Guidelines for the Collaborative Management of Persons with Diabetes Mellitus by Eye Care Professionals

1. Background:

Diabetes is a disease that is growing rapidly in both incidence and prevalence in Ontario (dramatically exceeding the global estimates of the World Health Organization), and poses a major public health challenge on many fronts [1]. More specifically, diabetic retinopathy is the most common cause of new cases of legal blindness in people of working age [2,12]. Approximately 12% of new cases of blindness are caused by diabetic retinopathy, and people with diabetic retinopathy are 25 to 29 times more likely than the general population to become blind within four years [3,13]. As many as 20% of patients newly diagnosed with Type 2 Diabetes (90% of cases of diabetes are Type 2), have some evidence of diabetes-related eye disease at the time of diagnosis, and approximately 5% will need immediate treatment to help prevent vision loss. Within 7 years of diagnosis, 50% of patients with Type 2 Diabetes will develop diabetes-related changes to the eye. By 15 years, this number increases to as many as 85%, with 25% requiring treatment [3]. Essentially 100% of patients with Type 1 Diabetes will exhibit some diabetes-related eye disease 15 to 20 years after diagnosis [3,8]. Further, the vascular changes that occur within the eye are predictive of vascular changes occurring elsewhere in the body [6,7].

Vision loss from diabetic retinopathy is best treated (and may be prevented) if caught in time [4]. Unfortunately, data from the U.S. and Australia show that 50% of people with diabetes are not receiving regular eye examinations [9,10]. These numbers are staggering when extrapolated to the approximately 3 million Canadians currently living with diabetes (one-third of whom are unaware they have diabetes); a number predicted to increase to 3.7 million by 2020 [5]. Canada's Aboriginal people have a rate of diabetes nearly five times that of non-Aboriginal people, and are at a greater risk for vision loss from diabetes and its ocular complications than any other ethnic group in Canada [5].

Eye care providers face a challenge in the management and coordination of care for patients with diabetes. The delivery of eye care must provide cost effective and efficient use of resources to minimize preventable vision loss.

> *"Preventing blindness in people with diabetes is uniquely cost-saving and cost-effective. There are few cases in health care that are so self-evident."*
>
> *JC Javitt, MD, MPH*
> *"Blindness: We Know What It Costs! Now What?"*
> *Cost of Blindness Symposium* [11]

2. Effectiveness of current methods of assessment for diabetic retinopathy (DR):

Assessment plays an important role in early detection and intervention to prevent the progression of diabetic retinopathy (DR). Low vision/blindness is substantially reduced among people with diabetes who receive recommended levels of care [15]. Despite the high level of efficacy, and both clinical and cost effectiveness of DR assessment and treatment, problems remain with assessment and treatment compliance. Many people with diabetes do not access regular eye examinations and the barriers that prevent them from attending for assessment are numerous.

Successful distribution of comprehensive guidelines to ophthalmologists and optometrists in many locations have not resulted in any significant impact on management practices for DR and recommendations for assessment and examination have been poorly followed [16,17,18,19].

In Canada, only 32% of patients with Type 2 Diabetes meet the Canadian Diabetes Association [20,21] guideline-recommended schedule of evaluation for diabetic retinopathy [22]. A study that examined assessment patterns in five Canadian provinces has shown that 32% of the population with diabetes had not had an eye examination in the last 2 years and that another 32% had never had an eye examination for DR [23].

Factors affecting non-adherence to recommended guidelines are numerous. They include lack of awareness that diabetic retinopathy can lead to blindness or that severe retinopathy can be asymptomatic [24]. Limited access to eye care professionals, particularly in remote areas [25,26,27], can play a significant role. Fear of laser treatment, guilt about poor control causing retinopathy, the inconvenience of regular attendance [24] and limited personal mobility due to poor overall health and self-reported apathy [28] may also deter patients from attending assessment appointments.

Primary care provider recommendation about the necessity of a regular eye examination is the most significant predictor of assessment for diabetic retinopathy and once such a recommendation is given, the assessment rate improves [29]. Thus, all physician/allied health staff encounters with individuals with diabetes should be used as an opportunity for education on the need for regular eye assessment and on risk factors associated with DR.

Evidence [30] indicates that increasing patient awareness of diabetic retinopathy, improving provider and practice performance, improving healthcare system infrastructure processes to make attendance more convenient for patients, using patient recall systems and better outreach to disadvantaged populations can significantly improve the rates of assessment for diabetic retinopathy.

Any chosen assessment strategy or program needs sufficient resource allocation and access to information technology to ensure comprehensive coverage and compliance with quality-assurance standards [31].

3. Goal:

The goal of these guidelines is to coordinate the services of ophthalmologists, optometrists, family physicians, physician specialists, nurse practitioners and allied health staff in the management of patients with diabetes, thereby ensuring the most effective use of these professionals in the interest of patient safety, quality of care, accessibility and cost effectiveness.

4. Roles:

Primary Care Providers:
Family Physician/Physician Specialist/Nurse Practitioner/Allied Health Staff

The first step in preventing ocular complications from diabetes is identifying the population at risk. Primary care providers, including family physicians, are responsible for identifying patients with diabetes and play a key role in the care and treatment process. As the coordinators of patient care, primary care providers should promptly refer any newly diagnosed patient with Type 2 Diabetes for an assessment by an optometrist (or ophthalmologist). Patients over the age of puberty with Type 1 Diabetes need to be referred within 5 years of their diagnosis with diabetes.

Pediatric patients with Type 1 Diabetes should be referred for a comprehensive eye examination once the child has reached the age of 10, or has had diabetes for at least 3 years. Ideally, an ophthalmologist should perform this initial examination. Once the patient has reached the age of 13, in the absence of retinopathy, the patient should be followed by an optometrist (or ophthalmologist) on an annual basis.

Family physicians also need to ensure that their established patients with either Type 1 or Type 2 Diabetes, but without retinopathy, are assessed by an optometrist (or ophthalmologist) annually. Ideally, each referral would be accompanied by fasting blood glucose and HbA1c levels.

The above outlined pattern of referral to an optometrist is intended to improve patient access to timely and consistent surveillance for eye disease related to diabetes. While the Eye Health Council would recommend that initial referrals be directed to an optometrist, it is not the intent to restrict direct access to an ophthalmologist through a requirement to first see an optometrist.

5. RECOMMENDATIONS:

1. **Refer any patient over the age of puberty with Type 1 Diabetes within 5 years of their diagnosis with diabetes for an assessment by an optometrist (or ophthalmologist).**
2. **Refer any patient newly diagnosed with Type 2 Diabetes for an assessment by an optometrist (or ophthalmologist). The patient should be seen within six months of the referral.**
3. **Refer any pediatric patient with Type 1 Diabetes for a comprehensive eye examination once the child has reached the age of 10, or has had diabetes for at least 3 years. Ideally, an ophthalmologist should perform this initial examination. Once the patient has reached the age of 13, in the absence of retinopathy, the patient should be followed by an optometrist (or ophthalmologist) on an annual basis.**
4. **At every visit, a patient with diabetes should be asked about their liaison with an optometrist or ophthalmologist to ensure appropriate monitoring.**
5. **As mentioned later in this document, the optometrist and ophthalmologist will ensure that the next regular visit for their patient with diabetes is arranged, and will correspond with all appropriate physicians and allied health staff with ocular updates on the patient.**

6. Optometrist:

Optometrists will assess patients according to established protocols (see below) for ocular complications of diabetes and **should provide a report of the findings at the initial patient encounter, and thereafter when clinically indicated, to the family physician/primary care provider**. It is helpful to provide an annual update if the patient is being seen more frequently. In cases where diabetic eye disease is detected, optometrists should use generally accepted criteria (see below) when managing and/or referring the patient to an ophthalmologist or retinal specialist. Referral for subsequent care should include a report to the ophthalmologist and family physician.

7. Ophthalmologist:

Ophthalmologists are responsible for assessing and (if necessary) treating diabetic eye disease to prevent, minimize or restore vision loss. Patients with diabetic eye disease, who remain at high risk of vision loss, should continue to be monitored by the ophthalmologist. **The ophthalmologist should provide a report of the findings at the initial patient encounter, and thereafter when clinically indicated, to the family physician/primary care giver and optometrist.** It is helpful to provide an annual update if the patient is being seen more frequently.

All professionals share the common role of ensuring their patients are educated with respect to diabetes in general, and their specific clinical situation.

8. Initial / Ongoing Assessment:

8.1. Initiation of assessment in people with Type 1 Diabetes:

In Type 1 Diabetes, sight-threatening retinopathy is very rare in the first 5 years of diabetes or before puberty [32]. However, almost all patients with Type 1 Diabetes develop retinopathy over the subsequent two decades [33] and duration of diabetes is strongly associated with the development and severity of DR [34,35,36,37].

Based on the available evidence, assessment for diabetic retinopathy in post-pubertal individuals should be initiated within 5 years of diagnosis.

For pre-pubertal individuals, assessment should be initiated at age 10 or within 3 years of diagnosis, whichever comes first.

8.2. Initiation of assessment in people with Type 2 Diabetes:

Duration of diabetes is the strongest risk factor linked to the development of DR [38,39,40,41,42]. DR risk is continuous with no evident glycemic or blood pressure threshold [75].

At the time diabetes is diagnosed, up to 3% of patients with diabetes over age 30 have CSME or high-risk DR findings [43,44]. After a 10-year duration of diabetes, 7% of persons with diabetes were shown to have retinopathy; this number increased to 90% after 25 years. Proliferative disease was found in 20% of patients after 20 years of diabetes [45]. DR prevalence was shown to be lower in patients diagnosed with diabetes after the age of 70 years, and

patients with DR had a significantly higher median duration of diabetes (5.0 years) than those without DR (3.5 years)[46].

The interval between the onset of symptoms and diagnosis in patients with Type 2 Diabetes is 7 years. Given this and the foregoing information, retinopathy assessment for patients with Type 2 Diabetes should be initiated at the time of diagnosis.

8.3. Assessment intervals for people with diabetes:

Since 1985, lower rates of progression to PDR and of severe visual loss from DR have been reported. This may reflect an increased awareness of retinopathy risk factors, earlier identification and care for patients with retinopathy as well as improved glucose, blood pressure, and serum lipids management [47].

9. Type 1 Diabetes:

The EURODIAB Prospective Complications Study found that diabetes duration, age at onset before age 12 years, and metabolic control were significant predictors of progression, even when adjusted for presence of baseline retinopathy [48].

10. SPECIFIC RECOMMENDATIONS:

NO RETINOPATHY

Type 1 Diabetes

1. Available evidence indicates that an annual assessment needs to be performed by an optometrist (or ophthalmologist, or telemedicine screening if those doctors are not accessible).

Type 2 Diabetes

In the absence of any DR, assessment intervals of 19 to 24 months, as compared with intervals of 12 to 18 months, are not associated with increased risk of referable retinopathy [49], and biennial screening has been shown to be safe and effective with no person progressing from having no retinopathy to sight-threatening retinopathy in under two years [50]. This approach reduces the number of assessments by more than 25%, considerably reducing health costs, strain on resources and relieving patients with diabetes from unnecessary examinations [51]. However, screening intervals of more than 24 months are associated with an increased risk of sight-threatening DR [49]. The overriding concern, however, is that a move away from annual examinations will result in patients being lost to proper follow-up. This is especially true for people with poor access to care. Given that the current standard of care for people with Type 1 Diabetes is annual examinations, this will be the recommendation of these guidelines for patients with Type 2 Diabetes. Biennial follow-up may be suggested for those patients who can be relied upon to

recognize the need for recall after 24 months, or for offices that are able to recall patients effectively at the 2-year mark.

2. **<u>Annual</u> assessment of patients with Type 2 Diabetes with no retinopathy needs to be performed by an optometrist (or ophthalmologist, or telemedicine screening if those doctors are not accessible).**

PREGNANT WOMEN WITH DIABETES

3. **Before attempting to become pregnant, women with Type 1 or Type 2 Diabetes should undergo an ophthalmic evaluation by an optometrist or ophthalmologist. Repeat assessments should be performed during the first trimester, as needed during pregnancy, and again within the first year postpartum [76,77]. This guideline does not apply to women who develop gestational diabetes, because such individuals are not at increased risk for diabetic retinopathy.**

MINIMAL RETINOPATHY: Mild NPDR

- Several microaneurysms
- Visual acuity of 6/6 or better (unless other known cause of decreased vision)

4. **<u>Annual</u> follow-up of patients with mild NPDR by an optometrist (or ophthalmologist, or telemedicine screening if those doctors are not accessible).**

MODERATE RETINOPATHY: Moderate NPDR

- Intraretinal hemorrhages
- Hard exudates
- Nerve fibre layer infarcts/cotton wool spots (CWS)

5. **Consider referral of a patient with moderate NPDR to an ophthalmologist (or retinal specialist) if there is any concern about DME, CSME, or other treatable disease. Assessment of patients with moderate NPDR by an eye care professional (optometrist or ophthalmologist) needs to occur at least every six months.**

SEVERE RETINOPATHY: Severe NPDR

Severe NPDR includes all features of moderate NPDR, plus any one of the following:

- Intraretinal hemorrhages (≥20 in each of 4 quadrants)
- Venous beading (2 or more quadrants)
- Arteriolar narrowing
- Intraretinal microvascular abnormalities – IRMA (1 or more quadrant(s))

Very severe NPDR is defined as any 2 of the criteria for severe NPDR.

6. Referral to a retinal specialist (or ophthalmologist) for possible treatment. Assessment by an ophthalmologist <u>every 2 to 4 months</u>. Once stabilized, the patient requires follow-up by either an optometrist or ophthalmologist (or retinal specialist) so that assessment occurs <u>at least every six months</u>.

DIABETIC MACULAR EDEMA: DME, CSME

Clinically significant macular edema (CSME) is defined as [74]:

- Retinal thickening at or within 500 microns of the fovea
- Hard exudates at or within 500 microns of the fovea (if adjacent retina is thickened)
- Retinal thickening 1 disc diameter or larger if within 1 disc diameter of the fovea

7. Referral to a retinal specialist (or ophthalmologist) for treatment (laser, IVI). Follow-up by treating ophthalmologist until DME has stabilized or resolved. Once stabilized, the patient requires follow-up by either an optometrist or ophthalmologist (or retinal specialist) so that assessment occurs <u>at least every six months</u>.

PROLIFERATIVE DIABETIC RETINOPATHY: PDR

- Neovascularization of the disc – NVD
- Neovascularization elsewhere – NVE
- Vitreous/pre-retinal hemorrhage
- Neovascularization of the iris – NVI (anterior segment neovascularization)

8. Referral to a retinal specialist (or ophthalmologist) for treatment (laser, IVI, vitrectomy). Follow-up by treating ophthalmologist until regression. Once stabilized, the patient requires follow-up by either an optometrist or ophthalmologist (or retinal specialist) so that assessment occurs <u>at least every six months</u>.

11. Assessment Tools:

Patient assessment by both ophthalmologist and optometrist includes a full examination of all ocular structures and a commentary on **any** diabetes associated ocular complications, rather than only diabetic retinopathy. Clinical examination to detect and assess DR and its severity may be performed with slit lamp biomicroscopy, ophthalmoscopy or retinal photography. It should include measurement of visual acuity, and pupils should normally be dilated for the fundus examination. Adequate sensitivity and specificity in performing the assessments are required for the examiners in all assessment processes. Minimum sensitivity required for DR has been set to 80% [53,54] or, in the case of repeated examinations that would detect DR missed at earlier examinations, to 60% [55]. Specificity levels of 90-95% and technical failure rates of 5-10% are considered appropriate [54].

11.1 Biomicroscopy

Slit lamp biomicroscopy with a non-contact fundus lens after pupil dilation is the currently accepted standard of practice for DR detection (sensitivity of 87.4% and specificity of 94.4%), and is preferred over direct ophthalmoscopy, which has lower and more variable sensitivity even in the hands of an experienced examiner (sensitivity 56-98%, specificity 62-100%)[56]. Training should ensure examiners of sufficient diagnostic accuracy and adequate sensitivity and specificity [54,57]. Single-field retinal photography or optical coherence tomography are not replacements for a proper dilated retinal examination.

11.2 Retinal Photography

Stereoscopic seven-field fundus photography evaluated by a trained grader is the "gold standard" method of detecting DR and has been used in most of the large clinical trials in this area. However, it is costly and time consuming and is used rarely in routine practice. Single-field retinal photography can be useful for documentation and follow-up purposes as a part of a comprehensive examination by an optometrist or ophthalmologist.

11.3 Telemedicine

Digital retinal photography is increasingly being used in screening for DR. It is not a substitute for a comprehensive eye examination, but in circumstances where there is no optometrist or ophthalmologist available, there is level I evidence that it can serve as a screening tool for diabetic retinopathy. Patients identified as having retinopathy through this method should be referred to an optometrist or ophthalmologist for further evaluation and management [58,59,60,61,62,63].

Fundus imaging has the additional advantage of being perceived by patients as a valuable educational resource [24]. It can be performed with dilated pupils or with non-mydriatic cameras through non-dilated pupils [64]. The chosen technology, along with the number of camera fields taken, will influence sensitivity of screening [65].

11.4 Fluorescein Angiography (FA)

Fluorescein angiography has no role in screening for DR, but is essential in late-stage disease to detect and delineate retinal ischemia. It is an invasive examination with an inherent albeit small risk of significant side effects, some mild and transient, some severe (such as anaphylaxis or cardiac arrest).

11.5 Optical Coherence Tomography (OCT)

Optical coherence tomography is a non-contact, non-invasive technique that produces cross-sectional images of the retina and optic disc similar to histological sections. It has an axial resolution of 5 μm with newer instruments and provides qualitative and quantitative data that correlate well with fundus stereophotography or biomicroscopy to diagnose diabetic macular edema. It has good reproducibility and provides accurate measurements of retinal thickness [67,68].

OCT appears useful to detect macular thickening in the early stages of diabetic retinopathy in patients with retinopathy and no clinical evidence of macular edema, enabling closer follow-up for early DME [69,70]. However, OCT does not help in predicting which eyes with subclinical DME will progress to clinically significant DME [71].

OCT is an effective qualitative and quantitative method for detecting early macular thickening and following progression or regression of macular edema over the course of treatment, and has been incorporated as a routine measure in numerous ongoing studies of new treatments for DR.

Current data suggest that there is little reason to routinely obtain OCT in eyes with diabetes and no retinopathy or mild to moderate diabetic retinopathy when clinical examination fails to show macular edema [72]. However, OCT should be strongly considered when any change in macular architecture, or any unexplained change in best-corrected acuity, is encountered.

12. Conclusion:

The coordination of health care resources is essential in the care and treatment of patients at risk for ocular complications from diabetes. Timely optometric assessment of newly diagnosed diabetic patients will identify patients at risk for diabetic eye disease. Early intervention and treatment of eye disease through appropriate and timely referral for ophthalmologic care will assist in the preservation of quality vision for patients with diabetes. Inter-professional guidelines and generally accepted management and referral criteria will ensure appropriate coordination of care and the most effective use of health professional resources.

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APPENDIX 1

Diabetic Retinopathy (DR) Disease Severity Scale

No Apparent Diabetic Retinopathy

Non-proliferative Diabetic Retinopathy (NPDR)

- Mild to moderate NPDR – micro-aneurysms, intra-retinal hemorrhages, hard exudates, foveal avascular zone abnormalities
- Moderate to severe NPDR – cotton wool spots, venous beading, intra-retinal microvascular abnormalities (IRMA)
- Severe NPDR (4-2-1 rule) – any one of: severe (>20) intra-retinal hemorrhages in each of four quadrants; definite venous beading in two or more quadrants; prominent IRMA in one or more quadrant(s)
- Very severe NPDR – any two of the above criteria

Proliferative Diabetic Retinopathy (PDR) – one or more of:

- Neovascularization of the disc – NVD (particularly greater than 1 disc diameter in size)
- Neovascularization elsewhere – NVE
- Vitreous/pre-retinal hemorrhage
- Neovascularization of the iris – NVI (anterior segment neovascularization)

Clinically Significant (Diabetic) Macular Edema (CSME)

- Any retinal thickening within 500 microns of the center of the macula (fovea), or;
- **R**etinal thickening at least one disc area in size, any part of which is within one disc diameter of the center of the macula (fovea), or;
- Hard exudates within 500 microns of the center of the macula (fovea) with adjacent retinal thickening.

It is important to note that hard exudates are a sign of current or previous macular edema. CSME may be focal (leakage from micro-aneurysms or IRMA) or diffuse (leakage from the underlying capillary bed). CSME is the most common cause of decreased vision and blindness among patients with diabetes, and may occur concurrent with any stage of diabetic retinopathy.