

Improving the Care of Older Persons with Diabetes

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CHCF/AGS Panel on Care for Older Persons with Diabetes

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Outline

- What is Diabetes?
- Evidence Based Care for the Older Adult with Diabetes Mellitus
- Behavioral Change
- The Geriatric Syndromes Common among Persons with Diabetes

Glucose Metabolism in Diabetes

- Food is broken down in the normal way.
- Glucose is absorbed from the stomach in the normal way.

BUT

**There is not enough insulin action, so
blood glucose levels rise.**

HYPERGLYCEMIA

How Is Diabetes Diagnosed?



- A fasting blood glucose ≥ 126 mg/dl

OR

- A non-fasting blood glucose over 200 mg/dl

OR

- An oral glucose tolerance test

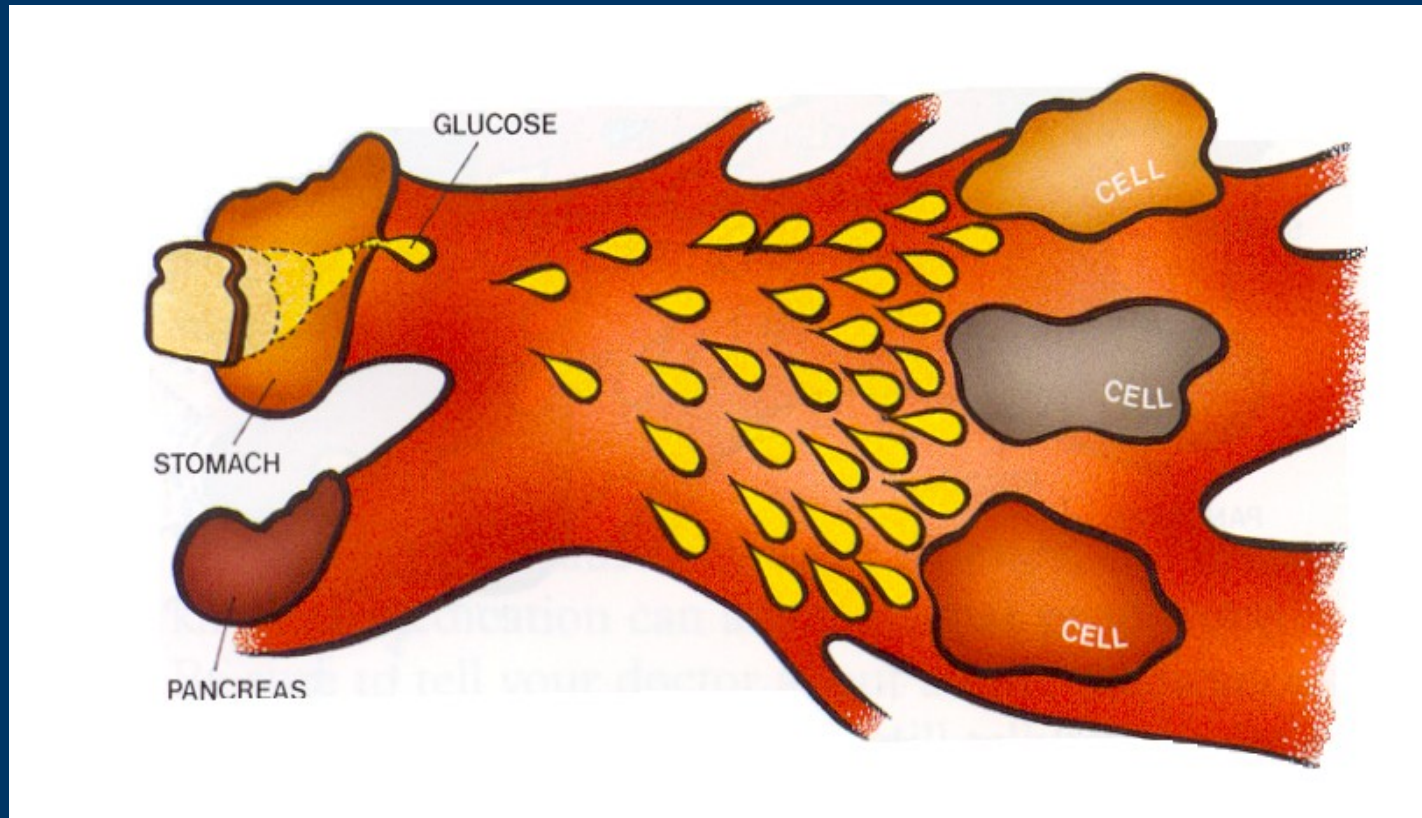
Terms Used to Describe Diabetes

- **Type 1 Diabetes**
- **Type 2 Diabetes**
- **Pre-diabetes (110 mg/dl – 125 mg/dl)**
- **Gestational Diabetes**
- **Secondary Diabetes**

Type 1 Diabetes

- The immune system destroys the beta cells.
- The pancreas therefore produces little or no insulin.
- This is called *insulin deficiency*.
- Daily insulin injections are required to live.

Glucose Metabolism in Type 1 Diabetes

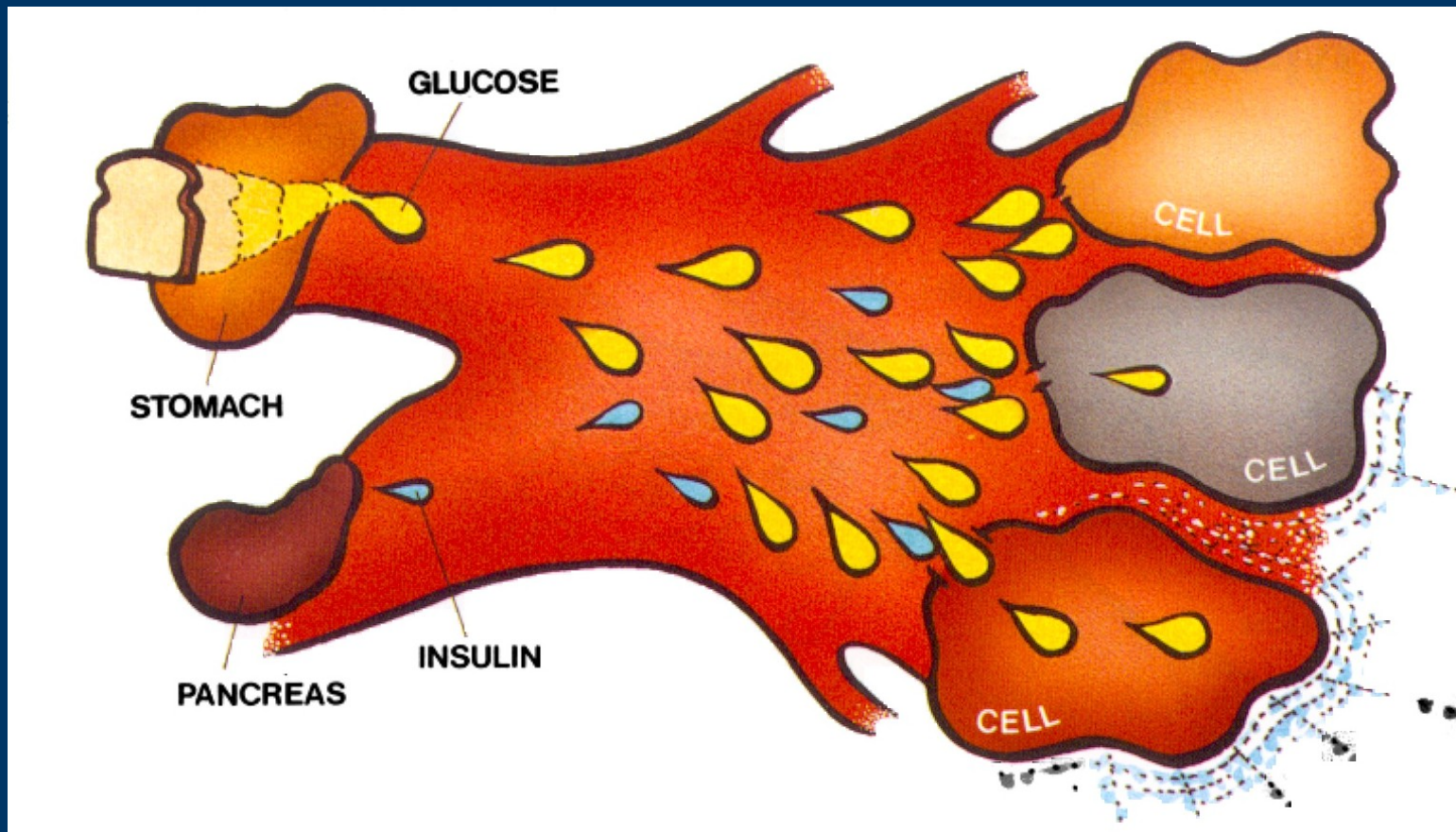


(Picture compliments of Novo Nordisk, 2000, Keeping Well With Diabetes, Page 7)

Type 2 Diabetes

- In Type 2 diabetes, the body either:
 - Produces enough insulin but it is unable to use it properly.
(Insulin Resistance)
 - Does not produce enough insulin.

Glucose Metabolism in Type 2 Diabetes



(Picture compliments of Novo Nordisk, 2000, Keeping Well With Diabetes, Page 8)

How is Diabetes Treated?

- **Food**

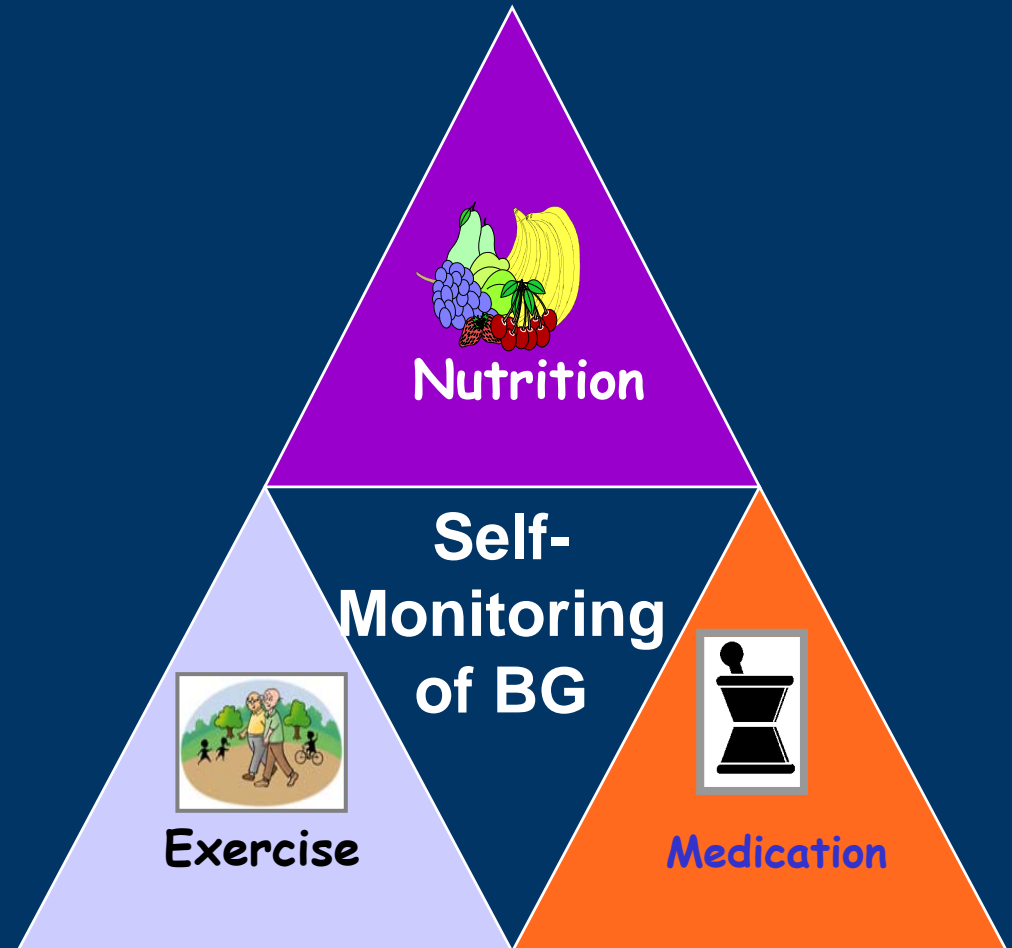
- timing
- amount
- type of food

- **Exercise**

- absolute necessity for Type 2

- **Medications**

- pills
- insulin



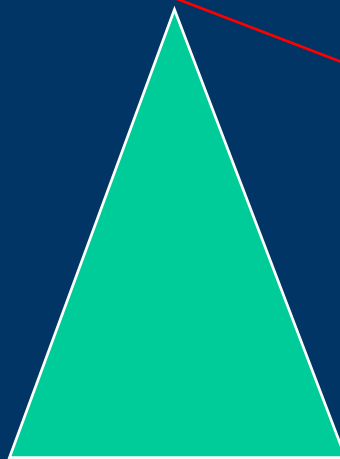
What Factors Affect Blood Glucose Balance?

Factors that raise BG

Food
Carbohydrate
Missed medicine
Stress / Illness
Lack of exercise

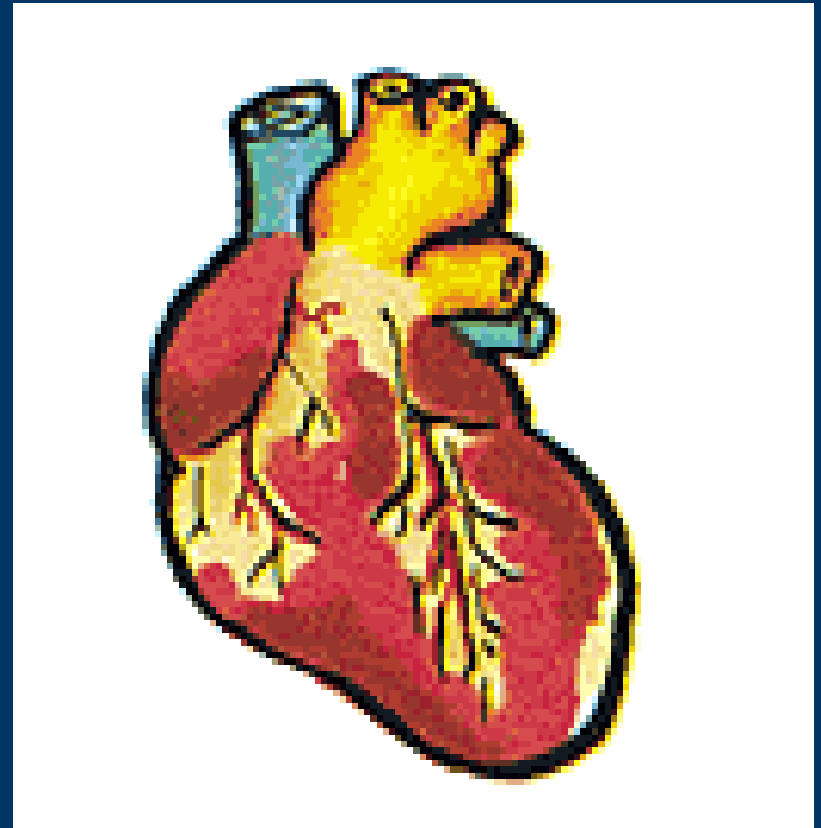
Factors that lower BG

Insulin / Pills
Exercise
Skipped meals
Illness



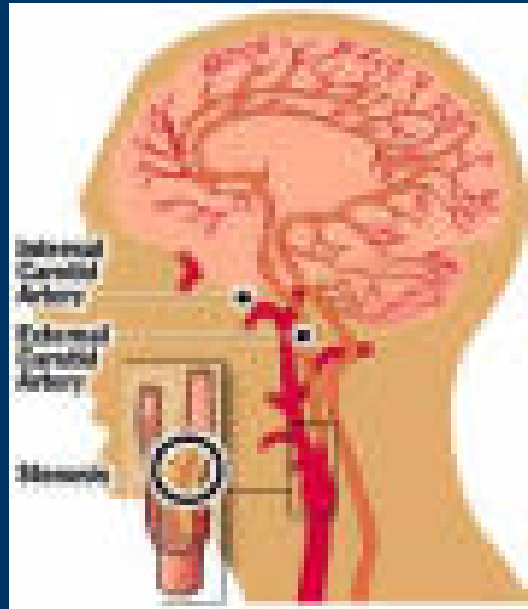
Heart

- There is a 2- 4 times greater chance of a heart attack in people with diabetes.



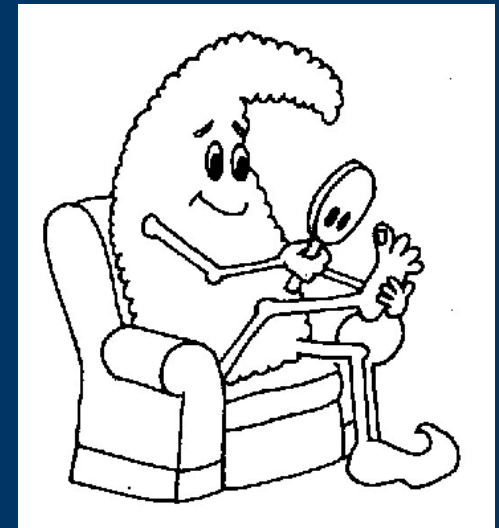
Brain

- There is also an increased risk of stroke.



Legs and Feet

- What causes leg and feet problems?
 - Macrovascular disease
 - Nerve Damage



Nerve Damage (Neuropathy)

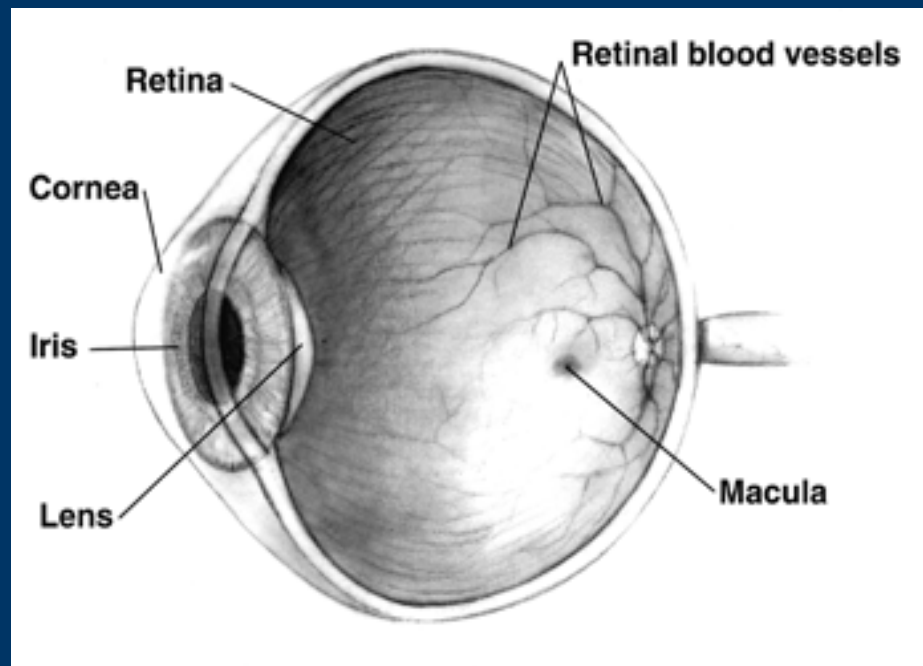
- Numbness / Tingling
- Pain or loss of feeling
- Burning sensation
- Muscle weakness
- Joint deformities

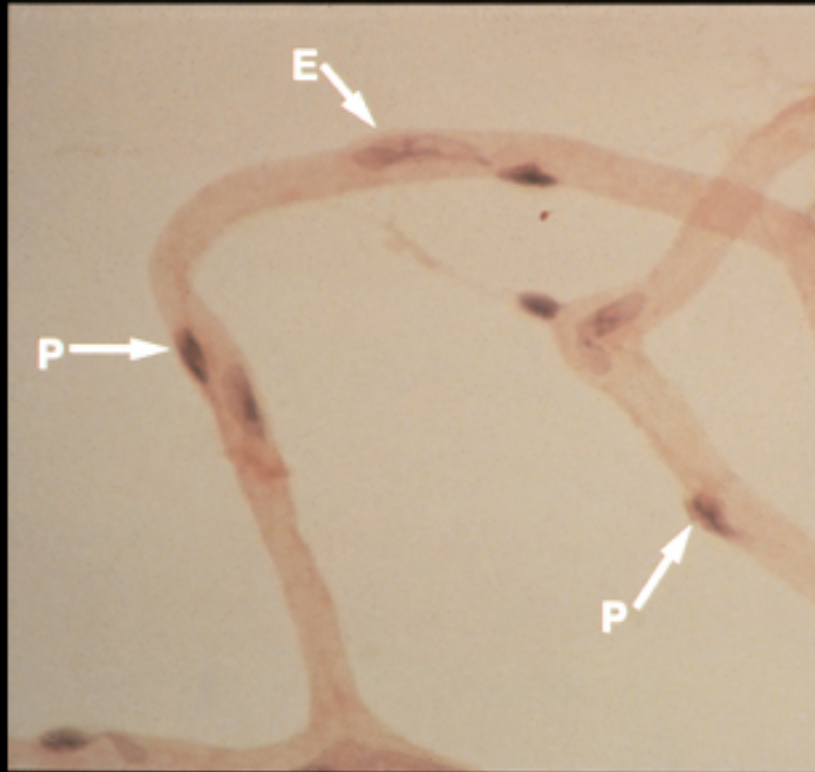
Other Nerve Problems (Neuropathies)

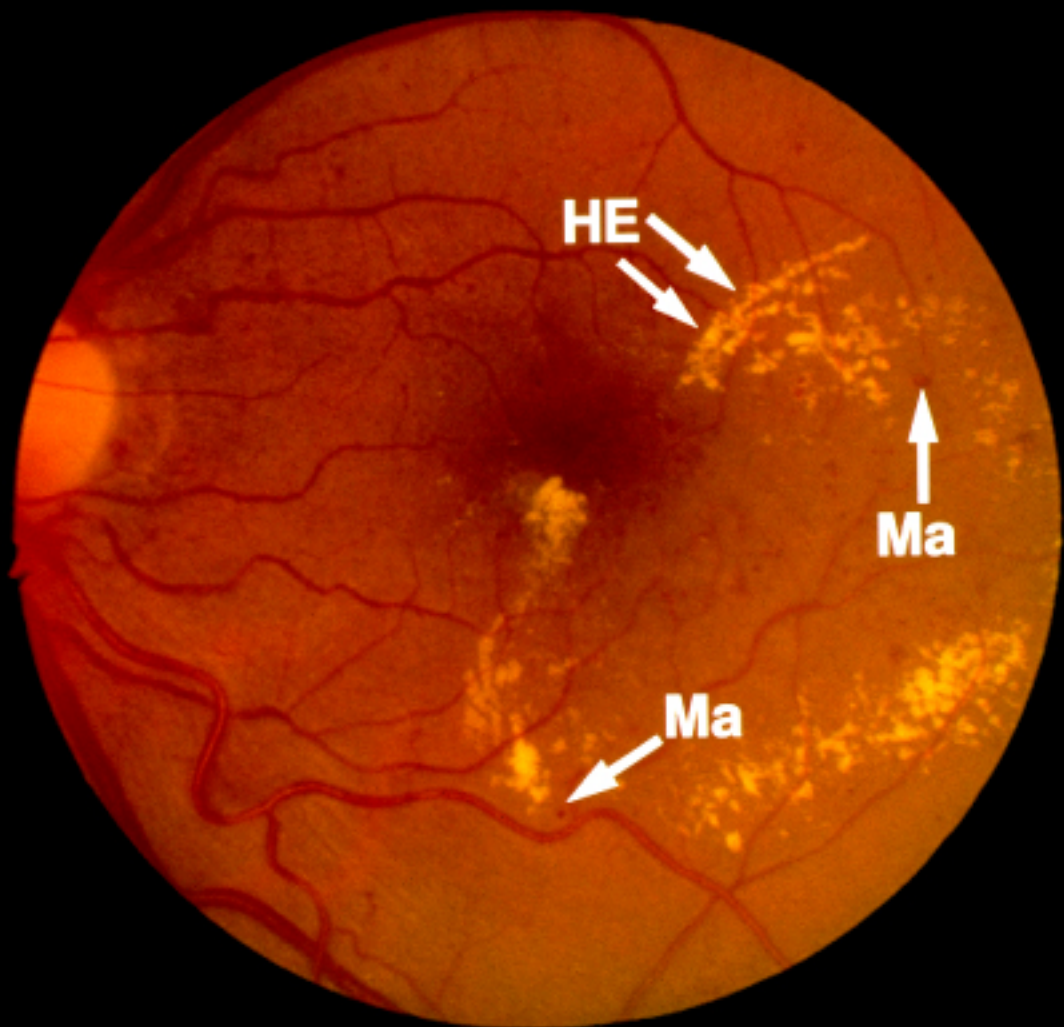
- **Gastroparesis**
- **Bladder Control**
- **Sexual Functioning**

Eyes

- Annual dilated eye exam







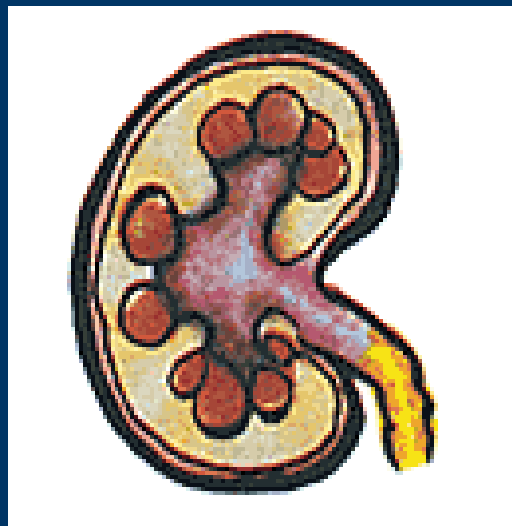
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Kidneys (Nephropathy)

- Kidneys filter waste products from the blood
- No warning signs
- Urine test (Microalbumin) once per year



Why Diabetes and its Management Differ in Older and Younger Adults

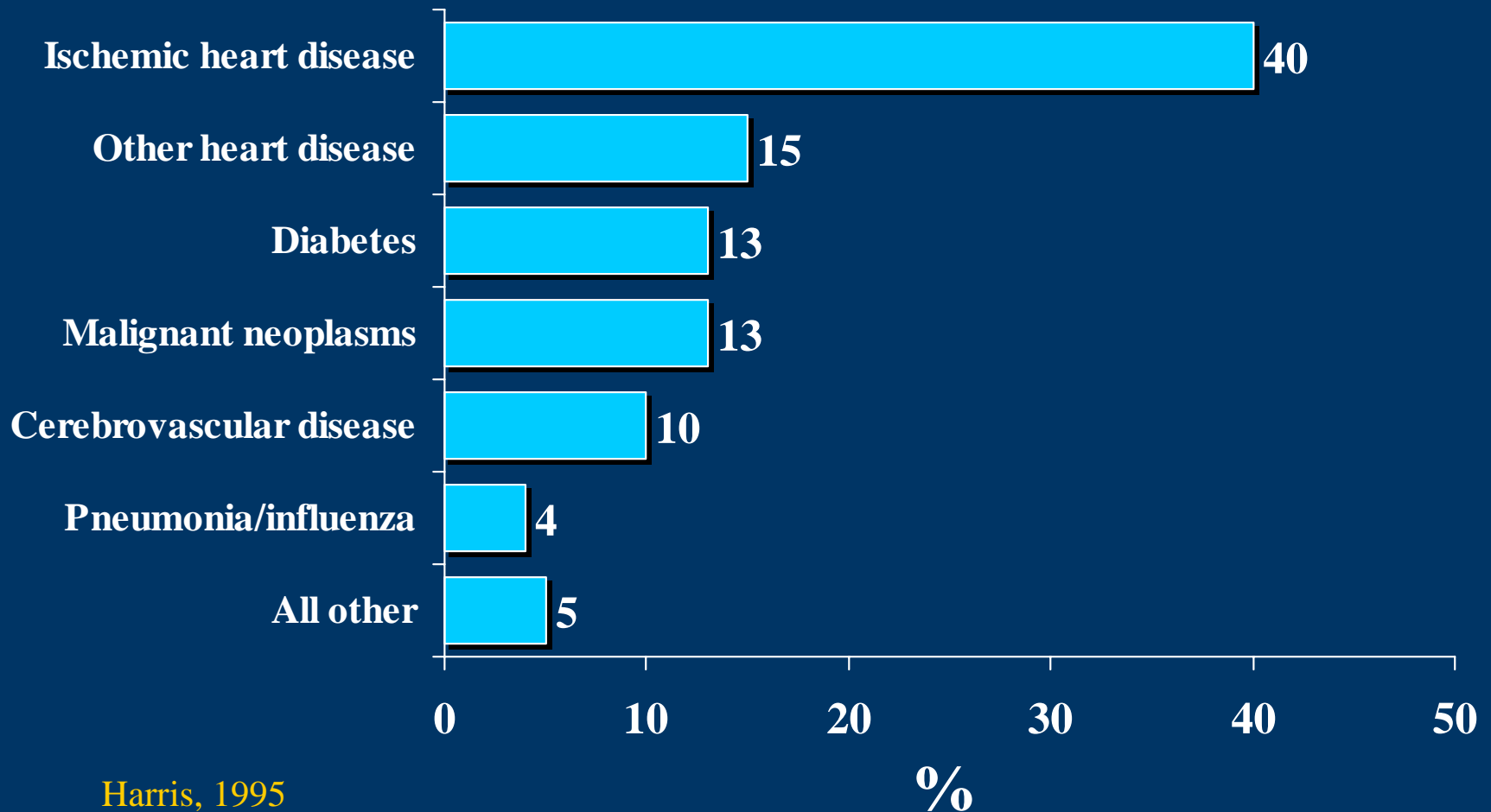
Diabetes Mellitus in Older Adults

- Prevalence among persons \geq 60 years of age:
 - 13% with diabetes mellitus (DM)
 - 12% with undiagnosed DM
- Excess morbidity and mortality from both microvascular and macrovascular complications
- Quality of care is suboptimal for older adults with diabetes
- Less randomized controlled trial evidence to support specific care recommendations for the older person with diabetes

Macrovascular Disease

- A higher proportion of older persons with DM have hypertension, hyperlipidemia, and atherosclerotic disease
- Macrovascular complications are the greatest cause of morbidity and mortality
- Control of macrovascular complications is associated with greater relative reduction in morbidity and mortality for older than younger persons with DM

Figure 1. Causes of Death for Older Persons with Diabetes



Harris, 1995

Microvascular Disease in Type 2 DM

- Prevalence of diabetic nephropathy increases with duration of disease and age
 - 8% of persons have proteinuria at diagnosis
- After 20 years of DM >60% have retinopathy
 - 21% have retinopathy at diagnosis
- Neuropathy increases with duration of disease and age:
 - 44% of those aged 70-79 years have neuropathy
 - 37% of those who have had diabetes for 10 years

DM Symptoms Vary by Age

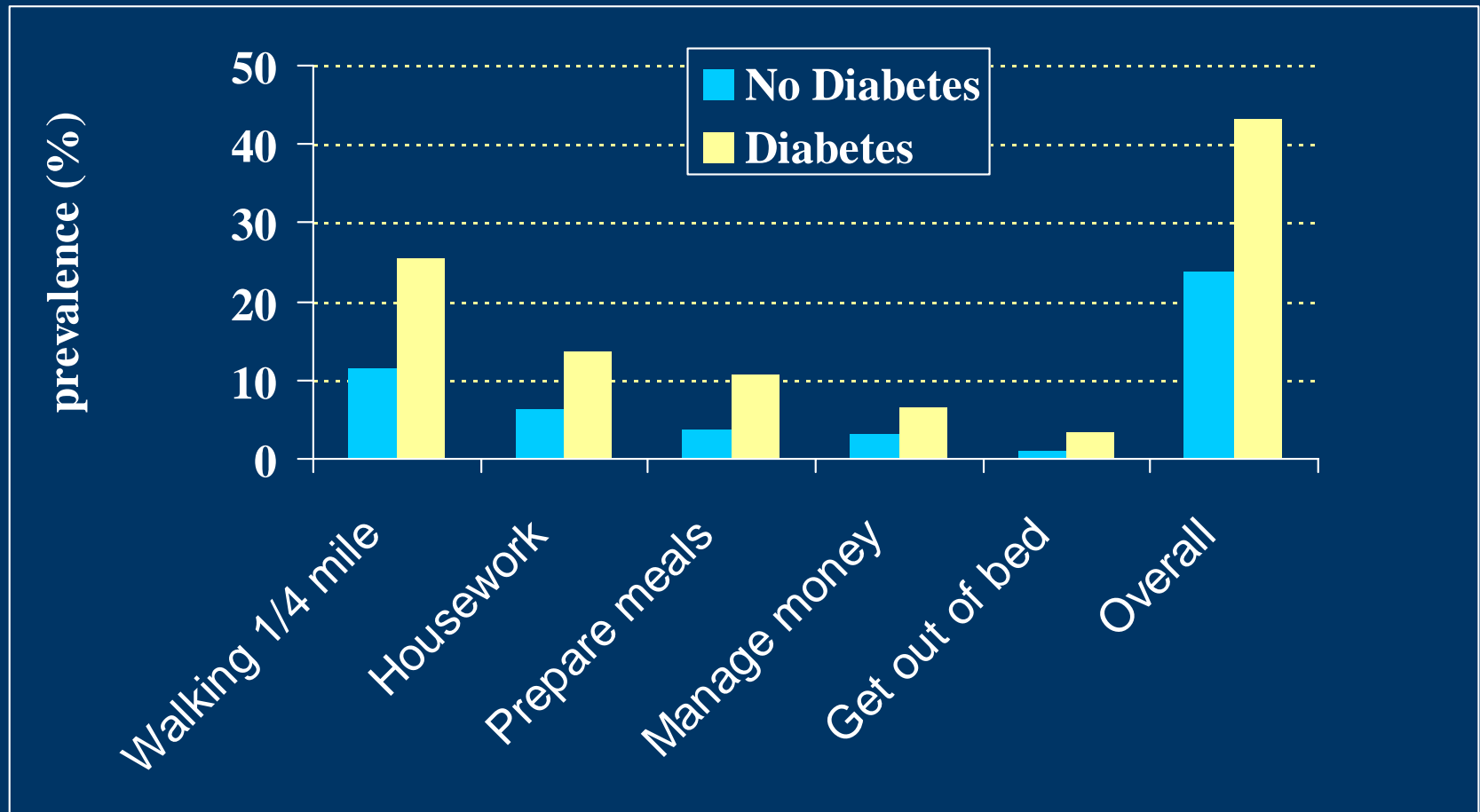
Symptoms may differ in older persons:

- May not have the classic presenting symptoms of increased urination, thirst, hunger
- Hyperglycemia may present as falls, urinary incontinence, fatigue, lethargy, mental confusion, weight loss, infections, poor wound healing, and visual disturbances
- Hyperglycemic hyperosmolar coma, though uncommon, mainly occurs in older persons

Why We Cannot Always Extrapolate to Older Adults with Diabetes

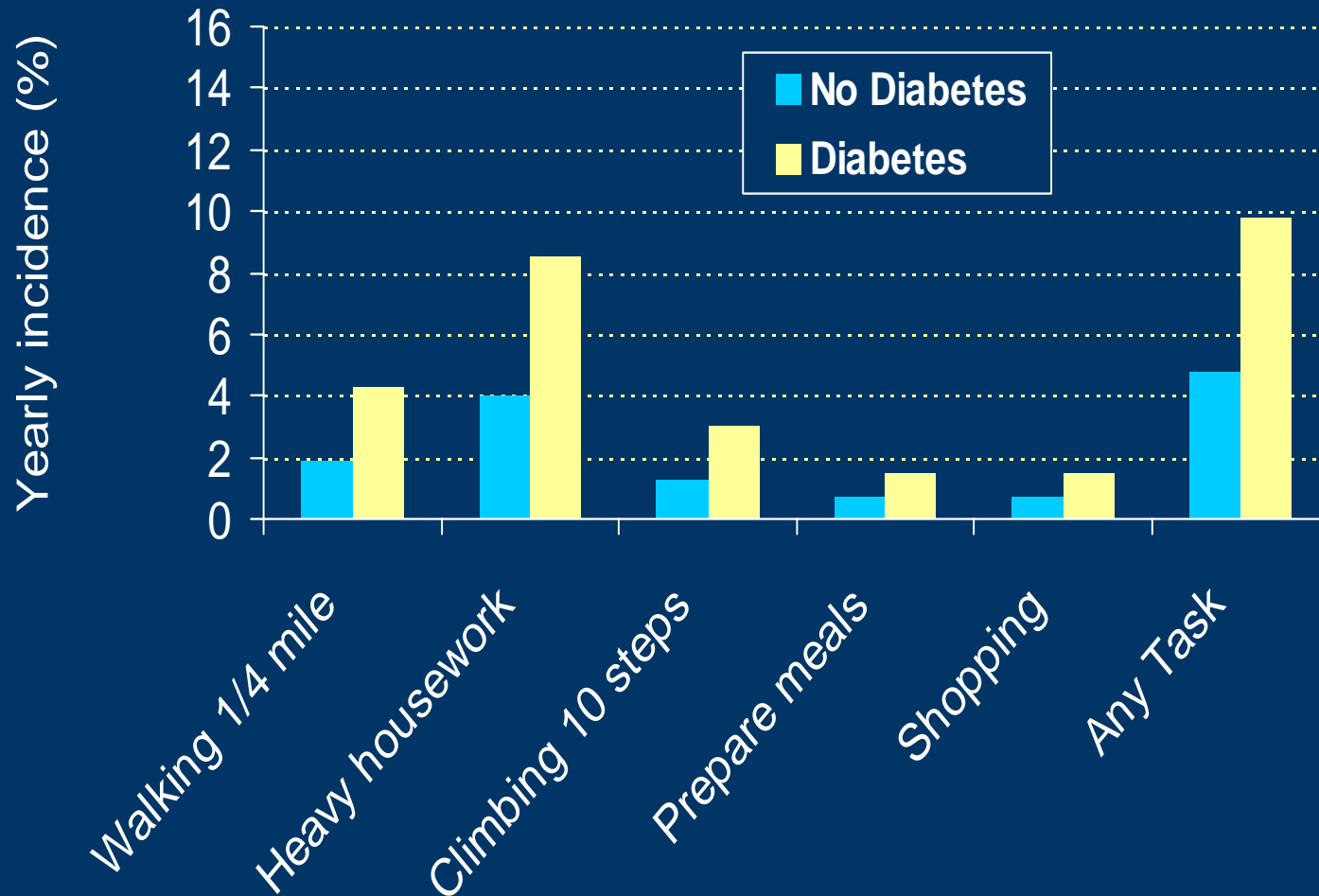
- Heterogeneity
- Comorbid conditions
 - Functional limitations
 - Cognitive decline
- Polypharmacy
- Life expectancy versus
 - time to incidence or progression of microvascular or macrovascular complications
 - time to expected benefit of intervention

Prevalence of inability to do physical tasks and basic activities of daily living among non-institutionalized U.S. women age 60+ with and without diabetes (NHANES III)



Gregg, 2000

Yearly incidence of inability to do physical and household tasks among women aged 65 and older with and without diabetes (SOF)



Gregg, 2002

**Relative risks and benefits of
glycemic control and management
of hypertension and dyslipidemias
among older persons with
diabetes mellitus**

Comparing the Effectiveness of Therapies

- Although no studies have evaluated treatment of blood pressure, lipids, and glycemia simultaneously, there are several ways to compare the benefits and risks of these interventions.
 - One approach is to consider the relative benefits of each of these therapies by the *number needed to treat* with the intervention to prevent one event (NNT)
 - A second approach is *time to benefit* for an intervention

Number Needed to Treat (NNT)

- The next slide summarizes data from several studies of glycemia, hypertension, and lipid management to show the number of patients that must be treated with each intervention to prevent specific events.
- The events evaluated are any diabetes endpoint, cardiovascular events, and all-cause mortality.

NNT to Prevent One Event

	DM Endpoints	CVD Events	All-cause Mortality
Glucose Control ^{1,2}	74 - 196	-----	141 - 1000 (NS)
HTN Treatment ³⁻⁸	11	12 - 38	19 - 31
Lipid Management ⁹⁻¹²		7 - 47	57

¹ UKPDS 33; ² UKPDS 34; ³ UKPDS 38; ⁴Tuomilehto, 1999;
⁵Lievre, 2000; ⁶Estacio, 2000; ⁷microHOPE, 2000; ⁸Estacio, 2000;
⁹Sacks, 1996; ¹⁰Elkeles, 1998; ¹¹Rubins, 1999; ¹²Heart Protection
Study

Time Needed to Benefit

	Microvascular Complications (Median Years)	Macrovascular Complications (Median Years)
Control of:		
Glycemia	4.5	10
Blood Pressure	4.5	3
Lipids	--	3 to 6

Benefits of Glycemic Control

The United Kingdom Prospective Diabetes Study (UKPDS)

- 3867 patients with newly diagnosed type 2 DM
 - 25 to 65 years old, mean age 54 years
- Intervention: Intensive glycemic control with sulphonylureas and insulin vs. diet alone over 10 years
- When applying UKPDS to older persons, **REMEMBER** most older persons have had DM greater than 10 years and are not newly diagnosed.

Glycemic Control Benefits Observed in UKPDS

For every 0.9% reduction in A1C:

	<u>RR</u>	<u>ARR*</u>	<u>NNT</u>
• Any DM endpoint	12%	5.1	196
• Microvascular endpoints	25%	2.8	357
• Myocardial infarction	16%	2.7	370

* Events per 1000 patient years

UKPDS 33, 1998

Glycemic Control: Potential Benefits, Risks, and Unanswered Questions

- If diabetic retinopathy or renal disease are present, glycemic control is very important
- Hypoglycemia increases with intensity of glycemic control. The risk of hypoglycemia precipitating injury, myocardial infarction, seizure, stroke, or death is greatest in:
 - frail older persons
 - those who eat erratically
 - those on insulin

Glycemic Control

Implications of Weight Change

- Intensive control can lead to weight gain, which is associated with poorer glycemic control.
- In population-based studies of older persons, weight loss has been associated with increased morbidity and mortality.
- However, some studies that included older persons with DM suggest that intentional weight loss is associated with improvement in control of DM and comorbid conditions.

Glycemic Targets

- For older persons, target hemoglobin A_{1c} (A1C) should be individualized.
- A reasonable goal for A1C in relatively healthy adults with good functional status is 7% or lower.
- For frail older adults, persons with life expectancy less than 5 years, and others in whom the risks of intensive glycemic control appear to outweigh the benefits, a less stringent A1C target such as 8% may be appropriate.

Treatment of Hyperglycemia

- Medical Nutritional Therapy
 - Nutritional recommendations to maintain optimal metabolic outcomes and prevent chronic complications of diabetes that takes into consideration cultural and lifestyle preferences
- Exercise
- Weight reduction when indicated
- Oral glucose lowering agents / insulin

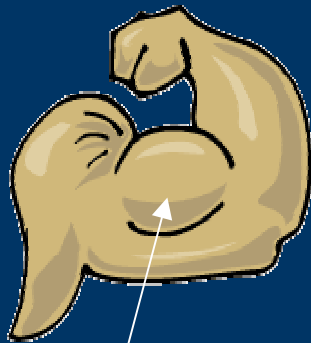
Site of Action for Medications

Insulin Sensitizers

Metformin

Secretagogues

Sulfonylureas
repaglinide,
nateglinide



Insulin Sensitizers

Thiazolidinediones TZD

Insulin Sensitizers

α -glucosidase inhibitors
acarbose, miglitol

Initial Therapy

- Shifting from secretagogues and α -glucosidase inhibitors to insulin sensitizers
- Very little head to head clinical trial data to support one class of drugs over another
- Insulin Sensitizers may decrease CVD risk
- Has major cost implications

Metformin (Glucophage)

- **Action:**
 - Decreases hepatic release of glucose
 - Decreases insulin resistance
- **Benefits:**
 - Induces weight loss by decreasing appetite
 - No hypoglycemia
 - Lowers cholesterol / triglycerides
- **Side Effects:**
 - Gas, Abdominal discomfort, Diarrhea
- **Special Considerations:** Do not use if there is CHF or Renal Failure
- **Generic available:** 60 tabs (500mg) \$33.99

TZDs

Pioglitazone (Actos), Rosiglitazone (Avandia)

- **Action:** Shift adipocytes from the peritoneum to subcutaneous space:
 - Lower FFA levels
 - Increased subcutaneous adipocytes and increased expression of gene for glycerol kinase results in increased FFA storage
 - Lower FFA causes increased glucose use by myocytes and decreases insulin resistance
- **Benefits:**
 - No hypoglycemic reactions
 - May increase HDL/LDL ratio
- **Side Effects:** Swelling, possible weight gain,
- **COST:** 30 tabs (15mg) \$90.99, 30 tabs (4mg) \$114.46
- **Special Considerations:**
 - May take 2-8 weeks to be effective
 - Liver function tests need to be monitored
 - Should not be taken with liver disease, alcohol abuse, & CHF

Sulfonylureas

Glyburide, Glipizide, Glimepiride
(Micronase), (Glucotrol), (Amaryl)

- **Action:** Stimulates the pancreas to produce more insulin
- **Benefits:** Improved blood sugar control
- **Side Effects:**
 - Hypoglycemic reactions
 - Weight gain
- **Special Considerations:**
 - Consistent meal times
- **Cost:** 30 tabs (2.5mg) \$7.99, 30 tabs (5mg) \$14.00, 30 tabs (1mg) \$13.06

Repaglinide, Nateglinide (Prandin), (Starlix)

- **Action:** Tells the pancreas to release insulin after meals
- **Benefits:**
 - Duration: 1-2 hours
 - Improved blood glucose after meals
- **Side Effects:** Possible weight gain, possible hypoglycemia
- **Special Considerations:**
 - If you skip a meal, skip the dose
 - Take immediately before eating
- **Cost:** #90 (0.5mg) \$95.42, #90 (60mg) \$102.03

Acarbose, Miglitol (Precose), (Glyset)

- **Action:** Slows or blocks the digestion of complex carbohydrates in the intestines
- **Benefits:** Improved blood glucose after meals
- **Side Effects:** Gas, Abdominal pain, Diarrhea
- **Special Considerations:**
 - Take with the first bite of food
 - Avoid with intestinal problems
- **Cost:** #90 (25mg) \$60.41, #90 (25mg) \$56.67

Hypertension

- Over 60% of persons with type 2 diabetes over the age of 65 have hypertension.
- Fewer than 50% of persons with diabetes aged 65-75 years have blood pressure <140/90
- Hypertension increases the risk of cardiovascular disease associated with type 2 diabetes.
- Hypertension is also a risk factor for the development of microalbuminuria and retinopathy.

Benefits of Lower Blood Pressure in SHEP

- Data: Systolic Hypertension in the Elderly Program (SHEP)
- Subjects: 583 persons with type 2 DM and 4149 without DM, mean age 71 years. Persons using insulin excluded
- Intervention: blood pressure reduction with low dose chlorthalidone + atenolol or reserpine if needed to achieve the target BP (Goal SBP < 160 with ≥ 20 mmHg decrease from baseline)
- Outcomes: 5 year rates of major CVD events and all cause mortality

Persons with diabetes in SHEP

- Event rates per 1000 person-years and risk reduction:
 - Major CVD - prevented 8.9 events
 - Nonfatal MI and fatal CHD - prevented 5.5 events
 - Major CHD (above + CABG or Angioplasty) - prevented 7.2 events
 - All cause mortality - not significantly different in intervention and control groups
 - For all endpoints, the number of events prevented was greater for persons with diabetes compared to those without

Hypertension Optimal Treatment HOT

- Subjects: 18,790 persons, mean age 61.5 years. 1,501 persons with DM, average f/u 3.8 years
- Intervention: diastolic blood pressure reduction in 3 ranges (≤ 90 , ≤ 85 , ≤ 80) with felodipine + 5 step regimen
- Outcomes: Rates of major CVD events (nonfatal MI, non fatal CVA, fatal CVD)

Persons with Diabetes in HOT

- Absolute risk reduction for DBP ≤ 80 vs ≤ 90 in events prevented per 1000 person-years:
 - major CVD events - prevented 12.5 events
 - cardiovascular mortality - prevented 7.4 events
 - all cause mortality - 6.9 events
- For all events prevented, rates were greater for persons with diabetes compared to those without diabetes

Blood Pressure Control

Other Recent Studies

- Several other recent studies support the beneficial effect of blood pressure control over a 2-6 year time period.
- Significant reduction in cardiovascular and cerebrovascular events and/or a reduction in rates of nephropathy and retinopathy.

Blood Pressure Control Studies of Older Persons and Persons with DM

- Studies that included significant numbers of older adults with DM:
 - ABCD [Schrier, 2002]
 - RENAAL [Brenner, 2001]
 - Sys-Eur [Staessen, 2001]
 - microHOPE [2000]
 - STOP Hypertension [Lindholm, 2000]
 - UKPDS 38 [1998]

Hypertension Guidelines

- The target blood pressure should be less than 140/80 if it is tolerated.
- Epidemiologic evidence shows that lowering blood pressure to less than 130/80 may provide further benefit.

Diabetic Dyslipidemia

- LDL levels not necessarily elevated, but LDL fraction has a higher proportion of dense small atherogenic particles
- Reduced HDL
- Elevated triglycerides (TG) and VLDL
- Associated with a 2-4 fold excess risk of coronary heart disease

Benefits of Lipid Management

- Lipid lowering therapies reduce mortality and morbidity among both older adults in general and adults of all ages with DM.
- Although data on *older adults with DM* are not available, it is likely that the risk reduction is comparable if not higher in this sub- group.

Meta-analyses of CHD Risk Reduction for Lipid Lowering Agents

	N	Mean RR
No Diabetes	25147	27%*
Diabetes	2443	31%*
Younger Age	19119	33%*
Older Age	16549	30%*

* $p < 0.05$

Source: ATP III, National Cholesterol Education Program, 2001

Benefits of Lipid Management in 4S

In 4S observed difference among those with DM:

- 27% reduction in total cholesterol
- 36% reduction in LDL
- 7% increase in HDL

Outcomes per 1000 person-years:

<u>Outcome</u>	<u>Events Prevented</u>
Major CHD	4.6
Total Mortality	8.2
All CVAs	5.0

Benefits of Lipid Management

- Other studies have shown similar benefits of lipid lowering agents:
 - Statins
 - Heart Protection Study, 2002
 - CARE (Sacks, 1996)
 - Fibrates
 - SENDCAP (Eikeles, 1998)
 - VA-HIT (Rubins, 1999)

Target lipoprotein levels

ADA targets are appropriate for the vast majority of older persons with DM:

LDL	HDL	TG
<100	>40	<150

American Diabetes Association, Clinical Practice Recommendations 2003

Priorities for treating dyslipidemia

- Lower LDL HMG CoA reductase inhibitor (statin)
- Raise HDL Behavioral interventions
- Lower TG Glycemic control, fibric acid derivative
- Combined Glycemic control + statin +/- fibric acid derivative

Strategies for CVD Risk Reduction

- Decrease weight
- Increase exercise
- Treat dyslipidemia
- Aspirin use
- Smoking cessation
- Decrease fat intake
- Control hypertension

Aspirin Therapy

- Daily use of ASA is associated with decrease in fatal and non-fatal MI
- Decrease is similar in magnitude to that observed for non-diabetics

Behavioral Change: Assessment and Education for the Older Adult with Diabetes Mellitus

Lifestyle Modification in Older Adults

- Lifestyle modification through diabetes education, diet, and exercise plays an important role in the management of DM and its complications.
 - Functional limitations, polypharmacy, and cognitive impairment may reduce the ability to participate in standard behavioral regimens
 - Cultural background and educational attainment may also influence patients' ability or willingness to participate in lifestyle modification

Behavioral Change

Diabetes Education

- Self-management education is an important tool in achieving clinical targets and enhancing quality of life.
- DM education and medical nutrition therapy are covered benefits under Medicare Part B.
- Involvement of family and caregivers can be important.
- Knowledge and information needs should be assessed and educational efforts tailored to these needs.

Behavioral Change

Exercise

- Evidence from several randomized controlled trials (RCTs) indicates that increased physical activity in combination with nutrition education can significantly reduce weight and enhance blood pressure, lipid, and glycemic control in older adults.

Glasgow, 1992; Agurs-Collins, 1997; Ridgeway, 1999

Behavioral Change

Diet

- 8 RCTs have evaluated dietary education in the management of older adults with DM and have found that it can significantly improve weight, blood pressure, lipid levels, and glycemic control.
- Most studies focus primarily on middle-aged adults, but one specifically targeted adults aged 65 years and older and produced results similar to the others.

de Bont 1981, Glasgow 1989, Turnin 1992, Frost 1994, Arseneau DL 1994, Pi-Sunyer 1999, Metz 2000, Miller 2002

Behavioral Change

Medication Education

- Older persons may receive inadequate information about their medications:
 - Package inserts do not meet the readability needs of older adults.
 - Language and health literacy can be a barrier to getting information about side effects and adverse reactions.

**The importance of screening for
and treatment of the geriatric
syndromes when caring for older
persons with diabetes mellitus**

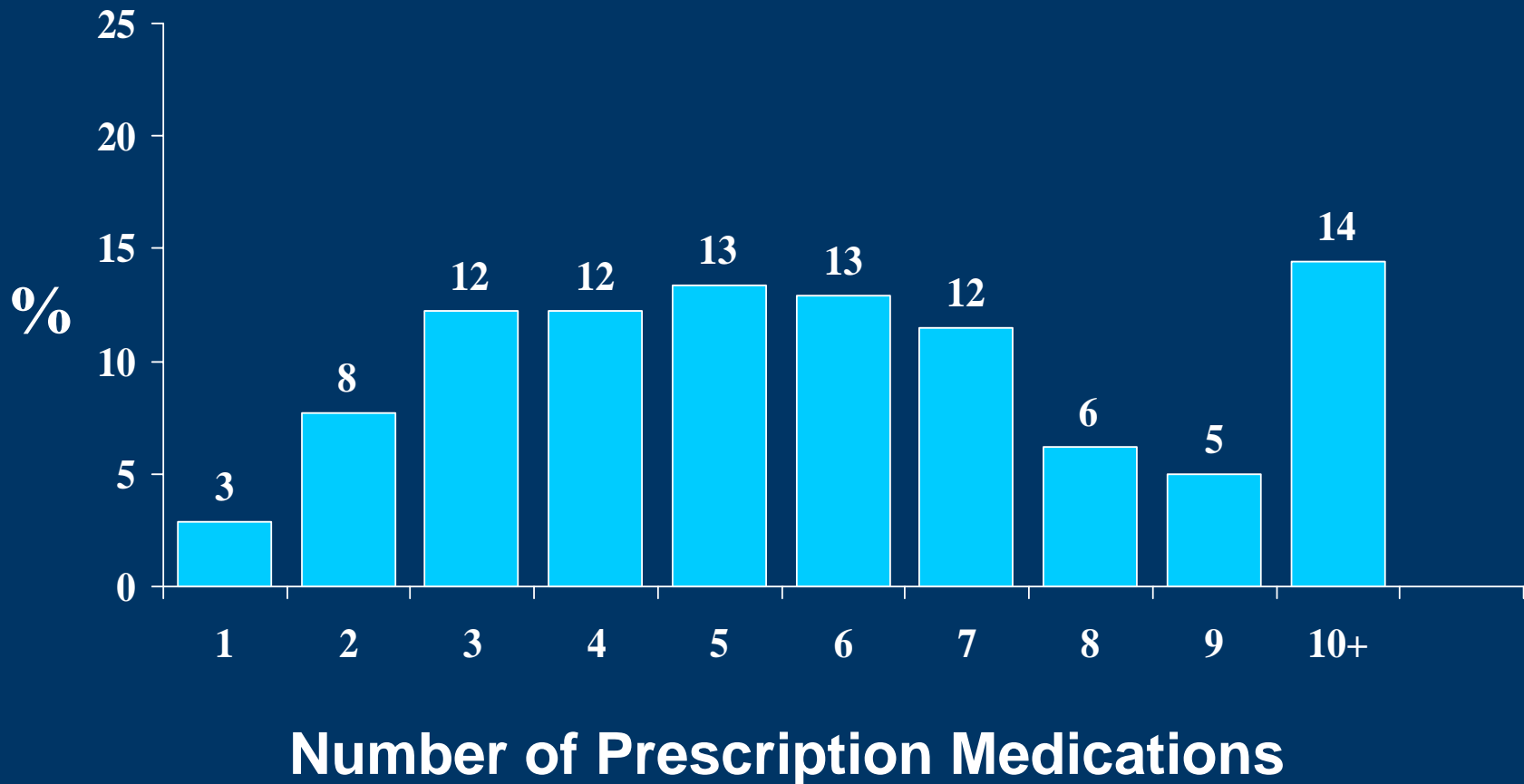
Why the Geriatric Syndromes?

- Geriatric syndromes are more common in older adults with diabetes than in those without.
- Therefore, screening and treatment of common geriatric syndromes may significantly reduce morbidity and improve quality of life in older adults with diabetes

Geriatric Syndromes

- Polypharmacy
- Depression
- Cognitive Decline / Dementia
- Injurious Falls
- Urinary Incontinence
- Chronic Pain

Number of Prescription Medications Used by Older Adults with Diabetes



Depression, Aging, and Diabetes

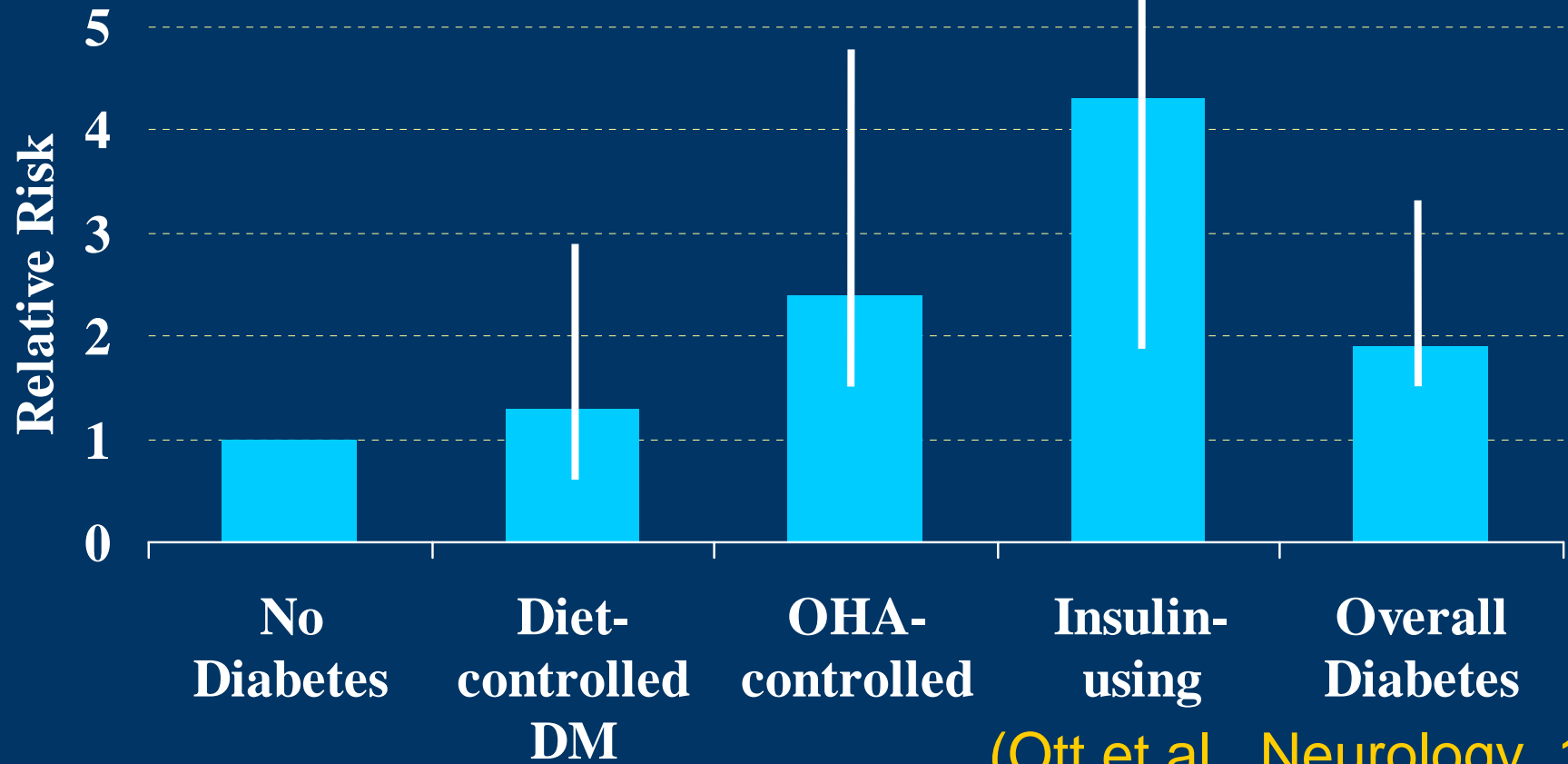
- Older adults with DM are at increased risk for depression, and there is evidence of under-detection and under-treatment in the primary care setting.
- Antidepressant use is low in older adults who may need these medications
 - <10% of depressed older adults
 - < 5% of older adults with high levels of depressive symptoms

Diabetes and Cognitive Impairment

Potential Mediators

- Accompanying and Following DM:
 - Chronic Hyperglycemia
 - Repeated Hypoglycemia
 - Medications / Polypharmacy
 - Microvascular Disease
 - Macrovascular Disease
 - Damage from Vascular Events

Age-adjusted Relative Risk of Dementia Associated with Diabetes among 6370 Adults age 55+ in the Rotterdam Study



(Ott et al., Neurology, 1999)

Relative risk of Dementia Associated with Diabetes from Prospective Epidemiologic Studies

Study

Bronx Aging Study, NY
(Katzman et al. '89)

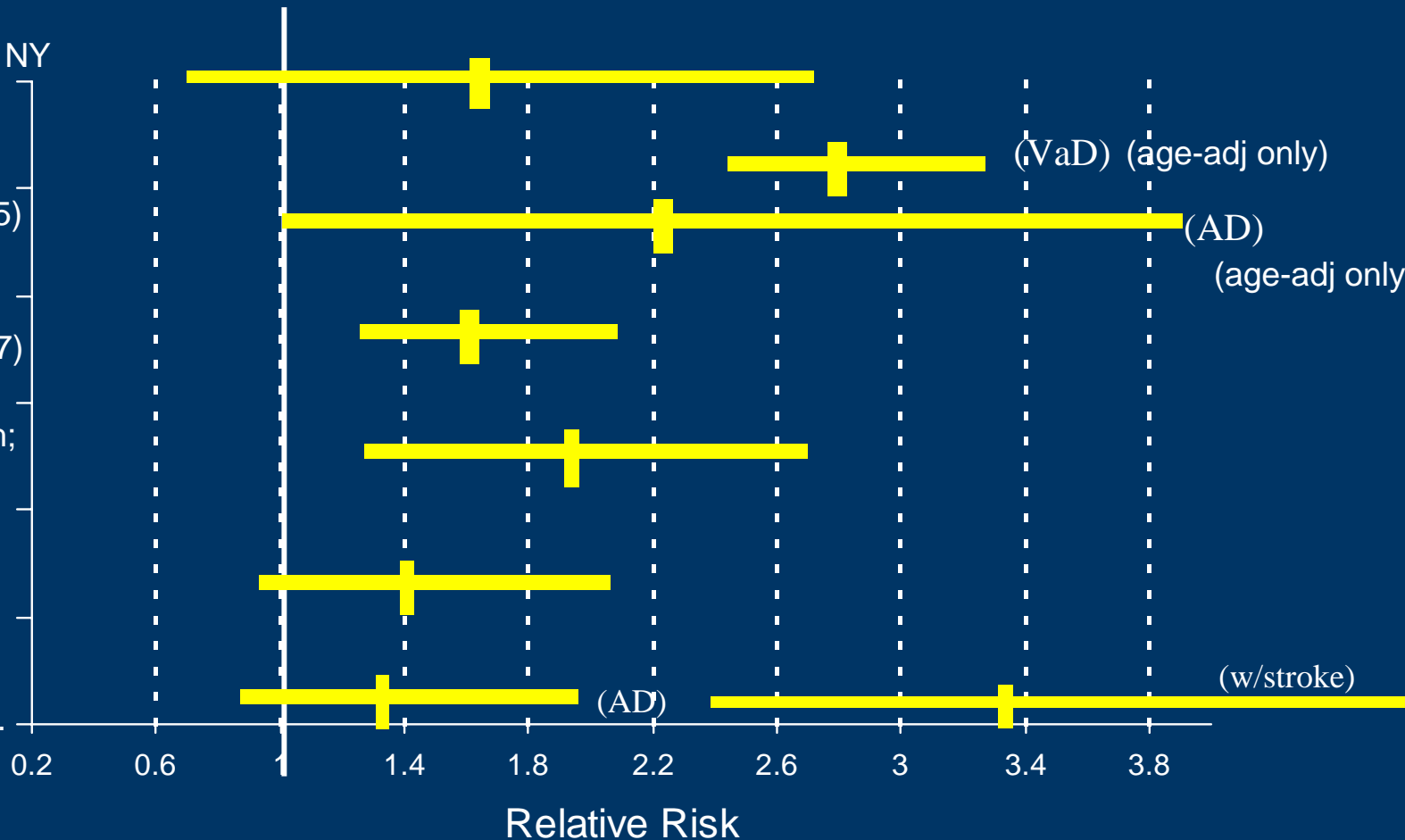
Hisayama, Japan;
(Yoshitake et al., '95)

Rochester, MN;
(Leibson et al. '97)

Rotterdam, Neth;
(Ott et al. '99)

Honolulu, HI
Curb et al.
'99

Manhattan, NY,
(Luchsinger et al.
'01)



Injurious Falls and Diabetes

- Possible risk factors for injurious falls among older persons with DM include:
 - high rates of frailty and functional disability
 - visual impairment
 - peripheral neuropathy
 - hypoglycemia
 - polypharmacy

Kelsey 1992, Morley 1998, Schwartz 2001, Cummings 1995, Gregg 2002

Urinary Incontinence and Diabetes

- Risk factors for urinary incontinence that are more common among older adults with DM:
 - Polyuria
 - Overflow secondary to neurogenic bladder and autonomic insufficiency
 - Urinary tract infection
 - Candida vaginitis
 - Fecal impaction due to autonomic insufficiency.

Key Elements of Care for Older Persons with Diabetes

- Individualized Care and Education
- Prevention and Management of Cardiovascular Risk Factors
- Glycemic Control and Prevention and Management of Microvascular Complications
- Screen and Treat Geriatric Syndromes

For the full text of the Guideline:

[http://www.blackwell-synergy.com/links/
doi/10.1046/j.1532-5415.51.5s.1.x/full/](http://www.blackwell-synergy.com/links/doi/10.1046/j.1532-5415.51.5s.1.x/full/)