Diagnostic Criteria for Diabetes and Pre-Diabetes

**Diabetes**
Any of the following—confirm by repeat testing on a different day:
- Symptoms of hyperglycemia, plus random plasma glucose ≥ 200 mg/dL
  or
- Fasting blood sugar (FBS) ≥ 126 mg/dL
  o No caloric intake for at least 8 hours prior to laboratory determination
  or
- Two-hour post-prandial plasma glucose 200 mg/dL during a fasting 75-gram Oral Glucose Tolerance Test (OGTT)
- HbA1c > 6.5%

**Pre-Diabetes**
- Impaired Fasting Glucose (IFG)
  o FBS 100–125 mg/dL
- Impaired Glucose Tolerance (IGT)
  o 2 hour plasma glucose 140–199 mg/dL
- HbA1c 5.7–6.4%

Screening for Pre-Diabetes and Diabetes in Asymptomatic, Undiagnosed Individuals
- Testing presumably healthy individuals for type 1 diabetes is not recommended.
- Routine testing for individuals ≥ 45 years of age for type 2 diabetes with FBS or OGTT. If normal, repeat every 3 years.
- Consider testing in all adults, and retest yearly, with BMI ≥ 25 kg/m², and/or:
  o Physical inactivity
  o First-degree relative with diabetes
  o High-risk ethnic population:
    - African American
    - Latino
    - Native American
    - Asian American
    - Pacific Islander
  o Delivered a baby weighing > 9 lb or gestational diabetes
  o Hypertension or treatment for hypertension (≥ 140/90 mmHg)
  o HDL cholesterol ≤ 35 mg/dL and/or triglycerides ≥ 250 mg/dL
  o Previously at risk for DM:
    - Impaired Fasting Glucose (IFG)
    - Impaired Glucose Tolerance (IGT)
    - A1c ≥ 5.7%
  o Women with Polycystic Ovary Syndrome (PCOS)
  o Other risk factors include severe obesity, Acanthosis nigricans, and history of CVD.

Outpatient Visit for Known Diabetes

**Medical History**
- History of diagnosis
  o Age
  o Characteristics
  o Initial treatment
  o Diabetic education
- History of acute complications:
  o DKA
  o Hypoglycemia
- Current treatment, level of adherence
- Lifestyle assessment
- History of:
  o Glycemic control
  o Hypoglycemia or hypoglycemia unawareness
  o Severe events requiring emergency care
- History of chronic complications
- Smoking status
- Use of steroids

**Physical Examination**
- Height, weight, BP, pulse
- Additional exams:
  o Eye
  o Oral
  o Thyroid
  o Cardiac
  o Abdominal (hepatomegaly)
  o Foot exam (see Special Considerations—Neuropathy)
  o Neurology
- Indications for secondary diabetes:
  o Hemochromatosis
  o Pancreatic disease
  o Endocrine disorders such as:
    - Acromegaly
    - Pheochromocytoma
    - Cushing’s syndrome
  o Post-transplant

**Overall Management Plan**
- Consider the following:
  o Age
  o Daily schedule
  o Physical activity
  o Eating patterns
  o Social, personality, and cultural factors
  o Capacity to understand and follow treatment plan
  o Hypoglycemia risk
  o Renal failure
  o Comorbidities
- Establish short- and long-term goals

*For inpatient management of diabetes in non-pregnant adults, please see OSUWMC guideline*
All patients should be referred to general diabetes education classes at diagnosis and periodically thereafter.

Recommend the following, as appropriate:
- Medical nutrition therapy (MNT)
- Lifestyle changes such as smoking cessation and exercise:
  - 150 min/week moderate intensity aerobic activity or 75 min/week vigorous intensity aerobic activity as appropriate
- Consider resistance training 3 times/week
  - Self-management and problem-solving training
  - Annual dilated eye exam
  - Dental hygiene
  - Mental health professional

Instruct on glucose monitoring (≥ 3 times/day for patients on insulin, individualized otherwise) and recording or downloading measurements.

Structured glucose monitoring data should be made available at clinic visits. Downloaded data provides an even more complete and accurate picture of glucose patterns.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Target*</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c</td>
<td>7.0%</td>
</tr>
<tr>
<td>Pre-meal glucose</td>
<td>80–130 mg/dL</td>
</tr>
<tr>
<td>Peak post-meal glucose</td>
<td>180 mg/dL</td>
</tr>
</tbody>
</table>

*Glucose targets should be individualized according to risk of hypoglycemia, comorbidities and life expectancy. In such patients, lower glycemic targets may not be safely achieved without undue risk .

- Family planning
- Prescribe medications (see Appendix A-C)
- Glucose monitoring may be used to guide therapy in patients with less frequent injections, on non-insulin therapies, or medical nutrition therapy

### Type 1 Diabetes Management

- Basic treatment plan to consist of:
  - Multiple-dose insulin injections or insulin pump therapy
  - Matching pre-meal insulin to carbohydrate intake, pre-meal glucose, and anticipated activity
  - Basal and prandial insulin analogues are preferred to human insulins due to lower risk of hypoglycemia.
- Patients not meeting treatment goals on injections or who have frequent or severe hypoglycemia or hypoglycemia unawareness should be considered for Endocrinology referral and continuous subcutaneous insulin infusion and/or real-time continuous glucose monitoring.

- Start with 0.5–0.6 units/kg/d, with 50% of insulin as basal and 50% as bolus
- Advise patients on urinary ketone testing and use of glucagon

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Action Onset</th>
<th>Peak</th>
<th>Action Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bolus Insulin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular q.a.c.</td>
<td>30 min</td>
<td>2-4 hr</td>
<td>6-10 hr</td>
</tr>
<tr>
<td>Aspart q.a.c.</td>
<td>5-15 min</td>
<td>1-2 hr</td>
<td>4-6 hr</td>
</tr>
<tr>
<td>Glulisine q.a.c.</td>
<td>5-15 min</td>
<td>1-2 hr</td>
<td>4-6 hr</td>
</tr>
<tr>
<td>Lispro q.a.c. (U100 or U200)</td>
<td>5-15 min</td>
<td>1-2 hr</td>
<td>4-6 hr</td>
</tr>
<tr>
<td><strong>Basal Insulin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPH daily or bid</td>
<td>1-2 hr</td>
<td>4-8 hr</td>
<td>10-20 hr</td>
</tr>
<tr>
<td>Detemir daily or bid</td>
<td>3-4 hr</td>
<td>Nearly flat</td>
<td>Approx 24 hr</td>
</tr>
<tr>
<td>Glargine daily (U100)</td>
<td>3-4 hr</td>
<td>Nearly flat</td>
<td>Approx 24 hr</td>
</tr>
<tr>
<td>Glargine daily (U300)</td>
<td>6 hr</td>
<td>Flat</td>
<td>24-30 hr</td>
</tr>
<tr>
<td>Degludec daily (U100 or U200)</td>
<td>1 hr</td>
<td>Flat</td>
<td>24-30 hr</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70/30, 75/25, 50/50 bid</td>
<td>5-15 min</td>
<td>1-2 hr</td>
<td>10-20 hr</td>
</tr>
<tr>
<td>Regular U500 bid</td>
<td>30 min</td>
<td>4-8 hr</td>
<td>18-23 hr</td>
</tr>
</tbody>
</table>

### Type 2 Diabetes

- Lifestyle interventions in patients with pre-diabetes or diabetes include:
  - MNT
  - Exercise for goal weight loss of 7%
  - Attention to cardiovascular risk factors
- Consider metformin in patients with pre-diabetes or an A1c 5.7–6.4% if:
  - BMI > 35 kg/m² and/or
  - Age < 60 years and/or
  - History of gestational diabetes
- Initiate metformin at diagnosis, unless contraindicated
  - Begin combination therapy if A1c 8–10% and initiate insulin if A1c > 10% or in patients that are overtly symptomatic with A1c < 10%
- Individualize therapy based upon:
  - Cost
  - Risk for severe hypoglycemia
  - Cautions and contraindications

**NOTE:** For detailed information about prescribing medications, see Appendix A-C.

### Continuing Care for Known Diabetes

**Quarterly Exam** (until treatment goals are achieved)
- Height, weight, BP
- Eye and bare foot exam
- Glucose results (hyperglycemia / hypoglycemia)
- Other illnesses
Current medications and adherence
Psychosocial issues / screening
Lifestyle changes
Smoking cessation
Adjustments / problems with therapeutic regimen
Symptoms suggesting development of complications
HbA1c if treatment changes / patient not meeting goals (or twice a year if stable)

Annual Exam
- Comprehensive visual exam
- Dental exam biannually
- TSH if type 1 diabetes, dyslipidemia or females > 50 years of age
- Microalbumin measurement and creatinine
- Liver panel and lipid profile, with follow-up tests as needed

Special Considerations

Intercurrent Illness
- If erratic glycemic control, obtain more frequent monitoring of blood glucose and urine ketones.
- If marked hyperglycemia, temporarily adjust treatment.
- If treated with oral glucose-lowering agents or MNT alone, consider insulin temporarily.
- Assure adequate fluid and caloric intake.
- Consider hospitalization for ketosis, infection, or dehydration.

Severe or Frequent Hypoglycemia
- May be due to:
  - Defective counter-regulation
  - Hypoglycemic unawareness
  - Insulin dose errors
  - Excessive alcohol intake
  - Physical activity
- If due to therapeutic regimen of patient who uses insulin, evaluate management plan, readjust as needed, and provide patient / family re-education.
- Medications that cause significant hypoglycemia include sulfonylureas, non-sulfonylurea insulin secretagogues, and insulins.
- Newer ultra-long acting basal insulins (Degludec, Glargine U300) may be associated with fewer hypoglycemic events, particularly overnight, than other basal insulins.
- Consider prescribing glucagon.

Cardiovascular Disease (CVD)
- Correction of:
  - Obesity
  - Smoking
  - Hypertension
  - Sedentary lifestyle
  - Dyslipidemia
  - Poorly regulated diabetes in addition to specific treatment of the cardiovascular problem
- Recommend low dose (75–162 mg) daily aspirin as primary prevention for men > 50 and women > 60 years old with 10 year CVD risk of > 10% or who have ≥ 1 of the following risk factors:
  - Current smoker
  - Hypertension
  - Hyperlipidemia
  - Family history of early CVD or albuminuria
- Consider daily low dose aspirin for primary prevention in younger patients with 10 year CVD risk 5-10% and > 1 risk factors, or older patients without additional risk factors
- Recommend daily aspirin as secondary prevention provided not at high risk for bleeding

Dyslipidemia
- Fasting lipid profile annually in adults unless low-risk lipid profiles, then every 2 years
- Advise weight loss if indicated
  - A meal plan designed to lower glucose levels and to alter lipid patterns
  - Increased physical activity as appropriate
- High intensity statin should be started in patients with overt CVD or in patients ≥ 40 years of age with 10 year CVD risk of > 7.5%
- Moderate intensity statin should be started as primary prevention in patients 40 to 75 years
- In patients < 40 years of age, estimate 10 year CVD risk to determine if statin beneficial

Hypertension
- Goal for adults ≥ 18 years of age:
  - BP < 140/90 mmHg
- ACE inhibitor or ARB preferred first line therapy, especially in patients with kidney disease.
  - If one class is not tolerated, the other should be substituted except in the case of angioedema.
- In African American patients, thiazide or calcium channel blocker is preferred first line therapy. The second line therapy is otherwise a thiazide diuretic.
- ≥ 2 drugs at maximal dose are usually required to achieve BP target

Retinopathy
- Screening with dilated retinal exam annually:
  - For type 2 diabetes, begin shortly after diagnosis.
  - For type 1, within 5 years of diagnosis.
- Risks for retinopathy include:
  - Duration of diabetes
  - Chronic hyperglycemia
  - Presence of nephropathy
  - Hypertension

NOTE: For retinopathy and nephropathy: Optimization of blood sugar and blood pressure control is key to prevention of development / progression. Women who are pregnant should be screened more frequently for retinopathy.
Nephropathy
- Screening with microalbumin/creatinine ratio (MCR) annually.
  - For type 2 diabetes, begin shortly after diagnosis.
  - For type 1, within 5 years of diagnosis.
  - Diagnosis of albuminuria is made if at least 2/3 samples with urine MCR >30 mg/gm over a 3-6 month period.
- Assess annual creatinine clearance with serum creatinine
- In hypertensive patients, lower BP to < 140/90 mmHg to decrease progression of diabetic nephropathy.
- Institute protein-restricted meal plans designed by a registered dietitian 0.8−1.3 gm/kg/d
- When using ACE-I / ARB, or diuretic, monitor creatinine and potassium
  - Monitor urine albumin excretion for response and progression
- Consider referral to a nephrologist

Neuropathy
- Screening for distal symmetric polyneuropathy performed at diagnosis and annually in all patients
- Distal symmetric polyneuropathy screen using two of the following:
  - Pinprick
  - Vibration (128 hertz tuning fork)
  - 10-gm monofilament
  - Deep tendon reflexes
- Autonomic neuropathy, screen for symptoms of:
  - Resting tachycardia
  - Exercise intolerance
  - Constipation
  - Gastropareisis
  - Erectile dysfunction
  - Hypoglycemic unawareness
  - Impaired neurovascular function
- Consider:
  - Special diagnostic testing and consultation with medical specialist
  - Medications
  - Alterations in MNT
  - Specialized procedures
  - Check B12 level

Foot Care
- Foot exam at least annually and more often if indicated:
  - Light touch
  - Vibratory sensation
  - Palpation and visual examination
- Educate about potential foot problems and regularly reinforce lifetime surveillance and precautions
- Risk of ulcers are increased with:
  - Diagnosed with diabetes for > 10 years
  - Male
  - Poor glucose control
  - Cardiovascular, renal, neuropathic or retinal complications
  - History of previous ulcer
  - Severe nail pathology
  - Bony deformities
- Consider referral to:
  - Podiatrist
  - Orthopedic surgeon
  - Vascular surgeon
  - Rehabilitation specialist

Referral for Diabetes Management
- If desired goals not met, consider referral to endocrinologist, co-management with diabetes team, or enhanced education.
- All patients should maintain a relationship with a primary care provider.

References
- American Association of Clinical Endocrinologists’ Comprehensive Type 2 Diabetes Management Algorithm 2016. Endocrine Practice 2016;22:84-113
- Standards of Medical Care in Diabetes 2017 - Diabetes Care, 40(1) S1-142
Quality Measures

- Percent of patients that receive:
  - HbA1c
  - Lipid panel
  - Microalbumin / creatinine ratio
- Report use of ACE inhibitor/ARB with concomitant hypertension diagnosis
- Report use of statin for > age 40

Guideline Authors

- Kathleen Dungan, MD, MPH
- Jay Lawrence, MD, MBOE
- Willa Hsueh, MD, PhD
- Sheila Mapes, CNP, CDE
- Elizabeth Buschur, MD
- Shumei Meng, MD
- David Bradley, MD
- Lindsey Karnes, CNP
- Susan Butler, MBA, BSN, RN, CPHQ

Guideline Approved


Disclaimer: Clinical practice guidelines and algorithms at The Ohio State University Wexner Medical Center (OSUWMC) are standards that are intended to provide general guidance to clinicians. Patient choice and clinician judgment must remain central to the selection of diagnostic tests and therapy. OSUWMC’s guidelines and algorithms are reviewed periodically for consistency with new evidence; however, new developments may not be represented.

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Appendix A: Medication Decision Tree for Uncontrolled A1c Before Adding Insulin

Note: Metformin is the preferred first line agent unless there is a contraindication or intolerance. Additional agents should be added rather than substituted (exception is insulin and sulfonylurea, DPP4-inhibitor and GLP-1 RA). Individual agents from a class were selected based upon efficacy, safety, tolerability, ease of use. Alternatives within the class may be acceptable based upon individual formulary considerations. This algorithm can be used repeatedly for adding medications, but only recommend prescribing up to three non-insulin agents before adding insulin.

Symptoms include: increased thirst, increased appetite, fatigue, increased urination (especially at night), weight loss, blurred vision, sores that do not heal.
**Appendix A: Medication Decision Tree for Uncontrolled A1c Before Adding Insulin, Continued**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Class</th>
<th>Medication</th>
<th>Contraindications</th>
<th>Hypoglycemia Risk</th>
<th>Weight</th>
<th>Side Effects</th>
<th>Costs</th>
<th>Route</th>
<th>Recommended medication/dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Biguanide</td>
<td>Metformin</td>
<td>If eGFR &lt;45, do not start Reconsider when eGFR drops below 45 Discontinue if eGFR &lt;30</td>
<td>low</td>
<td>neutral/loss</td>
<td>GI</td>
<td>$</td>
<td>PO</td>
<td>Start Metformin 500 mg daily and titrate to 500 mg twice daily after 1-2 weeks. Titrate up to 1000 mg BID as tolerated</td>
</tr>
<tr>
<td>D</td>
<td>GLP-1RA</td>
<td>Dulaglutide (Trulicity)</td>
<td>medullary thyroid cancer/MEN-2 pancreatitis eGFR &lt; 30</td>
<td>low</td>
<td>loss</td>
<td>GI</td>
<td>$$$</td>
<td>SQ</td>
<td>Start Dulaglutide (Trulicity) 0.75 weekly and titrate to 1.5 mg weekly as tolerated</td>
</tr>
<tr>
<td>Z</td>
<td>GLP-1RA</td>
<td>Semaglutide (Ozempic)</td>
<td>medullary thyroid cancer/MEN-2 pancreatitis eGFR &lt; 30</td>
<td>low</td>
<td>loss</td>
<td>GI</td>
<td>$$$</td>
<td>SQ</td>
<td>Start Semaglutide (Ozempic) at 0.25 mg once weekly. After 4 weeks, increase to 0.5 mg once weekly. Increase to 1 mg once weekly after another 4 weeks as needed.</td>
</tr>
<tr>
<td>L</td>
<td>GLP-1RA</td>
<td>Liraglutide (Victoza)</td>
<td>medullary thyroid cancer/MEN-2 pancreatitis eGFR &lt; 30</td>
<td>low</td>
<td>loss</td>
<td>GI</td>
<td>$$$</td>
<td>SQ</td>
<td>Start Liraglutide (Victoza) 0.6 mg daily and titrate by 0.6 mg weekly to 1.8 mg daily</td>
</tr>
<tr>
<td>E</td>
<td>SGLT-2i</td>
<td>Empagliflozin (Jardiance)</td>
<td>DKA eGFR&lt;45</td>
<td>low</td>
<td>loss</td>
<td>GU dehydration fx euglycemic DKA</td>
<td>$$$</td>
<td>PO</td>
<td>Start Empagliflozin (Jardiance) 10-25mg daily and titrate to 25 mg daily if needed</td>
</tr>
<tr>
<td>C</td>
<td>SGLT-2i</td>
<td>Canagliflozin (Invokana)</td>
<td>DKA eGFR&lt;45</td>
<td>low</td>
<td>loss</td>
<td>GU dehydration fx euglycemic DKA, amputation</td>
<td>$$$</td>
<td>PO</td>
<td>Start Canagliflozin 100 mg daily and titrate to 300 mg daily if needed</td>
</tr>
<tr>
<td>G</td>
<td>Sulfonylurea</td>
<td>Glimeperide (Amaryl)</td>
<td>Elderly MI Renal disease</td>
<td>moderate</td>
<td>gain</td>
<td>hypoglycemia</td>
<td>$</td>
<td>PO</td>
<td>Start Glimeperide (Amaryl) 1 mg daily and titrate to 8 mg daily based on A1c or keeping FBG &lt; 140</td>
</tr>
<tr>
<td>P</td>
<td>Thiazolidinedione</td>
<td>Pioglitazone (Actos)</td>
<td>CHF Edema</td>
<td>low</td>
<td>gain</td>
<td>edema HF fxs</td>
<td>$</td>
<td>PO</td>
<td>Start Pioglitazone (Actos) 15-30 mg daily</td>
</tr>
<tr>
<td>T</td>
<td>DPP-4i</td>
<td>(Tradjenta) Linagliptin</td>
<td>Do not combine with GLP-1RA</td>
<td>low</td>
<td>neutral</td>
<td>rare</td>
<td>$$$</td>
<td>PO</td>
<td>Start Linagliptin (Tradjenta) 5 mg daily</td>
</tr>
<tr>
<td>S</td>
<td>DPP-4i</td>
<td>Sitagliptin (Januvia)</td>
<td>Do not combine with GLP-1RA</td>
<td>low</td>
<td>neutral</td>
<td>rare</td>
<td>$$$</td>
<td>PO</td>
<td>Start Sitagliptin (Januvia) 100 mg daily (renally dose if eGFR&lt;45)</td>
</tr>
<tr>
<td>B</td>
<td>Basal Insulin</td>
<td>insulin glargine (Lantus/Basaglar) glargine U300 (Toujeo) detemir (Levemir) degludec U100, U200 (Tresiba)</td>
<td>Wean sulfonylurea if taking moderate (lower with Glargine U300, Degludec)</td>
<td>gain</td>
<td>hypoglycemia</td>
<td>$$$</td>
<td>SQ</td>
<td>Start 10 units insulin glargine(Lantus/Basaglar) or insulin detemir (Levemir) or insulin degludec (Tresiba) and titrate by 1 unit daily to FBG&lt;130</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>Rapid Acting (Prandial) Insulin</td>
<td>insulin aspart (Novolog) lispro (Humalog)</td>
<td>Discontinue Sulfonylurea and consider discontinuing medications other than metformin and GLP-1RA</td>
<td>high</td>
<td>gain</td>
<td>hypoglycemia</td>
<td>$$$</td>
<td>SQ</td>
<td>Start insulin aspart (Novolog)/lispro (Humalog) 4 units with largest meal. Titrate 1-2 units weekly or twice weekly. Start insulin aspart (Novolog)/lispro (Humalog) 4 units with second largest meal if needed.</td>
</tr>
</tbody>
</table>

**If cost is a major barrier to treatment: Use OSU Pharmacy to assist with formulary options and determining lowest price.**
**If private insurance, use co-pay cards. If self-pay, refer to Medication Assistance Program (MAP).**
## Appendix B: Types of Insulin

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Action Onset</th>
<th>Peak</th>
<th>Action Duration</th>
<th>Vial</th>
<th>Disposable Pens and Pen with Cartridges</th>
<th>Dispensing Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dosing Range per injection (Unit)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dosing Increment per Injection (Unit)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dispensing Amount</td>
<td></td>
</tr>
<tr>
<td><strong>Bolus Insulin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular q.a.c.</td>
<td>30 min</td>
<td>2-4 hr</td>
<td>6-10 hr</td>
<td>10 mL, 1000 unit</td>
<td>Kwikpen: 1-60 NovoPen3 PenMate: 1-60</td>
<td>Pen: 3 ml, 300 unit Cartridge: 3 ml, 300 unit</td>
</tr>
<tr>
<td>Aspart q.a.c.</td>
<td>5-15 min</td>
<td>1-2 hr</td>
<td>4-6 hr</td>
<td>10 mL, 1000 unit</td>
<td>Echo: 0.5-30</td>
<td>Cartridge: 3 ml, 300 unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Flextouch: 1-60</td>
<td></td>
</tr>
<tr>
<td>Glulisine q.a.c.</td>
<td>5-15 min</td>
<td>1-2 hr</td>
<td>4-6 hr</td>
<td>10 mL, 1000 unit</td>
<td>Solostar pen: 1-80</td>
<td>Pen: 3 ml, 300 unit</td>
</tr>
<tr>
<td>Lispro q.a.c. (U100)</td>
<td>5-15 min</td>
<td>1-2 hr</td>
<td>4-6 hr</td>
<td>10 mL, 1000 unit</td>
<td>Luxura: 0.5-30</td>
<td>Cartridge: 3 ml, 300 unit</td>
</tr>
<tr>
<td>Lispro q.a.c (U200)</td>
<td>5-15 min</td>
<td>1-2 hr</td>
<td>4-6 hr</td>
<td>N/A</td>
<td>Kwikpen: 1-60</td>
<td>Pen: 3 ml, 300 unit</td>
</tr>
<tr>
<td><strong>Basal Insulin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPH daily or bid</td>
<td>1-2 hr</td>
<td>4-8 hr</td>
<td>10-20 hr</td>
<td>10 mL, 1000 unit</td>
<td>Kwikpen: 1-60</td>
<td>Pen: 3 ml, 300 unit</td>
</tr>
<tr>
<td>Detemir daily or bid</td>
<td>3-4 hr</td>
<td>Nearly flat</td>
<td>Approx 24 hr</td>
<td>10 mL, 1000 unit</td>
<td>Flextouch: 1-80</td>
<td>Pen: 3 ml, 300 unit</td>
</tr>
<tr>
<td>Glargine daily (U100)</td>
<td>3-4 hr</td>
<td>Nearly flat</td>
<td>Approx 24 hr</td>
<td>10 mL, 1000 unit</td>
<td>Solostar: 1-80</td>
<td>Pen: 3 ml, 300 unit</td>
</tr>
<tr>
<td>Glargine daily (U300)</td>
<td>6 hr</td>
<td>Flat</td>
<td>24-30 hr</td>
<td>N/A</td>
<td>Solostar: 1-80</td>
<td>Pen: 1.5 ml, 450 unit</td>
</tr>
<tr>
<td>Degludec daily (U100)</td>
<td>1 hr</td>
<td>Flat</td>
<td>24-30 hr</td>
<td>N/A</td>
<td>Flextouch: 1-80</td>
<td>Pen: 3 ml, 300 unit</td>
</tr>
<tr>
<td>Degludec daily (U200)</td>
<td>1 hr</td>
<td>Flat</td>
<td>24-30 hr</td>
<td>N/A</td>
<td>Flextouch: 2-160</td>
<td>Pen: 3 ml, 600 unit</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70/30 regular bid</td>
<td>30 min</td>
<td>2-4 hr</td>
<td>10-20 hr</td>
<td>10 mL, 1000 unit</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>70/30 Aspart bid</td>
<td>5-15 min</td>
<td>1-2 hr</td>
<td>10-20 hr</td>
<td>10 mL, 1000 unit</td>
<td>Flextouch: 1-60</td>
<td>Pen: 3 ml, 300 unit</td>
</tr>
<tr>
<td>75/25 Lispro bid</td>
<td>5-15 min</td>
<td>1-2 hr</td>
<td>10-20 hr</td>
<td>10 mL, 1000 unit</td>
<td>Kwikpen: 1-80</td>
<td>Pen: 3 ml, 300 unit</td>
</tr>
<tr>
<td>Regular U500 bid or tid</td>
<td>30 min</td>
<td>4-8 hr</td>
<td>18-23 hr</td>
<td>20 mL, 10,000 unit</td>
<td>Kwikpen: 5-300</td>
<td>Pen: 3 mL, 1500 unit</td>
</tr>
<tr>
<td>Glargine/lixisenatide (Soliqua)</td>
<td></td>
<td>N/A</td>
<td></td>
<td></td>
<td>Pen 15-60 dose steps. Examples: 15 unit/5 mcg 30 unit/10 mcg 45 unit/15 mcg 60 unit/20 mcg</td>
<td>Each dose step contains 1 unit glargine/0.3 mcg lixisenatide</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Each dose step contains 1 unit degludec/0.036 mg lixilaglutide</td>
<td>Pen: 3 mL, 300 unit</td>
</tr>
<tr>
<td>Degludec/lixisenatide (Xultophy)</td>
<td></td>
<td>N/A</td>
<td></td>
<td></td>
<td>Pen 16-50 dose steps. Examples: 16 unit/0.6 mg 32 unit/1.2 mg 50 unit/1.8 mg</td>
<td>Pen: 3 mL, 300 unit</td>
</tr>
</tbody>
</table>
### Appendix C: Medication Table

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>% HbA1c Reduction</th>
<th>Starting Dose</th>
<th>Max Dose</th>
<th>Primary Effect</th>
<th>Cautions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biguanides</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metformin (Glucophage®)</td>
<td>1.1−3.0</td>
<td>250 mg PO bid</td>
<td>1000 mg p.o. bid</td>
<td>Reduce hepatic glucose production</td>
<td>Renal, CHF, liver disease</td>
</tr>
</tbody>
</table>

| **Sulfonylureas** |                   |               |          |                |          |
| Glipizide (Glucotrol®) | 0.9−2.5 | 5 mg/day | 40 mg/day | Secretagogue | Renal, liver disease |
| Glyburide (DiaBeta®, Micronase®) | 2.5-5 mg/day in single/divided doses | 20 mg/day | | | |
| Glyburide (Gynase®, PresTab®) | 1.5-3 mg/day in single/divided doses | 12 mg/day | | | |
| Glimpiride (Amaryl®) | 1-2 mg/day | 8 mg/day | | | |

| **Thiazolidinediones** |                   |               |          |                |          |
| Pioglitazone (Actos®) | 1.5−1.6 | 15 mg/day | 45 mg/day | Sensitizer | Liver disease, CHF, osteoporosis, edema |
| Rosiglitazone (Avandia®) | 4 mg/day | 8 mg/day | | | |

| **α-Glucosidase Inhibitors** |                   |               |          |                |          |
| Acarbose (Precose®) | 0.6−1.3 | 25 tid | 50-100 mg tid | Block glucose absorption | Renal, liver, malabsorption syndromes |
| Miglitol (Glyset®) | 25 tid | 100 mg tid | | | |

| **Meglitinides** |                   |               |          |                |          |
| Repaglinide (Prandin®) | 1.0−2.0 | 0.5-2 mg PO q.a.c. | 16 mg/day | Secretagogue | Renal, liver disease |
| Nateglinide (Starlix®) | 0.5 | 60 mg PO q.a.c. | 120 mg q.a.c. | Secretagogue | Renal, liver disease |

| **DPP-4 Inhibitors/combinations** |                   |               |          |                |          |
| Sitagliptin (Januvia®) | 0.8 | 100 mg PO daily | | Increase incretin activity | Pancreatitis, c-cell tumors, heart failure |
| Saxagliptin (Onglyza®) | | 2.5 mg daily | 5 mg daily | | |
| Linagliptin (Tradjenta®) | | 5 mg daily | 5 mg daily | | |
| Alogliptin (Nesina®) | | 25 mg daily | 25 mg daily | | |

| **GLP-1 Analogues/Receptor Mimetics** |                   |               |          |                |          |
| Exenatide (Byetta®) | 0.8−1.5 | 5 mcg SQ bid | 10 mcg SQ bid | | |
| Exenatide once weekly (Bydureon®) | | 2 mg SQ once weekly | 2 mg SQ once weekly | | |
| Liraglutide (Victoza®) | | 0.6 mg SQ daily for 1 week | 1.8 mg/day | | |
| Albiglutide (Tanzeum®) | | 30 mg once weekly | 50 mg once weekly | | |
| Dulaglutide (Trulicity®) | | 0.75 mg once weekly | 1.5 mg once weekly | | |
| Semaglutide (Ozempic) | | 0.25 mg once weekly | 1.0-1.0 mg once weekly | | |

| **SGLT-2 Inhibitors** |                   |               |          |                |          |
| Canagliflozin (Invokana®) | 0.5−1.0 | 100 mg daily | 300 mg daily | Block renal glucose reabsorption | Renal/liver disease, candidiasis, euglycemic diabetic ketoacidosis (DKA), amputation (canagliflozin) |
| Empagliflozin (Jardiance®) | | 10 mg daily | 25 mg daily | | |
| Dapagliflozin (Farxiga®) | | 5 mg daily | 10 mg daily | | |
| Ertugliflozin (Steglatro) | | 5 mg daily | 15 mg daily | | |

| **Miscellaneous** |                   |               |          |                |          |
| Pramlintide (Smylin®) | 0.3−0.6 | 60 mcg SQ q.a.c. | 120 mcg SQ q.a.c. | Amylin replacement | Gastro-paresis |
| Bromocriptine QR (Cycloset) | 0.5 | 0.8 mg within two hours after waking in the morning with food (2.1) | 1.6 to 4.8 mg within two hours after waking in the morning | Dopamine receptor agonist, mechanism possibly sympatholytic | Orthostasis, psychotic disorders, DA receptor antagonist/agonist, CYP3A inhibitors |
| Colesevelam (Welchol) | 0.5 | 6 tablets once daily or 3 tablets twice daily with food and liquid | 6 tablets once daily or 3 tablets twice daily with food and liquid | Bile acid sequestrant mechanism unknown | Bowel obstruction, hypertriglyceridemia |

*Note: Combination agents not listed.*