DIABETES 101 THE BASICS OF DIABETES CARE

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Objectives

After participating in this activity participants will be able to:

1) Explain type 1 and type 2 diabetes in basic terms.
2) Identify the treatment modalities for both types of diabetes.
3) List 4 complications of diabetes and how to reduce the risk.
4) Explain in basic terms what diabetic neuropathy is and what can be done to manage symptoms and prevent further complications.
5) Identify 3 important things a person with diabetes can do when sick to prevent blood sugars from becoming dangerously high or low.

The State of Diabetes in the US as of 2015

- Total: **30.3 million people of all ages** (9.4%) of the US population had diabetes (DM)

- Included: **30.2 million adults**, 18 yrs. or older (12.2% of all US adults); 7.2 million (23.8%) were not aware they had diabetes

- The percent increased with age to a high of **25.2% among those aged 65 yrs. or older**
Diabetes prevalence 2013-2015 by race/ethnicity and sex - US adults

Common Types of Diabetes

Type 1:
• Occurs in ~ 5% of people with diabetes

Type 2:
• Occurs in ~ 90 – 95% of people with diabetes

Gestational Diabetes:
• Occurs in ~ 2 – 10% of pregnancies

Other Types of Diabetes
• Latent Autoimmune Diabetes in Adults (LADA)
• Maturity Onset Diabetes of the Young (MODY)
• Genetic defects in beta-cell function, insulin action
• Diseases of the exocrine pancreas
• Drug- or chemical-induced
Facts About Type 1 Diabetes

- About 5% of all DM is Type 1
- Usually occurs at a younger age (less than 30 yrs. old)
- Pancreas is no longer able to make insulin
- Have to take insulin to survive

Type 1 Diabetes

In type 1 diabetes, autoimmunity is considered the major factor in the pathophysiology of the disease. Beta cells in the pancreas make insulin and they are destroyed. When ~80-90% are no longer able to make insulin, hyperglycemia develops and diabetes may be diagnosed.

This autoimmune β-cell destruction may be result of:
1) Genetic susceptibility
2) Environmental factors:
   - Viruses
   - Chemical agents

Risk Factors for Type 1 Diabetes

- Family history – parent or sibling with type 1 diabetes
- Genetics – presence of certain genes indicates an increased risk of developing type 1 diabetes
- Geography – incidence of type 1 DM tends to increase away from the equator
- Age – two noticeable peaks in incidence of type 1 diabetes in children:
  - between 4 and 7 yrs. old
  - between 10 and 14 yrs. old
Facts About Type 2 Diabetes

• About 90-95% of all DM is Type 2
• Most often occurs middle-to-older age
• Pancreas is still able to make insulin, but not enough and often the insulin does not work properly to lower blood sugar levels

Type 2 Diabetes

Less insulin is produced

Fat Cells and Muscle Cells

Do not use insulin properly

Risk Factors for Developing Type 2 Diabetes

• Over weight
• Age over 45
• Ethnicity- Native American, Asian, Black, Hispanic
• Family history
• Sedentary lifestyle
• High cholesterol
• High Triglycerides
• High blood pressure
• Gestational diabetes or baby >9 pounds
Symptoms of Diabetes
“Classic” symptoms of DM, type 1 and type 2 include:

- Polyuria - Excessive urination
- Polydipsia - Excessive thirst
- Polyphagia - Excessive hunger
- Increased tiredness/fatigue
- Vision changes

Additional Symptoms More Specific to Type of Diabetes

Type 1
- Weight loss that is unintentional
- Nausea/vomiting
- Feeling flu-like

Type 2
- Increase in infections - yeast, urinary, skin
- Dry itchy skin
- Slow healing sores
- No symptoms

Tests to Diagnose Diabetes

<table>
<thead>
<tr>
<th>Test</th>
<th>Hgb(A1C)</th>
<th>FPG</th>
<th>Random Glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td>How Performed</td>
<td>Measured at anytime regardless of eating</td>
<td>Must be measured after at least an 8 hour fast</td>
<td>Can be measured at anytime regardless of eating</td>
</tr>
<tr>
<td>Normal</td>
<td>≤5.6 %</td>
<td>&lt; 100 mg/dL</td>
<td></td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>≥ 6.5%</td>
<td>≥ 126 mg/dL</td>
<td>≥ 200 mg/dL with symptoms</td>
</tr>
</tbody>
</table>

In the absence of high blood glucose symptoms, results should be confirmed by repeat test.
Treatment Modalities for Type 1 and Type 2 Diabetes

- Medication
- Nutrition
- Exercise
- Blood glucose monitoring
- Education

Difference in Pharmacologic Treatment

Type 1
- Insulin therapy essential
  - Insulin injections several times per day
  - Wear an insulin pump

Type 2
- Insulin therapy not essential
  - Oral medications
  - Injectable medications
  - Insulin injections, one or more times per day
  - May take oral medications and insulin

Nutrition

Individuals with diabetes should receive Medical Nutrition Therapy (MNT) provided by a registered dietitian (RD).

The RD has the expertise to provide:
- Individualized meal plan that addresses healthy food choices & appropriate food amounts for managing blood glucose, blood pressure, and lipids
- Individualized plan for weight loss or weight maintenance
- Additional dietary considerations for:
  - specific conditions such as celiac disease, food allergies, etc.
  - dietary preferences such as vegan
Exercise

- General recommendation is for 150 min/week of moderate intensity aerobic physical activity over at least 3 days per week with no more than 2 consecutive days without exercise

- Types of exercise, duration and frequency need to be ‘individualized’:
  - precautions
  - risk of hypoglycemia

- Amount of time spent sedentary should be no more than 90 minute intervals

Benefits of Home Blood Glucose Monitoring

- Helps to determine what dose of insulin to take
- Tells if blood sugar level is too low (hypoglycemia)
- Shows:
  - how much activity/exercise lowers blood sugar level
  - how different foods affect blood sugar level
  - if blood sugar levels are running too high
  - if blood sugar level is safe to drive
  - if blood sugar level is safe to exercise

Times of Day To Check Blood Sugar Levels

- Fasting in the morning
- Before meals
- 2 hours after the start of a meal (or snack)
- Bedtime
- Before driving
- Before exercising
Blood Glucose Monitoring at Home

Type 1 DM - typically check blood sugars 4 or more times per day.

Type 2 DM - may check blood sugar levels once a day up to 4 times per day. Some individuals may check every other day.

How often a person checks blood sugar depends on:
- insurance coverage for testing supplies
- what kind of diabetes medication is being taken
- how stable blood sugar readings have been over time
- how the person is feeling, i.e. experiencing an illness

Blood Glucose Meters

Diabetes Education

• All individuals diagnosed with type 1 & type 2 diabetes should receive diabetes education -
  • Provided by staff experienced in working with patients with diabetes (Certified Diabetes Educators - CDEs)
  • At a site that has a recognized program by the American Diabetes Association (ADA) or the American Association of Diabetes Educators (AADE)
  • Comprehensive education to learn about the disease and treatment modalities in order to control blood sugars and prevent acute and long-term complications
## Diabetes Education Content

- What is diabetes
- How is diabetes diagnosed
- How does food affect blood sugars, blood pressure and heart health
- What are carbohydrates, healthy fats and what about salt
- How to read food labels
- Exercise options and how much is enough
- What to know about diabetes medicines
- How often should blood sugar be checked at home and at what times

## Diabetes Education Content (cont)

- What are recommended blood sugar targets
- How to prevent high and low blood sugars
- How to treat low blood sugar
- How to prevent long-term complications
- What to do when sick
- Tips to know for traveling
- What regular tests and exams are important
- Who should be contacted for questions

## Many Things Can Cause Blood Sugar Levels to Change:

- Diet
- Exercise
- Stress
- Illness
- Drugs – prescription and over the counter
- Time of day

Many Things Can Cause Blood Sugar Levels to Change:

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What is Hyperglycemia

Hyperglycemia refers to blood sugar levels that consistently run above an individual’s target blood sugar range.

Symptoms include:
- Polyuria
- Polydipsia
- Polyphasia
- Fatigue
- Impaired vision
- Slow healing cuts or sores
- Frequent infections
- Unexplained weight loss

Causes of Hyperglycemia

- Not enough or missed doses of DM medication
- Overeating carbohydrates
- Decreased physical activity
- Illness
- Pain or physical trauma
- Stress (physical or emotional)
- Certain medications (such as steroids)

Illness and Diabetes

During periods of illness, injury, or infection, individuals with type 1 or type 2 DM may experience elevated blood sugars. If adequate care is not taken, blood sugar levels may escalate out of control.

This can lead to a serious complication for individuals with type 1 diabetes called diabetic ketoacidosis (DKA).

For individuals with type 2 DM, the risk for developing hyperosmolar hyperglycemic state (HHS) can become a concern.
How to Manage Sick Days

• Monitor blood sugar levels every 4 hours.

• If Type 1 DM, check the urine for ketones every 4 hours.

• Take usual diabetes medication, if unable to eat, contact health care team for instructions on the dose to take.

• Stay hydrated – drink 6-8 ounces of liquids every hour – sugar free if blood sugar levels are higher; liquids with sugar if blood sugar levels are lower.

How to Manage Sick Days (cont)

If unable to stick to usual meal plan, but able to eat some foods, try to eat/drink at least 45 grams of carbohydrate (carb) every 3-4 hours. Choices that equal ~ 15 grams of carb are:

• ½ cup fruit juice
• ½ cup regular soda
• ½ cup regular jello
• 1 double popsicle
• 1 cup soup
• 1 slice toast
• 6 crackers
• 1/2 cup sports drink

How to Manage Sick Days (cont)

Call the health care team or go to the nearest Urgent or Emergency Care in the following instances:

• If ketones are “moderate or large”
• If vomiting and unable to keep fluids down
• Blood sugar levels are over 250 mg/dL for more than 2 checks
• Fever 101 or higher for more than 24 hours
• Vomiting and/or diarrhea for more than 6 hours
• Not sure what to do to manage situation
How to Manage Sick Days (cont)

Symptoms of diabetic ketoacidosis (DKA) include those for high blood sugar plus:
“Fruity” smelling breath
Nausea
Vomiting
Stomach cramps
Difficulty breathing
Confusion
Unconsciousness

This is a serious complication and can be fatal.

How to Manage Sick Days (cont)

Hyperosmolar Hyperglycemic State may become an issue for individuals with type 2 diabetes during acute infections and other illnesses. Characteristics include:

- Severe hyperglycemia
- BG may be > 600 mg/dL
- Extreme dehydration
- Altered consciousness
- Confusion
- Disorientation
- Coma
- Focal or generalized seizures may occur

Illness and Diabetes
How to be Prepared

Visits to Urgent or Emergency Care can usually be avoided if prepared for sick days and the situation is monitored closely when ill. Every one with diabetes should have a Sick Day Management Kit including:

Blood sugar test strips
Diabetes medications
Sugar-free and sugar fluids
Ketone test strips (if type 1 diabetes)
Medication for nausea or vomiting
Medication for diarrhea
Health care team contact number
What is Hypoglycemia

By definition, hypoglycemia is: blood glucose level < 70 mg/dL, with or without symptoms.

Some individuals experience symptoms of hypoglycemia when their blood sugar level is above 70 mg/dL, but lower than their ‘usual’ levels. This should be treated as hypoglycemia for these individuals.

Hypoglycemia Symptoms

‘Typically sudden Onset’

<table>
<thead>
<tr>
<th>Stage</th>
<th>Signs and Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild Hypoglycemia</td>
<td>Feeling of shakiness, trembling, Perspiration, Blurred vision, Dizziness, Difficulty concentrating, Feeling nervous or anxious, Feeling of weakness, Numbness or tingling around mouth and lips, Fatigue, Headache, Sudden hunger, Nausea, Rapid heart rate, palpitations</td>
</tr>
</tbody>
</table>

Advanced Hypoglycemia Symptoms

<table>
<thead>
<tr>
<th>Stage</th>
<th>Signs and Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate Hypoglycemia</td>
<td>Irritability, Agitation, Confusion, Lack of coordination, Difficulty speaking or slurred speech</td>
</tr>
<tr>
<td>Severe Hypoglycemia</td>
<td>Confusion, Fainting/loss of consciousness, Seizures, Inability to swallow</td>
</tr>
</tbody>
</table>
Causes of Hypoglycemia

- Skipping meals or eating less than usual at meals
- Eating a meal later than usual
- Drinking alcohol without eating/on an empty stomach
- Increase in physical activity beyond usual, i.e. mowing lawn, gardening, shopping, laundry, housework
- Adding new exercise
- Taking wrong dose of diabetes medicine
- Taking diabetes medicine at the wrong time
- Taking too much diabetes medicine

Treatment of Hypoglycemia

15 grams of “quick” carbohydrate

- ½ c fruit juice (any kind)
- ½ c regular soda
- 1 TBSP regular sugar, honey or regular syrup
- 1 c milk (low-fat)
- 4 glucose tablets
- 5 lifesaver candies (chewed)
- 2 TBSP raisins

Commercial Products For Treatment of Hypoglycemia
What not to use for treating hypoglycemia

For initial treatment of low blood sugar; avoid using the following:

Candy Bars
Sweets/Desserts
Chocolate
Ice Cream

These foods contain fat. Fat slows down the absorption of sugar into the blood stream. So these are not quick-acting.

Glucagon

All patients with type 1 diabetes and those with type 2 who are taking insulin and prone to (severe) hypoglycemic episodes or who have hypoglycemia unawareness should be prescribed a glucagon kit.

Medical Alerts

People with DM should always carry or wear medical identification (such as a bracelet or tag) to alert health care practitioners and others to the presence of diabetes.
Cardiovascular Disease (CVD)

- CVD is:
  - major cause of morbidity and mortality for individuals with diabetes
  - largest contributor to direct/indirect costs

- Diabetes itself confers an independent CV risk:
  ‘having type 2 diabetes and no prior MI is equivalent to not having diabetes, but having had a prior MI’
Diabetic Retinopathy

Normal vision

Same scene viewed by a person with diabetic retinopathy

Diabetic Nephropathy

Diabetic Neuropathy

• Most common microvascular complication of diabetes
• Affects up to 50% of individuals with type 1 and type 2
• In type 1 diabetes, becomes symptomatic after many years of chronic prolonged hyperglycemia
• In type 2 diabetes may present at the time of diagnosis or after only a few years of poor blood sugar control
• Neuropathy decreases the person’s quality of life
• Secondary complications of neuropathy can include: falls, foot ulcers, cardiac arrhythmias, and ileus
Types of Diabetic Neuropathy

- **Peripheral**: damage to peripheral/sensory nerves; most common to the nerves of the feet and legs
- **Proximal**: damage to nerves in the thighs, hips or buttocks
- **Autonomic**: affects the autonomic nervous system—the nerves that control body functions
- **Focal**: affects a specific nerve or area at any site in the body (carpal tunnel syndrome)

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Peripheral Neuropathy

Distal symmetric polyneuropathy (DSPN)

- Accounts for ~ 75% of diabetic neuropathies
- Research suggests that DSPN may be present in:
  - at least 20% of people with type 1 DM after ~ 20 years duration
  - 10-15% of newly diagnosed people with type 2 DM
  - Rates increase to ~ 50% in people with type 2 after 10 years duration
  - Rates in youth with type 1 and type 2 DM approach those noted in adults

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Peripheral Neuropathy (cont)

Risk factors for DSPN include:

- poor glycemic control
- smoking
- elevated blood pressure
- dyslipidemia
- heavy alcohol intake
- tall height (may be due to nerve length)
Peripheral Neuropathy (cont)

Symptoms of DSPN include:
- shooting pains
- burning sensation
- tingling sensation
- numbness
- hyperalgesia (exaggerated discomfort/pain)
- symptoms are typically worse at night
- not all people with DSPN feel symptoms

Peripheral Neuropathy (cont)

Individuals with diabetes should have an annual foot exam:
- pinprick
- 10 gm monofilament
- tuning fork
- ankle reflexes
- proprioception
  - combining two of the above will increase sensitivity and detection

Peripheral Neuropathy (cont)

Treatment:
Ideally prevention is the goal once diagnosed with diabetes.
- Tight glucose control:
  - Dramatically reduces incidence for individuals with type 1 DM
  - Modestly effective in preventing DSPN in individuals with type 2, must address lipids, blood pressure, smoking as well
- Medications most often prescribed:
  - Gabapentin (Neurontin)
  - Duloxetine (Cymbalta)
  - Pregabalin (Lyrica)
  - Amitriptyline (Elavil)
Charcot Foot, Result of Diabetic Neuropathy

Syndrome in individuals who have neuropathy or loss of sensation. It includes fractures and dislocation of bones and joints that occur with minimal or no known trauma. Initially there may be swelling, redness and increased warmth of the foot and ankle.

Charcot Foot

Later, when fractures and dislocations occur, there may be severe deformities of the foot and ankle.

Charcot Foot

These severe foot and ankle deformities include collapse of the midfoot arch (often called rocker bottom foot) or instability of the ankle and hindfoot.
Recommendations for Foot Care

- All patients with diabetes should have an annual comprehensive foot examination to identify risk factors predictive of ulcers and amputations
  - Inspection
  - Assessment of foot pulses
  - Test for loss of protective sensation: 10-g monofilament plus testing any one of following:
    - Vibration using 128-Hz tuning fork
    - Pinprick sensation
    - Ankle reflexes
    - Vibration perception threshold

Recommendations for Foot Care (cont)

- Not all patients with diabetes need to see a podiatrist
- Refer patients to foot care specialist for:
  - Nail trimming if:
    - Patient unable to perform safely and no one to assist patient at home
    - Ingrown toenails
    - Malformed/mycotic toenails
  - Callouses, corns, plantar warts…
  - Bunions, hammer toes/claw toes…
  - Plantar Fasciitis
  - Other foot problems

How To Care for Feet at Home

- Wash feet every day with mild soap and warm water; test the water temperature with an elbow first.
- Examine feet daily for redness, warmth, blisters, ulcers, scratches, cuts and nail problems from shoes or other sources. Look at the bottom of feet and between the toes. Use a mirror or have someone else check the bottoms if necessary.
- Never walk barefoot, neither indoors nor out.
- When drying them, pat each foot with a towel and dry well between the toes.
How To Care for Feet at Home

- Use quality lotion to keep the skin of the feet soft and moist — but don't put any lotion between toes. Curel, Lubriderm, olive oil, vitamin E oil, lanolin or Eucerin cream are good choices.
- Trim toe nails straight across. Avoid cutting the corners.
- Use a nail file or emery board. If an ingrown toenail, see the doctor.
- Do not file down, remove or shave calluses or corns. These should be taken care of by the physician or someone the physician recommends.
- Don't soak feet. Skin can break down and won't heal well.
- Avoid using antiseptic solutions, drugstore medications, heating pads or sharp instruments on feet.

How To Care for Feet at Home

- Don't put feet on radiators or in front of the fireplace.
- Always keep feet warm; wear loose socks to bed if needed.
- Wear warm socks and shoes in winter; don't get feet wet in snow or rain.
- Don't smoke or sit cross-legged for long periods as both decrease blood supply to the feet.
- Don't use any tape or sticky products such as corn plasters on feet. They can rip the skin.
- Examine shoes for foreign objects, protruding nails and rough spots inside before putting them on. Look and feel.

How To Care for Feet at Home

- Buy shoes late in the day. Never buy shoes that need "breaking in." They should be immediately comfortable. Request shoes with deep toe boxes and shoes made of leather or other flexible upper material.
- Do not wear stockings or socks with tight elastic backs and do not use garters. Wear only light-colored socks and do not wear any socks with holes. Always wear socks with shoes.
- Do not smoke. Smoking decreases the blood supply to the feet.
- Call the doctor immediately if any injury to the feet. Even a minor injury is an emergency for a person with diabetes.
Autonomic Neuropathy

Affects the parasympathetic or sympathetic nerves or both:
- hypoglycemia unawareness
- resting tachycardia
- orthostatic hypotension
- gastroparesis
- constipation, diarrhea, fecal incontinence
- erectile dysfunction
- neurogenic bladder
- increased or decreased sweating

Autonomic Neuropathy

Cardiovascular Autonomic Neuropathy (CAN)
- prevalence is very low in newly diagnosed type 1 DM
- increases substantially with diabetes duration; rates of 30% observed in research trials in individual with type 1
- in type 2 DM, prevalence increases with disease duration with rates up to 60% after 15 years disease duration
- can affect youth, particularly young women and those with elevated A1c levels; rates up to 20% reported in youth with type 1 or type 2 DM

Autonomic Neuropathy

Cardiovascular Autonomic Neuropathy (CAN) presents as:
- may be no symptoms early on
- elevated resting heart rate
- exercise intolerance
- orthostatic hypotension
Gastrointestinal Autonomic Neuropathy
- May involve any portion of the gastrointestinal tract with symptoms including:
  - gastroparesis: early satiety, fullness, bloating, nausea/vomiting
  - constipation
  - diarrhea
  - fecal incontinence
- May be the cause of blood sugar variability, including hypoglycemia
- More prevalent in persons with type 1 DM and with long-standing disease

Urogenital Neuropathies
- Diabetic autonomic neuropathy can cause genitourinary disturbances:
  - Sexual dysfunction in men (erectile dysfunction, retrograde ejaculation - 3x more common in men with diabetes than those without)
  - Sexual dysfunction in women (decreased desire, increased pain during intercourse, decreased lubrication - more common in women with diabetes than those without)
  - In both men and women: urinary incontinence, nocturia, urgency, weak urine stream, frequent urination

Sudomotor Dysfunction
Sudomotor - from Latin sudor, 'sweat' and motor; describes anything that stimulates the sweat glands.
- May manifest as:
  - Dry skin
  - Anhidrosis (inability to sweat normally; don't perspire)
  - Heat intolerance
  - Very rarely gustatory sweating (head and neck region triggered by eating or the smell of food)
Additional Diabetes-Related Complications

- Periodontitis:
  - 2-3 times more likely to develop with diabetes
  - recommend dental visit/exam q 6 months

- Cancer - increased risk for certain types:
  - ~ 30 - 38% increase in risk for colorectal cancer
  - ~ 20% increase risk for breast cancer
  - ~ 2x increased risk for liver cancer
  - ~ 2x increased risk for pancreatic cancer

Additional Diabetes-Related Complications (cont)

Hearing loss:
- Hearing loss is about twice as common in adults with diabetes compared to those who do not have the disease.

Research has shown significant effects of diabetes upon:
- structures of the cochlea
- auditory nerve
- blood supply to cochlea
- central auditory processing

- Bainbridge, et al., Annals of Internal Medicine, 2008

Diabetes and Alzheimer's Disease

Type 3 Diabetes or "Brain Diabetes"
- All people with diabetes have a 60% increased risk of developing any type of dementia
- Women with type 2 DM have a 19% > risk of vascular dementia than men
- Older adults with type 2 DM suffer from > declines in working memory and executive functioning than their non-diabetic peers
How to Reduce Risk of Complications

- Do not smoke
- Schedule regular exams with primary care provider, eye doctor, and dentist
- Keep vaccines up to date
- Follow foot care recommendations
- If alcohol consumption, do so in moderation
- Take stress seriously
- Manage the "ABCs"

### Treating the ABCs Reduces Diabetic Complications

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Complication</th>
<th>Reduction of Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood glucose control</td>
<td>Heart attack</td>
<td>↓ 37%</td>
</tr>
<tr>
<td>Blood pressure control</td>
<td>Cardiovascular disease</td>
<td>↓ 61%</td>
</tr>
<tr>
<td></td>
<td>Heart failure</td>
<td>↓ 58%</td>
</tr>
<tr>
<td></td>
<td>Stroke</td>
<td>↓ 44%</td>
</tr>
<tr>
<td>Lipid control</td>
<td>Diabetes-related deaths</td>
<td>↓ 22%</td>
</tr>
<tr>
<td></td>
<td>Coronary heart disease mortality</td>
<td>↓ 28%</td>
</tr>
<tr>
<td></td>
<td>Major coronary heart disease event</td>
<td>↓ 48%</td>
</tr>
<tr>
<td></td>
<td>Any atherothrombotic event</td>
<td>↓ 37%</td>
</tr>
<tr>
<td></td>
<td>Cardiovascular disease event</td>
<td>↓ 43%</td>
</tr>
</tbody>
</table>

References

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