At the point when diabetes management with oral medications no longer effectively lowers hyperglycemia and/or the use of certain oral medications is contraindicated, insulin therapy should be considered. Both age and diabetes-related changes alter physiology and glucose metabolism and utilization. As a result, older adults exhibit a higher prevalence of hyperglycemia throughout the day, along with more marked postprandial blood glucose values (Odegard, Setter, & Neumiller, 2007). Lowering hemoglobin A1C (HgA1C) levels to below or around 7% has been shown to reduce microvascular and neuropathic complications of type 2 diabetes and may be beneficial for lowering the risk of macrovascular disease in the years soon after initial diagnosis (Skyler et al., 2009). Evidence-based guidelines from the American Diabetes Association (ADA, 2011) serve as a valuable resource to guide clinicians in transitioning older adults with diabetes to insulin therapy.

**ABSTRACT**

Many older adults with type 2 diabetes require insulin to supplement or replace oral hypoglycemic agents to achieve better glycemic control. Over time, the addition of this more intensive therapy is needed to preserve beta cell function or prevent macrovascular or microvascular sequelae. This is the result of the natural progression of diabetes and not a failure on the part of the patient. Clinicians must evaluate many factors in an attempt to individualize a safe optimal glycemic level for older adults. Considerations should include when insulin should be initiated, the type of insulin and regimen, and a safe individualized target goal while preventing hypoglycemia. Important in this decision are the patient’s comorbid conditions, functional and cognitive status, social environment, financial ability, and life expectancy. The risks and benefits of more stringent glycemic control must be considered in the context of treatment options, priorities, and quality-of-life issues for both the patient and family.

**TRANSITIONING TO INSULIN THERAPY**

The approach to introducing older adults to insulin therapy differs from that of younger adults with type 2 diabetes in a number of ways. According to Hendra (2002), consideration must be given to existing comorbid conditions that may compromise physiological function and health. Further, age-related changes in the senses and functional abilities may make it difficult for older adults to self-monitor blood
glucose levels, administer insulin, and treat hypoglycemia. Such age-related changes are ongoing and will require regular follow up to monitor and make adjustments as needed. Furthermore, the social situation of older adults who live alone or depend on a caregiver must be considered when initiating therapy.

Hendra (2002) emphasized that starting insulin should be based on a comprehensive assessment to determine the patient’s functional abilities, cognitive status, and mood. The use of commonly available screening tools for assessment will provide a valid and realistic profile of the individual’s physical function related to activities of daily living (ADLs) (e.g., Katz Index of Independence in ADLs [Katz, 1983]), mental status (Mini-Mental State Examination [Folstein, Folstein, & McHugh, 1975]), and mood (Geriatric Depression Scale [Yesavage et al., 1982-1983]), specifically evaluating for the presence of anxiety and/or depression. Wang, Carabino, and Vergara (2003) noted that an assessment of these dimensions will provide helpful information about the older adult’s ability to self-administer insulin and manage hypoglycemia.

Mayfield and White (2004) suggested discussing “the possibility of insulin therapy well in advance of when it needs to be implemented, so patients will have time to explore their fears and obtain information” (p. 494). Insulin therapy should never be used as a threat to increase adherence to diet and oral medications or portrayed as a failure on the part of the patient. The natural progression of diabetes often results in even adherent patients having to transition to insulin therapy (Mayfield & White, 2004) to achieve better glycemic control. Whenever possible, providers should simplify instructions and dosing regimens when initiating insulin therapy. Educating the patient’s caregiver on the administration of insulin, recognition of hyper- and hypoglycemia, and appropriate treatment approaches must also be included in the plan of care (Chelliah & Burge, 2004; Ober, Watts, & Lawrence, 2006).

Polonsky and Skinner (2010) recommended using the concept of perceived treatment efficacy to help motivate individuals with diabetes to demonstrate how the effects of their actions influence the desired outcomes of treatment. By continuing to emphasize the goals of therapy, such as achievement of target HgA1C levels near 7% without any episodes of hypoglycemia, older adults may be motivated to add insulin to their regimen and to monitor the results via finger-stick blood glucose assessments at both fasting and postprandial times during the day. Self-monitoring actively engages older adults in management of the disease and helps reinforce the connection between physical activity and dietary patterns as well as the added effect of various medication regimens on the achievement of diabetic control outcomes. Recognizing these relationships—such as better glucose control after certain medications are introduced or titrated, after dietary patterns are followed, or after performing exercise activities—will help reinforce the older adult’s perceived benefits of the activity (Polonsky & Skinner, 2010).

This concept is depicted with the use of blood glucose monitoring by Dr. Polonsky in collaboration with Roche Diagnostics in a process called “Testing in Pairs.” This procedure is illustrated with online tools and videos of its application at https://www.accu-chek.com/us/
Such online resources may assist older adults in using self-monitoring of blood glucose (SMBG) to recognize the effects of therapies on diabetic management (Polonsky & Skinner, 2010). Patient involvement by way of self-titration can improve treatment success. Practical, real-life decisions will depend on preference for injection frequency, frequency of SMBG, lifestyle routines, and other factors affecting the patient’s ability to follow the prescribed regimen. For example, some patients may prefer premixed therapy to basal-bolus therapy or once-per-day therapy. Treatment intensification of insulin therapy will help patients maintain glycemic control. As individuals document changes in their SMBG logs and see lower HgA1C results on quarterly assessments, progress toward achieving these targets will reinforce and reward their efforts (ADA, 2011).

### Insulin Regimens for Type 2 Diabetes

**Table 1**

<table>
<thead>
<tr>
<th>Insulin Regimen/ Common Preparations</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Basal only*                          | • Simple initiation and dosage titration  
  • May involve only one daily injection  
  • Lower risk of hypoglycemia       | • Does not address postprandial hyperglycemia  
  • Patient may eventually need intensification of therapy, especially as HgA1C levels approach <8%  
  • Administration, absorption, and dosing errors are likely as changes in older adults’ functional and physiological status occur |
| Glargine (Lantus*), detemir (Levemir*), NPH (Humulin N*, Novolin N*) |                                                                                           |                                                                                                    |
| Twice-daily pre-mixed                | • Simple to use  
  • Offers postprandial coverage  
  • Requires two daily injections | • Need to re-suspend insulin at injection time  
  • Fixed mealtimes with stable carbohydrate content are recommended  
  • Administration, absorption, and dosing errors are likely as changes in older adults’ functional and physiological status occur |
| 70% NPH, 30% regular (Humulin* 70/30, Novolin* 70/30); 75% NPL, 25% lispro (Humalog® Mix 75/25); 70% aspart protamine, 30% aspart (NovoLog® Mix 70/30); 50% NPL, 50% lispro (Humalog® Mix 50/50) |                                                                                           |                                                                                                    |
| Basal-plus                           | • Time of main meal may vary  
  • At least two daily injections required  
  • Higher risk of weight gain  
  • Administration, absorption, and dosing errors are likely as changes in older adults’ functional and physiological status occur |                                                                                                    |
| Option 1: Glargine at bedtime or every morning PLUS rapid-acting insulins (i.e., lispro [Humalog®], aspart [NovoLog®], or glulisine [Apidra®]) with the main meal |                                                                                           |                                                                                                    |
| Option 2: NPH or detemir twice daily PLUS rapid-acting insulins (i.e., lispro, aspart, or glulisine) with the main meal |                                                                                           |                                                                                                    |
| Basal-bolus                          | • Allows maximum flexibility with timing and portion of meals  
  • Regimen most likely to achieve target HgA1C goals | • Four or more injections required per day and frequent self-monitoring of blood glucose  
  • Presents highest risk for hypoglycemia  
  • Administration, absorption, and dosing errors are likely as changes in older adults’ functional and physiological status occur |
| Option 1: Glargine at bedtime or every morning PLUS rapid-acting insulins (i.e., lispro, aspart, or glulisine) with each meal |                                                                                           |                                                                                                    |
| Option 2: NPH or detemir twice daily PLUS rapid-acting insulins (i.e., lispro, aspart, or glulisine) with each meal |                                                                                           |                                                                                                    |

*Adapted from Nathan et al. (2009) and Sheikh-Ali and Chehade (2009).

Note. Hg = hemoglobin; NPH = neutral protamine Hagedorn; NPL = neutral protamine lispro.

* Increase or decrease the dosage if fasting blood glucose readings are above or below target, respectively.

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protamine Hagedorn (NPH) or a basal insulin (e.g., glargine [Lantus®]) given at bedtime. For individuals with postprandial hyperglycemia and fasting euglycemia, oral antihyperglycemia therapy should be stopped, and NPH or detemir (Levemir®) should be given in the morning or a rapid or short-acting insulin given before the two or three main meals of the day (Table 1) (Sheikh-Ali & Chehade, 2009).

Most individuals with elevated fasting glucose in the range of 120 to 200 mg/dL and postprandial hyperglycemia in the range of 160 to 200 mg/dL will need to continue their oral antihyperglycemic agent and start on an intermediate insulin at bedtime, such as NPH or a basal insulin (e.g., glargine) at bedtime. Basal insulins are often preferred because they have a lower risk for hypoglycemia. For individuals who have contraindications for oral antihyperglycemic agents, twice-daily dosing of an intermediate insulin or premixed insulin or once-daily basal insulin (e.g., glargine) may be used. Individuals with elevated fasting glucose levels >200 mg/dL and postprandial hyperglycemia >240 mg/dL may require twice-daily mixed insulins or basal-plus regimens to achieve euglycemia (Table 1) (Sheikh-Ali & Chehade, 2009).

The ADA (2011) supports education and intensification of therapy for older adults with diabetes who have a reasonable life expectancy, are active, possess good cognitive function, and are willing and able to actively participate in their treatment. Goals of therapy should be less aggressive for those patients who are cognitively impaired or have significant life-limiting comorbidities. Aims of therapy for this latter group should be to achieve glycemic goals that avoid acute complications of diabetes, such as dehydration, poor wound healing, and hyperglycemic coma (ADA, 2011).

### INSULIN DELIVERY DEVICES

The availability of a wide selection of insulin pens has helped patients overcome some of the barriers to introducing insulin in the treatment plan. Some providers have embraced these devices while others have relied on more familiar syringes and vials. Multiple studies have demonstrated that insulin pens may be more ac-

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**TABLE 2**

<table>
<thead>
<tr>
<th>Service</th>
<th>Medicare Benefit</th>
<th>Cost to Older Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screening for diabetes</td>
<td>Covered if older adult is at risk for diabetes or has pre-diabetes</td>
<td>No cost</td>
</tr>
<tr>
<td>Diabetes self-management training and education</td>
<td>First year: 10 hours; every year thereafter: 2 hours</td>
<td>20% of Medicare-approved amount after the annual Part B deductible of $162</td>
</tr>
<tr>
<td>Medical nutrition therapy</td>
<td>With a physician’s referral, first year: 3 hours; every year thereafter: 2 hours (more if physician ordered)</td>
<td>No cost</td>
</tr>
<tr>
<td>Glucose monitors and supplies (e.g., test strips, lancet devices, lancets, test and control solutions)</td>
<td>In limited quantities; available whether or not insulin is used</td>
<td>20% of the Medicare-approved amount after the annual Part B deductible of $162.</td>
</tr>
<tr>
<td>Insulin (when used with a pump)</td>
<td>Insulin and pump may be covered as durable medical equipment</td>
<td>20% of the Medicare-approved amount after the annual Part B deductible of $162</td>
</tr>
<tr>
<td>Insulin (when not used with a pump)</td>
<td>Part D only: Insulin and supplies necessary for injection (e.g., syringes, needles, alcohol swabs, gauze); other medications for diabetes treatment as long as they are on plan’s formulary.</td>
<td>20% of the Medicare-approved amount after the annual Part B deductible of $162</td>
</tr>
<tr>
<td>Foot care for individuals with diabetes-related nerve damage</td>
<td>Every 6 months</td>
<td>20% of the Medicare-approved amount after the annual Part B deductible of $162</td>
</tr>
<tr>
<td>Therapeutic shoes for patients with severe diabetes-related foot disease</td>
<td>With physician certification, one pair of shoes and inserts per calendar year</td>
<td>20% of the Medicare-approved amount after the annual Part B deductible of $162</td>
</tr>
<tr>
<td>Glaucoma screenings</td>
<td>Once every 12 months</td>
<td>20% of the Medicare-approved amount after the annual Part B deductible of $162</td>
</tr>
</tbody>
</table>

Adapted from Centers for Medicare & Medicaid Services (2010).

* Certain restrictions apply regarding use of providers who accept Medicare assignment, use of Medicare–approved providers, and use of Medicare–contracted suppliers in certain states.
accurate, convenient, and less painful than syringes (Haak, Edelman, Walter, Lecointre, & Spollett, 2007; Kortkowski, Bell, Jacobsen, & Suwananasari, 2003; Spollett, 2008). Older adults also appreciate that pens can be used more discreetly and transported more safely than traditional vials and syringes. Based on a critical review of published studies comparing insulin delivery devices, Ashe, Shane-McWhorter, and Rapaparla (2010) concluded that switching to pens is preferred by many patients, improves adherence to therapy, improves dose accuracy, and eliminates waste, thus reducing health care costs. Studies with older diabetes patients as well as those with some hearing or visual impairment have demonstrated that the devices can be used safely (Case Western Reserve University, 2010; Valentine & Kruger, 2010).

Despite the obvious advantages of pen delivery devices over traditional vials and syringes, some older adults may prefer to use syringes and vials if they have done so for years and it is habit or because pens are not covered by their health insurance programs. In fact, fewer individuals with diabetes in the United States (17%) use insulin pens compared with patients in Japan and Western European countries (95% and 88%, respectively), largely due to lack of third-party coverage or higher co-pay requirements (Garg, 2010). Medicare, Medicaid, and Kaiser Permanente do not cover these devices.

Older adult consumer groups and health care providers should advocate for their patients to receive reasonable coverage for insulin and delivery systems that help patients achieve the best glycemic outcomes. Some older adults with diabetes also use insulin pump devices, which are covered by Medicare Part B—if patients meet certain requirements. Some patients may even use a combination of devices. For example, patients on a stable basal insulin dosage may use syringes prefilled by their caregivers for their basal dosage and then use an insulin pen pre-meal so they can dial in the dosage based on pre-meal glucose and carbohydrate content of the meal. If patients have manual dexterity or sensory impairments, which make self-administration difficult, their caregivers should be taught to administer the insulin doses. Education provided by qualified diabetes professionals who are familiar with these products will ensure selection of the appropriate delivery system that matches the abilities and needs of the patient (Valentine & Kruger, 2010).

**MEDICARE BENEFITS FOR OLDER ADULTS**

Primary care providers should be familiar with the recently revised Medicare benefits for diabetes self-management education (DSME) and diabetic supplies that began January 1, 2011, so they can effectively use these benefits in the treatment care plan (Table 2). Medicare Part B covers blood glucose monitors, test strips, lancets and devices, and test and control solutions. Insulin is only covered under Medicare Part B if used with an external insulin pump. Periodic monitoring evaluations such as dilated eye examinations, glaucoma screening, HgA1C screenings, and influenza and pneumococcal vaccines are also covered by this benefit (Centers for Medicare & Medicaid Services [CMS], 2010).

Medicare Part D covers diabetes self-management training. Services in a Medicare-approved diabetes education program for a total of 10 hours of initial training should be completed within a 12-month period from the onset of training. After that, an additional 2 hours of follow-up training each year is provided by this benefit, as long as these services are prescribed for the patient. The patient is required to pay 20% of the Medicare-approved amount after the yearly Part B deductible is met. A list of Medicare-approved training programs is available at http://professional.diabetes.org/ERP_List.aspx.

In addition to DSME, Medicare covers medical nutrition services if prescribed by the health care provider. These services, provided by registered dieticians or nutritional professionals, include nutrition assessment and counseling with emphasis on lifestyle factors, as well as follow-up sessions to help guide the patient through lifestyle changes. A total of 3 hours of individual or group sessions during the first year of eligibility are provided, with follow-up of 2 hours for each subsequent year with the provision that additional hours may be prescribed if the patient’s condition or treatment changes. Effective use of these Medicare benefits can help older adults overcome barriers to management of their diabetes. Moreover, patients with diabetes who have recently become eligible for Medicare are also eligible for these benefits. Providers should also prescribe medical nutrition therapy and DSME for these patients to enhance their understanding and management of this chronic disease. Some states require patients to use supplies or services that have been approved by that state, so providers may want to have a list of these requirements available for their patients (CMS, 2010).

**SUMMARY**

Finding the right balance of lifestyle and pharmacological interventions for older adults with diabetes is challenging. Ongoing education and surveillance are essential in helping older adults manage their diabetes. Initiating insulin therapy when oral therapy alone is no longer effective for controlling hyperglycemia, frequent monitoring for adverse effects, and adjustment of target goals and therapies will help individualize the treatment plan for older adults with diabetes. Engaging older adults in all aspects of their diabetic management while using available educational and reimbursement strategies will facilitate attainment of desired treatment goals that promote a higher quality of life.
REFERENCES


