INTRODUCTION
The educated and motivated law enforcement officer (LEO) with well-managed diabetes mellitus can be capable of safe and effective job performance. However, diabetes mellitus may place LEOs at risk for sudden incapacitation, thus jeopardizing their ability to perform critical job functions. (These job functions include those discussed in Appendix A, and in Chapter 3, Essential Job Tasks.)

Therefore, an individualized assessment of the LEO’s diabetes should be performed using the following evaluative criteria to determine whether the individual’s condition permits safe and effective job performance. Such evaluation must include the following key elements, which are discussed below and in detail in Appendix A:

- History of Diabetes and Its Treatment
- Risk for Impairing Events (Symptomatic and Severe Hypoglycemia, Hypoglycemia Unawareness, Symptomatic Hyperglycemia, and Diabetic Ketoacidosis)
- Presence of Diabetic Complications

OVERVIEW OF MEDICAL EVALUATION
The treating endocrinologist or other treating physician knowledgeable regarding the LEO’s diabetes management should provide a narrative report certifying whether the LEO has or has not met the criteria set out in the following discussion below. In addition, the treating physician should include supporting data (see Appendices A and B).

The LEO is under the care of an endocrinologist or other treating physician knowledgeable regarding the LEO’s diabetes management. Outpatient and in-patient medical record(s) for the last 3 years or since date of diagnosis or since last review by the police physician (whichever is shorter) should be provided by the treating physician to the police physician for review.

If the LEO has type 1 diabetes, the individual has been on a stable basal/bolus regimen or an insulin pump using analogue insulins for the 6 months prior to evaluation.

If the LEO has type 2 diabetes on insulin, the individual has been on a stable medication regimen for the 3 months prior to evaluation. If not on insulin, the LEO has been on a stable medication regimen for the month prior to evaluation.

---

A basal/bolus insulin regimen consists of the use of a basal insulin (glargine [Lantus], detemir [Levemir], Basalglar, Toujeo, Tresiba, or NPH) in a once or twice daily regimen to provide between-meal insulin, combined with the use of a short-acting insulin (Regular, Lispro, Aspart, or Glulisine) at mealtimes. Insulin pumps are small (beeper sized) battery-powered devices that deliver small amounts of short-acting insulin in a constant infusion to meet basal insulin requirements. The wearer selects an additional mealtime bolus to be infused at the time of meals.

For more information on pumps, see manufacturers’ websites:—

[www.minimed.com](http://www.minimed.com),
[www.go-vgo.com](http://www.go-vgo.com),
[www.myomnipod.com](http://www.myomnipod.com),
[www.snappump.com](http://www.snappump.com),
[www.tandemdiabetes.com/Products/t-slim-Insulin-Pump/](http://www.tandemdiabetes.com/Products/t-slim-Insulin-Pump/),

A stable insulin regimen is defined as maintaining the same types of insulin (long acting, intermediate acting, short or rapid acting). Changes in insulin dose are part of the appropriate self-management of diabetes and do not disqualify an applicant or incumbent under this section.

Changes in dose within the evaluation period will be allowed, but addition of a new class of medications or insulin should result in a new period of observation:

- 1 month for the addition of a sulfonylurea;
- 1 month for the addition of an additional agent to insulin or a sulfonylurea; or
- 3 months for the addition of insulin.
If the LEO uses an insulin pump, documentation is needed as follows:
- proper understanding and education in the use of the insulin pump;
- start date for the use of the pump;
- history of insulin site infections;¹
- history of pump cessation and pump malfunction;
- backup plan for pump malfunction including use of injectable insulin; and
- frequency of infusion set changes.

The LEO has received Diabetes Self-Management Education (DSME) and is thoroughly informed of and understands the procedures that must be followed to monitor and manage his or her diabetes and what procedures should be followed if complications arise.³

Criteria for Stable Regimen:
- A stable insulin regimen is defined as maintaining the same types of insulin (long acting, intermediate acting, short or rapid acting). Changes in insulin dose are part of the appropriate self-management of diabetes and do not disqualify an applicant or incumbent under this section.
- Changes in dose within the evaluation period will be allowed, but addition of a new class of medications or insulin should result in a new period of observation:
  - 1 month for addition of a sulfonylurea-containing medication (SU alone or in combination);
  - 1 month for the addition of an additional agent to insulin or a sulfonylurea; or
  - 3 months for the addition of insulin.

QUANTITATIVE GLUCOSE MONITORING
Glucose monitoring in the evaluation of the LEO includes assessment of hypoglycemia, variability of glycemia, and overall control using downloaded glucose meter logs and hemoglobin A1C. Only downloaded data directly from the glucose meter is acceptable; handwritten or typed logs are not acceptable. Data recorded by the meter should be tamper-resistant.⁵

The LEO has documentation of ongoing self-monitoring of blood glucose, i.e., glucose log. Glucose logs include glucose readings downloaded from a glucose meter or from a continuous glucose monitor.

Glucose monitoring must be done with a glucose meter that stores every reading, records date and time of reading, and from which data can be downloaded and printed.

After treatment has stabilized for the time period as described under Criteria for Stable Regimen, the glucose log must be available covering the time periods below:
- LEO with type 1 diabetes: 1 month, as suggested in the table below
- LEO with type 2 diabetes on insulin: 1 month, as suggested in the table below
- LEO with type 2 diabetes not on insulin but taking sulfonylurea: 1 month, as suggested in the table below
- LEO with type 2 diabetes not on insulin or sulfonylurea: as recommended by treating physician

The frequency of glucose monitoring must follow a schedule acceptable to the police physician in consultation with the treating physician. Testing schedules are individual. What follows are common maintenance patterns, but individual patterns may differ. The table found on the next page provides suggested glucose testing schedules.

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¹LEO has not had more than one pump-site infection that caused him/her to miss work or usual daily activities in preceding 6 months.

²Tamper resistance is required so that the user cannot remove or insert either hyper or hypoglycemic readings.
<table>
<thead>
<tr>
<th>DAILY THERAPEUTIC REGIMEN</th>
<th>GLUCOSE TESTING SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet alone</td>
<td>• Every 1 to 2 weeks for maintenance evaluation by the treating physician</td>
</tr>
<tr>
<td>Metformin, thiazolidinediones, or alpha glucosidase, or DPP-4 inhibitors, SGLT-2 inhibitors, GLP-1 agonists – alone or in combination</td>
<td>• Every 1 to 2 weeks for maintenance evaluation by the treating physician</td>
</tr>
</tbody>
</table>
| Sulfonylureas, meglitinides, or nateglinide – alone or in combination with the above group | • Twice a day, for example:  
  - upon awakening (prior to eating)  
  - prior to evening meal  
  - may also test before lunch or at bedtime  
  • With any suspected hypoglycemic episodes  
  • After treating low blood glucose, repetitively test at a minimum of every 15 minutes until >90 mg/dl. |
| Insulin – 1 dose of long-acting insulin alone or in combination with other medications (other than sulfonylureas, meglitinides, or nateglinide) | • Twice a day, for example:  
  - upon awakening (prior to eating)  
  - prior to evening meal  
  - may also test before lunch or at bedtime  
  • After treating low blood glucose, repetitively test at a minimum of every 15 minutes until >90 mg/dl.  
  • With any suspected hypoglycemic episodes or after an increase in overnight insulin, glucose should be checked once a week between 2 am and 3 am.⁸ |
| Insulin – 2 or more doses daily, insulin pump, or in combination with any non-insulin anti-diabetic agent. | • Multiple times a day (3-4 times per day), for example:  
  - Prior to eating (upon awakening, prior to mid-day and evening meals)  
  - At bedtime  
  - Prior to and following exercise  
  - Prior to critical tasks such as driving²uspendencias ⁴  
  • With any suspected hypoglycemic episodes  
  • After treating low blood glucose, repetitively test at a minimum of every 15 minutes until >90 mg/dl.  
  • With any suspected hypoglycemic episodes or after an increase in overnight insulin dose, glucose should be checked once a week between 2am and 3am.⁸ |

A blood glucose less than 70 mg/dl needs to be rechecked and treated immediately, and then repeated, at a minimum, every 15 minutes until a glucose value of 90 mg/dl or greater can be demonstrated in the glucose log.

The LEO with diabetes should have his/her hemoglobin A1C measured every 2-3 months.²uspendencias The A1C value should not be the sole determinant of ability of the LEO to carry out his or her duties.⁵ However, if the hemoglobin A1C is 8% or greater, this may signal a problem with the LEO’s diabetes management; this warrants further assessment by the LEO’s treating physician²uspendencias who should ensure that:  
✓ The treatment has been reviewed and, if indicated, adjusted, and  
✓ Criteria from the above sections on Overview of Medical Evaluation and Quantitative Glucose Monitoring are met, and  
✓ Information as described in Appendix B (Physician Evaluation Form) has been reviewed by the police physician and by the treating physician (especially the glucose log).

¹Glucose monitoring in this setting is intended to help the LEO be informed if glycemic control through dietary management is not optimal.  
⁸Or for persons with sleep cycles out of standard night hours, at the middle time of their sleep cycle.
**IMPAILING EVENTS**

**Severe Hypoglycemia**
Severe hypoglycemia is defined as an event requiring assistance of another person to actively administer carbohydrates, glucagon, or take other corrective actions.6,7(p 1584)

The LEO should be restricted for severe hypoglycemia when there has been:
- One or more episode(s) of severe hypoglycemia within the past 1 year, or
- More than 2 episodes of severe hypoglycemia in the past 3 years or since diagnosis of diabetes – whichever is shorter.

The LEO may be returned to full duty after the following evaluation has been completed:
- A documented analysis of the hypoglycemic episodes and its causes has been performed by treating physician;
- Treatment has been reviewed and, if indicated, adjusted;
- Information, as described in Appendix B (Physician Evaluation Form), has been reviewed by the treating physician and the police physician;
- Review of the glucose log demonstrating no blood glucose <70 mg/dl for at least 1 month, after the last adjustment in medication.

**Hypoglycemia**
Repeated episodes (two or more episodes in the glucose log) of blood glucose <70 mg/dl or a single episode of <60 mg/dl should be reviewed by the police physician to assess the frequency of events, presence of hypoglycemia unawareness, and potential for increased risk of incapacitating events (see Appendix A for evaluation of glucose logs).

The LEO should be restricted if the glucose log reveals one or more episodes of blood glucose of <50 mg/dl (unless the low measurement is documented to be caused by a technical error).8(p 520,9(p 696-728)

The LEO may be returned to full duty after the following evaluation has been completed:
- A documented analysis of the causes of any hypoglycemic episodes has been performed by treating physician;
- Treatment has been reviewed and, if indicated, adjusted;
- Information, as described in Appendix B (Physician Evaluation Form), has been reviewed by the treating physician and the police physician;
- Glucose log demonstrating no blood glucose <70 mg/dl for at least 14 days, after the last adjustment in treatment.

**Diabetic Ketoacidosis**
Diabetic ketoacidosis (DKA) is the result of acute insulin deficiency, often associated with type 1 diabetes, causing hyperglycemia, ketosis, and acidemia.8(p 504-18) It may be the presenting event for type 1 diabetes or may be caused by inappropriately withholding insulin, by a major physiologic stress (e.g., myocardial infarction, sepsis), or by dysfunction of an insulin pump.

The LEO should be restricted after an episode of DKA until the following evaluation has been completed:
- A documented analysis of the causes of DKA has been performed by treating physician;
- Treatment has been reviewed and, if indicated, adjusted;
- Criteria from the above medical evaluation and quantitative glucose monitoring sections are met;
- Information as described in Appendix B (Physician Evaluation Form) has been reviewed by the treating physician and the police physician.
- Review of glucose log after the last adjustment of treatment.
Hyperosmolar Hyperglycemic State
Hyperosmolar hyperglycemic state (HHS) occurs in people with type 2 diabetes who still have insulin secretion. The blood glucose is generally over 600 mg/dl. HHS is seen more frequently in elderly patients and those with newly diagnosed type 2 diabetes. The mortality rate is high, between 10-50%. The LEO should be restricted after an episode of HHS until the following evaluation has been completed:

- The treatment has been reviewed and, if indicated, adjusted.
- Criteria from the above sections on Overview of Medical Evaluation and Quantitative Glucose Monitoring sections are met.
- Information as described in Appendix B (assessment form) has been reviewed by the police physician (especially glucose logs).

CHRONIC COMPLICATION SCREENING
Chronic complications of diabetes may be associated with increased risk for impairment, severe hypoglycemia and inability to safely perform essential job functions, and warrant further assessment. Chronic complications of diabetes for which screening should be performed include:

Diabetic Retinopathy and Macular Edema – Diabetic retinopathy is a leading cause of new-onset blindness and visual loss. A complete eye exam by a qualified ophthalmologist or optometrist, including a dilated retinal exam should occur at time of diagnosis of type 2 diabetes and after 5 years of type 1 diabetes. Follow-up eye exams should be done every other year for those without retinopathy, and annually or more frequently for those with retinopathy or macular edema, as recommended by a qualified eye professional.

The LEO with the following conditions should be advised that vigorous physical intensity could lead to complications (see Appendix A):

- Proliferative diabetic retinopathy
- More than moderate non-proliferative diabetic retinopathy
- Clinically significant diabetic macular edema

LEOs with diabetic retinopathy or macular edema need further assessment by the LEO’s treating physician for the following:

- Exercise stress testing to at least 12 METs
- The treatment has been reviewed and, if indicated, adjustments made
- Criteria found in the Eye and Vision chapter are met
- Screening for other chronic complications of diabetes

Diabetic Neuropathy – Severe autonomic and/or peripheral diabetic neuropathy can impair the LEOs safe and effective performance of essential job functions and may require restrictions. Testing for diabetic neuropathy includes the following, with special attention to the feet:

- Motor examination (muscle strength and gait testing)
- Vibratory testing with a 128 Hz tuning fork (most sensitive in eliciting diabetic neuropathy)
- Sensation testing with 10 gram Semmes-Weinstein monofilament
- Deep tendon reflexes
- Position sense testing
- Orthostatic blood pressure and pulse testing.

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The International Classification of Diabetic Retinopathy and Diabetic Macular Edema is published by the American Academy of Ophthalmology.

Orthostatic hypotension is a physical finding defined by the American Autonomic Society and the American Academy of Neurology as a systolic blood pressure decrease of at least 20mm Hg or a diastolic blood pressure decrease of at least 10mm Hg within 3 minutes of standing.
The LEO with diabetic neuropathy should be evaluated to ensure that they can perform their essential job functions. The following conditions should be considered:

- Physical activity or performance that is limited due to pain, weakness or numbness
- Ataxia
- Reduced balance
- Reduced or loss of proprioception, which may result in the inability to control the foot pedals of vehicle, reduced balance, clumsiness or a history of falls
- Contact-induced discomfort or pain
- Foot ulceration or infection that affects wearing of footwear or ambulation
- Orthostatic hypotension, especially if symptomatic or if requiring treatment.

Cardiovascular Disease
Cardiovascular disease is a major cause of morbidity, mortality, and health care costs for patients with diabetes.\(^{13(p\ 82)}\) The following assessment is recommended:

**LEOs with No Known Cardiac Disease**\(^{8(p\ 586),13(p\ e50-103),14,15,16,17}\)
LEOs, both those with and without diabetes, should be assessed for risk of cardiovascular disease according to the Cardiovascular Disease Chapter, section on coronary artery disease.

**LEOs with Cardiac Symptoms**
LEOs with typical or atypical cardiac symptoms should be referred for further evaluation.\(^{18(p\ 567)}\)

**LEOs with an Abnormal Electrocardiogram**
LEOs with an abnormal electrocardiogram should be referred for further evaluation.\(^{18(p\ 567)}\)

**LEOs with Known Cardiac Disease**
LEOs with known cardiac disease should be referred for further evaluation (see Cardiovascular Disease chapter) and screened for other chronic complications of diabetes.

Diabetic Nephropathy
Diabetes is the leading cause of end-stage renal disease. Increased albuminuria and decreased GFR are each independently and additively associated with an increase in all-cause and cardiovascular disease mortality, and most of the excess cardiovascular disease of diabetes is accounted for by the population with diabetic kidney disease.\(^{19(p\ 2865),20}\)

LEOs with diabetes should provide the following information to the police physician annually:
- Serum Creatinine
- eGFR (estimated Glomerular Filtration Rate)\(^k\)
- Urinary albumin excretion\(^l\)

\(\text{eGFR levels <45 ml/min or albuminuria of } \geq 30 \text{ mg/g creatinine (moderate to severe loss of kidney function) may suggest changes that can impair the LEOs safe and effective performance of essential job functions and may require restrictions. This level of renal impairment is associated with a significantly greater risk of cardiovascular disease, anemia, malaise, and greater risk for hypoglycemia, especially in those treated with some sulfonylureas or insulin.}^{21(p\ 542-4),19(p\ 2869),21,22(p\ 91),23,24}\)

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\(^{1}\)This document addresses the risk of sudden incapacitation during performance of law enforcement essential job functions. The ACOEM LEO Task Group has reviewed current cardiovascular literature, including American College of Cardiology/American Heart Association guidelines, and current American Diabetes Association (ADA) guidelines concerning the assessment of cardiovascular risk of asymptomatic adults.


\(^{l}\)The urinary albumin excretion could be based on random urine test (expressed in milligrams of albumin per gram of creatinine) or a 24-hour collection (expressed in milligrams of albumin per 24 hours).
LEOs with diabetes and with an eGFR level of <45 ml/min or with albuminuria of ≥30 mg/g creatinine need further assessment by the LEO’s treating physician for the following:

- Confirmation of urinary albumin excretion
- Complete blood count
- Exercise stress testing to at least 12 METs
- Nephrologist evaluation—most important—with protection of renal status addressed
- The treatment has been reviewed and, if indicated, adjustments made
- Screening for other chronic complications of diabetes

**ONGOING EVALUATION AND REQUIREMENTS**

Medical records and glucose meter logs should be reviewed periodically by the police physician. Because of the nature of diabetes, it is important that regular medical follow up be provided to the LEO. The frequency and content of the evaluation should be determined on an individual basis by the police physician in consultation with the treating physician.\(^m\)

Must advise police physician of any change in type of medication (e.g., addition of a sulfonylurea or insulin).

Must advise police physician of any episodes of symptomatic hypoglycemia, severe hypoglycemia, symptomatic hyperglycemia, ketoacidosis, or hyperosmolar hyperglycemia state.\(^{25}\)

Must provide documentation of ongoing evaluation of cardiac, ophthalmological, neurological, and/or renal status (see section on Chronic Complication Screening).

\(^m\)It is the consensus of the ACOEM LEO Task Group that review by the police physician of glucose monitoring records and reports from the treating physician should occur at a minimum of every 12 months, but may need to be more frequent in specific cases.

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**ACKNOWLEDGEMENT**

*The ACOEM LEO Task Group wishes to warmly thank Daniel Lorber, MD, FACP, CDE, for his generous assistance in developing this and previous editions of the LEO Diabetes Mellitus chapter. Dr. Lorber is Director of Endocrinology at New-York Presbyterian (Queens) and Clinical Associate Professor at the Weill Medical College of Cornell University. We thank Dr. Lorber for the many hours and valued advice he has given the LEO Task Force in the preparation and development of this guidance.*
APPENDIX A: COMMENTARY
The commentary provided in Appendix A is for informational purposes only, and is made available for the police physician who wishes to dig deeper into the concepts of diabetes, its treatment, and its relationship to the medical evaluation of the LEO. The following important references concerning diabetes and its treatment were used in the preparation of this document. They are highly recommended to the police physician who wants to learn more about the complex disease that is diabetes mellitus.

- Standards of Medical Care in Diabetes. Published each January in Diabetes Care by ADA.

1. Diabetes Definitions
Type 1 diabetes was previously called insulin-dependent diabetes mellitus (IDDM) or juvenile-onset diabetes. Type 1 diabetes generally develops when the body’s immune system destroys pancreatic beta cells, the only cells in the body that make the hormone insulin that regulates blood glucose. This form of diabetes usually strikes children and young adults, although disease onset can occur at any age. Type 1 diabetes may account for 10% of all cases of diabetes. In order to survive, people with type 1 diabetes must have insulin delivered by injections or by a pump.

Type 2 diabetes was previously called non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes. Type 2 diabetes may account for 90% of all cases of diabetes. It usually begins as insulin resistance, a disorder in which the cells do not use insulin properly. As the need for insulin rises, the pancreas gradually loses its ability to produce sufficient insulin. Type 2 diabetes is associated with older age, obesity, family history of diabetes, prior history of gestational diabetes, impaired glucose tolerance, physical inactivity, and race/ethnicity. Type 2 diabetes is increasingly being diagnosed in children and adolescents. Many people with type 2 diabetes can control their blood glucose by following a careful diet and exercise program, losing excess weight, and taking oral medication. According to 2010-2012 statistics from the U.S. Centers for Disease Control and Prevention (CDC), among adults with diagnosed diabetes, about 14.7% take both insulin and oral medications, 14% take insulin only, 56.9% take oral medications only, and 14.4% do not take either insulin or oral medications.

2. Risk of Hypoglycemia with Treatment of Diabetes
The risk of hypoglycemia remains the major concern in regard to persons with diabetes being or becoming LEOs. This risk occurs primarily in those taking insulin, particularly those with type 1 diabetes, although it may also occur in those with type 2 diabetes who take insulin and/or other oral anti-diabetic medications, such as sulfonylureas. Hypoglycemia increases the risk for dysrhythmias, accidents, falls, and cognitive dysfunction. (See Hypoglycemia section for more detailed information.) Patients treated with metformin, alpha-glucosidase inhibitors, thiazolidinediones, GLP-1 agonists, DPP-4 inhibitors or SGLT2 inhibitors alone or in combination with each other are at little or no risk of significant hypoglycemia. For additional information concerning treatment of diabetes, see Approaches to Glycemic Treatment, ADA Standards of Medical Care in Diabetes, 2016 (available at: http://care.diabetesjournals.org/content/39/Supplement_1/S52).

<table>
<thead>
<tr>
<th>Medication</th>
<th>Monotherapy</th>
<th>Combinations</th>
<th>Other considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biguanides (Metformin)</td>
<td>Negligible</td>
<td>High with sulfonylureas, insulin</td>
<td></td>
</tr>
<tr>
<td>Sulfonylureas (Glipizide, Glimepide, Glyburide) or in combination</td>
<td>Moderate to high*</td>
<td>Increased with insulin or with the addition of any second agent</td>
<td>Hypoglycemia risk increases with erratic eating habits, intense or prolonged exercise, ethanol use, renal or hepatic disease, adrenal or pituitary insufficiency, advanced age (&gt;85 years).</td>
</tr>
<tr>
<td>DPP-4 inhibitors (Sitagliptin, Saxagliptin, Linaglaptin)</td>
<td>Negligible**</td>
<td>High with sulfonylureas, insulin</td>
<td></td>
</tr>
<tr>
<td>Glucose Homeostasis</td>
<td>Hypoglycemia risk increases with:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thiazolidinediones</td>
<td>• Erratic eating habits, intense or prolonged exercise, ethanol use, renal or hepatic disease, advanced age (&gt;85 years).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Pioglitazone, Rosiglitazone)</td>
<td>• Tight glucose control, low insulin reserves, adrenal or pituitary insufficiency.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glitzone</td>
<td>• Lower risk with long-acting basal insulin formulations insulin glargine and insulin detemir.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meglitinides</td>
<td>• Treatment duration on insulin.</td>
<td></td>
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</tbody>
</table>

3. Insulin Therapy

Previously, patients used insulins that were somewhat unpredictable in the time course of their action and generally took two or fewer injections per day. Today, there are insulins that are far more predictable and are either very long acting and essentially treat only basal hepatic glucose production (and therefore do not depend on a patient eating on a regular schedule) or are very rapid and therefore can be administered directly before or even shortly after eating, significantly decreasing the chance of insulin being taken and then the meal being interrupted due to professional duties. Insulin regimens, now referred to as “basal bolus,” are composed of a very long acting basal (or background) insulin, and rapid-acting (bolus) insulins. The goal is to mimic physiologic insulin secretion patterns. The basal insulin controls glucose levels during the day and overnight in the absence of carbohydrate intake. The rapid-acting bolus (or prandial) insulins that are dosed just prior to, during, or after meals are based on blood glucose levels at that time, the amount of carbohydrate that the person expects to consume, and any anticipated change in physical activity patterns. These regimens have resulted in improved overall blood glucose control with significantly less risk of hypoglycemia for many patients.

The most common insulin delivery systems are:
• **Subcutaneous injection** with traditional syringe and vial.
Insulin pen. Insulin pens come prefilled with insulin, are portable, and allow for simpler injection than syringe and vial. Needles for insulin pens can be of finer gauge than for standard syringes because they do not need to puncture the top of the insulin vial; thus can be more comfortable to use.\(^{[341]}\)

Insulin pump. Insulin pump therapy is covered in more detail below.

### Insulin Preparations\(^{[321]}\)

<table>
<thead>
<tr>
<th>Insulin Type</th>
<th>Product</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rapid-Acting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin aspart analog</td>
<td>Novolog</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Insulin glulisine analog</td>
<td>Apidra</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Insulin lispro analog</td>
<td>Humalog (U-100 or U-200)</td>
<td>10-30 min</td>
<td>0.5-3 hours</td>
<td>3-5 hours</td>
</tr>
<tr>
<td><strong>Short-Acting</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Regular insulin U-100</td>
<td>Humulin R</td>
<td>30-60 min</td>
<td>2-5 hours</td>
<td>up to 12 hours**</td>
</tr>
<tr>
<td>Regular insulin U-500*</td>
<td>Humulin R</td>
<td>30-60 min</td>
<td>4-8 hours</td>
<td>up to 14 hours</td>
</tr>
<tr>
<td><strong>Intermediate-Acting</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>NPH insulin</td>
<td>Humulin N</td>
<td>90 min-4 hours</td>
<td>4-12 hours</td>
<td>up to 24 hours***</td>
</tr>
<tr>
<td><strong>Long-Acting (“Basal”)</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Insulin detemir</td>
<td>Le vemir</td>
<td>45 min-4 hours</td>
<td>Minimal peak</td>
<td>up to 24 hours***</td>
</tr>
<tr>
<td>Insulin glargine</td>
<td>Lantus (biosimilar glargine—Tuojeo)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin degludec</td>
<td>Tresiba (U-100 or U-200)</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Premixed Insulin Combinations**

- 70% NPH; 30% Regular
  - Humulin 70/30
  - Novolin 70/30
- 75% lispro protamine suspension (NPL); 25% lispro
  - Humalog Mix 75/25
- 70% insulin aspart protamine suspension (intermediate); 30% aspart
  - Novolog Mix 70/30
- 50% lispro protamine suspension (NPL); 50% lispro
  - Humalog Mix 50/50

*Considerable variability from study to study
**Usual clinical relevance can be less than 12 hours
***Usual clinical relevance can be less than 24 hours. Often requires twice daily dosing
****Individual response may require twice daily dosing

4. **Insulin Pump Therapy**

An insulin pump, also known as continuous subcutaneous insulin infusion (CSII), therapy is a medical device used for the administration of insulin in the treatment of diabetes mellitus. Insulin pumps are small (beeper sized) battery powered devices that deliver small amounts of short-acting insulin in a constant infusion to meet basal insulin requirements. The wearer selects an additional mealtime bolus to be infused at the time of meals. Insulin pumps hold up to 300 units of insulin in a reservoir. The disposable plastic tubing and steel or soft Teflon needle transfer insulin from the pump reservoir to the subcutaneous tissue and is changed every 2 to 3 days. For more information on pumps, see manufacturers’ web sites—www.minimed.com, www.go-vgo.com, www.myomnipod.com, www.snappump.com, www.tandemdiabetes.com/Products/t-slim-Insulin-Pump/, www.animas.com/animas-insulin-pumps/onetouch-ping.

The device configuration may vary depending on design. A traditional pump includes:
- the pump (including controls, processing module, and batteries)
- a disposable reservoir for insulin (inside the pump)
- a disposable infusion set, including a cannula for subcutaneous insertion and a tubing system to interface the insulin reservoir to the cannula.
Newer pumps, also called “patch pumps,” may enclose the reservoir, pumping mechanism, and the subcutaneous cannula in a single unit, eliminating the need for tubing. This tubeless style of pump is controlled by a remote hand held controller or a smartphone.

The insulin pump delivers a single type of rapid-acting insulin in two ways:
1. basal insulin infusion is pumped continuously at an adjustable basal rate to deliver insulin needed between meals and overnight;
2. bolus dose is pumped to cover food eaten or to correct a high blood glucose level.

Advantages of Pumping Insulin:
- Users report better quality of life (QOL) compared to using other devices for administering insulin. The improvement in QOL is reported in both type 1 and insulin-requiring type 2 diabetes subjects on pumps.
- Programmable basal rates allow for scheduled insulin deliveries of varying amounts at different times of the day. This is especially useful in controlling events such as the dawn phenomenon resulting in less low blood sugar during the night.
- Many users feel that bolusing insulin from a pump is more convenient and discreet than injection.
- Many modern “smart” pumps have a “bolus wizard” that calculates how much bolus insulin is needed, taking into account expected carbohydrate intake, blood sugar level, and still-active insulin.

Disadvantages of Pumping Insulin:
- Insulin pumps, cartridges, and infusion sets may be far more expensive than syringes used for insulin injection with several insulin pumps costing more than $6,000.
- Insulin pump use has a higher risk of developing diabetic ketoacidosis if the pump malfunctions. This can happen if the pump battery is discharged, if the insulin is inactivated by heat exposure, if the insulin reservoir runs empty, the tubing becomes loose and insulin leaks rather than being injected, or if the cannula becomes bent or kinked in the body, preventing delivery. Therefore, pump users typically monitor their blood sugars more frequently to evaluate the effectiveness of insulin delivery.

Since the insulin pump needs to be worn most of the time, pump users need preventive strategies when participating in activities that may damage the pump, such as rough sports and activities in the water. Some users may find that wearing the pump all the time (together with the infusion set tubing) is uncomfortable or unwieldy. Insulin pumps may be disconnected for a short time with strenuous exercise, contact sports, or water sports, but interruption of insulin delivery for more than 1 to 2 hours without insulin injection substitution puts the patient at risk for hyperglycemia and ketoacidosis. 

Insulin pump users must be vigilant about maintaining the integrity of the infusion site during physical exertion. Sweating can dislodge the infusion set and precautions (e.g., strong adhesives, antiperspirants) may be needed. Infusion sets can be dislodged when bumped or brushed by a belt or waistband so sites should be chosen to minimize this risk. Infusion set tubing can easily get caught if not attached to the body properly, dislodging the needle and/or the pump. When a pump malfunctions, the person is instructed to resume multiple daily insulin injections. Most pump manufacturers will send a replacement by overnight delivery.

5. Continuous Glucose Monitor
A continuous glucose monitor (CGM) determines glucose levels on a continuous basis (every few minutes). A typical CGM system consists of:
- Disposable glucose sensor placed just under the skin, which is worn for 3 to 7 days.
- Link from the sensor to a non-implanted transmitter which communicates to a radio receiver.
- Electronic receiver worn like a pager (or insulin pump) that displays glucose levels with nearly continuous updates, as well as monitors rising and falling trends.

CGM allows examination of how the blood glucose level reacts to insulin, exercise, food, and other factors. This data can be useful for setting correct insulin dosing ratios for food intake and correction of hypo- or hyperglycemia. CGM monitoring during periods when blood glucose levels are not typically checked (e.g., overnight) can
help to identify problems in insulin dosing (such as nocturnal hypoglycemia). CGM monitors may also be equipped with alarms to alert patients of hyperglycemia or hypoglycemia so that a patient can take corrective action(s) (after fingerstick testing, if necessary) even in cases where they do not feel symptoms of either condition. Currently available CGM sensors communicate with the patient’s insulin pump, providing an extra layer of safety. If the sensor detects significant hypoglycemia, the pump will automatically suspend insulin infusion until the hypoglycemia is resolved.

Using continuous glucose monitoring (CGM) one must be aware of the sensor lag. The CGM sensor and glucose meter measure glucose in different fluids — interstitial for CGM vs. blood for glucose meter. Glucose readings can lag up to 30 minutes for glucose to pass from capillary blood into interstitial fluid. When glucose levels are falling, hypoglycemia may develop before it is detected by the CGM sensor.8(p 459-60)

6. Self-monitoring of Blood Glucose (SMBG)
Major advances in the size, speed, and sophistication of blood glucose meters provide for easy, accurate, and rapid assessment of blood glucose levels. All current blood glucose meters can be downloaded to computer programs, facilitating confirmation and review of blood glucose results. Such monitoring techniques, as well as the generally increased self-awareness that accompanies consistent self-monitoring, enables the motivated person with diabetes to assess blood glucose levels and ingest a safety net of carbohydrates before entering a hazardous environment. Similarly, major advances in insulin delivery systems have greatly increased the ability of the motivated individual with diabetes to achieve a level of diabetes self-management consistent with the LEO duties.

In order to obtain maximum effect from SMBG, and to minimize the risk of hypoglycemia, patients with diabetes must:
• Check their blood glucose level frequently (as recommended based on factors such as type of therapy and glycemic history)
• Review these results on a regular basis
• See their diabetes care provider regularly for review of the SMBG and discussion in regard to any necessary changes in treatment.

Self-monitoring blood glucose (i.e., SMBG or glucose log) is important for everyone with diabetes.8(p 66-7),28 Careful SMBG is an essential part of any insulin treatment program. “For those using (insulin) replacement programs seeking to closely mimic natural physiologic insulin patterns (basal/bolus), checking at least four times daily is essential — and checking even more frequently is often needed.”9(p 359) Those on basal-bolus insulin regimens should check blood glucose before each meal to calculate the dose of rapid-acting insulin and to reduce the risk of hypoglycemia.6 The LEO with diabetes should check blood glucose prior to driving or performing other safety-sensitive job tasks (see section on Driving Vehicles).

Especially for type 1 diabetes, a higher SMBG frequency has a strong correlation with glycemic control and a lower hemoglobin A1C. It is the “cornerstone of modern-day therapy for people with type 1 diabetes” and reflects behavior associated with good glycemic control. Despite this, acceptance of frequent SMBG has not been universal and some insurers continue to limit glucose test strips that they will provide.29

Glucose meters approved for home use calibrate whole blood glucose readings to plasma values. Plasma glucose values are 10 to 15% higher than whole blood glucose values. It is important for the health care provider (and the police physician reviewing the glucose log) to know whether the glucose meter and strips are recording whole blood or plasma results.8(p 49) The International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) has recommended reporting all SMBG results as glucose concentration in plasma to avoid misunderstanding.30

The self-monitoring of blood glucose (SMBG) is used by treating physicians for the following:
• To determine the efficacy of medications and treatment on blood glucose
• To determine the effect of lifestyle changes (e.g., change in diet) on blood glucose
• To refine diabetes care and adjust treatment in respond to stressful events (i.e., illness)
7. Hypoglycemia

Hypoglycemia is the major concern for LEOs with diabetes, as it can lead to sudden incapacitation. Hypoglycemia is defined as a plasma glucose of <70 mg/dl.28

Hypoglycemia symptoms can be divided into two major groups:

- Adrenergic symptoms, including tachycardia, diaphoresis, tremor, anxiety
- Neuroglycopenic symptoms, including confusion, agitation, syncope, or seizure

In patients with normal awareness of hypoglycemia, adrenergic symptoms precede neuroglycopenic symptoms. Mild adrenergic symptoms of hypoglycemia are associated with glucose levels 50-60 mg/dl and more severe hypoglycemic symptoms are associated with glucose levels of <40 mg/dl.8(p 520-1) Hypoglycemia in diabetes has also been defined as “all episodes of abnormally low plasma glucose concentration that expose the individual to potential harm.”7(p 1584) Hypoglycemia has been classified as the following, demonstrating that hypoglycemia is an individualized event requiring an individualized assessment — not all individuals with have the same symptoms at a given glucose level:

1. **Severe hypoglycemia (SH).** An event requiring assistance of another person to actively administer carbohydrate, glucagon, or other resuscitative actions.5,7(p 1584)

2. **Documented symptomatic hypoglycemia.** An event during which typical symptoms of hypoglycemia are accompanied by a low measured plasma glucose concentration (≤70 mg/dl).

3. **Asymptomatic hypoglycemia.** An event not accompanied by typical symptoms of hypoglycemia but with a measured low plasma glucose concentration (≤70 mg/dl).7(p 1584)

A. **Severe Hypoglycemia**

Severe hypoglycemia (SH) is defined as an event requiring assistance of another person to actively administer carbohydrates, glucagon, or take other corrective actions.5,7(p 1584) Research literature frequently uses a glucose level of <54 mg/dl, as the definition of severe hypoglycemia, even if assistance of others is not required, as this is the threshold of neuroglycopenic symptoms and thus brain fuel starvation.9(p 696-728)

SH is generally related to treatment with insulin and sulfonylureas. **SH is not compatible with LEO essential job functions,** as it generates sudden incapacitation and the inability to perform LEO essential job functions. Individuals with type 1 diabetes experience SH, defined as requiring assistance from another person, 1 to 1.7 times per year on average, and 30 to 40% of people with type 1 experience SH in a given year.7(p 1584),31 Individuals with type 2 diabetes experience about one-third as many episodes of SH as do people with type 1 diabetes.7(p 1584),9(p 696-728) In these groups, the rates of any type of hypoglycemia are about 50-fold higher than those of SH.7(p 1584) Among those with type 1 diabetes, 4 to 10% of all deaths are attributed to SH, and risk of death 5 years after an episode of SH is increased 3.4 fold in those who report SH.32

It is recommended that LEOs with diabetes treated with insulin, a sulfonylurea, or a meglitinide become aware of the possibility of developing hypoglycemia and take action to prevent SH at a SMBG of ≤70 mg/dl.7(p 1587)

Those with **established type 1 and advanced type 2 diabetes** (an absolute deficiency of endogenous insulin) may have the clinical syndrome of defective glucose counterregulation, which increases the risk of SH by a factor of more than 25. Attenuation of the sympathoadrenal response is thought to cause the clinical syndrome of **impaired awareness of hypoglycemia,** which increases the risk of SH by a factor of more than six.6,7(p 1587)

B. **Recurrent, Unrecognized or Decreased Awareness of Hypoglycemia**

**Recurrent, unrecognized, or decreased awareness of hypoglycemia** are a danger to the LEO with diabetes as it impairs counterregulatory hormonal responses to and awareness of hypoglycemia, predisposing patients to more frequent hypoglycemia and SH.6,33 These conditions can cause major morbidity or psychological morbidity that can be persistent, resulting in fear of hypoglycemia and a resistance to needed treatment, such as insulin.
Unrecognized or decreased awareness of hypoglycemia (also called impaired awareness of hypoglycemia) is found in 20 to 40% of patients with type 1 diabetes, which increases their risk of SH by 6 to 20 fold. Recurrent SH (two or more episodes annually) is reported by 21% of patients with type 1 diabetes and by 66% of patients whose type 1 diabetes is complicated by unrecognized or decreased awareness of hypoglycemia.32

C. Nocturnal Hypoglycemia

Nocturnal hypoglycemia is not benign simply because it does not occur during duty hours. It is estimated that about one-half of hypoglycemic episodes occur during sleep.36,7579,83,126 Nocturnal hypoglycemia may be the result of a mismatch of insulin type, insulin timing, food intake or physical activity prior to sleep. Nocturnal hypoglycemia can be frequent and unrecognized, which in turn leads to more frequent unrecognized hypoglycemia. Those experiencing nocturnal hypoglycemia often report poor quality of sleep, fatigue, and impaired next-day performance. The reduced awakening response following nocturnal hypoglycemia causes less ability to compensate for the hypoglycemia, thereby prolonging and worsening the hypoglycemia.34 “Dead-in-bed,” related to nocturnal hypoglycemia, is a leading cause of death in people with type 1 diabetes <40 years old.35

Those with type 1 diabetes are particularly vulnerable to severe hypoglycemic nocturnal events. The frequency of nocturnal hypoglycemia is increased twofold on nights after antecedent exercise.36

D. Risk for Hypoglycemia Due to Treatment

The risk for hypoglycemia differs depending on the treatment regimen (see table on page 8). Hypoglycemia is common in diabetes treated with insulin or a sulfonylurea, and less common with a meglitinide (Prandin, Starlix).

A low A1C (i.e., an A1C in the low to normal range) is a risk factor for hypoglycemia during intensive therapy of diabetes.7(p1586) An elevated A1C level can also be a risk factor for hypoglycemia due to high glucose variability (wide swings between hypoglycemia and hyperglycemia) and/or implementation of new treatments such as insulin or sulfonylurea to better control hyperglycemia. In a study by Pathak et al, there was a relative risk for severe hypoglycemia of 2.58 with an A1C of ≥9%, compared to an A1C of <7%.37

The risk for hypoglycemia varies with the type of insulin used. The risk for hypoglycemia increases as one goes down the following list:

- Basal analog insulin (e.g., Levemir or Lantus) is associated with fewer hypoglycemic events;
- Premixed biphasic insulin formulations (e.g., Humulin 70/30, Humalog Mix 75/25, Novolin 70/30, Novolog Mix 70/30, or Humalog Mix 50/50) have a higher hypoglycemic risk; and
- Prandial analog insulins (e.g., Humalog, Novolog, or Apidra) have the highest risk for hypoglycemia.

Median hypoglycemic events/patient/year for the above three insulin groups was 1.7, 3.0, and 5.7, respectively.38

The newer insulins (i.e., analog or synthetic insulins) are generally safer than the earlier insulins that they are now replacing. Basal analog insulins are associated with a 27% lower risk for severe hypoglycemia and a 31% lower risk for nocturnal hypoglycemia than is NPH insulin (which it has largely replaced).32 Prandial analog insulins are associated with a 20% lower risk for severe hypoglycemia and a 45% lower risk for nocturnal hypoglycemia than is regular insulin (which it has replaced).32

The incidence of SH increases with the duration of insulin therapy. The UK Hypoglycemia Study Group found that patients with type 1 diabetes with insulin therapy duration of <5 years had 110 episodes of SH per 100 patient-years and those treated >15 years had 320 episodes of SH per 100 patient-years. Patients with type 2 diabetes treated with insulin for <2 years had 10 episodes of SH per 100 patient years and those treated >5 years had 70 episodes of SH per 100 patient-years.39 Most patients with type 1 diabetes lose all residual insulin secretion as measured by C-peptide within 10 to 15 years after diagnosis (of type 1 diabetes), making it more challenging for those with long-standing (>15 years) type 1 diabetes to avoid hypoglycemia.32
Among sulfonylureas, glyburide (DiaBeta, Micronase) causes more hypoglycemia. Due to the risk of prolonged and delayed hypoglycemia, glyburide was added to Beer’s List of medications to avoid in older adults. 8(p 280),40

No one threshold value for hypoglycemia captures the risk of injury or death due to individual adoptions of the body to a range of values that might cause symptoms. “An alert value of ≤70 mg/dl is recommended that draws attention to possible harm from hypoglycemia. Although in the past it has been suggested that a threshold approximating when neuroglycopenic symptoms and thus brain fuel starvation begin (around 54 mg/dl) should be used, such a threshold likely would allow too little buffer to permit reliable self-treatment.”9(p 696-728) Therefore, the threshold alert glucose level of 70 mg/dl is used in this guidance.

8. Law Enforcement Essential Job Functions and Diabetes Mellitus

Law enforcement entails a unique set of conditions that need to be considered in regard to those with diabetes and the risks of impairment from either hypoglycemia or hyperglycemia. These may include (depending upon the duties of the particular LEO position):

- unpredictable meal schedules;
- shiftwork
- brief periods of maximal physical exertion;
- driving a vehicle, including high-speed pursuit driving;
- surveillance requiring sustained attention for prolonged periods of time;
- rapid decision making regarding the use of force, including deadly force;
- rapid analysis of complex visual stimuli to differentiate weapons from other objects; and
- control of one’s emotions under stress.

Driving Vehicles

Hypoglycemia affects the ability to safely perform cognitive job functions, which involve intelligence, judgment and a rational response. Hypoglycemia adds increased risk to safety when performing cognitive job functions. For example, driving a vehicle, an essential and cognitive job function for LEOs, is likely to be impaired by hypoglycemia. Therefore, the LEO with diabetes must be vigilant for hypoglycemia.

“Hypoglycemia indicating an impaired ability to drive, retinopathy or cataract formation impairing the vision needed to operate a motor vehicle, and neuropathy affecting the ability to feel foot pedals can each impact driving safety... The single most significant factor associated with driving collisions for drivers with diabetes appears to be a recent history of severe hypoglycemia. Also, very important in the risk for vehicle accidents is history of a prior glucose-related accident...Moderate hypoglycemia significantly and consistently impairs driving safety and judgment as to whether to continue to drive or to self-treat under such metabolic conditions.”41 Even mild hypoglycemia can reduce driving performance and decision making.41

Most individuals with diabetes never test their blood glucose before driving, but say that they would stop driving if they felt symptoms of hypoglycemia. But, milder symptoms of hypoglycemia, such as blurry vision, sweating or feeling tired or irritable may be difficult to recognize. In addition, many with diabetes are not informed of the dangers of hypoglycemia and driving by their physicians. Diabetes-related driving accidents due to hypoglycemia are most common in people treated with insulin or sulfonylureas (especially the longer-acting sulfonylurea, glyburide).52

The American Diabetes Association (ADA) has recommended that “Special care should be taken to prevent hypoglycemia while operating any vehicle in drivers with type 1 diabetes and in those with type 2 diabetes who are at risk for developing hypoglycemia. They should be instructed to:

- Always check blood glucose before getting behind the wheel and at regular intervals while driving for periods of 1 hour or greater;
- Always carry a blood glucose meter and appropriate snacks, including a quick-acting source of sugar...as well as snacks with complex carbohydrate, fat, and protein...in their vehicle;
• Never begin an extended drive with low normal blood glucose (e.g., 70 to 90 mg/dL) without prophylactic carbohydrate consumption to avoid a fall in blood glucose during the drive;
• Stop the vehicle as soon as any of the symptoms of low blood glucose are experienced and measure and treat the blood glucose level; and
• Not resume driving until their blood glucose and cognition have recovered.”

In addition to concerns about hypoglycemia, the LEO with diabetes with retinopathy, cataracts, or peripheral neuropathy should be evaluated to determine whether these conditions hinder safe driving of vehicles. Work restrictions may be needed if these conditions (e.g., insensate foot) impair safe driving.

9. Individualized Assessment of the LEO with Diabetes Mellitus

The criteria and individualized assessment process included in this guidance are intended to serve as a means to minimize the risk to individual LEOs, fellow LEOs, and the public while allowing well motivated, well-educated persons with well-controlled diabetes to serve as LEOs. Nonetheless, certain persons with diabetes, despite their motivation and adherence to optimum care, may have a greater tendency for symptomatic or severe hypoglycemia or may have diabetic complications that can compromise safe job performance. After an individualized assessment, such individuals may not be acceptable candidates to be LEOs. This individualized assessment is possible in large part because of significant improvements in the treatment and the management of diabetes over the last number of years. The individualized assessment of the LEO with diabetes is a team effort between the police physician, the LEO with diabetes and the diabetes health care provider.

The individualized assessment of the LEO with diabetes covers the following areas, discussed in detail below:
A. Review the History of Diabetes and its Treatment
B. Assess the Risk for Impairing Events (Symptomatic and Severe Hypoglycemia, Hypoglycemia Unawareness, Symptomatic Hyperglycemia, and Diabetic Ketoacidosis)
C. Presence of Diabetic Complications

By reviewing and assessing the above medical information of the LEO, the police physician will make an individualized assessment: “Can this LEO safely perform their essential LEO job functions?”

A. Review the History of Diabetes and Its Treatment

The medical history of the LEO with diabetes may be provided to the police physician by one or more of the following means:
• Completion of “Physician (Treating) Evaluation Form for LEO with Diabetes” — see Appendix B — by the treating physician or health care provider;
• Narrative summary report by the treating physician; or
• Copy of the LEO’s medical records.

If any of the above submitted to the police physician completely addresses all aspects of the medical history, other than review of the glucose log, additional reports may not be needed. A complete medical history report should include:
• Date of diabetes onset
• Type 1 or type 2 diabetes
• Current medication treatment for diabetes (name, dosage, frequency)
• Is the medication treatment currently stable? (See also section on Overview of Medical Evaluation.)
• Most recent medication change, reason for change, and date of change
• Current compliance with treatment plan
• Description of hypoglycemic episodes (date, glucose level, location, corrective action, treatment)
• Description of diabetic ketoacidosis episodes (date, glucose level, location, treatment)
• Clinical evaluation for chronic complications
Information concerning use of insulin pump, if used
- Hemoglobin A1C values
- Lab reports, including CBC, fasting glucose, blood chemistry, urinalysis
- Glucose log

A review of the medical history and records by the police physician is most important and should support the medications reported, need for medication changes, treatment compliance, evaluation for chronic complications, and the absence of symptomatic or severe hypoglycemia. A review of the medication history should reveal stability of medication treatment with timely modification of dosage as needed (see section on Overview of Medical Evaluation). The treating physician should provide the medical basis for the addition or subtraction of medications, i.e., addition of insulin or sulfonylureas.

1) Hemoglobin A1C

The A1C reflects the average glucose levels over the past 2 to 3-month period and is used as a marker for glucose control during that period. The A1C does not provide a measure of glucose variability (the daily highs and lows) or hypoglycemia; the glucose log (SMBG) is used for those purposes.

Although a useful measure of chronic glycemia, the A1C has limited utility in predicting hypoglycemia risk. As a screening tool, the A1C should be followed with a glucose log review to confirm treatment goals and avoidance of hypoglycemia. However, a low or low-normal A1C (or fasting glucose) in a patient treated with a sulfonylurea or insulin should raise concerns for hypoglycemia and lead to a review of glycemic management, beginning with the glucose log.

A high A1C can also be a risk factor for hypoglycemia. Early studies, such as the 1997 Diabetes Control and Complications Trial (DCCT), demonstrated a significant increase in severe hypoglycemia (SH) with intensive insulin treatment whose goal was a normal or near-normal A1C. Based on these studies, one was lead to think that when the A1C is very high (≥9%), hypoglycemia would be unlikely. But, recent studies have shown that an elevated A1C level can also be a risk factor for SH.37,44

It is thought that this increased risk for SH, despite the presence of a high A1C, is due to hypoglycemic unawareness and glucose variability.44 Another cause for SH in those with a reported high A1C may be the initiation of new treatment (sulfonylureas and/or insulin) after the discovery of the high A1C. Therefore, with a high A1C, SH remains a risk due to high glucose variability (instability), hypoglycemia unawareness, and treatment change. With a high A1C the police physician should request an updated list of the current treatment (medications) and a current glucose log.

In some patients, the A1C is an unreliable marker of glucose control due to conditions that affect the red blood cell (RBC) life cycle (e.g., sickle cell disease/trait, thalassemia, splenectomy, hemolytic anemia, iron or B12 deficiency anemia, severe chronic kidney disease, severe hypertriglyceridemia, chronic alcoholism, high dose vitamin C or E). When the mean RBC life span increases (splenectomy), the A1C increases; when the mean RBC life span decreases (hemolytic anemia, hereditary spherocytosis), the A1C decreases.

In a recently reported case, a patient with hereditary spherocytosis with a fasting glucose of 379 and glucose log of consistent readings >350 mg/dl, had an unexpected A1C of 6.9%. This demonstrates the potentially striking disconnect between actual blood glucose levels and the A1C in special populations. In these patients, either glycosylated albumin or fructosamine assays should be used.45 Currently, there is controversy as to whether there is a racial difference with the A1C between African-American and Caucasian adults.46,47

There is increasing interest in the use of fructosamine in these special populations for whom the A1C may not provide an accurate assessment of glycemic status. Major limitations at this time with the use of fructosamine are altered protein levels affecting results, the lack of evidence linking it to long-term complications of diabetes, and no generally accepted treatment targets.

There is similar interest in glycosylated albumin for these populations. Major limitations for the use of glycosylated albumin are values in blacks are significantly higher than in whites, for reasons that are unclear;
many factors can influence albumin metabolism (e.g., smoking, thyroid disease, altered protein levels); the lack of evidence linking it to long-term complications of diabetes; and no generally accepted treatment targets.\textsuperscript{48}

2) **Glucose Log**

Review of the glucose log by the police physician is a critical component of the medical review of the LEO with diabetes. The police physician must not depend on the treating health care provider for a history of hypoglycemic events but must review the LEO’s medical records and glucose log for this information. There is no substitute for the review of a properly maintained glucose log to evaluate for the presence and risk of hypoglycemia. “Many patients rarely or never inform their physician about episodes of hypoglycemia; therefore, health care practitioners must routinely inquire about a given patient’s frequency of and risk factors for hypoglycemia and glycemic liability and must screen for impaired awareness.”\textsuperscript{32(p 1021)}

The police physician should review the previously collected glucose log of the LEO with diabetes. Recommended testing schedules are (also see table in Section on Quantitative Glucose Monitoring):

- LEO with type 1 diabetes: 1 month
- LEO with type 2 diabetes on insulin: 1 month
- LEO with type 2 diabetes not on insulin but taking sulfonylurea: 1 month
- LEO with type 2 diabetes not on insulin or sulfonylurea: as recommended by treating physician. Unless the fasting glucose is inconsistent with the A1C, additional glucose log reporting is not necessary.

a) **Review of the collection and reporting of the glucose log**

In order to facilitate an effective review of the glucose log, the police physician must verify that the glucose log has been properly collected and reported. Proper collection and reporting of the glucose log will allow assessment of glucose control and variability and the risk for symptomatic and severe hypoglycemia.

**Proper reporting of the glucose log includes:**

- The glucose log is reported over a recent period of time with continuous (every day) and regular testing (e.g., same time in relation to meals or activity each day). The glucose log should cover an adequate period of time and a frequency that demonstrates glucose stability and absence of symptomatic and severe hypoglycemia. Often, when the LEO has demonstrated a history of acceptable glucose control and stable medications, shorter periods of time for glucose log reporting may be sufficient to establish acceptable glucose control.
- The glucose log must be printed off the memory of the glucose meter and not handwritten or typed.
- Each glucose value in the log must have a time stamp (hour and minutes) and each day of reporting must have the date printed.
- Glucose values in the log <70 mg/dl must be addressed with documentation by the LEO or his or her health care provider, of probable cause(s) of the low glucose, symptoms present at the time of low glucose, corrective action(s) taken, and work/non-work activities occurring at the time of low glucose.
- Glucose values in the log <70 mg/dl must be repeated, at a minimum, every 15 minutes until a glucose value of 90 mg/dl or greater has been reached. All glucose values obtained during this time must be documented in the glucose log with a time stamp for each value. If the LEO suspects a meter error, a quick repeat of the glucose may differentiate between a technical error and actual hypoglycemia. Waiting for a glucose value of 90 mg/dl allows the brain time to respond. The ADA Standard on Diabetes and Driving states to “Never begin an extended drive with low normal blood glucose (e.g., 70 to 90 mg/dl) without prophylactic carbohydrate consumption to avoid a fall in blood glucose during the drive.”\textsuperscript{4} Therefore, it is recommended that, after treating or detecting hypoglycemia in the LEO, testing continue until a glucose of at least 90 mg/dl has been reached.
- The treating health care provider should review and sign/initial the glucose log.
b) **Review of the glucose log for significant findings**

After proper collection and reporting of the glucose log has been verified, the police physician will examine the glucose values for the following:

i. **Hypoglycemia and hypoglycemic unawareness**

Some individuals with diabetes lose the ability to recognize the early warning signs of hypoglycemia over time. These individuals are at increased risk for a sudden episode of **severe hypoglycemia**. Low glucose readings can occur with inadequate testing procedures, and quick retesting can exclude actual hypoglycemia. Examinees who do not retest low glucose levels (<70 mg/dl) should be suspected of hypoglycemic unawareness, and those who repeatedly demonstrate hypoglycemic levels without retesting and documentation may require work restrictions. Even when recognized with retesting, frequent hypoglycemic levels (<70 mg/dl) indicates poor glucose control and may require work restrictions.

The glucose log may be imprecise especially in the low range, complicating interpretation of hypoglycemia without symptoms. This makes it important for the police physician to review documentation from the LEO and their health care provider concerning the validity of the glucose readings. How much hypoglycemia is acceptable? Commenting on the review of hypoglycemia using continuous glucose monitoring (CGM), one approach described was to break down hypoglycemia into the amount of time spent low (<70 mg/dl), very low (<60 mg/dl), or dangerously low (<50 mg/dl) over a 2-week period of CGM readings, and recommend restricted duty based on the level of risk accepted by the employer. Glucose values of less than 50 mg/dl, not caused by a technical error, are associated with severe hypoglycemia, and the LEO should be restricted until further assessment by the LEO’s treating physician has been performed. See previous section on Hypoglycemia, for evaluation guidance.

ii. **Glycemic variability**

Glycemic variability (GV) is the degree that a patient’s blood glucose level fluctuates between high and low levels. If high GV is present, the glucose log may show low glucose readings (<70 mg/dl) preceded or followed by very high glucose readings (>400 mg/dl). High GV is associated with SH. A meta-analysis of studies describing associations between A1C variability (high GV) and adverse outcomes in patients with type 1 and type 2 diabetes showed significant associations between A1C variability (high GV) and all-cause mortality, renal disease, and cardiovascular disease in type 2 diabetes and retinopathy, renal disease, and cardiovascular disease in type 1 diabetes. These relationships are independent of mean A1C, and in the majority of studies, A1C variability (high GV) was more predictive of adverse outcomes than mean A1C. The authors concluded that A1C variability (high GV) may play a future role in clinical risk assessment.

Also, high GV may present with significant changes in visual acuity due to osmotic changes causing the lens to swell and/or shrink. Fluctuating vision is frequently the result of poor blood glucose control. Elevated blood glucose levels may lead to a myopic shift, enabling presbyopic individuals to read without their glasses, while their distance vision becomes blurred. Periodic vision screening may be needed to verify that the LEO with high GV meets the required vision standards.

iii. **Hyperglycemia**

ADA considers an A1C ≥9% to be “very high” and an A1C ≥10% (i.e., an estimated average glucose of 240 mg/dl) to be “severe hyperglycemia.” Consistent severe hyperglycemia demonstrates very poor glucose control and risks diabetic ketoacidosis (DKA), requiring additional medical evaluation of current treatment by the treating physician and review by the police physician.
“While significant hyperglycemia may impair cognitive, motor, and perceptual functioning, there is only one report suggesting extreme hyperglycemia can impact driving safety.”4(p 599) Symptoms of hyperglycemia (cognitive impairment) are mainly seen with the acute, rapid rise of glucose55,56,57 to levels of 200-300 mg/dl,55,56 or to 400 mg/dl.58

Those with poorly controlled diabetes and severe hyperglycemia may need to avoid physical exertion. “Like people with type 2 diabetes, those with type 1 diabetes must avoid physical exertion if their diabetes is poorly controlled. For people with type 1, even more than those with type 2, elevated glucose levels, particularly if not due to a hypoglycemic event and rebound hyperglycemia, can reflect an insulin insufficiency. Exercise with hyperglycemia and with the presence of ketones may lead to increases in blood glucose levels or a worsening of the ketosis. A fasting blood glucose level over 250-300 mg/dl, especially with the presence of ketones, should be a warning not to be physically active until the abnormality is corrected.”48(p 162) When individuals with type 1 diabetes are deprived of insulin for 12-48 hours and are ketotic, exercise can worsen hyperglycemia and ketosis; therefore, vigorous activity should be avoided with ketosis.59(p 525)

Chronic hyperglycemia is not benign. The symptoms of major depression (common in persons with diabetes) and of chronic hyperglycemia are often very similar (e.g., lethargy, fatigue, poor concentration, changes in appetite and sleep patterns), and therefore, it can be very difficult to diagnose depression in a person with chronically high blood glucose levels.8(p 784-5)

B. Assess the Risk for Symptomatic and Severe Hypoglycemia, Hypoglycemia Unawareness, Symptomatic Hyperglycemia, and Diabetic Ketoacidosis

The police physician should assess:

- Has the LEO had symptomatic or severe hypoglycemia, hypoglycemia unawareness, symptomatic hyperglycemia, or diabetic ketoacidosis?
- What is the risk of these events re-occurring?

After reviewing the treating physician summary and medical records (including current Hemoglobin A1C, glucose log, medications used and their relative risk for hypoglycemia, and insulin pump records if used), the police physician should determine the presence and risk for symptomatic and severe hypoglycemia, hypoglycemia unawareness, symptomatic hyperglycemia, and diabetic ketoacidosis. If present, these conditions should require work restrictions.

1. Review of past history and assess risk for severe hypoglycemia (SH)

The strongest predictor of future SH is the occurrence of prior SH.60 Data from the 1997 DCCT Research study showed that after an episode of SH, the risk for recurrent SH was 8% in the conventional therapy group and 9% in the intensive therapy group four years after the initial event.61

To identify at-risk drivers for symptomatic hypoglycemia, the ADA recommends a questionnaire for drivers with diabetes, asking “whether the driver has, within the past 12 months, lost consciousness due to hypoglycemia, experienced hypoglycemia that required intervention from another person to treat or that interfered with driving, or experienced hypoglycemia that developed without warning.”4(p 100) The ADA further states, “However, recurrent episodes of severe hypoglycemia, defined as two or more episodes in a year, may indicate that a person is not able to safely operate a motor vehicle.”4(p 101)

The ACOEM LEO Task Group reviewed the medical literature and had discussions with endocrinologists to develop a consensus determination concerning LEO restriction recommendations based on a history of past SH. Recent medical literature shows that the risk for occurrence of SH to be less over time in major studies, due to factors such as improved insulin therapies (e.g., overall SH rates decreased from 62/100 patient years in 1993 DCCT to 13.3/100 patient years in 2010 STAR 3). The review and discussion process resulted in the current consensus recommendation of the ACOEM LEO Task Group (see Section on Impairing Events, Severe Hypoglycemia).
2. **Type 1 or type 2 diabetes**
Hypoglycemia and SH are more common with type 1 diabetes. If concern exists that a poorly controlled type 2 is actually a type 1, a C-peptide may be requested. Although rarely used by clinicians, measurement of C-peptide is a well-accepted method for quantification of endogenous insulin secretion and is used to assist classification and management of insulin-treated patients, especially where there is uncertainty about diabetes subtype (1 or 2).

3. **Review of past history of diabetic ketoacidosis (DKA)**
Diabetic ketoacidosis (DKA) is the result of acute insulin deficiency, often associated with type 1 diabetes, causing hyperglycemia, ketosis, and acidemia. It may be the presenting event for type 1 diabetes or may be caused by inappropriately withholding insulin, by a major physiologic stress (e.g., myocardial infarction, sepsis), or by dysfunction of an insulin pump. Often the blood glucose is elevated to over 400 mg/dl, but can present at 250 to 300 mg/dl, especially in patients who may have taken some insulin. DKA may result in significant morbidity or mortality. An episode of DKA may be explained by initial onset of diabetes, significant infection, or injury, but requires an in-depth medical review by the police physician. This condition should be closely monitored and managed by the treating physician. Only after a period of time of monitoring to ensure that the condition is resolved and unlikely to reoccur should the LEO be allowed to return to unrestricted duty. A second episode may indicate poorly managed or unmanaged diabetes and may be unacceptable due to the unpredictable clinical course and the risk for sudden incapacitation.

C. **Determine the Presence of Chronic Diabetic Complications**
The police physician should assess:
- Does the LEO have chronic diabetic complications (retinopathy, neuropathy, cardiovascular disease, nephropathy)?
- What is the extent of these complications and do they interfere with performance of essential job functions?

A major goal of diabetes treatment is to prevent its chronic complications — retinopathy, neuropathy, cardiovascular disease, and nephropathy. The chronic complications of diabetes increase with untreated hyperglycemia, lengthy time period between onset and diagnosis of diabetes, poor glucose control, and lack of careful screening for chronic complications.

A newly recognized increase in diabetic complications is seen with those with type 1 diabetes underdosing or omitting insulin to lose weight. It has been seen that 30 to 40% of young women with type 1 diabetes engage in underdosing or omitting insulin to lose weight, tripling their risk of early and severe neuropathy, nephropathy, retinopathy, and premature death. The health care provider must balance the prevention of diabetic chronic complications with avoidance of hypoglycemia.

1. **Diabetic retinopathy and macular edema**
Diabetic retinopathy (DR) is classified into:
- Nonproliferative DR (NPDR) (based on the presence and degree of retinal lesions, NPDR is classified clinically as mild, moderate, severe, or very severe);
- Proliferative DR (PDR).

Periodic ophthalmologic evaluation of the LEO with diabetes is necessary due to the increased risk of advanced retinopathy with retinal blood vessel leakage or hemorrhage or retinal detachment. The prevalence of DR in US patients with diabetes is 28.5% for all DR and 4.4% for vision-threatening DR, with 12,000-24,000 new cases of vision loss due to diabetes each year.

Those with type 1 diabetes have more frequent and severe DR, because of its earlier onset and longer duration. After 5 years of type 1 diabetes, 23% will have DR, and after 10 and 15 years, 60 and 80%, respectively, will have DR. Proliferative DR, the most sight-threatening stage of DR, is present in 25 and 56% of patients with type 1 diabetes after 15 and 20 years, respectively. Proliferative DR often remains asymptomatic until it has progressed well beyond the optimal stage for initiating treatment.
The stealthy nature of type 2 diabetes often delays diagnosis, and microvascular complications including DR may exist when diabetes is diagnosed. The prevalence of diabetic retinopathy at diagnosis (10-37%) highlights the importance of prompt dilated fundus eye examination upon diagnosis.66 The prevalence of DR increases to 60-85% after 15 years of type 2 diabetes. Proliferative DR was present in 3-4% of those with type 2 diabetes after 4 years, 5-20% after 15 years, and >50% after 20 years.69(p 729)

It is clinically appropriate for individuals with severe non-proliferative or proliferative diabetic retinopathy to avoid participating in vigorous physical intensity, jarring, straining, or Valsalva-like activities.8(p 532-41) To avoid retinal or vitreous hemorrhage or retinal detachment, those with severe nonproliferative or proliferative diabetic retinopathy should avoid vigorous-intensity aerobic exercise or resistance exercise.66(p 68-9,67,68 LEOs requiring laser photoagulation for proliferative retinopathy may need to wait 3-6 months after the procedure before resuming strenuous physical activity.69(p 69)

Diabetic macular edema (DME) can be present at any level of DR, but becomes more frequent with increasing severity of DR. Clinically significant DME (CSME) signifies an increased risk for moderate vision loss.69(p 734-40) “Diabetic macular edema is the principal cause of moderate vision loss (equivalent to difficulty with reading or driving) in patients with diabetes and affects roughly 3% of adults with diabetes in the United States.” Left untreated, 25% of eyes with DME will lose significant vision within 3 years.69(p 751)

2. Diabetic Neuropathy
The typical diabetic peripheral neuropathy is a distal symmetrical sensorimotor polyneuropathy (DSP) in a “stocking-glove” pattern. DSP is the most common complication of both type 1 and type 2 diabetes. Over 50% of people with diabetes will have DSP in their lifetime, and about 20% of newly diagnosed type 2 diabetes patients show evidence of DSP at the time of diagnosis. Persistent neuropathic pain develops in about 20% of diabetic patients. In the U.S., DSP is the primary cause of diabetic foot problems and ulcerations, which are the main causes of diabetes-related hospital admissions and non-traumatic amputations. Hyperglycemia and the duration of exposure to hyperglycemia contribute to the development of DSP.69(p 793-833)

The presence of diabetic peripheral neuropathy (DPN) is important to determine as it will affect safe usage of vehicle foot pedals, physical mobility, and balance. Those with severe DPN may have an altered gait and are at a fivefold increased risk of falling. For these individuals, falling is preceded by a loss of balance, and the more likely they are to lose balance, the more likely they are to fall. Determining balance control during everyday gait activities may be the closest proxy for determining the risk of falling.69 Foot ulcers and amputations, foot deformities, insensate feet, and peripheral arterial disease are common with DPN. LEOs with diabetes should have a comprehensive foot evaluation each year to identify risk factors for ulcers and amputations.70(p 578)

Cardiovascular Autonomic Neuropathy (CAN) causes exercise intolerance, orthostatic hypotension (weakness, faintness, dizziness, visual impairment, and syncope), silent myocardial ischemia and reduced appreciation for ischemic cardiac pain which can impair timely recognition of myocardial ischemia or infarction, delaying appropriate treatment.59(p 525) Advanced CAN may be indicated by resting tachycardia (>100 bpm) and orthostatic hypotension.59(p 562)

CAN increases substantially with the duration of diabetes regardless of diabetes type. Prevalence rates ≥60% were seen in patients with long-standing type 2 diabetes.69(p 839) About 30% of patients with diabetes and with neuropathy also have an autonomic neuropathy.8(p 587) Orthostatic hypotension is the most incapacitating manifestation of CAN and is a common feature of diabetic CAN. Estimates for the mortality associated with CAN range from 27-56% over 5-10 years. There is also an increased frequency of sudden death in patients with CAN.8(p 597) CAN may increase the risk of exercise-induced injury or adverse event through decreased cardiac responsiveness to exercise, postural hypotension, impaired thermoregulation, impaired night vision due to impaired papillary reaction, and higher susceptibility to hypoglycemia. CAN is also an independent risk factor for cardiovascular death and silent myocardial ischemia. Therefore, individuals with diabetic CAN should undergo cardiac investigation before beginning physical activity more intense than that to which they are accustomed.59(p 525)
3. Cardiovascular Disease

“CVD (cardiovascular disease) is the major cause of morbidity, mortality, and healthcare costs for patients with diabetes. Compared with the general population, patients with diabetes have a 4 times greater incidence of CHD (coronary heart disease) and a 2- to 4-fold higher risk of a cardiovascular event. The risk of myocardial infarction (MI) in patients with diabetes without prior documented CHD is similar to the risk of reinfarction in patients without diabetes with known CHD. Women with type 2 diabetes are particularly prone to developing cardiovascular complications (the age-adjusted risk ratio of developing clinical CHD among people with diabetes was 2.4 in men and 5.1 in women compared with patients without diabetes. “13(p 82) “More than half of the patients with newly diagnosed T2DM have established coronary artery disease, whereas one third of patients with coronary artery disease have known diabetes mellitus.”71

There is a relationship between poor glycemic control and cardiovascular death. One study showed that those with type 2 diabetes younger than 55 and an A1C of ≥9.7% had a hazard ratio for cardiovascular death of 5.38 compared to controls. The average increase in risk of cardiovascular mortality was 14% for each increase of 1 percentage point of the A1C.24

Diabetes is a significant risk factor for Peripheral Artery Disease (PAD). Together with peripheral neuropathy, PAD is a major risk factor for non-traumatic lower extremity amputation, with diabetes contributing to >60% of these amputations. The most common symptom of PAD is intermittent claudication (present with walking but relieved with rest). More severe symptoms of PAD include claudication pain at rest, non-healing foot ulcers, tissue loss, and gangrene.9(p 898)

Cardiovascular Screening and Testing

Despite the significantly increased cardiovascular risk for those with diabetes, exercise stress testing (EST) for the general population of asymptomatic persons with diabetes remains somewhat controversial. The goal of the medical evaluation of the LEO with diabetes by the police physician is not to treat or to improve long-term clinical outcomes, but is to evaluate whether the LEO is currently likely to suffer sudden cardiovascular incapacitation while performing their physically and mentally arduous LEO essential job functions.

The ACOEM LEO Task Group has determined that, due to the significantly elevated cardiovascular risk of the LEO with diabetes, EST is an important medical evaluation component for the LEO with diabetes. This determination was based on an extensive review of the medical literature, which included the American College of Cardiology (ACC) and American Heart Association (AHA) Task Force on Practice Guidelines (Committee on Exercise Testing), 2002 Guideline Update for Exercise Testing,15 that allows EST in selected populations:

Exercise Testing in Asymptomatic Persons Without Known Coronary Artery Disease (CAD)15

Class IIa (Weight of evidence/opinion is in favor of usefulness/efficacy):
- Evaluation of asymptomatic persons with diabetes mellitus who plan to start vigorous exercise.

Class IIb (Weight of evidence/opinion is less well established by evidence/opinion):
- Evaluation of persons with multiple risk factors as a guide to risk-reduction therapy.
- Evaluation of men older than 45 years and women older than 55 years who:
  - plan to start vigorous exercise (especially if sedentary) or
  - are involved in occupations in which impairment might impact public safety or
  - are at high risk for CAD due to other diseases (e.g., peripheral vascular disease and chronic renal failure)

Class III (Conditions for which there is evidence and/or general agreement that the procedure/treatment is not useful/effective and in some cases may be harmful):
- Routine screening of asymptomatic men or women.

The 2002 ACC/AHA Guidelines on Exercise Testing state: “Because of the role of false-positive test results, several studies have recommended consideration of other data complementary to the presence of greater than 1 mm of ST-segment depression. When other factors have been taken into account in a
multi-variate analysis, exercise testing has been shown to be predictive of hard events, with relative risks in the range of 4.1 or 5:1. These include other aspects of the ST-segment response, other exercise parameters, risk factors, and the results of stress imaging tests. However, the development of evidence of ischemia at low workload is associated with a relatively high risk of subsequent events. ST-segment depression that occurs after fewer than 6 minutes (<7 METs) of the Bruce protocol has been associated with a relative risk of 6.7 in men and 3.6 in women, and ischemia at fewer than 5 minutes of exercise has been associated with a relative risk of 14.7 in men and 5.6 in women. The Bayesian issues posed by testing patients with a low probability of CAD may be reduced somewhat by screening a slightly higher-risk group. This can be done by applying the test only to patients with risk factors for CAD.15

Cited by the 2002 ACC/AHA Guidelines on Exercise Testing, the Seattle Heart Watch Study showed “in patients with 1 or more risk factors and 2 abnormal features on exercise testing (chest pain, exercise for fewer than 6 minutes, attainment of less than 90% of predicted heart rate, or ST-segment depression), there was a 30-fold increment of cardiac risk.”15

The 2002 ACC/AHA Guidelines on Exercise Testing further state, “In asymptomatic diabetic persons, the likelihood of cardiovascular disease is increased if at least 1 of the following is present: age older than 35 years, type 2 diabetes of greater than 10 years’ duration, type 1 diabetes of greater than 15 years’ duration, any additional atherosclerotic risk factor for CAD, presence of microvascular disease (proliferative retinopathy or nephropathy, including albuminuria), peripheral vascular disease, or autonomic neuropathy. Exercise testing is recommended if an individual meeting the criteria is about to embark on moderate- to high-intensity exercise.”15

The 2010 ACCF/AHA Guideline for Assessment of Cardiovascular Risk in Asymptomatic Adults also makes a Class IIb recommendation for “An exercise ECG may be considered for cardiovascular risk assessment in intermediate-risk asymptomatic adults (including sedentary adults considering starting a vigorous exercise program), particularly when attention is paid to non-ECG markers such as exercise capacity.”13(p e74-75) To support this recommendation, this Guideline states, “Although many clinicians typically think of the exercise test as primarily a measure of ST-segment changes that may reflect ischemia, evidence has demonstrated that the ST segment is a weak marker for prevalent and incident CAD. In contrast, non-ECG measures have emerged as stronger predictors of risk. Probably the most powerful risk marker obtained during routine exercise testing is exercise capacity; numerous investigators have consistently found that depressed exercise capacity is associated with increased cardiovascular risk.” Frequent ventricular ectopy during recovery, failure of the heart rate to rise appropriately during exercise, and decreased heart rate recovery are additional risk factors for cardiovascular disease that can be seen on the EST.13(p e74-75) This 2010 guideline defined “intermediate-risk” as a 10% risk of a hard cardiac event over the next 10 years, using a global risk score such as the Framingham Risk Score.13(p e58)

In 2013, the American Heart Association (AHA) re-stated that the 2002 ACC/AHA Guidelines on Exercise Testing “recommend exercise testing before starting a vigorous exercise program (defined as ≥6 METs) in asymptomatic people with diabetes mellitus, in men and women >45 and 55 years of age, respectively, and in those with “major coronary risk factors.”” In addition, “Exercise stress testing also can be recommended before vigorous exercise in high-risk asymptomatic individuals who are classified as CAD equivalents by the National Cholesterol Education Program. This includes those with diabetes mellitus, symptomatic carotid disease, peripheral vascular disease, and a calculated Framingham 10-year risk of ≥20%.16(p 894) Further, “Because diabetes mellitus is a potent risk factor for CAD, exercise testing can be useful both in screening for CAD in asymptomatic individuals who have diabetes mellitus and in assessing prognosis.”16(p 898)

The Joslin Diabetes Center recommends that before starting a fitness program, the person with diabetes should have a careful evaluation.9(p 162) This evaluation should “look for symptoms suggestive of coronary artery disease. An exercise tolerance test, or perhaps a stress echo or stress thallium, should be considered, particularly if the patient is older than 35 years of age or has had type 1 diabetes or type 2 diabetes for more than 10 years or type 2 diabetes and at least one of the following:
- microalbuminuria
- overweight (BMI >28)
- dyslipidemia (LDL-C ≥100 mg/dl, HDL-C <40 mg/dl in men or <50 mg/dl in women, fasting TG >150 mg/dl)
- known macrovascular disease (PVD)
- family history of CAD in those younger than 55 years old
- hypertension (>130/85 mmHg on 3 occasions)
- smoker
- start of a new physical activity program
- autonomic neuropathy evidenced by:
  - cardiac autonomic function abnormalities
  - orthostatic hypotension
  - erectile dysfunction
  - gastroparesis

4. Diabetic Nephropathy

Diabetes is the leading cause of end-stage renal disease (ESRD), accounting for 50% of cases in the developed world. Increased albuminuria and decreased GFR are each independently and additively associated with an increase in all-cause and CVD mortality, and most of the excess CVD of diabetes is accounted for by the population with diabetic kidney disease.19(p 2865),20 End-stage renal disease (ESRD) develops in 50% of those with type 1 diabetes and overt nephropathy (macroalbuminuria – albuminuria ≥300 mg/g creatinine) within 10 years and >75% by 20 years. For those with type 2 diabetes, ESRD appears in 20% at 20 years.72

Diabetic nephropathy and poor glycemic control leads to a nearly 9-fold increase in relative cardiovascular mortality.71 In those with diabetes and an eGFR of 45-59 mL/min/1.73m², the CVD risk is increased by 43%, and with an eGFR <15 mL/min/1.73m² (kidney failure), the risk is increased by 343%.22(p 91)

Identifying and monitoring of diabetic nephropathy relies on assessment of reduced kidney function, using eGFR (estimated GFR) of <60 mL/min/1.73m², and kidney damage, using albuminuria >30 mg/g creatinine. Monitoring albuminuria alone may miss progressive kidney disease. The ADA recommends that “Serum creatinine with eGFR should therefore be assessed at least annually in all adults with diabetes, regardless of the degree of urine albumin excretion.”49(p 60) "Initial referral of a patient with diabetes to a nephrologist is advisable when urinary protein excretion exceeds 1 gram/day, because other causes of proteinuria need to be identified and the potential benefit of a percutaneous kidney biopsy must be weighed."9(p 765)

Those with an eGFR of <60 mL/min/1.73m² are more prone to hypoglycemia, especially if taking sulfonylureas and insulin; those with a baseline serum creatinine of 1.3 to 1.5 mg/dl had a 66% increased risk of severe hypoglycemia.19(p 2869) Kidney replacement therapy will be needed for those with eGFR of <30mL/min/1.73m² (severe loss of kidney function) to survive the ravages of uremia with a progressive worsening of kidney function.19(p 2874)

Chronic kidney disease (CKD) by itself is an independent risk factor for cardiovascular disease (CVD). With moderate CKD (eGFR <45 mL/min/1.73m²), the risk of death from CVD is greater than to progression to renal replacement therapy.9(p 773)

The ADVANCE study showed that, during a 4.3 year follow-up of patients with type 2 diabetes, those with both albuminuria ≥300 mg/g creatinine and eGFR <60 mL/min/1.73m² at baseline had a 3.2-fold increased risk for cardiovascular events and a 22.2-fold increased risk for renal events (death as a result of kidney disease, need for dialysis or transplantation, or doubling of serum creatinine to >2.26 mg%), compared to patients with neither of these risk factors. Below is a summary of the ADVANCE study23:

- With eGFR ≥60 and albuminuria of <30 mg/g creatinine (no CKD), there was an annual cardiovascular event rate of 1.54%, an annual cardiovascular death rate of 0.54%, and an annual renal event rate of 0.06%.
- With eGFR ≥60 and albuminuria of ≥30 mg/g creatinine, there was an annual cardiovascular event rate of 2.87%, an annual cardiovascular death rate of 1.55%, and an annual renal event rate of 0.38%.
- With eGFR <60 (range of eGFR 30 to 59) and albuminuria of <30 mg/g creatinine, there was an annual cardiovascular event rate of 2.37%, an annual cardiovascular death rate of 1.09%, and an annual renal event rate of 0.23%.
- With eGFR <60 (range of eGFR 30 to 59) and albuminuria of ≥30 mg/g creatinine, there was an annual cardiovascular event rate of 4.67%, an annual cardiovascular death rate of 2.77%, and an annual renal event rate of 1.32%.23

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<th>Type 2 Diabetes eGFR/Albuminuria</th>
<th>Annual Cardiovascular Event Rate</th>
<th>Annual Cardiovascular Death Rate</th>
<th>Annual Renal Event Rate</th>
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<tr>
<td>eGFR ≥60 and albuminuria of &lt;30 mg/g creatinine</td>
<td>1.54%</td>
<td>0.54%</td>
<td>0.06%</td>
</tr>
<tr>
<td>eGFR ≥60 and albuminuria of ≥30 mg/g creatinine</td>
<td>2.87%</td>
<td>1.55%</td>
<td>0.38%</td>
</tr>
<tr>
<td>eGFR &lt;60 (range of eGFR 30-59) and albuminuria of &lt;30 mg/g creatinine</td>
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<td>1.09%</td>
<td>0.23%</td>
</tr>
<tr>
<td>eGFR &lt;60 (range of eGFR 30-59) and albuminuria of ≥30 mg/g creatinine</td>
<td>4.67%</td>
<td>2.77%</td>
<td>1.32%</td>
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</table>

In another study, those with type 2 diabetes younger than 55 and macroalbuminuria had a hazard ratio for cardiovascular death of 5.58 as compared to controls. Those with an eGFR of >45 to 60 had a hazard ratio for cardiovascular death of 5.56 as compared to controls, those with an eGFR of >30 to 45 had a hazard ratio for cardiovascular death of 8.59, and those with an eGFR of 15 to 30 had a hazard ratio for cardiovascular death of 35.03.24

**Conclusion:**
Current published data suggest that persons with diabetes who can safely and effectively function as LEOs can be reliably identified through careful individualized assessment. Thus blanket bans of all people with diabetes or those with diabetes treated with insulin, in addition to being illegal, are not consistent with current medical knowledge. Because diabetes affects individuals very differently, whether or not an individual can safely perform a particular job must be determined by an individualized assessment using the combined expertise of the treating physician and the police physician. This guidance provides the information necessary for the police physician to work with a diabetes expert on this important task.
APPENDIX B: PHYSICIAN EVALUATION FORM FOR LEO WITH DIABETES

I. INTRODUCTION

The educated and motivated law enforcement officer (LEO) or applicant with well-managed diabetes mellitus can be capable of safe and effective job performance. An individualized assessment of the LEO’s or applicant’s diabetes should be performed including an assessment of the following:

- History of Diabetes and its Treatment
- Risk for Impairing Events (Symptomatic and Severe Hypoglycemia, Hypoglycemia Unawareness, Symptomatic Hyperglycemia, and Diabetic Ketoacidosis)
- Presence of Diabetic Complications

Risk of hypoglycemia remains the major concern in regard to those with diabetes being or becoming LEOs. This risk occurs primarily in those taking insulin, particularly those with type 1 diabetes, although it may also occur in those with type 2 diabetes who take insulin and/or sulfonylureas and other secretagogues.

Law enforcement entails a unique set of conditions that need to be considered in regard to those with diabetes and the risks of either hypo or hyperglycemia. These may include (depending upon the duties of the particular LEO position):

- unpredictable meal schedules;
- brief periods of maximal physical exertion;
- driving a vehicle, including high-speed pursuit driving;
- surveillance requiring sustained attention for prolonged periods of time;
- rapid decision making regarding the use of force, including deadly force;
- rapid analysis of complex visual stimuli to differentiate weapons from other objects; and
- control of one’s emotions under stress.

II. ASSESSMENT FORM*

*Times cited for durations of stable treatment regimen or stability of management are in reference to the date of current evaluation. Date sought is when patient first began current insulin regimen (pump or injection) using current types of insulin (long acting, intermediate acting, short or rapid acting).

1. LEO has been under the care of an endocrinologist or other treating physician knowledgeable about diabetes management. Outpatient and in-patient medical record(s) from the last three (3) years or since date of diagnosis (whichever is shorter) should be reviewed by the treating physician and provided to the police physician.

   My credentials as a physician knowledgeable about diabetes management are as follows (or attach CV):

   

   This person has: ☐ type 1 diabetes   ☐ type 2 diabetes

   Date of diagnosis: ____ ____ ____

   Please attach inpatient and outpatient records for the most recent 3 years or since onset of diabetes (whichever is shorter)
Please complete the rest of this form if the information is not contained in the medical records that you are providing.

2. If type 1 diabetes, please complete:
   If type 1 diabetes, patient must be on a basal/bolus regimen or an insulin pump using analogue insulins for the six (6) months prior to evaluation.
   
   - Current insulin regimen: ____________________________________________________________

   Insulin pump brand and model: ______________________________________________________

   Pump settings:
   
<table>
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<tr>
<th>Start Time</th>
<th>Basal Rate</th>
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   Usual bolus doses:
   - Breakfast __________________________________________
   - Lunch ________________________________
   - Supper ________________________________
   - Other ____________________________________________________________________________
   - Correction factor __________________________________________________________________

   Multiple dose insulin (specify regimen):
   - Basal: __________________________________________________________________________
   - Bolus: __________________________________________________________________________

   Starting date on current regimen: _____/_____/__________

3. If type 2 diabetes, please complete:
   If type 2 diabetes on insulin, patient must be on a stable medication regimen for the three (3) months prior to evaluation. If not on insulin, patient must be on a stable medication regimen for the month prior to evaluation.

   Current medication regimen (name, dosage, and frequency):
   - Non-insulin agents ____________________________________________________________
   - Insulin ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

   Starting date on current regimen: _____/_____/__________

4. Glucose Log
   Patient must have documentation of ongoing self-monitoring of blood glucose. This must be done with a glucose meter that stores every reading, records date and time of reading and from which data can be downloaded. The glucose log must be available covering one month if on insulin or on a sulfonylurea, or 2 weeks (daily fasting glucose) if on other agents or if diet-controlled.
The individual has been asked to test glucose ______ times a day, and
☐ is adhering to my recommended schedule for testing.
☐ is not adhering to my recommended schedule for testing.

Glucose logs:
☐ are attached for review
☐ are not attached for review (please explain):

Explanation for glucose values <70 mg/dl in the glucose log (cause of hypoglycemia, symptoms, corrective action(s), work/non-work activity):

Documentation of glucose testing after glucose values <60 mg/dl in the glucose log with time stamp for each value. Glucose values <60 mg/dl must be repeated initially within 15 minutes and repeated until glucose of 90 mg/dl or greater is reached.

5. Diabetes Education
Patient must be educated in diabetes and its management and thoroughly informed of and understands the procedures that must be followed to monitor and manage his/her diabetes and what procedures should be followed if complications arise.

The individual has completed the following diabetes education (include year of completion):

6. Insulin Pump Use
If an insulin pump user, documentation provided for the following:
☐ proper understanding and education in the use of the insulin pump
☐ start date for the use of the pump
☐ history of insulin site infections
☐ history of pump cessation and pump malfunction
☐ backup plan for pump malfunction including use of injectable insulin
☐ frequency of infusion set changes

The individual has completed the following education in the use of a continuous insulin infusion pump (indicate year of completion):

The individual routinely carries appropriate supplies to compensate for pump malfunction, including syringes and insulin vials or insulin pens.
☐ Yes
☐ No – please explain:
Has the individual had any of the following insulin infusion issues over the past 12 months?

- Pump failure
- Insulin infusion set blockage
- Infusion site problems, including infection
- Insulin stability issues
- User error
- No insulin infusion issues in past 12 months

If insulin infusion issues have occurred in past 12 months, please describe and provide date(s):

________________________________________________________________________________________
________________________________________________________________________________________

7. Continuous Glucose Monitor
   Has this individual used a continuous glucose monitor?
   - No
   - Yes. If yes:
   Dates used: ____________________________________________
   Why used: ____________________________________________
   Frequency of use: ______________________________________

8. Hemoglobin A1C
   Patient must have a hemoglobin A1C measured at least four times a year (intervals of 2-3 months) over the last 12 months prior to evaluation if diagnosis has been present over a year. Provide A1C values and dates below:

   Date            HbA1C
   _______________        ______%
   _______________        ______%
   _______________        ______%
   _______________        ______%

9. Impairing Events
   a. Severe Hypoglycemia
      Has individual had episode of severe hypoglycemia (defined as an event requiring assistance of another person to actively administer carbohydrates, glucagon, or take other corrective action) in the past 3 years?
      - Yes
      - No

      If the individual has had such episode(s), please describe episodes and provide dates of episodes:
      __________________________________________________________
      __________________________________________________________

   b. Diabetic Ketoacidosis
      Has individual had episode of diabetic ketoacidosis in the past 3 years?
      - Yes
      - No

      If the individual has had such episode(s), please describe episodes and provide dates of episodes:
      __________________________________________________________
      __________________________________________________________

   c. Hyperosmolar Hyperglycemic State
      Has individual had episode of hyperosmolar hyperglycemic state in the past 3 years?
      - Yes
      - No

      If the individual has had such episode(s), please describe episodes and provide dates of episodes:
      __________________________________________________________
      __________________________________________________________
10. **Eye Exam**

Patient must have a complete eye exam by a qualified ophthalmologist or optometrist, including a dilated retinal exam, documenting the presence or absence of retinopathy/macular edema and the degree of retinopathy and/or macular edema if present (using the International Classification of Diabetic Retinopathy and Diabetic Macular Edema).

Date of eye exam: ____________________________________________________________________________

Eye exam indicates the presence of the following conditions:

- Proliferative diabetic retinopathy
- Severe non-proliferative diabetic retinopathy
- Moderate/Mild diabetic retinopathy (circle one)
- Clinically significant macular edema
- Moderate/Mild macular edema (circle one)
- None of the above

Copy of ophthalmology or optometry report is attached:

- Yes  ❑ No – please explain: _________________________________________________________________________

Copy of automated visual perimetry field test (Humphrey or equivalent) is attached:

- Yes  ❑ No – please explain: _________________________________________________________________________

Did the ophthalmologist or optometrist recommend activity restrictions (i.e., no contact sports, no strenuous physical activity) based on the results of the eye exam?

- Yes  ❑ No – please explain: _________________________________________________________________________

11. **Neurologic Exam**

Patient must have normal vibratory testing with 128 Hz tuning fork, normal testing with 10 gram Semmes-Weinstein monofilament and normal orthostatic blood pressure (measurement of blood pressure sitting and within 3 minutes of standing) and pulse testing.

Vibration sensation: ____________________________

Monofilament: ________________________________

BP supine: ____________________________ Pulse supine: ____________________________

BP standing: ____________________________ Pulse standing: ____________________________

Neurologic exam indicates the presence of the following conditions:

- Physical activity or performance is limited due to pain, weakness or numbness
- Ataxia
- Reduced balance during observation of gait
- Reduced proprioception, such as the inability to feel the foot pedals of vehicle
- Loss of position sensation
- Pain of burning requiring maintenance pain medication (include use of gabapentin and pregabalin)
- Contact-induced discomfort or pain
- Foot ulceration or infection that affects wearing of footwear or ambulation
- History of falls
- None of the above

Please describe the presence of above conditions: ________________________________________________

_________________________________________________________________________________________

_________________________________________________________________________________________
12. **Cardiovascular Exam**

Please provide a 10 year risk estimation of heart disease using the American Heart Association calculator (http://tools.acc.org/ASCVD-Risk-Estimator): ____________ (another risk estimator of cardiovascular disease is acceptable)

**Patient with no known cardiovascular disease**: Please provide an exercise stress testing to at least 12 METs if the 10 year risk is 10% or more according to the American Heart Association calculator.

**Patient with known cardiovascular disease**: Please provide a recent (within past 12 months) normal exercise stress test to at least 12 METs.

Describe the **past history of cardiovascular disease and interventions** (e.g., MI, CABG, PCI, TIAs, stroke):
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________

13. **Renal function testing**

Date of testing: __________________________
Serum Creatinine: __________________________
Urine microalbumin/creatinine ratio: __________________________
eGFR: __________________________

Has this person been referred to a nephrologist? **Circle one**: Yes  No  Not indicated

III. **Treating Physician Statement**

Please provide additional information not included above, that may be helpful to the review by the police physician:
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
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REFERENCES


