MANAGEMENT OF DIABETES IN THE OLDER ADULT

by

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the requirement for the degree of

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TO THE FACULTY OF WASHINGTON STATE UNIVERSITY:

The members of the Committee appointed to examine the clinical project of MICHELE HANSEN find it satisfactory and recommend that it be accepted.

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Chair

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ACKNOWLEDGMENTS

When I started the journey to further my education a Masters in Nursing seemed out of my reach. It was only when I applied to the program and was admitted did I admit to myself it was something I wanted to do. I could not have made this journey without thanking the people who helped me reach my goal.

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Chair: Cynthia Corbett

Diabetes is a common problem in older adults, as they increasingly comprise a larger proportion of patients newly diagnosed with diabetes. Approximately 13% of adults 70 years and older have diabetes mellitus, and 11% of adults between age 60 and 74 have diabetes that remains undiagnosed. The increasing burden of caring for aging Americans will require improved patient care, greater public health involvement, and innovative clinical strategies and interventions.

Management of diabetes is complex and challenging, involving diet, exercise, daily medication and glucose testing. Older adults often have functional, physical, or cognitive deficits that make management even more challenging.

Uncontrolled blood glucose levels compound conditions such as heart disease, hypertension, eye and circulatory problems that are often found in the older adults. Age complicates treatment because of the patient’s concomitant chronic illnesses, age related physiological changes, sedentary lifestyle and medications that either promote the development of insulin resistance and hyperglycemia or complicate its management.

Diabetes is one of the most costly chronic medical conditions due largely to complications. In the United States, one in every seven health care dollars and 25% of the Medicare budget are spent on patients with diabetes. As glycemic control worsens
health care costs increase. Goals for therapy should include an assessment of the older adults' functional status, life expectancy, financial and social support, and their desire for treatment.

The Chronic Care Model identifies essential elements of a health care system that encourage high-quality chronic disease care. These important elements are the health system, self-management support, community, decision support and clinical information systems. Specific examples of how clinicians can implement elements of the Chronic Care Model to improve diabetes management with an older adult population will be provided.
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INTRODUCTION

Diabetes mellitus is a prevalent, costly condition that causes significant morbidity and mortality. In the United States, an estimated 18.2 million people (6.3% of the total population) have diabetes, of which 5.4 million are undiagnosed (ADA, 2005). According to 1996 death certificates, diabetes is the seventh leading cause of death in the United States. The costs of diabetes to the American healthcare system are enormous, with total costs estimated at $132 billion in 2002 (Hogan, 2003).

Reducing morbidity and mortality and improving quality-of-life for people with diabetes is a major public health objective. The Healthy People 2010 initiative includes goals to prevent diabetes, increase early diagnosis, improve rates of screening for its complications, and decrease morbidity and mortality (Norris, 2002). By implementing interventions shown to be effective, policymakers and healthcare providers can help their communities achieve these goals, while using community resources efficiently (Norris, 2002).

Type 2 diabetes traditionally occurs in individuals 40 years and older who have a family history of diabetes. However, during the past two decades type 2 diabetes is increasingly diagnosed in persons less than 40 years old. The disease is characterized by peripheral insulin resistance with an insulin-secretory defect that varies in severity (Votey, 2005).

The results of a study by Narayan and Boyle (2003) estimated lifetime risk of developing diabetes for individuals born in 2000 is 32.8% for males and 38.5% for females. Females have higher residual lifetime risks at all ages. The highest estimated lifetime risk for diabetes is among Hispanics (males 45.4% and females, 52.5%).
The Centers for Disease Control and Prevention (CDC) reported that because of improvements in the identification of chronic diseases, declining death rates, and Americans living longer, diabetes is increasing among persons aged 60 and older, nearly one-fifth of whom have been diagnosed with the disease (Jack, 2004). The chronic complications of diabetes tend to be more severe among older adults. Older adults with diabetes are at excess risk for disability associated with cardiovascular disease, peripheral vascular disease, stroke, vision loss, and neuropathy (Jack, 2004).

The goal of public health in aging is to extend health, functional independence, and health-related quality-of-life, for as long as possible. By delaying periods of illness and disability, individuals can maximize their senior years in good health and families can maximize the years they enjoy their senior family members (Jack, 2004).

The Chronic Care Model (Appendix A), has been used to successfully improve care for persons with chronic diseases (Wagner, 1998). Responding to the burden of diabetes among older adults will require a synergistic public health response that relies on collaborative patient-provider relationships, clinical findings, systematic reviews, translational research, and strong medical and public health partnerships (Jack, 2004). The Chronic Care Model can guide health care providers and health system administrators to implement these strategies.

PATHOGENESIS

Understanding the pathogenesis of type 2 diabetes is complicated by many factors. Patients present with a combination of varying degrees of insulin resistance and relative insulin deficiency, and it is likely that both contribute to type 2 diabetes (McCulloch, 2005).
Insulin resistance may be the best predictor of type 2 diabetes. It is possible, for example, that insulin resistance becomes more severe with increasing age and weight, thereby unmasking a concurrent defect in insulin secretion in susceptible people to cause impaired glucose tolerance and eventually overt hyperglycemia (McCullock, 2005). In normal-weight nondiabetic subjects at high risk for type 2 diabetes, both fasting and post-glucose hyperinsulinemia predict future weight gain, which in turn predisposes to hyperglycemia. Hyperglycemia itself may contribute to further progression by a toxic effect on Beta-cells, possibly by decreasing insulin gene expression (Terpstra, 1998).

Type 2 diabetes in the older adult has a strong, genetic predisposition. Older persons who have had family members with type 2 diabetes are more likely to develop the disease as they age. Physiological changes that occur with aging produce glucose intolerance even in healthy older individuals. The widespread recognition that aging is a major risk factor for the development of diabetes has led some to believe that glucose intolerance is an inevitable outcome of aging (Mooradian, 1999).

Metabolic studies have found that fasting plasma glucose (FPG) concentrations increase approximately 15mg/dl per decade of age. Most data suggest that the predominant dysfunction in lean older adults with diabetes is insulin deficiency, whereas obese older adults have both insulin resistance and relative insulin deficiency (Rendell, 2004).

Many age-related changes affect the clinical presentation of diabetes. These changes can make the recognition and treatment of diabetes problematic. Data suggests that at least half of older adults with diabetes do not even know they have the disease (Wallace, 1999). Because of the normal physiological changes associated with aging, older adults
rarely present with the typical symptoms of hyperglycemia. The renal threshold for glucose increases with advanced age, and glucosuria is not seen at usual levels. Polydipsia is usually absent because of decreased thirst associated with advance age. Dehydration is often more common with hyperglycemia because of older adults’ altered thirst perception and delayed fluid supplementation (Chau, 2001). More often, changes such as incontinence, confusion, or complications relating to diabetes are the presenting symptoms.

Factors affecting diabetes management in older adults are noted in Table 1. These factors show the multi-dimensional changes older adults go through as they age. These changes can impact their diabetes management. Physiologic changes occurring during normal aging, age-associated pathologic processes, increased prevalence of other chronic diseases, and polypharmacy all have an affect on diabetes management.

The major risk of tight glucose control is hypoglycemia. Risk factors that predispose older adults with type 2 diabetes to more frequent or severe hypoglycemic events are listed in Table 2. In older adults whose care is complicated by chronic medical illness, frailty, isolation, or a shortened life expectancy, a more realistic therapeutic goal may be reducing the signs and symptoms of hyperglycemia rather than attaining euglycemia (Wallace, 1999).

Pietropalo and Barinas-Mitchell (2000) evaluated whether signs of islet cell autoimmunity are associated with an abnormal glucose control, the presence of insulin requirement, or an activation of the acute-phase response in older individuals with type 2 diabetes. Study findings indicated that among people aged 65 years and older with type 2 diabetes, the presence of islet cell autoimmunity was associated with an impairment of
acute-phase insulin secretion, as revealed by an oral glucose tolerance test. A pronounced activation of the acute-phase response, found to be associated with islet cell autoimmunity may, in part, explain this defect in insulin secretion. These findings not only have direct implications for adequate classification and treatment of diabetes in the older adult, but also for understanding the autoimmune/inflammatory mechanisms involved in the pathogenesis of hyperglycemia.

DIABETIC COMPLICATIONS

A common misconception about diabetes in the older adult is that mild hyperglycemia is usually innocuous or that reduced life expectancy makes the consequences of chronic hyperglycemia irrelevant (Mooradian, 1999). Diabetes continues to be a major cause of morbidity and mortality among older adults. Several epidemiological studies have indicated that, even when the onset of diabetes is in the sixth or seventh decade of life, survival of the individual is reduced (Mooradian, 1999).

Older adults are more vulnerable to most of the diabetes-related complications because these complications can develop in older adults at an accelerated rate. The older adult with diabetes is prone to the same chronic microvascular and macrovascular complications as younger individuals, yet the prevalence of complications increases with age (Meneilly, 1999). There are many acute and chronic complications of hyperglycemia that may occur in the older adult with diabetes. These are summarized in Table 3. Osmotic diuresis may cause fluid and electrolyte loss, dehydration, hypotension and impaired cognitive function (Meneilly, 1999). An increased catabolic state may cause weight loss, muscle loss, decreased strength and decreased mobility.
Common diabetic microvascular complications include retinopathy, nephropathy, and lower extremity neuropathy (Chau, 2003). Because patients may have type 2 diabetes for several years before the diagnosis is made, microvascular complications are often already present.

Diabetic neuropathy commonly occurs as a distal, symmetric, predominantly sensory polyneuropathy that causes sensory deficits. Diabetic polyneuropathy may cause numbness, tingling, and paresthesias in the extremities and, less often, debilitating, severe, deep-seated pain and hyperesthesias (Chau, 2003).

Retinopathy is a common cause of blindness among all persons with diabetes. As in the young, good glucose control among older adults can retard the onset of retinopathy (Chau, 2003). Background retinopathy does not significantly alter vision, but it can progress to macular edema or proliferative retinopathy with retinal detachment or hemorrhage, which can cause blindness. About 85% of all persons with diabetes eventually develop some degree of retinopathy. Furthermore retinal changes begin at least 7 years before the diagnosis of type 2 diabetes is made (Vinicor, 2004).

Diabetic nephropathy is a common cause of renal failure in the geriatric population. Significant improvements in nephropathy can be made independent of blood glucose control. Angiotension converting enzyme inhibitors and blood pressure control to less than 140/80 mmHg can reduce nephropathy. Epidemiologic evidence shows that lowering blood pressure to less than 130/80 mmHg may provide further benefit (Brown, 2003).

Clinical trials have demonstrated that approximately 8 years are needed before the benefits of glycemic control are reflected in a reduction in microvascular complications
such as diabetic retinopathy or renal disease. Only 2-3 years are required to see benefits from better control of blood pressure and lipids (Brown, 2003).

Cardiovascular, cerebrovascular and peripheral vascular disease are more common among all patients with diabetes and are causes of excess mortality (Shumaker, 2004). These long-term macrovascular complications can contribute to considerable functional impairment in older adults.

The prevalence of hypertension in persons with type 2 diabetes rises from 40% at age 45 to 60% by age 75, a factor that contributes significantly to both macro- and microvascular disease complications (Wallace, 1999). Screening for and aggressive treatment of hypertension are critical components of diabetes care. In most cases, therapy should be instituted if blood pressure exceeds 140/80 mmHg, and expert opinion suggests a treatment goal of blood pressure <130/80 mmHg for patients with type 2 diabetes (ADA, 2005).

Although the association between hyperlipidemia and cardiovascular events declines with age, a significant association has been shown to persist into the eighth decade of life. Further, primary prevention trials with older adults up to age 73 and secondary prevention trials involving adults up to age 75, clearly demonstrate that lowering cholesterol levels can significantly reduce cardiovascular event rates in older adults with and without diabetes (Wallace, 1999).

The actual number of macrovascular events prevented by treatment of hyperlipidemia may be greatest for older adults with diabetes. Older adults with diabetes with elevated lipid levels who are expected to survive at least 1-2 years (the time frame to attain
benefits conferred by lipid-lowering) should be strongly considered for primary and secondary prevention (Buse, 2003).

Older adults often have cognitive impairments, limitations in their activities of daily living, undiagnosed depression and difficult social issues that may contribute to the development of complications (Chau, 2003). Coexisting health problems, such as dementia or psychiatric illnesses, may require a simplified approach to diabetes care. Creating a safe atmosphere through community support and family involvement, as described in the Chronic Care Model, can help the older adult manage their diabetes (Wagner, 1998).

The risks of hypoglycemia are higher in patients who are cognitively impaired. These patients often have decreased awareness of the autonomic warning symptoms of hypoglycemia or have delayed psychomotor responses to intervene in the correction of it. Therefore, a health care provider should assess each patient’s risk for hypoglycemia and their therapy should be individualized accordingly.

Niefeld and Braunstein (2003) examined the impact of comorbid conditions on preventable hospitalizations among Medicare beneficiaries aged 65 and older with type 2 diabetes. The results showed that 96% of beneficiaries in the sample of 193,556 had a comorbidity, and 46% had five or more comorbidities. Among persons with type 2 diabetes, cardiovascular-related comorbidities were common and accounted for increased odds of preventable hospitalization, controlling for other factors.

All complications of diabetes can occur in the elderly at high rates. This includes autonomic neuropathy, nephropathy, retinopathy, erectile dysfunction, and foot ulcers
(Chau, 2001). Table 4 outlines the unique syndromes occurring more commonly in elderly diabetic patients.

**FUNCTIONAL STATUS**

A functional assessment is a critical part of caring for an older adult. Activities of Daily Living (ADLs), as well as Instrumental Activity of Daily Living, which include more complex and demanding activities, such as answering the telephone, traveling, and managing money should be evaluated when caring for older adults. (Mooradian, 1999).

The psychosocial evaluation should include, at a minimum, the Mini Mental Status Examination and a depression scale, such as the Geriatric Depression Scale. In addition, an environmental and social assessment should be done to address issues such as social isolation, dependency, poverty, and financial limitations (Mooradian, 1999).

Major depression is more prevalent in older adults with diabetes, and health outcomes in this population are worse when depression is unrecognized (Olson, 2004). Depression can contribute to decreased physical and mental functioning that causes individuals to be less likely to follow daily diabetes self care routines, thus jeopardizing glycemic control and increasing the risk for complications (Owens, 2004).

Several studies have shown that psychosocial factors play an integral role in diabetes management (Delamater, 2001). Their impact is a stronger predictor of mortality in older adults with diabetes, than many physiologic variables (Delamater, 2001). Psychosocial factors combined with cognitive functioning, depression, stress, social support, and self-efficacy help predict differences in Activities of Daily Living and Instrumental Activities of Daily Living.
Older adults with diabetes are at high risk for injurious falls. Predisposing risk factors may include poor vision, cognitive impairment, gait/balance disturbances, muscular weakness, foot disorders. These factors may be related to peripheral neuropathy, hypoglycemia and polypharmacy (Narayan, 2003). The relative contribution of each risk factor differs according to the older adult’s underlying medical condition, functional level, and environmental circumstances (poor lighting, slippery floor surfaces, cluttered pathways). An increased number of risk factors are associated with a greater risk of falling (Narayan 2003).

Diabetes is associated with lower levels of cognitive functioning and greater cognitive decline in older adults (Gregg, 2000). Prospective trials have not shown consistent improvements in cognition with tight glucose control, although observational studies note improved cognitive functioning with lower hemoglobin A1C levels (Chau, 2003).

LIFESTYLE INTERVENTIONS

Diet and exercise are the cornerstones of diabetes treatment for persons of all ages. Although weight loss increases insulin sensitivity and has favorable effects on lipids and blood pressure, dietary strategies and even very-low-calorie diets are seldom effective in achieving long-term weight reduction (Wallace, 1999). A low-fat diet and endurance exercise can each reduce insulin resistance, and both are associated with mild weight loss.

Exercise combined with diet and weight loss can assist the older adult with diabetes to achieve glycemic control without the addition of pharmacological treatment. The
benefits of exercise are numerous including improvements in glucose tolerance, blood pressure, weight, lipid indices, cardiac status and insulin utilization (Meneilly, 1999).

Regular exercise is beneficial, especially in obese patients to burn calories. Exercise also increases insulin sensitivity. However, for this to occur, exercise must be sufficient to increase the resting heart rate. Although some older adults cannot undertake a vigorous exercise program, all patients with diabetes should be encouraged to increase activity, especially walking, swimming, and other aerobic activities.

Limitations to exercise in older adults with diabetes include cardiovascular disease, arthritis and peripheral neuropathy. Initiation of an exercise program in the older adult should be individualized, taking into consideration the current physical activity level of the patient. For the sedentary or frail adult with diabetes, strength-building exercises to improve flexibility, coordination and balance are recommended (Wallace, 1999).

A nutritional assessment includes evaluation of medical diagnosis, measurements of anthropometric parameters and biochemical indices, and review of medications. A thorough nutritional history would include evaluation of the patient’s food choices and eating patterns, use of alcohol or micronutrient supplements, weight history, and nutrient needs (Mooradian, 1999). Other elements of nutritional assessment include a history of exercise patterns, existing psychosocial problems and the patient’s knowledge base pertaining to diabetes and healthy eating. In addition, the patient’s interest in and willingness to change is essential.

Vitamin and mineral deficiencies may also contribute to poor glycemic control in the older adult (Meneilly, 1999). Older adults are often deficient in magnesium, and
magnesium supplementation has been shown to improve glucose control by increasing glucose-induced insulin release and improving insulin utilization (Meneilly, 1999).

In the overweight person with diabetes, weight loss is usually the goal. Insulin sensitivity increases when obese patients are in negative caloric balance, which occurs within weeks of starting a weight-loss diet. As hyperglycemia lessens, glucose toxicity may improve, leading to better metabolic control (Mooradian, 1999). Weight management or even weight gain may be the goal for the significant percentage of the older adults who are lean.

TREATMENT

Goals of therapy for older adults with diabetes should include an evaluation of their functional status, life expectancy, social and financial support, and their own desire for treatment. A full geriatric assessment performed before establishing any long-term diabetes therapy may aid in identifying potential problems that could significantly impair the success of a given therapy (Chau, 2001). Often, older patients have cognitive impairments, limitations in their activities of daily living, undiagnosed depression, and difficult social issues that need to be addressed.

Despite the increased risk of hypoglycemia, treatment of type 2 diabetes in the older adult is warranted to prevent the acute and chronic complications of the disease. Defining glycemic goals in the older adult with diabetes is a balancing act between preventing hypoglycemia, the symptoms of hyperglycemia, and the development of chronic complications (Meneilly, 1999). The achievement of euglycemia is often not possible in the older adult.
Controversy exists in deciding how aggressively to treat the older adult with diabetes because of the potential side effect of hypoglycemia. Hypoglycemia in the older adult is associated with an increased risk for stroke, myocardial infarction and seizures (Meneilly, 1999).

The goals of treatment for the older adult with type 2 diabetes are twofold: to achieve good control of hyperglycemia in the hope of minimizing long-term organ complications and provide good medical care while simultaneously avoiding the risks of vigorous therapy, including hypoglycemia (Terpstra, 2000). Coexisting cardiac risk factors, such as hypertension, hyperlipidemia, and cigarette smoking, must be addressed (Mooradian, 1999). Principles of therapeutic management for older adults are listed in Table 5. The principal goal of therapy is to enhance quality-of-life without undue risk of hypoglycemia.

The most compelling reason to treat older adults with diabetes is to prevent the effect of glucose toxicity, which include zinc deficiency, infection, dehydration and resulting orthostatis, increased risk of fall and hip fracture, excessive nocturia with enhance fall risk, decreased pain tolerance, and cognitive deficits (Terpstra, 2000).

For the older adult with diabetes who has dyslipidemia, efforts should be made to correct the lipid abnormalities. Current American Diabetes Association guidelines suggest that all adults with diabetes should be managed to achieve an LDL cholesterol of less than 100mg/dl employing statins as first-line therapy (Buse, 2003).

There is strong evidence from a number of randomized controlled trials that drug therapy for blood pressure management reduces cardiovascular events and mortality in older adults with diabetes (Brown, 2003). The Appropriate Blood Pressure Control in
Diabetes study found that intensive control (blood pressure approximately 128/75 mmHg) in normotensive older adults with diabetes slows the progression of diabetic nephropathy and retinopathy (Estacio, 2000).

**UTILIZING THE CHRONIC CARE MODEL**

Proponents of the Chronic Care Model strive to establish a health care system that provides more services with better outcomes for patients with chronic diseases. These system changes are ultimately intended to bring about the development of informed, activated patients and prepared proactive practice teams. Better patient outcomes in a sound fiscal environment are essential. The focal elements of the Chronic Care Model are the community, the health care system, self-management support, delivery system design, decision support and clinical information systems (Wagner, 1998). The strength of the Chronic Care Model is that it is evidence-based, incorporating proven effective interventions as found in research and in practice (Wagner, 1998).

An example of the Chronic Care Model in action is occurring at the Sandy Clinic, a primary care clinic of the Clackamas County Health Department in Oregon. The clinic offers regular diabetes group visits with 6-8 participants per group. Group participants set individual measurable health improvement goals (e.g. walking 2 blocks every day). During the group visit patients have the opportunity to talk about how they are managing their disease, share a healthy snack that reinforces proper dietary habits, and have one-on-one time with their provider. The group visits do not supplement routine visits with providers, but offer an extra measure of education and support to reinforce prevention and good diabetic care.
A comprehensive Clinical Information System can enhance the care of individual patients by providing timely reminders about needed services and summarized data to track and plan care (Piturro, 2003). The office staff of a Nurse Practitioner can implement a preventative care flow sheet for each older adult with diabetes to track their blood pressure, lipids, eye exams, urine microalbumin, hemoglobin AIC and foot exam to include mono-filiment test during periodic visits. The improvements in the office setting, particularly in the patient self-management component, can keep the older adults with diabetes motivated between office visits.

Case management as outlined in the Chronic Care Model acknowledges older adults with diabetes as equal partners, and encourages patient participation to develop a diabetes care plan that considers physical strengths and limitation, personal preferences, emotional support, and financial and social resources (Owens, 2004). Part of case management would be to make a referral for diabetes education, nutrition, and/or therapy consultation as indicated.

To assist the frail, homebound older adult with diabetes the Nurse Practitioner can enlist the help of a home health agency. The goal would be to develop strategies with the older adult to live as productively as they can while managing their diabetes. Oftentimes, the homebound older adult is either too ill or lacks the finances or transportation for a routine office visit. Home health agencies can assist the Nurse Practitioner in identifying changes in the older adult’s condition so treatment can be initiated in a timely manner.

Patient self-management is an important component of the Chronic Care Model. The Nurse Practitioner can initiate individual and group programs that help older adults with
diabetes understand their health-related behaviors, develop strategies to manage their disease and emphasize the standard assessments needed to track their progress. The older adult with diabetes will be able to see improvements in their health and receive encouragement from other group members and their health care provider.

The Chronic Care Model promotes the efficient use of staff, certified diabetes nurse educators, medical assistants and dietitians. The goal of the Nurse Practitioner is to provide the older adult with diabetes the tools and information needed to make lifelong health changes as they manage the effects of their disease.

SUMMARY

Ideal geriatric care requires a multidisciplinary approach. Successful diabetes care in the aging population requires an understanding of the physiology of aging, recognition of the special issues facing the older adult, and interaction with geriatricians, pharmacists, social workers, dietitians and diabetes educators to ensure the most efficacious treatment.

Healthcare providers will be increasingly challenged by the complexity of problems that face the older adult with diabetes, and must therefore be prepared to assess and treat diabetes within the milieu of many geriatric syndromes. The healthcare provider along with the older adult with diabetes must co-manage treatment methods, with the ultimate goal of not only achieving glycemic control but preventing diabetes related complications.

The Chronic Care Model encourages the use of community resources, organization of health services and self-management support to promote patients' decisions in the management of their disease. Nurse Practitioners can form partnerships with their patients to develop interventions to enhance care.
Given the complexity of diabetes and the possibility of multiple comorbid factors, more research is needed to understand the full impact of diabetes in older adults. The increasing burden of diabetes among Americans age 65 and older during the next few decades will require improved patient care, greater public health involvement, and innovative clinical strategies and interventions.
### TABLE 1

**Factors Affecting Diabetes Management in Older Adults**

- Decreased visual acuity could affect a patient’s ability to see printed educational material, medications, or markings on a syringe.
- Auditory impairments could lead to difficulty hearing instructions.
- Altered taste could affect food choices and nutritional status.
- Poor dentition could lead to difficulties with food ingestion and digestion.
- Altered ability to recognize hunger and thirst.
- Changes in hepatic function.
- Arthritis could affect the older adult’s ability to self-administer medications.
- Parkinsonian tremor.
- Polypharmacy.
- Depression affects motivation for self-management.
- Cognitive impairments.
- Inadequate education and poor literacy.
- Level of income can affect level of care sought or obtained.
- Living alone.
- Obesity.
- Sedentary lifestyle.

TABLE 2

Risk Factors That Predispose Older Adults with Type 2 Diabetes to Hypoglycemia

- Poor or erratic nutritional intake.
- Changes in mental status that impair the perception or response to hypoglycemia
- Polypharmacy and medication adherence difficulties
- Dependence or isolation that limits receipt of early treatment for hypoglycemia.
- Impaired renal or hepatic metabolism.
- Presence of comorbid conditions that can mask or lead to misdiagnosis of hypoglycemic symptoms

### TABLE 3

**Complications of Diabetes in the Older Adult**

<table>
<thead>
<tr>
<th>Acute</th>
<th>Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osmotic diuresis</td>
<td>Macrovascular</td>
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<tr>
<td>dehydration</td>
<td>cardiovascular disease</td>
</tr>
<tr>
<td>hypotension</td>
<td>cerebrovascular disease</td>
</tr>
<tr>
<td>fluid and electrolyte loss</td>
<td>peripheral vascular disease</td>
</tr>
<tr>
<td>impaired cognition</td>
<td></td>
</tr>
<tr>
<td>Weight loss</td>
<td>Microvascular</td>
</tr>
<tr>
<td>muscle loss</td>
<td>retinopathy</td>
</tr>
<tr>
<td>loss of strength and mobility</td>
<td>nephropathy</td>
</tr>
<tr>
<td>Infection</td>
<td>neuropathy</td>
</tr>
<tr>
<td>Hyperosmolar hyperglycemia</td>
<td>Impaired cognition</td>
</tr>
<tr>
<td>nonketotic syndrome</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Information gathered from: Menially (1999), Schlock (2004)*
**TABLE 4**

**Commonly Occurring Syndromes in the Older Adult**

- Diabetic neuropathic cachexia- associated with painful peripheral neuropathy, anorexia, depression, and weight loss.

- Diabetic neuropathy-third-nerve palsy is the most common mononeuropathy in the older adult.

- Amyotrophy- considered in all older adults with diabetes who report new difficulty rising from chairs.

- Malignant otitis externa: should be a diagnostic consideration when older adults report severe ear pain.

- Papillary necrosis- considered when older adult report severe ear pain.

- Osteoporosis- older adults with diabetes at high risk.

### TABLE 5

**Principles of Therapeutic Management of Type 2 Diabetes in the Older Adult**

- Treatment goals: preventing hypoglycemia, symptoms of hyperglycemia, chronic complications.

- Diet, exercise and weight loss are the preferred initial treatment.

- Therapy should be based on life expectancy and current functional status.

- If lifestyle changes fail to achieve therapeutic goals, oral monotherapy should be considered followed by oral combination therapy.

- Lifestyle and pharmacotherapeutic treatments must be tailored to individual patient needs.

- Pharmacotherapy in the elderly should be initiated at the lowest possible dose and slowly titrated upward until the desired therapeutic response is achieved.

- In patients who fail to achieve therapeutic goals on oral combination therapy, insulin alone or in combination with an oral agent may be utilized.

FIGURE 1

Overview of the Chronic Care Model

Wagner (1998)
APPENDIX A

Permission to use the Chronic Care Model
September 1, 2005

Michele Hansen  
351 Strand Rd.  
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