ENDOCRINE SYSTEM[1]

I. INTRODUCTION

A. OUTLINE OF HIGHLIGHTED CONDITIONS

1) Diabetes Mellitus

2) Parathyroid Disorders

3) Thyroid Disorders

4) Adrenal Disorders

B. IMPLICATIONS FOR JOB PERFORMANCE

The patrol officer position includes a variety of physically and emotionally demanding duties that require proper endocrine function, such as:

- Engagement in critical incidents involving exertion at maximum capacities for short periods of time (i.e., less than 15 minutes)
- Completion of academy training which may require prolonged exercise (i.e., greater than 30 minutes)
- Interruption of meals
- Prolonged driving with responsibility for the safety of a partner or arrestee
- High-speed pursuit driving
- Surveillance requiring sustained attention for hours at a time
- Split-second decision making regarding use of lethal force
- Rapid analysis of complex visual stimuli to differentiate weapons from other objects
- Control of one's emotions under stress

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II. MEDICAL EXAMINATION AND EVALUATION GUIDELINES

A. GENERAL SCREENING RECOMMENDATIONS

1) History: See Medical History Statement.

2) Examination: The routine physical exam should include measurement of the pulse at rest, and palpation of the thyroid.

3) Routine Tests: Urinalysis, which includes glucose and protein, should be performed.

B. EVALUATION OF COMMON CLINICAL SYNDROMES

1) DIABETES MELLITUS

a. GENERAL CONSIDERATIONS:

Diabetes is generally divided into two types. Type 1 is characterized by *insulin deficiency*, and requires treatment with insulin. Type 2 is characterized by *insulin resistance* which creates a relative insulin deficiency. It may be treated with diet modification, exercise, oral agents, and/or insulin. After a number of years, persons with type 2 diabetes are likely to develop insulin deficiency and require treatment with insulin.

Diabetes has implications for the safe and effective performance of peace officer duties because of both chronic and acute complications involving several major organ systems.

1. Job-Relevant Chronic Complications

Visual: Diabetic retinopathy may progress through three non-proliferative stages (mild, moderate, and severe) before proliferative retinopathy finally develops. In a survey from 1990, various stages of retinopathy were observed in 57% of patients (n=44) under the age of 30 with diabetes for less than ten years, with 2% having evidence of proliferative changes (Orchard, et al., 1990). Diabetic retinopathy can threaten central visual acuity. Additionally, at the severe non-proliferative and proliferative stages, activities that dramatically increase blood pressure (such as heavy lifting or wrestling) or cause active jarring (such as blows to the head, or jumping off walls) may precipitate vitreous hemorrhage or traction retinal detachment (A.D.A., 2004a). The risks of these complications can be substantially reduced by laser photocoagulation. However, this treatment can

cause significant loss of visual field in a substantial percentage of patients. Studies from England indicate that 12-19% of post laser patients were not able to meet the vision standards for driving in that country which include testing of peripheral vision (Pearson, et al., 1998; Mackie, et al., 1995).

Diabetic retinopathy can also cause a predominantly blue-yellow color vision deficiency (Utku & Atmaca, 1992; Lakowski, et al., 1972), and impairment of contrast sensitivity (Banford, et al., 1994; Brinchmann-Hansen, et al., 1993). Several studies indicate that impairment of color vision and contrast sensitivity may occur before the retinopathy is clinically visible (Kurtenbach, et al., 1994; Hardy, et al., 1992).

Neurological: Diabetes can cause both peripheral and autonomic neuropathy. Peripheral neuropathy may result in loss of protective sensation in the feet, and warrants limiting weight-bearing exercise such as prolonged walking and jogging to prevent ulcerations and fractures (A.D.A., 2004a). Autonomic neuropathy can affect cardiac function resulting in postural hypotension and hypotension following vigorous exercise. It may also result in abnormal thermoregulation which could create problems during exercise in hot or cold environments (A.D.A., 2004a).

Renal: Diabetes is the most common cause of renal failure. The earliest clinical evidence of diabetic nephropathy is the appearance of low, but abnormal levels of albuminuria, referred to as microalbuminuria (A.D.A., 2004b). While kidney function may not be affected initially, a high incidence of coronary heart disease has been shown to develop within the first few years after the onset of microalbuminuria in type 1 diabetic subjects (Jensen, et al., 1987).

Cardiac: Diabetes is well recognized as a major risk factor for coronary disease and silent ischemia. Additionally, it may cause impaired aerobic work capacity (Benbassat, et al., 2001; Wanke, et al., 1992), especially in patients who are not well-controlled (Niranjan, et al., 1997; Barkai, et al., 1996) or have complications such as autonomic dysfunction (Barkai, et al., 1996), neuropathy (Veves, et al., 1997), or microalbuminuria (Jensen, et al., 1988; Kebaek, et al., 1991). The magnitude of the aerobic impairment may be of relevance to the performance of peace officer duties. The study by Jensen, et al. (1988) found that the VO2max in young (mean age = 30) type 1 diabetic subjects with only microalbuminuria (30-300 mg/24 hr) was 28 ml O2/kg/min compared to 42 ml O2/kg/min (12 METS) in non-diabetic subjects.

It is important to note that the prevalence rates of these chronic complications are determined by the duration of the disease (Orchard, et al., 1990), and the level of glycemic control. In the Diabetes Control and Complications Trial (DCCT 1993) and the UK Prospective Diabetes Study Group (1998) trials, treatment regimens that reduced average A1C levels to approximately 7% were associated with significantly fewer microvascular complications. Epidemiological studies also

support the potential of good diabetic control to reduce the incidence of cardiovascular disease (Lawson, et al., 1999; Stratton, et al., 2000).

2. Job-Relevant Acute Complications

Hypoglycemia: Hypoglycemia can occur due to a relative excess of insulin or oral hypoglycemic medications. If not treated by ingestion of glucose, hypoglycemia will impair the performance of peace officer duties due to the rapid development of cognitive impairment. Functions that are most affected by hypoglycemia include rapid decision-making, sustained attention, analysis of complex visual stimuli, "mental flexibility," memory of recently learned information, and hand-eye coordination (Deary, 1999). Hypoglycemia can also cause increased irritability and anger (Deary, 1999). As hypoglycemia progresses to what is commonly called "severe" levels, frank confusion ensues which prevents self-treatment. If assistance is not forthcoming, the development of seizures, coma, and death may ensue.

The blood glucose level at which cognitive impairment begins varies considerably among individuals. However, several research studies have demonstrated significant neuropsychological and driving simulation impairments in 12-19% of subjects at blood levels as high as 65 mg/dl (Cox, et al., 2000; Gonder-Frederick, et al., 1994). Other studies have documented statistically significant decrements in cognitive function tests among groups of subjects at 60 mg/dl (Gschwend, et al., 1995) and 55 mg/dl (Fanelli, et al., 1998).

The major job-related factor that increases the risk of hypoglycemia for peace officers is the disruption of meals (DCCT, 1991). This is especially true for officers whose treatment regimen involves injecting regular insulin 30-45 minutes prior to meals, or those who use an intermediate acting insulin (such as NPH) that is expected to peak postprandially.

Additionally, when hypoglycemia develops in a peace officer, the demands of the job may distract or prevent the officer from responding appropriately to warning symptoms. For example, this could easily occur while responding to a call which requires in high speed pursuit driving, searching a building for an armed suspect, or when involved in confrontational situations.

Unanticipated exercise may also be a risk factor for hypoglycemia. However, this depends on the duration and intensity of the exercise. Exercise at moderate levels for more than 30 minutes will lower blood sugars. However, intense exercise of short duration (<15 minutes) has the opposite effect, resulting in sustained elevation of blood sugar for up to two hours (Sigal, et al., 1994; Mitchell, et al., 1988; Kjaer, et al.,1990). Since the vast majority of peace officer critical events involve intense exertion for a short period of time (< 10 minutes), hypoglycemia would not be expected to occur.

Hyperglycemia: Acute hyperglycemia is of potential concern because it may be a harbinger of diabetic ketoacidosis (DKA), or may produce cognitive impairment, fatigue, increased urination, and blurred vision.

DKA can develop in an individual with type 1 diabetes who has been insulin-deficient for a number of hours. This can potentially be precipitated by exercise. For this reason, the American Diabetic Association (A.D.A.) recommends that someone with type 1 diabetes use caution if exercising with blood glucose levels >300 mg/dl (A.D.A., 2004a). However, it seems highly unlikely that the short bursts of activity (i.e., <15 minutes) associated with critical events would be a major factor in causing ketoacidosis to occur in an officer.

Cognitive Impairment: The hyperglycemic level at which cognitive impairment is likely to develop is not clear. One study found that the time to complete subtractions significantly slowed above 270 mg/dl (Cox, et al., 2002). However, most studies have found no significant impairment during neuro-cognitive testing in the 300-380 mg/dl range (Draelos, et al., 1995; Hoffman, et al., 1989; Gschwend, et al., 1995; Holmes, et al., 1986). At higher glycemic levels (approximately 470 mg/dl), one study found that children score about 10% worse on I.Q. tests (Davis, et al., 1996).

Fatigue: Patients often report fatigue when their diabetes is chronically in poor control. However, there are very few studies documenting the hyperglycemic level at which this is expected to occur. Weinger, et al., (1995) found no significant increase in the mean intensity of fatigue complaints at blood sugars of 380 mg/dl in 42 type I diabetic subjects during an insulin-clamp study. Twenty-nine percent of her subjects did complain of feeling tired or weak, but an equal percentage reported feeling more energetic.

Increased Urination: Weinger, et al., (1995) found that urination was significantly increased at 380 mg/dl, affecting 39% of her subjects. More frequent or urgent urination could interfere with maintaining effective patrol duty or surveillance activities.

Blurred Vision is a common presenting symptom of diabetes. Myopic shifting with hyperglycemia was first reported in 1925 (Duke-Elder, 1925). The inverse phenomenon - hyperopic shifting - has been repeatedly observed with the initial treatment of uncontrolled diabetes (Okamoto, et al., 2000; Saito, et al., 1993), and has led to the general recommendation that persons with new onset diabetes wait until their sugars have stabilized before obtaining new glasses.

Several studies indicate that the magnitude of the myopic shifting expected with acute hyperglycemia could cause a candidate with poorly controlled diabetes to intermittently not meet an agency's vision guidelines. Gwinup, et al., (1976) administered a 25-gram dose of glucose intravenously to a group of six type 2 diabetic subjects who initially had a blood glucose of <150 mg/dl. Myopic shifting was observed within 15 minutes and peaked at approximately -0.75 D at 45 minutes after the glucose infusion. While the authors did not repeat measurements of blood sugars after the infusion, they noted that a rise in blood sugar of 150 mg/dl would be expected based on prior work by Amatuzio et al. (1953). Therefore, they estimated the rate of myopic change to be -0.5 D per 100 mg/dl increase in blood sugar. A second study measured refractions and glycemic levels in seven non-diabetic subjects who were given an oral glucose load with suppression of their insulin secretion by somatostatin (Furushima, et al., 1999). As average glucose levels rose from 70 to 279 mg/dl, the average change in refraction was -1.93 D, or approximately -0.9 D per 100 mg/dl. Unfortunately, neither of these studies conducted repeated direct measurements of the subjects' uncorrected visual acuity as glycemic levels rose. However, the myopic shifting observed would be expected to cause visual acuity to fall into the 20/50-20/70 range at glycemic levels of 300 mg/dl (see Table XI-13 in the Vision Guidelines Chapter).

The one study that conducted repeated direct measurements of visual acuity found that acuity remained stable when hyperglycemia was experimentally induced to an average level of 274 mg/dl in twenty diabetic subjects (Mangouritsas, et al., 1995). However, this study found that contrast sensitivity was significantly reduced during the hyperglycemic state.

These vision studies would seem to support an upper glycemic limit of 300 mg/dl in order to ensure adequate visual acuity. However, the studies' small sample sizes, use of non-diabetic subjects, and/or the use of indirect estimates of acuities and glycemic levels severely limits their reliability for quantitative purposes. Of note is that only 5% of subjects in the study by Weinger (1995) complained of blurry vision at 380 mg/dl.

In summary, it appears reasonable to require peace officers to maintain glycemic levels below 400 mg/dl while on duty. Until further research is completed, this level balances evidence-based concerns for job-related impairment against uncertainties regarding impairment at lower levels. It is interesting to note that the U.S. Federal Motor Carrier Safety Administration (2003) requires that truck drivers who use insulin to stop driving if their blood sugar exceeds 400 mg/dl.

3. Basis for Individualized Risk Assessments

Chronic Complications: An individualized assessment is necessary to determine the presence and significance of chronic complications. However, this will require more extensive testing than is routinely conducted on non-diabetic candidates (see Recommended Evaluation Protocol below).

Acute Complications:

Hypoglycemia - For a given individual, the risk of impairment on duty depends on two factors: the individual's glycemic threshold for impairment, and the likelihood of dropping below this threshold while on duty.

As discussed above, the threshold for neuro-cognitive impairment has been measured to be as high as 65 mg/dl in 12-19% of diabetic subjects. Ideally, it would be advantageous to directly measure the impairment threshold in each candidate. However, outside of research settings, it is currently not possible to individually assess impairment thresholds. Given the critical need for patrol officers to be neuro-cognitively intact at all times, one must assume that a diabetic officer would be significantly impaired in the performance of their duties at glycemic levels of 65 mg/dl or lower.

Notwithstanding the job-related factors that can increase the risk of hypoglycemia, the likelihood that a diabetic peace officer will experience glycemic levels of 65 mg/dl or lower on the job depends primarily on the medication used.

Use of Insulin: The risk of having glycemic levels of $\leq$65 mg/dl is highest for officers who use insulin. A great deal of research has attempted to identify individual risk factors for hypoglycemia among insulin-users. This research indicates that patients who either have hypoglycemia unawareness, or who have had a recent occurrence of severe hypoglycemia (an episode requiring assistance from another person) are at exceptionally high risk. For example, MacLeod, et al. (1993), found that 91% of patients with hypoglycemia unawareness had experienced an episode of severe hypoglycemia (SH) in the preceding year. In the DCCT study (1997), an episode of SH was shown to result in an elevated risk for a second event for the next three years (see Table III-1).

Even in the absence of these two major risk factors, the incidence rate of hypoglycemia is high enough to be of concern for police work. For example, two studies in the early 1990s found that 18-26% of patients with normal hypoglycemic awareness had an episode of SH in the preceding year (MacLeod, et al., 1993; Gold, et al., 1994). In the DCCT study, subjects whose last episode of SH was three years prior, still had annual rates of SH of approximately 8% (Table III-1).

Table III-1: Annual Risk of a Recurrent Major Hypoglycemic Event After an Initial Occurrence				
	Conventional Therapy		Intensive Therapy	
Time after initial event (yrs)	Severe Hypoglycemia	Seizure/ Coma	Severe Hypoglycemia	Seizure/ Coma
0	42%	27%	52%	32%
1	17%	10%	31%	19%
2	15%	5%	27%	7%
3	7%	3%	8%	12%
4	8%	5%	9%	16%

Data derived from DCCT Research Group, 1997. Hypoglycemia in the Diabetes Control and Complications Trial. Diabetes (46):271-286.

Secondary risk factors for hypoglycemia include a low hemoglobin A1C (A1C), use of intensive insulin therapy (i.e., ≥three injections per day or use of an insulin pump), and autonomic dysfunction. However, formulas which considered these factors as well as the recency of SH and hypoglycemia unawareness have been shown to predict, at most, only 18% of future severe hypoglycemic episodes (Gold, et al., 1997). Their predictive value for the occurrence of glycemic levels of ≤65 mg/dl would be considerably less.

A research group at the University of Virginia has taken a different approach to the prediction of hypoglycemia. Over the last ten years, they have developed software that can be used to analyze routinely collected blood glucose (BG) meter data. Based on 4-6 weeks of data, the software generates a Low Blood Glucose Index (LBGI), which has been shown to independently predict 55% of the episodes of SH over the ensuing several months (Kovatchev, et al., 2003; Kovatchev, et al., 1998). Adding recent SH episodes and A1C levels to the statistical model only predicted an additional 7% of future SH episodes. The index has also been shown to be very effective in predicting the incidence of blood sugars in the range of 39-55 mg/dl. Table III-2 shows that the LBGI can be used to categorize patients into likelihood groups for recurrent blood sugars in this range. However, even in the lowest risk group (LBGI <1.1), type 1 diabetic subjects were still observed to have blood sugars =/<55 mg/dl an average of 1 ½ times per month.

Table III-2: Number of Prospectively Observed Hypoglycemic Episodes (39-55 mg%) Per Person Per Month by Risk Category and Type of Diabetes				
Diabetes Type	LBGI Value			
	<1.1	1.1-2.5	2.6-5.0	>5.0
T1 DM (n=48)	1.47	2.56	6.20	11.50
T2 DM (n=48)*	0.38	0.65	5.91	11.00

**Treated with insulin*

From Kovatchev BP, et al., 2002. Algorithmic evaluation of metabolic control and risk of severe hypoglycemia in type 1 and type 2 diabetes using self-monitoring blood glucose data. Diabetes Technology & Therapeutics 5(5):817-28.

While studies indicate that type 2 diabetic subjects on insulin therapy are at lower risk for SH than type 1 diabetic subjects, their risk of having glycemic levels of ≤65 mg/dl remains high. Annual rates of symptomatic SH appear to range from 2-12% per year (Leese, et al., 2003; UKPDS,1998; Hepburn, 1993; Abraira, et al., 1995). Schwartz, et al (1998) followed a group of 118 type 2 diabetic subjects (mean age 56 years) for six months. During this time period, 8% had BG meter values ≤50mg/dl despite an average A1C of more than 9%. Recently, a peakless insulin, glargine (trade name Lantus), has been advocated for use by persons with type 2 diabetes. While this does reduce the risk of hypoglycemia compared to NPH, Rosenstock, et al. (2001) observed that 7% of patients using glargine had episodes of blood glucose <36 mg/dl over a 28-week observation period. As with type 1 diabetes, the best individualized predictor of future hypoglycemic episodes is the LBGI. However, even in the lowest risk group (LBGI <1.1), type 2 subjects using insulin were still observed to have blood sugars =/<55 mg/dl an average of 0.4 times per month or almost five times per year (Table III-2).

In conclusion, research has indicated that the use of insulin by a peace officer creates a significant risk[2] of hypoglycemia on the job regardless of individual risk factors, state-of-the-art risk assessment tools, or diabetes type.

Use of Oral Medications: There are presently six classes of oral medications available for the treatment of type 2 diabetes. Hypoglycemia is of concern primarily for three of these classes- sulfonylureas, meglitinides (trade name Prandin), and d-phenylalanine derivatives (trade name Starlix).

For the second generation sulfonylureas that are in common use (glyburide, glipizide, and glimepiride), the reported incidence rates of hypoglycemia are highest with glyburide (Holstein & Egberts, 2003). For this drug, the incidence of SH has been reported to be 0.6-1.6% per year (Sugarman, 1991; Holstein, et al., 2001; UKPDS,1998). This compares to a rate of 0.09% for glimepiride (Holstein, et al., 2001). The hypoglycemic rates for glipizide have been reported to be similar to glimepiride (Clark & Goldberg, 1997).

While the occurrence of SH with sulfonylureas does not appear be a major concern, the same cannot be said for the occurrence of glycemic levels of ≤65 mg/dl. Studies indicate that patients who take sulfonylureas frequently complain of hypoglycemia. The UK Prospective Diabetes Study Group (1998) found that symptomatic self-treated hypoglycemia occurred in 16-

[2] As discussed in "Pre-Employment Screening and the Law," an absolute risk of >1% per year is used in this manual as an informal rule-of-thumb guideline for determining risk to others

21% of patients annually. Jennings, et al. (1989) found that 20% of patients (age 40-65) reported hypoglycemic symptoms over a 6-month period. Among subjects in a series of five one-year clinical trials, 20% of those using glyburide and 19% of those using glipizide reported mild or moderate hypoglycemia (Novo Nordisk, 2004).

In these studies, subjects did not measure their glycemic levels at the time of their symptoms. Therefore, their perception of hypoglycemia may not always indicate a glycemic level ≤65 mg/dl, especially in patients with poorly controlled diabetes. However, it is likely that a substantial portion of the symptomatic episodes did occur at ≤65 mg/dl. Korzon-Burakowska, et al. (1998) observed that the average plasma glucose threshold at which hypoglycemic symptoms first developed in a group of seven poorly controlled type 2 diabetic subjects (average A1C=11.3) was 65 mg/dl. After improvement in their control to an average A1C level of 8.1, their threshold dropped to 54 mg/dl.

Most studies indicate that age >60 and taking drugs that potentiate the effects of sulfonylureas are risk factors for hypoglycemia. Nevertheless, the absence of these risk factors in the typical police candidate does not warrant that the hypoglycemic risks associated with sulfonylureas be ignored. Regarding age, the average age of the participants in the UK Prospective Diabetes Study Group (1998) study was only 54 years. Furthermore, Leese, et al. (2003), found no difference in age between type 2 diabetic subjects who had SH vs. those who did not. Regarding potentiating medications, Jennings, et al. (1989) reported that 75% percent of patients reporting hypoglycemic symptoms with sulfonylureas were not taking potentiating drugs.

Finally, the risk of hypoglycemia with sulfonylureas increases if a meal is missed or food intake is reduced (Stahl & Berger, 1999; Seltzer, 1989). Damsbo, et al. (1999) measured afternoon glycemic levels in 41 patients (average age 58 years) who skipped lunch. Four complained of hypoglycemic symptoms, and two were asymptomatic but had measured blood sugar levels <45 mg/dl. Burge, et al. (1998) did not observe any glycemic levels <50 mg/dl after subjects were fasting for 23 hours. However, these patients started the fasting period with a mean glycemic level of about 170 mg/dl. For the lower quartile who started the fast at a glycemic level of 104 mg/dl, the average dropped to 71 mg/dl. Therefore, it is very likely that some of these patients experienced hypoglycemic levels of concern for peace officers (i.e. <66 mg/dl) during the fast.

Prandin is a newer medication that is designed to treat postprandial hyperglycemia. It has a duration of action of only 2-3 hours and is taken just prior to meals. It offers an advantage over sulfonylureas in that meals can be missed or delayed with a lower risk of hypoglycemia (Damsbo, et al., 1999; Mafauzy 2002). Perhaps for this reason, the incidence of SH with

Prandin has been reported to be approximately half of that with sulphonylureas (Schatz, 1999; Kristensen, et al., 2000). However, in one-year comparative trials, the overall incidence of hypoglycemia in patients who use Prandin was observed to be fairly equivalent to those who use sulfonylureas (Schatz, 1999; Novo Nordisk 2004).

While structurally different from Prandin, Starlix is also a short-acting hypoglycemic designed to be taken with meals. However, its hypoglycemic effect has a more rapid onset and shorter duration than Prandin. Consequently, Starlix is also associated with less hypoglycemia than the sulfonylureas. However, the incidence of hypoglycemia is still high enough to be of concern for an officer. In an 8-week clinical trial, Hollander, et al. (2001) found that 12% of subjects complained of hypoglycemic symptoms. Hypoglycemia was confirmed by self-monitoring of blood glucose in 3% of the subjects (levels not given). Saloranta, et al. (2002), found that 5% of patients using Starlix experienced symptomatic hypoglycemia with documented blood sugars < 60 mg/dl during a 24-week study.

For various reasons, the incidence of hypoglycemia is very low if any of the following classes of medications are used as mono therapy: biguanides (Glucophage), alpha-glucosidase inhibitors (Precose, Glyset), or thiazolidinediones (Actos, Avandia) [Holstein & Egberts, 2003].

Hyperglycemia - As discussed above, glycemic levels >400 mg/dl are of concern for a peace officer. All persons with diabetes are at risk of having high sugars, especially after meals. However, the frequency at which this will occur depends on the overall level of disease control. In a study of type 2 diabetic subjects who were either diet-controlled (n=84) or taking oral agents (n=134), Erlinger & Brancati (2001) observed that average postprandial glucose levels rose dramatically if A1C levels were >7%. At A1C level of <7%, the mean two-hour postprandial glucose level was 185 mg/dl. However, at A1C levels of 7-7.9%, the mean rose to 325 mg/dl; at A1C levels of 8% or higher, the mean was 402 mg/dl.

In summary, the only candidates who are not at significant risk of experiencing either significant hypo- or hyperglycemia as peace officers are those who have type 2 diabetes controlled by either diet, a biguanide (Glucophage), alpha-glucosidase inhibitor (Precose, Glyset), or a thiazolidinedione (Actos, Avandia), and who also have an A1C <7%. For other candidates, requiring methods to reduce the risk of impairment on duty can be justified to ensure the safe and effective performance of essential duties.

4. Methods of Reducing Risks

There are several methods that potentially can reduce the risk of hypo- and hyperglycemia occurring while on-duty or mitigate the resulting impairment. The purpose of the following analysis is to determine which are reasonable and effective.

Carrying Glucose Tablets: Hypoglycemia can be self-treated by ingestion of 10-30 grams of carbohydrate. Glucose tablets which contain 4-5 grams each can be easily carried by an officer. However, carrying these tablets will not sufficiently reduce the risk of impairment on duty. Using a driving simulator, Cox, et al.(2000), has shown that diabetic subjects who are provided with a food source will not reliably consume food to prevent their blood sugars from dropping below 66 mg/dl. The mean blood glucose level at which subjects either treated themselves or stopped driving was 49 mg/dl, and 43% of the severely impaired subjects took no corrective action. Failure to use an available glucose source was not solely due to hypoglycemia unawareness. When blood glucose levels were in the 50-59 mg/dl range, 33% of the subjects detected their hypoglycemia and 22% detected their driving impairment, yet only 3% took corrective action.

Self-Monitoring of Blood Glucose (SMBG): Frequent SMBG can lead to detection and correction of dangerously low or high blood sugars, and, in theory, should reduce the risk of hypoglycemia on the job. However, for this to be the case, the following considerations regarding SMBG must be addressed:

Frequency of Testing - Despite testing at commonly recommended frequencies (3-4 times per day), persons with type 1 diabetes can still experience SH at high frequencies. In the DCCT (1997) study, the intensively treated group was instructed to perform SMBG four times a day, and to awaken at 3 a.m. to do SMBG at least once a week. Despite this monitoring, SH still occurred at a rate of 0.6 episodes/patient per year. Cox, et al. (1999) found no difference in the frequency of SMBG/day between a group of patients who reported at least two episodes of SH in the past year vs. a group with no SH in the past year (3.5 tests/day vs. 3.8 tests/day). Therefore, testing 3-4 times a day or every 4-5 hours will not prevent hypoglycemia from occurring. Additionally, traditional recommendations for testing before meals will not detect postprandial hyperglycemia.

Consequently, to effectively prevent on-the-job impairment for officers using insulin, testing will have to be more frequent than every four hours. A pre-shift test followed by testing every 2 hours would be ideal. With this set as a goal, the occasional short delays in testing caused by situations beyond the control of the officer should not pose a major risk.

For officers using sulfonylureas, a lower risk of hypoglycemia warrants less frequent testing. A pre-shift test is needed to determine the officer's fitness

to begin the shift. Testing every four hours thereafter should significantly lower the risk of impairment on the job. Testing at two hours after meals to detect hyperglycemia is also indicated if A1C levels are ≥ 7.0%. For example, if a 10-hour shift starts at 7 a.m. and ends at 5 p.m. with a meal at noon, testing should be done at 7 a.m., 11 a.m., and 2 p.m. (two hours after the meal started). For a 12-hour shift ending at 7 p.m., an additional test should be done at 6 p.m.

For officers on Prandin or Starlix, the risk of hypoglycemia would be expected to be greatest in the postprandial period as glycemic levels drop, but drug action is still present. These officers should be required to conduct a pre-shift test and a test at two hours after meals.

For officers on non-hypoglycemic medication or diet, detection of hyperglycemia would warrant a pre-shift test followed by testing at two hours after each meal unless A1C levels are < 7.0%.

Performance Characteristics of the BG Meter - There are a large number of BG meters on the market. To ensure the integrity of the information that is reviewed by the health professional, the BG meter must meet the following requirements:

- Be downloadable to software in the health professional's office,
- Not allow the patient to change recorded values, dates, or times, and
- Automatically recognize and record when control solutions are placed on the testing strip.

At the time of this writing, there are only two meters that can meet these requirements: the OneTouch Profile by Johnson & Johnson, and the Contour by Ascensia (Bayer). The Contour meter is preferable in that it reports results more quickly, requires less blood, and is smaller in size than the OneTouch. Furthermore, the OneTouch is no longer actively marketed.

To date, two devices capable of continuous glucose monitoring have received FDA approval: the Glucowatch by Cygnus and the Guardian by Medtronic MiniMed. The GlucoWatch is worn like a watch and measures glucose non-invasively from interstitial fluid. However, there are several limitations with this device that would greatly limit its effectiveness for officers. First, it is very sensitive to perspiration, temperature changes (i.e., going from air conditioning to a hot car) and jarring. These factors can cause it to miss readings and to unexpectedly shut off. To restart the meter after a shut-off, one must apply a new sensor pad and wait through the two-hour warm-up period. Colberg (2003) found that slightly more than a third of subjects who were just resting outdoors for 45 minutes in temperatures from 75-91 degrees with humidity from 30-100% got no readings at all. Indoor resting was only slightly better with 29% of subjects obtaining no readings. The device shut off 37-50% of the time following

outdoor activity. The second major limitation of the Glucowatch is its very poor sensitivity for detecting low blood glucose. Research from the Jaeb Center for Health Research (DirecNet Study Group, 2004) indicates that in order to detect 92% of the occurrences of a glucose of ≤60 mg/dl, the alarm would have to be set at 120 mg/dl. This would result in a false alarm rate of 85%.

The second continuous glucose monitoring device, the Guardian, uses a subcutaneous sensor consisting of a glucose oxidase-plated platinum electrode that is inserted subcutaneously on the abdomen or another location by the patient and is worn for three days. During that time, the sensor measures glucose in the subcutaneous fluid every 10 seconds and stores the average of 30 measures obtained over five minutes. Calibration of the device requires that SMBG be done by the patient at the time of application and four times a day thereafter. While the data collected must be downloaded to a computer before it can be viewed, the Guardian features an alarm system that can be set for both high and low values. However, there are several potential concerns regarding its use by peace officers. The first is the potential disruption of the wireless (RF) link from the sensor to the recording device by placement of the sensor under a bulletproof vest, although it is unknown whether this would occur. Second, as with the GlucoWatch, sensitivity for detecting low sugars is a problem. In order to detect 100% of the occurrences of a glucose of ≤60 mg/dl, the alarm would need to be set at 100 mg/dl. This would result in a false alarm rate of 75%(DirecNet Study Group, 2004). Between doing SMBG for calibrations and repeating SMBG for false alarms, the user would probably end up doing SMBG as often as required in the protocols above.

Cut Points for Intervention - As discussed above, impairment from hypoglycemia may begin when blood sugars drop to approximately 65 mg/dl. However, as glycemic levels approach 65 mg/dl, action to raise glycemic levels is warranted to provide a margin of safety while performing safety-related tasks. Unfortunately, there are no studies available to assist in the selection of an appropriate threshold at which action should be taken. However, recent consensus guidelines regarding the initiation of driving have been published from three sources. The research group at the University of Virginia, which has conducted numerous driving simulation studies, recommends that the threshold for corrective action be 90 mg/dl for persons with type 1 diabetes (Cox, et al., 2003). Based on recommendations by a panel of endocrinologists, the U.S. Federal Motor Carrier Safety Administration (D.O.T., 2003) requires that truck drivers who are treated with insulin (type 1 and 2 diabetes) take corrective action at glycemic levels <100 mg/dl. Finally, Cooppan (2003) recommends in the Joslin's Diabetes Deskbook that carbohydrate be ingested prior to driving if glycemic levels are <125 mg/dl, especially in patients using intensive insulin regimens involving multiple injections or insulin pumps.

Cooppan's recommendations suggest that the hypoglycemic threshold for action should be different for different patients. There is a rational basis for this, as vulnerability to rapid declines in glycemic levels varies among individuals. In general, persons with type 1 diabetes demonstrate faster descent into hypoglycemia than those with type 2 on insulin (Kovatchev, et al., 2002). Type 2 diabetic subjects on oral hypoglycemics are likely to descend even more slowly. Therefore, it would be reasonable to require, in general, that persons with type 1 diabetes take corrective action when their glycemic levels are less than 100 mg/dl. However, if individual review of historical SMBG data indicates evidence of recurrent rapid glycemic descents, the evaluating physician could be justified in recommending an action threshold as high as 125 mg/dl. For persons with type 2 diabetes on insulin or oral medications, an action threshold of 90 mg/dl could be used unless individual review warrants a higher level.

Action levels for hyperglycemia should be set at 400 mg/dl based on the considerations described above.

Appropriate Interventions - To reduce the risk of impairment on the job, aggressive intervention is justified if blood sugars are found to be outside the safe ranges. If below the hypoglycemic intervention threshold but above 65 mg/dl, 15 grams of fast-acting carbohydrate should be consumed. Thirty minutes later, the blood sugar should be retested. If the glycemic level is still below threshold, another 15 grams should be ingested. If the glycemic level drops to 65 mg/dl or lower, the officer must be restricted from safety-related duties until levels increase to the hypoglycemic threshold and have been maintained for at least 30 minutes. This is necessary to allow delayed recovery of cognitive functioning (Gonder-Frederick et al., 1994; Lingren et al., 1996). If SH occurs either on or off-duty, the officer should be placed on restricted duty until the risk of recurrence can be assessed by the employer's medical staff. The risk criteria for returning such an officer to full duty should be the same as that used in pre-placement assessments.

For glycemic excursions above the hyperglycemic threshold, the officer should be restricted from safety-related duties until his/her blood sugar has dropped below the threshold. Testing every 30-60 minutes would be appropriate.

If the candidate is willing to comply with these requirements, then it is likely that SMBG would significantly reduce the risk of impairment on the job.

Basal-Bolus Regimens: Older insulin regimens typically involve taking two shots a day with each shot combining a short-acting insulin such as regular with an intermediate acting insulin such as NPH. The NPH in the morning dose is intended to provide coverage for the anticipated glycemic load consumed at lunch. However, if lunch is missed or disrupted (a not-unlikely event for officers),

there is a significant risk of hypoglycemia. This risk can be substantially reduced if a basal-bolus regimen is used. A basal-bolus regimen typically involves a peakless insulin given once a day (insulin glargine) or a continuous constant infusion of insulin (see "Insulin Pumps" below) supplemented by ultra-rapid insulin (insulin aspart or lispro) taken at each mealtime. Unlike regular insulin, which should be taken 30-45 minutes before a meal, insulin aspart and lispro can be effective when taken as the meal arrives or minutes after eating has commenced. Therefore, basal-bolus regimens greatly increase flexibility in the timing of meals, making it safer for an officer to delay a meal in the event of an emergency. For this reason, a basal-bolus regimen should be required for candidates who use insulin, unless the hiring agency places their officers off radio call during meals.

5. Miscellaneous Issues

Alternate site testing: The Contour meter is able to analyze blood obtained from sites other than the fingers. However, testing by the manufacturer indicates that the only alternate site that met the performance criteria established by the International Standards Organization was the hypothenar eminence of the palm (Baum, 2003). Additionally, it is generally well established that glucose values obtained from alternate sites may not reflect current values when glycemic levels are rapidly changing (A.D.A. 2003). At these times, the detection of hypoglycemia may be delayed for 15-20 minutes if alternate sites are used. For these reasons, alternate site testing should not be considered acceptable for monitoring officers.

Insulin Pens: Insulin pens eliminate the need for officers to carry syringes and vials. They are compact and facilitate precise dosing. While the cost is somewhat higher, use of pens for administration of insulin while on duty should be strongly encouraged.

Insulin Pumps: Insulin pumps consist of a pager-sized insulin storage and pumping device which is connected to a plastic cannula attached to a small needle. The needle is inserted subcutaneously, usually into the abdomen. The device provides a continuous basal infusion of insulin, which is supplemented by pre-meal boluses that are controlled by the patient. This allows for more physiologic dosing of insulin and more flexibility in the timing of meals. It is expected that the pump could be used successfully by officers. Dislodgement of the needle is possible due to trauma, but this would result in slowly rising glycemic levels that would be detectable by the frequent SMBG performed by officers who use insulin. Officers who choose to use a pump should be strongly encouraged to carry an insulin pen as a back-up in case their infusion cannot be easily reestablished.

Academy vs. Field Assignments: Despite rigid scheduling of activities, fair employment laws would require that an academy allow a diabetic recruit to perform SMBG, take insulin, and to consume rapidly absorbable carbohydrate as needed during training. Of note is that the U.S. Department of Justice recently

settled a complaint, in favor of the complainant, involving a training academy's failure to accommodate a diabetic police recruit who was discharged from a training academy for having hypoglycemia (DOJ, 2004). The academy had denied the recruit's repeated requests for access to additional food at more frequent intervals.

b. RECOMMENDED EVALUATION PROTOCOL:

The evaluation protocol includes three phases. The first phase assesses the need for work restrictions due to chronic complications or recent episodes of severe hypoglycemia, seizure, or coma. The second phase evaluates candidates' ability to maintain their glycemic levels in the range (66-399 mg/dl) that will not require frequent periods of restricted duty. This requires a prospective observation period of simulated on-duty testing. The third phase of the protocol requires the candidate to review and sign a customized pre-placement agreement which obligates them to perform SMBG while on duty, to take appropriate action for blood sugars that are out of range, and to provide the employer's designated health professional with access to relevant medical records after hire.

Phase I - Initial Screening.

History and Record Review:
The screening physician should obtain detailed information regarding the candidate's medication regimen, symptoms and complications of diabetes, use of SMBG, and prior episodes of hypoglycemia with particular emphasis on severe episodes in the previous three years that required assistance or resulted in seizure or coma. The physician should download the candidate's BG meter if possible, or manually scan the data. Blood sugars below 66 mg/dl or above 399 mg/dl should be discussed with the candidate.

Medical, laboratory, and pharmacy records from the last three years should be obtained from all health care providers. Examinations and testing for retinopathy and nephropathy (microalbuminuria) should be noted. If a retinal examination with dilated pupils has not been completed by an ophthalmologist in the past year, it should be requested for all candidates with type 2 diabetes and those with type 1 diabetes for three years or more.

Special Examination Recommendations:

Eyes: In addition to pseudoisochromatic plate testing, routine color vision testing for candidates with diabetes should include the Farnsworth D-15 or other test which specifically assesses the presence of blue-yellow color vision deficiency. A history of laser photocoagulation would warrant formal perimetry testing conducted by a vision specialist.

Neurological: Screening for peripheral neuropathy should include testing of the deep tendon reflexes, vibratory testing, testing of position sense, and touch sensation. The latter should be done with a Semmes-Weinstein 5.07 (10 gm) monofilament.

Cardiovascular: Orthostatic blood pressure should be measured (see Carlson 1999 for protocol and interpretative recommendations). Postural hypotension or resting tachycardia (heart rate >100, not otherwise explained) is indicative of autonomic neuropathy. The physical examination should include palpation of pedal pulses and observation of distal extremity hair to evaluate the presence of peripheral vascular disease. To detect silent ischemia, cardiac stress testing is recommended if any of the following criteria are present (A.D.A., 2004a):

- Age >35 years
- Age >25 years, and either type 2 diabetes >10 years, or type 1 diabetes > 15 years duration
- Any additional risk factor for coronary artery disease, such as smoking, obesity, hypertension, or elevated cholesterol
- Evidence of microvascular disease such as retinopathy or
- Peripheral vascular disease

Additionally, to detect significant diabetes-related aerobic impairment, candidates with autonomic neuropathy, peripheral neuropathy, microalbuminuria, or poor control (A1C >10%) should also be given a cardiac stress test and be required to complete at least 12 METs.

Routine Testing: A1C and urinary microalbumin should be tested if not previously performed within the last six months. Testing for microalbumin can be conducted with specialized dipsticks that are commercially available.

Based on record review and the above testing results, restrictions would be warranted if any of the following conditions are detected:

Untreated or unstable severe non-proliferative or proliferative retinopathy - These candidates should be restricted from heavy lifting, wrestling, or jarring activities, such as jumping off walls or exposure to head trauma. These restrictions could be reconsidered after successful laser photocoagulation, assuming that post-operative visual acuity and fields are still acceptable.

Color vision deficiency - Candidates who fail the Farnesworth D-15 should be restricted from duties requiring rapid and accurate color identification and high-speed emergency driving (see Chapter XI - Vision Guidelines).

Coronary disease - Unless adequate fitness (≥12 METS), without ischemic change or hypertensive response is demonstrated, candidates should be restricted from physical activities (see Chapter I - Cardiovascular System).

Exercise impairment - If <12 METs is obtained on treadmill testing, restrictions can be based on the measured maximum aerobic capacity of the candidate. However, candidates should be encouraged to increase the intensity of their physical training, and be offered retesting at a later time.

One or more episodes of severe hypoglycemia in the last three years - Table III-1 indicates that the risk of recurrence in the next year is 15-52% for these candidates, which far exceeds an acceptable risk level for on-duty incapacitation.[3] This is true even considering that approximately half of the episodes of severe hypoglycemia observed in the DCCT trial occurred while asleep (DCCT, 1991), and that only a third of a person's waking hours are spent at work. Therefore, restricting these candidates from safety-related duties is warranted.

Seizure or coma in last two years - Table III-1 indicates that the risk of recurrence in the next year is 10-32%. Even if this annual risk is reduced by factoring in nocturnal and off-duty episodes (thereby reducing the estimate by a factor of 6), the on-duty annual risk still remains above an acceptable level.

Loss of protective sensation in the feet - To prevent ulcerations and fractures, these candidates should be restricted from prolonged walking and jogging.

Postural hypotension - If this condition is symptomatic, these candidates would need to be restricted from field duty.

Use of a two-shot insulin regimen - To prevent hypoglycemia, these candidates would need to be restricted from assignments that could result in meal disruption.

If there are no findings that warrant restrictions, or if the restrictions indicated above can be accommodated by the agency, then the evaluation can proceed to Phase II. However, prior to doing so, the screening physician should explain to candidates with A1C >7.0% that they will be required to conduct more rigorous and frequent SMBG testing while on duty. They should be encouraged to see their health care provider to determine if their therapeutic regimens can be intensified in order to achieve an A1C level of <7.0%, as recommended by the American Diabetes Association (A.D.A., 2004b). Additionally, candidates using a two-shot insulin regimen should have the opportunity to change to a basal-bolus regimen if the hiring agency does not allow officers to go off radio-call during

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[3] As discussed in "Pre-Employment Screening and the Law," an absolute risk of >1% per year is used in this manual as an informal rule-of-thumb guideline for determining risk to others.

meals. If the therapeutic regimen is changed, the Phase II evaluation should be deferred until the candidate is stabilized on the new regimen.

Phase II - Simulated On-Duty Testing

With the exception of those candidates who meet the conditions specified under Group I, Level 1 (see below), all candidates will be required to perform SMBG while on duty, and to maintain their blood sugars in the range of 66-399 mg/dl. Since many candidates will find it difficult to achieve 100% compliance with this target range, and excursions will result in periods of restricted duty, the screening physician should advise the hiring agency regarding how often periods of restricted duty are likely to occur.

To make this assessment on an individualized basis, the screening physician should require the candidate to undergo a prospective observation period of at least three months duration that simulates on-duty SMBG testing requirements. To accomplish this, the candidate should be required to perform the following:

(1) Obtain a Contour BG meter. The screening physician should recommend that this meter be used exclusively for required testing under this protocol, and that other testing be done on the candidate's pre-existing BG meter. This ensures that the memory capacity of the required BG meter (250 values) will not be exceeded, and facilitates review of required testing by the physician.

(2) Select five days of the week that will be simulated on-duty days. (This assumes that the candidate will be working 8-hour shifts. Four days could be selected for 10-hour shifts; three days for 12-hour shifts.) The days selected cannot be changed by the candidate once the observation period begins without prior approval from the screening physician.

(3) Select the times that the "work shift" will start and end. This cannot be changed by the candidate once the observation period begins without prior approval from the screening physician.

(4) Select the time that "on-duty" meals will start (only for candidates who do not use insulin). This cannot be changed by the candidate once the observation period begins without prior approval from the screening physician.

(5) Select a start date for the observation period.

(6) Perform SMBG within +/- 5 minutes of the testing times specified by the screening physician. A short testing window is necessary to prevent candidates from "pre-testing" with an alternate BG meter and manipulating their glycemic level prior to testing with the designated BG meter. These testing times should be clearly communicated to the candidate before the

observation period commences. The recommended frequency of testing during the observation period is as follows:

GROUP I: CANDIDATES WHO DO NOT USE INSULIN :

Level 1: *Controlled with diet and/or a biguanide (Glucophage), alpha-glucosidase inhibitor (Precose, Glyset), or a thiazolidinedione (Actos, Avandia); and A1C <7.0%, and historical glycemic levels are >65 and <400 mg/dl*

No on-duty SMBG is necessary. Therefore, the candidate's evaluation may proceed to Phase III.

Level 2: *Controlled with diet and/or a biguanide (Glucophage), alpha-glucosidase inhibitor (Precose, Glyset), or a thiazolidinedione (Actos, Avandia); but A1C ≥7.0%, or historical glycemic levels are occasionally >400 mg/dl. Also includes all candidates who use a meglitinide (Prandin), or d-phenylalanine derivative (Starlix)*

The observation period should include testing at the shift start time and at 2 hours after "on-duty" meals.

Level 3: *Controlled with a sulfonylurea, and A1C <7.0%, and historical glycemic levels are <400 mg/dl*

The observation period should include testing at the shift start time and every four hours thereafter. No testing at the end of the shift is needed.

Level 4: *Controlled with a sulfonylurea, but A1C ≥7.0%, or historical glycemic levels are ≥400 mg/dl*

The observation period should include testing at the shift start time, followed by a test every four hours and at two hours after "on-duty" meals. For example, if a 10-hour shift starts at 7 a.m. and ends at 5 p .m. with a meal at noon, testing would be conducted at 7 a.m., 11 a.m., and 2 p.m. (two hours after the meal started). For a 12-hour shift ending at 7 p.m., an additional test would be done at 6 p.m. No testing at the end of the shift is needed.

GROUP II: CANDIDATES WHO USE INSULIN: The observation period should include testing at the shift start time, and then every 2 hours. No testing at the end of the shift is needed.

(7) Repeat SMBG within 30 minutes whenever a reading is <100 mg/dl in candidates with type 1 diabetes, or <90 mg/dl for those with type 2 diabetes. To avoid dropping below 66 mg/dl, the candidate must take appropriate action such as ingesting 15 grams of fast-acting carbohydrate.

Before starting the observation period, the screening physician should inform the candidate that the goal is to maintain all pre-shift and on-duty blood sugars between 66-399 mg/dl. To accomplish this, candidates should be encouraged to practice on their own and to make any necessary adjustments prior to starting the observation period. Additionally, the screening physician should stress the need for compliance with the timing of the testing regimen, as late or missed tests will be considered to be equivalent to those which are out of range.

During the observation period, candidates should provide their BG meter to the screening physician at 4-6 week intervals for downloading. Submission of BG meter printouts from candidates is not acceptable, since the BG meter software allows the user to alter the data prior to printing. Screening physicians can obtain the required software and cables from the manufacturer at no cost.

After reviewing the BG meter data, the physician should discuss out-of-range and missed tests with the candidate. There may be occasions when the candidate questions the results of a test and immediately repeats it. An inaccurate result could result from technique errors, such as failure to cleanse and dry fingers appropriately. If a second test is completed within 2-3 minutes, the physician may consider it. However, frequent retests (>1-2/month) should be discussed with the candidate. In addition, if recurrent missed tests result from scheduling conflicts with other activities, the screening physician may consider changing the test days and start times for future testing.

At the end of the three-month observation period, the physician should be able to estimate the number of times per year that the candidate will be on restricted duty (counting any missed values as out-of-range). For example, if there was one excursion out of the required range during the three-month observation period, the physician can advise the hiring agency that the candidate will likely experience four episodes of short-term restricted duty per year (for exact wording of this advisement see Phase III below). For those with zero excursions or missed values, no advisement is necessary.

In certain cases, an extension of the observation period beyond three months may be advantageous to the candidate. For example, if the candidate experienced one or two excursions/misses during the three month observation period, an additional three months of monitoring with zero excursions or misses would allow the physician to reduce the estimate for the frequency of restricted duty periods in half. This option should be discussed and offered to the candidate.

Phase III - Required Conditions for Employment

To ensure that neither acute nor chronic complications of diabetes create a direct threat of harm to themselves or others, it is critically important for candidates to agree to the following conditions:

Acute Complications: Candidates should sign an agreement that obligates them to perform SMBG while on duty (except for Group I, Level 1 candidates; see below) and to take appropriate action for values that are out of range. Additionally, since type 2 diabetes is usually a progressive disease with the eventual need for more intensive therapy, these candidates must agree to notify the employer's designated health care professional if their medication regimen is significantly altered. Finally, since an episode of severe hypoglycemia (even while off duty or asleep) creates a period of particularly high risk for a recurrent episode, the candidate must also agree to immediate notification of such an event. Verification of these conditions also requires that candidates agree to periodically provide their diabetic records for review by the employer's designated health care professional.

Chronic Complications: The potential for development of chronic complications warrants that the special examination procedures recommended above in Phase I (i.e. color vision, monofilament, orthostatic blood pressure, and stress testing) be repeated periodically. As a balance between the cost of these examinations and the probability of detecting a condition that would warrant restrictions, it is recommended that their procedures be repeated every five years for candidates who either have had diabetes for less than 10 years, or who have demonstrated good glycemic control (A1C levels predominately <7.0%). Retesting in other candidates should be performed every two years. Also, per the recommendations of the A.D.A., a dilated retinal exam by a vision specialist should be performed at least every two years for all candidates.

Sample Pre-Placement Agreements (Form III-1 - Form III-5) are provided for each evaluative group and level described in Phase II. Note that all of the agreements for Group I candidates include an admonishment that more intensive on-duty monitoring may be required after hire if their condition worsens.

Once the agreement is signed and returned to the screening physician, the evaluation process may be completed by informing the hiring agency of any restrictions identified in Phase I. Additionally, except for Group I, Level 1 candidates, the screening physician should advise the hiring agency that the following accommodations are necessary for the candidate to perform safety-related duties without posing a direct threat of harm to oneself or others:

(1) The candidate must be allowed several minutes for blood glucose testing while on duty. This will be necessary at least ___ [insert frequency excluding pre-shift test] times per ___ [insert number of hours] hour shift. Testing could be deferred if the candidate is responding to an emergency situation.

(2) The candidate must be allowed to carry glucose tablets or oral gel.

(3) The candidate is medically authorized to self-identify brief periods of time (usually lasting 30-60 minutes) during which he/she is not fit to perform safety-related duties. It is anticipated that these periods will occur approximately ___ times per year [the frequency of restricted duty periods was estimated above in Phase II. Note: this advisement can be omitted for candidates who had no out-of-range excursions or missed tests during Phase II].

c. MONITORING ON THE JOB COMPLIANCE:

As discussed above, the mitigation of the risks posed by a diabetic officer requires that the candidate agree to numerous conditions. However, the effectiveness of the pre-placement agreement depends in large part on enforcement of these provisions by the employer. This requires the services of a health care professional (HCP) to monitor compliance with the agreement.

The duties of the HCP include the following:

1) Designating the times at which the officer must perform on-duty SMBG

2) Critically reviewing documentation provided by the officer regarding any failure to perform SMBG at the designated times

3) Downloading of the officer's BG meter at intervals of 1-2 months

4) Assessing the need for changes in on-duty SMBG protocols based on changes in therapy or A1C levels per POST guidelines

5) Placing the officer on restricted duty if indicated by POST guidelines

6) Reviewing medical records to determine if the officer has failed to report initiation of insulin therapy, an episode of impairment, or has failed to obtain proper eye examinations

7) Reporting compliance violations to the employer for possible disciplinary action

8) Conducting a periodic medical work fitness evaluation to determine if any chronic complications have developed that may pose a direct threat of harm in the performance of peace officer duties

The HCP selected should be a physician who has a thorough knowledge of the P.O.S.T. diabetes guidelines. However, this physician could delegate many of the duties listed above to an ancillary HCP under his/her supervision, such as a registered nurse, or other health professional having certification in diabetes education (C.D.E.). Moreover, since the responsibilities of the HCP may necessitate placing work restrictions on the officer and/or reporting violations that could lead to disciplinary action, including discharge, it is critically important that the HCP selected by the employer be free of any conflict of interest that could inhibit the performance of such duties.

Form III-I Pre-Placement Agreement for Group I, Level 1

Diabetes Controlled with Diet and/or a Biguanide (Glucophage), Alpha-Glucosidase Inhibitor (Precose, Glyset), or a Thiazolidinedione (Actos, Avandia), and A1C <7.0%, and Historical Glycemic Levels >65 and <400 mg/dl.

Form III-2 Pre-Placement Agreement for Group I, Level 2

Diabetes Controlled with Diet and/or a Biguanide (Glucophage), Alpha-Glucosidase Inhibitor (Precose, Glyset), or a Thiazolidinedione (Actos, Avandia), and A1C ≥7.0%, or Historical Glycemic Levels Occasionally >400 mg/dl. Also Includes All Candidates Who Use a Meglitinide (Prandin), or D-Phenylalanine Derivative (Starlix).

Form III-3 Pre-Placement Agreement for Group I, Level 3

Diabetes Controlled with a Sulfonylurea, with A1C <7.0%, and Historical Glycemic Levels <400 mg/dl.

Form III-4 Pre-Placement Agreement for Group I, Level 4

Diabetes Controlled with a Sulfonylurea, with A1C ≥7.0%, or Historical Glycemic Levels ≥ 400 mg/dl.

Form III-5 Pre-Placement Agreement for Group 2

Diabetes Controlled with Insulin.

Form III-1

PRE-PLACEMENT AGREEMENT

I, _____, agree to the following as conditions of employment as a peace officer for the _____. I understand that these conditions are offered to me as an accommodation for my medical condition of diabetes.

1) I will obtain A1C testing every 6 months from my doctor, and will inform the agency's designated health care professional (HCP) before my next shift if any A1C level is greater than or equal to 7.0%. I understand that this will obligate me to begin self-monitoring my blood sugars while on duty, and to maintain my blood sugars in a range of 66-399 mg/dl.

2) I will obtain a dilated retinal examination from a vision specialist at least every two years, and will inform the HCP before my next shift if laser photocoagulation is recommended or performed.

3) If I begin using insulin or a new oral medication on an intermittent or regular basis to control my diabetes, I will notify the HCP before my next shift. I understand that use of these medications will result in the need for me to begin self-monitoring of my blood sugars while performing peace officer duties, and to maintain my blood sugar in a range of 66-399 mg/dl.

4) I will report any episodes of impaired mental abilities or altered consciousness to the HCP either on the day of occurrence, or before beginning my next shift, regardless of whether the episode occurs on or off duty.

5) To verify compliance with items 1-4 above, I agree to provide the HCP with full access to the medical and pharmacy records related to my diabetes upon request. I understand that these will be requested on a routine basis every 1-2 years.

6) I consent to medical work fitness examinations by the HCP every 2-5 years to ensure that I have not developed any chronic complications that may pose a direct threat of harm to myself or others while on duty.

7) I understand that failure to comply with this agreement could result in work restrictions and/or disciplinary action, including discharge.

By my signature below, I acknowledge that I have read and accept the conditions of this agreement.

_____ _____

Signature Witness Signature

_____ _____

Date Date

Form III-2

PRE-PLACEMENT AGREEMENT

I, _____, agree to the following as conditions of employment as a peace officer for the _____. I understand that these conditions are offered to me as an accommodation for my medical condition of diabetes.

1) While performing duties as a peace officer, I agree to test my blood sugar using a blood glucose meter designated by the agency's designated health care professional (HCP) at the start of my work shift and two hours following each on-duty meal. The specific times at which testing must be performed will be designated by the agency's HCP.

2) I understand that the test must be conducted within a time frame that commences 5 minutes before the specified testing time and ends 5 minutes thereafter. If, on occasion, I am not able to perform testing within this designated time frame, I must record and/or obtain sufficient documentation indicating that my failure to test was due to circumstances beyond my control. I must maintain this documentation and agree to provide it to the HCP upon request.

3) If my blood glucose reading is 66-89 mg/dl during any of these tests, I agree to raise my blood sugar by consuming a fast-acting carbohydrate. Furthermore, I agree to retest my blood sugar within 30 minutes. If upon this repeat testing, my blood sugar is not 90 mg/dl or higher, I agree to repeat ingestion of additional fast-acting carbohydrate and blood sugar testing as necessary to raise my blood sugar to 90 mg/dl or higher.

4) If my blood glucose meter reading is less than 66 mg/dl during any of these tests, I agree to inform my supervisor that I am not fit to perform safety-related duties. I will then attempt to raise my blood sugar by consuming a fast-acting carbohydrate. I may return to full duty if retesting of my blood sugar after 30 minutes indicates a glycemic level of 90 mg/dl or higher.

5) If my blood glucose meter reading is greater than 399 mg/dl during any of these tests, I agree to inform my supervisor that I am not fit to perform safety-related duties. I may return to full duty when retesting of my blood sugar, to be performed a minimum of at least every 30-60 minutes, indicates a glycemic level of 399 mg/dl or lower.

6) I agree to provide the blood glucose meter that I use for testing pursuant to this agreement to the HCP for downloading. I understand that I may be required to do this as frequently as once per month.

7) If I begin using insulin or a new oral medication even on an intermittent basis to control my diabetes, I will notify the HCP before my next shift. I understand that use of these medications will result in the need for me to increase the frequency of on-duty blood sugar testing.

8) I will report any episodes involving impaired mental abilities or altered consciousness to the HCP either on the day of occurrence or before beginning my next shift, regardless of whether this occurs on or off duty.

9) I will obtain a dilated retinal examination from my vision specialist a minimum of every two years, and will inform the HCP before my next shift if laser photocoagulation is recommended or performed.

10) To verify compliance with items 7-9 above, I agree to provide the HCP with full access to the medical and pharmacy records related to my diabetes upon request. I understand that these will be requested on a routine basis every 1-2 years.

11) I consent to a medical work fitness examination conducted by the HCP every 2-5 years to ensure that I have not developed any chronic complications that may pose a direct threat of harm to self or others

12) I understand that failure to comply with this agreement could result in work restrictions and/or disciplinary action, including discharge.

By my signature below, I acknowledge that I have read and accept the conditions of this agreement.

_____	_____
Signature	Witness Signature
_____	_____
Date	Date

Form III-3

PRE-PLACEMENT AGREEMENT

I, _____, agree to the following as conditions of employment as a peace officer for the _____. I understand that these conditions are offered to me as an accommodation for my medical condition of diabetes.

1) While performing duties as a peace officer after completion of a training academy, I agree to test my blood sugar using a blood glucose meter designated by the agency's designated health care professional (HCP) at the start of my work shift and every four hours thereafter. The specific times at which testing must be done will be designated by the agency's HCP

2) I understand that the test must be conducted within a time frame that commences 5 minutes before the specified testing time and ends 5 minutes thereafter. If, on occasion, I am not able to perform testing within this designated time frame, I must record and/or obtain sufficient documentation indicating that my failure to test was due to circumstances beyond my control. I must maintain this documentation and agree to provide it to the HCP upon request.

3) If my blood glucose reading is 66-89 mg/dl during any of these tests, I agree to raise my blood sugar by consuming a fast-acting carbohydrate. Furthermore, I agree to retest my blood sugar within 30 minutes. If upon this repeat testing, my blood sugar is not 90 mg/dl or higher, I agree to repeat ingestion of additional fast-acting carbohydrate and blood sugar testing as necessary to raise my blood sugar to 90 mg/dl or higher.

4) If my blood glucose meter reading is less than 66 mg/dl during any of these tests, I agree to inform my supervisor that I am not fit to perform safety-related duties. I will then attempt to raise my blood sugar by consuming a fast-acting carbohydrate. I may return to full duty if retesting of my blood sugar after 30 minutes indicates a glycemic level of 90 mg/dl or higher.

5) If my blood glucose meter reading is greater than 399 mg/dl during any of these tests, I agree to inform my supervisor that I am not fit to perform safety-related duties. I may return to full duty when retesting of my blood sugar, to be performed a minimum of at least every 30-60 minutes, indicates a glycemic level of 399 mg/dl or lower.

6) I agree to provide the blood glucose meter that I use for testing pursuant to this agreement to the HCP for downloading. I understand that I may be required to do this as frequently as once per month.

7) If I begin using insulin on an intermittent or regular basis to control my diabetes, I will notify the HCP before my next shift. I understand that use of this medication will result in the need to increase the frequency of on-duty blood sugar testing.

8) I will report any episodes involving impaired mental abilities or altered consciousness to the HCP either on the day of occurrence or before beginning my next shift, regardless of whether this occurs on or off duty.

9) I will obtain a dilated retinal examination from my vision specialist a minimum of every two years, and will inform the HCP before my next shift if laser photocoagulation is recommended or performed.

10) I will obtain A1C testing every 6 months from my treating physician, and will inform the agency's HCP before my next shift if any A1C level is greater than or equal to 7.0%. I understand that this will result in the need to increase the frequency of on-duty blood sugar testing.

11) To verify compliance with items 7-10 above, I agree to provide the HCP with full access to the medical and pharmacy records related to my diabetes condition upon his or her request. I understand that these will be requested on a routine basis every 1-2 years.

12) I consent to a medical work fitness examination conducted by the HCP every 2-5 years to ensure that I have not developed any chronic complications that may pose a direct threat of harm to self or others

13) I understand that failure to comply with this agreement could result in work restrictions and/or disciplinary action, including discharge.

By my signature below, I acknowledge that I have read and accept the conditions of this agreement.

_____	_____
Signature	Witness Signature
_____	_____
Date	Date

Form III-4

PRE-PLACEMENT AGREEMENT

I, _____, agree to the following as conditions of employment as a peace officer for the _____. I understand that these conditions are offered to me as an accommodation for my medical condition of diabetes.

1) While performing duties as a peace officer, I agree to test my blood sugar using a blood glucose meter designated by the agency's designated health care professional (HCP), at the start of my work shift, every four hours thereafter, and at two hours after each on-duty meal. The specific times at which testing must be done will be designated by the agency's HCP

2) I understand that the test must be conducted within a time frame that commences 5 minutes before the specified testing time and ends 5 minutes thereafter. If, on occasion, I am not able to perform testing within this designated time frame, I must record and/or obtain sufficient documentation indicating that my failure to test was due to circumstances beyond my control. I must maintain this documentation and agree to provide it to the HCP upon request.

3) If my blood glucose meter reading is 66-89 mg/dl during any of these tests, I agree to raise my blood sugar by consuming a fast-acting carbohydrate. Furthermore, I agree to retest my blood sugar within 30 minutes. If upon this repeat testing, my blood sugar is not 90 mg/dl or higher, I agree to repeat ingestion of additional fast-acting carbohydrate and blood sugar testing as necessary to raise my blood sugar to 90 mg/dl or higher.

4) If my blood glucose meter reading is less than 66 mg/dl during any of these tests, I agree to inform my supervisor that I am not fit to perform safety-related tasks. I must then attempt to raise my blood sugar by consuming a fast-acting carbohydrate. I may return to full duty if retesting of my blood sugar after 30 minutes indicates a glycemic level of 90 mg/dl or more.

5) If my blood glucose meter reading is more than 399 mg/dl during any of these tests, I agree to inform my supervisor that I am not fit to perform safety-related tasks. I may return to full duty when retesting of my blood sugar, which I will perform at least every 30-60 minutes, indicates a glycemic level of 399 mg/dl or less.

6) I agree to provide the blood glucose meter that I use for testing pursuant to this agreement to the HCP for downloading. I understand that I may be required to do this as frequently as once per month.

7) If I begin using insulin on an intermittent or regular basis to control my diabetes, I will notify the HCP before my next shift. I understand that use of this medication will result in the need to increase the frequency of on-duty blood sugar testing.

8) I will report any episodes involving impaired mental abilities or altered consciousness to the HCP either on the day of occurrence or before beginning my next shift, regardless of whether this occurs on or off duty.

9) I will obtain a dilated retinal examination from my vision specialist a minimum of every two years, and will inform the HCP before my next shift if laser photocoagulation is recommended or performed.

10) To verify compliance with items 7-9 above, I agree to provide the HCP with full access to the medical and pharmacy records related to my diabetes condition upon his or her request. I understand that these will be requested on a routine basis every 1-2 years.

11) I consent to a medical work fitness examination conducted by the HCP every 2-5 years to ensure that I have not developed any chronic complications that may pose a direct threat of harm to self or others

12) I understand that failure to comply with this agreement could result in work restrictions and/or disciplinary action, including discharge.

By my signature below, I acknowledge that I have read and accept the conditions of this agreement.

_____	_____
Signature	Witness Signature
_____	_____
Date	Date

Form III-5

PRE-PLACEMENT AGREEMENT

I, _____ agree to the following as conditions of employment as a peace officer for the _____. I understand that these conditions are offered to me as an accommodation for my medical condition of diabetes.

1) While performing duties as a peace officer after completion of a training academy, I agree to test my blood sugar using a blood glucose meter designated by the agency's designated health care professional (HCP), at the start of my work shift and every two hours thereafter. The specific times at which testing must be done will be designated by the agency's HCP

2) I understand that the test must be conducted within a time frame that commences 5 minutes before the specified testing time and ends 5 minutes thereafter. If, upon occasion, I am not able to perform testing within this designated time frame, I must record and/or obtain sufficient documentation indicating that my failure to test was due to circumstances beyond my control. I must maintain this documentation and agree to provide it to the HCP upon request.

3) If my blood glucose reading is 66-99 mg/dl during any of these tests, I agree to raise my blood sugar by consuming a fast-acting carbohydrate. Furthermore, I agree to retest my blood sugar within 30 minutes. If upon this repeat testing, my blood sugar is not 100 mg/dl or higher, I agree to repeat ingestion of additional fast-acting carbohydrate and blood sugar testing as necessary to raise my blood sugar to 100 mg/dl or higher.

4) If my blood glucose meter reading is less than 66 mg/dl during any of these tests, I agree to inform my supervisor that I am not fit to perform safety-related tasks. I must then attempt to raise my blood sugar by consuming a fast-acting carbohydrate. I may return to full duty if retesting of my blood sugar after 30 minutes indicates a glycemic level of 100 mg/dl or more.

5) If my blood glucose meter reading is more than 399 mg/dl during any of these tests, I agree to inform my supervisor that I am not fit to perform safety-related tasks. I may return to full duty when retesting of my blood sugar, which I will perform at least every 30-60 minutes, indicates a glycemic level of 399 mg/dl or less.

6) I agree to provide the blood glucose meter that I use for testing pursuant to this agreement to the HCP for downloading. I understand that I may be required to do this as frequently as once per month.

7) I will report any episodes involving impaired mental abilities or altered consciousness to the HCP either on the day of occurrence or before beginning my next shift, regardless of whether this occurs on or off duty.

8) I will obtain a dilated retinal examination from my vision specialist a minimum of every two years, and will inform the HCP before my next shift if laser photocoagulation is recommended or performed.

9) To verify compliance with items 7-8 above, I agree to provide the HCP with full access to the medical and pharmacy records related to my diabetes condition upon his or her request. I understand that these will be requested on a routine basis every 1-2 years.

10) I consent to a medical work fitness examination conducted by the HCP every 2-5 years to ensure that I have not developed any chronic complications that may pose a direct threat of harm to self or others

11) I understand that failure to comply with this agreement could result in work restrictions and/or disciplinary action, including discharge.

By my signature below, I acknowledge that I have read and accept the conditions of this agreement.

_____ _____

Signature Witness Signature

_____ _____

Date Date

2) PARATHYROID DISORDERS

Asymptomatic hypercalcemia is usually caused by primary hyperparathyroidism. Depending on the degree of elevation, excess calcium may cause fatigue, depression, mental confusion, anorexia, nausea, vomiting, constipation, or cardiac arrhythmias. Kidney stones may be associated with hypercalcemia, and the possibility of an underlying malignancy causing hypercalcemia should be considered.

Undiagnosed abnormalities in calcium levels require evaluation, diagnosis, and treatment before medical clearance. Calcium and phosphorous levels should be in an acceptable range based on two testings conducted at least one month apart.

3) HYPER AND HYPOTHYROIDISM

Hyperthyroidism commonly causes nervousness, emotional lability, inability to sleep, tremors, frequent bowel movements, excessive sweating and heat intolerance. Muscle weakness and weight loss may progress to the point where stair climbing is difficult. Cardiovascular disorders, such as atrial fibrillation or congestive heart failure, may occur. Hypothyroidism often has an insidious onset and includes symptoms such as lethargy, constipation, stiffness or cramping of muscles, or carpal tunnel syndrome. Intellectual activity slows, hair loss may occur, and the voice may become hoarse.

Thyroid abnormalities require evaluation, diagnosis, and treatment prior to medical clearance. Stable thyroid levels (Free T4, & TSH) in the normal range should be obtained from two testings conducted at least one month apart. Candidates on thyroid replacement should be asymptomatic and have normal or low TSH levels.

4) ADRENAL DISORDERS

The adrenal glands produce corticosteroids that affect metabolism and sodium-potassium balance in the body, catecholamines that regulate heart rate, blood pressure and sweating, and other body responses. Corticosteroid insufficiency is characterized by fatigability, weakness, anorexia, nausea, vomiting, hypotension, or hypoglycemia. Excess corticosteroids may cause hypertension, glucose intolerance, psychologic conditions and gastrointestinal problems.

Adrenal abnormalities require evaluation, diagnosis, and treatment before medical clearance. No cardiac arrhythmia or hypertension should be present. Sodium and potassium should be in normal range. Candidates with hypoadrenalism should document their ability to perform vigorous physical activity under stress and adverse environmental conditions without weakness or compromised function. Acceptable documentation may include review of current job duties, work attendance records, medical records and recreational activities.

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