Purpose
To report post-operative visual acuity and refractive outcomes (prediction error) after cataract surgery with IOL implantation in a pediatric tertiary care center

Introduction
In 2006 the Centers for Medicare and Medicaid Services implemented the Physician Quality Reporting Initiative, now the Physician Quality Reporting System (PQRS). PQRS is a reporting program that uses a combination of incentive payments and negative payment adjustments to promote reporting of quality information by eligible professionals. The aim is to empower providers and consumers with information that would support the overall delivery and coordination of health care (and ultimately support new payment systems that rewards physicians for providing improved quality care).

As a result, an increasing number of publications include outcome measures gathered to satisfy quality reporting requirements. Benchmark studies for uncomplicated adult cataract surgery have been published, and guidelines for outcomes in visual acuity and refractive outcomes have been suggested. Complex cases are generally excluded from such series. Pediatric cataract surgery is commonly classified as complex or “complicated”, with unique challenges including:

- Lack of cooperation in many aspects of measurement
- Inability to obtain biometry in office or with optical coherence
- With cooperation, measures may be limited by factors such as dense cataract or nystagmus
- Eyes often have short axial length (AL) or associated anatomic abnormalities

As part of our quality assurance, we reviewed our final visual acuity and refractive outcomes for pediatric cataract surgery.

Material and Methods
Chart review was performed for all patients <18 years of age undergoing cataract surgery with primary IOL implantation over an 8-year period (2006-2013) as part of the Boston Children’s Hospital quality assurance program. Data collection included visual acuity measures, biometry data, and refractive outcomes.

Visual acuity (VA)
Pre- and post-operative VA measured with M&S system
Refractometry and manifest refraction performed and best corrected vision recorded
Exclusions: lack of Snellen visual acuity, other ocular structural abnormalities known to account for poor vision

Refractive outcomes:
Surgical technique, refractive target, IOL calculation formula, IOL type chosen by surgeon
Post-operative refraction and prescription management performed by surgeon
Refraction within 90 days used for calculation of:
Prediction error (PE): Prediction Refraction – Actual Refraction
Absolute PE: |Prediction Refraction – Actual Refraction|

Results

**Visual Acuity**
88 eyes with pre- and post-operative Snellen VA measures
-Mean age at surgery: 6.4 ± 4.6 years
-VA at last visit:
  -20/40 or better in 94%
  -VA <20/40 had amblyopia; all had improved from pre-operative measures

**Prediction Error**
Complete data for 172 eyes

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean PE</th>
<th>Mean absolute PE</th>
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</thead>
<tbody>
<tr>
<td>PE within 0.5D of target in 45 eyes</td>
<td>0.8 ± 0.7 D</td>
<td>1.1 D (median, 0.75)</td>
</tr>
<tr>
<td>PE within 1D of target in 68 eyes</td>
<td>0.2 ± 1.1 D</td>
<td>1.1 D (median, 0.75)</td>
</tr>
<tr>
<td>PE within 2D of target in 95 eyes</td>
<td>0.2 ± 1.1 D</td>
<td>1.1 D (median, 0.75)</td>
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</table>

Mean PE: 0.2 ± 1.1 D (median, 0.75)
Mean absolute PE: 0.8 ± 0.7 D

**Discussion**
To date, no benchmark studies for cataract surgery have been published that include children, in part because many pediatric cataract surgeries represent "complicated" cases. In addition to technical challenges surgically or in obtaining accurate biometry, young or developmentally delayed patients also present challenges in measurement of vision, which must be obtained in a standardized form to be used for QA outcome measures.

For adult populations undergoing cataract surgery for eyes with co-pathologies, visual acuity of 20/40 or better visual acuity has been found in 80-95% of patients. In our cohort, children were selected by surgical technique (cataract surgery with primary IOL implantation), which may result in bias for better visual acuity reporting because the patients were old enough to have primary IOL implantation and as such had a developmental or acquired cataract, rather than an infantile cataract. Additionally, we chose to select only patients with standard measures of best corrected Snellen visual acuity, which depends on age and developmental status reflecting an ability and cooperation for reading of Snellen letters.

For this reason, our VA outcomes are similar to adult populations, with deficiencies only due to amblyopia.

For assessment of refractive outcomes by measure of PE, a large multicenter study found within 1D in 94-99% of adult patients' and in an academic teaching institution, within 1D in 94%. Furthermore, improvement can be gained after implementing customization of constants, as reflected by improvement in PE within 1D of the target refraction for 80% of eyes in the first study cycle to 87% in the third study cycle. In contrast, we found only 68% of our patients within 1D of the target refraction, and customization of constants is often not possible in clinical practice, where the volume of pediatric eye surgery is too low per surgeon to allow customization.

Previous studies have reported PE in pediatric cohorts, and typical pediatric mean absolute PE values range from 0.7D-1.5D. An association has been established with higher absolute PE and shorter AL, and pediatric eyes usually have short AL compared to a typical adult eye. In this cohort, almost half the eyes were <22mm AL. While there was no statistical difference in PE overall, 57 eyes with PE ≥2D had AL <22mm. In the Infant Aphakia Treatment Study, which likely represents the shortest of eyes (mean AL 18.0mm), the mean absolute PE was 1.8D ± 1.3D.

Conclusion
In children with developmental or acquired cataract, cataract surgery should result in good vision in >80% of uncomplicated cases; amblyopia is the most frequent cause of VA <20/40. Prediction Error is greater than benchmarks suggested for adult population studies; we found only 68% within 1D but 95% within 2D of the target refraction.

References