Diabetes mellitus poses serious health concerns and economic burdens as incidence and prevalence rates continue to rise at alarming rates in the United States. Estimates indicate that 25.8 million people, or 8.3% of the US population, have diabetes mellitus, although the disease is undiagnosed in 7 million of those individuals. In addition, approximately 79 million adults meet criteria for prediabetes based on impaired fasting glucose levels or increased levels of glycated hemoglobin (HbA1c). Type 2 diabetes mellitus (T2DM) accounts for 90% to 95% of the diagnosed cases of diabetes mellitus in the United States.1

Cardiovascular disease is the predominant cause of morbidity and mortality in patients with T2DM. Furthermore, patients with T2DM, as well as those at risk for T2DM, have a high prevalence of comorbidities, including obesity, dyslipidemia, and hypertension, which also increases their risk for cardiovascular disease and other T2DM-related complications.2

Despite the high prevalence of both prediabetes and undiagnosed diabetes, the value of universal screening for T2DM remains controversial. Practice guidelines have been published that can facilitate identification of at-risk individuals and optimize screening procedures.2,3 Evidence-based guidelines are available that provide effective treatment strategies for patients with prediabetes and T2DM.4 Achieving recommended clinical goals substantially reduces the risk of morbidity and mortality and ultimately improves patient outcomes. A review of the latest and most effective approaches to T2DM management and practical suggestions for implementing treatment strategies in order to provide optimal T2DM care will be presented.
glycemic control, which may lead to progression of disease as well as serious microvascular and macrovascular complications.

Providers face challenges in translating clinical trial evidence into effective treatments in clinical practice. Barriers to achieving optimal clinical outcomes are present in almost every aspect of T2DM care. Therapy-related obstacles; issues related to lifestyle, education, and psychological well-being; and disparities in disease management due to racial, ethnic, and socioeconomic differences may influence patient outcomes. Effective management of T2DM requires an interaction between health providers delivering interventions and well-informed patients implementing self-management strategies.

The present report provides a discussion of recommended approaches to screening, diagnosis, and treatment in patients with T2DM, as well as in those at risk for the disease. Practical strategies to increase patient adherence to lifestyle interventions and a review of appropriate and effective pharmacotherapies are provided.

Identifying At-Risk Patients and Optimizing Screening

Patients at risk for T2DM include those with cardiovascular disease, dyslipidemia, obesity, a sedentary lifestyle, or a family history of diabetes mellitus, as well as members of specific racial and ethnic minority groups (Figure 1).7 Despite the high prevalence of prediabetes and undiagnosed T2DM, the value of office-based screening for T2DM in asymptomatic patients remains unclear. While available data generally do not support this practice, the results of some studies suggest that screening patients with multiple risk factors for T2DM, especially during routine office visits, may be worthwhile.8

A number of professional organizations have published guidelines that identify specific groups that should undergo T2DM screening (Figure 2).7-13 These recommendations are related to some of the recognized risk factors for the development of T2DM. Primary care physicians may find these recommendations a useful starting point from which to further hone their own screening criteria, based on the patient demographics and specific risk factors that they see most frequently in their individual practices.

Our understanding of the risk factors associated with the development of T2DM continues to expand and improve. As Figure 1 shows, risk factors may be related to personal or family history (eg, family history of diabetes mellitus, previously identified glucose intolerance), personal history of gestational diabetes, comorbidities (eg, hypertension, dyslipidemia, polycystic ovary syndrome, psychiatric illness), and race or ethnicity.7 An awareness of these potential red flags and clinical clues such as acanthosis nigricans may help the primary care provider identify patients in need of testing who might otherwise be overlooked.

Taking a Multidisciplinary Approach

Given the demands of a busy primary care practice, it may be difficult to adhere to clinical practice guidelines. Lack of time during physician office visits and lack of information about gaps in patient care (eg, unsatisfactory control of blood pressure and cholesterol levels) are major barriers to guideline adherence.14 To address these barriers, the current guidelines recommend an office-wide multidisciplinary approach. In this framework, the primary care physician serves as the team leader, who is responsible for coordinating the identification and screening of patients at risk for T2DM. During patient intake, nurses or other office staff can be assigned to ask about and record risk factors for common diseases, including T2DM. Technology can also assist in identifying patients at risk. Electronic medical records can facilitate within-office care coordination by providing electronic messaging and easy access to data during patient office visits.15 In addition to screening reminders, health information technology could be used to create a registry of the patient popula-

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**Figure 1. Risk factors for prediabetes and diabetes mellitus and potential screening criteria for primary care physicians. Reprinted with permission from the AACE (American Association of Clinical Endocrinologists) Diabetes Mellitus Clinical Practice Guidelines Task Force.**

**Figure 2. Patient populations recommended for diabetes screening.**

<table>
<thead>
<tr>
<th>Guideline</th>
<th>Population to Be Screened</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Preventive Service Task Force9</td>
<td>Adults with blood pressure &gt;135/80 mm Hg</td>
</tr>
<tr>
<td>American Academy of Family Physicians10</td>
<td>Adults with both hypertension and hyperlipidemia</td>
</tr>
<tr>
<td>Canadian Task Force for Preventive Health Care11</td>
<td>Adults with hypertension, hyperlipidemia, or both</td>
</tr>
<tr>
<td>American College of Obstetricians and Gynecologists12</td>
<td>Women aged ≥45 years</td>
</tr>
<tr>
<td>American Diabetes Association13</td>
<td>Adults aged ≥45 years or &lt;45 years if body mass index ≥25 with additional risk factors</td>
</tr>
<tr>
<td>American Association of Clinical Endocrinologists7</td>
<td>Adults at increased risk for diabetes beginning at age 30 years</td>
</tr>
</tbody>
</table>
tion with T2DM with care prompts and decision supports. The registry can also provide access to published evidence and patient educational materials.16

**Screening: Where Does HbA1c Testing Fit?**

For decades, the diagnosis of T2DM has been based on plasma glucose criteria: either a fasting plasma glucose (FPG) level of 126 mg/dL or higher, a 2-hour postprandial glucose (PPG) level of 200 mg/dL or higher after ingestion of 75 g of oral glucose, or a random plasma glucose level of greater than 200 mg/dL with symptoms of diabetes mellitus such as polyuria, polydipsia, or weight loss. The use of other measures—such as HbA1c levels, which reflect long-term glycemic exposure—has been the subject of ongoing debate. In 2008, an International Expert Committee with members representing the American Diabetes Association (ADA), the European Association for the Study of Diabetes (EASD), and the International Diabetes Foundation convened and recommended that the diagnosis of T2DM be made if the HbA1c level is 6.5% or higher; the ADA affirmed this decision.13,17 One limitation of measuring HbA1c levels is that, because it is a hemoglobin-based test, anemia or hemoglobinopathies may interfere with the validity of the results. Many physicians acknowledge that measurement of HbA1c levels is a powerful tool, but they still consider measurement of FPG and PPG levels to be the standard of testing. If HbA1c testing is not possible, diagnosis should be based on previously recommended diagnostic methods (eg, measurement of FPG levels or 2-hour PPG levels, with confirmation by repeat testing on a separate day).17

As a practical matter, if a patient’s FPG and HbA1c levels are both elevated, even though the guidelines recommend that the diagnosis not be made until the test results are confirmed, many physicians will assume T2DM is present and base their recommendations to the patient on the basis of that assumption—without necessarily giving the patient that diagnosis until they have had a chance to confirm it with repeat testing. Arriving at a correct, valid diagnosis is especially important for patients with T2DM, because any error could lead to misinformation in medical records and difficulty with healthcare insurance once the diagnosis of T2DM is a matter of record.

**Over-the-Counter Testing Kits: A Teachable Moment**

Concerned that they might have T2DM, some patients will buy and use an over-the-counter testing kit to determine their status. This situation offers an opportunity to teach the patient about the value of the test and how it can be used to discuss further testing. Patients should be encouraged to bring their test results to their next visit. Be realistic; however, that the results of these tests are not definitive because they have not been standardized. More accurate testing is needed before a definitive diagnosis can be made.

**Diagnosing T2DM: Breaking the News and Following Up**

Personalize the Discussion

Whenever possible, try to individualize the initial “discovery” of the disease to each patient’s needs. Be sensitive to what patients already know (or do not know) about T2DM, with the ultimate goal of getting patients to accept the diagnosis and to understand the disease.

Set Goals for Glycemic Control

In newly diagnosed patients with T2DM, physicians can turn to clinical guidelines published by several professional associations. A recent joint position statement by the ADA, the American College of Endocrinology (ACE), and the American Heart Association reviewed a number of clinical trials (including ACCORD and ADVANCE) and concluded that lowering HbA1c levels to less than 7% can reduce the microvascular and neuropathic complications of T2DM. In addition, long-term macrovascular benefits may be achieved in patients with newly diagnosed disease by their maintaining HbA1c levels at less than 7%, and incremental benefits may be achieved by further reduction of HbA1c levels in select patients, such as those with long life expectancy and no clinically significant cardiovascular disease. The American Association of Clinical Endocrinologists (AACE) recommends maintaining a more stringent glycemic target of HbA1c levels at 6.5% or lower.19 Additional patient care goals that have been suggested by the ADA and American College of Endocrinology (ACE)/AACE are given in Figure 3.13,20

Many patients need to return frequently for office visits in the beginning of their treatment. Once the management...
process is established, a good rule of thumb for return visits is every 3 months. Some patients think that such frequent office visits are unnecessary, but it should be understood that the disease can change quickly, even within that short amount of time. As such, it is important to monitor patients closely and adjust their therapy accordingly.

**Tailor the Discussion**

Disparities in disease management due to racial, ethnic, and socioeconomic differences have been well described (Figure 4). Changing population demographics are substantially impacting medical practices that care for patients with T2DM. Minority groups, including Hispanics and African Americans, have higher risks for the disease, and trends in immigration suggest that these segments of the population are increasing in the United States. Lack of social and financial support contributes to the challenge of providing treatment for patients with T2DM. Poor disease control, including changes in blood pressure and glycemic control, is more frequent among racial and ethnic minority groups. Perhaps as a direct consequence, T2DM complications and mortality rates are higher among patients from ethnic minority groups.

Uncover and clear up patient misperceptions—One of the first things that should be determined is whether the patient knows anyone who has had a bad experience with diabetes. Patients with that frame of reference may not be ready to engage in a discussion about the disease. It is important to convey to them that “today’s diabetes is not your grandmother’s diabetes,” that we know a great deal more now, and that we’ve come a long way in terms of managing it. Another important consideration is combating the many culturally based misconceptions about T2DM. To cite just 1 example, young patients who listen to rap music may be exposed to repeated images suggesting that obesity is cool, that it is just a case of being “pumped” and is a desirable trait. The challenge is to convince this patient that obesity is not healthy and is in fact a major contributor to the development of T2DM.

Draw from your knowledge of the patient’s family—Knowing something about a patient’s family members or, better yet, having had the opportunity to treat some of them will help you understand the patient’s perspective, which in turn may help you to be more effective in addressing his or her concerns. For example, if a patient recalls that his diabetic brother needed an amputation or mentions that a family member goes for dialysis, he might be more motivated to adhere to treatment to avoid those complications. At the same time, the patient needs to be reassured that not all people are affected equally by the complications of T2DM. Similarly, while many people are aware of the link between T2DM and its complications, particularly the microvascular ones such as blindness, they often don’t know enough about the power of prevention that is available today.

Play the “celebrity card”—In the absence of a patient’s having an experience with a relative, it may be helpful to point out that many celebrities, such as Dizzy Gillespie and Mahalia Jackson, both died because of complications related to T2DM—but that they didn’t have to. This is a new day for T2DM. That is why Patti LaBelle and B.B. King are still performing. They are taking the necessary steps to control their disease so that they can live full and active lives. Or, to put it more graphically, if B.B. King was not in control of his glucose levels and was developing neuropathy and numbness in his fingers, he would not be able to play his guitar, “Lucille.” If Patti LaBelle developed neuropathy in her feet, she would not be able to spin around in her high heels while performing on stage.

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**Figure 3.** Patient care goals recommended by the American Diabetes Association (ADA), the American College of Endocrinology, and the American Association of Clinical Endocrinologists. In addition, the ADA recommends aspartin use and the pneumococcal vaccination, when appropriate.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="American Diabetes Association*" /></td>
<td></td>
</tr>
<tr>
<td>□ Glycemia</td>
<td><img src="image" alt="" /></td>
</tr>
<tr>
<td><img src="image" alt="Glycated hemoglobin, %" /></td>
<td>&lt;7.0</td>
</tr>
<tr>
<td><img src="image" alt="Fasting plasma glucose, mg/dL" /></td>
<td>70-130</td>
</tr>
<tr>
<td><img src="image" alt="Postprandial glucose, mg/dL" /></td>
<td>≤ 180</td>
</tr>
<tr>
<td><img src="image" alt="Blood Pressure, mm Hg" /></td>
<td>≤ 130/80</td>
</tr>
<tr>
<td><img src="image" alt="Lipids, mg/dL" /></td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Low-density lipoprotein cholesterol" /></td>
<td>≤ 100</td>
</tr>
<tr>
<td><img src="image" alt="High-density lipoprotein cholesterol" /></td>
<td>&gt; 40 (men)</td>
</tr>
<tr>
<td><img src="image" alt="Triglycerides" /></td>
<td>≤ 150</td>
</tr>
<tr>
<td><img src="image" alt="American College of Endocrinology" /></td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Glycemia" /></td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Glycated hemoglobin, %" /></td>
<td>≤ 6.5</td>
</tr>
<tr>
<td><img src="image" alt="Fasting plasma glucose, mg/dL" /></td>
<td>≤ 110</td>
</tr>
<tr>
<td><img src="image" alt="Postprandial glucose, mg/dL" /></td>
<td>≤ 140</td>
</tr>
</tbody>
</table>

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**Figure 4.** Physician considerations in a culturally oriented clinical encounter.

- Acculturation
- Body image
- Cultural competence
- Depression
- Educational level
- Fears
- General family integration and support
- Health literacy
- Individual and social interaction
- Judgment and beliefs about the disease
- Language
- Myths
- Nutritional preferences
- Other types of medicine (alternative therapies)
- Physical activity
- Quality of life
- Religion and faith
- Socioeconomic status
Dealing with denial—Perhaps the greatest challenge with some patients is to get them to acknowledge that they have the disease at all. Many patients will be in denial initially, especially those who are asymptomatic. It may help to ask, “Do you think you have diabetes?” Be prepared to encounter barriers that will need to be overcome through discussions and explanations. For patients to become engaged in their therapy, they need to admit that they have the disease. A useful analogy is the alcoholic who says at an Alcoholics Anonymous meeting, “I am an alcoholic.” Conversely, you may encounter patients who are actually relieved to know why they have not been feeling well and are pleased to learn that the cause is not something far worse.

Assess Patients for Current and Potential Complications
Studies have shown that early signs of atherosclerosis may be present in untreated patients with newly diagnosed T2DM. In other studies of patients with newly diagnosed T2DM, lipid abnormalities, particularly elevated triglyceride levels, and obesity have been associated with an increased risk of cardiovascular death. In addition, many patients with impaired fasting glucose levels, impaired glucose tolerance, or diabetes at all. Many patients will be in denial initially, especially those who are asymptomatic. It may help to ask, “Do you think you have diabetes?” Be prepared to encounter barriers that will need to be overcome through discussions and explanations. For patients to become engaged in their therapy, they need to admit that they have the disease. A useful analogy is the alcoholic who says at an Alcoholics Anonymous meeting, “I am an alcoholic.” Conversely, you may encounter patients who are actually relieved to know why they have not been feeling well and are pleased to learn that the cause is not something far worse.

Empower Your Office Staff to Support the Patient
For primary care providers, it is important to emphasize the team approach that your staff offers for patients. Let patients know that they are not alone and that a wide range of expertise is available so that the patient feels supported while engaged in their therapy, they need to admit that they have the disease. A useful analogy is the alcoholic who says at an Alcoholics Anonymous meeting, “I am an alcoholic.” Conversely, you may encounter patients who are actually relieved to know why they have not been feeling well and are pleased to learn that the cause is not something far worse.

Involving the Patient’s Family and Use Resources Outside of Your Practice
Inform patients about evidence from large, prospective, randomized controlled trials that indicate that intensive management of T2DM can reduce the number of chronic complications and that early and aggressive glycemic control has been found to prevent or delay the development of complications. It helps to explain to patients that the blood sugar goals you are recommending have been established by organizations like the ADA and the AACE and are based on data from large clinical studies. You can point out that evidence indicates patients can avoid eventual complications by achieving and maintaining therapeutic goals such as the ones you are setting.

Family integration is often critical. If only 1 person in the family has diabetes mellitus and the rest of the family is not supportive, it is much less likely that the patient will be successful in controlling the disease. If the patient happens to be the mother, she may feel less urgency to make the recommended changes, such as cooking a different meal for herself, or expect the rest of the family to follow her new eating habits. In some communities, however, the opposite may be true. Some physicians try to find out if there is a matriarch or a patriarch in the family and then bring that person into the office because of his or her potential positive influence on the rest of the family. In cases where a parent is the patient, it might help to point out that if these changes are made for the rest of the family as well, the children may be healthier as a result.

The motivation for parents to change may be increased by their willingness to do anything to help their children.

In some rural areas, the medical community may not be fully trusted, so to engage the population fully it may be necessary to engage nonmedical providers, such as the local clergy or community health workers.

Treating T2DM: Lifestyle Modifications Alone or With Metformin?
Guidelines Support Lifestyle Changes Plus Metformin as Initial Therapy
The ADA guidelines recommend the inclusion of metformin relatively early in the management of T2DM. Indeed, the ADA/EASD algorithm for the management of patients with T2DM recommends the combination of lifestyle modifications plus metformin as initial therapy (Figure 5). A similar recommendation for patients with an HbA1c level of 6.5% to 7.5% has been given by the AACE/ACE Consensus Panel on Type 2 Diabetes Mellitus (Figure 6). The evidence supporting these recommendations shows that, in many cases, the most likely means of stemming disease progression includes the use of metformin plus lifestyle changes.

Since T2DM is a lifelong disease and treatment goals therefore extend beyond short-term gain, it is important to be aggressive early and then reduce therapeutic interventions if appropriate.

During the past 40 years, the therapeutic profile of metformin has improved. Metformin is relatively inexpensive and has an established safety profile; lower doses are associated with fewer adverse effects. Evidence points to improved efficacy of metformin the earlier it is introduced. A 2010 study found that the use of metformin within the first 3 months of diagnosis decreased the drug’s failure rate by 50%. Conversely, waiting 3 months before initiating therapy reduces the drug’s duration of effectiveness.
deserve to be given the chance to see whether lifestyle modifications alone can provide sufficient improvement in their blood sugar levels. They think that a pharmaceutical agent like metformin, introduced simultaneously, can obscure the results of and undermine the importance placed on lifestyle changes as a means of improving glycemic control.

Nonetheless, physicians should refrain from making predictions about the course of the disease if only lifestyle measures such as dieting and exercise are initially prescribed. Patients may give up on lifestyle modifications as a valid treatment approach if, after 6 weeks, blood glucose levels do not improve. To set expectations at a reasonable level at the outset, the patient should be told that the initial test results suggest that T2DM may be present. As a result, the first step...
will be to see what happens to the blood sugar levels after some lifestyle changes are made for a specified period. If the blood sugar levels are still abnormal when the patient is retested at the end of that interval, it will be necessary to proceed with a definitive drug treatment plan. The physician can then position the lifestyle changes as “something we tried, and now we need something else to add to your existing lifestyle changes, which I know you are working on.”

One controversy is that according to the ADA guidelines, an HbA1c level greater than 6.5% is diagnostic of T2DM, but the glycemic goal is less than 7%. In this case, it might be argued that lifestyle may be sufficient to slow the progression of the disease. However, because lifestyle modifications are often not successful, it may still be reasonable to start metformin concurrently.

Adjusting Metformin Dosing

No matter which course is taken, early intervention affords the best chance of halting and possibly reversing T2DM. There is now clear evidence that the sooner patients can reach and maintain their blood sugar level goals, the better their long-term outcomes will be. This is called the legacy effect, and it is associated with a window of opportunity to minimize T2DM-related complications.36-39 Paralleling this approach, the algorithms for the management of T2DM developed by the ADA/EASD and AACE/ACE place an increased emphasis on tight glycemic control. They call for the assessment of patients every 2 to 3 months with a switch to new regimens or the addition of medications when glycemic goals are not met.19,32 Adjustments to metformin dosing should follow this assessment schedule.

When Lifestyle Modification Plus Metformin Is No Longer Enough

The current guidelines produced by the ADA, EASD, and ACE/AACE offer treatment algorithms for the addition of agents when the combination of lifestyle modifications and metformin no longer provides adequate glycemic control (Figure 7).19,32 Various categories of agents are currently available for use at this stage, including sulfonylureas, thiazolidinediones (TZDs), and incretin-based agents.

Sulfonylureas

The sulfonylurea class of agents (eg, glipizide, glibenclamide) has been in use for more than 6 decades. Sulfonylureas have the advantage of the familiarity of use that comes with such long-term use. These drugs have an established level of efficacy and well-known safety concerns involving hypoglycemia and weight gain.40

Thiazolidinediones

The TZD class includes the agents pioglitazone and rosiglitazone, although rosiglitazone is under restricted use in the United States because of cardiovascular concerns. A third agent, troglitazone, was withdrawn because of concerns about drug-induced hepatitis, leaving pioglitazone as the most-used drug in this category.

Pioglitazone has a unique mechanism of action and is effective as an add-on agent to metformin, the sulfonylureas, and insulin. Because pioglitazone is an insulin sensitizer, insulin-resistant patients might experience greater benefit, especially because they might gain more weight. The agent is associated with an 81% efficacy in preventing the progression of prediabetes to T2DM,42 offers a durable reduction of HbA1c levels, and has positive β-cell effects. Its adverse event profile includes weight gain, fluid retention, and precipitation of heart failure in susceptible people, as well as concerns about bladder cancer and risk for bone loss.43

Incretin-Based Agents

The dipeptidyl peptidase-4 (DPP-4) inhibitors include the oral agents sitagliptin and saxagliptin, which are similar in efficacy but differ in their pharmacokinetics. Both sitagliptin and saxagliptin are available as combination products with metformin, which simplifies the regimen and is an important consideration for some patients. Sitagliptin is also an option for patients who cannot tolerate metformin because of gastrointestinal problems. Major Adverse Cardiac Events, or MACE, data for saxagliptin suggest a potential for cardioprotective effects.44 Although some patients might gain weight with DPP-4 inhibitors, these agents typically cause neither weight gain nor weight loss (Figure 8).45

There are 2 injectable glucagon-like peptide-1 (GLP-1) agonists currently on the market: exenatide (taken twice daily) and liraglutide (taken once daily). Exenatide has been approved as monotherapy and in combination; liraglutide has been approved for only combination therapy. These agents lower HbA1c levels and provide improvements in blood pressure and lipid levels independent of weight loss (Figure 9). For people in high-risk categories, these added benefits may improve long-term outcomes. For patients with the metabolic syndrome cluster of risk factors, these agents are an alternative to TZDs. The primary care

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADA/EASD</th>
<th>AACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycated hemoglobin goal</td>
<td>7.0%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Treatment strategy</td>
<td>Encourage early combination therapy</td>
<td>Based on baseline glycemia; early combination therapy</td>
</tr>
<tr>
<td>Choice of blood glucose–lowering drugs</td>
<td>Uses tiered approaches (well validated vs less well validated); includes GLP-1 agonists</td>
<td>Uses all approved therapies including GLP-1 agonists and DPP-4 inhibitors</td>
</tr>
</tbody>
</table>

Figure 7. Comparison of recommendations from the American Diabetes Association (ADA)/European Association for the Study of Diabetes (EASD) and the American Association of Clinical Endocrinologists (AACE).19,32 Abbreviations: DPP-4, dipeptidyl peptidase-4; GLP-1, glucagon-like peptide-1.
physician should explain to the patient that this is a noninsulin product, describe how the drug works, and include realistic expectations of the weight loss it may provide. It may be helpful to have patients receive the first injection in the office so they can overcome any fear that they might have.

Both DPP-4 inhibitors and GLP-1 agonists function in a glucose-dependent manner, which minimizes the risk of hypoglycemia. This is an attractive benefit for patients with certain occupations in whom hypoglycemia would be of particular concern, such as airplane pilots.

**Fostering Patient Self-Management

**Primary Care Physician’s Role: Central to Care

Primary care physicians are in the best position to treat patients with a chronic disease such as T2DM because these physicians usually have the most knowledge about the patient and have an established relationship through regular interactions. It is difficult for referral centers to develop that kind of relationship. The physician and office staff can teach patients the basics of self-care and self-monitoring including how to check their feet, tips on smoking cessation, how to monitor their blood pressure and glucose levels, and perhaps most important, what any changes mean to the patient’s overall health. Patients should be asked to use a blood glucose monitor and to keep a diary recording preprandial and 2-hour postprandial readings. The physician or a staff member should review these findings with patients so that they understand the value of these tools and why they are being asked to use them.

The physician may be seen as the coach or the technical advisor, but it is the patient who is responsible for the majority of T2DM care. If the patient is not cooperative, the physician is limited in what he or she can do. To make more clear to the patient the importance of his or her cooperation, some primary care providers draw up a written contract for patient self-management, which is signed by the patient and kept with the patient’s chart.

**Patient’s Role: Critical to Success

Emphasize the central role that the patient will play in the management of his or her disease. As the healthcare provider, you can set goals for the patient from 1 visit to the next. For example, 1 person might start walking more and another person might stop drinking soda.

Either of those is a positive step, and letting patients choose which step to attempt helps them engage in the process and gives them an opportunity to be proactive. It also helps when patients understand that if the disease is controlled they will feel better, and that if they don’t feel better the therapy can be adjusted until they do. Even with the omnipresent time constraints in the typical primary care physician’s office, T2DM is sufficiently serious to warrant 4 visits per year—visits during which the physician and the patient are devoted solely to the issue of T2DM.

**Improved Medications and Information Sources

A major factor that negatively influences adherence to disease self-management is a frequent or complex dosing regimen of medications. Fortunately for patients engaged in self-care, an increasing number of therapeutic agents are being developed in long-acting, once-a-day (or even less frequent) formulations. Combinations of some medications are available as a single tablet, and administration of T2DM medications is becoming less dependent on when patients eat. All of these factors enhance patient adherence to self-care regimens.

Patient education materials that describe self-care and provide helpful guidance are available in many languages and have been developed by people from various cultures. These materials include Web-based programs and social networking sites.

**Wellness Coaches

A relatively new aid to patient self-management is the advent of the wellness coach. These are medical assistants who deal with the most challenging patients—those who rarely or never meet their goals and make excessive use of emergency medical services. The wellness coach visits patients’ homes to observe their personal environment. Coaches are trained to give standard tests, evaluations, and interviews, as well as to observe the surroundings. They are instructed not to be intrusive, but if it is mealtime they can see what is being served and the size of the portions. If someone opens a cabinet, they can glean clues about the patient’s and family’s lifestyle, as well as about adherence or nonadherence through the presence of durable medical goods and prescriptions and medicines that may be unopened or unused.

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**Figure 9. Profile of glucagon-like peptide-1 agonists.**

**Figure 8. Profile of dipeptidyl peptidase-4 inhibitors.**
Long-Term Patient Care: Disease Progression

Why Is Glycemic Control So Difficult to Maintain Over Time?

Targets of current therapeutic agents—Despite the wide availability of various oral antihyperglycemic agents and insulin formulations, nearly half of patients with T2DM have HbA1c levels above the recommended goal of 7.0%. Patients treated with traditional antihyperglycemic agents often fail to reach glycemic goals or, once achieved, do not maintain these goals long term. The inability to maintain long-term glycemic control may result, in part, from agents not targeting the underlying pathophysiologic processes, which include progressive decline in β-cell function and an impaired incretin response.

Patient complacency—As patients continue with self-management year after year, it is easy for them to become complacent toward the importance of maintaining the lifestyle changes that were established at the beginning of their therapy. Patients may develop bad habits, forget important details, or become overconfident about the level of their glycemic control. To keep from sliding backward, patients should be re-educated every few years about the importance of the lifestyle component of their disease management. The value of this aspect of their self-care is reinforced by the fact that all T2DM medications are approved for use in conjunction with recommended changes in lifestyle.

Indirect monitoring of disease progression—The continuous assessment of glycemia is considered by some to be an indirect monitoring of the progression of β-cell function. Disease progression is measured by when and how quickly additional agents are needed to maintain or improve the HbA1c levels—that is, tracking which agents are best able to maintain HbA1c levels for the longest time without deterioration.

Monitoring for T2DM-Related Complications

The ADA provides recommendations for screening for T2DM-related complications; nevertheless, many patients remain unscreened. Evidence of cardiovascular complications in the presence of a stable HbA1c level might be an indicator of the progression of T2DM. If a patient is asymptomatic, however, the early indicators of ischemia might be missed. Although most patients with T2DM will die of cardiovascular disease, there is a lack of consensus regarding which tests are most appropriate for monitoring cardiovascular complications. If patients admit to shortness of breath or chest pains, electrocardiography would be indicated. Cardiologists and other providers will often recommend stress tests or imaging studies, but there is no evidence regarding the efficacy of these tests until a patient has an event, such as chest pain. Biomarkers and surrogate markers are being developed to monitor patients with T2DM; it is hoped that these agents will be used commonly in practice once the science behind them is sufficiently robust.

Referral to an Endocrinologist

Many primary care physicians will refer a patient to an endocrinologist when the patient has reached the point of needing insulin. This can be problematic in areas of the United States in which endocrinologists are scarce. In general, a primary care physician should refer the patient if the patient exceeds his or her capability to handle a clinical problem. This might involve a patient’s attitude toward the illness or might be due to progression of disease to a stage requiring a regimen that is more complex than the primary care physician has the time, expertise, or willingness to engage. The primary care physician may feel unable to provide the treatment or sense that the patient requires a new approach. Some patients will determine from self-education that referral might be appropriate for them and will refer themselves to an endocrinologist.

Conclusion

Identification of individuals at risk for T2DM, as well as of those who may already have the disease but in whom it has not yet been diagnosed, is a key element in reducing the overall burden of this disease. Early initiation of treatment can prevent or delay disease progression and reduce the risk for diabetes-related complications. Achieving evidence-based clinical goals by implementing effective management strategies substantially reduces the risk of morbidity and mortality and ultimately improves patient outcomes.

References


Editor’s Note: Slides from the roundtable discussion are available online at http://www.jaao.org/gk/content/full/111/5/suppl/453/DC1.