Validity of a Telemedicine System for the Evaluation of Acute-Phase Retinopathy of Prematurity

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**IMPORTANCE** The present strategy to identify infants needing treatment for retinopathy of prematurity (ROP) requires repeated examinations of at-risk infants by physicians. However, less than 10% ultimately require treatment. Retinal imaging by nonphysicians with remote image interpretation by nonphysicians may provide a more efficient strategy.

**OBJECTIVE** To evaluate the validity of a telemedicine system to identify infants who have sufficiently severe ROP to require evaluation by an ophthalmologist.

**DESIGN, SETTING, AND PARTICIPANTS** An observational study of premature infants starting at 32 weeks’ postmenstrual age was conducted. This study involved 1257 infants with birth weight less than 1251 g in neonatal intensive care units in 13 North American centers enrolled from May 25, 2011, through October 31, 2013.

**INTERVENTIONS** Infants underwent regularly scheduled diagnostic examinations by an ophthalmologist and digital imaging by nonphysician staff using a wide-field digital camera. Ophthalmologists documented findings consistent with referral-warranted (RW) ROP (ie, zone I ROP, stage 3 ROP or worse, or plus disease). A standard 6-image set per eye was sent to a central server and graded by 2 trained, masked, nonphysician readers. A reading supervisor adjudicated disagreements.

**MAIN OUTCOMES AND MEASURES** The validity of grading retinal image sets was based on the sensitivity and specificity for detecting RW-ROP compared with the criterion standard diagnostic examination.

**RESULTS** A total of 1257 infants (mean birth weight, 864 g; mean gestational age, 27 weeks) underwent a median of 3 sessions of examinations and imaging. Diagnostic examination identified characteristics of RW-ROP in 18.2% of eyes (19.4% of infants). Remote grading of images of an eye at a single session had sensitivity of 81.9% (95% CI, 77.4-85.6) and specificity of 90.1% (95% CI, 87.9-91.8). When both eyes were considered for the presence of RW-ROP, as would routinely be done in a screening, the sensitivity was 90.0% (95% CI, 85.4-93.5), with specificity of 87.0% (95% CI, 84.0-89.5), negative predictive value of 97.3%, and positive predictive value of 62.5% at the observed RW-ROP rate of 19.4%.

**CONCLUSIONS AND RELEVANCE** When compared with the criterion standard diagnostic examination, these results provide strong support for the validity of remote evaluation by trained nonphysician readers of digital retinal images taken by trained nonphysician imagers from infants at risk for RW-ROP.
Retinopathy of prematurity (ROP) is a leading cause of avoidable blindness in children worldwide and an increasing problem in underserved areas of the United States and Canada. In most settings, ophthalmologists travel regularly to neonatal units to perform serial eye examinations of infants at risk; however, less than 10% of infants examined require treatment. The interpretation of the ROP findings varies across examiners. A potential solution is to develop a telemedicine system using digital retinal imaging to detect sight-threatening disease. The solution must deal with key screening principles. Such evaluations differ fundamentally from clinical examinations by physicians and must provide compelling evidence for a high likelihood of altering the natural history of the disease in a significant proportion of individuals evaluated.

In recent years, studies have evaluated the validity of retinal imaging to detect moderate to severe ROP. However, the sensitivities varied widely (33% to 100%), as did the number of infants included (range, 10-122), and the primary outcome (plus disease to suspect treatment requiring care). Images for these studies were largely obtained by an ophthalmologist and were also graded by ophthalmologists. Given the current status of retinal imaging in ROP, the American Academy of Ophthalmology prioritized the need for “understanding...the place of digital wide-angle photography in the evaluation of at-risk infants.”

Ells et al introduced the term referral-warranted ROP (RW-ROP) in 2003 for use in telemedicine to describe eyes with ROP that had high-risk characteristics defined as plus disease, ROP in zone I, or stage 3 ROP or greater. Eyes with RW-ROP require careful ophthalmoscopic examination and many require treatment.

This large multicenter, National Eye Institute–funded clinical study evaluated the validity of an ROP telemedicine system to detect eyes with RW-ROP. We compared remote evaluations of digital images to the findings of a criterion-standard indirect ophthalmoscopic examination performed by experienced ophthalmologists.

### Methods

#### Eligibility

Infants with birth weight (BW) less than 1251 g meeting current ROP screening guidelines in 12 US centers and 1 Canadian center were included in the study. Exclusion criteria were postmenstrual age greater than 39 weeks at first opportunity for imaging unless transferred in for ROP treatment, admission to a neonatal intensive care unit (NICU) with regressors or treated ROP, significant media opacity precluding visualization of the retina, or major ocular or systemic congenital abnormality. The protocol and informed consent processes were approved by the institutional review boards of the participating study centers. Written informed consent was obtained for all participants.

#### Procedures

Infants underwent serial ROP imaging in both eyes using the RetCam Shuttle (Clarity Medical Systems), in addition to a standard diagnostic examination by study-certified ophthalmologists experienced in diagnosing ROP. The diagnostic examination results were classified as having clinical findings consistent with RW-ROP: zone I ROP, stage 3 ROP, or plus disease. The imagers were masked to the results of the examination and the physicians were masked to images and subsequent grading. The timing of diagnostic examinations was determined by local clinical center criteria for usual clinical care and imaging sessions began at 32 weeks’ postmenstrual age. To prevent bias in terms of adverse events, the order of imaging and examinations alternated.

Imaging was conducted by 25 nonphysician study-certified personnel including NICU nurses (44%), neonatal nurse practitioners (24%), ophthalmic photographers (8%), an ocular coherence tomography technician (4%), an ophthalmic medical technologist (4%), and individuals with nonclinical backgrounds (16%). All participated in classroom and hands-on instruction in taking retinal images in infants and selecting and uploading images to the Inoveon ROP Data Center server in Oklahoma City, Oklahoma. Imagers were certified after submission of quality prestudy image sets and passing a knowledge assessment test.

Images were obtained for each eye using the video mode with a 130° wide-field imaging system. The imager selected still frames for a standard 6-image set consisting of the pupil and 5 retinal fields, with optic disc central, nasal, temporal, superior, and inferior.

Demographic data and the medical status of the infant before, during, and after each session were collected. Surveillance for ocular and systemic complications and other adverse events was conducted.

The paired diagnostic examinations and imaging sessions continued as clinically indicated until the examining ophthalmologist noted any of the following: mature retinal vessels, immature zone III on 2 occasions at least 7 days apart, ROP regressed or regressing on 2 occasions at least 7 days apart, treatment for severe ROP, or the infant reached 40 weeks’ postmenstrual age with no ROP or only stage 1 or 2 ROP.

#### Image Grading

Image sets were uploaded as unmodified uncompressed files in .png format from the RetCam Shuttle to the Inoveon ROP Data Center server and used for remote grading by nonphysician trained readers and by expert readers (ophthalmologists with ROP expertise). All readers participated in joint didactic and image grading training sessions, underwent a certification process, and practiced with training image sets. All readers, including 3 trained readers and 3 expert readers, used the same software to access the images, used standardized workstations to grade images, and recorded findings on the same web-based data collection form. Each image set was graded independently by 2 trained readers, with discrepancies adjudicated by a reading supervisor. All readers were masked to the results of diagnostic examinations, previous gradings for either eye of the infant, and demographic data.

All readers determined the quality of each of the 5 retinal images in a set as good, acceptable, poor, or missing. They also determined, by quadrant, whether the posterior pole vessels were normal or sufficiently abnormal to be plus disease and determined zone of vascularization or the zone in which morphologic features consistent with ROP were present. Retinopathy...
of prematurity was determined by the presence of a demarcation line (stage 1), a ridge (stage 2), extraretinal neovascularization (stage 3), or retinal detachment (stage 4).

Image Selection for Grading
Trained readers graded all images from 242 infants who developed RW-ROP based on the diagnostic examination. Approximately 80% of infants were not expected to develop RW-ROP; therefore, a random sample of 613 infants (60.5%) who never developed RW-ROP was selected a priori. All image sets from this selected subsample of infants (n = 242 + 613 = 855) were graded by the trained readers. A random sample of 200 of these 855 infants was also graded by expert readers (eFigure in the Supplement).

Statistical Considerations
Sample Size
The sample size was determined by the need to have half width of the 95% CI of sensitivity within 5%. Assuming sensitivity between 80% and 95%, approximately 250 infants with RW-ROP were needed for the study.

Sensitivity/Specificity Analysis
At the same session, we compared the RW-ROP finding (positive, negative, or indeterminate) from evaluation of an image set to findings of the diagnostic examination consistent with RW-ROP (presence, absence, or indeterminate). Sensitivity and specificity of image grading of detecting RW-ROP were calculated by using the results of the diagnostic examination as the criterion standard. Eyes with indeterminate status in the diagnostic examination were excluded from the sensitivity/ specificity analysis. When the image set did not provide sufficient information for determining RW-ROP status, the eye was scored as RW-ROP positive in sensitivity/specifcity analysis because the primary aim of this study was to determine whether referral for a diagnostic examination was warranted.

We included only 1 session of digital image/diagnostic examinations from each eye in the primary analysis (single-session-per-eye analysis). For sensitivity calculation, the session when the diagnostic examination first identified RW-ROP was used, while a random session was chosen for each eye that did not develop RW-ROP for the specificity calculation.

Sensitivity was calculated as the proportion of RW-ROP-positive image gradings when examination indicated RW-ROP presence, and specificity was calculated as the proportion of RW-ROP-negative image gradings when examination indicated RW-ROP absence. The 95% CIs for sensitivity and specificity were calculated, with intereye correlation adjusted by generalized estimating equations using the sandwich robust estimate of variance. The prespecified subgroup analyses of sensitivity specificity were performed by birth weight, gestational age (GA), and image quality.

Secondary analyses of sensitivity specificity were conducted at the infant level by comparing the presence or absence of RW-ROP on examination vs RW-ROP positive/negative status from image grading at 1 selected session (single-session-per-infant analysis) and any sessions (any-session-per-infant analysis). The sensitivity and specificity for detecting the infants who underwent ROP treatment were also calculated based on the last session before treatment (last-session-per-infant analysis).

For per-infant analysis, the negative predictive value (NPV) and the positive predictive value (PPV) were calculated based on their corresponding sensitivity, specificity, and the observed rate of RW-ROP. All the statistical analyses were performed using SAS version 9.3 (SAS Institute Inc).

Results
Population and ROP Status
A total of 1284 infants with BW less than 1251 g were enrolled from May 25, 2011, through October 31, 2013 (eFigure in the Supplement). Twenty seven (2.1%) were discharged prior to a diagnostic examination. Table 1 provides the characteristics of 1257 study infants who completed at least 1 diagnostic examination. The mean BW was 864 g and mean GA of 27 weeks. Most infants had BW less than or equal to 1000 g including 34.1% of infants with BW of 750 g or less and 36.2% with BW from 751 to 1000 g. About half had GA of less than 27 weeks (51.9%) and few infants had GA of 31 weeks or greater (5.9%). More than half were

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Table 1. Characteristics of 1257 Study Infants at Enrollment

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. of Infants</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth weight, g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>864 (212)</td>
<td></td>
</tr>
<tr>
<td>Median (1st-3rd quartile)</td>
<td>860 (690-1040)</td>
<td></td>
</tr>
<tr>
<td>Gestational age, wk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>27 (2.2)</td>
<td></td>
</tr>
<tr>
<td>Median (1st-3rd quartile)</td>
<td>26 (25-28)</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>122</td>
<td>9.7</td>
</tr>
<tr>
<td>Not Hispanic or Latino</td>
<td>1085</td>
<td>86.3</td>
</tr>
<tr>
<td>Unable to answer</td>
<td>50</td>
<td>4.0</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>705</td>
<td>56.1</td>
</tr>
<tr>
<td>Asian</td>
<td>18</td>
<td>1.4</td>
</tr>
<tr>
<td>Black</td>
<td>368</td>
<td>29.3</td>
</tr>
<tr>
<td>American Indian</td>
<td>21</td>
<td>1.7</td>
</tr>
<tr>
<td>Native Hawaiian or Pacific Islander</td>
<td>4</td>
<td>0.3</td>
</tr>
<tr>
<td>Mixed</td>
<td>18</td>
<td>1.4</td>
</tr>
<tr>
<td>Unable to answer</td>
<td>123</td>
<td>9.8</td>
</tr>
<tr>
<td>Any ROP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>456</td>
<td>36.3</td>
</tr>
<tr>
<td>Yes</td>
<td>801</td>
<td>63.7</td>
</tr>
<tr>
<td>RW-ROP findings based on examination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>983</td>
<td>78.2</td>
</tr>
<tr>
<td>Yes</td>
<td>244</td>
<td>19.4</td>
</tr>
<tr>
<td>Unknown</td>
<td>30</td>
<td>2.4</td>
</tr>
<tr>
<td>Laterality of RW-ROP*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unilateral</td>
<td>30</td>
<td>12.3</td>
</tr>
<tr>
<td>Bilateral</td>
<td>214</td>
<td>87.8</td>
</tr>
</tbody>
</table>

Abbreviations: ROP, retinopathy of prematurity; RW, referral-warranted.
* Among those infants with RW-ROP.
non-Hispanic white, 29.3% black, and 49.2% female; 63.0% were born at the enrolling clinical center and 29.8% were multiple births, of which 84.3% were twin births.

Among 1257 infants who had eye examinations, the mean (SD) number of examinations per infant was 3.4 (2.1) (median, 3; range, 1-12) and 40% had 4 or more examinations. The median interval between examinations was 9 days (range, 1-54 days), with 11% of examinations within 1 week and 88% within 2 weeks.

At least 1 imaging session was conducted in 1241 infants. The mean (SD) number of imaging sessions per infant was 3.2 (2.0) (median, 3; range, 1-12) and 36% had 4 or more imaging sessions.

Among the 5520 image sets selected for trained reader grading, a total of 27,600 possible individual retinal images were evaluated for availability and image quality. Among these images, 3% were missing, 91% were adequate quality, and 6% were poor quality.

Retinopathy of prematurity was noted on examination in 801 infants (63.7%) (Table 1). Clinical findings consistent with RW-ROP were noted in 1 or both eyes of 244 infants (19.4%) and were bilateral in 87.8% of infants. The presence of RW-ROP could not be determined for only 2.4% of infants. Clinical findings consistent with RW-ROP were detected in 458 eyes (18.2%), most frequently owing to stage 3 or worse alone (48.5%) or in combination with zone I ROP and/or plus disease (33.6%; Table 2). All 3 components (plus disease, zone I ROP, and stage 3 ROP) were rarely present (3.3%).

**Comparison of Results From Examination and Imaging Grading**

Among the 5520 pairs of diagnostic examinations and image gradings, their RW-ROP status was in agreement in 78.6% (Table 3). In the 813 pairs (14.7%) with RW-ROP findings on diagnostic examination, image grading by trained readers detected 1 or more of the components of RW-ROP in 77.2% of image sets, while in 19.8%, the image grading did not detect RW-ROP and 2.5% were indeterminate. In the 4648 pairs without RW-ROP on diagnostic examination, trained readers agreed in 3703 image gradings (79.7%), while in 854 pairs (18.4%), trained readers detected findings consistent with RW-ROP. In 91 pairs, RW-ROP status was indeterminate.

**Sensitivity and Specificity for RW-ROP**

When image sets for a single session were graded by the trained readers and compared with the results of diagnostic examinations (1709 image sets in which the first session when RW-ROP findings were diagnosed were used and a random ses-

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**Table 2. Combination of RW-ROP Components Among 458 Eyes With RW-ROP Findings From Diagnostic Examinations**

<table>
<thead>
<tr>
<th>Combination of RW-ROP Components</th>
<th>Eyes, No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plus and stage 3 or worse</td>
<td>121 (26.4)</td>
</tr>
<tr>
<td>Only stage 3 or worse</td>
<td>222 (48.5)</td>
</tr>
<tr>
<td>Only zone I</td>
<td>44 (9.6)</td>
</tr>
<tr>
<td>Zone I and stage 3 or worse</td>
<td>18 (3.9)</td>
</tr>
<tr>
<td>Plus disease, zone I, and stage 3 or worse</td>
<td>15 (3.3)</td>
</tr>
<tr>
<td>Only plus disease</td>
<td>33 (7.2)</td>
</tr>
<tr>
<td>Plus disease and zone I</td>
<td>5 (1.1)</td>
</tr>
</tbody>
</table>

Abbreviations: ROP, retinopathy of prematurity; RW, referral-warranted.

**Table 3. Cross-Tabulation of RW-ROP Findings From Diagnostic Examination vs Image Grading of All Sessions per Eye**

<table>
<thead>
<tr>
<th>RW-ROP From Diagnostic Examination</th>
<th>RW-ROP From Image Grading, No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No (67.1)</td>
</tr>
<tr>
<td>No</td>
<td>3703</td>
</tr>
<tr>
<td>Yes</td>
<td>161</td>
</tr>
<tr>
<td>Indeterminate b</td>
<td>47</td>
</tr>
<tr>
<td>Total</td>
<td>3911</td>
</tr>
</tbody>
</table>

Abbreviations: ROP, retinopathy of prematurity; RW, referral-warranted.

b In 19 sessions, images were taken and graded but no diagnostic examination was performed.

**Table 4. Sensitivity and Specificity of Image Grading for Detecting RW-ROP**

<table>
<thead>
<tr>
<th>Analysis Approach</th>
<th>No. of Eyes/Infants for Analysis</th>
<th>Positive From Image Grading, No.</th>
<th>Negative From Image Grading, No.</th>
<th>Sensitivity, % (95% CI)</th>
<th>Positive From Image Grading, No.</th>
<th>Negative From Image Grading, No.</th>
<th>Specificity, % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single session per eye a, c</td>
<td>1709 eyes</td>
<td>366</td>
<td>81</td>
<td>81.9 (77.4-85.6)</td>
<td>125</td>
<td>1133</td>
<td>90.1 (87.9-91.8)</td>
</tr>
<tr>
<td>Single session per infant a, c</td>
<td>855 infants</td>
<td>215</td>
<td>24</td>
<td>90.0 (85.4-93.5)</td>
<td>80</td>
<td>534</td>
<td>87.0 (84.0-89.5)</td>
</tr>
<tr>
<td>Any session per infant d</td>
<td>855 infants</td>
<td>232</td>
<td>7</td>
<td>97.1 (94.0-98.6)</td>
<td>144</td>
<td>453</td>
<td>75.9 (72.2-79.1)</td>
</tr>
<tr>
<td>Last session before treatment per infant d</td>
<td>855 infants</td>
<td>159</td>
<td>3</td>
<td>98.2 (94.4-99.9)</td>
<td>137</td>
<td>554</td>
<td>80.2 (77.0-83.0)</td>
</tr>
</tbody>
</table>

Abbreviations: ROP, retinopathy of prematurity; RW, referral-warranted.

a RW-ROP defined as the presence of zone I ROP, stage 3 ROP, or plus disease.

b For infants with RW-ROP, the images from the session when diagnostic examination first identified RW-ROP were used. For infants without RW-ROP findings on any diagnostic examination, a random image session was selected.

c RW-ROP status could not be determined in 2 eyes based on the diagnostic examination and were excluded from analysis, and 2 eyes did not have images taken (while their fellow eye did have images) in the randomly selected session.

d Comparison of an infant who ever had RW-ROP (yes or no) from results of all sessions vs ever had RW-ROP (yes or no) from diagnostic examination results of all sessions, irrespective of whether the RW-ROP from image grading and diagnostic examination was at the same session. Nineteen infants with RW-ROP status unknown in either eye were excluded.

2 infants with RW-ROP status unknown in either eye at selected session were excluded.
sion for infants without RW-ROP, the sensitivity for detection of RW-ROP was 81.9% (95% CI, 77.4-85.6), with a specificity of 90.1% (95% CI, 87.9-91.8) (Table 4).

As shown in Table 4, when both eyes of the infant were considered, as would routinely be done in a clinical setting, the sensitivity for RW-ROP was 90.0% (95% CI, 85.4-93.5), with specificity of 87.0% (95% CI, 84.0-89.5), NPV of 97.3%, and PPV of 62.5% at the RW-ROP prevalence rate of the study (19.4%).

When RW-ROP results from any session of image grading and diagnostic examination were paired for the infant, the sensitivity increased to 97.1% (95% CI, 94.0-98.6). Specificity for this comparison was 75.9% (95% CI, 72.2-79.1), NPV was 99.1%, and PPV was 49.2%.

We also calculated the sensitivity and specificity of this telemedicine system to detect RW-ROP in infants who underwent treatment in 1 or both eyes. When the last session before treatment was analyzed, sensitivity was 98.2% (95% CI, 94.4-99.4), with specificity of 80.2% (95% CI, 77.0-83.0), NPV of 99.6%, and PPV of 44.3% at a 13.8% treatment-requiring ROP rate. Only 3 of 162 infants treated by clinical center ophthalmologists did not have RW-ROP detected on the last image grading before treatment. On diagnostic examination, 1 infant had zone 1 stage 3 disease in both eyes and another 2 infants had plus disease in both eyes.

Expert and trained readers independently graded a random sample of 1312 image sets from 100 infants with RW-ROP and 100 without RW-ROP. Using all 1312, expert readers had a lower sensitivity of 85.9% (95% CI, 80.8-89.8) compared with 91.4% (95% CI, 86.1-94.2) for trained readers and a lower specificity of 56.5% (95% CI, 51.9-61.0) vs 73.3% (95% CI, 67.6-78.3) for detecting an eye with RW-ROP.

**Timing of RW-ROP Detection on Image Grading**

The timing of the detection of RW-ROP was compared between the image grading and diagnostic examination. In 87.3% of the cases (391 of 447), RW-ROP was detected on image grading before or at the same examination that documented RW-ROP findings. Referral-warranted ROP was detected on image grading an average (SD) of 15 (11) days earlier than the examination in 44.7% of cases (200 of 447). Image grading did not detect RW-ROP at any image grading in 7.2% of cases (32 of 447). In 5.4% of cases (24 of 447), RW-ROP was detected an average (SD) of 15 (13) days after the examination documented RW-ROP. The results were very similar when analyzed by infant (data not shown).

**Sensitivity and Specificity by BW, GA, and Image Quality**

In the single-session-per-eye analysis, sensitivity of RW-ROP detection decreased with increasing BW (Table 5). This pattern was not observed for GA.

The quality of the images submitted was important. When all 5 retinal images were judged to be of good or acceptable image quality by trained readers, the sensitivity was 84.7% compared with 68.0% when 4 or fewer images were of good or acceptable quality. Specificity for this comparison was similar.

**Discussion**

The e-ROP Study results provide strong support for the validity of using a telemedicine system consisting of trained nonphysician imagers and readers to detect RW-ROP in infants at risk. When image-set grading of an eye was compared with the results of its paired diagnostic examination, the sensitivity for detection of RW-ROP was 81.9%, with a specificity of 90.1%. When both eyes of an infant were considered, the sensitivity increased to 90.0%, with specificity of 87.0%, NPV of 97.3%, and PPV of 62.5% at the observed RW-ROP rate of 19.4%. Importantly, among infants treated for ROP, the sensitivity of image grading increased to 98.2%.

Among the strengths of the e-ROP Study is the successful use of nonphysician imagers. The imagers were trained to capture standard image sets for grading by nonphysician trained readers using a standard grading protocol. The diagnostic ex-
Aim: To evaluate the effect of telemedicine on ROP staging and management.

Methods: A retrospective review of ROP referrals and telemedicine consultations at the University of Pennsylvania Children's Hospital. The study included 200 cases of ROP staging performed via telemedicine between 2010 and 2014.

Results: The telemedicine system allowed for early detection and management of ROP in 95% of cases. The system also reduced the need for in-person consultations by 40%. The system was well-received by parents and medical professionals.

Conclusion: Telemedicine is an effective tool for managing ROP and improving patient outcomes.

Keywords: Telemedicine, ROP, Ophthalmology

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