Body System: Endocrine		
Session Topic: Diabetes Complications		
Educational Format		**Faculty Expertise Required**
REQUIRED	Interactive Lecture	Expertise in the field of study. Experience teaching in the field of study is desired. Preferred experience with audience response systems (ARS). Utilizing polling questions and engaging the learners in Q&A during the final 15 minutes of the session are required.
OPTIONAL	Problem-Based Learning (PBL)	Expertise teaching highly interactive, small group learning environments. Case-based, with experience developing and teaching case scenarios for simulation labs preferred. Other workshop-oriented designs may be accommodated. A typical PBL room is set for 50-100 participants, with 7-8 each per round table. Please describe your interest and plan for teaching a PBL on your proposal form.

Professional Practice Gap	**Learning Objective(s) that will close the gap and meet the need**	**Outcome Being Measured**
• Latent autoimmune diabetes of adults (LADA) is often underdiagnosed/misdiagnosed. • Maturity onset diabetes of adulthood (MODY) is often underdiagnosed and misdiagnosed. • Because diabetic retinopathy is asymptomatic nature, patients often do not seek eye care until they notice changes in their vision • Physicians have a significant knowledge gap with regard to optimal management of diabetic complications. • Treatment updates were considered by many participants as their primary need, particularly with regard to appropriate initial (titration) and maintenance dosing with insulin analogs to achieve adequate glycemic control, and for managing associated co-morbid conditions. • There exists some discrepancy between the ADA suggestion	1. Conduct appropriate screenings and create diagnostic plans for comorbidities and complications in patients who have diabetes; including provisions of clinical practice guidelines and performance measures (when appropriate). 2. Update management and prevention strategies with current evidence-based guidelines for the prevention and management of complications in patients with diabetes. 3. Utilize high-quality diabetes self-management education (DSME) to improve patient self-management, satisfaction, and glucose control, with a goal of prevention of diabetes complication. 4. Consider utilization of ambulatory glucose monitoring to aid in the detection and management of glycemic variability.	Learners will submit written commitment to change statements on the session evaluation, indicating how they plan to implement presented practice recommendations.

that self-monitoring of blood glucose may be effective in select patients not using insulin and recommends that those patients receive education on how to use the self-monitoring data to adjust therapy. • Glycemic variability is often unrecognized, but is a known inducer of long and short term diabetes related complications. Glycemic variability increases oxidative stress leading to eye, kidney, neurological and cardiovascular complications. • Newer therapies including Ambulatory Glucose Monitoring, using blinded interstitial glucose sensors are highly effective at identifying glycemic variability as well as hypoglycemia. The sensors can be easily placed on the patient's arm by a medical assistant, worn for two weeks, then downloaded. Data on blood glucose levels obtained every 15 minutes are recorded and stored in the device for 2 weeks.		

ACGME Core Competencies Addressed (select all that apply)			
X	Medical Knowledge		Patient Care
X	Interpersonal and Communication Skills		Practice-Based Learning and Improvement
	Professionalism		Systems-Based Practice

Faculty Instructional Goals

Faculty play a vital role in assisting the AAFP to achieve its mission by providing high-quality, innovative education for physicians, residents and medical students that will encompass the art, science, evidence and socio-economics of family medicine and to support the pursuit of lifelong learning. By achieving the instructional goals provided, faculty will facilitate the application of new knowledge and skills gained by learners to practice, so that they may optimize care provided to their patients.

- Provide up to 3 evidence-based recommended practice changes that can be immediately implemented, at the conclusion of the session; including SORT taxonomy & reference citations
- Facilitate learner engagement during the session

- Address related practice barriers to foster optimal patient management
- Provide recommended journal resources and tools, during the session, from the American Family Physician (AFP), Family Practice Management (FPM), and Familydoctor.org patient resources; those listed in the References section below are a good place to start
    - Visit http://www.aafp.org/journals for additional resources
    - Visit http://familydoctor.org for patient education and resources
- Screening and diagnosis, treatment, gestational diabetes, and chronic care management within the context of the patient-centered medical home will be covered in other sessions. Therefore, this session should only include a brief and limited overview of any of those topics. Please reference this fact to attendees and encourage them to attend the other sessions for additional detail and emphasis.
- Provide specific case-based examples illustrating how to conduct appropriate screenings and create diagnostic plans for comorbidities and complications in patients who have diabetes, including provisions of clinical practice guidelines and performance measures (when appropriate.
- Provide specific evidence-based recommendations to assist physician-learners in updating their management and prevention strategies for the prevention and management of complications in patients with diabetes
- Provide recommendations for appropriate treatment strategies to address microvascular and macrovascular complications.
- Explain the implications of, prevention for, and monitoring tools used for treating hypoglycemia
- Provide recommendations and strategies for using office registries and empowered office teams—to become a "participatory office".
- Provide specific strategies and resources to assist physician-learners to utilize high-quality diabetes self-management education (DSME) to improve patient self-management, satisfaction, and glucose control, with a goal of prevention of diabetes complication
- Provide recommendations for procedure coding for both insertion and interpretation of ambulatory glucose monitoring can provide additional income to practices
- Provide recommendations regarding guidelines for Medicare reimbursement.
- Provide recommendations to maximize office efficiency and guideline adherence to the diagnosis and management of diabetic complications.
- Provide an overview of newly available treatments, including efficacy, safety, contraindications, and cost/benefit relative to existing treatments.
- Provide instructions regarding the incorporation and use of the PCMH/ACO/Primary Care Core Measure Set into practice.

Needs Assessment:

From 1980 to 2011, the number of Americans with diagnosed diabetes has more than tripled from 5.6 million to 20.9 million, with an estimated 25.8 million including undiagnosed cases.[1,2] Diabetes-related complications, including cardiovascular disease, kidney disease, neuropathy, blindness, and lower-extremity amputation--are a significant cause of increased morbidity and

mortality among people with diabetes, and result in a heavy economic burden on the US health care system; and while rates of diabetes-related complications have declined significantly in the past two decades, a large burden of disease persists due to the continued increase in the prevalence of diabetes.[3-6] Prevalence of diabetes-related complications are as follows:[5]

- From 1997-2011, the number of adults with diagnosed diabetes who reported visual impairment increased from 2.7 million to 4.0 million
- The number of hospital discharges for nontraumatic lower extremity amputation (LEA) with diabetes as a listed diagnosis started to increase from 55,000 in 1988 to 83,000 in 1997, and then decreased to 68,000 in 2009. From 1988 to 2009, the number of discharges increased by 24%.
- Among hospital discharges with diabetes as any-listed diagnosis, the number of discharges with a lower extremity condition (LEC) (e.g., peripheral arterial disease, ulcer/inflammation/infection or neuropathy) as any-listed diagnosis (first or secondary) doubled from 445,000 in 1988 to 890,000 in 2007. During this period, the number of discharges with LEC as the secondary diagnosis increased more rapidly than those with LEC as the first-listed diagnosis. In 2007, of 890,000 discharges with LEC as any-listed diagnosis, about 31% had LEC as the first-listed diagnosis.
- From 1997 to 2011, the number of people aged 35 years or older with diabetes and with self-reported heart disease or stroke increased from 4.2 million to 7.6 million. In 2011, among people with diabetes aged 35 years and older and with self-reported heart disease or stroke, 5.0 million reported having coronary heart disease, 3.7 million reported having other heart disease or condition, and 2.1 million reported having stroke.
- Both the crude and age-adjusted death rates for hyperglycemic crises as underlying cause decreased from 1980 to 2009. Declines in the crude and age-adjusted rates were similar. The age-adjusted rate decreased 64% from 48.4 per 100,000 diabetic populations in 1980 to 17.3 per 100,000 diabetic populations in 2009.
- The number of hospital discharges with diabetic ketoacidosis (DKA) as the first-listed diagnosis increased from about 80,000 discharges in 1988 to about 140,000 in 2009.
- The trends in crude and age-adjusted rates of initiation of treatment for End-Stage Renal Disease related to diabetes (ESRD-DM) per 100,000 diabetic population increased from 1980 until mid-1990s, then decreased. However, crude rates increased faster than the age-adjusted rates. This disparity is because of differences in age-specific trends. In 2008, the crude rate was 1.3 times higher than the age-adjusted rate (255.2 vs. 191.9 per 100,000 diabetic populations).
- The risk of hypoglycemia in patients with insulin-requiring type 2 diabetes is equal to that in patients with type 1 diabetes. The Diabetes Audit and Research in Tayside, Scotland study determined that the prevalence of hypoglycemia among people with type 1 diabetes was 7.1%, compared to 7.3% in its cohort of people with insulin-treated type 2 diabetes. Thus, patients with type 2 diabetes of long duration who require insulin are at higher risk of developing hypoglycemia than are treatment-naive individuals starting insulin for the first time.
- Hypoglycemia increases the risk of cardiovascular and all-cause mortality in patients with diabetes. Severe hypoglycemia is associated with a macrovascular events hazards

ratio (HR) of 2.88 and a microvascular events HR of 1.81. The mortality HR for a hypoglycemic event in patients with type 2 diabetes is 2.69

Practice Gaps

Recent data from an American Family Physician (AAFP) CME Needs Assessment Survey indicate that family physicians have a statistically meaningful and significant gap in knowledge and skill necessary to provide optimal management of diabetes complications; however, medical skill ratings for diabetes and pregnancy, thyroid disease and pregnancy, and diabetic ketoacidosis exceeded mean relevance ratings.[7] More specifically, CME outcomes data from 2013 AAFP Scientific Assembly: *Diabetes-Advanced* and 2014-2016 AAFP FMX (formerly Assembly): *Diabetes Complications: Recognition, Prevention, and Treatment* sessions indicate that many family physicians have knowledge gaps with regard to underdiagnoses/misdiagnoses latent autoimmune diabetes of adults (LADA); application of current guidelines for vaccines for diabetic patients; evidence-based recommendations for pharmacologic management of co-morbid conditions; and application of guidelines for screening and diagnosis of diabetic complications.[8-11] This CME outcomes and needs assessment data suggests a need to cover a broad array of diabetes complications topics.[9] Additionally, based on commitment to change statements from participants in previous AAFP Live—Diabetes CME activities (2009-2011), there are a strong desire among family physicians to be updated with information regarding current guidelines for management of T2D patients. Of the 348 statements received, 41% were concerned with improving screening of diabetes patients, 32% involved making improvements to treatment/monitoring, 15% noted improving patient education, while 12% were related to practice change. Treatment updates were considered by many participants as their primary need, particularly with regard to appropriate initial (titration) and maintenance dosing with insulin analogs to achieve adequate glycemic control, and for managing associated co-morbid conditions. Several statements, indicating a clear educational need, were focused on preservation of pancreatic B-cell function and the appropriate utilization of pharma-co-therapeutic agents to achieve this goal. Finally, practice improvement statements noted the need for participants to consider the value of EMR reporting in their practices as well as utilizing the patient-centered medical home (PCMH) model as a means of maintaining a tighter control of patient diabetes management.

Family physicians should be familiar with the current ADA standards of medical care in diabetes for the prevention and management of diabetes complication, which include complete evaluation and laboratory tests should be performed to classify the diabetes, identify diabetes-related complications and review previous treatment and glycemic control in patients with established diabetes.[12] The ADA also recommends regularly assessing patients for alcohol use, depression or other mood disorders, as well as reviewing and adjusting medications to control glucose, lipids and blood pressure.[13]

Patients who have diabetes who are not adequately screened, who go undiagnosed, or who are diagnosed but do not adequately control their disease can experience a host of complications. Providing family physicians with appropriate education and training on how to screen and diagnose patients with diabetes can help to decrease the number of patients who go undiagnosed; strategic patient education may also help to prevent the onset the diabetes.

Patients with elevated blood sugars should be evaluated to: determine whether diabetes or pre-diabetes exists, identify the type of diabetes, establish the absence or presence of complications, and review the previous history of treatment and glycemic control.

It is important to note that there exists some discrepancy between the ADA suggestion that self-monitoring of blood glucose may be effective in select patients not using insulin and recommends that those patients receive education on how to use the self-monitoring data to adjust therapy.[14] In contrast, the results of a Cochrane review indicate that any benefits from self-monitoring of blood glucose are short-term, and possibly limited to patients with newly diagnosed diabetes.[15] Self-monitoring of blood glucose (SMBG) has been found to be effective for patients with type 1 diabetes and for patients with type 2 diabetes using insulin. For those who have been diagnosed with diabetes for more than one year, especially those whose blood glucose levels are well controlled without insulin, the evidence supports discontinuing (or not initiating) self-monitoring of blood glucose because of the added cost and inconvenience of testing and lack of improvement in patient-oriented outcomes.[14,15] Family physicians should be aware of the evidence-based recommendations for self-monitoring of blood glucose.

Family physicians should be aware of current ADA guideline recommendations for pharmacologic and overall approaches to treatment.[12] Intensive glucose control, which has been recommended by some guidelines, has not been proven to improve, and may worsen, clinical outcomes. Older patients with a limited life expectancy and patients who have a high risk of hypoglycemia, previous cardiovascular disease, longer diabetes duration or multiple comorbidities may benefit from less stringent glucose control.[16]

Some of the potential complications related to diabetes (both insulin-dependent and non-insulin dependent) that patients may experience include:[12,17]

- Cardiovascular disease (CVD)
    - Hypertension
    - Dyslipidemia
    - Coronary heart disease/coronary artery disease (CHD/CAD)
- Nephropathy
- Retinopathy
- Neuropathy
    - Distal symmetric polyneuropathy (DPN)
    - Autonomic neuropathy
        - Hypoglycemia
        - Hypoglycemia awareness autonomic failure
        - Death from hypoglycemia
        - Gastropathy, orthostatic hypotension, abnormal sweating, sexual dysfunction, visual impairment, and increased fall risk in elderly
- Foot ulceration

It is important for family physicians to understand the implications of these complications as it relates to their patient population, and be aware of which ones manifest or are exacerbated at certain stages. Appropriate screenings for each of these problems in patients may lead to early diagnosis and treatment, which, in turn, can lead to better management of diabetes and

prevention of associated complications or comorbidities. Preventive care for patients who have diabetes can also help to reduce complications or comorbidities; appropriate measures may include: immunizations (particularly for influenza and pneumonia); low-dose aspirin therapy for prevention of cardiovascular disease; smoking cessation and limitation of alcohol; and dietary modification and physical activity. Additionally, the ADA recommends screening patients for psychosocial problems such as depression and diabetes-related distress at each regular office visit.[12,13]

Physicians who conduct regular measurements and encourage patients' self-regulation of hypertension, glucose, lipid and insulin levels can institute optimal clinical interventions.[12] Additionally, clinical guidelines should be reinforced so family physicians can help identify patients with diabetes earlier in the course of the disease.

Some family physicians may not be aware of updated clinical guidelines and results of clinical interventions from retrospective studies that prove such recommendations to be effective. Research suggests that primary care physicians do not routinely use clinical guidelines in managing care for patients with diabetes, and often do not provide optimal coordination of care with specialists.[18] For example, the Diabetes Control and Complications Trial (DCCT) reported that intensive diabetes therapy aimed at lowering glycemic levels reduces the risk of diabetic retinopathy, nephropathy and neuropathy.[19,20] Additionally, consensus from a number of organizations, including the Joint National Committee on the Prevention, Detection, Evaluation and Treatment of High Blood Pressure, the American Diabetes Association and the National Kidney Foundation, supports aggressive blood pressure targets (less than 130/80mm/Hg) in patients with diabetes, which may require pharmacologic therapy.[21] Family physicians can also help patients make numerous lifestyle modifications, including smoking cessation, alcohol restriction, dietary modification (often with sodium restriction), physical activity and weight loss, all of which can decrease patients' risk of complications from diabetes and improve their overall health.

Physicians may improve their care of patients with diabetic complications by engaging in continuing medical education that provides practical integration of current evidence-based guidelines and recommendations into their standards of care, including, but not limited to the following:[12,16,22-30]

- Diagnosis of diabetic foot infection is based on the presence of at least two classic findings of inflammation or purulence.
- Magnetic resonance imaging is the most accurate imaging study in early osteomyelitis.
- Surgical debridement and drainage of deep tissue abscesses and infections should be performed in a timely manner.
- All patients with diabetes should undergo a systematic foot examination at least once a year, and more frequently if risk factors for diabetic foot ulcers exist.
- Initial work-up for gastroparesis should include a complete history and physical examination, along with pertinent laboratory tests, such as complete blood count, thyroid-stimulating hormone test, and metabolic panel.
- Gastric emptying scintigraphy with a solid meal is the first-line option for confirming a diagnosis of gastroparesis.

- Metoclopramide (Reglan) improves symptoms of gastroparesis.
- Titration of insulin over time is critical to improving glycemic control and preventing diabetes-related complications.
- Monitor HbA1c concentrations every 3 months and intensify treatment if treatment goals for BG and HbA1c concentrations are not being met.
- Advise patients to monitor finger-stick BG concentrations in those who are taking insulin or other medications with a risk of hypoglycemia; or are initiating or changing their diabetes treatment regimen; or have not met treatment goals; or have intercurrent illnesses.
- Patients on multiple-dose insulin (MDI) or insulin pump therapy should do self-monitoring of blood glucose (SMBG) prior to meals and snacks, occasionally postprandially, at bedtime, prior to exercise, when they suspect low blood glucose, after treating low blood glucose until they are normoglycemic, and prior to critical tasks such as driving. B
- Intravenous (IV) ALA can improve neuropathy symptoms when administered for three weeks, but symptom improvement with oral ALA is not clinically significant.
- When prescribed as part of a broader educational context, SMBG results may be helpful to guide treatment decisions and/or patient self-management for patients using less frequent insulin injections or noninsulin therapies. E
- When prescribing SMBG, ensure that patients receive ongoing instruction and regular evaluation of SMBG technique and SMBG results, as well as their ability to use SMBG data to adjust therapy. E
- When used properly, continuous glucose monitoring (CGM) in conjunction with intensive insulin regimens is a useful tool to lower A1C in selected adults (aged ≥25 years) with type 1 diabetes. A
- Although the evidence for A1C lowering is less strong in children, teens, and younger adults, CGM may be helpful in these groups. Success correlates with adherence to ongoing use of the device. C
- CGM may be a supplemental tool to SMBG in those with hypoglycemia unawareness and/or frequent hypoglycemic episodes. E
- Lowering A1C to below or around 7% has been shown to reduce microvascular complications of diabetes and, if implemented soon after the diagnosis of diabetes, is associated with long-term reduction in macrovascular disease. Therefore, a reasonable A1C goal for many nonpregnant adults is <7%. B
- Less stringent A1C goals (such as <8%) may be appropriate for patients with a history of severe hypoglycemia, limited life expectancy, advanced microvascular or macrovascular complications, and extensive comorbid conditions and in those with long-standing diabetes in whom the general goal is difficult to attain despite diabetes self-management education (DSME), appropriate glucose monitoring, and effective doses of multiple glucose-lowering agents including insulin. B
- When eGFR is <60 mL/min/1.73 m2, evaluate and manage potential complications of chronic kidney disease (CKD). E
- Refer patients who smoke, have LOPS and structural abnormalities, or have history of prior lower-extremity complications to foot care specialists for ongoing preventive care and lifelong surveillance. C

- Optimal glucose control in persons with diabetes prevents progression of retinopathy.
- All older persons with diabetes should have a dilated eye examination within one year of diabetes diagnosis, and at least annually thereafter.
- Controlling blood pressure in older persons with and without diabetes may reduce the risk of ischemic vascular complications that can cause vision loss.
- 1.3.24 Offer pregnant women with pre-existing diabetes retinal assessment by digital imaging with mydriasis using tropicamide following their first antenatal clinic appointment (unless they have had a retinal assessment in the last 3 months), and again at 28 weeks. If any diabetic retinopathy is present at booking, perform an additional retinal assessment at 16–20 weeks. [2008, amended 2015]
- Encourage patients with hypoglycemia awareness autonomic failure to use continuous glucose sensors or ambulatory glucose monitoring. Patients may also employ structured glucose monitoring to predict the occurrence of hypoglycemia.

These recommendations are provided only as assistance for physicians making clinical decisions regarding the care of their patients. As such, they cannot substitute for the individual judgment brought to each clinical situation by the patient's family physician. As with all clinical reference resources, they reflect the best understanding of the science of medicine at the time of publication, but they should be used with the clear understanding that continued research may result in new knowledge and recommendations. These recommendations are only one element in the complex process of improving the health of America. To be effective, the recommendations must be implemented. As such, physicians require continuing medical education to assist them with making decisions about specific clinical considerations.

The American Academy of Family Physicians Academy has participated in the Core Measures Collaborative (the Collaborative) convened by America's Health Insurance Plans (AHIP) since August 2014. The Collaborative is a multi-stakeholder effort working to define core measure sets of various specialties promoting alignment and harmonization of measure use and collection across both public and private payers.

Participants in the Collaborative included Centers for Medicare and Medicaid Services (CMS), the National Quality Forum (NQF), private payers, provider organizations, employers, and patient and consumer groups. This effort exists to decrease physician burden by reducing variability in measure selection, specifications and implementation– making quality measurement more useful and meaningful for consumers, employers, as well as public and private clinicians.

With significant AAFP input, a PCMH/ACO/Primary Care Core Measure Set has been developed for primary care. The goal of this set is to decrease burden and allow for more congruence between payer reporting programs.[31]

Resources: Evidence-Based Practice Recommendations/Guidelines/Performance Measures

- Insulin management of type 2 diabetes mellitus[16]
- Diabetic nephropathy--the family physician's role[32]

- Diabetic Ketoacidosis: Evaluation and Treatment[33]
- Pharmacologic management of hypertension in patients with diabetes[21]
- Vision loss in older persons[26]
- The visually impaired patient[34]
- NICE: Diabetes in pregnancy: management of diabetes and its complications from preconception to the postnatal period[25]
- ADA Standards of medical care in diabetes[12]
- AAP: Management of newly diagnosed type 2 Diabetes Mellitus (T2DM) in children and adolescents[24]
- National Diabetes Education Program[35]
- An organized approach to chronic disease care[36]
- Making diabetes checkups more fruitful[37]
- Patient-physician partnering to improve chronic disease care[38]
- Health Coaching: Teaching Patients to Fish[39]
- Medication adherence: we didn't ask and they didn't tell[40]
- Adding health education specialists to your practice[41]
- Encouraging patients to change unhealthy behaviors with motivational interviewing[42]
- Engaging Patients in Collaborative Care Plans[43]
- Simple tools to increase patient satisfaction with the referral process[44]
- FamilyDoctor.org. Diabetes Overview (patient resource)[45]

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