincision sclerotomy was the most common intraoperative complication, recorded in 5.2% of cases.
An analysis of postoperative complications in patients who had follow-up of at least 3 to 12 months revealed that 96.4% of cases did not have any postoperative complications. The most prevalent postoperative complications were vitreous hemorrhage (1.3%), retinal detachment following surgery (0.8%), and intraocular pressure spike > 30 mm Hg (0.6%). Other complications included traumatic open macular hole, retained perfluoro-n-octane, optic nerve atrophy, and hypotony.
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 educational opportunities and training programs designed to help them provide the best possible experience in every patient encounter.

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

**CG-CAHPS Assessment\(^a\) (N = 4074)**

2013

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**Percent Best Response**

- Appointment Access
- Doctor Communication
- Doctor Rating
- Clerical Staff
- Test Results Communication

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\(^a\)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.

\(^b\)Based on results submitted to the CAHPS database from 2399 medical practices in 2012.

Source: Press Ganey, a national hospital survey vendor
Focus on Value

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 top strategic priority for Cleveland Clinic as healthcare reform moves care delivery from fee-for-service to a population health and bundled payment delivery system, while concurrently improving patient safety, outcomes, and experience.

What will our new model of care look like?

- The Cleveland Clinic Integrated Care Model is a value-based model of care, designed to improve outcomes while reducing cost.
- The patient remains at the heart of the Cleveland Clinic Integrated Care Model.
- The blue band represents the care system, which is a seamless pathway that patients move along as they receive care in the different settings listed. The care system represents integration of care across the continuum.
- To build this new care system, critical competencies are care paths and care coordination. We have therefore begun to build disease and condition-specific care paths, and are implementing comprehensive care coordination.
- Care paths guide patient care both within a venue (e.g., a hospital) as well as along the care system (blue band) to appropriate care venues. Care paths will improve value by employing evidence and/or experience-based practice to reduce unnecessary variation in care, with the goal of achieving optimal outcomes at the lowest possible cost. Measurement of use and outcomes is integral to care paths.
- Care coordination identifies high-risk patients and risk points in transitions of care, and enhances communication and handoffs between providers and locations.
NIH Award Supports Early Diagnosis and Patient-Specific Therapy of the Cornea

Fueled by a recent $2 million 5-year grant from the National Institutes of Health’s National Eye Institute, researchers at Cleveland Clinic Cole Eye Institute are developing new ways to measure corneal mechanical properties and put that information into clinical use. The goal is to develop patient-specific modeling for simulation-based therapy that can eventually lead to more customized treatments for conditions such as keratoconus. Computational modeling of the cornea to achieve patient-specific, simulation-based therapy is another important aspect of the research program. A number of computational models will be developed from clinical measurements and then validated as accurately representing the behavior of their living counterparts.
Forging Next-Generation Integrated Intraoperative Optical Coherence Tomography Instrumentation

Optical coherence tomography (OCT), a noninvasive imaging modality that creates high-resolution images of biological structures in living tissues, is used to diagnose and monitor many eye diseases, but it has not yet been widely used in surgery due to the lack of an integrated intraoperative OCT platform. At Cole Eye Institute, researchers are using a new prototype intraoperative microscope-integrated OCT system that includes dedicated surgical instruments and specially crafted analysis software. The system provides direct feedback to the surgeon regarding the location and depth of the surgical instrumentation during surgical maneuvers, which was previously unavailable with conventional surgical microscopes. This integrated OCT instrumentation enables surgeons to differentiate between anatomical structures that appear transparent on conventional microscopes, possibly leading to novel surgical procedures.
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 134 publications in 2013.
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**
855.REFER.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 3,200 Cleveland Clinic staff physicians and scientists in 130 medical specialties and subspecialties care for more than 5.5 million patients across the system, performing more than 202,000 surgeries and conducting more than 476,000 emergency department visits. Patients come to Cleveland Clinic from all 50 states and more than 130 nations around the world.

Cleveland Clinic is an integrated healthcare delivery system with local, national, and international reach. The main campus in midtown Cleveland, Ohio, has a 1,440-bed hospital, outpatient clinic, specialty institutes, labs, classrooms, and research facilities in 44 buildings on 167 acres. Cleveland Clinic patients represent the highest CMS case-mix index in the nation. Cleveland Clinic encompasses 75 northern Ohio outpatient locations, including 16 full-service family health centers, eight community 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) scheduled to begin offering services in the spring of 2015. Cleveland Clinic is the second-largest employer in Ohio, with more than 43,400 employees. It generates $10.95 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 Riyadh, Saudi Arabia; London, England; Istanbul, Turkey; and Dubai, UAE, as well as El Salvador, Panama, Guatemala, Honduras, the Dominican Republic, and other Caribbean nations.

The Cleveland Clinic Model

Cleveland Clinic was founded in 1921 by four 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 system began to grow in 1987 with the founding of Cleveland Clinic Florida and expanded in the 1990s with the development of 16 family health centers across Northeast Ohio. Fairview Hospital, Hillcrest Hospital, and six other community hospitals joined Cleveland Clinic over the past decade and a half, 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 around specific diseases or body systems under single 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.
Cleveland Clinic Lerner Research Institute

At the Lerner Research Institute, hundreds of principal investigators, project scientists, research associates, and postdoctoral fellows are involved in laboratory-based translational and clinical research. Total research expenditures from external and internal sources exceeded $248 million in 2013. Research programs include cardiovascular, oncology, neurology, musculoskeletal, allergy and immunology, ophthalmology, metabolism, and infectious diseases.

Cleveland Clinic Lerner College of Medicine

Lerner College of Medicine of Case Western Reserve University is known for its small class size, unique curriculum, and full-tuition scholarships for all students. The program is open to 32 students who are preparing to be physician investigators. Cleveland Clinic is building a new Health Education Campus as the new home for the college and for its partner Case Western Reserve University’s schools of medicine, dental medicine, and nursing.

Graduate Medical Education

In 2013, nearly 1,800 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, and its heart and heart surgery program has been ranked No. 1 in the nation since 1995. In 2013, five programs were ranked No. 2 in the nation—diabetes and endocrinology, gastroenterology and GI surgery, nephrology, rheumatology, and urology.

For more information about Cleveland Clinic, please visit clevelandclinic.org.
**Referring Physician Center and Hotline**
For the 24/7 hotline to streamline access to an array of medical services and schedule patient appointments, call 855.REFER.123 (855.733.3712), email refdr@ccf.org, or visit clevelandclinic.org/refer123. A free Physician Referral App is now available so you can get in touch immediately with one click of your iPhone®, iPad®, or Android™ phone or tablet.

**Remote Consults**
Online medical second opinions from Cleveland Clinic’s MyConsult® are particularly valuable for patients who wish to avoid the time and expense of travel. Cleveland Clinic offers online medical second opinions for more than 1,200 life-threatening and life-altering diagnoses. For more information, visit clevelandclinic.org/myconsult, email eclevelandclinic@ccf.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**
DrConnect® offers referring physicians secure access to their patients’ treatment progress while at Cleveland Clinic. To establish a DrConnect account, visit clevelandclinic.org/drconnect or email drconnect@ccf.org. MyPractice Community gives referring physicians online access to their patients’ test results, medications, and treatment plans during Cleveland Clinic care. Cleveland Clinic eRadiology system offers teleradiology consultation for physicians nationwide.

**Medical Records Online**
Cleveland Clinic continues to expand and improve electronic medical records (EMRs) to provide faster, more efficient, and more accurate care by sharing patient data through a highly secure network. Patients using MyChart® can renew prescriptions and review test results and medications from their personal computers. MyChart provides a link to Microsoft HealthVault, a free online service that helps patients securely gather and store health information. It connects to Cleveland Clinic’s social media and Internet site, currently the most visited hospital website in America. For more information, visit clevelandclinic.org/mychart.

**Critical Care Transport Worldwide**
Cleveland Clinic’s critical care transport team and fleet of mobile ICU vehicles, helicopters, and fixed-wing aircraft serve critically ill and highly complex patients across the globe. 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 one of the largest and most successful CME programs in the country. The center’s website (ccfcme.org) is an educational resource for healthcare providers and the public. Available 24/7, it houses programs that cover topics in 30 areas. Among other resources, the website contains a virtual textbook of medicine (Disease Management Project) and myCME, a system for physicians to manage their CME portfolios. Live courses, however, remain the backbone of the center’s CME operation. Most live courses are held in Cleveland, but outreach plans are underway.
Clinical Trials

Cleveland Clinic has promoted research from its earliest days, and has led to historic, large, multicenter clinical trials. Today, Cleveland Clinic is running more than 2,200 clinical trials of various types. Researchers are focused on an array of 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. To learn more, go to clevelandclinic.org/research.

Cancer Clinical Trials is a new mobile app that provides up-to-date information on the more than 100 active clinical trials available for cancer patients. Download the free Cancer Clinical Trials App at clevelandclinic.org/cancertrialapp.

Healthcare Executive Education

Cleveland Clinic’s executive education program offers its programs to caregivers worldwide seeking insights into the business, operations, and logistics of a major medical center. The Executive Visitors’ Program is an intensive three-day behind-the-scenes view of Cleveland Clinic organization for the busy executive. The Samson Global Leadership Academy is a two-week immersion into the challenges of leadership, management, and innovation. The curriculum includes coaching and a personalized three-year leadership development plan. Learn more at clevelandclinic.org/execed.
This project would not have been possible without the commitment and expertise of a team led by Peter K. Kaiser, MD, and Monica Jain, MBBS, MHA.

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