APPLIES TO:

All lines of business

BENEFIT APPLICATION

Medicaid Members

Oregon: Services requested for Oregon Health Plan (OHP) members follow the OHP Prioritized List and Oregon Administrative Rules (OARs) for coverage determinations.

For other lines of business, refer to the Policy Criteria section below:

POLICY CRITERIA

I. Retinal photography may be considered medically necessary and is covered to screen for diabetic retinopathy in patients with diabetes mellitus when all of the following criteria (A.-C.) are met:

   A. The individual does not have prior diagnosis of diabetic retinopathy; and
   B. The imaging technique is performed with a U.S. Food and Drug Administration (FDA) approved device; and
   C. The final images are graded for diabetic retinopathy using a manual process.

II. Retinal photography is considered not medically necessary and is not covered in patients with a current diagnosis of diabetic retinopathy, including but not limited to:

   A. Monitoring potential progression of a disease process; or
   B. Guidance in evaluating the need for or response to a specific treatment or intervention.

III. Retinal photography is considered experimental/investigational and is not covered for any other situation, including, but not limited to:
A. When criterion 1. above is not met; or
B. For screening of a condition other than diabetes mellitus, including, but not limited to:
   1. Suspected diabetes, pre-diabetes, or gestational diabetes; or
   2. Macular degeneration; or
   3. Retinopathy of prematurity; or
C. When the final retinal images are graded using an automatic process only (e.g., Intelligent Retinal Imaging System [IRIS]).

BILLING GUIDELINES

Code 92227 for diabetic retinopathy screening may only be covered when medical necessity criteria above are met and code 92227 is billed with any of the following ICD-10 codes noted below:

- E08.0 – E08.29
- E08.36 – E08.9
- E09.0 – E09.29
- E09.36 – E09.9
- E10.0 – E10.29
- E10.36 – E10.9
- E11.0 – E11.29
- E11.36 – E11.9
- E12.0 – E12.29
- E12.36 – E12.9
- E13.0 – E13.29
- E13.36 – E13.9
- O24.0 – O24.33
- O24.8 – O24.93

CPT CODES

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<tr>
<th>All Lines of Business</th>
<th>No Prior Authorization Required</th>
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<tr>
<td>92227</td>
<td>Remote imaging for detection of retinal disease (e.g., retinopathy in a patient with diabetes) with analysis and report under physician supervision, unilateral or bilateral</td>
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<tr>
<td>92228</td>
<td>Remote imaging for monitoring and management of active retinal disease (e.g., diabetic retinopathy) with physician review, interpretation and report, unilateral or bilateral</td>
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DESCRIPTION

Diabetic retinopathy is a microvascular complication of diabetes mellitus that is the most common ophthalmologic complication of diabetes and the leading cause of new blindness in the United States. The risk of developing retinopathy increases with duration of disease. After 20 years of diabetes, nearly all patients with type 1 diabetes and over 60% of patients with type 2 diabetes have some degree of retinopathy, which can lead to retinal detachments, retinal tears, and macular edema, with subsequent partial or total loss of vision.¹

The standard of care for prevention of vision loss due to diabetic retinopathy includes a comprehensive annual eye examination, including measurement of visual acuity, intraocular pressure, and an examination of the retina performed with the pupils pharmacologically dilated. This is generally performed by an ophthalmologist or retinal specialist. If diagnosed in an early stage, laser photocoagulation can be effective in preventing or reducing vision loss in patients with proliferative retinopathy or macular edema if lesions.¹

Access to the specialist equipment and expertise may not always be available and retinal telescreening systems have emerged as a way to increase screening for diabetic retinopathy. Photographic methods have been developed to allow images of the retina to be documented and examined by expert readers who are not located conveniently to the patient. The gold standard for screening is currently the seven-field stereoscopic color fundus photography. Recently, digital fundus photography, which may or may not involve dilation of the pupils, has become popular. Digital imaging has the advantage of allowing for evaluation by trained examiners at distant locations thereby enhancing patient access to retinal specialists.

More recently, nonmydriatic digital retinal imaging allows remote interpretation by an ophthalmologist, which may improve retinopathy screening in areas with a shortage of eye care specialists, and is reported to have good sensitivity and specificity for detecting diabetic retinopathy.

REVIEW OF EVIDENCE

A review of the ECRI, Hayes, Cochrane, and PubMed databases was conducted regarding the use of various forms of retinal imaging as a screen for diabetic retinopathy. Below is a summary of the available evidence identified through July of 2017.

Mydriatic versus Nonmydriatic Status

Systematic Reviews

In 2011, Bragge et al. reported a meta-analysis which examined how pupil dilation affected the accuracy of screening for diabetic retinopathy, including 20 studies that measured the sensitivity and specificity of imaging tests used for screening for diabetic retinopathy.² Studies measured sensitivity and specificity for the detection of diabetic retinopathy, using either digital photography; film photography; direct examination; Polaroid photography; various combinations of camera types or camera plus examination
and scanning laser ophthalmoscope. All included studies used either seven-field mydriatic photography or dilated fundus examination (by an ophthalmologist or equivalent specialist) as the reference standard. Compared to a reference standard for imaging, the overall estimate of sensitivity was 82.5% (95% CI, 75.6% to 87.9%) and specificity was 88.4% (95% CI, 84.5% to 91.4%) for alternative imaging methods. The reviewers reported that mydriatic status did not significantly influence sensitivity (odds ratio [OR], 0.89; 95% CI, 0.56-1.41; p = 0.61) or specificity (OR, 0.94; 95% CI, 0.57-1.54; p = 0.80). The authors concluded that outreach screening was an effective alternative to on-site specialist examination, regardless of imaging technique used or mydriatic status.

**Randomized Controlled Trials (RCTs)**

In 2015, Mansberger et al. published the results of a study that randomized 567 participants to either receive telemedicine with a nonmydriatic camera in a primary care clinic (n=296) or traditional surveillance with an eye care professional (n=271). Patients were followed for 5 years. After 2 years, telemedicine was offered to all participants. During the 6-month or less time period, the telemedicine group participants were more likely to receive a diabetic retinopathy screening examination when compared with the traditional surveillance group (94.6% versus 43.9%; 95% CI, 46.6%-54.8%; p<0.001). In addition, in the 6-18 month timeframe, the telemedicine group was also more likely to receive diabetic retinopathy screening exams (53.0% versus 33.2%; 95% CI, 16.5%-23.1%; p<0.001). After 2 years when telemedicine was offered to both groups, there was no difference between the groups in the percentage of diabetic retinopathy screening examinations.

**Nonrandomized Studies**

In 2004, Murgatroyd reported on the effect of pupillary dilation on screening for diabetic retinopathy, including 398 individuals (794 eyes). Slit lamp examination findings were compared to non-mydriatic fundus images. Three photographic strategies were used: undilated single field, dilated single field, and dilated multiple fields. The photographs were presented randomly to retinal screeners and the screeners were masked to the use of mydriatics. Although mydriasis significantly reduced the proportion of ungradable photographs from 26% to 5% (p<0.001), the sensitivity and specificity were no different for dilated versus undilated pupils. The sensitivity and specificity for detecting retinopathy using undilated single field photography was 77% (95% CI: 71 to 84) and 95% (95% CI: 93 to 97), respectively. Using dilated single field photography the figures were 81% (95% CI: 76 to 87) and 92% (95% CI: 90 to 94), respectively. Using dilated three field photography the figures were 83% (95% CI 78 to 88) and 93% (95% CI: 91 to 96), respectively.

**Digital Imaging Screening Methods**

The validity of digital image acquisition and the reliability of digital image evaluation have been established to be acceptable for diagnostic purposes. Key studies comparing the accuracy of high-resolution digital stereoscopic fundus photographs to plain film stereoscopic fundus photographs (the gold standard), are described below.
Nonrandomized Studies

In 2002, Fransen et al. published the results of a case series including 290 diabetic participants. All pts had seven standard field color stereo photos taken on film and captured digitally. Photos and digital images were each graded in a blinded fashion by trained graders. Concordance was 80.1%. The sensitivity of digital photography in detecting threshold events was 98.2% and the specificity was 89.7%. The positive predictive value was 69.5% and the negative predictive value was 99.5% for this sample. The authors concluded that evaluation of film and digital images provided substantially equivalent results.

In 2005, Schiffman et al. published the results from a masked prospective image validation study, including 111 patients with diabetes (222 eyes) who were imaged with both the DigiScope and with seven-field stereo color fundus photography. The authors reported that there was high correlation between the DigiScope and seven-field stereo color fundus photography between “no diabetic retinopathy” and “any diabetic retinopathy” (Kappa statistic 0.97 for the right eye [OD] and 0.94 for the left eye [OS]). This was reflected in the sensitivities (0.99 OD, 1.00 OS) and specificities (1.00 OD, 0.92 OS) of the DigiScope test. The investigators concluded that the DigiScope has excellent agreement, sensitivity, and specificity compared with the “gold-standard” seven-field color stereo photography for identifying patients with any or low levels of diabetic retinopathy that should be referred to ophthalmologist. The authors noted, however, that the DigiScope is not designed as a diabetic retinopathy disease management tool or to replace a comprehensive eye examination.

In 2006, Zimmer-Galler published a case series that included 2,771 individuals with diabetes who had not undergone an eye examination in the past year who were imaged with the DigiScope (EyeTel Imaging, Inc.) in the primary care physician's office. A total of 9% of those screened were referred for a conventional comprehensive ophthalmological examination based on DigiScope findings, while 11% were referred due to unreadable images. The authors concluded that implementation of the DigiScope in the primary care setting was practical as it allowed screening of patients with diabetes who were otherwise not receiving recommended comprehensive eye examinations.

In 2010, Wilson et al. published the results of a large study that evaluated the sensitivity and specificity of wide-field scanning laser ophthalmoscopy (WSLO) for screening of diabetic retinopathy, comparing its performance with digital retinal photography. A total of 380 patients (759 eyes) underwent nonmydriatic WSLO imaging, single- and dual-field mydriatic digital retinal photography, and examination with slit lamp biomicroscopy, the reference standard. Grading of retinopathy was performed in a masked fashion. Screening sensitivities for dilated single-field retinal photography, dual-field retinal photography and WSLO were not significantly different (82.9, 82.9 and 83.6%; p > 0.2). Specificities for the three types of imaging were also similar (92.1, 91.1 and 89.5%, respectively; p > 0.2). However, the technical failure rate (number of ungradable images) with undilated WSLO was greater than that obtained with dilated 2-field retinal photography (10.8 vs. 5.8%, p = 0.005) and with dilated 1-field retinal photography (10.8 vs. 6.3%, p = 0.02). Additional limitations of implementing WSLO into telecercening includes lack of studies performed in a mobile setting, low resolution to detect small lesions, and significantly more time spent on image analysis.

In 2013, Ku et al. published a study that assessed the accuracy of grading diabetic retinopathy using a
single-field digital fundus photograph compared to clinical grading from a dilated slit-lamp fundus exam, including 360 participants (706 eyes) from remote communities in central Australia.\(^8\) On clinical grading, 163 eyes had diabetic retinopathy, 51 eyes were vision-threatening. The sensitivity and specificity for detecting diabetic retinopathy were 74% (95% CI, 67%-80%) and 92% (95% CI, 90%-94%), respectively. The sensitivity and specificity for detecting vision-threatening diabetic retinopathy were 86% (95% CI, 77%-96%) and 95% (95% CI, 93%-97%), respectively. The authors concluded that even single-field digital fundus photography is a valid screening tool for DR in remote communities and may be used to provide eye care services with acceptable accuracy.

**Telemedicine**

Since there is sufficient evidence of the relative equivalence of digital imaging to plain film photography, retinal telescreening systems can be a valid alternative to conventional exams by an eye specialist. Recent studies reporting on the validity of telescreening are described below.

**Systematic Review**

In 2015, Shi et al. conducted a systematic review assessing the diagnostic accuracy of telemedicine in various clinical levels of diabetic retinopathy (DR), including 20 studies (N= 1960 participants).\(^9\) Pooled sensitivity and specificity of telemedicine in detecting the absence of DR were 86% and 95%, respectively. For non-proliferative diabetic retinopathy (NPDR) sensitivities (53-76%) and specificities (89-99%) varied by severity (low-, medium, and high). For proliferative diabetic retinopathy (PDR), sensitivities (75-76%) and specificities (95-97%) varied by risk (low versus high). In addition, subgroup analysis of non-mydriasis versus mydriasis in telemedicine detection of absence of DR indicated that non-mydriasis-based methods were less sensitive than mydriasis (sensitivity of 80% versus 91%, respectively). Limitations of this review included heterogeneity between included studies and three included studies had missing data for several outcomes.

**Nonrandomized Studies**

In 2014, Raman et al. published the results of a randomized study that compared the diagnostic accuracy of telescreening (using single-field 45-degree fundus photography) to that of traditional ophthalmologist-based diabetic retinopathy screening in rural India.\(^10\) Overall 3522 people with diabetes mellitus underwent ophthalmologist-based screening and 4456 people with diabetes underwent ophthalmologist-led telescreening. A total of 519 people (14.7%) were diagnosed to have diabetic retinopathy in the ophthalmologist-based model, and 853 people (19.1%) in the ophthalmologist-led model \(p < 0.0001\). More sight-threatening retinopathies were found in the ophthalmologist-led model than in the ophthalmologist-based model (6.3% vs. 5%). Thus the investigators concluded that telescreening did not underestimate the prevalence of diabetic retinopathy.
Automated Processing of Images

Technology Assessment

In 2016, Tufail et al. published a technology assessment of automated diabetic retinopathy image assessment software on behalf of the U.K.-based National Institute for Health Research (NHS) Diabetic Eye Screening Programme (DESP). The assessment compared three automated retinal image analysis systems (ARIASs); iGradingM, Retmarker and EyeArt; to determine their screening performance, compared to each other and manual grading of images. Currently, only EyeArt is available in the United States. This was an observational retrospective measurement comparison study that evaluated 102,856 images from consecutive diabetic patients who attended a routine annual NHS DESP visit. The sensitivity estimates of the ARIASs were as follows: EyeArt 94.7% (95% CI 94.2% to 95.2%) for any retinopathy, 93.8% (95% CI 92.9% to 94.6%) for referable retinopathy and 99.6% (95% CI 97.0% to 99.9%) for proliferative retinopathy; and Retmarker 73.0% (95% CI 72.0% to 74.0%) for any retinopathy, 85.0% (95% CI 83.6% to 86.2%) for referable retinopathy and 97.9% (95% CI 94.9 to 99.1%) for proliferative retinopathy. iGradingM classified all images as either ‘disease’ or ‘ungradable’, which limited iGradingM analysis. The sensitivity and false-positive rates for EyeArt were not affected by ethnicity, sex or camera type but sensitivity declined with increasing patient age. The screening performance of Retmarker varied with patient’s age, ethnicity and camera type.

The assessment reported a number of limitations of some of these ARIASs, including scaling and infrastructure issues due to uploading and processing a large number of images, lacking of blinding of certain manual graders to previous manual grades and automated grading classification, and not assessing referral or rescreening as an outcome. Observational trials evaluating ARIAS effectiveness by way of correct patient referral or rescreen rates are needed to validate this hypothesis. The assessment concluded that Retmarker and EyeArt achieved acceptable sensitivity for referable retinopathy and false-positive rates (compared with human graders as reference standard), but observational trials evaluating ARIAS effectiveness by way of correct patient referral or rescreen rates are needed.

Nonrandomized Study

In 2016, Walton et al. conducted a retrospective cohort study designed to determine the efficacy of an automated algorithm in interpreting screening ophthalmoscopic photographs from patients with diabetes compared with a reading center interpretation, including 15 015 patients with type 1 or 2 diabetes. Patients who had undergone a retinal screening examination and nonmydriatic fundus photography via the Intelligent Retinal Imaging System (IRIS) from June 2013 to April 2014 were included. The sensitivity of the IRIS algorithm in detecting sight-threatening diabetic eye disease compared with the reading center interpretation was 66.4% (95% CI, 62.8%-69.9%) with a false-negative rate of 2%. The specificity was 72.8% (95% CI, 72.0%-73.5%). The IRIS algorithm had a positive predictive value of 10.8% (95% CI, 9.6%-11.9%) and a negative predictive value of 97.8% (95% CI, 96.8%-98.6%). The authors noted that although the algorithm shows promise as a screening program, algorithm refinement is needed to achieve better performance and that further studies are needed to assess test performance and patient safety.
CLINICAL PRACTICE GUIDELINES

American Diabetes Association (ADA)

The 2017 ADA Standards of Medical Care in Diabetes recommended the following for screening for diabetic retinopathy.\textsuperscript{13}

- “Adults with type 1 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist within 5 years after the onset of diabetes. (Evidence grade: B = well-conducted cohort, case-control, registry studies)
- Patients with type 2 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist at the time of the diabetes diagnosis. (Evidence grade: B = well-conducted cohort, case-control, registry studies)
- If there is no evidence of retinopathy for one or more annual eye exams and glycemia is well controlled, then exams every 2 years may be considered. If any level of diabetic retinopathy is present, subsequent dilated retinal examinations should be repeated at least annually by an ophthalmologist or optometrist. If retinopathy is progressing or sight-threatening, then examinations will be required more frequently. (Evidence grade: B = well-conducted cohort, case-control, registry studies)
- While retinal photography may serve as a screening tool for retinopathy, it is not a substitute for a comprehensive eye exam. Women with preexisting type 1 or type 2 diabetes who are planning pregnancy or who are pregnant should be counseled on the risk of development and/or progression of diabetic retinopathy. (Evidence grade: B = well-conducted cohort, case-control, registry studies)
- Eye examinations should occur before pregnancy or in the first trimester in patients with preexisting type 1 or type 2 diabetes, and then patients should be monitored every trimester and for 1 year postpartum as indicated by the degree of retinopathy. (Evidence grade: B = well-conducted cohort, case-control, registry studies)”

Regarding pregnant women, the ADA states:
- “Pregnancy is associated with a rapid progression of diabetic retinopathy. Women with preexisting type 1 or type 2 diabetes who are planning pregnancy or who have become pregnant should be counseled.
- Women who develop gestational diabetes mellitus do not require eye examinations during pregnancy and do not appear to be at increased risk of developing diabetic retinopathy.”

Regarding telescreening, the ADA states:
- “Retinal photography with remote reading by experts has great potential to provide screening services, especially in areas where qualified eye care professionals are not readily available.
- High quality fundus photographs can detect most clinically significant diabetic retinopathy. Interpretation of the images should be performed by a trained eye care provider.
- In-person exams are still necessary when the retinal photos are of unacceptable quality and for follow-up if abnormalities are detected. Retinal photos are not a substitute for comprehensive eye exams.”
American Academy of Ophthalmology (AAO)

The 2016 updated Preferred Practice Pattern on Diabetic Retinopathy published the following strong recommendations, based on good quality evidence (high-quality systematic reviews of case-control or cohort studies):\textsuperscript{14}

- “Individuals with Type 1 diabetes mellitus without diabetic retinopathy should have annual screenings beginning 5 years after the onset of diabetes.
- Individuals with Type 2 diabetes mellitus without diabetic retinopathy should be screened at the time of diagnosis and at least yearly examinations thereafter.
- Pregnant individuals with pre-existing Type 1 or Type 2 diabetes mellitus should have an eye examination soon after conception and early in the first trimester. If no retinopathy is found, follow-up is encouraged every 3–12 months.
- For patients with type 1, type 2 or pregnant women with type 1 or type 2, abnormal findings may dictate frequent follow-up examinations (e.g., retinal vascular abnormalities)
- Women who develop gestational diabetes do not require an eye examination during pregnancy and do not appear to be at increased risk of developing diabetic retinopathy during pregnancy.”

Regarding telescreening, the AAO states:
- “There is a positive association between participating in a remote photographic screening program and subsequent adherence to receiving recommended comprehensive dilated eye examinations by a clinician. These screening programs are more relevant when access to ophthalmic care is limited.
- Telescreening programs should follow established practice guidelines, as outlined by the evidence-based Telehealth Practice Recommendations by Li et al. in 2011.\textsuperscript{15}
- Given the known gap in accessibility of direct ophthalmologic screening, fundus photographic screening programs may help increase the chances that at-risk individuals will be promptly referred for more detailed evaluation and management.”

INSTRUCTIONS FOR USE

Providence Health Plan (PHP) and Providence Health Assurance (PHA) Medical Policies serve as guidance for the administration of plan benefits. Medical policies do not constitute medical advice nor a guarantee of coverage. PHP and PHA Medical Policies are reviewed annually and are based upon published, peer-reviewed scientific evidence and evidence-based clinical practice guidelines that are available as of the last policy update. PHP and PHA reserve the right to determine the application of Medical Policies and make revisions to its Medical Policies at any time. Providers will be given at least 60-days’ notice of policy changes that are restrictive in nature.

The scope and availability of all plan benefits are determined in accordance with the applicable coverage agreement. Any conflict or variance between the terms of the coverage agreement and PHP and PHA Medical Policy will be resolved in favor of the coverage agreement.
REGULATORY STATUS

Mental Health Parity Statement

Coverage decisions are made on the basis of individualized determinations of medical necessity and the experimental or investigational character of the treatment in the individual case.

REFERENCES
