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**Diabetes and Disability: What Can the Rehabilitation Professional Do**

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**Diabetes and Disability:  
What Can the  
Rehabilitation  
Professional Do**

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**Objectives**

- ⦿ Define diabetes and describe its impact on society.
- ⦿ Identify the acute and chronic complications of diabetes, their impact on functioning and related precautions and adaptations to care.
- ⦿ Describe the role of the therapy professional in the rehabilitation of persons with diabetes and identify potential arenas of practice and available supporting evidence.

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## Defining Diabetes

- ⊙ Diabetes Mellitus
  - > A group of metabolic diseases characterized by hyperglycemia or high blood glucose
  - > Occurs when the body cannot use the glucose in the blood because
    - The pancreas is not able to make or release enough insulin, or
    - The insulin that is made is not effective because of resistance of the cells receiving it, or
    - Both
  - > Is a systemic disease with acute and chronic complications

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## Major Types

- ⊙ Type 1 – Affects 10%
  - > Before age 30
  - > Requires external source of insulin to survive
  - > Autoimmune destruction of the beta cells
  - > Genetic predisposition
- ⊙ Type 1.5 (LADA – Latent Autoimmune Diabetes in Adults) – Affects 15%
  - > Show signs of both Type 1 and Type 2 diabetes
- ⊙ Type 2 – Affects 75%
  - > After 30 years of age
  - > Internal insulin levels variable; insulin resistance present
  - > Weight loss, diet, and exercise → oral medications → insulin
  - > Age, ethnic background, positive family history, obesity
  - > Frequently asymptomatic at diagnosis, but 20% end organ complications

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## Diagnosing Diabetes

Preferred test to date :

- ⊙ Fasting plasma glucose (FPG) is a blood glucose test taken after no food/calorie intake of 8-12 hours
- ⊙ Blood glucose measurements are given as milligrams of glucose in blood plasma (not whole blood) per deciliter of blood (mg/dL)
- ⊙ Blood glucose range
  - > Prediabetes\* FPG 100 mg/dL to 125 mg/dl
    - \*prediabetes is risk factor for future diabetes (blood glucose levels are high but not high enough to be diagnosed as diabetes)
  - > Diabetes FPG > or = to 126 mg/dL

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### Diagnosing Diabetes 2010

- ⊙ A1c - Measurement of average blood glucose levels over past 2-3 months
- ⊙ As of February 2010 A1c now can be used to diagnose diabetes (6.5%) and pre-diabetes (5.5 – 6.4%)

A1C	mg/dL
6	135
7	170
8	205
9	240
10	275
11	310
12	345

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### Diabetes Prevalence in U.S.

- ⊙ Current  
(<http://diabetes.niddk.nih.gov/dm/pubs/statistics/#allages>)
  - > 17.9 million people diagnosed in 2007 + 5.7 million undiagnosed = 23.6 million people (7.8 % of the population)
- ⊙ Projected (Centers for Disease Control and Prevention)
  - > 165% increase in prevalence between 2000 and 2050, from 11 million cases of diagnosed diabetes in 2000 to 29 million cases in 2050

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### Cost of Diabetes – in U.S. in 2007

Direct medical costs (2.3 times higher in the absence of diabetes)	\$116 billion	<input type="checkbox"/>
+		
Indirect costs (disability, work loss premature mortality)	\$58 billion	
<hr/>		
<b>Total</b>	<b>=</b>	<b>\$174 billion</b>

Source: <http://diabetes.niddk.nih.gov/dm/pubs/statistics/#allages>

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### **Acute Complications of Diabetes - Hyperglycemia**

- Symptoms: 3 "Ps" : Polyuria (frequent urination)  
Polydipsia (excessive thirst)  
Polyphagia (extreme hunger)
- Weight loss, blurred vision, headache, occasional muscle cramps, poor wound healing
- Life-threatening conditions: Hyperglycemia with Diabetic Ketoacidosis and Hyperglycemic Hyperosmolar Nonketotic Syndrome

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### **Causes of Hyperglycemia**

- Too little or irregular timing of insulin, food, or activity
- Illness, stress, surgery, certain medications
- Dawn Phenomena – sudden rise in blood glucose level in the morning
- Rebound Effect – a swing to a high blood glucose level after an extremely low level, usually occurs in the middle of the night

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### **Acute Complications of Diabetes - Hypoglycemia**

- Hypoglycemia is a blood glucose less than 70 mg/dL.
  - > Hypoglycemia is not a result of diabetes itself but is a consequence of its treatment. Insulin and certain oral medications (but not all) that are used to control blood glucose levels can result in blood glucose levels that are even lower than desired.
  - > A client should consult his or her physician if unsure whether or not a medication can result in hypoglycemia.

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### Causes of Hypoglycemia

- ⦿ Too much insulin when eating less, or irregular timing of insulin
- ⦿ Skipping or delaying meals or snacks
- ⦿ Irregular timing or carbohydrate content of meals
- ⦿ Insufficient carbohydrates to support physical activity; physical activity schedule is too variable
- ⦿ Other causes: certain medications, alcohol intake (especially if consumed without food), and change of season

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### Symptoms of Hypoglycemia

- ⦿ Symptoms vary from person-to-person & episode-to-episode
- ⦿ Sweating, shakiness, fast pulse, difficulty concentrating, decreased coordination, blurred vision, dizziness, weakness, headache, feeling of something not right
- ⦿ Trouble or more effort in performing a routine task may be indicative of low blood sugar
- ⦿ Can result in severe confusion and disorientation, irrational behavior, unconsciousness, seizures, coma, death
- ⦿ Hypoglycemic unawareness: the client is unable to recognize the symptoms of low blood



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### Treatment - General

- ⦿ First step in treating hypoglycemia is for the client to check his or her blood glucose level if possible;
- ⦿ If the blood glucose level is between 50 and 70 mg/dL, the client will need to consume a food or beverage containing **15 grams of carbohydrate**.
  - > This treatment should increase the blood glucose level by 30-45 mg/dL over 15 minutes. (If the blood glucose level initially is less than 50 mg/dL, 30 grams of carbohydrate should be consumed.)
  - > After 15 minutes the client should recheck his or her blood glucose level and consume an additional 15 grams of carbohydrate if it is still below 70 mg/dL.
  - > This is known as the **15/15 rule**.
- ⦿ If a meal is not planned within 1-2 hours of treating a hypoglycemic reaction, then a snack containing 15-30 grams of carbohydrate and protein should be consumed to prevent another episode of hypoglycemia.

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### Treatment - Specific

- Carbohydrate sources (15 grams):
  - > 3 - 4 glucose tablets
  - > 1 tube of glucose gel containing 15 grams carbohydrate
  - > 4 oz non-diet soft drink/fruit juice
  - > 1 tablespoon honey or sugar
  - > 2 tablespoons raisins
  - > 7 Lifesavers or 9 sweet tarts
- Exclude products high in fat such as chocolate, candy bars, cake, potato chips, as they absorb too slowly and increase weight
- If a client becomes or is found unconscious, or you are in doubt as to why symptoms occur, immediately call emergency services



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### Precautions

- Be aware of general symptoms; ask about individual symptoms
- Do not interfere with meal or medication times
- Schedule "physical" activities one to three hours after mealtime
- After a hypoglycemic incident has occurred and been treated by the client, discontinue teaching activity to allow for return of mental and motor function which may have declined during more significant hypoglycemia
- Request client bring their blood glucose monitor and carbohydrate source to every session



<http://www.td.com/health/tech/monitor>  
High Blood Sugar, Low Blood Sugar... Know the Difference

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### Chronic Complications

- Chronic:
  - > Microvascular Effects – Neuropathy, Nephropathy, Retinopathy
  - > Macrovascular Effects - Cerebral Vascular Disease, Coronary Artery Disease, Peripheral Vascular Disease
  - > Skin and Dental Changes

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## Retinopathy

- ⊙ Damage to the microvasculature that nourishes the retina
  - > Nonproliferative Diabetic Retinopathy (NPDR): often no vision loss is noted or detected
  - > Proliferative Diabetic Retinopathy (PDR): characterized by bleeding in the eye; vision loss can range from mild blurring → irregular patches of vision loss → severe vision loss/ total blindness



Source: National Eye Institute

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## Eye Precautions to Avoid Retinal Bleeding

- ⊙ Avoid heavy lifting
- ⊙ Avoid bending resulting in head lower than waist. Use adaptive bathing and dressing techniques and devices; cross leg/prop foot during ADLs



- ⊙ Avoid activities that raise blood pressure

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## Exercise Precautions

- ⊙ Activities that raise the blood pressure in the body or head (doing resistance exercises with weight machines, lifting free weights, or using rubber exercise bands)
- ⊙ Bending the head forward below the level of the heart /waist (toe touches, sit-ups, some yoga exercises)
- ⊙ Holding breath or straining (as when tightening abdominal muscles and lifting legs)
- ⊙ Activities that jar or involve bouncing of the head (jogging, contact sports)
- ⊙ Strenuous, high impact activities (high impact aerobic dance, racquet sports, intense competitive sports)
- ⊙ Strenuous arm exercises (rowing or arm bike exercise)
- ⊙ Activities involving severe atmospheric pressure changes (diving, mountain climbing)

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### Types of Diabetic Neuropathy

- ⊙ Peripheral – more common in feet than hands; the nerves leading to the feet are longer and therefore more likely to be damaged
- ⊙ Autonomic - tends to occur later in the course of diabetes
- ⊙ Focal - affecting a single nerve or nerve group (in one study 15% to 25% of people with diabetes had carpal tunnel syndrome)

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### Peripheral Neuropathy

- ⊙ Symptoms
  - > pins-and-needles; pain; numbness; inability to detect temperature, position sense
  - > impaired balance
  - > diminished touch or pressure sensation; inability to feel feet when walking
  - > loss of "protective sensation"
  - > muscle weakness
  - > foot deformity (Charcot Foot -- bones in foot fracture and become misaligned; also known as rocker bottom foot)



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### Incorporating Proper Foot Care into ADLs

- ⊙ Feeling inside shoes before putting them on each time to make sure lining is smooth and there are no hidden objects, nail points, or rough areas inside.
- ⊙ Regular bathing of feet with warm water, emphasis on washing/drying between toes; lotion on feet but not between toes
- ⊙ Daily foot inspections after bathing/just before bed
- ⊙ Encourage client to inspect feet with good lighting and a mirror/magnifying mirror



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## Components of a Foot Inspection

- ⊙ Look for cuts, blisters, swelling, new calluses, bumps, changes in foot texture/shape; pay attention to any previous or existing foot problems
- ⊙ Use back of hand to detect temperature changes comparing to other areas of foot/opposite foot – excessively cool (decreased circulation), warm (infection)
- ⊙ Pay particular attention to between toes, nail beds and pressure points

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## Foot Screening

Diabetes Foot Screen

Name (Last, First, MI) \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Fill in the following blanks with a "Y" or "N" to indicate findings in the right or left foot.

	R	L	
Is there a history of a foot ulcer?	_____	_____	
Is there a foot ulcer now?	_____	_____	
Is there a claw toe deformity?	_____	_____	
Is there swelling or an abnormal foot shape?	_____	_____	
Is there elevated skin temperature?	_____	_____	
Is there limited ankle dorsiflexion?	_____	_____	Sources: <a href="http://www.hrsa.gov/osp/levelonescreening.htm">http://www.hrsa.gov/osp/levelonescreening.htm</a>
Are the toenails long, thick or ingrown?	_____	_____	
Is there heavy callous build-up?	_____	_____	Can obtain up fifty "10 gram" monofilaments free
Is there foot or ankle muscle weakness?	_____	_____	
Is there an absent pedal pulse?	_____	_____	
Can the patient see the bottom of their feet?	_____	_____	
Are the shoes appropriate in style and fit?	_____	_____	



Note the level of sensation in the circles:  
 ● = Can feel the 5.07 filament — = Can't feel the 5.07 filament

**RISK CATEGORY:**  
 \_\_\_\_\_ 0 No loss of protective sensation.  
 \_\_\_\_\_ 1 Loss of protective sensation.  
 \_\_\_\_\_ 2 Loss of protective sensation with either high pressure (callous/deformity), or poor circulation.  
 \_\_\_\_\_ 3 History of plantar ulceration, neuropathic fracture (Charcot foot) or amputation.

Performed by \_\_\_\_\_

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## Autonomic Neuropathy

- ⊙ Results from damage to nerves that affect internal organs and control automatic body functions, systems include:
  - > Cardiovascular
  - > Genitourinary
  - > Gastrointestinal
  - > Sudomotor (body's ability to regulate its temperature)

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**Autonomic Neuropathy:  
Symptoms and Precautions (1)**

- ⊙ Cardiovascular Effects
  - > Postural hypotension
  - > May lead to edema which desensitizes feet
  - > Fixed heart rate during physical activity or exercise
  - > Silent (painless) heart attack – Occurs in 25% of persons with diabetes (15% in those without)
- ⊙ Cardiovascular Precautions:
  - > Symptoms to attend to include: pressure or squeezing in chest, excessive tiredness and loss of energy, back/abdominal pain, lightheadedness, dizziness, nausea, mild chest discomfort, vague shortness of breath, or excessive sweating/clamminess
  - > Encourage slow positional changes; avoid heavy physical activity; avoid hypoglycemia

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**Autonomic Neuropathy:  
Symptoms and Precautions (2)**

- ⊙ Genitourinary: Frequent urination, blunted sense of need to urinate, possible incontinence
  - > Precautions: Permit frequent urination
- ⊙ Gastrointestinal: Delayed food absorption, nausea, sense of fullness, vomiting, diarrhea
  - > Precautions: Permit frequent blood glucose monitoring; insure restroom availability.
- ⊙ Sudomotor: Abnormal patterns sweating/dryness
  - > Precautions: Avoid high heat, humidity, extreme cold, encourage use of emollients and creams.

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**Nephropathy**

- ⊙ Damage to the kidney's small blood vessels or filtration system
- ⊙ Renal failure occurs in 30-40 % of persons with Type 1; 20-30% of persons with Type 2
- ⊙ Renal-retinal syndrome:
  - > 95% of persons with diabetic nephropathy have some retinopathy,
  - > 50% of those being blind or having lost significant vision

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### Macrovascular Disease

- Macrovascular Disease is responsible for 80% of mortality of persons with diabetes
- Caused by arteriosclerosis (blood vessels become thick, hard, nonelastic) and atherosclerosis (plaque build up)
- Types of Macrovascular Disease
  - > Coronary artery disease
  - > Cerebral vascular disease
  - > Peripheral vascular disease

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### Macrovascular Disease and Precautions

- Coronary Artery Disease: Food preparation activities should adhere to client's personal meal plan regarding fat, protein, carbohydrate, and sodium content and reinforce healthy cooking and eating habits
- Cerebral Vascular Disease: Planned activities should not exceed client's heart and blood pressure limits (generally desired BP = less than 130/80 mm Hg)
- Peripheral Vascular Disease: If calf pain occurs during standing/walking activities( intermittent claudication) incorporate rest periods. If calf pain occurs at rest or during night, walking program contraindicated .

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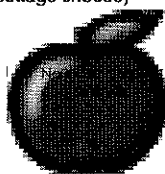
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### Precautions – Adhering to Dietary Guidelines

- Carbohydrate – average 3 to 4 carbohydrate choices per meal = 45 to 60 grams of carbohydrate (1 choice = 15 grams carbohydrate)
- Protein – average 3 ounces; range 2 to 5 ounces of meat or meat substitute (eggs, beans, cottage cheese)
- Fat – About 15 grams of saturated fat (7% of total daily calories)
- Salt - 2010 American Heart Association having less than 1500 mg of sodium total per day. Meal type" products must not exceed 600 mg sodium per labeled serving size.
- Fiber – 25 to 35 grams



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## How Food Affects Diabetes – The Role of Carbohydrates

- ⊙ Carbohydrates:
  - > 1 of 3 main nutrients in food, in addition to protein, and fat.
  - > Are “sugars and starches,” found in fruit, breads and cereals, milk and dairy, starchy vegetables, and other foods such as cake and ice cream.
  - > Become glucose in the blood.
  - > Cause blood glucose to rise about 2 hours after a meal.
  - > The type of food and the amount determines how high or low blood glucose levels will go.

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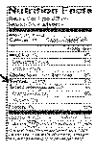
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## Carbohydrate Counting

- ⊙ Most useful method of meal planning for persons with diabetes
- ⊙ May involve counting carbohydrate choices or grams
- ⊙ Focuses on the “total amount” of carbohydrates in food being eaten (not just sugar)
- ⊙ Reading nutrition facts labels or using a nutrition reference guide is essential to determining carbohydrate content of foods.




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## Sample Meal



- ⊙ Sample lunch meal: 1 sandwich with 3 ounces turkey, 1 ounce american cheese and lettuce, 1 cup chicken noodle soup, ½ sliced peaches in light syrup, 1 glass artificially sweetened ice tea.
  
- ⊙ Nutrition Facts for Sandwich Recipe Serving 1 person – 291 Calories; Calories from fat 110, Total Fat 11.3g (Saturated Fat 5.6g) Sodium 959mg, Total Carbohydrate 27.5g ( Dietary Fiber 4g, Sugars 4.1g) Protein 18.27g (28 grams in 1 ounce)

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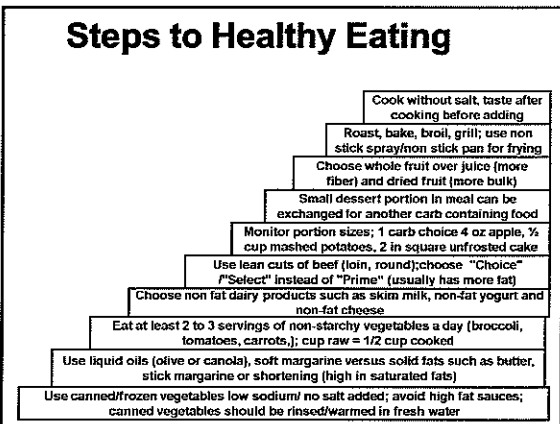
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### Resources for Practice Arenas

- ⊙ AADE (American Association of Diabetes Educators) Guidelines for the Practice of Diabetes Self-Management Education and Training (DSME/T), © 2009, Parkin, C., Hinnen, D. et al. Viewed at: [http://www.diabeteseducator.org/DiabetesEducation/position/Practice\\_Guidelines.html](http://www.diabeteseducator.org/DiabetesEducation/position/Practice_Guidelines.html)
- ⊙ Topics in Geriatric Rehabilitation, upcoming August 2010 edition will focus on diabetes; several article will discuss the role and potential interventions by PTs and OTs
- ⊙ Contact the Physical Activity and Disability Specialty Practice groups of AADE

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### Resources for Practice Arenas

- ⊙ OTs/PTs eligible to become certified diabetes educators
- ⊙ Visit
- ⊙ <http://www.ncbde.org>
  - > Minimum of two (2) years to the day of professional practice experience in the discipline under which the individual is applying for certification

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### **AADE7 Self-Care Behaviors**

- ⦿ (1) healthy eating
- ⦿ (2) being active
- ⦿ (3) monitoring - blood glucose levels, blood pressure, foot checks, steps walked, weight, and achievement of goals.
- ⦿ (4) taking medication
- ⦿ (5) problem solving – managing sick days, vacations
- ⦿ (6) healthy coping
- ⦿ (7) reducing risks -smoking cessation, foot checks, blood pressure monitoring, self-monitoring of blood glucose, maintenance of personal care records, and regular eye, foot, and dental examinations.

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### **Five Steps in Diabetes Education**

- ⦿ Implementation of Diabetes Self-Management Education/Training (DSME/T) involves five defined steps:
  - > assessment
  - > goal setting
  - > planning
  - > implementation
  - > evaluation/monitoring

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### **Five Levels of Professional**

- ⦿ Level 1 - Non-Healthcare Professional – community healthcare worker, health promoters/educators
- ⦿ Level 2 - Healthcare Professional Non-Diabetes Educator - medical assistants, licensed practical nurses, registered nurses, nutritionists, dietetic technicians, registered pharmacists, and physical/occupational therapists
- ⦿ Level 3 - Non-Credentialed Diabetes Educator - healthcare professionals who have in-depth knowledge and skills in diabetes self-management education/self-management training
- ⦿ Level 4 – Credentialed Diabetes Educator - meets certification requirements set by the National Certification Board of Diabetes Educators (NCBDE)
- ⦿ Level 5 - Advanced Level Diabetes Educator/Clinical Manager\* (non-Rx with protocols or Rx)

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### Healthcare Professional Non-Diabetes Educator Versus Non-Credentialed Diabetes Educator

- ⊙ Provide basic health information
- ⊙ Instruct in healthy food choices and appropriate exercise/physical activity
- ⊙ Lead support group
- ⊙ Refer for diabetes self care education
- ⊙ Example: OT working on kitchen skills while incorporating healthy food choices for persons with diabetes; PT instructing client in proper foot care during LE exercise
- ⊙ All activities in former column
- ⊙ Instruct in basic DM skills/knowledge
- ⊙ Screen for acute and long term complications and address within scope of practice
- ⊙ Refer to credentialed diabetes educator
- ⊙ Example: OT instructing client with vision loss in adaptive insulin measurement; PT teaching client about relationship between exercise, blood glucose levels and carbohydrate intake

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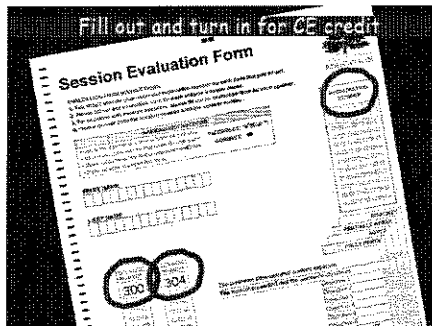
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