Diabetes is epidemic throughout the United States. In New York City (NYC), the prevalence has doubled in the past 8 years. Approximately 1 in 5 New Yorkers 65 years of age and older has diabetes.\(^1\)

Diabetes is a leading cause of hospitalization and death. Persons with diabetes have a 2–6 times greater risk of death from cardiovascular events than persons without diabetes. Nationally, the annual cost of caring for persons with diabetes is estimated to be $132 billion; 1 in 10 health care dollars.\(^2\)

Overweight and obesity greatly increase the risk of diabetes. Eighty percent of adults in NYC with diabetes are overweight. In the United States, epidemics of both obesity and type 2 diabetes are emerging in both children and adolescents.\(^3\) The national prevalence of obesity among children and adolescents is over 15%, and among certain ethnic populations is as high as 30%.\(^4,5\) Type 2 diabetes now accounts for 8–45% of new cases of childhood diabetes.\(^6\) There is also an increase in adult New Yorkers under the age of 40 who have diabetes, particularly Hispanics. In this age group, the prevalence in Hispanics is 3%, twice that of blacks and 4 times that of non-Hispanic whites and Asians.

On average, diabetes is present 4–7 years before being diagnosed.\(^7\) At the time of diagnosis, approximately half of all persons with the disease are already experiencing complications. It is estimated that 1 in 3 Americans with diabetes is undiagnosed.\(^7\)

Gestational diabetes (GDM) complicates approximately 7% of all pregnancies and is seen in 14% of pregnancies among certain ethnic groups (eg, Hispanic, African-American, and Native-American).\(^8\) Approximately half of all women with GDM progress to diabetes, usually type 2, within 10 years.\(^8\) Offspring of women with GDM are at increased risk for obesity, glucose intolerance, and diabetes in late adolescence and young adulthood (Table 1).

There are significant neighborhood and racial/ethnic disparities in diabetes prevalence. East Harlem has the highest prevalence in NYC (15%), 7.5 times that of the Upper East Side (2%). Other neighborhoods with high prevalence (10–15%) include Bushwick, Bedford-Stuyvesant, Washington Heights, and the South Bronx. Hispanic (12%) and black (11%) adult New Yorkers are more likely to have diabetes than non-Hispanic whites or Asians (< 7%).\(^1\)

**PREVENTING DIABETES**

Recently, persons at high risk for developing diabetes have been described as having pre-diabetes. Pre-diabetes is defined as either impaired fasting glucose or impaired glucose tolerance (Box 1). Without lifestyle modification, most individuals with pre-diabetes will develop diabetes within 10 years.\(^9\) Persons with pre-diabetes are also at a

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**CLINICAL CARE PRIORITIES: THE ABC’S OF DIABETES**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Frequency of Monitoring</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1C</td>
<td>Every 3–6 months</td>
<td>&lt; 7%</td>
</tr>
<tr>
<td>Blood Pressure</td>
<td>Every visit</td>
<td>&lt; 130/80</td>
</tr>
<tr>
<td>Cholesterol (LDL)</td>
<td>Annually</td>
<td>&lt; 100 mg/dL</td>
</tr>
<tr>
<td>Smoking status</td>
<td>Every visit</td>
<td>Prevention and cessation</td>
</tr>
</tbody>
</table>

**WHAT PROVIDERS CAN DO**

- Promote physical activity, healthy food choices, and weight loss in persons at risk for developing diabetes.
- Screen for diabetes and pre-diabetes in adults with hypertension, hyperlipidemia, and those ≥ 45 years of age who are overweight.

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50% greater risk of developing heart attack or stroke than are persons without pre-diabetes. There is strong evidence that overweight persons (Table 2) with pre-diabetes can reduce their risk of developing diabetes by up to 60% with modest increases in physical activity and reduction in weight. Lifestyle modification is more effective at preventing or delaying diabetes than drug therapy with metformin. For every 7 persons with pre-diabetes who engage in 30 minutes of physical activity 4 days each week and reduce their weight by 5%, 1 case of diabetes is prevented.


Stopping smoking and controlling the ABC’S of diabetes (hemoglobin A1C, Blood pressure, Cholesterol, Smoking status) (Boxes 2, 3) can significantly improve the quality of life and rates of illness and death in persons with diabetes. Intensive glycemic control (Table 3) in persons with type 1 diabetes reduces retinopathy, nephropathy, and neuropathy by 54–76%. Persons with type 2 diabetes who adhere to intensive blood pressure control significantly reduce their risk of microvascular complications, visual loss, stroke, heart failure, and diabetes-related death. Intervention aimed at intensive control of blood glucose (A1C) (Table 4), blood pressure, and cholesterol reduces by approximately 50% the risk of cardiovascular and microvascular events in patients with type 2 diabetes and microalbuminuria (a strong predictor of cardiovascular risk). Optimally treating 5 people who have type 2 diabetes and microalbuminuria will prevent 1 cardiovascular event. Studies suggest that aspirin therapy and angiotensin-converting enzyme (ACE) inhibition also reduce cardiovascular risk. Moderate drinking (not more that 1–2 drinks a day) is associated with lower CVD risk.

Caring for patients with diabetes (Box 3) involves a team approach, including physicians, nurses, diabetes educators, pharmacists, nutritionists, podiatrists, mental health professionals, exercise specialists, and the patient. Meal planning, physical activity, blood glucose monitoring, and patient education are the cornerstones of diabetes management for all patients. When drug therapy is used (Box 4), it should always be in combination with meal planning and physical activity. Over time, most patients will require insulin and/or combination therapy with 2 or more drugs with different mechanisms of action. If glycemic control is not maintained, more aggressive therapy, including starting insulin, should be initiated early in the progression of the disease (Figure 1). The practice of medicine is a blend of science and art, and guidelines are not a substitute for good clinical judgment.

Clinicians can address the diabetes epidemic by identifying and effectively counseling high-risk patients (Box 2) and by treating diabetes and its complications aggressively.

| TABLE 1. GESTATIONAL DIABETES: SCREENING AND DIAGNOSIS |

Screening for Gestational Diabetes (GDM): Risk assessment should begin at the first prenatal visit.

**High risk:** Women with a personal history of GDM or an obstetric outcome indicative of GDM, a strong family history of diabetes, marked obesity, or glycosuria should be screened as soon as feasible. If they are found not to have GDM, they should be re-screened at 24–28 weeks of gestation.

**Average risk:** Women > 25 years of age not considered to be at high-risk should be screened at 24–28 weeks of gestation.

**Low risk:** Women who have ALL of the following characteristics do not need to be screened: < 25 years of age; normal weight before pregnancy; member of an ethnic group with low prevalence of GDM; no known history of diabetes in first-degree relatives; no history of abnormal glucose tolerance; and no history of poor obstetric outcome.

Diagnosis of GDM is made with a 1-step or 2-step approach.

**1-step approach:** Perform a diagnostic oral glucose tolerance test (OGTT) without prior glucose screening. This may be cost-effective in high-risk patients or populations.

**2-step approach:** Perform an initial screening with the 1-hour 50-g oral glucose load using a glucose challenge test (GCT). Perform a diagnostic OGTT on women exceeding a glucose threshold of 140 mg/dL (80% sensitivity) or 130 mg/dL (90% sensitivity) for the GCT at 1 hour.

Diagnosis of GDM with a 100-g OGTT

| **Fasting** | ≥ 95 mg/dL |
| **1-h** | ≥ 180 mg/dL |
| **2-h** | ≥ 155 mg/dL |
| **3-h** | ≥ 140 mg/dL |

**Two or more** of the above 100-g OGTT values must be met for a positive diagnosis of GDM. The test should be done in the morning after an 8–14 hour fast.
TABLE 2. HEALTHY WEIGHT GUIDELINES

<table>
<thead>
<tr>
<th>Height (inches)</th>
<th>Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>4'0&quot;</td>
<td>65</td>
</tr>
<tr>
<td>4'1&quot;</td>
<td>70</td>
</tr>
<tr>
<td>4'2&quot;</td>
<td>75</td>
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<tr>
<td>4'3&quot;</td>
<td>80</td>
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<tr>
<td>4'4&quot;</td>
<td>85</td>
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<tr>
<td>4'5&quot;</td>
<td>90</td>
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<td>4'6&quot;</td>
<td>95</td>
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<tr>
<td>4'7&quot;</td>
<td>100</td>
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<tr>
<td>4'8&quot;</td>
<td>105</td>
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<td>115</td>
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<td>120</td>
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<td>5'2&quot;</td>
<td>125</td>
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<td>130</td>
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<td>5'4&quot;</td>
<td>135</td>
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<td>5'6&quot;</td>
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<td>235</td>
</tr>
<tr>
<td>7'1&quot;</td>
<td>240</td>
</tr>
</tbody>
</table>

To calculate BMI visit [http://nhlbi.nih.gov/bmi](http://nhlbi.nih.gov/bmi)

*Not applicable to pregnant women.


TABLE 3. GLYCEMIC CONTROL FOR NON-PREGNANT ADULTS WITH DIABETES

<table>
<thead>
<tr>
<th>A1C (%)</th>
<th>Mean Plasma Glucose (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 7.0</td>
<td>&lt; 180</td>
</tr>
<tr>
<td>7.0</td>
<td>170</td>
</tr>
<tr>
<td>8.0</td>
<td>205</td>
</tr>
<tr>
<td>9.0</td>
<td>240</td>
</tr>
<tr>
<td>10.0</td>
<td>275</td>
</tr>
<tr>
<td>11.0</td>
<td>310</td>
</tr>
<tr>
<td>12.0</td>
<td>345</td>
</tr>
</tbody>
</table>

Key concepts for setting optimal glycemic goals:
- Goals are tailored to meet a patient’s individual needs. Certain populations, such as children, pregnant women, and the elderly, warrant special consideration.
- Patients with severe or frequent hypoglycemia may warrant less intensive glycemic control.
- Intensive glycemic goals may reduce microvascular complications but at the cost of increased risk of hypoglycemia.
- If preprandial glucose goals have been met, but A1C goals have not, consider altering postprandial glucose goals.


TABLE 4. CORRELATION BETWEEN A1C AND MEAN PLASMA GLUCOSE LEVELS

<table>
<thead>
<tr>
<th>A1C (%)</th>
<th>Mean Plasma Glucose (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0</td>
<td>135</td>
</tr>
<tr>
<td>7.0</td>
<td>170</td>
</tr>
<tr>
<td>8.0</td>
<td>205</td>
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<tr>
<td>9.0</td>
<td>240</td>
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<tr>
<td>10.0</td>
<td>275</td>
</tr>
<tr>
<td>11.0</td>
<td>310</td>
</tr>
<tr>
<td>12.0</td>
<td>345</td>
</tr>
</tbody>
</table>

References

NATIONAL DIABETES STUDIES CURRENTLY RECRUITING PARTICIPANTS IN NEW YORK CITY

Diabetes Prevention Studies

DREAM
Diabetes Reduction Approaches with Ramipril and Rosiglitazone Medications
The aim of this study is to determine if the drugs ramipril and/or rosiglitazone can prevent type 2 diabetes in persons at high risk with impaired glucose tolerance.
(212) 305-6357
www.dream-ctn.org

TRIGR
Trial to Reduce Insulin-Dependent Diabetes in the Genetically at Risk
The aim of this trial is to determine if a diet free of complex proteins within the first 6 months of life will reduce the risk of type 1 diabetes in persons at high-risk genetically for diabetes.
(212) 851-5425
www.TRIGR.org

Diabetes Management Studies

ACCORD
Action to Control Cardiovascular Risk in Diabetes
The aim of this study is to determine the best approach to lowering the risk of heart disease and stroke by controlling blood sugar, blood pressure, and cholesterol in adults with type 2 diabetes.
(212) 305-6357
www.accord-ne.org

BARI 2D
Bypass Angioplasty Revascularization Investigation in Type 2 Diabetes
The aim of this study is to determine if immediate coronary revascularization vs. delayed or no revascularization improves the 5-year survival in patients with type 2 diabetes, coronary stenoses, and stable angina who are simultaneously given optimal medical care.
Local (212) 241-8901 National (412) 624-4300
www.BARI2D.org

LOOK AHEAD
Action for Health in Diabetes
The aim of this study is to assess the long-term effects of weight loss, especially on heart attack and stroke incidence, in both men and women who are overweight and have type 2 diabetes.
(212) 523-8037
www.lookaheadstudy.org

RESOURCES

National
American Association of Diabetes Educators . . . . (800) Team-Up-4 (800) 832-6874 www.aadenet.org
American Diabetes Association . . . (800) DIABETES (800)-3-422-3837 www.diabetes.org
American Dietetic Association . . . . (800) 366-1655 www.eatright.org
Centers for Disease Control and Prevention Division of Diabetes Translation . . . . . . . (877) 232-3422 www.cdc.gov/diabetes
Juvenile Diabetes Research Foundation International . . . . . (800) JDF-CURE (800) 533-2873 www.jdf.org

State
New York State Diabetes Prevention and Control Program . . . . . . . . . . . . . . . . . (518) 474-1222 www.cdc.gov/diabetes/states

Local
New York City Department of Health and Mental Hygiene Diabetes Prevention and Control Program . . . . . . (212) 676-2165 www.nyc.gov/health

Greater New York City Area American Diabetes Association . . . . . . . . . (888) DIABETES (888)-3-422-3837 www.diabetes.org
DIABETES PREVENTION AND MANAGEMENT

BOX 1. DIAGNOSING DIABETES

<table>
<thead>
<tr>
<th>Blood Glucose Test</th>
<th>Pre-Diabetes</th>
<th>Diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting Plasma Glucose</td>
<td>60–100 mg/dL</td>
<td>126–200 mg/dL</td>
</tr>
<tr>
<td>2-h Post-prandial</td>
<td>&lt;140 mg/dL</td>
<td>&gt;199 mg/dL</td>
</tr>
</tbody>
</table>


BOX 2. SCREENING FOR DIABETES AND PRE-DIABETES IN ADULTS

TARGET POPULATIONS:
- Screen adults with hypertension or hyperlipidemia. If test results are normal, repeat periodically.
- Screen adults 45 years of age or older if they are overweight (BMI 25–29.9 kg/m2). If test results are normal, repeat in 3 years.
- Use clinical judgment to determine if adults with other risk factors should be screened.

RECOMMENDATION SCREENING TEST (TABLE 1):
- Fasting plasma glucose (preferred initial screening test) or Oral Glucose Tolerance Test (OGTT). A1C should not be used as a screening test.

BOX 3. NYC DOHMH ADULT DIABETES CLINICAL PRACTICE RECOMMENDATIONS

STANDARDS OF CARE

Laboratory Analysis Frequency Goal

- Hemoglobin A1C (HbA1C) Every 3–6 months <7.0%
- Fasting lipid profile Annually
- Lipid profile Total <200 mg/dL
- Triglycerides <150 mg/dL
- HDL >40 mg/dL in men; >50 mg/dL in women
- LDL <100 mg/dL

DIABETES PREVENTION AND MANAGEMENT

1. Diabetes education:
- Personalize diabetes education.
- Encourage patients to make lifestyle changes.

2. Pharmacological therapy:
- Consider pharmacological therapy for patients with type 2 diabetes.

3. Monitoring:
- Monitor patients at least annually.

COUNSELING AND RISK REDUCTION

Blood pressure
-目标: 130/80 mmHg.

Box 4. DIABETES DRUGS

INITIAL ORAL DRUG THERAPY OPTION

- Metformin: Consider in most patients, especially those with BMI ≥25 kg/m²
- Primary mechanism of action: Decrease hepatic glucose output
- A1C % reduction: 1.5–2%
- Advantages:
  - No weight gain, possible weight loss
  - Little or no hypoglycemia
  - Improved fasting profile
  - Decreased cardiovascular events by 1/3 in overweight patients
  - Long-term outcomes have been studied
- Contraindications:
  - Severe renal failure or end-stage renal disease
  - Insulin-dependent diabetes mellitus
- Advantages:
  - No hypoglycemia

OTHER ORAL DRUG THERAPY OPTIONS

- Sulfonylureas: Consider in patients with contraindications for Metformin or on additional therapy
- Primary mechanism of action: Increase insulin secretion
- A1C % reduction: 1–2%
- Advantages:
  - Can be used in patients with mild renal or mild disease
  - Long-term outcomes have been studied
- Contraindications:
  - Severe liver or renal disease
  - Hypoglycemia unawareness
  - No role effective in market hypoglycemia due to lack of use
  - Hypoglycemia
- Adverse effects:
  - Hypoglycemia, especially in the elderly, weight gain

BOX 5. DIABETES DRUGS

SULfonylureAs

- Glipizide: 5–20 mg once or divided
- A1C % reduction: 1–2%
- Advantages: Best hypoglycemia with sulfonylureas
- Contraindications:
  - No role effective in market hypoglycemia due to lack of use
  - Hypoglycemia
- Adverse effects:
  - Hypoglycemia, especially in the elderly, weight gain

LONG-TERM OUTCOMES HAVE NOT BEEN WELL STUDIED

THIAZOLIDINEDIONES:
May be useful in some patients with persistently high hyperglycemia

Primary mechanism of action: Increase insulin sensitivity
- A1C % reduction: 1–2%
- Advantages: Short-acting, hypoglycemia without sulfonylureas
- Contraindications:
  - Does not add to insulin resistance and impaired liver function
  - Hypoglycemia
- Adverse effects:
  - Hypoglycemia, especially in the elderly, weight gain

LONG-TERM OUTCOMES HAVE NOT BEEN WELL STUDIED

COMBINATION THERAPY

COSMIDINOS:
Glyburide/metformin
- A1C % reduction: 1–2%
- Advantages: Consider in most patients, especially those with BMI ≥25 kg/m²

INSULIN

<table>
<thead>
<tr>
<th>ORAL AGENTS</th>
<th>USUAL DAILY DOSE</th>
<th>COST/MONTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin</td>
<td>1,500 mg/day</td>
<td>$20.50</td>
</tr>
<tr>
<td>Glimepiride</td>
<td>1,500 mg/day</td>
<td>$20.50</td>
</tr>
</tbody>
</table>

MONOTHERAPY
Monotherapy is used as initial drug therapy for most patients, especially if BMI ≥25 kg/m²

- Add a second oral agent that has a different mechanism of action

MIXED INSULINS

<table>
<thead>
<tr>
<th>CONTENT</th>
<th>COST/MONTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lantus + Humalog T1/2 50%</td>
<td>$125.30</td>
</tr>
</tbody>
</table>


*Use of brand names for informational purposes only and does not imply endorsement by the New York City Department of Health and Mental Hygiene.