Diabetes Update

This edition of *FP Essentials™* will update family physicians about diabetes and will cover four sections: update on type 1 diabetes, screening, diagnosis, and prevention of type 2 diabetes; pharmacotherapy for type 2 diabetes, and insulin and device therapy in diabetes.

This edition should be approximately 10,000 words in length, divided into four sections of approximately 2,500 words each (each with an abstract of 200 words or less) plus key practice recommendations, a maximum of 15 tables and figures, recommended reading, and approximately 100 references. This edition should focus on what is new in each topic and should answer the key questions listed for each section. Each section should begin with an illustrative case, similar to the examples provided, with modifications to emphasize key points; each case should have a conclusion that demonstrates resolution of the clinical situation. The references here include information that should be considered in preparation of this edition. However, these references are only provided as a useful starting point that should be used to identify additional information to review.

**Needs assessment:** According to the Centers for Disease Control and Prevention, 8.5% of the US population had a diagnosis of diabetes in 2017.¹ It is one of the most common chronic diseases that family physicians manage. However, in a recent survey of American Academy of Family Physicians, members ranked diabetic complications among the top 12% of medical conditions for which a gap was identified between clinical relevance and physician skill. This may be because management and prevention of diabetes is a rapidly evolving area of medical research, with frequent changes in management guidelines. Many new diabetes drugs, some with beneficial cardiovascular outcomes, have been introduced in the past decade. At the same time, important technological developments have been made in glucose monitoring systems and insulin delivery devices, with which family physicians need to be familiar.

Section 1: Update on Type 1 Diabetes

Example case: Rachel, a 9-year-old girl, is brought to your office by her parents for concerns of polyuria, polydipsia, and lethargy for the past 10 days. She has lost 2.27 kg (5 lb) during this time. Her medical and family history are unremarkable. She is afebrile and alert but appears moderately dehydrated on examination. Urine dipstick reveals 3+ glucose and 1+ ketones. Plasma glucose is 275 mg/dL. What are the next steps in her evaluation and management?

Key questions to consider:

- How does new-onset type 1 diabetes typically present? Describe nonacidotic and acidotic presentations. Why is diagnosis often delayed in young children? How often does new-onset present during adulthood?

- What are the known and suspected risk factors and causes? What is the role of genetic testing for susceptibility to type 1 diabetes? Is microbiome involved?

- What are the diagnostic criteria and initial evaluations? How is type 1 diabetes distinguished from type 2 diabetes? What other conditions should be considered in the differential diagnosis?

- What are the recommended approaches for initial and ongoing management in children and adolescents? What are the recommended starting doses and regimens for insulin? How do intensive regimens differ from conventional ones? Note: Insulin pumps will be discussed in Section 4.

- Do oral drugs have any role in management?

- What are the recommendations for nutrition and physical activity in type 1 diabetes?

- What are the suggested targets for glycemic control (eg, A1c, preprandial and bedtime blood glucose) for children, adolescents, and adults? What other home and outpatient monitoring tests are helpful to achieve those targets?

- How does pregnancy affect the management of type 1 diabetes?

- What are the recommended approaches for preventing and managing acute hypoglycemia in type 1 diabetes?

- What are the screening recommendations for common complications, such as growth disorders, hypertension, dyslipidemia, nephropathy, neuropathy, retinopathy, autoimmune thyroiditis, and celiac disease?

- What is the average life expectancy of a patient with type 1 diabetes? What is the average age of onset of complications (eg, retinopathy, neuropathy, kidney failure/dialysis, etc.)?

- How common are depression and eating disorders in patients with type 1 diabetes? What kind of psychosocial support should be provided for patients and their families?

- What strategies can foster increasing self-management and independence in patients, particularly children and adolescents, with type 1 diabetes?

- What is the role of islet cell transplantation? What approaches (eg, collagen microencapsulation of islet cells) are being researched to improve the applicability of this therapy?
What is the current status of research on stem cell therapy in diabetes, and how effective is that therapy likely to be?

**Initial references to consider:**


Section 2: Screening, Diagnosis, and Prevention of Type 2 Diabetes

Example case: Anthony, a 40-year-old man, comes to your office after a recent employee health screening with results of: A1c level of 6.1% and low-density lipoprotein of 138 mg/dL. He reports unhealthy eating, sedentary behavior, and a family history of type 2 diabetes. Body mass index is 28 kg/m². The examination is otherwise unremarkable. He called the health screening results a “wake-up call” and is very interested in lifestyle modification and pharmacotherapy to prevent diabetes and to improve his health.

Key questions to consider:

- What are the prevalence and incidence rates of prediabetes and type 2 diabetes? Why have these rates been rising, particularly in children and adolescents, for the past 3 decades?
- What are the risk factors? Is the microbiome involved?
- Who should be screened, according to various guidelines?
- What methods should be used for screening? At what intervals should screening be repeated?
- What are the diagnostic criteria for prediabetes and type 2 diabetes in adults and children?
- What are the differences between impaired glucose tolerance, impaired fasting glucose, and prediabetes?
- What are the most effective ways physicians can promote lifestyle changes in patients who could benefit from them?
- What educational and lifestyle interventions are effective for preventing type 2 diabetes and for limiting progression from prediabetes to type 2 diabetes? What approaches are best suited for children and adolescents?
- When should patients be referred for counseling about nutrition or other lifestyle interventions? What is the role of a multidisciplinary approach to diabetes prevention?
- How frequently should patients with prediabetes be monitored and retested? Should they be offered pharmacotherapy? If so, when?
- What pharmacotherapies should be considered for preventing progression from prediabetes to type 2 diabetes? Is pharmacotherapy an appropriate consideration in children and adolescents?
- How common is it for patients with type 2 diabetes to no longer meet criteria for diagnosis due to successful lifestyle interventions? What about patients who have undergone bariatric surgery? What is the long-term outcome for such patients? How often do they relapse and again meet criteria for type 2 diabetes?

Initial references to consider:


Section 3: Pharmacotherapy for Type 2 Diabetes

Example case: Karen, a 56-year-old woman, comes to your office for follow-up for type 2 diabetes, stage 3 chronic kidney disease, and heart failure. The most recent ejection fraction result was 40-45%. She reports adherence to a regimen of metformin, lisinopril, carvedilol, and furosemide; however, body mass index is 31 kg/m² and A1c level is 8.4%. She wants to avoid insulin therapy for as long as possible. What other diabetes drugs would be safe and beneficial for the diabetes given her medical comorbidities?

Key questions to consider:

- Describe the mechanism of action, dosing, average cost, contraindications, and adverse effects of the following drugs/classes of drugs for type 2 diabetes. Consider using a table to summarize this information.
  - Metformin
  - Dipeptidyl peptidase 4 (DPP-4) inhibitors
  - Glucagon-like peptide 1 (GLP-1) analogs
  - Sodium-dependent glucose cotransporter 2 (SGLT2) inhibitors
  - Thiazolidinediones
  - Sulfonylureas

- Which of these drugs/drug classes have proven cardiovascular and mortality benefits for patients with diabetes? How significant are the beneficial effects?

- What preference do current guidelines give to these drugs? In which order should they be used? Which ones are preferred in patients or settings with limited resources?

- Which diabetes drugs are preferred/nonpreferred in patients with comorbid heart failure, renal impairment, and/or other medical conditions?

- Is there an algorithm available to help clinicians decide which of the drugs to use for which patients? If not, consider creating one.

- Which of the previously discussed drugs/drug classes are approved for use in children and adolescents with type 2 diabetes?

- What is the role of insulin therapy in adults and children with type 2 diabetes? Which formulations and doses are recommended? When should basal insulin be used as add-on therapy? When should mealtime insulin be used? What is the role of concentrated insulins (e.g., U200, U300)? Note: insulin delivery devices such as insulin pens will be discussed in Section 4.

- What are the recommended treatment goals and glycemic targets for patients of various ages with type 2 diabetes?

- When should patients be referred to a diabetes subspecialist?

Initial references to consider:


Example case: Connor, a 14-year-old, was diagnosed with type 1 diabetes at age 10 years. The challenges of a growth spurt, irregular meals, sports, and going out with friends have led to wider fluctuations in his blood glucose levels during the past year. Last week, he experienced two episodes of severe hypoglycemia that resulted in missed school and soccer practice. He and his parents ask whether an insulin pump might help to achieve better glycemic control and prevent hypoglycemia.

Key questions to consider:

Continuous glucose monitoring
- What are the indications for and benefits of continuous glucose monitoring (CGM) in type 1 and type 2 diabetes?
- What kinds of devices are available for CGM, and how accurate are they?
- How can family physicians start using CGM for their patients in an outpatient setting?
- What is the role of CGM in inpatient settings?
- How much does CGM cost? Does insurance cover it? What are the criteria to be met for insurance to cover CGM?

Insulin pens and inhalers
- What are the various types of insulin pens available? What are smart/connected insulin pens? What do physicians need to know when prescribing insulin pens and teaching patients how to use them?
- What is the current role of inhaled insulin therapy in managing diabetes? How effective is it? What are the contraindications, adverse effects, and potential safety concerns? Do patients like taking insulin this way?
- What are the potential applications for using intranasal insulin in nondiabetic conditions, such as Alzheimer dementia?
- How much do insulin pens cost? Does insurance cover them? What are the criteria to be met for insurance to cover them?

Insulin pumps (continuous subcutaneous insulin infusion)
- How do insulin pumps work? What are the indications for insulin pump therapy?
- What are the various types of pumps available for patients with diabetes? What are the advantages of sensor-augmented insulin pumps? What are hybrid closed-loop insulin pumps?
- What are the advantages and disadvantages of insulin pumps? Have they been shown to improve glycemic control and/or to reduce diabetic complications?
- Which insulin preparations are used in pumps? How are the total daily dose, basal rate, and bolus doses determined?
• How should insulin pumps be managed in an acute care setting when patients who use them are hospitalized?

• What is the development status of a bihormonal, fully automated, closed-loop insulin pump or artificial pancreas?

• How much do insulin pumps cost? Does insurance cover them? What are the criteria to be met for insurance to cover these devices?

Other devices and apps

• What smartphone apps and other electronic devices can help patients and families manage diabetes? Are any of these apps interactive, and if so, what are the hyperlinks?

• How can patients and their physicians keep abreast of new technology for diabetes management?

Initial references to consider:


