Treatment Algorithms, Protocols, Guidelines, and Recommendations

NOTE: the treatment algorithms are updated routinely. The most recent versions will appear online. Please be sure to use the most recent version by accessing the Texas Diabetes Council Web site at www.texasdiabetescouncil.org

A1c Goals	Texas Diabetes Council A1c Goals – APPROVED: 10/29/09
	Diabetes Minimum Practice Recommendations – REVISED: 10/29/09
Prevention	Prevention and Delay of Type 2 Diabetes in Children and Adults with Impaired Fasting Glucose (IFG) and/or Impaired Glucose Tolerance (IGT) – REVISED: 01/27/05
Weight Loss	Weight Loss Algorithm for Overweight and Obese Adults – REVISED: 01/27/05
	Weight Management Algorithm for Overweight Children and Adolescents – APPROVED: 04/28/05
Exercise	Exercise Algorithm Type 2 Diabetes Prevention and Therapy – REVISED: 01/22/04
Nutrition	Diabetes Medical Nutrition Therapy and Prevention Algorithm for Adults – REVISED: 07/22/10
	Nutrition Recommendations and Interventions for Diabetes *(supplement)* – APPROVED: 10/29/09
Glycemic Control	Glycemic Control Algorithm for Type 2 Diabetes Mellitus in Adults – REVISED: 07/22/10
Cardiovascular Risk Reduction	Hypertension Algorithm for Diabetes in Adults – REVISED: 01/26/12
	Lipid Algorithm for Type 1 and Type 2 Diabetes Mellitus in Adults – REVISED: 01/24/08
	Macrovascular Risk Reduction in Diabetes: Antiplatelet Therapy *(supplement)* – PUBLICATION DATE: 2004
Insulin Administration	Insulin Algorithm for Type 1 Diabetes Mellitus in Children and Adults – REVISED: 01/27/10
	Insulin Algorithm for Type 2 Diabetes Mellitus in Children and Adults – REVISED: 10/28/10
	Initiation of Once Daily Insulin Therapy for Type 2 Diabetes Mellitus in Children and Adults – REVISED: 10/28/10
	Worksheet: Advancing to Intensive/Physiologic Basal: Bolus Insulin Therapy – REVISED 01/27/10
	IV Insulin Infusion Protocol for Critically-Ill Adult Patients in the ICU Setting – REVISED: 10/25/07
	ICU Insulin Orders – I.V. Insulin Infusion Protocol – REVISED: 02/21/08
	Orders for Adults with DKA and Hyperglycemic Hyperosmolar State (HHS) – APPROVED: 07/31/08
	Transition Algorithm from I.V. to S.Q. Insulin for Patients with Diabetes or Hyperglycemia – APPROVED: 07/31/08
	Transition from I.V. to S.Q. Insulin Order Set Eating Status NPO or PO – APPROVED 10/27/11
	Transition from I.V. to S.Q. Insulin Order Set TPN or Enteral (Tube) Nutrition – APPROVED 10/27/11
	Insulin Pump Therapy *(supplement)*
Foot Care	Diabetic Foot Care – APPROVED: 04/23/04
	Diabetic Foot Screen – APPROVED: 04/23/04
	Diabetic Foot Exam – APPROVED: 04/23/04
	Diabetic Foot Care/Referral Algorithm – APPROVED: 04/23/04
	High Risk Scenario and Ulcer Management – APPROVED: 04/23/04
	Foot Screening Mapping Examples *(supplement)*
Pain Management	Recommendations for Treatment of Painful Peripheral Diabetic Neuropathy in Adults – APPROVED: 04/26/07
Care of the Elderly	Considerations for Elderly Persons with Diabetes *(supplement)*
	Guidelines for Management of the Elderly with Diabetes in Long-Term Care Facilities *(supplement)*
	Screening and Management of Hyperglycemia in the Geriatric Population – APPROVED: 10/23/08
Authors	Texas Diabetes Council Authorship – Minimum Practice Recommendations, Algorithms and Reports – REVISED: 12/04/08

Texas Diabetes Council A1c Goals

TEXAS Department of State Health Services
TEXAS DIABETES COUNCIL
Approved 10/29/09

A1c Goals

Individualize goal based on patient risk factors

A1c < 6-7%  **A1c < 7-8%**

Intensify management if:

- Absent/stable cardiovascular disease
- Mild-moderate microvascular complications
- Intact hypoglycemia awareness
- Infrequent hypoglycemic episodes
- Recently diagnosed diabetes

Less intensive management if:

- Evidence of advanced or poorly controlled cardiovascular and/or microvascular complications
- Hypoglycemia unawareness
- Vulnerable patient (ie, impaired cognition, dementia, fall history)

A1c is referenced to a non-diabetic range of 4-6% using a DCCT-based assay. ADA Clinical Practice Recommendations. *Diabetes Care* 2009;32(suppl 1):S19-20

References

1. The Action to Control Cardiovascular Risk in Diabetes Study Group. Effects of intensive glucose lowering in type 2 diabetes. N Engl J Med 2008;358:2545-2559.
2. The ADVANCE Collaborative Group. Intensive blood glucose control and vascular outcomes in patients with type 2 diabetes. N Engl J Med 2008;358:2560-2572.
3. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. N Engl J Med 1993;329:977-986.
4. The Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications (DCCT/EDIC) Study Research Group. Intensive diabetes treatment and cardiovascular disease in patients with type 1 diabetes. N Engl J Med 2005;353:2643-2653.
5. Gæde P, Vedel P, Larsen N, Jensen GVH, Parving H-H, Pedersen O. Multifactorial intervention and cardiovascular disease in patients with type 2 diabetes. N Engl J Med 2003;348:383-393.
6. Gæde P, Lund-Anderson H, Parving H-H, Pedersen O. Effect of a Multifactorial Intervention on Mortality in Type 2 Diabetes. N Engl J Med 2008;358:580-591.
7. Holman RR, Paul SK, Bethel MA, Matthews DR, Neil HAW. 10-Year follow-up of intensive glucose control in type 2 diabetes. N Engl J Med 2008;359:1577-1589.
8. Ohkubo Y, Kishikawa H, Araki E, et al. Intensive insulin therapy prevents the progression of diabetic microvascular complications in Japanese patients with non-insulin-dependent diabetes mellitus: a randomized prospective 6-year study. Diabetes Res Clin Pract 1995;28:103-117.
9. Reichard P, Bengt-Yngve N, Rosenqvist U. The effect of long-term intensified insulin treatment on the development of microvascular complications of diabetes mellitus. N Engl J Med 1993;329:304-309.
10. Shichiri M, Ohkubo Y, Kishikawa H, Wake N. Long term results of the Kumamoto Study on optimal diabetes control in type 2 diabetic patients. Diabetes Care 2000;23:Suppl 2:B21-B29.
11. UK Prospective Diabetes Study (UKPDS) Group. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). Lancet 1998;352:837-853.
12. UK Prospective Diabetes Study (UKPDS) Group. Effect of intensive blood-glucose control with metformin on complications in overweight patients with type 2 diabetes (UKPDS 34). Lancet 1998;352:854-865.
13. The Veterans Affairs Diabetes Trial Investigators. Glucose Control and Vascular Complications in Veterans with Type 2 Diabetes. N Engl J Med 2009;360:129-139.

Diabetes Minimum Practice Recommendations

TEXAS Department of State Health Services
Publication # 45-12085
TEXAS DIABETES COUNCIL
Revised 10/29/09

Name: _____ ID#: _____ D.O.B.: _____ Sex: M F

Exam/Test/Counseling Schedule

Suggested Result Codes: **O**=Ordered, **N**=Normal, **A**=Abnormal, **E**=Done Elsewhere, **R**=Referred

1.	**Complete history & physical**	Initial visit and at clinician's discretion (including risk factors, exercise & diet)		Date Result						
2.	**Diabetes Education**[1]	Initial visit and at clinician's discretion		Date Result						
3.	**Medical Nutrition Therapy**	Initial visit and at clinician's discretion		Date Result						
4.	**Exercise Counseling**	Initial visit and at clinician's discretion		Date Result						
5.	**Psychosocial Counseling**	Initial visit and at clinician's discretion		Date Result						
6.	**Lifestyle/Behavior Changes Counseling**	Initial visit and at clinician's discretion	Smoking cessation Alcohol reduction	Date Result						
7.	**Weight/Height/BMI** Adult Overweight=BMI 25–29.9 Adult Obesity=BMI ≥ 30	Every Visit		Date Result						
8.	**Blood Pressure** Target: <130/80 mm Hg Target: < 125/75 mm Hg if ≥ 1g proteinuria	Every Visit		Date Result						
9.	**Foot Inspection** Visual inspection for skin and nail lesions, calluses, infections	Every Visit		Date Result						
10.	**Oral/Dental Inspection** Refer for dental care annually or as needed	Every Visit		Date Result						
11.	**Growth and Development** (including height) in Children	Every Visit		Date Result						
12.	**Aspirin/Antiplatelet Prophylaxis** (if no contraindications) Type 1 or 2 ≥ age 30	Every Visit		Date Result						
13.	**A1c2** Individualize goal based on patient risk factors Intensive management - A1c < 6-7% Less intensive management – A1c <7-8%	Every 3–6 months		Date Result						
14.	**Kidney evaluation** Estimate GFR (eGFR) & microalbumin determination (>30mg = abnormal). Consider nephro/endocrine evaluation at Stage 3 CKD (eGFR <60); also consider PTH & Hgb if CKD Stage 3 If significant proteinuria; monitor serum creatinine every 3–6 months	Type 1: Annually beginning 5 years from diagnosis Type 2: Initial visit then annually		Date Result						
15.	**Dilated funduscopic eye exam** By an ophthalmologist or therapeutic optometrist	Type I: Annually beginning 5 years from diagnosis Type 2: Initial, then annually		Date Result						
16.	**Oral/Dental Exam** Refer to appropriate provider	Annually or as needed		Date Result						
17.	**Foot Exam** Complete foot exam and neurologic assessment	Annually or as needed								
18.	**Lipid Profile** Targets: LDL-C <100 mg/dL (CHD <70mg/dL) Triglycerides <150 mg/dL	Annually if at goal; otherwise every 3–6 months (> age 18)		Date Result						
19.	**Immunizations** Influenza (Flu) Vaccine Td Vaccine Pneumococcal Vaccine Childhood Immunizations	Annually Every 10 Years Initial; repeat per ACIP Per CDC Schedule		Date Result						

[1] **Diabetes Education should address the following:** self-management skills (i.e. monitoring, sick day management), medications, frequency of hypoglycemia, high-risk behaviors (e.g. smoking, alcohol), adherence with self-care (self-management plan from the last visit including diet, medication use, exercise plan), assessment of complications, diabetes knowledge and follow-up of referrals.

[2] **Intensify management if:** Absent/stable cardiovascular disease, mild-moderate microvascular complications, intact hypoglycemia awareness, infrequent hypoglycemic episodes, recently diagnosed diabetes. **Less intensive management if:** Evidence of advanced or poorly controlled cardiovascular and/or microvascular complications, hypoglycemia unawareness, vulnerable patient (ie, impaired cognition, dementia, fall history).

Prevention and Delay of Type 2 Diabetes in Children and Adults with Impaired Fasting Glucose (IFG) and/or Impaired Glucose Tolerance (IGT)

TEXAS Department of State Health Services
Publication #45-11825
TEXAS DIABETES COUNCIL
Revised 01/27/05

BMI Body mass index (kg/m^2)
FPG Fasting plasma glucose
OGTT 1.75g/kg to max 75g Oral glucose tolerance test
PCP Primary care provider

Screening[1]:

1. **General population;** BMI ≥25
   Individuals ≥45 years
   Baseline and q 3 years
2. **High risk population ≥18 years;** BMI ≥25
   Baseline and yearly
3. **Children and youth at risk**
   Baseline at age 10 and q 2 years
   - Overweight BMI (≥85th %'ile for age and gender and ≥ two risk factors)

Risk Factors:

- 1st degree (and/or 2nd degree in children) relative with diabetes
- Hx of gestational diabetes or delivery of a baby weighing >9 lbs
- High-risk ethnic group
- Hypertension
- Dyslipidemia
- Polycystic Ovary Syndrome
- Metabolic[2] and/or Insulin Resistance[3] Syndromes
- Vascular disease
- Acanthosis nigricans

TESTING[1,4,5]: FPG Recommended: (if abnormal confirm X 1); however 2-hr OGTT acceptable in adults and should be used for diagnosis in children[6] (routine measurement of insulin levels is not recommended)

NORMAL
FPG <100 mg/dL;
2-hr OGTT <140 mg/dL

Rescreen Based on Risk Factors

Continue Aggressive Management of Modifiable Risk Factors and Appropriate Lifestyle Intervention

Diagnosis: IFG
FPG ≥100 and <126 mg/dL and/or
IGT 2-hr OGTT
Glucose ≥140 and <200 mg/dL

Diagnosis: Type 2 Diabetes
FPG ≥126 mg/dL and/or 2-hr OGTT ≥200 mg/dL—
Refer to Texas Diabetes Council Algorithms

Initial Intervention: Lifestyle[7,8]
Weight Loss: 5–10% if BMI ≤40; 10–15% if BMI >40
Exercise/Physical Activity: ≥30–60 minutes per day
Hypocaloric diet: Deficit 250–1000 Kcal per day ± Meal Replacements
Behavior Modification: Nutrition/Family Counseling
Regular Follow-up by PCP

6 months

Successful Outcome
Normal FPG and/or 2-hr OGTT Lifestyle Maintenance—
Continue Physical Activity and Weight Loss/Maintenance

Reassess yearly
FPG and/or 2-hr OGTT

Abnormal—
Consider Drug Therapy[9]

Normal—
Continue Lifestyle Intervention

6 months

Unsuccessful Outcome: Children
Abnormal 2-hr OGTT—Intervention and Continue Lifestyle
Refer to Pediatric Endocrinologist or Obesity Specialist

Unsuccessful Outcome: Adults
Abnormal FPG and/or 2-hr OGTT—Consider Adding Drug Therapy[9] to Lifestyle Intervention

Metformin[8,10]	**Orlistat[11]**	**Acarbose[12]**
Contraindicated in Renal Disease, Liver Disease, CHF	Contraindicated in Chronic Malabsorption, Cholestasis	Contraindicated in Gastrointestinal Disease

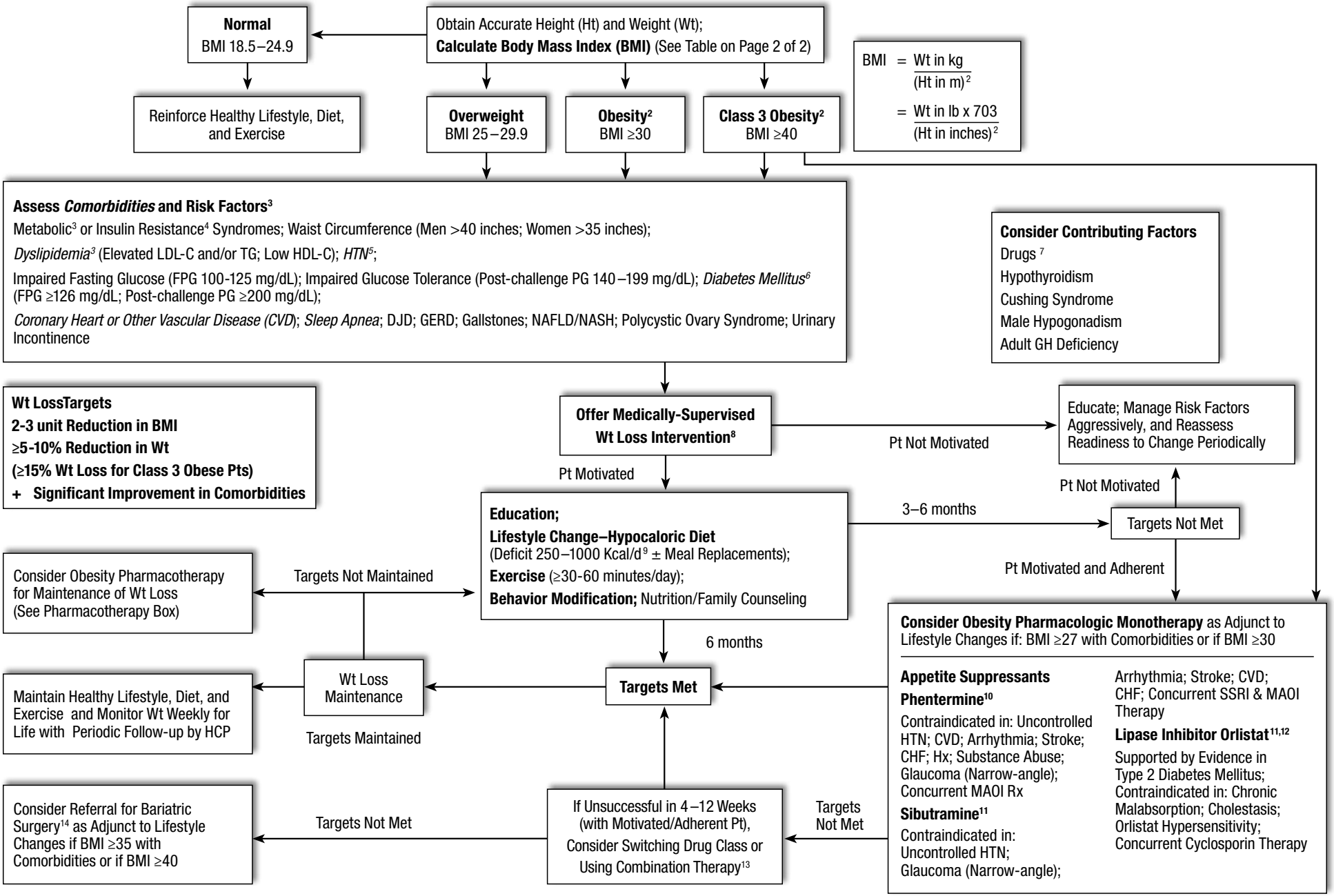
Reassess FPG and/or 2-hr OGTT every 6 months
Abnormal—Re-evaluate Lifestyle and Medication Regimen
Normal—Continue Current Therapy

Footnotes:

1. American Diabetes Association: Clinical Practice Guidelines 2004. Screening for type 2 diabetes. *Diabetes Care*. 2004;27(suppl 1):S11-4; Diabetes Care. 2005;28(suppl 1):S4-S36.
2. National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). *JAMA*. 2001;285(19):2486–97.
3. American College of Endocrinology position statement on the insulin resistance syndrome. *Endocr Pract*. 2003;9(3):237-52.
4. American Diabetes Association: Clinical Practice Guidelines 2004. The prevention or delay of type 2 diabetes. Diabetes Care. 2004;27(suppl 1):S47-54; *Diabetes Care*. 2005;28(suppl 1):S4-S36.
5. Edelstein SL, Knowler WC, Bain RP, et al. Predictors of progression from impaired glucose tolerance to NIDDM: an analysis of six prospective studies. *Diabetes*. 1997;46(4):701-10.
6. Sinha R, Fisch G, Teague B, et al. Prevalence of impaired glucose tolerance among children and adolescents with marked obesity. N Engl J Med. 2002;346(11):802-10. Erratum in: *N Engl J Med*. 2002;346(22):1756. Correction of dosage error in abstract.
7. See Texas Diabetes Council algorithms for treatment of exercise, weight loss, and nutrition.
8. Knowler WC, Barrett-Connor E, Fowler SE, et al. Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med.* 2002;346(6):393-403 (dose of metformin 850 mg twice daily).
9. No medication is currently FDA-approved for prevention of type 2 diabetes in adults, but a number of studies provide evidence for drug treatment.
10. Metformin is as effective as lifestyle intervention in individuals <age 45 or those with BMI ≥35; metformin is nearly ineffective in individuals ≥age 60 or those with BMI <30 (DPP evidence).
11. Torgerson JS, Hauptman J, Boldrin MN, et al. XENical in the prevention of diabetes in obese subjects (XENDOS) study: a randomized study of orlistat as an adjunct to lifestyle changes for the prevention of type 2 diabetes in obese patients. *Diabetes Care*. 2004;27(1):155-61 (dose of orlistat 120 mg three times daily with food).
12. Chiasson JL, Josse RG, Gomis R, et al. Acarbose for prevention of type 2 diabetes mellitus: the STOP-NIDDM randomised trial. *Lancet*. 2002;359(9323):2072-7 (dose of acarbose 100 mg three times daily with food).

Weight Loss Algorithm for Overweight and Obese Adults[1]

TEXAS Department of State Health Services
Stock # 45-11694
TEXAS DIABETES COUNCIL
Revised 01/27/05



Body Mass Index Table

BMI TABLE	WEIGHT (lb)																						
HEIGHT (ft/in)	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330
4'5"	30	33	35	38	40	43	45	48	50	53	55	58	60	63	65	68	70	73	75	78	80	83
4'6"	29	31	34	36	39	41	43	46	48	51	53	56	58	60	63	65	68	70	72	75	77	80
4'7"	28	30	33	35	37	40	42	44	47	49	51	54	56	58	61	63	65	68	70	72	75	77
4'8"	27	29	31	34	36	38	40	43	45	47	49	52	54	56	58	61	63	65	67	70	72	74
4'9"	26	28	30	33	35	37	39	41	43	46	48	50	52	54	56	59	61	63	65	67	69	72
4'10"	25	27	29	31	34	36	38	40	42	44	46	48	50	52	54	57	59	61	63	65	67	69
4'11"	24	26	28	30	32	34	36	38	40	43	45	47	49	51	53	55	57	59	61	63	65	67
5'0"	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65
5'1"	23	25	27	28	30	32	34	36	38	40	42	44	45	47	49	51	53	55	57	59	61	62
5'2"	22	24	26	27	29	31	33	35	37	38	40	42	44	46	48	49	51	53	55	57	59	60
5'3"	21	23	25	27	28	30	32	34	36	37	39	41	43	44	46	48	50	51	53	55	57	59
5'4"	21	22	24	26	28	29	31	33	34	36	38	40	41	43	45	46	48	50	52	53	55	57
5'5"	20	22	23	25	27	28	30	32	33	35	37	38	40	42	43	45	47	48	50	52	53	55
5'6"	19	21	23	24	26	27	29	31	32	34	36	37	39	40	42	44	45	47	49	50	52	53
5'7"	19	20	22	24	25	27	28	30	31	33	35	36	38	39	41	42	44	46	47	49	50	52
5'8"	18	20	21	23	24	26	27	29	30	32	34	35	37	38	40	41	43	44	46	47	49	50
5'9"	18	19	21	22	24	25	27	28	30	31	33	34	36	37	38	40	41	43	44	46	47	49
5'10"	17	19	20	22	23	24	26	27	29	30	32	33	35	36	37	39	40	42	43	45	46	47
5'11"	17	18	20	21	22	24	25	27	28	29	31	32	34	35	36	38	39	41	42	43	45	46
6'0"	16	18	19	20	22	23	24	26	27	29	30	31	33	34	35	37	38	39	41	42	43	45
6'1"	16	17	19	20	21	22	24	25	26	28	29	30	32	33	34	36	37	38	40	41	42	44
6'2"	15	17	18	19	21	22	23	24	26	27	28	30	31	32	33	35	36	37	39	40	41	42
6'3"	15	16	18	19	20	21	23	24	25	26	28	29	30	31	33	34	35	36	38	39	40	41
6'4"	15	16	17	18	20	21	22	23	24	26	27	28	29	30	32	33	34	35	37	38	39	40
6'5"	14	15	17	18	19	20	21	23	24	25	26	27	29	30	31	32	33	34	36	37	38	39
6'6"	14	15	16	17	19	20	21	22	23	24	25	27	28	29	30	31	32	34	35	36	37	38
6'7"	14	15	16	17	18	19	20	21	23	24	25	26	27	28	29	30	32	33	34	35	36	37
6'8"	13	14	15	17	18	19	20	21	22	23	24	25	26	28	29	30	31	32	33	34	35	36
6'9"	13	14	15	16	17	18	19	20	21	23	24	25	26	27	28	29	30	31	32	33	34	35
6'10"	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	34	35
							Less risk															More risk

Abbreviations

CHF	Congestive Heart Failure
CVD	Cardiovascular Disease
DJD	Degenerative Joint Disease
FPG	Fasting Plasma Glucose
GERD	Gastro-esophageal Reflux Disease
HCP	Health Care Professional
HDL-C	High-density Lipoprotein Cholesterol
HTN	Hypertension
LDL-C	Low-density Lipoprotein Cholesterol
MAOI	Monoamine Oxidase Inhibitors
NAFLD	Non-alcoholic Fatty Liver Disease
NASH	Non-alcoholic Steatohepatitis
SSRI	Selective Serotonin Reuptake Inhibitors
TG	Triglycerides

Footnotes:

1 Adapted from NIH/NHLBI/NAASO;1998; NIH Publication No. 98-4083 (*Obes Res* 1998; 6[Suppl 2]:51S-210S)

2 Consider starting obesity pharmacotherapy concurrent with other treatment modalities at presentation in motivated/adherent pts if BMI ≥35 with comorbidities or ≥40 with no comorbidities

3 National Cholesterol Education Program-Adult Treatment Panel III. *JAMA* 2001; 285:2466-2497

4 American Association of Clinical Endocrinologists Consensus Conference on the Insulin Resistance Syndrome, Washington, DC; August 2002 (*Diabetes Care* 2003; 26:1297-1303)

5 The 7th Report of the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure (JNC 7). *JAMA* 2003; 289: 2560-2572

6 See Glycemic Control Algorithm in Type 2 Diabetes Mellitus in Children and Adults; Diabetes medications may need to be adjusted to avoid hypoglycemia in pts who lose wt

7 Most antipsychotics, tricyclic antidepressants, lithium, valproic acid, carbamazepine, insulin/insulin analogs, sulfonylureas, thiazolidinediones, cyproheptidine, glucocorticoids, and estrogens/progestins may be associated with wt gain

8 Assuming BMI ≥25 and/or waist circumference >40 inches in men, >35 inches in women, and one or more major comorbidity

9 Calorie deficit of 250 Kcal/day will result in ~1/2 lb/week wt loss (1000 Kcal/day ~2 lb/week wt loss)

10 FDA-approved for adjunctive short-term use ≤3 months for wt loss; see drug prescribing brochure; ~Cost–$0.85/30 mg pill (generic- AWP 2003)

11 FDA-approved for use for up to 2 years for wt loss and maintenance of wt loss; see drug prescribing brochures; ~Cost– sibutramine $3.64/15 mg pill; orlistat $1.38/120 mg pill (AWP 2003)

12 *Diabetes Care* 1998; 21:1288-1294; *Diabetes Care* 2002; 25:1033-1041; *Diabetes Care* 2002; 25:1123-1128

13 Orlistat can be combined with the other agents; sibutramine and phentermine are not to be used in combination

14 After minimum of 6 months of intensive wt loss management (including obesity pharmacotherapy if no contraindications) in motivated and adherent pts

Weight Management Algorithm for Overweight Children and Adolescents[1]

TEXAS Department of State Health Services
Publication # 45-12083
TEXAS DIABETES COUNCIL
Approved 04/28/05

Obtain Accurate Height (Ht) & Weight (Wt)
Calculate Body Mass Index (BMI-see page 3 of 4)
(Refer to gender-specific BMI Chart on page 4 of 4)

Normal[2]
<85th%ile BMI for Age & Gender
→ Reinforce Healthy Lifestyle, Diet, and Exercise; Watch for Rapid Wt Gain[2]

At Risk for Overweight[2]
85%–95th%ile BMI for Age & Gender; Rapid Wt Gain[2]

Overweight[2]
>95th%ile BMI for Age & Gender

BMI = Wt in kg / (Ht in m)^2
= Wt in lb x 703 / (Ht in inches)^2

Assess for Comorbidities[3]

Sleep Apnea; Pseudotumor Cerebri; Dyslipidemia (Elevated LDL-C and/or TG; Low HDL-C); HTN; NAFLD; GERD; Wt-bearing Joint Pain; PCOS /Hyperandrogenism; AN; Psychological Adjustment Disorders; T2DM (FPG≥126 mg/dL; Post Challenge PG ≥200 mg/dL)

Assess for Risk Factors and/or Contributing Factors

Medications[4]; Hypothyroidism; Cushing Syndrome; Prader-Willi Syndrome; SGA; Low Birth Wt; Post Malignancy Treatment

Initial Wt Loss Targets[5] (1st 6 Months)
- >95th%ile BMI for Age & Gender
- >85th%ile BMI with Comorbidities

Pubertal: = 10% Body Wt Loss

Pre-pubertal: ≥age 7 = 1–2 lbs per Month Wt Loss
<age 7 = Wt Maintenance or Modest Wt Loss

Degree of Wt Loss will Depend on the Severity of the Comorbidity

Offer Medically Supervised Wt Management Intervention

Pt/Family Not Motivated → Educate Patient and Family; Manage Comorbidities and Risk Factors; Reassess Readiness Periodically

Pt/Family Motivated

Pt/Family Motivated

Pt/Family Not Motivated

Education; Lifestyle Changes[2]**; Nutrition; Increased Physical Activity; Behavior Modification; Nutrition/Family Counseling.**

≥6 months → Targets Not Met

Pt/Family Motivated

≥6 months

Consider Obesity Pharmacologic Monotherapy as Adjunct to Lifestyle Changes if BMI ≥27 with Comorbidities or if BMI ≥30

Appetite Suppressant Sibutramine[6]
Contraindicated in: Uncontrolled HTN; Glaucoma (Narrow-angle); Arrhythmia; CVA; CVD; CHF; Concurrent SSRI; MAOI Therapy; Pregnancy; Bulimia/Anorexia Nervosa Hx

Lipase Inhibitor Orlistat[7]
Contraindicated in: Chronic Malabsorption; Cholestasis; Orlistat Hypersensitivity; Concurrent Cyclosporin Therapy; Pregnancy

Targets Met → **Wt Loss Maintenance** → Maintain Healthy Lifestyle, Diet and Exercise; Reinforce Education; Monitor Wt Weekly for Life with Periodic Follow-up by HCP

≥6 months

Motivated & Targets Not Met → Targets Maintained → **Consider Bariatric Surgery**[8] **for adolescents who meet criteria. (See page 2)**

Abbreviations

AN: Acanthosis Nigricans
CHF: Congestive Heart Failure
CVA: Cerebrovascular Accident
CVD: Cardiovascular Disease
FPG: Fasting Plasma Glucose
GERD: Gastro-esophageal Reflux Disease
HCP: Health Care Professional
HDL-C: High-density Lipoprotein Cholesterol
HTN: Hypertension (>95th%ile Blood Pressure for Age & Gender & Ht)
LDL-C: Low-density Lipoprotein Cholesterol
MAOI: Monoamine Oxidase Inhibitors
NAFLD: Non-alcoholic Fatty Liver Disease
PCOS: Polycystic Ovary Syndrome
SGA: Small for Gestational Age
SSRI: Selective Serotonin Reuptake Inhibitors
T2DM: Type 2 Diabetes Mellitus
TG: Triglycerides

Criteria for Bariatric Surgery[8]

Adolescents being considered for bariatric surgery should:

- Have failed 6 months of organized attempts at wt management, as determined by their primary care provider
- Have attained or nearly attained physiologic maturity
- Be severely obese (BMI ≥40) with serious obesity-related comorbidities or BMI ≥50 with less severe comorbidities
- Demonstrate commitment to comprehensive medical and psychologic evaluations both before and after surgery
- Agree to avoid pregnancy for at least 1 yr postoperatively
- Be capable of and willing to adhere to nutritional guidelines postoperatively
- Provide informed consent to surgical treatment
- Demonstrate decisional capacity
- Have a supportive family environment

Footnotes:

1. Adapted from the Texas Council's *Weight Loss Algorithm for Overweight and Obese Adults*
2. Barlow SE, Dietz WH. Obesity evaluation and treatment: Expert Committee recommendations. The Maternal and Child Health Bureau, Health Resources and Services Administration and the Department of Health and Human Services. *Pediatrics*. 1998;102(3):E29
3. Barlow SE, Dietz WH. Obesity evaluation and treatment: Expert Committee recommendations. The Maternal and Child Health Bureau, Health Resources and Services Administration and the Department of Health and Human Services. *Pediatrics*. 1998;102(3):E29; and American Diabetes Association. Type 2 diabetes in children and adolescents. *Pediatrics*. 2000;105(3 Pt 1):671-80; Refer to appropriate Texas Diabetes Council algorithms
4. **Medications that affect insulin sensitivity:**

   Inhaled steroids:
   - 1000 mcg/day fluticasone (Flovent)
   - 2000 mcg/day of all others

   Oral Steroids:
   - 20 days in previous year, or any within 60 days of screening
   - L-asparaginase
   - FK506 (Tacrolimus)
   - Cyclosporine (Neoral/ Sandimmune)
   - Niacin

   Medications known to cause wt gain:
   - Risperidone (Risperdal)
   - Olanzapine (Zyprexa)
   - Clozapine (Clozaril)
   - Quetiapine (Seroquel)
   - Ziprasidone (Geodon)
   - Carbamazepine (Tegretol)
   - Valproic acid (Depakote/ Depakene/Depacon)
   - Tricyclic Antidepressants
   - Lithium
   - Insulin/Insulin Analogs
   - Sulfonylureas
   - Cyproheptadine
   - Estrogens/Progestins
5. No evidence-based outcomes data are yet available for weight loss targets
6. Berkowitz RI, Wadden TA, Tershakovec AM, et al. Behavior therapy and sibutramine for the treatment of adolescent obesity: a randomized controlled trial. *JAMA*. 2003;289(14):1805-12; sibutramine is FDA-approved for ages ≥16 yr
7. McDuffie JR, Calis KA, Uwaifo GI, et al. Efficacy of orlistat as an adjunct to behavioral treatment in overweight African American and Caucasian adolescents with obesity-related co-morbid conditions. *J Pediatr Endocrinol Metab*. 2004;17(3):307-19; orlistat is FDA-approved for ages ≥12 yr
8. Inge TH, Krebs NF, Garcia VF, et al. Bariatric surgery for severely overweight adolescents: concerns and recommendations. *Pediatrics*. 2004;114(1):217-23
9. Rosner B, Prineas R, Loggie J, et al. Percentiles for body mass index in U.S. children 5 to 17 years of age. *J Pediatr.* 1998;132(2):211-22.

Additional References

Bobo N, Evert A, Gallivan J, et al. An update on type 2 diabetes in youth from the National Diabetes Education Program. *Pediatrics*. 2004;114(1):259-63

Garcia VF, Langford L, Inge TH. Application of laparoscopy for bariatric surgery in adolescents. *Curr Opin Pediatr*. 2003;15(3):248-55

Krebs NF, Jacobson MS; American Academy of Pediatrics Committee on Nutrition. Prevention of pediatric overweight and obesity. *Pediatrics*. 2003;112(2):424-30

APPENDIX. Weight (lb) for different combinations of height (inch) and BMI (kg/m^2)

Height (in)	Weight (lb)																	
36	24	26	28	29	31	33	35	37	39	40	42	44	46	48	50	52	53	55
37	25	27	29	31	33	35	37	39	41	43	45	47	49	51	52	54	56	58
38	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61
39	28	30	32	35	37	39	41	43	45	47	50	52	54	56	58	60	63	65
40	30	32	34	36	39	41	43	45	48	50	52	55	57	59	61	64	66	68
41	31	33	36	38	41	43	45	48	50	52	55	57	60	62	64	67	69	72
42	33	35	38	40	43	45	48	50	53	55	58	60	63	65	68	70	73	75
43	34	37	39	42	45	47	50	52	55	58	60	63	66	68	71	73	76	79
44	36	38	41	44	47	49	52	55	58	60	63	66	69	71	74	77	80	82
45	37	40	43	46	49	52	55	57	60	63	66	69	72	75	78	80	83	86
46	39	42	45	48	51	54	57	60	63	66	69	72	75	78	81	84	87	90
47	41	44	47	50	53	56	60	63	66	69	72	75	78	82	85	88	91	94
48	43	46	49	52	56	59	62	65	69	72	75	78	82	85	88	92	95	98
49	44	48	51	55	58	61	65	68	72	75	78	82	85	89	92	95	99	102
50	46	50	53	57	60	64	67	71	75	78	82	86	89	92	96	99	103	106
51	48	52	55	59	63	66	70	74	78	81	85	89	92	96	100	103	107	111
52	50	54	58	61	65	69	73	77	81	84	88	92	96	100	104	107	111	115
53	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120
54	54	58	62	66	70	74	79	83	87	91	95	99	103	108	112	116	120	124
55	56	60	64	69	73	77	82	86	90	94	99	103	107	112	116	120	125	129
56	58	62	67	71	76	80	85	89	93	98	102	107	111	116	120	125	129	134
57	60	65	69	74	78	83	88	92	97	101	106	111	115	120	125	129	134	138
58	62	67	72	76	81	86	91	95	100	105	110	115	119	124	129	134	138	143
59	64	69	74	79	84	89	94	99	104	109	114	119	124	128	133	138	143	148
60	66	72	77	82	87	92	97	102	107	112	118	123	128	133	138	143	148	153
61	69	74	79	85	90	95	100	106	111	116	121	127	132	137	143	148	153	158
62	71	76	82	87	93	98	104	109	115	120	125	131	136	142	147	153	158	164
63	73	79	85	90	96	101	107	113	118	124	130	135	141	146	152	158	163	169
64	76	81	87	93	99	105	110	116	122	128	134	140	145	151	157	163	169	174
65	78	84	90	96	102	108	114	120	126	132	138	144	150	156	162	168	174	180
66	80	87	93	99	105	111	117	124	130	136	142	148	155	161	167	173	179	185
67	83	89	96	102	108	115	121	127	134	140	147	153	159	166	172	178	185	191
68	85	92	98	105	112	118	125	131	138	144	151	158	164	171	177	184	190	197
69	88	95	101	108	115	122	128	135	142	149	155	162	169	176	182	189	196	203
70	90	97	104	111	118	125	132	139	146	153	160	167	174	181	188	195	202	209
71	93	100	107	114	122	129	136	143	150	157	165	172	179	186	193	200	207	215
72	96	103	110	118	125	132	140	147	155	162	169	177	184	191	199	206	213	221
73	98	106	113	121	129	136	144	151	159	166	174	182	189	197	204	212	219	227
74	101	109	117	124	132	140	148	155	163	171	179	187	194	202	210	218	225	233
75	104	112	120	128	136	144	152	160	168	176	184	192	200	208	216	224	232	240
76	107	115	123	131	139	148	156	164	172	180	189	197	205	213	221	230	238	246
77	109	118	126	135	143	151	160	168	177	185	194	202	210	219	227	236	244	252
78	112	121	130	138	147	155	164	173	181	190	199	207	216	225	233	242	250	259
BMI (kg/m^2)	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

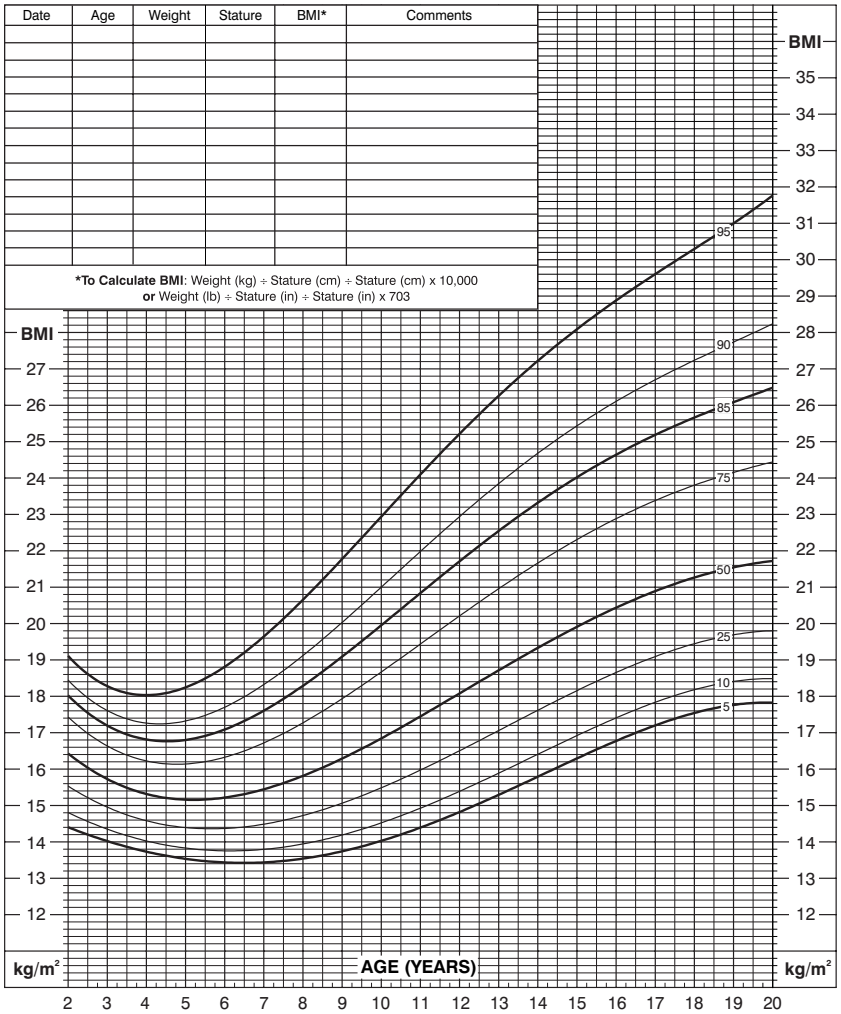
2 to 20 years: Girls
Body mass index-for-age percentiles

NAME _____

RECORD # _____

Date	Age	Weight	Stature	BMI*	Comments

***To Calculate BMI**: Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



Published May 30, 2000 (modified 10/16/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

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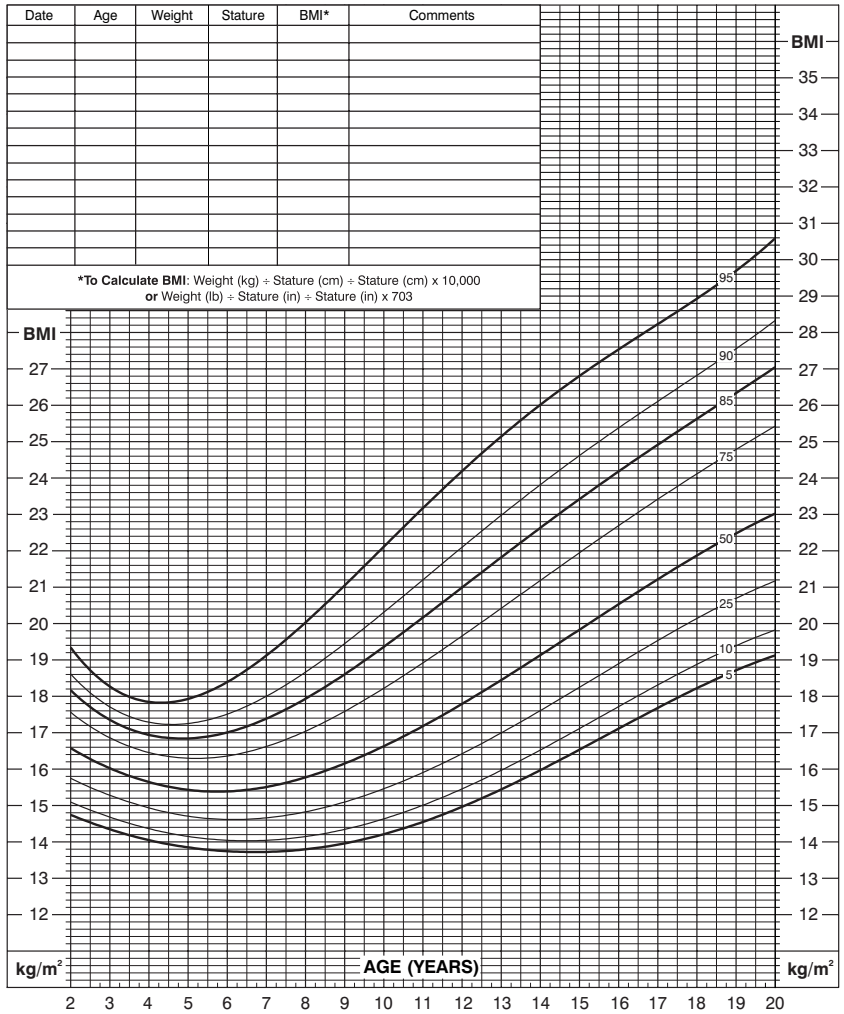
2 to 20 years: Boys
Body mass index-for-age percentiles

NAME _____

RECORD # _____

Date	Age	Weight	Stature	BMI*	Comments

***To Calculate BMI**: Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



Published May 30, 2000 (modified 10/16/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

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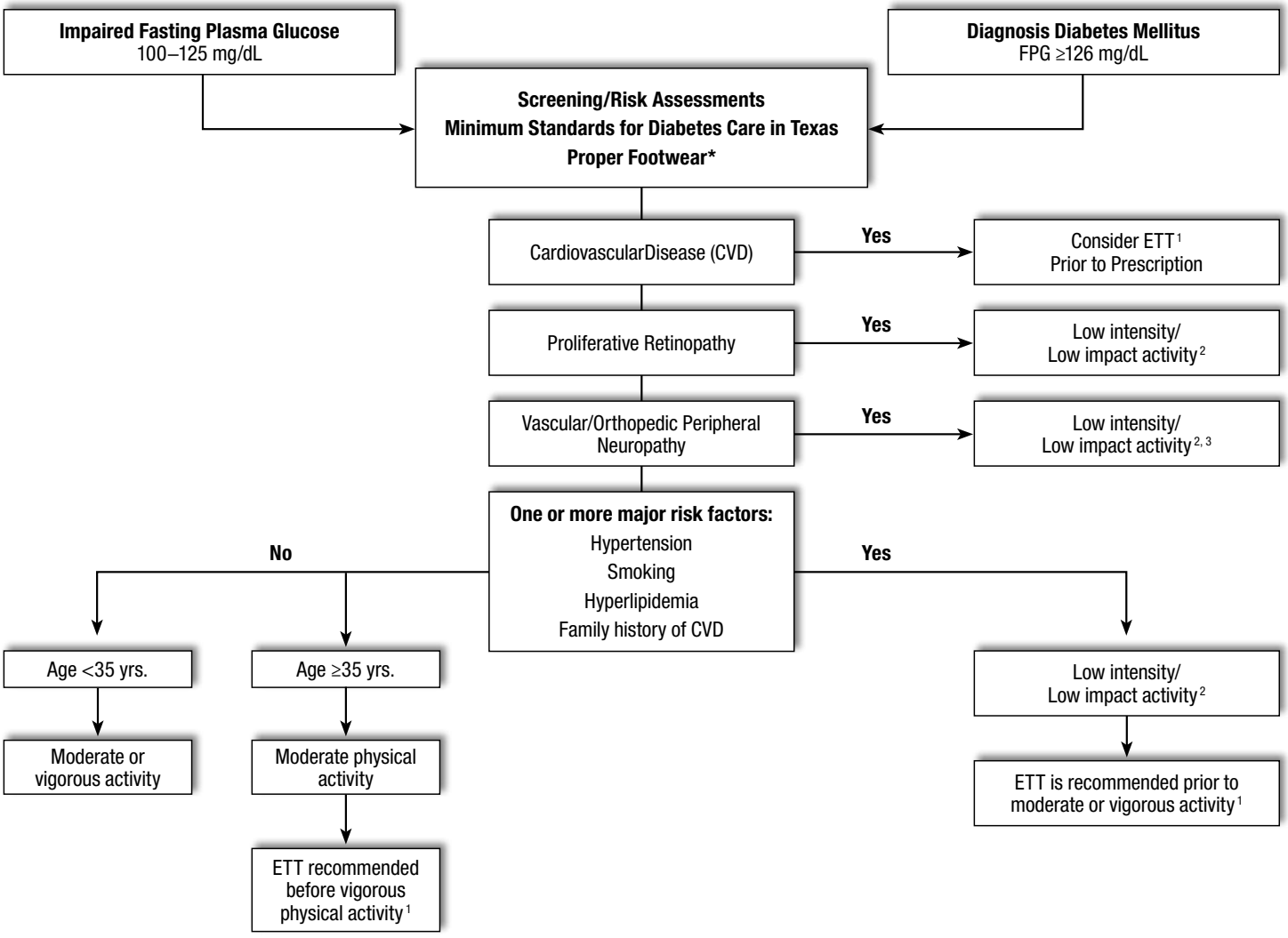
Exercise Algorithm Type 2 Diabetes Prevention and Therapy

TEXAS Department of State Health Services
Publication # 45-11266
TEXAS DIABETES COUNCIL
Revised 01/22/04



[1] **Recommendation for Exercise Tolerance Test**
Based on the clinical context in which they occur, if your patients have any of the following signs or symptoms of cardiovascular or metabolic disease, consider an exercise tolerance test (ETT) before recommending moderate or vigorous activity.

- Pain, discomfort (or other anginal equivalent) in the chest, neck, jaw, arms, or other areas that may be ischemic in nature
- Shortness of breath at rest or with mild exertion
- Dizziness or syncope
- Orthopnea or paroxysmal nocturnal dyspnea
- Ankle edema
- Palpitations or tachycardia
- Intermittent claudication
- Unusual fatigue or shortness of breath with usual activities
- Any macrovascular disease
- Any microvascular disease
- Peripheral vascular disease

[2] Moderate activity is recommended to achieve physiologic improvement.

[3] Orthotics as indicated.

*Proper footwear (socks, shoes, insoles) to prevent injury.

If your patients are "apparently healthy" and have fewer than two major risk factors for cardiovascular disease (CVD), then they are categorized by age.

- For men and women under 35 yrs. of age, there are no limitations. They can safely begin or continue a program of moderate or vigorous activity.
- If they exceed the age limit (≥35 yrs.), it is safe to limit your recommendations to moderate activity (55% to 70% maximum heart rate) for both genders. Patients in this group who wish to participate in vigorous or competitive activities should be considered for an ETT screening.

If your patients have one or more major risk factors for cardiovascular disease, they should undergo an ETT before beginning a moderate exercise program.

It is important to underscore the fact that the majority of your patients, regardless of risk factors, can and should be encouraged to start or continue a program of regular moderate physical activity.

CONSIDERATIONS FOR PRESCRIBING PHYSICAL ACTIVITY FOR TYPE 2 DIABETES PREVENTION AND TREATMENT

Significant health benefits can be obtained by including an accumulated 30 minutes of moderate physical activity on most, if not all, days of the week.

Regular physical activity lowers the risk of developing type 2 diabetes – 1996 Surgeon General's Report on Physical Activity and Health.

"Regular physical activity" includes all movements in everyday life, including work, recreation, exercise, and sporting activities.

- **Low Intensity/Low Impact Activity** – includes activities like walking, housework, light gardening, light yard work, and social dancing
- **Moderate Intensity Activity** – includes activities like brisk walking, vigorous gardening, slow cycling, aerobic dancing, doubles tennis, or hard work around the house

PRECAUTIONS FOR EXERCISE PRESCRIPTION

Retinopathy

Patients with proliferative diabetic retinopathy have abnormal hemodynamic responses of the cerebral and ophthalmic circulation both at rest and with exercise. **Vigorous physical activity, especially isometric contractions, produces significant increases in blood pressure and can accelerate proliferative diabetic retinopathy with significant risk of retinal and vitreal hemorrhage and detachment.** Low impact/low intensity physical activity recommended.

Orthopedic Problems

Neuropathy and peripheral vascular disease can predict unnoticed foot injury. Footwear that relieves forefoot plantar pressure by up to 50% has been shown to be effective in preventing the recurrence of foot ulcers when worn for more than 60% of the day (Peirce, N. 1999. British Journal of Sports Medicine).

Guidelines for Exercise Prescription

1. Appropriate attire for physical activity, i.e., footwear – socks, shoes, insoles/orthotics
2. Do not exercise at peak hypoglycemic times
3. Monitor blood glucose before and during exercise if symptoms of hypoglycemia occur with exercise
4. Wear a form of personal identification or medical alert
5. Carry fast-acting carbohydrate, i.e., sucrose and glucose products
6. Examine feet after exercise
7. Maintain adequate hydration

Diabetes Medical Nutrition Therapy and Prevention Algorithm For Adults

TEXAS Department of State Health Services
Publication # 45-10778
TEXAS DIABETES COUNCIL
Revised 07/22/10

Categories of Increased Risk
- IFG: Fasting glucose 100–125mg/dL[1] or
- IGT: Post challenge glucose 140–199mg/dL or
- Alc: 5.7– 6.4%

Diabetes Mellitus
- Fasting glucose 126 ≥ mg/dL or
- 2 hr. PP ≥ 200 mg/dL or
- Alc ≥6.5%

Abbreviations:
A1c – Hemoglobin A1c
BMI – Body Mass Index
BP – Blood Pressure
CHO – Carbohydrates
DASH – Dietary Approaches to Stop Hypertension
IFG – Impaired Fasting Glucose
IGT – Impaired Glucose Tolerance
LDL-C – Low Density Lipoprotein Cholesterol
PP – Postprandial
TG – Triglycerides

Medical Nutrition Therapy

Recommend Registered/Licensed Dietitian or Certified Diabetes Educator with Experience in Diabetes Nutrition Counseling

Individual Nutrition Assessment

BMI, Waist Circumference/Waist-to-hip ratio, Medical History, Lab Values (Chemistry panel, Lipid panel, A1c, microalbumin-to-creatinine ratio), Diet History, Lifestyle, Physical Activity, Readiness to Change

Interventions

Diabetes Self-Management Education (DSME)
- Set individualized goals to meet patient needs
- Promote weight loss, if needed[2]
- Self-monitored blood glucose (SMBG)
- Increase physical activity[3]
- Incorporate other needed dietary modifications with meal plan

- Meal plan[4] – Distribute food throughout the day to avoid large concentrations of calories or carbohydrates that cause postprandial glucose elevations.
  Recommended: low CHO diet, no more than 45–65% Kcal from CHO
  Not Recommended: <130g CHO (~9 servings/day)
- Individualize meals and snacks to include healthy food choices
- ↑ dietary fiber intake to 14 g fiber/1,000 Kcal /day

- Fasting glucose>110 mg/dL
- 2-hr PP ≥140–180 mg/dL
- A1c >6.5%
- Monitor total CHO intake
- Refer to Glycemic Control Algorithm

Overweight/Obesity [2, 3]
BMI >25

- Set weight loss goals (5–10% minimum)
- ↑ physical activity

- Evaluate total calories from fat and CHO.
- If excessive, ↓ Kcal from CHO and/or fat, (especially from saturated fat) by 500-1000 Kcal below usual daily intake.

TG >150 mg/dL [5]

- ↓ Total CHO intake
- ↑ Omega-3 fatty acids

If TG >500 mg/dL, ↓ fat calories to <15% total Kcal/day

LDL-C >100 mg/dL[5]

- ↓ Saturated fat < 7% total Kcal/day
- ↓ trans fats (minimized)
- ↓ cholesterol intake < 200 mg/day
- ↑ omega-3 fatty acids
- ↑ soluble fiber 10–25g/day
- ↑ plant stenols / sterols

BP >130/80 mmHg [6]

- Sodium restriction to ≤ 1.5g/day[7]
- DASH diet

If proteinuric:
- Maintain protein intake between 0.8–1g/kg
- Continue sodium restriction

Monitor glucose (SMBG), A1c, weight, lipids, and blood pressure. Adjust food portions and distribution with medication and activity to achieve metabolic goals.

Follow-up Evaluation

Monitor glucose (SMBG), A1c, weight, lipids, and blood pressure. Modify meal plan as needed to achieve metabolic goals.

If metabolic targets are not met within 1–3 months, evaluate nutrition care plan, re-educate and review goals.
Verify patient follow-up with healthcare provider for further assessment and treatment.

Footnotes

1 This test requires the use of a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water. 2-hr post-challenge glucose.
2 Refer to Weight Loss Algorithm
3 Refer to Exercise Algorithm
4 ADA. Standards of Medical Care in Diabetes – 2010. *Diabetes Care*. 2010;33 (suppl 1): S11-S61.
5 Refer to Lipid Treatment Algorithm
6 Refer to Hypertension Algorithm
7 Dietary Guidelines for Americans, 2005. Available online at http://www.health.gov/dietaryguidelines/dga2005/document/html/chapter8.htm Accessed on July 22, 2010.

Nutrition Recommendations and Interventions for Diabetes

TEXAS Department of State Health Services
TEXAS DIABETES COUNCIL

Medical nutrition therapy (MNT) is important in preventing diabetes, managing existing diabetes, and preventing, or at least slowing, the rate of development of diabetes complications. It is an integral component of diabetes self-management education (or training). The following recommendations and interventions are evidence-based.

The goal of these recommendations is to make people with diabetes and health care providers aware of beneficial nutrition interventions. This requires the use of the best available scientific evidence while taking into account treatment goals, strategies to attain such goals, and changes individuals with diabetes are willing and able to make. Achieving nutrition-related goals requires a coordinated team effort that includes the person with diabetes and involves him or her in the decision-making process. It is recommended that a registered dietitian, knowledgeable and skilled in MNT, be the team member who plays the leading role in providing nutrition care. However, it is important that all team members, including physicians, certified diabetes educators, nurses, pharmacists and other providers, be knowledgeable about MNT and support its implementation.

Goals: At risk for diabetes or with pre-diabetes

1) To decrease the risk of diabetes and cardiovascular disease (CVD) by promoting healthy food choices and physical activity leading to moderate weight loss that is maintained.

Goals: Individuals with diabetes

1) Achieve and maintain
   - Blood glucose levels in the normal range or as close to normal as is safely possible
   - A lipid and lipoprotein profile that reduces the risk for cardiovascular disease
   - Blood pressure levels in the normal range, less than 130/80
2) To prevent, or at least slow, the rate of developing complications of diabetes by modifying nutrient intake and lifestyle
3) To address individual nutrition needs, taking into account personal and cultural preferences and willingness to change
4) To maintain the pleasure of eating by only limiting food choices when indicated by scientific evidence

Goals: Specific Situations

1) For youth with type 1 diabetes, youth with type 2 diabetes, pregnant and lactating women, and older adults with diabetes, to meet the nutritional needs of these unique times in the life cycle.
2) For individuals treated with insulin or insulin secretagogues, to provide self-management training for safe conduct of physical activity, including the prevention and treatment of hypoglycemia and diabetes treatment during acute illness.

EFFECTIVENESS of Medical Nutrition Therapy

Recommendations

- Individuals who have pre-diabetes or diabetes should receive Individualized MNT; such therapy is best provided by a registered dietitian familiar with the components of diabetes MNT.
- Nutrition counseling should be sensitive to the personal needs, willingness to change, and ability to make changes of the individual with pre-diabetes or diabetes.

Reference: *Diabetes Care*. 2007 Jan;30 Suppl 1:S48-65.

A. Nutrition Guidelines

1. Stress consistent timing of meals, snacks, and portion control. Review the number of servings needed per meal and snacks.
2. Eat a variety of foods every day including fruits and vegetables.
3. Achieve or maintain a desirable weight.
4. Reduce total calories if overweight or obese to lose weight.
5. Read nutrition facts labels.
6. Eat foods high in fiber (whole grain products, vegetables, raw fruit, beans, and legumes).
7. Eat the least amount of saturated fats and trans fats.

B. Carbohydrate (CHO) Intake

Low carbohydrate diets, restricting total CHO to less than 130 grams per day, are not recommended.

1. Total grams of carbohydrate should be individualized based on glucose control, medication and physical activity.
2. Consume more complex (unrefined) carbohydrates with fiber.
3. Eat 2 servings of fruits each day, preferably with lunch and dinner. One serving equals: ½ c. canned fruit or juice, or 1 c. fresh fruit. Avoid juices (except when hypoglycemic) which may cause the blood glucose to rise very rapidly. Focus on fresh fruits that have more fiber, but no more than 2–3 servings per day.
4. Eat 4–6 servings of non-starchy vegetables each day. One serving equals: ½ c. cooked vegetable, ½ c. vegetable juice, or 1 c. raw vegetable.
5. Other CHO choices include: 1 tortilla, 1 slice of bread, 1/3 c. cooked pasta, rice, garbanzo beans, ½ c corn, peas, potatoes, beans, or 6 saltine crackers. Limit CHO choices to 2–3 per meal.
6. Sucrose containing foods can be substituted for other CHO choices in the meal plan, if added to the meal plan.

C. Fiber Intake

1. Eat 14 grams per 1,000 calories. Example: 22 grams for 1,500 calories, 28 grams for 2,000 calories a day.
2. Major sources: raw fruits, unpeeled vegetables, beans, legumes, whole grain breads, pastas, and fiber-rich cereals (≥ 5 grams per serving).

D. Protein Intake

1. 15-20% of total calories per day; approximately 4-6 ounces per day (3 oz. = the size of a deck of cards).
2. Restrict to 0.8–1.0 gram protein/kg of body weight for adults with onset of early nephropathy. Restrict to 0.8gram protein/kg of body weight for adults with onset of later stages of nephropathy
3. One serving is: 1 oz. lean beef, chicken, turkey, pork, lamb or fish, 1 c. skim milk, yogurt, 1 oz. cheese, 1 egg, 1 T. peanut butter
4. Adjustments should be made for conditions such as renal failure, hypertension, or hyperlipidemia.

E. Fat Intake

1. Limit dietary cholesterol to less than 200 mg per day
2. Limit saturated fat to less than 7% of total calories per day

   Sources: Animal fats (found in fatty meats, poultry skin, hydrogenated shortenings and fats, some vegetable oils (coconut, palm, palm kernel, cocoa butter), whole milk, whole milk products, butter, and most commercially baked products.
3. Minimum intake of trans fatty acids (found in most commercially baked products)
4. Use more mono-unsaturated fats, i.e., olive oil and poly-unsaturated fats, i.e., canola or corn oils.
5. Two or more servings of fish per week (with the exception of commercially fried filets)

F. Alcohol (Use with doctor's approval)

1. Limited to a moderate amount (less than 1 drink per day for adult women and less than 2 drinks per day for adult men).
2. One drink is: 1.5 oz. distilled spirits, 5 oz. wine or 12 oz. beer.
3. Food should be consumed with alcoholic beverages to prevent hypoglycemia.

G. Reduced Calorie Sweeteners

Nonnutritive Sweeteners:

1. Acesulfame potassium
2. Aspartame

3. Neotame
4. Saccharin
5. Sucralose

Nutritive Sweeteners:

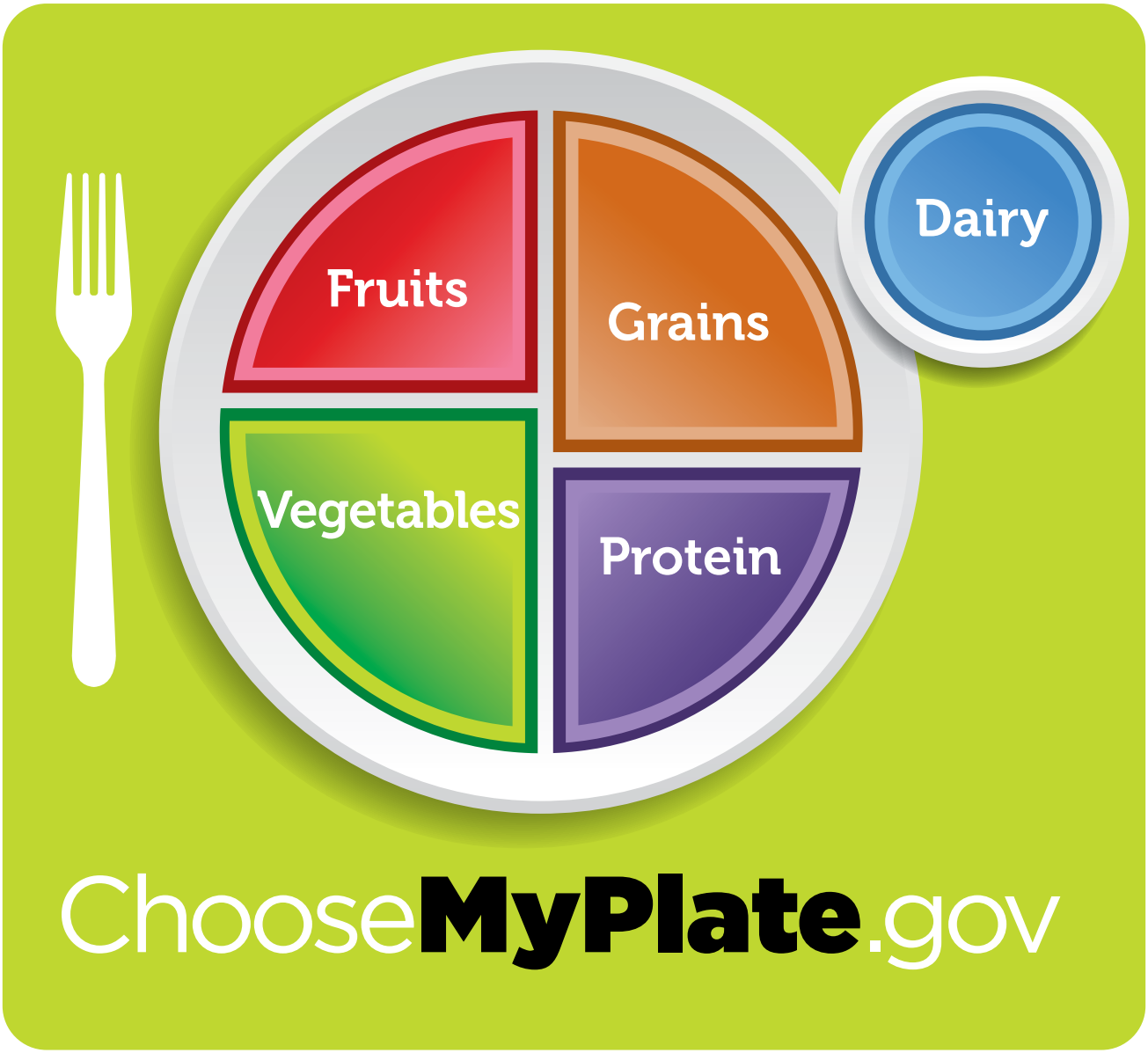
1. Glucose, dextrose, corn syrup
2. Fructose (fruit sugar), molasses, lactose
3. Honey, raw honey, invert sugar
4. Maltose, malted syrup, dextrin

Sugar Alcohols (Polyols):

1. Erythritol, isomalt, lactitol, maltitol, mannitol, sorbitol, xylitol, tagatose, and hydrogenated starch hydrolysates.

H. Sodium

- In normotensive and hypertensive individuals, a reduced sodium intake (e.g., 2,300 mg per day with a diet high in fruits, vegetables, and low-fat dairy products lowers blood pressure.
- Individuals with diabetes at risk for CVD, diets high in fruits, vegetables, whole grains, and nuts may reduce the risk.
- Individuals with diabetes and symptomatic heart failure, dietary sodium intake of <2,000 mg. per day may reduce symptoms.
- In most individuals, a modest amount of weight loss beneficially affects blood pressure.
- Choose low-sodium foods: fresh or frozen vegetables (avoid regular canned foods) and powdered seasonings with sodium (avoid onion and garlic salt). Avoid salty sauces such as soy sauce. Eat less fast food and convenience foods, these foods contain high levels of sodium.



10 tips
Nutrition Education Series

choose MyPlate

10 tips to a great plate

Making food choices for a healthy lifestyle can be as simple as using these 10 Tips.
Use the ideas in this list to *balance your calories*, to choose foods to *eat more often*, and to cut back on foods to *eat less often*.

1 balance calories

Find out how many calories YOU need for a day as a first step in managing your weight. Go to www.ChooseMyPlate.gov to find your calorie level. Being physically active also helps you balance calories.

2 enjoy your food, but eat less

Take the time to fully enjoy your food as you eat it. Eating too fast or when your attention is elsewhere may lead to eating too many calories. Pay attention to hunger and fullness cues before, during, and after meals. Use them to recognize when to eat and when you've had enough.

3 avoid oversized portions

Use a smaller plate, bowl, and glass. Portion out foods before you eat. When eating out, choose a smaller size option, share a dish, or take home part of your meal.

4 foods to eat more often

Eat more vegetables, fruits, whole grains, and fat-free or 1% milk and dairy products. These foods have the nutrients you need for health—including potassium, calcium, vitamin D, and fiber. Make them the basis for meals and snacks.

5 make half your plate fruits and vegetables

Choose red, orange, and dark-green vegetables like tomatoes, sweet potatoes, and broccoli, along with other vegetables for your meals. Add fruit to meals as part of main or side dishes or as dessert.

6 switch to fat-free or low-fat (1%) milk

They have the same amount of calcium and other essential nutrients as whole milk, but fewer calories and less saturated fat.

7 make half your grains whole grains

To eat more whole grains, substitute a whole-grain product for a refined product—such as eating whole-wheat bread instead of white bread or brown rice instead of white rice.

8 foods to eat less often

Cut back on foods high in solid fats, added sugars, and salt. They include cakes, cookies, ice cream, candies, sweetened drinks, pizza, and fatty meats like ribs, sausages, bacon, and hot dogs. Use these foods as occasional treats, not everyday foods.

9 compare sodium in foods

Use the Nutrition Facts label to choose lower sodium versions of foods like soup, bread, and frozen meals. Select canned foods labeled "low sodium," "reduced sodium," or "no salt added."

10 drink water instead of sugary drinks

Cut calories by drinking water or unsweetened beverages. Soda, energy drinks, and sports drinks are a major source of added sugar, and calories, in American diets.

USDA Center for Nutrition Policy and Promotion

Go to www.ChooseMyPlate.gov for more information.

DG TipSheet No. 1
June 2011

Glycemic Control Algorithm For Type 2 Diabetes Mellitus In Adults

TEXAS Department of State Health Services
Stock # 45-11265
TEXAS DIABETES COUNCIL
Revised 07/22/10

Glycemic Goals[1]

Individualize goal based on patient risk factors

A1c	≤6%	<7%	<8%
FPG	≤110	120	140 mg/dL
2h PP	≤130	180	180 mg/dL

Initial Intervention[2]

1. Diabetes Self-Management Education *and*
2. Self-monitored Blood Glucose[3] *and*
3. Medical Nutrition[3], Weight Control[3], Exercise[3] *and*
4. Monotherapy if A1c <1% above goal otherwise Dual Therapy (optimize therapy as tolerated)

Goals not met after 3 months of optimized therapy

If A1c < 1% above goal:

- If on monotherapy → add second agent (oral or GLP-1)
- If on dual therapy → add third agent (oral or GLP-1 or insulin[6])

If A1c ≥ 1% above goal:

- If on monotherapy → add second agent +/- once-daily insulin[6]
  OR add two non-insulin agents (oral or GLP-1)
- If on dual therapy → add third agent (oral or GLP-1)
  OR add insulin[6]

Goals Achieved

Continue Therapy
A1c every 3-6 months

Goals not met after 3 Months of optimized therapy

Add or intensify insulin[6]
Consider referral to endocrinologist / diabetes specialist

Recommended Options for Dual Therapy[4]

Metformin
+ TZD or DPP-4 or SU[5] or GLP-1 or Meglitinide or colesevelam

Recommended Options for Triple Therapy

Metformin
+ TZD or SU[5]
+ GLP-1 or DPP-4 or AGI or colesevelam

Metformin
+ TZD or DPP-4 or AGI or SU[5] or colesevelam
+ Insulin

Abbreviations

AGI	Alpha-glucosidase inhibitors
DPP-4	Dipeptidyl peptidase-4 Inhibitor
FPG	Fasting plasma glucose
GLP-1	Glucagon-like peptide-1 agonist
PP	Postprandial
SU	Sulfonylurea
TZD	Thiazolidinedione

Footnotes

[1] **Intensify management if:** Absent/stable cardiovascular disease, mild-moderate microvascular complications, intact hypoglycemia awareness, infrequent hypoglycemic episodes, recently diagnosed diabetes. **Less intensive management if:** Evidence of advanced or poorly controlled cardiovascular and/or microvascular complications, hypoglycemia unawareness, vulnerable patient (ie, impaired cognition, dementia, fall history). Refer to TDC "A1c Goal" treatment strategy for further explanation. A1c is referenced to a non-diabetic range of 4-6% using a DCCT-based assay. ADA Clinical Practice Recommendations. *Diabetes Care* 2010;33(suppl 1):S19-20.

[2] If initial A1c on presentation is ≥10%, consider the use of insulin, with or without oral agents, as the initial intervention (see Insulin Algorithm). Other agents may be introduced as glycemic control improves. If ketoacidosis or recent rapid weight loss, consider Type 1 diagnosis.

[3] These interventions should be maintained life-long; (refer to Medical Nutrition, Weight Loss, and Exercise Algorithms).

[4] Refer to the Diabetes Medications Supplement: Working Together to Manage Diabetes found in the Texas Diabetes Council's Diabetes Toolkit.

[5] If a SU is selected, low dose glipizide ER or glimepiride are recommended because they have a lower incidence of hypoglycemia than glyburide.

[6] Refer to Insulin Algorithm for Type 2 Diabetes Mellitus in Children and Adults / Initial Insulin Therapy for Type 2
Diabetes Mellitus in Children and Adults: A Simplified Approach

GLYCEMIC CONTROL BIBLIOGRAPHY

Recent Review Articles

Inzucchi SE. Oral antihyperglycemic therapy for type 2 diabetes: scientific review. *JAMA*. 2002;287(3):360-72.

Inzucchi SE, McGuire DK. New drugs for the treatment of diabetes: part II: Incretin-based therapy and beyond. Circulation. 2008 Jan 29;117(4):574-84.

Riddle, MC. Glycemic management of type 2 diabetes: An emerging strategy with oral agents, insulins and combinations. *Endocrinol Metab Clin N Am*. 2005;34(1):77-98.

Drucker DJ, Sherman SI, Gorelick FS, Bergenstal RM, Sherwin RS, Buse JB. Incretin-based therapies for the treatment of type 2 diabetes: evaluation of the risks and benefits. *Diabetes Care*. 2010 Feb;33(2):428-33.

Dual Therapy

Metformin or Sulfonylurea + Acarbose
Chiasson JL, Josse RG, Hunt JA, et al. The efficacy of acarbose in the treatment of patients with non-insulin-dependent diabetes mellitus. A multicenter controlled clinical trial. *Ann Intern Med.* 1994;121(12):928-35.

Metformin + Pioglitazone
Einhorn D, Rendell M, Rosenzweig J, et al. Pioglitazone hydrochloride in combination with metformin in the treatment of type 2 diabetes mellitus: a randomized, placebo-controlled study. The Pioglitazone 027 Study Group. *Clin Ther*. 2000;22(12):1395-409.

Metformin + Rosiglitazone
Fonseca V, Rosenstock J, Patwardhan R, et al. Effect of metformin and rosiglitazone combination therapy in patients with type 2 diabetes mellitus: a randomized controlled trial. *JAMA*. 2000;283(13):1695-702. Erratum in: *JAMA* 2000;284(11):1384.

Sulfonylurea + Pioglitazone
Kipnes MS, Krosnick A, Rendell MS, et al. Pioglitazone hydrochloride in combination with sulfonylurea therapy improves glycemic control in patients with type 2 diabetes mellitus: a randomized, placebo-controlled study. *Am J Med*. 2001;111(1):10-7.

Sulfonylurea + Rosiglitazone
Wolffenbuttel BH, Gomis R, Squatrito S, et al. Addition of low-dose rosiglitazone to sulphonylurea therapy improves glycaemic control in type 2 diabetic patients. *Diabet Med*. 2000;17(1):40-7.

Metformin or Sulfonylurea + Exenatide
Buse JB, Henry RR, Han J, et.al. Effects of exenatide (exendin-4) on glycemic control over 30 weeks in sulfonylurea-treated patients with type 2 diabetes. *Diabetes Care*. 2004;27(11):2628-35.

DeFronzo RA, Ratner RE, Han J, et.al. Effects of exenatide (exendin-4) on glycemic control and weight over 30 weeks in metformin-treated patients with type 2 diabetes. *Diabetes Care*. 2005;28(5):1092-100.

Nateglinide or Repaglinide + Metformin
Raskin P, Klaff L, McGill J, et al. Efficacy and safety of combination therapy: repaglinide plus metformin versus nateglinide plus metformin. *Diabetes Care*. 2003;26(7):2063-8. Erratum in: *Diabetes Care*. 2003;26(9):2708.

Repaglinide + Metformin
Moses R, Slobodniuk R, Boyages S, et al. Effect of repaglinide addition to metformin monotherapy on glycemic control in patients with type 2 diabetes. *Diabetes Care*. 1999;22(1):119-24.

Nateglinide + Metformin
Horton ES, Clinkingbeard C, Gatlin M, et al. Nateglinide alone and in combination with metformin improves glycemic control by reducing mealtime glucose levels in type 2 diabetes. *Diabetes Care*. 2000;23(11):1660-5.

Nateglinide + Thiazolidinedione
Rosenstock J, Shen SG, Gatlin MR, et al. Combination therapy with nateglinide and a thiazolidinedione improves glycemic control in type 2 diabetes. *Diabetes Care*. 2002;25(9):1529-33.

Fonseca V, Grunberger G, Gupta S, et al. Addition of nateglinide to rosiglitazone monotherapy suppresses mealtime hyperglycemia and improves overall glycemic control. *Diabetes Care*. 2003;26(6):1685-90.

Repaglinide + Thiazolidinedione
Raskin P, Jovanovic L, Berger S, et al. Repaglinide/troglitazone combination therapy: improved glycemic control in type 2 diabetes. *Diabetes Care*. 2000;23(7):979-83.

Liraglutide + Metformin
Nauck M, Frid A, Hermansen K, Shah NS, Tankova T, Mitha IH, Zdravkovic M, Düring M, Matthews DR; LEAD-2 Study Group.Efficacy and safety comparison of liraglutide, glimepiride, and placebo, all in combination with metformin, in type 2 diabetes: the LEAD (liraglutide effect and action in diabetes)-2 study. *Diabetes Care*. 2009 Jan;32(1):84-90.

Liraglutide + Sulfonylurea
Marre M, Shaw J, Brändle M, Bebakar WM, Kamaruddin NA, Strand J, Zdravkovic M, Le Thi TD, Colagiuri S; LEAD-1 SU study group. Liraglutide, a once-daily human GLP-1 analogue, added to a sulphonylurea over 26 weeks produces greater improvements in glycaemic and weight control compared with adding rosiglitazone or placebo in subjects with type 2 diabetes (LEAD-1 SU). *Diabet Med.* 2009 Mar;26(3):268-78.

Triple Therapy

Sulfonylurea + Metformin + Alpha glucosidase inhibitors
Lam KS, Tiu SC, Tsang MW, et al. Acarbose in NIDDM patients with poor control on conventional oral agents. A 24-week placebo-controlled study. *Diabetes Care*. 1998;21(7):1154-8.

Standl E, Schernthaner G, Rybka J, et al. Improved glycaemic control with miglitol in inadequately-controlled type 2 diabetics. *Diabetes Res Clin Pract*. 2001;51(3):205-13.

Sulfonylurea + Metformin + Thiazolidinedione
Dailey GE 3rd, Noor MA, Park JS, et al. Glycemic control with glyburide/metformin tablets in combination with rosiglitazone in patients with type 2 diabetes: a randomized, double-blind trial.
Am J Med. 2004;116(4):223-9.

GLYCEMIC CONTROL BIBLIOGRAPHY (CONT.)

Aljabri K, Kozak SE, Thompson DM. Addition of pioglitazone or bedtime insulin to maximal doses of sulfonylurea and metformin in type 2 diabetes patients with poor glucose control: a prospective, randomized trial. *Am J Med*. 2004;116(4):230-5.

Sulfonylurea + Metformin + Exenatide
Kendall DM, Riddle MC, Rosenstock J, et.al. Effects of exenatide (exendin-4) on glycemic control over 30 weeks in patients with type 2 diabetes treated with metformin and a sulfonylurea. *Diabetes Care*. 2005;28(5):1083-91.

Heine RJ, Van Gaal LF, Johns D, et al. Exenatide versus insulin glargine in patients with suboptimally controlled type 2 diabetes: a randomized study. *Ann Intern Med*. 2005; 143(8):559-69.

Liraglutide + Metformin and TZD
Zinman B, Gerich J, Buse JB, Lewin A, Schwartz S, Raskin P, Hale PM, Zdravkovic M, Blonde L; LEAD-4 Study Investigators. Efficacy and safety of the human glucagon-like peptide-1 analog liraglutide in combination with metformin and thiazolidinedione in patients with type 2 diabetes (LEAD-4 Met+TZD). *Diabetes Care*. 2009 Jul;32(7):1224-30.

Liraglutide + Metformin and Sulfonylurea
Russell-Jones D, Vaag A, Schmitz O, Sethi BK, Lalic N, Antic S, Zdravkovic M, Ravn GM, Simó R; Liraglutide Effect and Action in Diabetes 5 (LEAD-5) met+SU Study Group. Liraglutide vs insulin glargine and placebo in combination with metformin and sulfonylurea therapy in type 2 diabetes mellitus (LEAD-5 met+SU): a randomised controlled trial. *Diabetologia*. 2009 Oct;52(10):2046-55.

Colesevelam
Welchol™ Prescribing Information. Daiichi Sankyo, Inc. October 2009.

Bays HE, Goldberg RB, Truitt KE, Jones MR. Colesevelam hydrochloride therapy in patients with type 2 diabetes mellitus treated with metformin: glucose and lipid effects. *Arch Intern Med*. 2008 Oct 13;168(18):1975-83.

Goldberg RB, Fonseca VA, Truitt KE, Jones MR. Efficacy and safety of colesevelam in patients with type 2 diabetes mellitus and inadequate glycemic control receiving insulin-based therapy. *Arch Intern Med*. 2008 Jul 28;168(14):1531-40.

Hypertension Algorithm for Diabetes in Adults

TEXAS Department of State Health Services
Publication # 45-11267
TEXAS DIABETES COUNCIL
Revised 1/26/12

Assess Blood Pressure[1] (BP)

BP ≤130/80 mmHg → Follow-up BP each visit
If microalbuminuria or nephropathy present (Table 1)

BP>130/80 mmHg → **Start ACE inhibitor (ACEi) therapy[2-5]**

IF microalbuminuria or nephropathy present (Table 1)
IF African-American- Start ACEi in combination with diuretic or CCB
IF SBP ≥145mmHg and/or DBP≥90mmHg[6]
Start with combination antihypertensive therapy

Reassess therapy in 4-8 weeks-Titrate to at least 1/2 max dose
Encourage self-monitoring of blood pressure[1]
(on average ≥ 3 medications will be needed to achieve blood pressure goals)

BP ≤130/80 mmHg → Continue Therapy
BP Check Every Visit

BP>130/80 mmHg → **Add[6] Diuretic OR Calcium Channel Blocker (CCB) OR Beta Blocker**

If Diuretic Chosen: (Preferred if no other compelling indications)

Creatinine <1.8 mg/dL	**Creatinine ≥1.8 mg/dL**
Thiazide diuretic^	Loop Diuretic

(^ Max. dose 25mg Hydrochlorothiazide or equivalent)

If Beta Blocker Chosen: (Strongly recommended if history of MI) Choose beta blocker without intrinsic sympathomimetic activity[7]

If CCB Chosen:
If Diltiazem or Verapamil Chosen: Pulse and conduction effects should be considered if combined with β blocker
If Dihydropyridine CCB8 Chosen: **Not** to be used without ACEi or ARB agents

Reassess therapy in 4-8 weeks
Titrate to at least 1/2 max dose or add additional agent[6]

BP ≤130/80 mmHg → Continue Therapy
BP Check Every Visit

BP>130/80 mmHg → **ADD:** Medication not chosen from above
OR Go to Alternative Treatment***

BP ≤130/80 mmHg → Continue Therapy
BP Check Every Visit

BP>130/80 mmHg → ***Alternative treatment**

BP >130/80 mmHg despite above agents or if intolerance/contraindications exist:

Refer to Specialist (Endocrinologist or Nephrologist)
OR
ADD: α blocker, hydralazine, clonidine (caution with β blocker)

Table 1

Microalbuminuria/Proteinuria[3]

- In Type 2 patients, an ACEi or angiotensin receptor blocker (ARB) may be used first line.
- In Type 1 patients, an ACEi is recommended to reduce protein excretion
- Consider the use of verapamil or diltiazem in patients with proteinuria unable to tolerate ACEi or ARBs.

DBP Diastolic Blood Pressure
MI Myocardial Infarction
SBP Systolic Blood Pressure

Footnotes

1 Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure: The seventh report of the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure (JNC 7). *JAMA*. 2003;289(19):2560-72; consider secondary causes as appropriate

2 Maintain non-pharmacological therapy throughout treatment. Medical Nutrition Therapy Algorithm + low sodium diet (<2.4 g/day; if ≥ age 50, ≤ 1.5 g/day) + limit alcohol intake (1 oz./day for men, 0.5 oz./day for women) Weight Loss and Exercise Algorithms.

3 ADA Clinical Practice Guidelines 2004. *Diabetes Care*. 27(suppl 1):S15-S35, S65-S68.

4 Monitor serum K^+ and creatinine periodically

5 If intolerant to ACEi (except angioedema) consider angiotensin receptor blocker (ARB).

6 *Am J Kids Dis*. 2000;36:646-61

7 Metoprolol, carvedilol, bisoprolol, atenolol

8 Amlodipine, felodipine, isradipine, nicardipine, nisoldipine

HYPERTENSION ALGORITHM FOR DIABETES IN ADULTS

Proper blood pressure assessment

National Committee on Detection, Evaluation and Treatment of High Blood Pressure: *The Seventh Report of the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure (JNC 7).* National Institutes of Health, National Heart, Lung and Blood Institute, 2003 http://www.nhlbi.nih.gov/guidelines/hypertension/

ACE inhibitor as 1st line therapy in Diabetes Mellitus

National Committee on Detection, Evaluation and Treatment of High Blood Pressure: *The Seventh Report of the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure (JNC 7).* National Institutes of Health, National Heart, Lung and Blood Institute, 2003 http://www.nhlbi.nih.gov/guidelines/hypertension/

Kasiske BL, Kalil RS, Ma JZ, et al.: Effect of antihypertensive therapy on the kidney in patients with diabetes: a meta-regression analysis. *Ann Intern Med* 118:129–38, 1993

UK Prospective Diabetes Study Group: Efficacy of atenolol and captopril in reducing the risk of macrovascular complications in type 2 diabetes (UKPDS 39) *BMJ* 317:713–20, 1998

The Heart Outcomes Prevention Evaluation Study. Effects of an ACE inhibitor, ramipril, on cardiovascular events in high risk patients. *N Engl J Med* 342:145–53, 2000

Pahor M, Psaty BM, Alderman MH, et al. Therapeutic benefits of ACE inhibitors and other antihypertensive drugs in patients with type 2 diabetes. *Diabetes Care* 23:888-92, 2000

Wing LMH, Reid CM, Ryan P, et al. A comparison of outcomes with angiotensin-converting-enzyme inhibitors and diuretics for hypertension in the elderly (ANBP2). *N Engl J Med* 348:583-92, 2003

Diuretic as second line

National Committee on Detection, Evaluation and Treatment of High Blood Pressure: *The Seventh Report of the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure (JNC 7).* National Institutes of Health, National Heart, Lung and Blood Institute, 2003 http://www.nhlbi.nih.gov/guidelines/hypertension/

Antihypertensive & Lipid Lowering Treatment to Prevent Heart Attack (ALLHAT) *JAMA* 288:2981-97, 2002

Beta-Blocker as second line

National Committee on Detection, Evaluation and Treatment of High Blood Pressure: *The Seventh Report of the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure (JNC 7).* National Institutes of Health, National Heart, Lung and Blood Institute, 2003 http://www.nhlbi.nih.gov/guidelines/hypertension/

UK Prospective Diabetes Study Group: Efficacy of atenolol and captopril in reducing the risk of macrovascular complications in type 2 diabetes (UKPDS 39) BMJ 317:713–20, 1998

Hansson L, Lindholm LH, Niskanen L, et al. Effect of angiotensin converting-enzyme inhibition compared with conventional therapy on cardiovascular morbidity and mortality in hypertension: the Captopril Prevention Project (CAPPP) randomised trial. *Lancet* 353: 611–16, 1999

Verapamil or Diltiazem

Hansson L, Hedner T, Lund-Johansen P, et al. Randomized trial of effects of calcium antagonists compared with diuretics and beta-blockers on cardiovascular morbidity and mortality in hypertension. NORDIL. *Lancet* 356:359–65, 2000

Bakris GL, Copley JB, Vicknair N, et al. Calcium channel blockers versus other antihypertensive therapies on progression of NIDDM associated nephropathy. *Kidney Int* 50:1641–50, 1996

Dihydropyridine calcium channel blockers

Tuomilehto J, Rastenyte D, Birkenhager WH, et al. Effect of calcium channel blockage in older patients with diabetes and systolic hypertension. *N Engl J Med* 340:677–84, 1999

Dahlof B, Sever P, Poulter N, et al. Prevention of cardiovascular events with an antihypertensive regimen of amlodipine adding perindopril as required versus atenolol adding bendroflumethiazide as required, in the Anglo-Scandinavian Cardiac Outcomes Trial-Blood Pressure Lowering Arm (ASCOT-BPLA): a multicentre randomised controlled trial. Lancet 366: 895-906, 2005

Estacio RO, Jeffers BW, Hiatt WR, et al. The effect of nisoldipine as compared with enalapril on cardiovascular outcomes in patients with non-insulin-dependent diabetes and hypertension. *N Engl J Med* 338:645–52, 1998

Alpha-Blockers

Major cardiovascular events in hypertensive patients randomized to doxazosin vs chlorthalidone. (ALLHAT Data) *JAMA* 283:1967–75, 2000

Blood Pressure Goal <130/80

American Diabetes Association: Clinical Practice Recommendations 2004. *Diabetes Care* 27 (suppl 1):S15-S35; S65-S67, 2004

Hansson L, Zanchetti A, Carruthers SG, et al. Effects of intensive blood-pressure lowering and low-dose aspirin in patients with hypertension: principal results of the Hypertension Optimal Treatment (HOT) randomised trial. *Lancet* 351:1755–62, 1998

Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38 *BMJ* 317:703–13, 1998

Urine Protein Excretion >1 gram/ 24 hour BP goal <125/75

Peterson JC, Adler S, Burkart JM, et al. Blood pressure control, proteinuria, and the progression of renal disease. The Modification of Diet in Renal Disease Study. *Ann Intern Med* 123:754–62, 1995

Angiotensin Receptor Blockers

Renoprotective effect of the angiotensin-receptor antagonist irbesartan in patients with nephropathy due to type 2 diabetes. *N Engl J Med* 345: 851–60, 2001

Effects of losartan on renal and cardiovascular outcomes in patients with type 2 diabetes and nephropathy. *N Engl J Med* 345:861–69, 2001

Effects of irbesartan on the development of diabetic nephropathy in patients with type 2 diabetes. *N Engl J Med* 345:870–78, 2001

African Americans

Wright JT, Dunn JK, Cutler JA, et al. Outcomes in hypertensive black and nonblack patients treated with chlorthalidone, amlodipine, and lisinopril. *JAMA* 293:1595-1607, 2005

Wright JT, Bakris G, Greene T, et al. Effect of blood pressure lowering and antihypertensive drug class on progression of hypertensive kidney disease: results from the AASK Trial. *JAMA* 288:2421-31, 2002

Lipid Algorithm For Type 1 and Type 2 Diabetes Mellitus in Adults

TEXAS Department of State Health Services
Publication # 45-10777
TEXAS DIABETES COUNCIL
Revised 04/28/11

Determine Fasting Lipid Profile (FLP) yearly

FLP Goals:

LDL-C <100 mg/dL (<70 with CVD, CVA, or PVD)

HDL-C ≥ 40 mg/dL

TG <150 mg/dL

Abnormal fasting lipids:

- **Initial therapy with TLC & Intensive Glucose Control (with A1c goal < 6%)**
- Evaluate and treat secondary causes of dyslipidemia: alcohol, estrogen, anabolic steroids, corticosteroids, hypothyroidism, hepatic disease, nephrotic syndrome, chronic renal failure.
- LDL-C is the primary target of therapy unless TG ≥ 400 mg/dL, at which point TG then becomes the primary treatment target.

Isolated low HDL-C (with LDL-C & TG at target) → Optimize TLC, smoking cessation, fibrate, niacin, fish oil or statin[1]

Elevated LDL-C
or
LDL-C at goal with at least one additional CV risk factor present

→ Start statin, titrate to goal, reinforce TLC
Goal: LDL-C <100
(<70 if history of CVD, CVA, or PVD)

→ If LDL-C remains above goal and/or patient does not tolerate statin, then add bile acid resin, ezetimibe, niacin or orlistat

→ If not at goal

→ Refer to Lipid Specialist

Elevated TG

- 150-199 → Optimize TLC
- 200-399 → Optimize TLC, smoking cessation, start fibrate, niacin and/or fish oil
- ≥ 400 → Optimize TLC, smoking cessation, start fibrate, niacin and/or fish oil
  When TG < 400, reassess LDL-C
  → LDL-C not at goal, follow elevated LDL-C guideline[1]

Footnotes:

[1] If a fibrate is combined with a statin, then fenofibrate is preferred rather than gemfibrozil due to risk of myositis and rhabdomyolysis.

Definitions:

TLC = Therapeutic Lifestyle Changes (refer to TDC Medical Nutrition, Weight Loss, and Exercise Algorithms)
Statin = HMG Co-A Reductase Inhibitor
TG = Triglycerides
CVD = cardiovascular disease
CVA = cerebrovascular accident
PVD = peripheral vascular disease

HMG CO-A REDUCTASE INHIBITORS LDL-C EQUIVALENCY IN PATIENTS WITH HYPERCHOLESTEROLEMIA*

FLUVASTATIN	PRAVASTATIN	LOVASTATIN	PITAVASTATIN	SIMVASTATIN	ATORVASTATIN	ROSUVASTATIN	EZETIMIBE/ SIMVASTATIN	APPROXIMATE % LDL ↓
20 mg	10 mg	10mg	—	—	—	—	—	15–20
40 mg	20 mg	20mg	—	5–10mg	—	—	—	21–29
80-XL	40–80mg	40 mg	1-2 mg	20mg	10mg	—	—	30–38
—	—	80 mg	4 mg	40mg	20mg	5–10mg	10/10 mg	39–47
—	—	—	—	80mg	40mg	20mg	10/20 mg	48–54
—	—	—	—	—	80mg	40mg	10/40 mg	55-59
—	—	—	—	—	—	—	10/80 mg	>59

* **Footnote:** This information is not completely based on head to head comparison

REFERENCES

Collins R, Armitage J, Parish S, Sleigh P, Peto R; Heart Protection Study Collaborative Group. MRC/BHF Heart Protection Study of cholesterol-lowering with simvastatin in 5963 people with diabetes: a randomised placebo-controlled trial. Lancet. 2003 Jun 14;361(9374):2005-16.

Heart Protection Study Collaborative Group. MRC/BHF Heart Protection Study of cholesterol lowering with simvastatin in 20,536 high-risk individuals: a randomised placebo-controlled trial. Lancet. 2002 Jul 6;360(9326):7-22.

Colhoun HM, Betteridge DJ, Durrington PN, Hitman GA, Neil HA, Livingstone SJ, Thomason MJ, Mackness MI, Charlton-Menys V, Fuller JH; CARDS investigators. Primary prevention of cardiovascular disease with atorvastatin in type 2 diabetes in the Collaborative Atorvastatin Diabetes Study (CARDS): multicentre randomised placebo-controlled trial.Lancet. 2004 Aug 21-27;364(9435):685-96.

Grundy SM, Cleeman JI, Merz CN, Brewer HB Jr, Clark LT, Hunninghake DB, Pasternak RC, Smith SC Jr, Stone NJ; National Heart, Lung, and Blood Institute; American College of Cardiology Foundation; American Heart Association.Implications of recent clinical trials for the National Cholesterol Education Program Adult Treatment Panel III guidelines. Circulation. 2004 Jul 13; 110(2):227-39.

Jones P, Kafonek S, Laurora I, Hunninghake D.Comparative dose efficacy study of atorvastatin versus simvastatin, pravastatin, lovastatin, and fluvastatin in patients with hypercholesterolemia (the CURVES study) Am J Cardiol. 1998 Mar 1;81(5):582-7.

Jones PH, Davidson MH. Reporting rate of rhabdomyolysis with fenofibrate + statin versus gemfibrozil + any statin.Am J Cardiol. 2005 Jan 1;95(1):120-2.

Maeda K, Noguchi Y, Fukui T.The effects of cessation from cigarette smoking on the lipid and lipoprotein profiles: a meta-analysis. Prev Med. 2003 Oct;37(4):283-90.

Keech A, Simes RJ, Barter P, Best J, Scott R, Taskinen MR, Forder P, Pillai A, Davis T, Glasziou P, Drury P, Kesäniemi YA, Sullivan D, Hunt D, Colman P, d'Emden M, Whiting M, Ehnholm C, Laakso M; FIELD study investigators. Effects of long-term fenofibrate therapy on cardiovascular events in 9795 people with type 2 diabetes mellitus (the FIELD study): randomised controlled trial. Lancet. 2005 Nov 26;366(9500):1849-61.

Rubins HB, Robins SJ, Collins D, Fye CL, Anderson JW, Elam MB, Faas FH, Linares E, Schaefer EJ, Schectman G, Wilt TJ, Wittes J.Gemfibrozil for the secondary prevention of coronary heart disease in men with low levels of high-density lipoprotein cholesterol. Veterans Affairs High-Density Lipoprotein Cholesterol Intervention Trial Study Group. N Engl J Med. 1999 Aug 5; 341(6):410-8.

Cholesterol Treatment Trialists' (CTT) Collaborators, Kearney PM, Blackwell L, Collins R, Keech A, Simes J, Peto R, Armitage J, Baigent C.Efficacy of cholesterol-lowering therapy in 18,686 people with diabetes in 14 randomised trials of statins: a meta-analysis.Lancet. 2008 Jan 12;371(9607):117-25.

Saku K, Zhang B, Noda K. Randomized Head-to-Head Comparison of Pitavastatin, Atorvastatin, and Rosuvastatin for Safety and Efficacy (Quantity and Quality of LDL). Circ J. 2011 Apr 15. [Epub ahead of print] PMID: 21498906

Motomura T, Okamoto M, Kitamura T, Yamamoto H, Otsuki M, Asanuma N, Takagi M, Kurebayashi S, Hashimoto K, Sumitani S, Saito H, Kouhara H, Nshii K, Nakao M, Koga M, Sato B, Morimoto Y, Kasayama S. Effects of pitavastatin on serum lipids and high sensitivity C- reactive protein in type 2 diabetic patients. J Atheroscler Thromb. 2009 Oct;16(5):546-52. Epub 2009 Sep 3. PMID:19729863

Macrovascular Risk Reduction in Diabetes: Antiplatelet Therapy

TEXAS Department of State Health Services
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TEXAS DIABETES COUNCIL
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People with diabetes have a 2 to 4 fold higher risk of dying from cardiovascular disease. People with diabetes have a complex procoagulant state, which contributes to the increased risk of atherosclerotic events. Antiplatelet therapy is a simple intervention that can reduce the risk of events in this high-risk population. NHANES III data shows that 27% of people with diabetes are eligible for secondary prevention strategies, while an additional 71% had at least one risk factor for atherosclerotic disease. Thus, basically all persons with diabetes are candidates for antiplatelet therapy, yet only 13% of eligible patients were currently taking aspirin.1, 2

Recommendations:

1) People with diabetes who are age 30 or above should be offered aspirin therapy if no contraindications exist to therapy.
2) Dose: 75 to 325mg daily. An enteric-coated product may be used to minimize gastrointestinal side effects
3) If an aspirin allergy is present, clopidogrel may be recommended (75mg/day) for secondary prevention. Currently, no primary prevention trials in people with diabetes have been conducted. In primary prevention patients with multiple risk factors, the risk, benefit, and cost of clopidrogrel must be considered.

Do not use antiplatelet therapy in people with:

1) Bleeding tendency
2) Anticoagulant therapy
3) Recent gastrointestinal bleeding
4) Clinically active hepatic disease
5) Patients at risk of Reye's syndrome

Combination Therapy:

In people with diabetes who have an event on aspirin, aspirin resistance may play a role.3

1) The CURE trial used combination therapy with aspirin 75mg to 325mg and clopidogrel 75mg every day. Though over 22% of the patients enrolled had diabetes, the relative risk of an event in subjects with diabetes was not reduced significantly by the combination.
2) No benefit has been shown with the addition of warfarin to aspirin therapy 4

Secondary Prevention

1) **Anti-platelet Trialists'**
Antiplatelet Trialists' Collaboration: Collaborative overview of randomised trials of antiplatelet therapy, I: Prevention of death, myocardial infarction, and stroke by prolonged antiplatelet therapy in various categories of patients. BMJ 308:81-106,1994

a. Meta-analysis of 145 prospective controlled trials of antiplatelet therapy
b. Risk reduction of 38±12 vascular events per 1000 diabetics treated (p<0.02)
c. Placebo rate of events 22.3%, reduced to 18.5% on doses of 75mg to 325mg a day

2) **Early Treatment of Diabetic Retinopathy Study (ETDRS)**
ETDRS Investigators: Aspirin effects on mortality and morbidity in patients with diabetes mellitus. JAMA 268:1292-1300, 1992

a. Mixed group of primary and secondary prevention in 3711 diabetics
b. Dose: 650mg/day or placebo
c. Results: 9.1% had myocardial infarction (MI) on aspirin vs. 12.3% on placebo
d. No increase in retinal bleeding was seen on serial eye exams

3) **Hypertension Optimal Treatment (HOT)**
Hansson L, Zanchetti A, Carruthers SG, et al: Effects of intensive blood-pressure lowering and low-dose aspirin in patients with hypertension: Principal results of the Hypertension Optimal Treatment (HOT) randomised trial. Lancet 351:1755-1762, 1998

a. Mixed primary and secondary prevention trial in hypertensive type 2 diabetics
b. 1501 diabetics enrolled in study for average of 3.8 years follow-up
c. Dose: 75mg or placebo
d. Results: 15% reduction in pooled cardiovascular events (p=0.03), and a 36% reduction in the risk of MI (p=0.002)

4) **Clopidogrel versus Aspirin in Patients at Risk of Ischemic Events (CAPRIE)**

a. 19185 persons with recent atherosclerotic event randomized to clopidogrel or aspirin
b. Dose: clopidogrel 75mg every day, aspirin 325mg every day
c. 5.32% risk of ischemic stroke, MI, or vascular death with clopidogrel vs. 5.83% for aspirin (p=0.043)
d. Post-hoc subset analysis of 3866 subjects diagnosed with diabetes by intake questionnaire from investigator5
e. Composite outcome endpoint was: vascular death, MI, stroke, or hospitalization for angina or bleeding event.
f. Event rate was 15.6% vs. 17.7%/ year (p=0.042), for clopidrogrel and aspirin respectively. No significant difference in individual outcomes.
g. Would need to treat approximately 47 individuals with clopidrogrel instead of aspirin to reduce one event.

5) **Effects of Clopidogrel in Addition to Aspirin in Patients with Acute Coronary Syndromes without ST-Segment Elevation. The Clopidogrel in Unstable Angina to Prevent Recurrent Events Trial Investigators (CURE)**
N Eng J Med 345:494-502, 2001

a. 12, 562 subjects who presented to the hospital with an acute coronary syndrome within 24 hours of symptoms

b. Given aspirin 75mg to 325mg every day plus one time dose of clopidogrel 300mg, followed by 75mg every day vs. aspirin alone

c. Results: In 2849 subjects who had diabetes, the combination group experienced a 14.2% event rate vs. 16.75% in the aspirin alone group.

d. Though the relative risk favored addition of clopidogrel, the reduction was not significant

6) **Ticlopidine in Microangiopathy of Diabetes (TIMAD)**
TIMAD Study Group: Ticlopidine treatment reduces the progression of nonproliferative diabetic retinopathy. Arch Ophthalmol 108:1577-1583, 1990

a. 435 diabetic with nonproliferative diabetic retinopathy

b. ticlopidine 250 mg two times a day or placebo

c. followed up to 3 years

d. fluorescein angiograms of eyes done

e. Reduction in progression of retinopathy by 67% (p=0.03) in ticlopidine group vs. placebo

f. Side effects limit usefulness: 2-3% experience neutropenia, serial CBC's must be followed for a minimum of 3 months

Primary Prevention

1) **Physician's Health Study**
Steering Committee of the Physicians' Health Study Research Group: Final report on the aspirin component of the ongoing Physicians' Health Study. N Engl J Med 321:129-135, 1989

a. Dose: 325mg every other day or placebo

b. 22, 071 participants followed for approximately 5 years, 533 had diabetes

c. Outcome: myocardial infarction in 11/275 (4.0%) on aspirin vs. 26/258 on placebo (10.0%). Relative risk = 0.39 (significance not reported)

References:

1. Rolka DB, Fagot-Campagna A, Narayan KM: Aspirin use among adults with diabetes: Estimates from the Third National Health and Nutrition Examination Survey. Diabetes Care 24:197-201, 2001
2. American Diabetes Association. Position Statement. Aspirin Therapy in Diabetes. Diabetes Care. 25:S78-S79, 2002; Diabetes Care. 2004 Jan;27 Suppl 1:S72-3.
3. Gum PA, Kottke-Marchan K, Poggio ED, et al. Profile and prevalence of aspirin resistance in patients with cardiovascular disease. Am J Cardiol 88:230-5, 2001
4. Fiore LD, Ezekowitz MD, Rophy MT, et al. Department of veterans affairs cooperative studies program clinical trial comparing combined warfarin and aspirin with aspirin alone in survivors of acute myocardial infarction: primary results of the CHAMP study. Circulation 105:557-563, 2002
5. Cannon CP. CAPRIE Investigators. Effectiveness of clopidrogrel versus aspirin in preventing acute myocardial infarction in patients with symptomatic atherothrombosis (CAPRIE trial). American Journal of Cardiology 90(7):760-2;2002

Insulin Algorithm for Type 1 Diabetes Mellitus in Children and Adults[1]

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ABBREVIATIONS

BASAL: Glargine or Detemir

BOLUS (Prandial):

Reg: Regular Insulin (peak action 3-4 hrs)

RAI: Rapid Acting Insulin = Aspart, Glulisine, or Lispro (peak action 1-1 ½ hrs)

PPG: Post-Prandial Glucose

SMBG: Self-monitored blood glucose[3]

TDI: Total daily insulin dosage in units

Glycemic Goals[2,3]

Individualize goal based on patient risk factors

A1c	≤6%	<7%	<8%
FPG	≤110	120	140 mg/dL
2h PP	≤130	180	180 mg/dL

Split-Mix Insulin Therapies[4]

1. Two shots: NPH + Reg or RAI
   2:1 ratio AM; 1:1 ratio PM
2. Three shots: AM: NPH + Reg or RAI
   PM: Reg or RAI
   HS: NPH
   2/3 TDI ÷ as 2/3 AM NPH + 1/3 as Reg or RAI
   1/3 TDI ÷ as ½ PM Reg or RAI + ½ NPH at HS
3. Two shots Premix
   2/3 AM + 1/3 PM

Total Daily Insulin[5]**:** 0.3-0.5 units/kg/day, and titrate to glycemic targets

OR

Intensive Insulin Therapy (IIT)

Physiologic Insulin-1:1 basal:bolus ratio SQ

Basal: Glargine QD or Detemir QD-BID[6,9]

Bolus: RAI (or Reg) before each meal: If meal skipped, skip dose.

Premeal insulin dose includes:

1. Insulin to cover carbohydrate ingested[7]; 1 unit RAI covers 500/TDI grams carbohydrate from meal
2. Additional insulin to correct for high SMBG; 1 unit RAI lowers PG by approximately 1800/TDI mg/dL. (Reg lowers PG by ~1500/TDI)
3. Consider adjustment for exercise[8]

Total Daily Insulin[5]**:** 0.3-0.5 units/kg/day and titrate to glycemic targets

Pramlintide[1,9]

Consider as adjunct therapy to insulin in patients unable to stabilize PPG.

Follow A1c Every 3-6 months and Adjust Regimen to Maintain Glycemic Targets

Footnotes

1 **Consider referring all type 1 patients to pediatric/adult endocrinologist/comprehensive diabetes specialty team, and consider continuous glucose monitoring.** If insulin pump therapy is considered-refer to Certified Pump Trainer.

2 **Intensify management if:** Absent/stable cardiovascular disease, mild-moderate microvascular complications, intact hypoglycemia awareness, infrequent hypoglycemic episodes, recently diagnosed diabetes. **Less intensive management if:** Evidence of advanced or poorly controlled cardiovascular and/or microvascular complications, hypoglycemia unawareness, vulnerable patient (ie, impaired cognition, dementia, fall history). See "A1c Goal" treatment strategy for further explanation. A1c is referenced to a non-diabetic range of 4-6% using a DCCT-based assay. ADA Clinical Practice Recommendations. *Diabetes Care* 2009;32(suppl 1):S19-20.

3 Modern glucose meters give values corrected to plasma glucose.

4 Most type 1 patients need IIT to attain glycemic targets; IIT may be by SQ multiple injection or by SQ continuous insulin pump.

5 Dosages may differ in children and adolescents.

6 Twice daily dosing may be required at low basal insulin doses.

7 **Strongly recommend referral to Registered/Licensed Dietitian or Certified Diabetes Educator with experience in diabetes nutrition counseling.**

8 Consider decreasing 1 unit for every 30 minutes of vigorous physical activity.

9 **IMPORTANT:** See package insert for dosing

Insulin Algorithm for Type 2 Diabetes Mellitus in Children and Adults

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Glycemic Goals[1,2]

Individualize goal based on patient risk factors

A1c	≤6%	<7%	<8%
FPG	≤110	120	140 mg/dL
2h PP	≤130	180	180 mg/dL

Treatment Naïve[3]
A1c ≥10% or A1c <10% when considering early insulin initiation

If ketoacidosis or recent rapid weight loss, see Type 1 Diabetes algorithm

INITIAL OPTIONS [3,4]
- Once-daily Insulin[5] + oral(s)
- Multi-dose Insulin[6] +/- oral(s)
- Intensive Insulin Management[6] +/- oral(s)

Uncontrolled on non-insulin therapy:
A1c <1% above goal

Uncontrolled on non-insulin therapy:
A1c ≥1% above goal

- Continue oral agent therapy +/- insulin secretagogue
- Stop GLP-1 agonist prior to insulin therapy

INITIAL OPTIONS [4]
- Once-daily Insulin[5]
- Multi-dose Insulin[6]
- Intensive Insulin Management[6]

INITIAL OPTIONS [4]
- Multi-dose Insulin[6]
- Intensive Insulin Management[6]
- Once-daily Insulin[5]

Basal insulin: Glargine or Detemir
Bolus insulin: Aspart or Glulisine or Lispro
Fast-acting insulin: Aspart; Glulisine; Lispro
F: Fast-acting insulin
R: Regular insulin
FPG: Fasting plasma glucose
PP: Postprandial plasma glucose
SMBG: Self-monitored blood glucose
TDD: Total daily dose of insulin

Once-daily Insulin Therapy

Morning – Basal insulin
Bedtime – Basal insulin *or* NPH
Before supper (Evening)
NPH + R or F 2:1 ratio *or*
Premix 70/30 or 75/25
Starting dose[9,10]
0.1-0.25 units/kg/day *or*
6-10 units/day if patient is elderly or thin
Achieving Goals
Adjust Basal insulin / Bedtime NPH based on FPG
Adjust NPH + R or F / Premix based on bedtime glucose and FPG
Titration schedule[9]
Add 1 unit of insulin each day to reach glycemic goals ***OR***
If FPG:

>180 mg/dL	Add 6 units
If 141–180 mg/dL	Add 4 units
If 121–140 mg/dL	Add 2 units
If 100–120 mg/dL	Add 1 unit
If 80-99 mg/dL	No change
If <80 mg/dL	Subtract 2 units

Glycemic Goals Not Met After 6–12 Weeks

Multi-dose Insulin Therapy (MDI)[10]

2 injections
NPH with R or F (ratio 2:1) before AM and evening meal
or
Premix 70/30 or 75/25 before AM and evening meal

3 injections (especially if nocturnal hypoglycemia)
NPH with R or F morning; R or F[7] evening; NPH bedtime or Premix (as above) morning, noon, evening

Starting dose[8,9]: 0.3-0.5 units/kg/day, divided as follows:
2 injections: 2/3 morning; 1/3 evening
3 injections: Premix: 1/3 morning; 1/3 noon; 1/3 evening
NPH + R or F:

	Before AM Meal	Before evening meal	At Bedtime
NPH	40% of TDD		25% of TDD
R or F	20% of TDD	15% of TDD	

Glycemic Goals Not Met After 3–6 Months

Intensive Insulin Management [10]

Basal: Once-daily, either morning or bedtime (alternative: NPH morning and bedtime)

Bolus: Fast-acting insulin before each meal; (alternative: R may be used)

Premeal insulin dose includes:
1. Insulin to cover carbohydrate ingested[11] &
2. Additional insulin to correct for high SMBG:
   1 extra unit premeal insulin ↓ glucose (mg/dL)
   ~1500/TDD for Regular;
   ~1800/TDD for Aspart/Glulisine/Lispro

Starting dose [8,9]:
1. 0.3-0.5 units/kg/day (1:1 basal:bolus ratio SQ)

Or

2. If current dose >0.5 units/kg/day
   Basal dose = 80% Total daily NPH *or*
   80% Total long-acting component of premix
   Bolus dose = 80% of basal dose divided between 3 meals

Pramlintide
Consider as adjunct therapy to insulin in patients unable to stabilize post-prandial glucose

Follow A1c every 3-6 months and Adjust Regimen to Maintain Glycemic Goals

Footnotes

1 **Intensify management if:** Absent/stable cardiovascular disease, mild-moderate microvascular complications, intact hypoglycemia awareness, infrequent hypoglycemic episodes, recently diagnosed diabetes. **Less intensive management if:** Evidence of advanced or poorly controlled cardiovascular and/or microvascular complications, hypoglycemia unawareness, vulnerable patient (ie, impaired cognition, dementia, fall history). SEE "A1c Goal" treatment strategy for further explanation. A1c is referenced to a non-diabetic range of 4-6% using a DCCTbased assay. ADA Clinical Practice Recommendations Diabetes Care 2009;32(suppl 1):S19-20.

2 Current glucose meters give values corrected to plasma glucose.

3 May also begin combination oral agent therapy. See Glycemic Control Algorithm for Type 2 Diabetes Mellitus in Children and Adults.

4 Combining metformin with insulin therapy has been shown to result in less weight gain and better glycemic control with lower insulin requirements.

5 Continue combination oral agent therapy ± sulfonylurea.

6 Continue metformin (± 3rd oral agent); probably discontinue sulfonylurea.

7 Fast-acting insulin is given with the start of each meal. Regular insulin to be given 30-60 minutes before meals.

8 Dosage may differ in children and adolescents; consider referral to pediatric endocrinologist/comprehensive diabetes specialty team.

9 Start lower and increase slower for thin/elderly/complicated patients.

10 Consider referral to pediatric/adult endocrinologist/diabetes specialty team (option – insulin pump, Pramlintide).

11 Typical "carb" bolus = 1 unit bolus insulin covers 500/TDI x g carbohydrate from meal (~10-15 gm); **strongly recommend referral to Registered/Licensed Dietitian or Certified Diabetes Educator with experience in diabetes nutrition counseling (see Worksheet D).**

Initiation of Once Daily Insulin Therapy for Type 2 Diabetes Mellitus in Children and Adults

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TEXAS DIABETES COUNCIL
Revised 10/28/10

Glycemic Goals[2,3]

Individualize goal based on patient risk factors

A1c	≤6%	<7%	<8%
FPG	≤110	120	140 mg/dL
2h PP	≤130	180	180 mg/dL

Treatment Naïve[3]:

A1c ≥10% or A1c <10% when considering early insulin initiation

If ketoacidosis or recent rapid weight loss, see Type 1 Diabetes algorithm

Oral Agent Failure;
A1c above target

Initiate Insulin Therapy with daily Glargine or Detemir or bedtime NPH[5,6]

Beginning Dosage: 10 units or 0.1–0.25 units/Kg

Suggested Titration Schedule – Adjust Every 2-3 Days

If FPG:			
>180 mg/dL	Add 6 units		
If 141–180 mg/dL	Add 4 units	**OR**	Add 1unit insulin each day until fasting SMBG is at goal
If 121–140 mg/dL	Add 2 units		
If 100–120 mg/dL	Add 1 unit		
If 80-99 mg/dL	No change		
If <80 mg/dL	Subtract 2 units		

If A1c remains >A1c goal over 3 months, discontinue oral secretagogue, continue oral insulin sensitizer(s) and initiate multi-dose insulin or intensive insulin therapy[1] or consult an endocrinologist

Abbreviations:

FPG: Fasting plasma glucose
SMBG: Self-monitored blood glucose
PP: Postprandial plasma glucose

Footnotes

1 For the complete approach to insulin initiation in Type 2 Diabetes Mellitus, see Insulin Algorithm for Type 2 Diabetes Mellitus in Children and Adults.

2 **Intensify management if:** Absent/stable cardiovascular disease, mild-moderate microvascular complications, intact hypoglycemia awareness, infrequent hypoglycemic episodes, recently diagnosed diabetes. **Less intensive management if:** Evidence of advanced or poorly controlled cardiovascular and/or microvascular complications, hypoglycemia unawareness, vulnerable patient (ie, impaired cognition, dementia, fall history). See "A1c Goal" treatment strategy for further explanation. A1c is referenced to a non-diabetic range of 4-6% using a DCCT-based assay. ADA Clinical Practice Recommendations. *Diabetes Care* 2009;32(suppl 1):S19-20.

3 Current glucose meters give values corrected to plasma glucose.

4 Usually with an insulin secretagogue (sulfonylurea, repaglinide or nateglinide) and sensitizer (metformin or thiazolidinedione). See Glycemic Control Algorithm.

5 The pharmacokinetic profile of NPH compared to that of glargine or detemir is less predictable, therefore can result in blood sugar variations and increased nocturnal hypoglycemia. Cost of glargine or detemir is 1.5-2 times that of NPH. Lispro 75/25 or Aspart 70/30 can be considered at pre-supper adjusting dosage according to HS **and** fasting SMBG.

6 **IMPORTANT:** See package insert for dosing.

7 If daytime hypoglycemia develops, contact healthcare professional.

Worksheet: Advancing to Intensive/Physiologic Basal: Bolus Insulin Therapy

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Note: "Analog" = Rapid Acting (Bolus) Analog insulin throughout this document.

A. Conversion from once-daily insulin to intensive/physiologic insulin replacement:

Oral therapy failure: Once-daily glargine was added to the oral regimen and titrated to 30 units per day. How do you add analog insulin if the patient reports the following SMBG values?

	FPG	2-HR PP BRKFT	2-HR PP LUNCH	2-HR PP DINNER
Case 1	105	140	140	240
Case 2	105	140	190	240
Case 3	105	190	240	240

Case 1

a. Continue the oral agents (± sulfonylurea) and 30 units glargine or detemir (or NPH)

b. There are 2 approaches for adding analog (RAI) 10-15 minutes before a meal:

#1 Arbitrary start: 5 units
Titrate: Add 2 units every 2 days to reach 2-hr pp goal

#2 Carb-counting 1 unit/50 mg/dL over 2-hr pp goal

PLUS

1 unit/15 grams carbohydrate

Titrate: Add 1 unit/50 mg/dL >2-hr pp goal every 2 days

Cases 2 and 3

As above, but add and titrate analog before each meal where the postprandial glucose is above goal. Also, see part D below for more information on how to optimize the use of analog insulin. Re-evaluate each week to be certain that about half of the total daily dose is basal and half is bolus insulin.

B. Conversion from once-daily premix to intensive/physiologic insulin replacement:

Oral therapy failure: Once-daily 70/30 premixed insulin was added and titrated to 30 units per day. The fasting glucose is at goal, but daytime control is poor. How do you convert to physiologic insulin therapy?

a. **Basal insulin dose:** The first step in the conversion is based on the total dose of intermediate-acting insulin. In this case, the person is taking 21 units of NPH or aspart-protamine insulin (70% x 30 units=21 units). So, give 21 units basal glargine (use "unit-for-unit" conversion for once-daily intermediate regimens). *Remember, do not stop oral agents (+ sulfonylurea) at this time.*

b. **Bolus insulin dose:** There are several ways to start the analog.

   i. *See Case 1 (Arbitrary start or Carb-counting)*

   ii. Begin with the previous dose of fast-acting insulin, divide it before meals and titrate every 2 days. In this case, the person was using 30 units of 70/30 or about 9 units of fast-acting insulin (30% x 30 units=9 units). So give 3 units of analog before each meal and titrate every 2 days as per Case 1.

C. Conversion from twice-daily premix to intensive/physiologic insulin replacement:

Oral therapy failure in an 80 kg person: 70/30 premixed insulin was started and advanced to 60 units per day: 40 units before breakfast and 20 units before dinner. The fasting glucose was at goal, but wide glycemic excursions occurred at other times during the day and night. How do you convert this person to physiologic insulin therapy? There are several approaches. Use which ever method you want.

a. Start over and begin insulin at 0.5 units/kg. Give half as basal insulin and half as analog, divided before meals. In this case, the starting dose would be 40 units per day. Start giving 20 units glargine each morning and about 7 units analog before each meal. Titrate the basal and bolus insulins every 2 days to fasting and 2-hr postprandial goals.

b. Conversion based on current insulin usage:

   Basal dose: The first step in the conversion is based on the **80% of the total dose of intermediate-acting insulin.** In this case, the person is taking 42 units of NPH or aspart-protamine insulin (70% x 60 units = 42 units). When a person is taking multiple doses of intermediate-acting insulin, we give only 80% as glargine. So, give 34 units basal glargine (80% x 42=~34). *Remember, do not stop oral agents (+ sulfonylurea) at this time.*

   Bolus insulin dose: There are several ways to start the analog.

   i. *See Case 1 (Arbitrary start or Carb-counting)*

   ii. Begin with the previous dose of fast-acting insulin, divide it before meals and titrate every 2 days. In this case, the person was using 60 units of 70/30 or 18 units of fast-acting insulin (30% x 60 units = 18 units). So, give 6 units of analog before each meal and titrate every 2 days as per Case 1.

c. The "**80%-80%" rule:** Similar to the above method, but yields an ideal ratio of basal:bolus insulin in one step. The dose of basal glargine will be 80% of the total intermediate insulin, and the analog will be 80% of the glargine dose, divided before meals.

Basal dose: = 80% of total intermediate insulin
= 80% x 42 units (70% x 60 = 42)
= 34 units glargine

Analog dose: = 80% of the glargine dose, divided TID
= 80% x 34 units = 27 units
= 27 units, divided TID = 9 units
= 9 units aspart, glulisine or lispro before meals

Note: Total dose of insulin is conserved and an ideal ratio between basal and bolus will always result with the "80%-80%" method.

D. Optimizing analog insulin use

Tight control of blood glucose requires that the patient participates in the management of their diabetes. This includes monitoring their blood glucose and learning to count carbohydrates or "carb count." The following material explains how to calculate the dose of analog required to cover a meal and how to add extra analog to correct a hyperglycemic event.

a. Determining the dose of analog insulin to use before a meal

The "**Rule of 500**" is used to determine how many grams of carbohydrate 1 unit of analog insulin will cover. When this number is known, then the person can easily give the correct dose of analog by simply counting the grams of carbohydrate they intend to eat at the meal.

Specifically, 500 divided by the total daily insulin dose (500/TDI) yields the number of grams of carbohydrate that 1 unit of analog will cover. For example, if a person has established that they require about 50 units of insulin per day, then it follows that 1 unit of analog will cover 10 grams of carbohydrate (500/50 = 10). If the person carb counts 140 grams in the dinner meal, then the dose of analog will be 14 units given 10 minutes before eating.

b. Correcting for hyperglycemia

The "**Rule of 1800**" is used to determine how much insulin to use to bring a high glucose reading back to goal. Even with tight control, hyperglycemia occurs and people need to be able to correct this situation.

Specifically, 1800 divided by the total daily insulin dose yields a value indicating how much 1 unit of analog insulin will lower the blood glucose. Thus, if a person uses 90 units of insulin per day, then 1 unit of analog will reduce the blood glucose by 20 mg/dL (1800/90 = 20). **This augment dose of insulin can be used by itself to correct hyperglycemia, or added to the bolus dose if glucose is high before a meal.**

References

1. Riddle MC, Rosenstock J, Gerich J. *Diabetes Care*. 2003; 26:3080-3086.
2. Spellman CW, Renda SM, Davis SN. *Realizing the Potential of Insulin Therapy in Type 2 Diabetes: A Case Presentation-Based Monograph.* presented at the American College of Osteopathic Internists 64th Annual Convention; Chicago, IL (September 30, 2004).
3. www.texasdiabetescouncil.org.

Reviews/Important Articles

- Abraira C, Colwell J, Nuttall F, et al. Cardiovascular events and correlates in the Veterans Affairs Diabetes Feasibility Trial. Veterans Affairs Cooperative Study on Glycemic Control and Complications in Type II Diabetes. *Arch Intern Med.* 1997;157(2):181-8.
- Anonymous. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group. *Lancet*. 1998;352(9131):837-53.
- DeWitt DE, Dugdale DC. Using new insulin strategies in the outpatient treatment of diabetes: clinical applications. *JAMA*. 2003;289(17):2265-9.
- DeWitt DE, Hirsch IB. Outpatient insulin therapy in type 1 and type 2 diabetes mellitus: scientific review. *JAMA*. 2003;289(17):2254-64.
- Implementation Conference for ACE Outpatient Diabetes Mellitus Consensus Conference Recommendations: Position Statement, February 2, 2005. Available online at http://www.aace.com/pub/odimplementation/PositionStatement.pdf. Accessed on May 2, 2005.
- Hirsch IB. Insulin analogues. *N Engl J Med*. 2005;352(2):174-83.

Once Daily Insulin

Morning vs. Bedtime NPH

- Groop LC, Widen E, Ekstrand A, et al. Morning or bedtime NPH insulin combined with sulfonylurea in treatment of NIDDM. *Diabetes Care*. 1992;15(7):831-4.

Morning vs. Bedtime Glargine

- Fritsche A, Schweitzer MA, Haring HU. Glimepiride combined with morning insulin glargine, bedtime neutral protamine hagedorn insulin, or bedtime insulin glargine in patients with type 2 diabetes. A randomized, controlled trial. *Ann Intern Med*. 2003;138(12):952-9.

NPH vs. Glargine

- Riddle MC, Rosenstock J, Gerich J. The treat-to-target trial: randomized addition of glargine or human NPH insulin to oral therapy of type 2 diabetic patients. *Diabetes Care*. 2003;26(11):3080-6.

Once Daily vs. Twice Daily Regimen

- Raskin P, Allen E, Hollander P, et al. Initiating insulin therapy in type 2 diabetes: a comparison of biphasic and basal insulin analogs. *Diabetes Care*. 2005;28(2):260-5.

Multiple Dose Insulin Regimens (2-shot Regimens)

NPH/Regular vs. NPH/ short acting analogue therapy

- Vignati L, Anderson JH Jr, Iversen PW. Efficacy of insulin lispro in combination with NPH human insulin twice per day in patients with insulin-dependent or noninsulin-dependent diabetes mellitus. Multicenter Insulin Lispro Study Group. *Clin Ther.* 1997;19(6):1408-21.

70% NPH/ 30% Regular vs. Humalog Mix 75/25™ or Novolog Mix 70/30™

- Roach P, Yue L, Arora V. Improved postprandial glycemic control during treatment with Humalog Mix25, a novel protamine-based insulin lispro formulation. Humalog Mix25 Study Group. *Diabetes Care*. 1999;22(8):1258-61.
- Boehm BO, Home PD, Behrend C, et al. Premixed insulin aspart 30 vs. premixed human insulin 30/70 twice daily: a randomized trial in Type 1 and Type 2 diabetic patients. *Diabet Med*. 2002;19(5):393-9.

Multiple Dose Insulin Regimens (3-shot Regimens)

- Ohkubo Y, Kishikawa H, Araki E, et al. Intensive insulin therapy prevents the progression of diabetic microvascular complications in Japanese patients with non-insulin-dependent diabetes mellitus: a randomized prospective 6-year study. Diabetes Res Clin Pract. 1995;28(2):103-17.

Intensive Insulin Therapy

- Ohkubo Y, Kishikawa H, Araki E, et al. Intensive insulin therapy prevents the progression of diabetic microvascular complications in Japanese patients with non-insulin-dependent diabetes mellitus: a randomized prospective 6-year study. *Diabetes Res Clin Pract*. 1995;28(2):103-17.
- Saudek CD, Duckworth WC, Giobbie-Hurder A, et al. Implantable insulin pump vs multiple-dose insulin for non-insulin-dependent diabetes mellitus: a randomized clinical trial. Department of Veterans Affairs Implantable Insulin Pump Study Group. *JAMA*. 1996;276(16):1322-7.
- Raskin P, Bode BW, Marks JB, et al. Continuous subcutaneous insulin infusion and multiple daily injection therapy are equally effective in type 2 diabetes: a randomized, parallel-group, 24-week study. *Diabetes Care*. 2003;26(9):2598-603.
- Bretzel RG, Arnolds S, Medding J, et al. A direct efficacy and safety comparison of insulin aspart, human soluble insulin, and human premix insulin (70/30) in patients with type 2 diabetes. *Diabetes Care*. 2004;27(5):1023-7.

IV Insulin Infusion Protocol for Critically-Ill Adult Patients in the ICU Setting

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TEXAS DIABETES COUNCIL
Revised 10/25/07

This algorithm is not intended to be used for those individuals with Type 1 diabetes, diabetic ketoacidosis or hyperglycemic hyperosmolar states.

TARGET RANGE FOR GLYCEMIC CONTROL: 80–140 mg/dL (Generally 110 mg/dL)

1. Standard drip 100 units/100 mL 0.9% NaCl.
   Approved IV insulins include Regular, aspart and glulisine
2. Start IV insulin therapy when glucose is above target range. Insulin infusions should be discontinued when
   a. Patient has no history of diabetes and is receiving <1 Unit/hour
   b. Patient receives 1st dose of SC basal + bridging dose of fast analog or R (see #10)
3. Bolus dose and Initial Infusion rate: Divide initial glucose level by 100, then round to nearest 0.5 units for bolus AND initial infusion rate

   Examples: 1) Initial glucose=326 mg/dL: 326÷100=3.26, round to 3.5: IV bolus 3.5 units + start infusion @ 3.5 units/hour

   2) Initial glucose=174 mg/dL: 174÷100=1.74, round to 1.5: IV bolus 1.5 units + start infusion @1.5 units/hour

4. Intravenous Fluids
   - Most patients will need 5–10 g glucose per hour D5W or D5W½NS at 100–200 mL/hour or equivalent (TPN, enteral feeding, etc.)
5. Adjusting the Infusion:
   - **Algorithm 1:** Start here for most patients.
   - **Algorithm 2:** For patients not controlled with Algorithm 1, or start here if s/p CABG, solid organ or islet cell transplant, receiving glucocorticoids etc. or patient with diabetes receiving >80 units/day of insulin as an outpatient.
   - **Algorithm 3:** For patients not controlled on Algorithm 2. NO PATIENT STARTS HERE without authorization from the endocrine service.
   - **Algorithm 4:** For patients not controlled on Algorithm 3. NO PATIENT STARTS HERE

Algorithm 1		Algorithm 2		Algorithm 3		Algorithm 4	
Glucose	units/h	Glucose	units/h	Glucose	units/h	Glucose	units/h
<60 = Hypoglycemia (See #8 for treatment)							
<70	Off	<70	Off	<70	Off	<70	Off
70–109	0.2	70–109	0.5	70–109	1	70–109	1.5
110–119	0.5	110–119	1	110–119	2	110–119	3
120–149	1	120–149	1.5	120–149	3	120–149	5
150–179	1.5	150–179	2	150–179	4	150–179	7
180–209	2	180–209	3	180–209	5	180–209	9
210–239	2	210–239	4	210–239	6	210–239	12
240–269	3	240–269	5	240–269	8	240–269	16
270–299	3	270–299	6	270–299	10	270–299	20
300–329	4	300–329	7	300–329	12	300–329	24
330–359	4	330–359	8	330–359	14	330–359	28
>360	6	>360	12	>360	16	>360	32

6. **Moving from Algorithm to Algorithm:**
   - **Moving Up**: When glucose remains outside the target range after titrating insulin
   - **Moving Down:** When glucose is <70 mg/dL x 2 or decreases >60 mg/dl in 1 hour
7. **Patient Monitoring:**
   - Hourly venous (lab) determinations until glucose <450 mg/dL; then capillary glucose (finger sticks) q 1hour until glucose is within goal x 4 hours; then every 2 hours x 4 hours; If stable, decrease monitoring to every 4 hours
   - Hourly monitoring indicated for critically ill patients even if the glucose is stable
   - In hypotensive patients (BP <80/60), capillary glucose values may be inaccurate. Obtain venous blood for glucose determinations
   - If any of the following occur, temporarily resume hourly glucose monitoring, until glucose is again stable (2–3 consecutive values within target range):

     Any change in insulin infusion rate

     Significant changes in clinical condition

     Starting or stopping pressor or steroid therapy

     Starting or stopping dialysis

     Starting, stopping or changing rates of TPN, PPN or tube feedings
8. **Treatment of Hypoglycemia (Glucose <60 mg/dL)**
   - Discontinue insulin drip AND
   - Give D50W IV Glucose 40–60 mg/dL 12.5 g (1/2 amp)
     Glucose <40 mg/dL 25.0 g (1 amp)
   - Recheck glucose every 15–30 minutes and repeat D50W IV as above. Restart insulin drip, one algorithm lower, when glucose >80 mg/dL x 2

9. **Notify the physician:**
   - For patients not responding to Algorithm 1 or 2.
   - For hypoglycemia which has not resolved after administration of D50W IV and discontinuation of the insulin drip

10. **Transition from IV insulin to SC insulin: "Basal-Analog" Method**

    a. Calculate Total Daily Dose (TDD) for subcutaneous insulin
    TDD = Infusion rate/h x 20h

    b. *First* dose SQ insulin includes [basal insulin + bridging dose aspart, glulisine, lispro or R] x 1

    1. If patient *will begin eating give*:
       - Half TDD as basal glargine, detemir* or NPH* Plus
       - Bridging insulin** @ 10% of basal insulin dose
       - Stop IV insulin
       - Continue primary I.V.

    2. If patient *will continue NPO, TPN or tube feeding give*:
       - All TDD as basal glargine, detemir* or NPH* Plus
       - Bridging insulin** @ 5% of basal insulin dose
       - Stop IV insulin and continue primary I.V.

    c. Proceed to "Inpatient Management of Insulin in the Non-Critical Care Setting" algorithm for management of daily basal insulin, prandial + supplemental insulin**

* No evidence-based data on inpatient transition from I.V. insulin to detemir. If detemir is selected, expect to use at least 25% greater dose than glargine. If the dose of detemir is <0.6 units/Kg, use half bid. If NPH is used as a basal insulin the dose is 2/3 of the TDD (whether or not the patient is eating) and is distributed bid as 2/3 A.M. and 1/3 H.S. or may be divided equally and given q 6h.

** R (regular insulin) is not preferred as a bridging or prandial insulin

REFERENCES:

1. Garber AJ, Moghissi ES, Bransome ED Jr., et al; American College of Endocrinology Task Force on Inpatient Diabetes Metabolic Control. American College of Endocrinology position statement on inpatient diabetes and metabolic control. Endocr Pract. 2004;10 (Suppl 2):4–9.
2. Bode BW, Braithwaite SS, Steed RD, et al. Intravenous insulin infusion therapy: indications, methods, and transition to subcutaneous insulin therapy. Endocr Pract. 2004;10 (Suppl 2):71–80.
3. Goldberg PA, Siegel MD, Sherwin RS, et al. Implementation of a safe and effective insulin infusion protocol in a medical intensive care unit. Diabetes Care. 2004;27(2):461–7.
4. Vora AC, Saleem TM, Polomano RC, et al. Improved perioperative glycemic control by continuous insulin infusion under supervision of an endocrinologist does not increase costs in patients with diabetes. Endocr Pract. 2004;10(2):112–8.
5. Chaudhuri A, Janicke D, Wilson MF, et al. Anti-inflammatory and profibrinolytic effect of insulin in acute ST-segment-elevation myocardial infarction. Circulation. 2004;109(7):849–54.
6. Trence DL, Kelly JL, Hirsch IB. The rationale and management of hyperglycemia for in-patients with cardiovascular disease: time for change. J Clin Endocrinol Metab. 2003;88(6):2430–7.
7. Lien L, Spratt S, Woods Z, et al. A new intravenous insulin nomogram in intensive care units improves management of persistent hyperglycemia (Abstract). Diabetes. 2003;52 (Suppl 1):A125.
8. Preiser JC, Devos P, Van den Berghe G. Tight control of glycaemia in critically ill patients. Curr Opin Clin Nutr Metab Care. 2002;5(5):533–7.
9. Markovitz LJ, Wiechmann RJ, Harris N, et al. Description and evaluation of a glycemic management protocol for patients with diabetes undergoing heart surgery. Endocr Pract. 2002;8(1):10–8.
10. Van den Berghe G, Wouters P, Weekers F, et al. Intensive insulin therapy in the critically ill patients. N Engl J Med. 2001;345(19):1359–67.
11. Hirsch IB. Insulin therapy for diabetes: is the future now? Clin Diabetes. 2001;19:146–7.
12. Furnary AP, Zerr KJ, Grunkemeier GL, et al. Continuous intravenous insulin infusion reduces the incidence of deep sternal wound infection in diabetic patients after cardiac surgical procedures. Ann Thorac Surg. 1999;67(2):352–60.
13. Malmberg K, Ryden L, Efendic S, et al. Randomized trial of insulin-glucose infusion followed by subcutaneous insulin treatment in diabetic patients with acute myocardial infarction (DIGAMI study): effects on mortality at 1 year. J Am Coll Cardiol. 1995;26(1):57–65.
14. Woo J, Lam CW, Kay R, et al. The influence of hyperglycemia and diabetes mellitus on immediate and 3-month morbidity and mortality after acute stroke. Arch Neurol. 1990; 47(11):1174–77.
15. Watts NB, Gebhart SS, Clark RV, et al. Postoperative management of diabetes mellitus: steady-state glucose control with bedside algorithm for insulin adjustment. Diabetes Care. 1987;10(6):772–8.
16. Pittas AG, Siegel RD, Lau J. Insulin therapy for critically ill hospitalized patients: a meta-analysis of randomized controlled trials. Arch Intern Med. 2004;164(18):2005-11.
17. Desantis AJ, Schmeltz LR, Schmidt K et.al. Inpatient management of hyperglycemia: The northwestern experience. Endocrine Practice. 2006;12(5):491-505.
18. Donaldson S, Villanuueva G, Rondinelli L, Baldwin D. Rush university guidelines and protocols for the management of hyperglycemia in hospitalized patients. Elimination of the sliding scale and improvement of glycemic control throughout the hospital. The Diabetes Educator. 2006;32(6):954-962.
19. Hirsch IB. An endocrinologist's view on the practical use of insulin. Insulin. 2006;1(Suppl A):S18-23.
20. Novo Nordisk detemir monograft, 2005. Studies 1337,1530, NNTTT, 1373.

ICU Insulin Orders – IV Insulin Infusion Protocol

TEXAS Department of State Health Services
Publication # E45-12614
TEXAS DIABETES COUNCIL
Revised 2/21/08

(Not intended for use in patients with type 1 diabetes, DKA or hyperglycemic hyperosmolar states)

1) **Start an IV Insulin Flow Sheet and keep record at bedside**

2) **Start IV:** _____ D5W at 100ml/h
_____ D5W½NS at _____ ml/h
_____ Other: _____

3) **Mix standard insulin drip**:
- 100 units Regular, aspart or glulisine insulin in 100 cc NS (1 unit insulin /cc) (Circle one)

4) **Give initial insulin bolus:**
- Bolus units of I.V. insulin = Glucose ÷ 100 (e.g. if glucose = 240 mg/dL, give 2.5 units)

5) **Start insulin infusion:**
- Initial infusion rate of insulin units/h = Glucose ÷ 100 (e.g. if glucose=240, begin 2.5 units/h)

6) **Target range for glucose:**
- Low Target (circle one) 70 100 or _____ mg/dL
- High Target (circle one) 110 120 140 or _____ mg/dL

7) **Monitor capillary (finger stick) glucose every hour:**
- Obtain ***lab*** glucose if finger stick BG is <40 or >400 mg/dL
- Change frequency of glucose monitoring to: _____

8) **Adjust insulin infusion rate each hour <u>after</u> initial insulin bolus and infusion**
- ❑ Start on Algorithm 1 (No patient begins on Algorithm 3 or 4 without endocrine service authorization)
- ❑ Start on Algorithm 2 (s/p CABG, transplant, glucocorticoids or >80 units/d insulin outpatient)
- Move up or down on the same algorithm each hour if glucose remains outside the target range
- Advance to the next algorithm (i.e. 1→2 etc.) if outside target range at highest infusion rate
- Treat for hypoglycemia is glucose <60 mg/dL (see # 9)
- Decrease 1 algorithm (i.e. 3→2 etc.) if glucose 60-69 mg/dL x 2 or decreases >60 mg/dL in 1 hour

Algorithm 1		Algorithm 2		Algorithm 3		Algorithm 4	
BG	units/h	BG	units/h	BG	units/h	BG	units/h
<60 = Hypoglycemia (See #9 for treatment)							
<70	Off	<70	Off	<70	Off	<70	Off
70–109	0.2	70–109	0.5	70–109	1	70–109	1.5
110–119	0.5	110–119	1	110–119	2	110–119	3
120–149	1	120–149	1.5	120–149	3	120–149	5
150–179	1.5	150–179	2	150–179	4	150–179	7
180–209	2	180–209	3	180–209	5	180–209	9
210–239	2	210–239	4	210–239	6	210–239	12
240–269	3	240–269	5	240–269	8	240–269	16
270–299	3	270–299	6	270–299	10	270–299	20
300–329	4	300–329	7	300–329	12	300–329	24
330–359	4	330–359	8	330–359	14	330–359	28
>360	6	>360	12	>360	16	>360	32

9) **Treat for hypoglycemia if glucose <60 mg/dL or _____ mg/dL.**

- Glucose 40-59 mg/dL: Give ½ ampule (12.5 grams glucose) D50W by slow IV push over 30 seconds.
- Glucose <40 mg/dL: Give 1 ampule D50W (25 grams glucose) by slow IV push over 30 seconds
- Decrease insulin drip rate by moving down 1 algorithm (i.e. from Algo 3 to Algo 2, etc.)
- Recheck glucose in 15 minutes and repeat D50W, as above, if necessary

10) **Call Endocrine Service if:**

- Other physicians make changes to subcutaneous or IV insulin regimen
- TPN, steroids or feedings are started, stopped or changed
- Other physicians turn off the insulin drip for any reason
- Patient does not respond to above pathways for glycemic control

11) **Transition from IV insulin to SC insulin:** *Proceed to the Insulin Transition Pathway*

Physician: _____ Time:_____ Date:_____

Orders for Adults with DKA and Hyperglycemic Hyperosmolar State (HHS)

TEXAS Department of State Health Services
TEXAS DIABETES COUNCIL
Approved 7/31/08

These orders may be initiated in the Emergency Department

DKA: Moderate ketonemia, arterial pH <7.3, serum glucose >250 mg/dL, serum bicarbonate <18 mEq/L
HHS: Serum glucose >600 mg/dL, minimal ketonemia or ketonuria, serum bicarbonate >15 mEq/L, pH ≥7.3

Admit	Date: Time: Location: Attending
Diagnosis	
Drug allergies or adverse reactions	❑ No known drug allergies ❑ List:
Monitor and Record	1. Vital signs & I&O every hour until stable, then every 2 hours x 24 hours ❑ Insert Foley if no urine output within first hour or within _____ hours 2. STAT fingerstick (capillary) blood glucose (Use venous or arterial draw if glucose >450 or <45 mg/dL or SBP <60 mmHg) ❑ Neuro checks every 2 hours (maintain seizure precautions) x 24 hours
Diet	❑ NPO ❑ Ice Chips ❑ Other:
Activity	❑ Bed rest ❑ Bathroom privileges with assistance ❑ Other:
Admission lab	❑ STAT Metabolic Profile (Glucose, BUN, Creatinine, Na, K, Cl, HCO_2, Ca) ❑ Serum ketones ❑ Serum PO_4, Mg ❑ Arterial blood gas ❑ CBC with diff. ❑ Blood cultures x 2 ❑ Urine C&S ❑ A1C ❑ TSH ❑ ß-hydroxybutyrate ❑ Serum osmolarity (measured) ❑ Record acidosis-ketosis gap (AKG = arterial pH – plasma ß-hydroxybutyrate. AKG >3 may indicate drug abuse[5]) ❑ Other:
Additional labs & studies	❑ K and HCO_3 every _____ hour(s). Call results to physician (hourly monitoring is recommended) ❑ Metabolic profile every 4 hours x 24 hours. ❑ Call results to physician _____ ❑ Ca, PO_4 , Mg every _____ hours x 24 hours. ❑ Call results to physician _____ ❑ Record anion gap AG = (Na) – (Cl + HCO3) ❑ EKG ❑ Chest X-ray ❑ Portable chest X-ray ❑ Culture and sensitivity of: _____ ❑ Other: _____
Initial IV fluids	Run IV at _____ ml per hour for _____ hours (Adjust for fluid volume already given in ER) ❑ Use 0.9% NaCl if corrected sodium is low (less than _____ mEq/L) ❑ 0.45% NaCl if corrected serum sodium is normal or elevated (Corrected sodium: Add 1.6 mEq to Na lab value for each 100 mg/dL glucose greater than 100 mg/dL) ❑ Other: _____
Mix standard insulin drip	**Discontinue all previous insulin orders** ❑ Mix 100 units Regular insulin in 100 mL NS ❑ Other: Mix units of insulin in mL NS
Give initial IV insulin bolus	❑ Bolus _____ units Regular insulin IV (recommend 10-15 units Regular insulin IV) ❑ Other: Bolus units of insulin in mL NS
Start insulin infusion	Start insulin infusion at _____ units per hour Recommend infusion rate is calculated as: Glucose mg/dL ÷ 100 (Ex: Glucose=350 → Start 3.5 units/h)

Target range for glucose

Rate of glucose reduction not to exceed 100 mg/dL per hour

DKA: ❑ 100 to 130 mg/dL ❑ Other _____

HHS: ❑ Low target: ❑ High target:

Monitor glucose every hour

Obtain *lab* glucose if fingerstick blood glucose is >450 or <45 mg/dL or SBP <60 mmHg

❑ Change frequency of glucose monitoring to:

Adjust insulin infusion rate

Note: No patient begins on Algorithm 3 or 4 without endocrine service authorization

❑ Start on Algorithm 1

❑ Start on Algorithm 2 (Consider if s/p CABG, transplant, glucocorticoid therapy, >80 U/d insulin)

- Move up or down on the same algorithm each hour if glucose remains outside target range
- Advance one algorithm column (i.e. 1→2, etc.) if glucose is outside the target range at highest infusion rate
- Treat for hypoglycemia if glucose is <60 mg/dL
- Decrease one algorithm column (i.e. 2→1, etc.) if glucose is 60-69 mg/dL x 2 or decreases >60 mg/dL in 1 hour

Algorithm 1		Algorithm 2		Algorithm 3		Algorithm 4	
BG	units/h	BG	units/h	BG	units/h	BG	units/h
<60 = Hypoglycemia							
<70	Off	<70	Off	<70	Off	<70	Off
70–109	0.2	70–109	0.5	70–109	1	70–109	1.5
110–119	0.5	110–119	1	110–119	2	110–119	3
120–149	1	120–149	1.5	120–149	3	120–149	5
150–179	1.5	150–179	2	150–179	4	150–179	7
180–209	2	180–209	3	180–209	5	180–209	9
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240–269	3	240–269	5	240–269	8	240–269	16
270–299	3	270–299	6	270–299	10	270–299	20
300–329	4	300–329	7	300–329	12	300–329	24
330–359	4	330–359	8	330–359	14	330–359	28
>360	6	>360	12	>360	16	>360	32

Treat hypoglycemia

1. • Glucose <40 mg/dL: Give 1 ampule D50W (25 grams) by slow IV push over 30 seconds
   • Decrease insulin infusion by moving down 1 algorithm (i.e. 2→1, etc.)
   • Recheck glucose in 15 minutes; repeat D50W, as above, if necessary

2. • Glucose 40-59 mg/dL: Give ½ ampule D50W by slow IV push over 30 seconds
   • Recheck glucose in 15 minutes; repeat D50W, as above, if necessary

Maintenance IV fluids

When blood glucose is:

❑ **DKA:** 200 mg/dL, change IV to D5 ½ NS and run at _____ mL/hour

❑ **HHS:** 250 mg/dL, change IV to D5 ½ NS and run at _____ mL/hour

❑ Other: _____

For patients at risk of volume overload, consider $D_{10}W$ or $D_{50}W$ (Infuse D_{50} via central line using infusion pump)

Note: HHS: Maintain blood glucose at 250-300 mg/dL until plasma osmolarity is ≤315 mOsm/Kg

Potassium replacement

Call physician if K is <3 or >6 mEq/L (Note: Urine output should be >30 mL/hour before starting K^+ replacement)

Add KCl to IV fluids:

- If K is <3.3 mEq/L, add 30 mEq KCl/L of IV fluid
- If K is 3.3- 5.2 mEq/L add 20 mEq KCl/L IV fluid to maintain K between 4-5 mEq/L
- If K^+ is >5.2 mEq/L, hold KCl
- Consider KPO_4 instead of KCl if serum PO_4 is low

❑ Other: _____

Phosphorus replacement	Consider if evidence of alcohol abuse, malnutrition, etc. ❑ Give 10 mEq/L KPO_4 in one liter of IV fluid x 1 ❑ Other: _____
Sodium bicarbonate (DKA)	❑ Give sodium bicarbonate If pH <6.9 dilute 100 mmol $NaHCO_3$ in 400 mL H_2O containing 20 mEq KCl ❑ Infuse over 2 hours ❑ Other _____ ❑ IV Push _____ ampule of $NaHCO_3$ ❑ Recheck arterial pH (ABG) within _____ minutes and call results to the attending
Alert parameters for notifying physician	• Two consecutively treatments for hypoglycemia • K less than _____ mEq/L • Withholding IV insulin infusion for >1 hour with no other source of insulin • TPN stopped, interrupted or any change in formulation • Deterioration in mental status • Patient does not respond to above orders for glycemic control ❑ Other _____ ❑ Other _____
Transition to SQ insulin	❑ Proceed to Texas Diabetes Council Transition Algorithm From I.V. to S.Q. Insulin ❑ Other:
Other orders	1. _____ 2. _____ 3. _____ 4. _____

References:

1. American Diabetes Association. Standards of medical care in diabetes-2008. Diabetes Care. 2008;31(Suppl 1): S12-S54.
2. Kitabchi AE, Umpierrez GE, Murphy MB, et al. Hyperglycemic crises in adult patients with diabetes. A consensus statement from the American Diabetes Association. Diabetes Care. 2006;29(12):2739-2748.
3. American Diabetes Association. Hyperglycemic crises in patients with diabetes mellitus (Position Statement). Diabetes Care. 2004;27 (Suppl 1):S94-S102.
4. Clement S, Braithwaite S, Magee M, et al. Management of diabetes and hyperglycemia in hospitals (technical review). Diabetes Care. 2004;27:533-591.
5. Lee P, Greenfield JR, Campbell LV. "Mind the gap" when managing ketoacidosis in type 1 diabetes. Diabetes Care. 2008;31(7):e58.

Physician Signature _____ Date _____ Time _____

Transition Algorithm from I.V. to S.Q. Insulin for Patients with Diabetes or Hyperglycemia

TEXAS Department of State Health Services
TEXAS DIABETES COUNCIL
Approved 7/31/08

GOALS: NPO or PO

FPG 100-130 mg/dL
2h pp <180 mg/dL
AC <140 mg/dL
Avoid hypoglycemia

GOALS: TPN or Enteral

<180 mg/dL
Avoid hypoglycemia

Transition From I.V. to S.Q. Insulin[1-4]

1. **Patient's Total Daily Dose** (TDD) = Sum of the previous 4 hours x 5
   (This will provide ~80% of the current insulin infusion)
   Note: *If patient was nondiabetic and using <1 unit per hour, insulin can be discontinued*
2. **Give one-time injection** of Basal Insulin[5-7] + Bridging Dose[8] of aspart, lispro or glulisine
   Basal dose = TDD
   Bridge dose = 10% of TDD
3. **Stop IV insulin infusion**
4. **Start patient on pathway** 1, 2, 3 or 4[1-3] depending on route or number of meals per day

1 Patient will not start eating

Prandial[8] Insulin = None
Basal[5] Insulin = TDD q AM

2 Patient eats <3 meals/day

Each prandial dose = 10% TDD
Basal Insulin: 90%TDD if 1 meal
Basal Insulin: 80%TDD if 2 meals

3 Patient will eat 3x per/day

Prandial Insulin = ½TDD÷ t.i.d. AC
Basal Insulin = ½TDD q AM

4 TPN or Enteral Nutrition

TPN: Use R insulin; Dose = 80% TDD
May add part or all to TPN bag
Tube feeding:
Continuous rate
Basal insulin =TDD
Intermittent feedings
Basal[5] insulin =½ TDD
Prandial[8] insulin =½ TDD÷ t.i.d. AC

Changing Basal[5] Insulin
Adjust Each Morning

FPG	Insulin Change
<60 mg/dL	- 4 units
60-80	- 2
81-99	- 1
100-130	No Change
131-140	+ 2
141-160	+ 4
161-180	+ 6
>180	+ 8

Changing Prandial[8] Insulin

- Add/subtract to prandial dose if glucose is ↑/↓ before meal
- Use alone to correct any random high glucose

FPG	TDD <40 units/d	TDD ~40-80 units/d	TDD >80 units/d
<60	– 2 unit	– 3 unit	– 4 unit
60-99	– 1	– 2	– 2
100-139		No Change	
140-199	+ 1	+ 1	+ 2
200-249	+ 2	+ 3	+ 4
250-299	+ 3	+ 5	+ 7
300-349	+ 4	+ 7	+10
>349	+ 5	+ 8	+12

Changing Prandial or Basal Insulin

Any glucose <80 ↓ insulin 20%
All glucose 80-179 No Change
Any glucose ≥180 ↑ insulin 10%

Correcting Hyperglycemia

- Use prandial insulin q4-6 h
- Dose: see "Changing Prandial Insulin"

Reevaluate Total Daily Dose of Insulin

1. Recalculate the TDD every 1-2 days as the doses of insulin are adjusted.
2. The ratio of basal to prandial insulin should be approximately 50:50

Footnotes:

1 www.diabetes.org/for-health-professionals-and-scientists/insulin-administration.jsp,

2 Donaldson S, et al. Diabetes Educator. 2006;32:954

3 Hirsch IB. Insulin. 2006;1(Suppl A):S18-24

4 DeSantis AL, et al. Endocrine Practice. 2006;12:491-505

5 Basal insulin = glargine or detemir

6 If patient is transferred out of the unit in the later evening and will begin eating in the A.M. give half the basal dose and all of the bridging dose. Begin full basal dose the next morning.

7 If NPH is used, then give 2/3 of the TDD and distribute as 2/3 in the morning and 1/3 at bedtime.

8 Aspart, lispro or glulisine is recommended because the action profiles better approximate normal physiology. Regular insulin may be substituted.

Transition from I.V. to S.Q. Insulin Order Set Eating Status NPO or PO

TEXAS Department of State Health Services
TEXAS DIABETES COUNCIL
Approved 10/27/11

GOALS:

Fasting	100-140 mg/dL
2 hr postprandial	140-180
Before Meals	<140-180

INSULIN:

IV insulin	regular
Basal insulin	glargine, detemir (or NPH BID)
Prandial	aspart, glulisine, lispro, regular
Supplemental	aspart, glulisine, lispro, regular

1. Total Daily Dose (TDD) of S.Q. insulin equals I.V. units insulin used over the last 4 hours x 5
   TDD = (_____units used **over the last 4 hours**) X (5) = _____units insulin

   NOTE: If patient was using less than 1 unit insulin per hour, D/C basal insulin & use only supplemental insulin if T2 DM

2. Start S.Q. basal insulin 2 hours prior to discontinuing insulin drip
   1st basal dose insulin = TDD = _____units basal insulin

3. Daily insulin regimen (Start Basal-Bolus insulin regimen depending on route or number of meals per day)

	TDD	Prandial Insulin Dose **Do not give prandial insulin dose if patient missing meal**	Supplemental Dose (CBG = capillary blood glucose) (see #**5**, below)
NPO	100% TDD = _____units basal insulin every 24 hours	None	Every 6 hours for CBG >140 mg/dL
1 meal per day	80% TDD = _____units basal insulin every 24 hours	10% TDD = _____units insulin before meal	Before meal and every 6 hours for CBG >140 mg/dL
2 meals per day	70% TDD = _____units basal insulin every 24 hours	15% TDD = _____units insulin before each meal	Before meals, and bedtime for CBG >140 mg/dL
3 meals per day	50% TDD = _____units basal insulin every 24 hours	50% TDD ÷ 3 = _____units before each meal	Before meals, and bedtime for CBG >140 mg/dL

4. Monitor capillary blood glucose ❑ before meals and bedtime ❑ 2 a.m. ❑ every 4 hours ❑ every 6 hours

5. Correction dose for preprandial or random hyperglycemia

Glucose mg/dL	High Insulin Sensitivity <40 units/day	Average Insulin Sensitivity 40-80 units/day	Low Insulin Sensitivity >80 units/day
	Units Insulin to Administer		
141-200	1	1	2
201-250	2	3	4
251-300	3	5	7
301-350	4	7	10
>350	5 & call _____	8 & call _____	12 & call _____

6. Titrate basal insulin each morning based on fasting glucose: Increase 2 units if glucose >140 mg/dL
   Decrease 2 units if glucose <80 mg/dL

7. Titrate prandial insulin. Use same schedule as in #5, above

8. Recalculate new TDD every 1-2 days based on changes in basal and prandial insulin requirements

9. Remember, the ratio of basal to prandial insulin should be approximately 1:1

Transition from I.V. to S.Q. Insulin Order Set TPN or Enteral (Tube) Nutrition

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TEXAS DIABETES COUNCIL
Approved 10/27/11

GOAL:
80-180 mg/dL

INSULIN:

IV insulin	regular
Basal insulin	glargine, detemir (or NPH BID)
Prandial	aspart, glulisine, lispro, regular
Supplemental	aspart, glulisine, lispro, regular

1. Total Daily Dose (TDD) of S.Q. insulin equals units insulin used over the last 4 hours x 5
   TDD = (_____units used **over the last** 4 hours) X (5) = _____units insulin

   NOTE: If patient was using less than 1 unit insulin per hour, D/C basal insulin & use only supplemental insulin if T2DM

2. Start S.Q. basal insulin 2 hours prior to discontinuing insulin drip
   1st basal dose insulin = TDD = _____units basal insulin

3. Daily insulin regimen

	TDD	Prandial Insulin Dose **Do not give prandial insulin dose if patient missing meal**	Supplemental Dose (CBG = capillary blood glucose) (see #**5**, below)
TPN	100% TDD = _____units basal insulin every 24 hours	None	Every 4 hours as needed for CBG >140 mg/dL
Tube (continuous)	100% TDD = _____units basal insulin every 24 hours	None	Every 4 hours as needed for CBG >140 mg/dL
Tube (bolus)	50% TDD = _____units basal insulin every 24 hours	50% TDD ÷ # bolus feeds = _____units insulin before each bolus	Before each bolus as needed for CBG >140 mg/dL

4. Monitor capillary blood glucose ❑ before meals and bedtime ❑ 2 a.m. ❑ every 4 hours ❑ every 6 hours

5. Correction dose for preprandial or random hyperglycemia

Glucose mg/dL	High Insulin Sensitivity <40 units/day	Average Insulin Sensitivity 40-80 units/day	Low Insulin Sensitivity >80 units/day
	Units Insulin to Administer		
141-200	1	1	2
201-250	2	3	4
251-300	3	5	7
301-350	4	7	10
>350	5 & call _____	8 & call _____	12 & call _____

6. Titrate basal and prandial insulin:

Any glucose	<80 mg/dL →	Decrease insulin 20%
All glucose	80-180 mg/dL →	No Change
Any glucose	>180 mg/dL →	Increase insulin 10%

Insulin Pump Therapy

TEXAS Department of State Health Services
TEXAS DIABETES COUNCIL

Introduction

The goal of insulin delivery is to regulate blood glucose levels to achieve normoglycemia. In someone without diabetes, pancreatic B-cells continuously secrete insulin throughout the day and night, providing a continuous insulin infusion or basal amount. In response to meals, the pancreas provides "bursts" of insulin referred to as boluses.

Pump therapy is intended to more closely mimic this pancreatic function. Continuous subcutaneous insulin infusion (CSII) utilizes only fast acting insulins (Humalog, Novolog) and eliminates the use of long-acting insulins (NPH, Ultralente, Lantus). Pumps can deliver insulin in 0.1 unit increments as a basal/continuous flow between meals and through the night. Basal rates can be increased or decreased at any point, allowing for exercise, illness, skipped meals, sensitivity to insulin and the dawn phenomenon. Boluses of insulin can be delivered via the pump to provide insulin to compensate for carbohydrate intake and hyperglycemic episodes when needed.

Insulin pump therapy gives people with diabetes the freedom to enjoy life, despite their chronic condition. The value of an improved lifestyle, increased flexibility and optimal diabetes control is obvious from the impact the insulin pump has made in the twenty-five years since its inception.

The ability to control how and when insulin is delivered provides the "pumper" with increased flexibility in scheduling their day-to-day activities. For those people with erratic lifestyles, a desire to achieve optimal glycemic control (A1c ≤ 6.5%) and prevent chronic complications, the pump is an ideal choice.

INDICATIONS FOR PUMP THERAPY

Clinical Indications

1. Inadequate glycemic control with MDI (Multiple Daily Injections) therapy
2. Recurrent severe hypoglycemia
3. Recurrent hyperglycemia
4. Hypoglycemia unawareness
5. Dawn phenomenon
6. Preconception
7. Pregnancy
8. Gastroparesis
9. Early neuropathy or nephropathy, when improvement in glucose control can reduce acceleration of complications
10. Renal transplantation

11. Frequent DKA
12. Uncontrolled diabetes
13. Erratic Blood Glucose
14. Prevent or delay complications
15. Desire to improve lifestyle flexibility
16. A1c greater than 6.5%

Lifestyle indications

1. Erratic schedule
2. Varied work shifts
3. Desire for improved flexibility
4. Inconvenience of multiple daily injections

Advantages of Pump Therapy

1. More flexible lifestyle
2. Improved overall control
3. Prevent chronic complications
4. Improved control during exercise and "growth spurts"
5. Tight control during pregnancy

Characteristics of Pump Candidates

Ready, willing, and able

1. Is motivated — pump therapy requires a strong desire to improve one's health and is a time investment for weeks or months in advance and during the initiation of pump therapy.
2. Has realistic expectations — a potential pump candidate must understand that the pump will not "fix" blood glucose variations automatically, nor will it grant freedom from frequent SMBG (self monitoring of blood glucose).
3. Demonstrates independent diabetes management — a thorough knowledge of diabetes and its management and the ability to demonstrate appropriate self-care behaviors provide the foundation for advanced self-management skills required by pump users.
4. Is practicing counting carbohydrates — has a willingness to practice the Carbohydrate (CHO or carb) Counting method, and an understanding of insulin actions and pre-meal bolus dosing calculations.

5. Has manual dexterity — able to use buttons on the pump and has good visual acuity to see the screen.
6. Has a good support system — emotional support is crucial to the success of pump therapy.
7. Demonstrates emotional stability — a potential pumper must attend education sessions and attend to tasks that require routine attention. The patient must keep physician appointments.

Poor Candidates for Pump Therapy

1. Patients who are unwilling to comply with follow-up appointments.
2. Patients who are unwilling to receive diabetes education.
3. Patients who are unwilling to perform SMBG 8 times a day initially and then, 4-6 times a day after CSII therapy is established.
4. Patients who are unable or unwilling to count carbohydrates.

DETERMINING TOTAL DAILY DOSE AND BASAL RATE

Method #1:

Pre-pump Total Daily Dose (TDD)

Reduce pre-pump Total Daily Dose by 25%

Divide "pump" TDD in half: 50% for basal; 50% for bolus

Method #2:

Using Patients Weight Factor: Weight (lbs) X 0.1 = basal rate per hour

Start with 1 basal rate per 24 hours.

Based on blood glucose results during the times listed below, it may be necessary to implement additional basal rates based on patient's blood glucose (BG)

12:00 midnight – 3:00 a.m.

3:00 a.m. – 7:00 a.m.

7:00 a.m. – 12:00 noon

12:00 noon – 6:00 p.m.

6:00 p.m. – 12:00 midnight

Time Frame For Beginning Pump Therapy

1. 1–2 months before pump start:

- Assess whether or not patient meets the criteria for a "pumper."

- MD writes orders for insulin pump therapy. Contacts the insurance company for pre-authorization of coverage.
- Patient is seen by a CDE/dietitian for carbohydrate counting instruction.
- Patient is seen by the pump trainer for knowledge assessment and education as needed — to include: hypoglycemia, hyperglycemia and sick day management, prevention of DKA, patient's responsibilities, and general knowledge regarding diabetes.

2. 1-2 weeks before pump start:

- Patient watches video/DVD on use of the pump several times to familiarize him/herself with the pump.
- May attend "pump school" via the Internet if available.
- Meets with pump trainer for basal rates, boluses, insulin to carbohydrate ratio, and insulin correction factor if not already done.

3. Day before pump start:

- Discontinue use of long-acting insulin (NPH, Lantus, Ultralente).
- Continue injecting Novolog or Humalog before meals.
- Use "correction formula" to cover for "highs."

4. Day of pump start:

- Eat breakfast and inject Humalog or Novolog as usual.
- Wear comfortable, loose-fitting clothing — preferably 2-piece outfit.
- Allow 3 hours for training.
- Bring supplies with you to include:

  Pump, User's Manual, Infusion Sets — at least 2, Cartridges — at least 2, Skin Prep, Glucose Meter / Lancets / Strips, Alcohol Wipes, Insulin (Novolog or Humalog), Batteries, Carbohydrate Snack.

5. First Day of Pump Therapy:

- Begin "Four-Day Plan."
- Call pump trainer with glucose levels and carbohydrate intake.

6. When "Four-Day Plan" completed:

- Come into office for first follow-up. Patients MUST bring: documentation of glucose readings, boluses (for elevated glucoses or meals), diary of carbohydrate Intake.
- Begin "Three-Day Plan."

7. Within 1–2 days after completing "Three-Day Plan"

- Call pump trainer with readings.
- Adjust basals/boluses as needed.

8. Weekly for four weeks:

- Call pump trainer and report complete record.
- Adjust basals, insulin to carbohydrate ratios as needed.
- Instruct on added features of the pump, i.e., Dual and Square Wave Boluses, utilizing temporary basal rate, Easy Bolus, Audio Bolus.
- Adjust basal rates first, based on fasting glucoses. When fasting glucoses are at goal, adjust boluses and/or insulin to carbohydrate ratios to achieve pre- and post-meal glucose goals.

TESTING BASAL RATES: FOUR DAY PLAN

First Day

1. Eat supper by 7 p.m.
2. **Skip a bedtime snack.**
3. Test blood sugar every 2 hours between supper and bedtime; at 12:00 Midnight, and at 3:00 a.m.
4. Record your results!

Second Day

1. Eat breakfast.
2. **Skip lunch.**
3. Test blood sugar every 2 hours between breakfast and supper.
4. Record your results!

Third Day

1. **Skip breakfast.**
2. Test blood sugar every 2 hours between waking up until lunch.
3. **DO NOT SLEEP IN!**
4. Record your results!

Fourth Day

1. Skip supper.
2. Test blood sugar every 2 hours between lunch and your bedtime snack at 10:00 p.m.
3. Record your results!

NOTE: Do not "fix" a high blood sugar during the time you are checking every 2 hours. Correct at your next scheduled meal using your correction factor.

If you miss a day, continue the plan the next day. But try not to miss a day — the sooner the plan is completed, the sooner your basal rates will be set.

PRE-PUMP EDUCATION CHECKLIST

Patient Name _____ Date _____

Certified Pump Trainer _____

MD's Name _____

Pump Model _____ Serial # _____

UNDERSTANDING PUMP THERAPY	NUTRITION
☐ Theory ☐ Insulin Type ☐ Basal Rate ☐ Meal Bolus ☐ Insulin Sensitivity/ Correction Factor	☐ Carb. Counting ☐ Using Food Labels ☐ Insulin to Carb. Ratio ☐ Proper Snacks
BLOOD GLUCOSE TESTING	**EXERCISE**
☐ Schedule ☐ Alc	☐ Safety ☐ Hypoglycemia ☐ Proper Snacks ☐ BG Checks
HYPOGLYCEMIA	**PUMP THERAPY RESOURCES**
☐ Protocol/"Rule of Fifteen ☐ Glucagon	☐ User's Guide ☐ Pump School Online ☐ Websites
HYPERGLYCEMIA	**WHEN TO CALL YOUR DOCTOR**
☐ Protocol ☐ Ketone Testing	
DKA	**WHEN TO CALL 24 HOUR HELP LINE**
☐ Causes ☐ Signs and Symptoms ☐ Prevention	
SICK DAY MANAGEMENT	
☐ Protocol ☐ Supplies	

Notes:

DETERMINING BOLUSES

Calculating Insulin Sensitivity Factor (ISF)

Also may be referred to as the Insulin Correction Factor (ICF)

The Insulin Sensitivity Factor (ISF) is the amount of blood glucose reduced by 1 unit of rapid or short acting insulin over a 2–4 hour period. Two commonly accepted formulas are used to determine the ISF: the 1800 Rule and the 1500 Rule. Endocrinologist Paul C. Davidson, MD developed the 1500 Rule. With the introduction of rapid-acting insulin, John Walsh, PA CDE modified the 1500 Rule into the 1800 Rule. Generally, the 1800 Rule is used for patients who are insulin sensitive or those who use rapid-acting insulin and the 1500 Rule for patients who are insulin resistant or those who use short-acting insulin. The Rules calculate the ISF by dividing either 1800 or 1500 by the TDD.

Amount of Blood Glucose lowered by 1 unit of insulin (1800 Rule)

$$\frac{1800}{\text{TDD}} = \text{ISF}$$

Note: 1800 currently used with Humalog or Novolog instead of 1500 (1500 Rule)

Calculating Insulin to Carb Ratio (ICR)

This method of determining the Insulin:Carbohydrate ratio is based on Total Daily Insulin Dose (TDD). The TDD is divided into 500 and the result is the amount of carbohydrate that one unit of rapid- or short-acting insulin will cover. The goal is to bring blood glucose levels into the target range 3–4 hours after the meal.

Grams of carbs covered by 1 unit of insulin (500 Rule)

$$\frac{500}{\text{TDD}} = \text{ICR}$$

TYPES OF BOLUSES

Normal Bolus—total bolus infused at onset of meal

Square Wave—total bolus infused slowly over several hours; useful in cases of gastroparesis

Dual Wave—part of bolus is infused at onset of meal, and remainder is infused slowly over several hours; useful for high fat meal, i.e., pizza, Mexican food.

Adjusting/Fine Tuning Dosage

Empower patients to evaluate and adjust their BG. Resume intensive monitoring if necessary, i.e., 8 times a day. Start with overnight basals; promote low-fat, consistent carb content meals. Introduce high fat meals after ICR has been established or corrected. When high fat meals are consumed, consider utilizing **Dual Wave** bolus. Two-hour postprandial glucose goals should be 30 +/- points above preprandial BG. Patient may require a different ICR for each meal. BG targets should be determined by the provider and the patient and depending on age of the patient, concomitant

conditions and the patients' ability and willingness to achieve tight control of their diabetes.

POSSIBLE COMPLICATIONS OF PUMP THERAPY

Hypoglycemia — fewer episodes than with MDI. Possible improvement in hypoglycemic unawareness.

Diabetic Ketoacidosis — interruption in Humalog/Novolog delivery can lead to high BG and DKA in 4 +/- hours. Patient must check BG 4–6 times a day.

Skin Infections — meticulous skin care is necessary at infusion sites, which must be rotated every 2–3 days.

Weight Gain — could be a result of improved control or if patient liberalizes diet.

Initiation of CSII should be done by a Certified Pump Trainer (CPT) who is usually provided by the insulin pump manufacturer, or a Certified Diabetes Educator (CDE), who has received specialized training in insulin pump therapy. The various features of the pump should be demonstrated/explained to the patient who should be provided with phone numbers of the insulin pump company and the provider. The patient should be encouraged to keep detailed records of BG, insulin dosage, carb intake, and other daily activities.

Table for Estimated Basal Rate and Insulin to Carbohydrate Ratio

WEIGHT IN POUNDS	BASAL INSULIN	CARBOHYDRATE RATIO
100	0.3 to 0.5	1 unit / 16 gms
110	0.3 to 0.5	1 unit / 15 gms
120	0.4 to 0.6	1 unit / 15 gms
130	0.4 to 0.6	1 unit / 14 gms
140	0.5 to 0.7	1 unit / 13 gms
150	0.5 to 0.7	1 unit / 12 gms
160	0.6 to 0.8	1 unit / 12 gms
170	0.6 to 0.8	1 unit / 11 gms
180	0.7 to 0.9	1 unit / 10 gms
190	0.8 to 1.0	1 unit / 9 gms
200	0.9 to 1.1	1 unit / 8 gms

Estimated Correction Factor

CURRENT TDD	CORRECTION FACTOR
10 units	150 points
20 units	75 points
25 units	60 points
30 units	50 points
40 units	38 points
50 units	30 points
60 units	25 points
75 units	20 points
100 units	15 points
150 units	10 points

Carbohydrate Counting

Carbohydrate counting is a meal planning approach that works well with insulin pump therapy. It is a great way to add variety and flexibility in choices of meals and snacks. Carbohydrate counting has been proven to help achieve better glucose control.

Generally carbohydrate is the main food group that increases blood sugar. Protein has a sustaining effect and fat slows absorption.

It is essential that the patient understands and practices the techniques of carbohydrate counting prior to pump initiation.

Many references such as the materials included in Chapter 5 of Diabetes Life Skills Book or the "Daily Meal Planning Guide" by Eli Lilly are used by the CDE or Registered Dietitian to teach Carbohydrate Counting.

Tools needed to count carbs:

1. Measuring cups
2. Food labels
3. Calculator
4. Carb counting book/guide

Carbohydrate containing foods include breads, pasta, rice, other grains, starchy vegetables (potatoes, corn, peas), crackers, cereals, fruit (fresh, canned, frozen, or juice), milk, yogurt & ice cream, cooked dried beans, cake, cookies, pie, sugar/honey.

One serving is considered 15 grams of carbohydrate and is contained in:

1/3 cup cooked rice, beans, or pasta

1/2 cup starchy vegetables like corn, peas, potato, or cooked cereal

1 slice bread or 1 tortilla

1 small piece of fruit, ½ small banana, or ½ cup light canned fruit

1 cup milk

Using measuring cups and reading labels are highly recommended as the patient practices at home.

THE RULE OF 500

This method of determining the Insulin:Carbohydrate ratio is based on Total Daily Insulin Dose (TDD). The TDD is divided into 500 and the result is the amount of carbohydrate that one unit of rapid- or short-acting insulin will cover. The goal is to bring blood glucose levels into the target range 3–4 hours after the meal.

Example:

TDD is 36 units
Glucose levels are within target range
500/36 = 13.8 (round up to 14 or 15)
Insulin to carbohydrate ratio is 1:15
1 unit of insulin covers 15 gm carbohydrate

Some CDEs find that dividing 450 (rather than 500) by the TDD is more accurate for short-acting insulin and/or for people who are more insulin resistant.

Insulin Sensitivity

The Insulin Sensitivity Factor (ISF) is the amount of blood glucose reduced by 1 unit of rapid or short acting insulin over a 2–4 hour period. Two commonly accepted formulas are used to determine the ISF: the 1800 Rule and the 1500 Rule. Endocrinologist Paul C. Davidson, MD developed the 1500 Rule. With the introduction of rapid-acting insulin, John Walsh, PA CDE modified the 1500 Rule into the 1800 Rule. Generally, the 1800 Rule is used for patients who are insulin sensitive or those who use rapid-acting insulin and the 1500 Rule for patients who are insulin resistant or those who use short-acting insulin. The Rules calculate the ISF by dividing either 1800 or 1500 by the TDD.

Example:

TDD is 34 units
1800/34 = 52.9
ISF is 52.9. One unit of rapid-acting insulin decreases glucose by 52.9 mg/dL
This can be rounded to 55

Another method of calculating the ISF is to use the general "safe" starting point of 1 unit: 50 mg/dL. This method may work well with most lean to average adults.

An alternative method for Insulin:Carb ratio can be figured once the person's ISF is calculated, multiplying it by 0.33 provides an insulin-to-carbohydrate ratio.

Example:

ISF is 55 mg/dL
55 x 0.33 = 18.15 (round to 18)
Insulin to carb ratio is 1:18
1 unit of insulin covers 18 g of carbohydrate

Verifying Insulin:Carb Ratio and Insulin Sensitivity

Prior to eating, the bolus insulin dose is partially based on the insulin to carbohydrate ratio. This ratio tells how many grams of carbohydrate are affected by one unit of insulin. The ratios can be verified with one of the methods described below:

Method 1: Food diary, insulin dose, and SMBG information

The pump user is to keep 3 days of records, including:

1. Fasting, pre-meal, and 2-hour PPG results
2. Pre-meal insulin doses
3. Amount of carbohydrate consumed at meals and other times. It is helpful if the patient consumes the same amount of carbohydrate at each breakfast for 3 days, same amount of carbohydrate at each lunch for 3 days, etc.
4. Amount of all food and beverage consumed, as fat and protein moderately affect blood sugar.

With these records, determine the amount of insulin the patient used to cover the carbohydrate consumed at each meal by dividing the total grams of carbohydrate by the number of units of insulin.

Example:

Consumed 60 g carbohydrate
Injected (bolused) 5 u rapid-acting insulin
PPG is within 30 mg increase of pre-meal blood glucose
60/5 = 12
Insulin to carbohydrate ratio = 1:12
1 unit of insulin covers 12 g carbohydrate

CARBOHYDRATE COUNTING FOOD LOG

Write down all food or drink you consume for at least 3 days. Be sure to include portion sizes and the time you eat or drink. Estimate the amount of carbohydrates in each meal and snack; then record the amount of insulin you took. Bring this log with you on appointments to the pump trainer or the dietitian.

DATE/TIME	BLOOD SUGAR (2 HRS PP)	FOOD	GRAMS OF CARBS	INSULIN

DATE/TIME	BLOOD SUGAR (2 HRS PP)	FOOD	GRAMS OF CARBS	INSULIN

DATE/TIME	BLOOD SUGAR (2 HRS PP)	FOOD	GRAMS OF CARBS	INSULIN

Calculating Total Grams of Carbohydrate in a Recipe

To determine the amount of carbohydrates in a recipe:

1. Make a table as noted below
2. List ALL the ingredients in the recipe
3. Using food labels or a nutrient composition book, list the total grams of carbohydrate in each ingredient (amount of fat and sodium can also be calculated)
4. Total the grams of carbohydrate from all ingredients
5. Divide the total grams of carbohydrate by the number of servings in the recipe
6. Note the total grams of carbohydrate PER SERVING on the recipe for future reference

Recipe Name: _____

Ingredient	Amount	Grams of Carbohydrate	Grams of Fat

Example:

Corn Pudding (Makes 8 Servings)

Ingredient	Amount	Grams of Carbohydrate	Grams of Fat
Cornstarch	2 Tablespoons	14	0
Egg Substitute	½ cup	2	0
Sugar	½ cup	100	0
Creamed Corn	16 oz. can	60	0
Evaporated Skim Milk	16 oz. can	60	0
TOTAL		**236**	**0**
Divide total carbohydrate by number of servings (236/8)		45	

This recipe has 29.5 grams of carbohydrate and zero (0) grams of fat per serving.

IDENTIFYING AND MANAGING HYPERGLYCEMIA

Sick Day Management (Refer to "Sick Day Guidelines" in TDC Tool Kit)

During periods of illness, it may be more difficult to maintain good control of blood glucose. Examples of illness or "sick days" include: dental surgery, colds, sore throat, mild infections, nausea, vomiting, diarrhea, or fever. It is important to monitor blood glucose more frequently during a sick day and to take immediate action to prevent ketoacidosis.

Guidelines to follow:

Medication

Never omit insulin. Even if unable to eat, insulin need continues and may increase.

Continue the basal dose of insulin and make additional corrections using the Correction/Sensitivity Factor as needed. Urine ketone testing can further guide the correction doses.

Blood/Urine Testing

Check blood glucose before usual mealtimes and every 2 to 4 hours, keeping a written record of results.

Check urine for ketones if blood glucose is greater than 250 mg/dL or as directed by the physician.

Fluids/Meal Planning

Consuming adequate fluids is important during illness. Drink fluids every hour while awake and during blood glucose checks at night.

If able to eat, drink non-caloric beverages.
If unable to eat, alternate non-caloric beverages with those containing carbohydrate.

Consume 10–15 grams of carbohydrate every 1–2 hours.

Severe high blood glucose and ketoacidosis (DKA) are serious medical problems that sometimes occur in diabetes. High blood glucose can exist for some time without triggering ketoacidosis. Ketoacidosis begins only after insulin levels in the body go very low. When insulin is low, glucose cannot be used as fuel. Glucose is the body's first choice for energy, but if not available due to inadequate insulin levels, the body must start burning fat even though glucose is high in the blood. Ketones are the by-product of burning fat for energy and in high levels, cause nausea and vomiting. Vomiting, in combination with high blood sugars, can lead to dehydration.

Ketoacidosis can be triggered by:

1. Illness
2. Infections
3. Pump Malfunction
   · Loose Luer-lock connection

- Dislodged infusion set
- Site irritation or overuse
- Empty pump reservoir/cartridge
- Expired insulin
- Incorrect bolus calculation
- Missed bolus doses
- Inadequately programmed basal rates

A pump user needs to take a correction dosage using a syringe if spilling moderate to large ketones, then change the infusion set. Plenty of water should be consumed to help flush ketones from the body.

Call a physician for further instruction.

IDENTIFYING AND MANAGING HYPOGLYCEMIA

Causes:

Glucose levels can drop to dangerously low levels if there is not a balance between food, medication, and activity. It can occur very quickly and without warning. Not eating properly, delaying or skipping meals, an error in medication dose, or engaging in exercise that is too difficult or too strenuous are all causes of hypoglycemia.

Signs and Symptoms:

Shaking	Sweating
Weakness	Anxiety
Headache	Blurred vision
Dizziness	Fast heartbeat
Irritability	Fatigue

"Rule of 15"

1. Immediately stop activity and check glucose levels. If driving, immediately pull off the road
2. If no glucose meter is available, treat regardless
3. Consume 15 gms of a fast-acting carbohydrate
   - ½ cup juice
   - 6–7 lifesavers
   - 2 tsp. sugar
   - 5 sugar cubes
   - ½ cup regular soda
   - 8–9 jellybeans
   - 4 glucose tablets
   - 8 oz. skim milk
   - 1 tube glucose gel

4. Rest for 15–20 minutes
5. Retest glucose — if still below 70 mg/dl, repeat fast-acting carbohydrate. Or if no glucose meter is available, and symptoms are still present, repeat fast-acting carbohydrate
6. Continue steps 1 – 5 until glucose level is above 70 mg/dl
7. An extra snack consisting of a carbohydrate and protein may be needed if more than one treatment was required and no meal will be eaten within a half-hour. Examples are:

   ½ sandwich

   Cheese and crackers

   Peanut butter and crackers
8. If several hypoglycemic episodes occur at the same time over a few days, the basal rate will need to be adjusted; notify the pump trainer immediately
9. ALWAYS carry a fast-acting carbohydrate in a place that is easily accessible
10. ALWAYS wear identification stating that you have diabetes and are being treated with an insulin pump

APPENDIX
PHYSICIAN'S ORDERS FOR INSULIN PUMP START

Patient Name _____ Date _____

Certified Pump Trainer _____

These orders expire on _____

Basal rates may be adjusted by 0.05 increments for BG above _____ and/or _____ below.

Starting Basal Rate:

Profile	Time	Units per Hour
#1	12:00 a.m.	_____

Starting Bolus Doses

Insulin to Carbohydrate Ratio: 1 unit per _____ gms. carbohydrate

Insulin Sensitivity Ratio
(Correction Factor): 1 unit of insulin will lower BG by _____ mg/dl

Target Blood Glucose Levels

3:00 A.M. _____ to _____

Fasting. _____ to _____

Before meals. _____ to _____

After meals. _____ to _____

Additional Instructions: _____

_____

_____

_____

Physician's Signature _____

PATIENT INSULIN PUMP CONTRACT

Patient Name _____ Date _____

Physician _____

I understand, as the patient, it is my responsibility to:

1. Maintain open communication with my physician, dietitian, and diabetes educator. This will include recording and reporting my glucose levels, carbohydrate intake, exercise, boluses, basal rate changes, and other information requested.
2. Perform glucose testing as requested.
3. I will change my infusion set every 2 to 3 days and follow the guidelines as set forth for proper pump management.
4. If hospitalized, I will bring all the needed equipment from home to ensure I have enough supplies. If I do not have the supplies, it is my responsibility to make arrangements to obtain them.
5. I will follow the formulas for meal boluses and correction factors prescribed to me by my physician and/or diabetes educator.
6. I will respond quickly and correctly to hypoglycemia and will report these to my health care team. I understand the "Rule of 15" to treat a low glucose with 15 grams of a fast-acting carbohydrate, retest in 15 minutes, and repeat the sequence if necessary.
7. I will respond quickly to hyperglycemia and prevent DKA by following the rules for sick-day management using my correction factor. I will report to my diabetes care team as needed, increase the frequency of monitoring, and test my urine for ketones if my glucose is over 240 mg/dl for 2 consecutive glucose readings.
8. I will not disconnect from the pump for longer than an hour. If I desire a "vacation" from the pump, I will first discuss this with my diabetes care team before doing so and follow their recommendations.
9. If I am having any difficulty with either pump use or carbohydrate counting, I will immediately call my diabetes care team for the proper assistance.
10. I will make sure that I have the proper supplies on hand at all times and that it is my responsibility to reorder supplies as I need them. I will also carry "emergency supplies" with me at all times, including syringes, in case my site becomes dislodged. I will also wear identification stating that I have diabetes and wear an insulin pump. This information will also include emergency contact, my doctor's name, and telephone number.

Patient's Signature _____ Date _____

LETTER OF MEDICAL NECESSITY

Date _____

RE: Patient Name _____ Phone ( ) _____

Patient's date of birth _____ Insurance identification # _____

To whom this may concern:

This letter serves as prescription and letter of medical necessity for the above referenced patient for an insulin infusion pump as a lifetime need.

Check the following:

☐ Patient has had diabetes for ____ years

☐ Patient has the ability to regularly monitor blood glucose ____ to ___ times per day.

☐ Patient is motivated to achieve and maintain glycemic control and has the support needed to stay motivated.

☐ Patient demonstrates compliance with dietary regimen.

☐ Patient's insulin regimen consists of _____ to _____ injections per day.

☐ Patient has attempted several different regimens and/or has had multiple dose changes.

☐ Patient uses the following type(s) of insulin: _____.

Patient exhibits one or more of the following:

☐ A1c level ___% on ___/___/_____.

☐ History of severe glycemic excursions and/or ☐ Nocturnal Hypoglycemia
☐ Hypoglycemia unawareness ☐ Extreme insulin sensitivity or low insulin req.

☐ Widely fluctuating blood glucose levels before meals. (e.g., pre-prandial BG levels commonly exceed 140 mg/dl and/or are below 70 mg/dl. The range of these blood glucose levels is from _____ to _____.

☐ Dawn Phenomenon where fasting blood glucose often exceeds _____ mg/dl.

☐ Day to day schedule variations such as meal times, work schedules or activity level confound the degree of regimentation required to self manage glycemia with Multiple daily injections.

☐ Patient has been hospitalized or needed emergency assistance due to his/her diabetes.

☐ Patient has frequent hypoglycemic episodes, up to _____ times per week.

☐ Pregnancy or preconception with a history of poor glycemic control.

☐ Secondary complications requiring tighter glycemic control to slow or stop progression of
☐ Retinopathy ☐ Neuropathy ☐ Nephropathy ☐ Other: _____

☐ Sub-optimal glycemic and metabolic control post-renal transplant.

☐ Patient has been fully informed of the risks and benefits of pump therapy.

PHYSICIAN NOTES

I certify that this information is complete and correct. _____

Physician's Signature

I am an endocrinologist, internist or diabetes specialist: ☐ Yes ☐ No

I am prescribing an insulin infusion pump, insulin pump supplies, and diabetes supplies for the following patient. The supplies may be refilled as necessary for one year. Please dispense as written.

PHYSICIAN NAME	PATIENT NAME
PHYSICIAN STREET	PATIENT STREET
PHYSICIAN CITY, STATE, ZIP	PATIENT CITY, STATE, ZIP
PHYSICIAN SIGNATURE	DATE
MEDICAL LICENSE NUMBER	
UPIN NUMBER	

INSURANCE COVERAGE FOR INSULIN PUMP THERAPY

Private Insurance

1. Contact pump company with information about the patient
   A. Insurance information
   B.Indications that would require utilizing the insulin pump
   C. Must be on multiple insulin injections (2 or more a day)
   D. Cover type 1 and some type 2 diabetes
   E. Prescription from MD

Medicare

1. Contact pump company with patient's information
2. Must meet criteria for insulin pump therapy
   A. C-Peptide of less than 0.6 mcg/L
   B. A1c over 7%
   C. Monitoring 4 times a day
3. Medicare pays 80% for pump and supplies. Secondary insurance may cover the other 20%. If Medicare denies coverage, secondary may cover.

Medicaid

1. Contact pump company with insurance information
2. Must meet criteria for insulin pump therapy
2. Prescription from MD
4. Medicaid will cover 100%

Indications for Insulin Pump Therapy

1. Unable to normalize glucose levels
   A. Erratic glucose excursions
   B. A1c over 7%
2. Severe episodes of hypoglycemia or hypoglycemia unawareness
3. Preconception/pregnancy
4. Early chronic complications
5. Organ transplant
6. Patient desires better control
7. Prevent chronic complications

OVERVIEW FOR PUMPING INSULIN

Indications For Insulin Pump

1. Multiple episodes of severe hypoglycemia
2. Erratic glucose levels – "brittle diabetes"
3. Early complications
4. Organ transplant
5. Pregnancy

Advantages of The Pump

1. More flexible lifestyle
2. Improved overall control
3. Prevent chronic complications
4. Improve control during exercise and "growth spurts"
5. Tight control during pregnancy

Characteristics of Pump Candidate

1. Must be willing to monitor BG several times a day
2. Must be willing to count carbohydrates
3. Must have manual dexterity to use buttons on pump and have good visual acuity to see the screen
4. Good support system
5. Committed to self-care
6. Ability to problem solve
7. Good basic knowledge of diabetes
8. Reasonable expectations of what the pump can do

Time Line

1–2 months before pump start:

1. Assess patient's current knowledge about diabetes
2. Assess whether or not patient meets the criteria for a "pumper"
3. MD contacts the pump company and writes orders for the pump
4. Patient is seen by dietitian for carbohydrate counting
5. Patient is seen by the pump trainer for general assessment and education

QUESTIONNAIRE

Are you ready for pumping?

1. **How motivated are you to achieve good control?**
   Not very 0 1 2 3 4 5 very _____

2. **How many times do you test every day?**
   0 1 2 3 4 5 _____

3. **How many injections per day?**
   0 1 2 3 4 5 _____

4. **Do you keep a record?**
   Yes (5 points) No (0 points) _____

5. **Do you adjust your insulin for test results?**
   Yes (5 points) No (0 points) _____

6. **Do you adjust your insulin for meals?**
   Yes (5 points) No (0 points) _____

7. **Do you adjust insulin for "highs"?**
   Yes (5 points) No (0 points) _____

8. **Do you adjust your insulin for exercise?**
   Yes (5 points) No (0 points) _____

9. **Do you get regular A1c tests?**
   Yes (5 points) No (0 points) _____

10. **Do you call your doctor when you have a problem?**
    Yes (5 points) No (0 points) _____

SCORING

Score	What It Means
0–9	Are you in charge or someone else?
10–19	At least you're honest!
20–29	Where can you improve?
30–39	Just a few minor changes
40–49	How soon can you start?

1–2 weeks before pump start

1. Patient watches video or DVD on pump use several times to begin familiarizing him/herself with the pump
2. May attend "Pump School" via Internet
3. Meets with pump trainer for basal, bolus, correction factor, and insulin to CHO ratio

Day before pump start

1. Discontinue use of long-acting insulin
2. Continue injections of Humalog/Novolog before meals
3. Use "correction formula" to cover for highs

Day of pump start

1. Eat breakfast and take fast-acting insulin as usual
2. Wear comfortable clothing-preferably two-piece outfits
3. Allow 3 hours for training
4. Bring with you:

    Pump

    User's Manual

    Infusion sets — at least 2

    Cartridges — at least 2

    Skin prep

    Glucose meter/strips/lancets

    Alcohol wipes

    Insulin (Novolog or Humalog)

    Carbohydrate snack

    2 Batteries

First day after beginning pump therapy

1. Call Pump Trainer with glucose readings and grams of carbohydrate
2. Begin "4 Day Plan"

Within 3–5 days after pump training

1. Come in to office for follow-up
2. Continue "4 Day Plan" until basal rates are adjusted correctly

When basal rates correct,

1. Adjust insulin to carb ratio
2. Begin "3 Day Plan"
3. Call Pump Trainer with BG readings and CHO grams

Weekly for 4 weeks

1. Call Pump Trainer with BG's and CHO grams for adjustment
2. Basals are adjusted first, then boluses

STARTING BEGINNING BASAL RATE

Total Daily Pre-pump Insulin x 75% = Total Daily Insulin per Pump
(total pre-pump dose minus 25%)

Divide the new dose by 2
Half is basal; half is boluses

For basal, divide half by 24 = basal rate per hour

Begin with 1 basal rate and adjust as needed

Example:

TDD pre-pump — 50 units

50 – 25% = 38 — new dose

38 ÷ 2 = 19 (19 units for boluses; 19 units for basal)

19 ÷ 24 = 0.79 units per hour (may round up to 0.8 units per hr.)

INSULIN TO CHO RATIO: RULE OF 500

Divide 500 by the new total daily dose:

Example:

TDD = 25 units

500 ÷ 25 = 20 — 1 unit of insulin per 20 gms of CHO

TDD = 45

500 ÷ 45 = 11 — 1 unit of insulin per 11 gms of CHO (may round down to 10 for ease)

INSULIN CORRECTION FACTOR: RULE OF 1500

Divide new TDD into 1500

Example:

TDD = 45 units

1500 ÷ 45 = 33 (amount I unit of insulin will decrease glucose level by)

If target level is 100 and glucose level 289 mg/dL – how many units to get BG level to 100?

289 – 100 = 189 (189 points above target)

189 ÷ 33 = 5.7 units of insulin

Used to correct for a high

May be added to regular mealtime bolus if high occurs right before eating a meal

MONITORING SCHEDULE

For first few days to 2 weeks (or until basals and boluses adjusted)

1. Between 2:00–3 a.m. (Dawn Phenomenon)
2. Fasting (overnight basal) Goal 70 – 100 mg/dL
3. 2 hours after each meal Goal 140 mg/dL or less
4. Before and after exercise
5. Before driving
6. If hypoglycemia is suspected

ADJUSTING BASALS – "4 DAY PLAN"

Overnight Basal

1. First basal to be checked
2. Eat regular dinner (no later than 7:00 p.m.), NO bedtime snack

3. BG @ bedtime should be 100-150 mg/dL
4. Test BG every 2 hours between supper and bedtime, @ Midnight, and 3:00 a.m.
5. If BGs stay within 30 mg/dl basal OK — if more than 30, adjust
6. Divide night into 3 "test windows"
    a. BEDTIME: 9:00 P.M. to midnight
    b. NIGHT: Midnight to 3:00 a.m.
    c. DAWN: 3:00 a.m. to 7:00 a.m.

Afternoon Basal

1. Eat breakfast and take bolus for food
2. NO lunch, NO bolus
3. Check BG every 2 hours between breakfast to supper
4. If BGs stay within 30 mg/dl, basal OK; if not, adjust

Morning Basal

1. NO breakfast, NO bolus
2. Test BG every 2 hrs from waking until lunch. DO NOT SLEEP IN!
3. If BGs stay within 30 mg/dl, basal OK; if not, adjust

Evening Basal

1. NO supper NO bolus
2. Test BG every 2 hrs between lunch & bedtime snack at 10:00 p.m.
3. If BGs stay within 30 mg/dl, basal OK; if not, adjust

NOTE — DO NOT "fix" a high glucose during the time you are checking your BGs every 2 hours. Correct at the next scheduled meal, using your correction factor. If you miss a day — continue the plan the next day. May need to repeat the "4 Day Plan" two or three times until the basal rates are corrected.

ADJUSTING INSULIN TO CHO RATIO

1. Check 2 hours after each meal
2. If BGs not over 140 mg/dL, ratio correct; if higher — increase, if lower — decrease
3. May have 2-3 different ratios during the day — may need 1 unit per 8 gms in a.m., 1 unit per 10 or 15 for lunch and dinner, or 1 per 8 in a.m., 1 per 10 for lunch, and 1 per 15 for dinner.

ADJUSTING CORRECTION FACTOR

1. If hypoglycemia occurs after correcting for a high, lower correction factor
2. If BG still high after 3–4 hours, increase factor.

OTHER TIPS AND SAFETY

1. Change site every 2–3 days (every other day with pregnancy). ALWAYS do site changes in the MORNING — NEVER at bedtime! Check BG 2 hours after a site change to ensure the "cath" is placed correctly and pump is functioning properly
2. Inspect site twice a day — if swelling, redness, pain, or drainage — CHANGE SITE!
3. ALWAYS carry extra supplies with you in case the catheter gets dislodged
4. ALWAYS have a supply of syringes on hand in case of pump malfunction
5. ALWAYS wear identification stating you have Diabetes and wear an insulin pump
6. If you have 2 BGs over 240 mg/dL in a row — inject insulin according to the correction factor and CHANGE SITE. Retest 2 hours after
7. NEVER NEVER NEVER go to bed with a low battery
8. If you perspire heavily, may use a solid non-fragrance antiperspirant around site or try other types of tape that are available. Skin Tac "H", Polyskin, Tegaderm, Hypafix, HyTape, Dermicell, SkinPrep, Mastasol, and toupee glue are other options to try.

GOING OFF THE PUMP

1. Be sure you check with your doctor before disconnecting from the pump for any length of time.
2. DO NOT disconnect for more than 1-2 hours unless you have the OK from MD.
3. Reasons to go off the pump may be due to pump malfunction — call 1-800-send pump — the pump manufacturer will immediately send a loan pump until yours is repaired or replaced. Another reason may be just a desire to have a "vacation" from the pump.

Time Off Pump	Action
1–1½ hrs	No action unless CHO will be eaten or BG is high
1½–5 hrs.	Before disconnecting, give a bolus to replace 80% of the basal that will be lost Inject before eating using insulin to CHO Ratio
DAYTIME ONLY	Give injection before each meal by using your insulin to CHO ratio PLUS the basal insulin needed until the next meal
3–4 Days or More	Inject fast-acting insulin before each meal using your insulin to CHO ratio and correction factor for highs. At bedtime, inject Lantus to equal 1.5 X the basal rate used for the overnight period.

TRAVELING

1. ALWAYS carry at least 1 weeks' worth of extra supplies on top of what you will normally use — if you are staying for 2 weeks, carry supplies for 3 weeks.
2. NEVER check your supplies in baggage — CARRY them with you.
3. Carry snacks with you.
4. WEAR IDENTIFICATION stating you have diabetes and wear an insulin pump.
5. Remember to change the time on your pump if you will be crossing time zones.
6. Get a letter from your doctor explaining what to do for your diabetes, listing medications and devices that you may use. The letter should also state any food or medication allergies you may have. Also get a prescription to carry with you for any medications you may need. Know the name and number of an endocrinologist in the area where you're traveling may prove useful.
7. Carry bottles of insulin IN THEIR BOXES with your name, doctor's name, your pharmacy's name, and medication on a pre-printed label.
8. Contact your airline for any specifics — different airlines have different rules regarding diabetes supplies — don't be surprised!
9. The pump can be worn through the scanner at the airport without causing it harm. Don't call attention to it.

HOSPITALIZATIONS

1. Remove pump for X-rays, MRIs.
2. Be prepared beforehand — carry a letter from your endocrinologist with orders for you to keep the pump on, check your own glucose levels and do your own adjustments.
3. If you are unable to care for the pump, have a family member do so. If you have no family with you, the pump may be removed, but ONLY after the nurses have orders for insulin coverage. DKA can occur much faster after disconnecting from the pump because there is no long-acting insulin on board.
4. The pump gives better control during and after surgery, so ask doctors to allow that it stay connected. As soon as possible after surgery, ask to have the pump reconnected if it was discontinued during the surgery.
5. Pregnant patients will need to move insertion site to the thigh area immediately after beginning labor and leave the pump connected during labor. Insulin resistance dramatically decreases after the placenta is delivered — so be prepared to decrease basal rates. Basal rates will remain lower if the mother is breast feeding also.

STANDARDS OF CARE: DIABETES EDUCATION AND MANAGEMENT PROGRAM

Insulin Pump Education: Up to 8 Visits

A. Initial visit/s prior to pump start, CDE:

1. Data collection & review; assessment of self-management skills, readiness to learn and barriers to learning
2. Prerequisites for successful pumping:
   a. One month of multiple injection therapy with Lantus and Humalog or Novolog
   b. Many BGs showing testing at least 4 times a day for one month
   c. Knowledge of pump function through watching video or doing on online pump program
3. Intro to pumps; basal & bolus rates, insertion sites
4. Refer to RD for dietary counseling and CHO counting assessment
5. Assess glucose meter skills
6. Resources: videos, books, pamphlets, web sites
7. Goal setting

B. Initial visit/s prior to pump start, RD:

1. Data collection & review; weight, food record
2. Review of meal planning and CHO counting
3. Validate ability to count carbs at home, at work or school, at restaurants and fast-food locations
4. Goal setting

C. Follow-up visit, day of pump start, CDE (3–4 hours):

1. Pump specifics; buttons, syringe filling, priming, insertion technique
2. Initial settings
3. Problem solving, alarms
4. Restocking supplies
5. Hypoglycemia and hyperglycemia management, DKA prevention
6. Review of tasks and follow-up plan
7. Status of goals and reinforcement of positive changes
8. Resources: videos, books, pamphlets, web sites
9. Goal setting

D. The CDE will emphasize that regulating basal and bolus rates and determining insulin to carb ratios is essential until the blood sugars are within the preset goal ranges. Telephone support for emergencies is available 24 hours per day.

E. Follow up visit, within one month or more frequently if needed, CDE:

1. Data collection & review; blood sugar trends, meter download
2. Review basal & bolus rates
3. Review of site adequacy & insertion technique
4. Confirm completion of basal rate testing
5. Sick day management/DKA prevention.
6. Status of goals and reinforcement of positive changes
7. Goal setting

F. Follow-up visits with RD as needed.

1. Data collection & review; blood sugar trends, food records
2. Review of meal plan and carb counting
3. Review of food adjustments for sick days and exercise
4. Status of goals and reinforcement of positive changes
5. Goal setting

G. Follow-up visits (quarterly for first year then annually) with CDE:

1. Data collection & review; blood sugar trends, A1c results
2. Self-management review and problem solving
3. Status of goals and reinforcement of positive changes
4. Goal setting
5. If child, movement toward independence in diabetes care

INSULIN PUMP FOLLOW-UP

Patient Name _____ Date _____

Certified Pump Trainer _____

Pump Model _____ Serial # _____

BASIC REVIEW	SITE CHANGE PROTOCOL

ADDITIONAL FEATURES INSTRUCTED:	NOTES

BLOOD GLUCOSE RECORD

DATE	TIME	BG	CHO GRAMS	INSULIN

Basal Rate Changes:

From 12 Midnight to _____ : _____ units per hour

From _____ to _____ : _____ units per hour

From _____ to _____ : _____ units per hour

From _____ to _____ : _____ units per hour

Pump Trainer Signature _____ Date _____

INSULIN PUMP CONTACTS

Trainer: _____

Phone: _____

Alternate trainer: _____

Alternate phone: _____

REFERENCES

Bode, BW. *Pumping Protocol A Physician's Guide to Insulin Pump Therapy Initiation*, Atlanta Diabetes Associates, Atlanta, Georgia

Bolderman, KM. *Putting Your Patients on the Pump*, American Diabetes Association, 2002 Alexandria, Virginia. ISBN 1-58040-148-1

Frederickson, L, ed. In. *The Insulin Pump Therapy Book Insights From The Experts*. MiniMed Technologies. Los Angeles, California. 1995 ISBN 0-9647837-0-3

Walsh, J & Roberts, R. *Pumping Insulin Everything You Need To Know For Success With An Insulin Pump,* 3rd edition. ISBN 1-88480484-5

Amrhein, James A. MD and Hess, B, RN, BSN, CDE. *Optimizing Glycemic Control with Diabetes Technology.* AADE 29th Annual Meeting, August 7, 2002, Philadelphia, Pennsylvania.

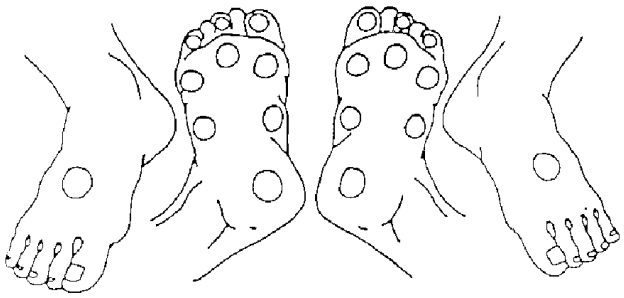
Brooks, AM, RN, CDE. St. Marks Hospital Diabetes Center, Salt Lake City, Utah and Kulkarni, K, MS, RD, BC-ADM, CDE, St. Marks Hospital Diabetes Center, Salt Lake City, Utah. *Core Curriculum for Diabetes Education,* Fourth Edition. Diabetes Management Therapies, Chapter 6, pg. 203-225.

*Diabetic Foot Screen**

TEXAS Department of State Health Services
Stock #45-12000
TEXAS DIABETES COUNCIL
Approved 04-23-04

**performed every primary care visit (for complete foot exam details, see page 2 of 4)*

	NO	YES	
Acute swelling and/or Acute deformity	☐	○ →	**Page 4–A**
Skin breakdown (ulcer)	☐	○ →	**Page 4–C**
Callus – with deeper color changes	☐	○ →	**Page 4–B**
Digital Deformity or chronic midfoot/rearfoot prominence	☐	○ →	**Page 3–C**
History of amputation and/or ulceration	☐	○ →	**Page 3**
Dystrophic Nails &/or Dry Skin	☐	○ →	**Page 3–D**
Neuropathy: using 10-gram nylon monofilament performed yearly 4 out of 10 sites imperceptible = "yes"	☐	○ →	**Page 3–B**



Assign Risk Category:

No Present Risk
____ 0 No loss of protective sensation, no deformity.

Impending Risk
____ 1 No loss of protective sensation. Deformity present.

High Risk
____ 2 Loss of Protective sensation with or without weakness, deformity, callus, pre-ulcer or history of ulceration.

Adapted from the National Foot Treatment Center LEAP Program

FOOT PULSES:		**PALPABLE**	**NONPALPABLE**	
Right:	Dorsalis Pedis	☐	○ →	**Ankle Brachial Index (ABI) Page 1–A**
	Posterior Tibialis	☐	○ →	
Left:	Dorsalis Pedis	☐	○ →	
	Posterior Tibialis	☐	○ →	

Resources & References:

1. International Consensus on the Diabetic Foot, 2003. International Working Group on the Diabetic Foot (consultative section of the International Diabetes Federation)
2. University of Texas Health Science Center-San Antonio Texas-Department of Orthopedics-Division of Podiatry
3. Scott & White Clinic / Texas A&M University System Health Science Center-Department of Surgery, Division of Podiatry
4. American Diabetes Association: Clinical Practice Recommendations. *Diabetes Care*. 2004; 27[S1]:63-64.

*Diabetic Foot Exam***

TEXAS Department of State Health Services
Stock #45-12000
TEXAS DIABETES COUNCIL
Approved 04-23-04

***Performed Initially at Diagnosis, Annually in Primary Care*

Foot History

1. **Ulcers:** location, time to heal, wound care necessary for healing
2. **Infections:** type, bacteria involved, medical treatment necessary
3. **Amputations:** type, time to heal, modalities used in healing process
4. **Surgeries/Injuries:** type, location

Foot Exam

Vascular (Vasc)

1. **Palpate DP, PT pulses** (present or absent)
2. **Temperature gradient:** from ankle to toes, focal "hot spots"
3. **General Color:** pink, palor, rubor on dependency
4. **Digital Capillary refill time:** in seconds
5. **ABI:** for both DP & PT arteries (abnl if <0.85–0.9)

Neurologic (Neuro)

1. **10-gram nylon monofilament:** test sites on feet as indicated on page 1
2. **Vibratory perception:** via 128 Hz tuning fork (>10 secs) OR Biothesiometer (>25 volts)—tested at hallux
3. **Tactile sensation (light touch):** via cotton wool (dorsum of foot)
4. **Reflexes:** Achilles tendon

Dermatologic (Derm)

1. **General skin turgor/texture**
2. **Focal lesions:** calluses (debride to fully assess), cracks, pigmentation
3. **Interdigital:** calluses, maceration
4. **Nails:** incurvated, nail plate thickness, coloration, inappropriate self-care

Musculoskeletal (Msk)

1. **General Range of Motion:** ankle, subtalar, midtarsal, metarsophalangeal
2. **Foot type:** rectus, pes planus, pes cavus, Charcot foot
3. **Digits:** hammertoes, claw toes, mallet toes, bunion/hallux abductovalgus
4. **Bony prominences**

Footwear

1. **Type**
2. **Wear pattern:** outsole and upper counter distortion
3. **Insole inspection:** foreign bodies, staining, excessive wear
4. **Socks:** foreign bodies, staining, excessive wear

Social

1. **Tobacco/alcohol/drug use**
2. **Work environment/foot demands/footwear requirements**
3. **Physical activities:** footwear used
4. **Family support:** marital status, spouse/family involvement in health
5. **Education:** diabetes self-management

Diabetic Foot Care/ Referral Algorithm

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Complete Diabetic Foot Exam (see page 2 of 4)**

ABBREVIATIONS:

MD	medical doctor
DO	doctor of osteopathy
DPM	doctor of podiatric medicine (Podiatrist)
NL	normal
ABNL	abnormal
ABI	ankle/brachial index
TCPO2	transcutaneous oxygen pressure
NCV	nerve conduction velocities
PSSD	pressure specified sensory device

Normal (NL) Exam

MD/DO/DPM (or physician extender)

NL vasc
NL neuro
NL msk
NL derm

DM FOOT EDUCATION
- patient/family (Diabetes Self-Management Education)
- verbal/written
- websites
- clinic phone numbers

REPEAT Diabetic Foot Screen*
per MD, DO, physician extender visits or DPM exam
REPEAT EVERY VISIT

Abnormal (ABNL)

NORMAL testing-repeat per change in exam or onset symptoms

A

ABNL VASC
NL neuro
NL msk
NL derm

VASCULAR CONSULT/TESTING
Consider: PVR, Seg. pres., ABI, TCPO2
- peripheral arteriogram as indicated
- intervention as indicated to re-establish blood flow

Documentation of vascular disease
OR
Post intervention with improvement

- EDUCATION: signs/symptoms
- HIGH RISK foot status
- Foot screen every MD/DO/DPM, or physician extender visit

B

NL vasc
ABNL
NEURO
NL msk
NL derm

NEURO or PM&R CONSULT
Consider: NCV, PSSD
- other causes: consider and rule out as indicated
- if painful consider pharmaceutical vs. surgical treatment

- EDUCATION: signs/symptoms
- HIGH RISK foot status
- Foot screen every MD/DO/DPM, or physician extender visit, **PRN**

C

NL vasc
NL neuro
ABNL MSK
NL derm

COMPLETE BIOMECHANICAL EXAM
(Podiatrist, Orthopedist)
- discuss clinical significance
- Treatment options: surgical, non-surgical

- EDUCATION: signs/symptoms
- Intervention: surgery→healed = low risk
- Biomech: shoes, orthoses, phys.medicine
- Follow up DPM per modality needed
- Foot screen: every MD/DO/ physician extender visit

D

NL vasc
NL neuro
NL msk
ABNL DERM

Dystrophic (thick, discolored) toenails

- Debride/reduce
- Culture as needed
- Educate on condition management
- Referral as needed (podiatrist, dermatologist)

Dry skin, fissures

- Diagnostic tests as indicated, e.g., for fungus
- Topicals as indicated
- Referral as indicated

Ingrown toenail

- Instruct on proper nail care
- Matrixectomy if NL vasc exam

High Risk Scenario and Ulcer Management

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A

Peripheral Sensory **Neuropathy & Unilateral Swelling** / calor
- x-ray exam
- r/o infection

Deep venous thrombosis (DVT)

→ **No skin breakdown** or **Lesion**, no erythema → Extremely High Probability of **Charcot Arthropathy** → Treat as such until proven otherwise **COMPLETE OFF-LOADING OF EXTREMITY** to prevent severe foot/ankle deformity

→ **Skin Breakdown** → Treat as **Ulcer** 4-C (below) → **CAUTION** → Consider Double ETIOLOGY, **OFF-LOAD to prevent severe foot/ankle deformity**

B

Hyperkeratosis
With underlying sub-epidermal hemorrhage (no ulceration)

→ Follow pathways for associated abnl VASC, NEURO as indicated

→
1. **DEBRIDE** callus
2. Re-examine MSK exam for underlying cause – follow 3-C

→
1. **OFF-LOAD** as needed (change insole, offloading devices as indicated)
2. Assess **Footwear & Insoles** for causes, prevention

→
1. Re-examine/debride q 3–7 days until skin normalized
2. Progress back to normal activities/ footwear based on etiology & risk factors

C

ULCER
- assess/document

→ Once healed = patient remains extremely **HIGH RISK**—frequent foot exams/education

Immediate Debridement & Wound Care

→
1. Local wound care, dressings per etiology and clinical course
2. Surgical (OR) treatment if indicated

→
1. Frequent re-assessment & re-debridements as indicated
2. Continued changes in dressings/wound care
3. Advanced wound care if needed

Grade Ulcer
1. Assess size, depth, tissue levels
2. X-ray exam

→ **GRADE 1**: Superficial full thickness
- not penetrating deeper than dermis

→ **GRADE 2**: Deep ulcer (below dermis)
- subcutaneous structures (fascia, muscle, tendon)

→ **GRADE 3**: All subsequent layers involved
- including bone and/or joint
- assess probing to bone/soft tissue tracts

TYPE of Ulcer
- underlying etiology

→
1. **Neuropathic**
2. **Ischemic**
3. **Neuro-Ischemic**

→ Assess/manage causal pathway(s) 3–A, B, C

→ **OFF-LOAD** (relieve pressure)
- non-weightbearing essential
- crutches, walkers, modified shoes/insoles, total contact cast, etc.

INFECTION
Assess: fever, WBC, ESR, erythema, calor, drainage, necrosis, foreign material

→
1. Inflammatory response may be mitigated by diabetic complications
2. Outpatient vs. inpatient based on severity of infection & co-morbidity management

Culture & Sensitivity via
- tissue at wound base
- aspirating pus
- swab base of wound **after** debridement
- bone culture if suspect osteomyelitis
- blood if systemic toxicity suspected

Etiologic Agents
- Aerobic gram positive cocci most frequent (staphylococcus)
- Gram negative & anaerobes usually part of polymicrobial, chronic necrotic ulcers

Antibiotics – consider:
- local institutional and community susceptibility data when prescribing
- published efficacy data

Foot Screening Mapping Examples

TEXAS Department of State Health Services
Stock #45-12000
TEXAS DIABETES COUNCIL
Approved 04/23/04

Foot Screening Mapping Examples

Touch-Test™ Sensory Evaluators

North Coast Medical, Inc.
18305 Sutter Boulevard
Morgan Hill, CA 95037-2845
800 821-9319
www.touch-test.com

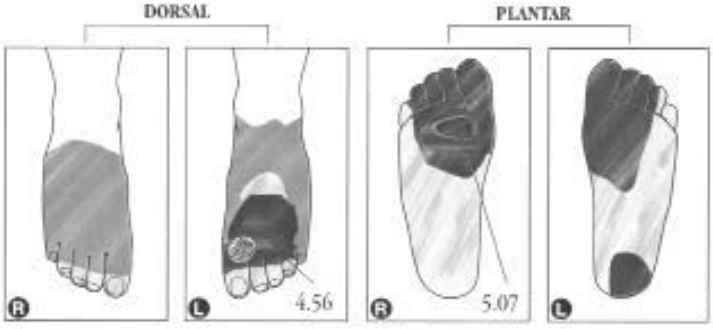
Key	Monofilament Size	Representation	Dorsal Surface Threshold	Plantar Surface Threshold
Callus	2.83	Green	Normal	Normal
Pre-ulcer	3.61	Blue	Diminished light touch	Normal
Ulcer	4.31	Purple	Diminished protective sensation	Diminished light touch
	4.56	Red	Loss of protective sensation	Diminished protective sensation
	5.07	Red	Loss of protective sensation	Loss of protective sensation
	6.65	Red	Deep pressure sensation only	Deep pressure sensation only

Initial Evaluation - Visit #1

RIGHT FOOT: Superficial ulcer on plantar surface over the second metatarsal head.

LEFT FOOT: Pre-ulcer proximal to the first dorsal web space.

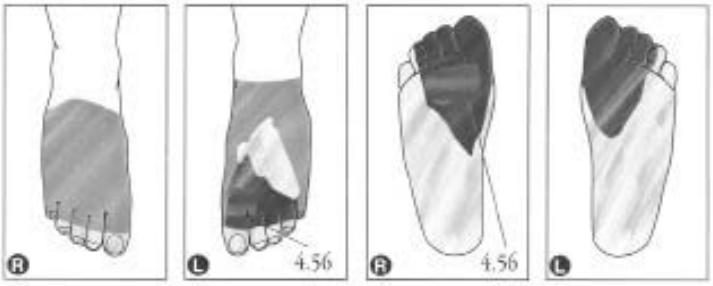
Patient education, treatment intervention and wound care management initiated.



Re-evaluation - Visit #2

RIGHT FOOT: Ulcer healed. Improved to diminished protective sensation on plantar surface over the second metatarsal head.

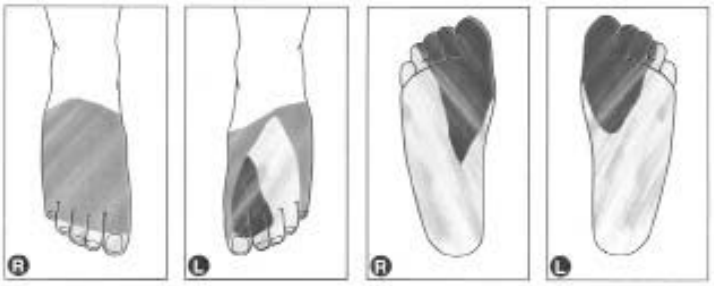
LEFT FOOT: Pre-ulcer healed. Loss of protective sensation proximal to the first dorsal web space.



Re-evaluation - Visit #3

BOTH FEET: Diminished light touch sensation at toes and plantar surfaces.

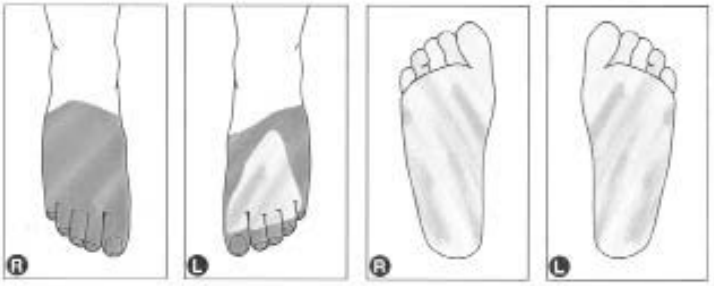
LEFT FOOT: Improved to diminished protective sensation proximal to the first dorsal web space.



Re-evaluation - Visit #4

RIGHT FOOT: Normal throughout.

LEFT FOOT: Improved to diminished light touch sensation over dorsal web spaces.



Foot Screening Forms (NC12749)

Recommendations for Treatment of Painful Peripheral Diabetic Neuropathy in Adults

TEXAS Department of State Health Services
Publication #45-12613
TEXAS DIABETES COUNCIL
Approved 04/26/07

No treatment has been shown to result in superior pain control compared to another agent

Choice of agent should be based on:

- Side effects
- Comorbidities
- Cost
- Concomitant Medications
- Realistic expectations: Goal pain relief /partial relief

Evaluate for and treat secondary causes of peripheral neuropathy:

- Glucose control
- Macrocytic anemia, B12, Folic acid or Vitamin D deficiency
- Lifestyle changes-alcohol & smoking cessation
- Radiculopathy
- Electrophysiology assessment recommended if glucose control does not improve pain due to other potential etiologies

Glycemic control goals should be met, if possible, prior to the start of pain medications → Select any of the agents to initiate at low dose and titrate to minimal effective dose [1] → At least 2 months at minimum effective dose → Change to a different agent if initial therapy is not effective

OR

- Refer to Specialist
- Consider low dose combination therapy if partial pain relief with any agent
- Consider other therapeutic agents with reported efficacy
- Consider surgical intervention/referral if other modalities fail

Medications Listed *Alphabetically*

Duloxetine[1]

Pros:
- May also treat depression

Cons:
- May cause nausea, dizzy/drowsy
- Use with caution with other antidepression medication

Minimum Effective Dose
60 mg daily

Gabapentin[1]

Pros:
- Generic

Cons:
- Saturable absorption gives lower absorption with increasing doses
- Example: absorption at 900mg/day: 60%
  3600mg/day: 33%
- Some risk of dizzy/drowsiness/ weight gain
- Renal adjustment of dose may be needed

Minimum Effective Dose
100-600 mg tid

Pregabalin[1]

Pros:
- No saturable absorption issues as with gabapentin

Cons:
- Similar mechanism of action to gabapentin
- Some risk of dizzy/drowsiness/ weight gain
- Renal adjustment of dose may be needed

Minimum Effective Dose
50 mg tid or 150 mg hs

Tramadol[1]

Pros:
- Generic

Cons:
- Nausea
- Dizziness

Cautions
- Contraindicated in known seizure disorder or with MAO Inhibitors
- Caution with use with other serotonergic agents
- Avoid abrupt withdrawal

Minimum Effective Dose
50 mg bid

Tricyclic antidepressants[1] (TCA's)

Pros:
- Generic

Cons:
- Anticholinergic side effects

Cautions
- Caution with use with other antidepressants
- Dose-related QTc prolongation
- Caution with other medications that inhibit CYP450 significantly

Minimum Effective Dose
12.5-50 mg at bedtime

Other therapeutic agents with reported efficacy:
Topical capsaicin, topical lidocaine, venlafaxine, bupropion, opioid derivatives, alpha-lipoic acid, MIRE therapy (Anodyne);
Consider surgical intervention if other modalities fail.

[1] Refer to prescribing information for titration recommendations Argoff CE et al. Mayo Clin. Proc. 2006 Apr; 81(4 Suppl): S12-25.

Considerations for Elderly Persons with Diabetes

Diabetes continues to be a disease that disproportionately affects the elderly. In Texas, approximately 16.3% of people over age 65 have been diagnosed with diabetes, compared to approximately 8.1% of the overall population (BRFSS, 2003). Older adults with diabetes are more likely to experience complications from diabetes, thus, elderly patients with diabetes generate most of the costs of treating complications.

In particular the goals for treatment of the elderly person with diabetes should include:

1. Improving or maintaining health and functional status of the elderly with diabetes by maximizing glucose control.
2. Early detection and treatment of the complications of diabetes through organized, pro-active screening efforts.
3. Aggressive treatment of co-morbid risk factors, specifically hypertension and dyslipidemia.
4. Careful monitoring of therapy to avoid common problems in the elderly: polypharmacy, adverse drug events and inappropriate medication use.

Given that these goals are similar to those for treatment of diabetes in any age group, the patient's stage in the disease process and their co-morbid conditions rather than age alone are most important in determining the appropriate course of treatment. The Council supports the basic recommendations summarized in the *Minimum Practice Recommendations* flow sheet with modifications that consider issues for elderly populations.

Health care providers and payers, including managed care organizations, should adopt the Texas Diabetes Council's *Minimum Practice Recommendations* as the basis for managing diabetes in elderly patients.

Clinicians should strive to achieve the same levels of glycemic control (blood glucose, A1c), blood pressure and lipid control in elderly patients with diabetes as in younger ones. Targets may be modified in light of advanced complications, life-limiting co-morbid illness, or severe cognitive or functional impairments.

Given the high risk of secondary complications among elderly patients with diabetes, such as cardiovascular disease and lower extremity complications, clinicians should screen aggressively for and treat secondary complications.

Foot screening conducted at every visit includes not only visual inspection for lesions, infections, and calluses, but also assessment of pulses and use of monofilaments to further screen for neuropathy.

At each office visit, the clinician should specifically inquire about and consider comorbidities and the risks associated with polypharmacy, common problems in the elderly. Increased attention may be necessary in selecting and monitoring drug therapy in the elderly; for example, metformin may be contraindicated because of renal disease or heart failure.

Diabetes self-management education for the elderly should take into account special instructional needs:

A) Elderly patients should be encouraged to include their caregiver or a family member in all educational sessions

B) Educational materials and methods should consider vision impairment, mobility, dexterity, mental state, functional status, and financial resources.

C) Elderly patients should be educated about possible effects of multiple medications and how concurrent illnesses may affect their treatment, self-care, and disease progression.

D) Preventing long-term complications of diabetes should be stressed.

Physiologic Changes in Glucose Metabolism

The elderly are prone to glucose intolerance and thus are at higher risk for developing diabetes. Fasting plasma glucose increases 1–2 mg/dl and the 2-hour postprandial glucose increases on average 8–20 mg/dl per decade of age after the age of 30–40 years. The changes to glucose intolerance have been attributed to age-related defects, post receptor defects in insulin action with decrease in velocity of glucose transport and/or other post receptor defects. There is also a depletion of intracellular pool of transporters or a defect in insulin-mediated translocation to the plasma membrane, along with impairment of the intracellular glucose metabolism beyond the defect in transporters.

Diagnostic Criteria and Goals

The diagnostic criteria and goals of therapy remain the same throughout the lifespan.

- Maintain quality of life by minimizing impacts of this disease
- Preserve functional capacity by preventing complications
- Minimize risk of hypoglycemia
- Meet realistic weight goals
- Avoid glucose readings > 200mg/dl
- For frail elderly, aim for fasting or bedtime glucose > 100mg/dl
- Safety precautions are imperative to prevent falls

Acute Complications are common in the Elderly

- Increased frequency of infections (respiratory, skin, urinary)/ Foot infections can lead to amputations
- Difficulty healing of breaks in the skin even without infection
- Hyperglycemic Hyperosmolar Nonketotic Syndrome
- DKA, not rare
- Hypoglycemia related to sulfonylurea or insulin treatment, especially with declining renal function

Atypical Presentation of Hyperglycemia in the Elderly

- A vague sense of not feeling oneself.
- Electrolyte imbalance and dehydration (blunted sense of thirst).
- Incontinence (masking polyuria).
- Appetite loss (due to depression, GI disease, or drug side effects).
- Fatigue ("just getting old") and gradual profound loss (unnoticed for months).

Diabetes Symptoms Often Present Differently in Frail Elderly

PATHOPHYSIOLOGIC STATE	TYPICAL PRESENTATION	COMMON PRESENTATION IN FRAIL ELDERLY
Hyperglycemia/ hyperosmolarity	Polydipsia	Impaired vision, confusion, dehydration
Catabolism due to lack of insulin	Polyphagia	Weight loss, anorexia
Increased urinary volume due to glucosuria	Polyuria	Incontinence

Drugs That May Worsen Hyperglycemia in the Elderly

- Glucocorticoids
- Thiazide diuretics
- Phenytoin
- Lithium and Phenothiazines
- Estrogens
- Growth Hormone
- Isoniazid and Sympathomimetic agents
- Sugar-containing medications

Altered Presentation of Hypoglycemia in the Elderly

- Adrenergic symptoms: sweating, nervousness, tremor
- Neuroglycopenic symptoms: confusion
- Elderly lose the adrenergic symptoms (loss of autonomic nerve function) and have more profound neuroglycopenic symptoms than the young: reversible hemiparesis.
  - This occurs late in the course of hypoglycemia.

Consequences of Severe Hypoglycemia:

- Tissue damage in elderly patients with impaired cardiac and cerebral circulation and serious chronic neurological consequences

- Exacerbation of ischemic heart disease with anginal symptoms
- Injuries including fractures
- Death caused by hypoglycemia or its consequences

Cause of Serious or Fatal Hypoglycemia

- Skipping meals or not eating enough
- Error in dosage of sulfonylurea or insulin agents (10% of SFU-related hypoglycemia patients die)
- Excessive activity or exercising with a low blood sugar
- Alcohol abuse associated with skipped meals

Contraindications of Tight Control in the Elderly

- Dementia
- Autonomic nerve dysfunction
- Physical disability
- Social isolation or food restriction
- Chronic renal insufficiency
- Cirrhosis

Goal: Decrease hyperglycemic symptoms and prevent hyperosmolar state

Monitoring in the Elderly

- Most elderly incorrectly perform glucose and urine tests.
- Blood glucose monitoring correlates to A1c and is a better tool for titrating insulin.
- Assess albuminuria to assess cardiovascular status and treat HTN/Lipids.
- Feet should be screened/treated vigorously.

Medical Nutrition Therapy Goals and Points of Consideration

- Individualize dietary modifications. Consider preferences and household.
- Minimize unnecessary restrictions.
- Vitamin and mineral supplements may be indicated. Talk to physician prior to starting any supplement.
- Minimal weight loss for obese can be very effective. Limit intake of saturated and trans fats as much as possible. Saturated fat should consist of less than 7% of the total calories*.
- Unless medically contradicted, encourage drinking 2 quarts of water per day.

* Diabetes Care, 2007 Jan; 30 Suppl 1 S11

- Recommend at least 20 grams of fiber per day to prevent constipation and reduce heart disease and cancer.
- Calcium intake should be encouraged. Those older than 70 years need 1,200 mg per day (32 ounces of milk equivalent).
- The recommended daily dose of Vitamin D and B-12 supplements for those over the age of 70 are 600 IU for Vitamin D and 2.4 micrograms for Vitamin B-12 (many elderly are unable to absorb Vitamin B-12 from food).
- Overdose of Vitamin A is more likely in the elderly, since Vitamin A is absorbed more readily and clears more slowly.
- Protein needs to make up greater part of elders' meal plans since they usually take in fewer calories.

Exercise in Older Adults

- Consider risks and benefits of specific activities.
- Conduct pre-exercise evaluation (medical evaluation, ECG, exercise stress testing).
- Start with low intensity; slowly increase activity.
- Range-of-motion exercises, walking and swimming are great choices.
- Perform some light weight lifting (strength building).

Diabetes-Associated Changes That Affect Teaching-Learning

- Sensory — (visual acuity, lens clarity, night vision, hearing)
  - Impaired seeing syringe marks, perceiving blue-tone colors, interpreting home glucose monitoring instruments
  - Impaired communication may lead to non-adherence
- Cognition — memory, complex psychomotor tasks
  - May need repetition or caretaker assistance
  - May have difficulty with insulin administration (mixing insulins and injection, site rotation) and glucose monitoring
- Cutaneous — skin vibratory and thermal sensitivity, tactile sensitivity
  - Impaired ability to discern temperature and pressure
  - otential for unawareness of burns and ischemia
  - Decreased manual dexterity for injections and glucose monitoring
- Urinary — decreased renal function, altered renal threshold for glucose
  - Potential for hypoglycemia, increasing drug half-life
  - Decreased utility of urine testing

- Gustatory, Olfactory — taste, smell
  - Reduced dietary adherence
- Gastointestinal — thirst mechanism, motility, delayed gastric emptying
  - Altered dietary intake
  - Potential for hypoglycemia and dehydration
- Vestibular-Proprioceptive-Equilibrium — sense of bodily orientation
  - Vertigo and imbalance, potential for falls
  - Decreased motivation for exercise/activity
- Limit other medications that can increase risk of falls:
  - Drowsiness
  - Dizziness
  - Urinary or fecal problems

Guidelines for Management of the Elderly with Diabetes in Long-Term Care Facilities

Introduction

High Risk for Diabetes-related Complications

The elderly in long-term care facilities such as nursing homes or assisted living centers are at high risk for developing diabetes-related complications such as infections, non-healing wounds, amputations, myocardial infarction, strokes, and particularly, electrolyte depletion and dehydration that lead to high hospitalization rates in this population.

The elderly are often unable to detect and report problems due to age-related factors such as decreased cognition, sensation, mobility, communication, thirst response, that are typically associated with aging. Diabetes-related complications appear differently in the elderly, especially the frail. Often symptoms such as urinary frequency, nocturia or incontinence, volume depletion or dehydration, excessive skin alterations (ulcers), infections, or delayed wound healing, dental caries, periodontal disease, burning mouth, foot ulcers or deformities, and increased pain perception, rapid weight alteration, urinary frequency are symptoms that can be attributed to the aging process or noted as insignificant are often not associated with symptoms of complications secondary to diabetes.

	GUIDELINES FOR DIABETES MANAGEMENT	INDIVIDUALIZE CARE ACCORDING TO: PREFERENCES, FUNCTIONAL AND MEDICAL STATUS, AND PROGNOSIS OF PATIENT
	Adapted from American Medical Directors Association (2002), British Diabetic Association Report (1999) & Pandya, AMDA Clinical Practice Guidelines Steering Committee	
Evaluation Diabetes-Related of Complications	**Glycemic Control**	Pre-prandial and post-prandial glucose levels, A1c
	Assess Cardiovascular Disease Risk Factors or Conditions	Assess and treat atherosclerotic heart & cerebrovascular disease and/or cardiovascular complications Order electrocardiogram, echocardiogram, chest X-ray, arterial doppler studies of the legs, cognitive testing, computed tomography (CT), and brain magnetic resonance imaging (MRI) Consider prescribing: enteric-coated aspirin, clopidogrel or aspirin/extended release dipyridamole, beta-blockers

	GUIDELINES FOR DIABETES MANAGEMENT	INDIVIDUALIZE CARE ACCORDING TO: PREFERENCES, FUNCTIONAL AND MEDICAL STATUS, AND PROGNOSIS OF PATIENT
	Assess Peripheral or Autonomic Neuropathy	Foot deformity, gait impairment
	Psychological Assessment	Unrecognized depression, cognitive impairment
	Determine Severity of Complications	CBC, basic serum chemistry, renal and hepatic function, careful review of facility glucose logs (Not necessary to do A1c for treatment regimen change)
	Obtain History	Recent hospital records, community physicians & family members
Health Care Provider	**Guidelines to notify health care provider should be established within institution and for patient**	Glucose <60mg/dl or <75mg/dl with symptomatology of hypoglycemia (See "Hypoglycemia" in Diabetes Tool Kit) Marked changes in glucose: If >250mg/dl along with change in status, condition Glucose >300mg/dl for 3 consecutive days (Unless represents improvement to status or orders note method of management) Difficulty with oral intake for > 2 days or more accompanied with fever, lethargy, abdominal pain, hypotension, respiratory distress, etc.

	GUIDELINES FOR DIABETES MANAGEMENT	INDIVIDUALIZE CARE ACCORDING TO: PREFERENCES, FUNCTIONAL AND MEDICAL STATUS, AND PROGNOSIS OF PATIENT
	See Algorithms: **Glycemic Control for Type 2 Diabetes in Children & Adults** **Insulin for Type 1 Diabetes in Children and Adults** **Insulin for Type 2 Diabetes in Children and Adults** **Initiation of Insulin Therapy for Type 2 Diabetes in Children and Adults: A Simplified Approach** **IV Insulin Infusion Protocol for Critically Ill Adult Patients in the ICU Setting** **ICU Insulin Orders** **Insulin Pump Therapy**	**Anti-Diabetes Agents** **Metformin:** Consider if obese, not recommended over age 80, use only with normal liver, renal function, do not use with CHF, acute illness **Secretagogues, Sulfonylureas:** Consider for non-obese or mildly obese Consider for insulin resistance, obese patient **Thiazolidinediones:** Not used with Class III, IV CHF Normal liver function **Alpha-Glucosidase Inhibitors:** For patients near A1c goal (milder diabetes) and/or post-prandial hyperglycemia **Incretins:** No information at this time for use in the elderly population

	GUIDELINES FOR DIABETES MANAGEMENT	INDIVIDUALIZE CARE ACCORDING TO: PREFERENCES, FUNCTIONAL AND MEDICAL STATUS, AND PROGNOSIS OF PATIENT
Prevention & Treatment of Complications	**Hypoglycemia** **(See "Hypoglycemia," Section, 8.1, in Diabetes Tool Kit, TDC)** **Elderly (particularly frail) may exhibit atypical symptoms of hypoglycemia such as: disorientation, incoordination, altered personality, falls for unknown cause.** **Morbidity is heightened with nocturnal hypoglycemia, cognitive and communication problems, chronic cardiac and liver disease, and adrenal or pituitary insufficiency.**	Treat with carbohydrate in the form of glucose, sucrose tablet or juice combined with light snack containing protein: Oral glucose paste, intramuscular glucagon, intravenous 50% dextrose Consider and assess for risks of hypoglycemia High doses, rapid acting insulin (with delayed meal consumption) Inconsistent calorie intake, hypoglycemia unawareness **Insulin & Hypoglycemia:** To decrease risk of hypoglycemia: Avoid prolonged use of "sliding-scale insulin" (graded increases in short- or rapid-acting insulin for every 50 to 100 mg/dl rise in blood glucose, usually administered before meals and at bedtime); increases morbidity, nursing time, not shown to improve metabolic control Sliding scale should be reserved for short-term glucose control post illness or surgery Fixed daily doses of insulin are recommended once daily insulin requirements are noted Endocrinologist consultant recommended for labile diabetes or for those on insulin pump

	GUIDELINES FOR DIABETES MANAGEMENT	INDIVIDUALIZE CARE ACCORDING TO: PREFERENCES, FUNCTIONAL AND MEDICAL STATUS, AND PROGNOSIS OF PATIENT
	Foot Care **See Foot Care Materials:** **Foot Screening Mapping Examples** **Diabetic Foot Screen** **Diabetic Foot Exam** **Diabetic Foot Care/Referral** **High Risk Scenario & Ulcer Management** **Recommendations for Treatment of Painful Peripheral Diabetic Neuropathy**	Assess skin and soft-tissue for alterations, sensation, color, temperature, circulation, presence of neuropathy, foot deformity, gait Order protective footwear with accommodating insoles Assure that feet are examined during all scheduled visits Teach preventive foot care to patients, families, nursing assistants If foot at risk: Order Routine Podiatric care; daily foot care by patient and caregivers With mild infection or ulcer consider local dressings; baseline X-ray for bone integrity or osteomyelitis; podiatry or wound care referral as needed (so that wounds are treated, reassessed, and debrided on site if at all possible). Limb-threatening ulcer or infection: consider hospitalization; referral to podiatry or vascular surgery

	GUIDELINES FOR DIABETES MANAGEMENT	INDIVIDUALIZE CARE ACCORDING TO: PREFERENCES, FUNCTIONAL AND MEDICAL STATUS, AND PROGNOSIS OF PATIENT
	Eye Disease **(See Chronic complications sections in Diabetes Tool Kit, TDC, Section, 9.1)** **Oral care** **See Diabetes and Gum Disease, H9.13** **Hypertension** **See Algorithm: Hypertension for Diabetes in Adults** **Diabetic nephropathy** **Dyslipidemia** **See Algorithm: Lipid Treatment for Type 1 and Type 2 Diabetes in Adults** **Macrovascular Risk Reduction in Diabetes: Antiplatelet Therapy**	Assessment of pain, infections, visual disturbance Annual dilated eye examination if appropriate Diabetes, hypertension, and proteinuria control prevention Evaluate oral cavity for pain, signs of infection, eating, swallowing disorders. Consider dietitian consult, prophylactic antibiotics, and/or dental services Consider angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs) Consider dietitian & nephrologist consultation Consider protein-restricted diet Utilize multiple methods to control of blood glucose and hypertension: angiotensin-converting enzyme inhibitors, angiotensin receptor blockers Consider dietitian consult Important to maintain control of lipids, blood pressure, blood glucose Utilized lipid-lowering medication as applicable and appropriate Note: Dietary restriction is not recommended in frail elderly patients
	Immunization	Consider influenza & pneumococcal vaccine
An Interdisciplinary Approach	**Health Care Provider Assessment and Team Intervention to evaluate functional and medical status, and rehabilitation needs**	Team members needed include: consultations from dietitian, pharmacist, physical therapist, activity therapist, podiatrist, mental health professional as needed

	GUIDELINES FOR DIABETES MANAGEMENT	INDIVIDUALIZE CARE ACCORDING TO: PREFERENCES, FUNCTIONAL AND MEDICAL STATUS, AND PROGNOSIS OF PATIENT
Medical Nutrition Therapy	**Dietitian Consult & Assessment Warranted** **No "ADA" diet recommended; Assess for common problems such as, chewing difficulty, decreased appetite, undernourished, anorexia, depression, dependency, chewing difficulty, and chronic gastrointestinal complaints.** **See Algorithm: Nutrition Recommendations and Interventions for Diabetes** **Diabetes Medical Nutrition Therapy & Prevention**	"No concentrated sweets": or "no added sugar" diets are inappropriate and do not contribute to good outcomes (*J Am Dietetic Assoc* 2001;101:1463-1466) and affect quality of life. Avoid calorie restricted diets particularly in those with major infections, major surgical procedures with multiple complications incurred Avoid fat and sugar-free restriction, except for obese and/or dyslipidemic residents: decreases palatability of food Meals should be prepared considering cultural, religious themes (Consider eating habits, food preferences, and food brought in by family members) Balanced meals and snacks with consistent carbohydrate content should be consumed at consistent times of the day Lean meats, nuts, eggs, fish, (6–8 servings/oz., 1 oz. Meat, fish, poultry, cheese Low & Non Fat Milk , Yogurt (2–3 servings, 1 cup milk, yogurt Dark, bright colored vegetables (6 servings ½ cooked, 1 cup raw) Dark Colored Fresh fruit (2 servings- small, size of tennis ball) Whole enriched fortified grains, beans and strachy vegetables (5–6 servings) Exercise regimens should be individualized with attention to diabetes related complications, preventing worsening of glycemic status, hypoglycemia and adjusting oral medication and/or insulin therapy according to optimize glucose and prevent hypoglycemia Special formulas are expensive, often unnecessary; the health care provider should pay close attention to glucose logs while making periodic pharmacological regimen adjustments

	GUIDELINES FOR DIABETES MANAGEMENT	INDIVIDUALIZE CARE ACCORDING TO: PREFERENCES, FUNCTIONAL AND MEDICAL STATUS, AND PROGNOSIS OF PATIENT
Personal Care	**Personal hygiene, skin, oral & foot care 20-40% Have neuropathy, peripheral vascular disease, or both**	Caregivers are needed for basic daily, mobility, toileting care to prevent ulcers or infected feet
	References	American Medical Directors Association. (2002). Managing diabetes in the long-term care setting, Columbia (MD): American Medical Directors Association (AMDA); Pandya, N. (2003) Long-term care guidelines for diabetes management, Clinical Practice Guidelines Steering Committee, Albuquerque, NM, AMDA, Caring for the Ages, 4(2). British Diabetic Association Report. (1999). Guidelines of practice for residents with diabetes in care homes, A report prepared by a Working Party of the British Diabetic Association on behalf of the Diabetes Care Advisory Committee.

Key Points About Diabetes in LTC

- Diabetes management must be individualized: patients' preferences, medical and functional status, and prognosis should be taken into consideration.
- Strict dietary restrictions should be replaced with a diet plan that incorporates eating habits and food preferences.
- Weight loss and increased activity may not be possible for many patients, and attempts to implement this may delay proper treatment.
- The physician is responsible for controlling blood glucose with pharmacological means if possible, to match food consumption.
- A thorough clinical evaluation of the patient is essential to determine the burden of diabetes and to formulate a treatment plan.
- An interdisciplinary effort is required to manage this complex disease.
- Daily attention to oral care and skin care may prevent complications overall. Specifically nutritional problems, pressure sores, foot ulcerations, and deep infections may be eliminated.
- Patient-specific treatment goals and reasons for not following recommended treatments should be documented in the medical record.
- Glycemic goals should be liberalized for the patient at risk of frequent hypoglycemia and for the patient who is at the end of life.

Screening and Management of Hyperglycemia in the Geriatric Population

TEXAS Department of State Health Services
TEXAS DIABETES COUNCIL
Approved 10/23/08

Geriatric is defined as age 65+ years[1]

Screening Recommendations for IFG, IGT & DM

FPG Annually[2]:

if above 100 mg/dL confirm with repeat fasting glucose. Avoid OGTT if possible[2]

if below 100 and high risk based on multiple risk factors and/or metabolic syndrome consider checking postload glucose[2]

Diabetes Management

Goals of Therapy: consider comorbidities before setting targets[1]:

A1c < 7% if attainable without significant hypoglycemia[3]

BP <130/80 mmHg

LDL <100 mg/dL (<70 if clinical vascular disease present)

Aspirin therapy (if no contraindications-older adults are more susceptible for GI bleeds)

Smoking cessation

Cardiovascular Risk Reduction

- Assess fasting lipids → Refer to TDC Algorithm on Lipid Management; use fibrates in caution due to renal insufficiency & consider 24 hour urine for Creatinine Clearance
- Obtain baseline EKG
- Consider stress testing based on appropriate evaluation of comorbidities & life expectancy
- Treat BP to goal
- Initiate ACE inhibitor or ARB if indicated
- Aspirin therapy if no contraindication

Diabetes Management

Initial Intervention:

1) When considering interventions, consider the following: life expectancy, comorbidities and specific geriatric syndromes such as cognitive impairment, history of falls, & sensory impairment
2) Diabetes Education: Blood glucose monitoring: establish daily glucose pattern (if appropriate and patient/caregiver able) using preprandial and 2 hours postprandial glucose checks; Lifestyle (exercise, weight control); Medical Nutrition Therapy (See TDC Algorithm & Toolkit)
3) Cardiovascular Risk Reduction [see CV risk reduction on left below]
4) If lean body habitus, consider diagnosis of Type 1 DM and consider measuring ICA & GAD antibodies and C-peptide. If positive antibodies or low C-peptide then consider insulin therapy.
5) Consider initiation of pharmacologic monotherapy at this time if A1c > 7-7.5% [see pharmacologic therapy below]

↓

Glucose goals not met within 3-6 months

↓

Pharmacologic Therapy

Considerations in choosing agent[1]: risk of hypoglycemia, comorbidities, polypharmacy, cost, life expectancy

Start with monotherapy[1]: acarbose, BAR, DPP-4, incretin mimetic, insulin, meglitinide, metformin, SU, TZD[4]

↓

Goals achieved: continue therapy

↓

A1c every 3-6 months

Not at goal within 3 months Add second agent if on monotherapy

↓

Not at goal within 3-6 months Consider adding third agent and/or referral to diabetes specialist

Footnotes:

1 Chronologic and physiologic age may diverge after age 65 so patients need to be assessed individually. The presence of comorbidities impacts therapeutic approach: Life expectancy, CHF, Renal disease, Cognitive impairment, Depression, Incontinence, Injurious falls, Persistent pain, Hip fracture, Malignancy, Nutritional Status and Polypharmacy (see TDC Diabetes Toolkit). Certain individuals aged < 65 years may benefit from this approach. If a more aggressive approach is desired please see TDC Algorithm for Glucose Control for Type 2 DM in Children and Adults and Diabetes Toolkit.

2 Fasting may miss people who have postload hyperglycemia. If the person has the Metabolic Syndrome with FPG below 126 mg/dl, consider also obtaining a postload glucose level. For postload glucose a 2 hour postprandial is preferred. Avoid OGTT if possible due to associated risks in this population. Postprandial glucose and/or postprandial urinalysis for glycosuria is less sensitive but have a place within certain screening programs where other methods are not practical. IGT is a 2 hour postload of 140-199 mg/dL. DM is a 2 hour postload of > 200 mg/dL.

3 Consider an individual target of <6% if attainable without significant hypoglycemia (Please see TDC Algorithm for Glucose Control for Type 2 DM in Children and Adults). If unable to reach <7% without hypoglycemia then target is < 8%

4 SUs not preferred due to risk of hypoglycemia; if an SU is used then it is recommended to avoid use of glyburide and chlorpropamide. TZDs must be used with caution in people with CAD or CHF. Refer to TDC Insulin Algorithm for insulin use.

Abbreviations

AGI	Alpha-Glucosidase Inhibitors
ACE inhibitor	Angiotensin Converting Enzyme Inhibitor
ARB	Angiotensin Receptor Blocker
BAR	Bile Acid Resin (colesevelam)
CAD	Coronary Artery Disease
DPP-4	Dipeptidyl peptidase-4 Inhibitor
FPG	Fasting Plasma Glucose
IFG	Impaired Fasting Glucose
IGT	Impaired Glucose Tolerance
GAD*	Glutamic Acid Decarboxylase
ICA*	Islet Cell Antibodies
OGTT	Oral Glucose Tolerance Test
SU	Sulfonylurea
TZD	Thiazolidinedione

*note: ICA and GAD antibodies usually take 1-2 weeks to be reported. If result is positive then patient has autoimmune mediated diabetes and insulin needs to be considered and oral agents may need to be discontinued

Hypoglycemia: Autonomic hypoglycemic warning signs may not be recognized in older adults due to changes in counter regulatory hormone response. Symptoms of hypoglycemia are often mistaken for co-existing medical conditions including postural hypotension, Parkinson's, dementia, traumatic brain injury or CVA. Patients that cannot communicate verbally with caregivers are at greater risk.

References

1. Sinclair A, Finucane P, eds. Diabetes in Old Age. 2nd ed. Chichester, UK: John Wiley & Sons, Ltd; 2001.
2. Madden KM, Tedder G, Lockhart C. The oral glucose tolerance test induces myocardial ischemia in healthy older adults. Clinical and Investigative Medicine 2007;30(3):E118-26.
3. Chang AM, Smith MJ, Bloem CJ, Galecki AT, Halter JB. Effect of lowering postprandial hyperglycemia on insulin secretion in older people with impaired glucose tolerance. Am J Physiol Endocrinol Metab 2004;287(5):E906-11.
4. Meneilly GS, Cheung E, Tuokko H. Altered responses to hypoglycemia of healthy elderly people. J Clin Endocrinol Metab 1994;78(6):1341-8.
5. Munshi M, Grande L, Hayes M, et al. Cognitive dysfunction is associated with poor diabetes control in older adults. Diabetes Care 2006;29(8):1794-9.
6. Care California Healthcare Foundation/American Geriatrics Society Panel in Improving Care for Elders with D. Guidelines for Improving the Care of the Older Person with Diabetes Mellitus. J Am Geriatr Soc 2003;51(5s):265-80.
7. Katakura M, Naka M, Kondo T, et al. Prospective analysis of mortality, morbidity, and risk factors in elderly diabetic subjects: Nagano study. Diabetes Care 2003;26(3):638-44.
8. Lipscombe LL, Gomes T, Levesque LE, Hux JE, Juurlink DN, Alter DA. Thiazolidinediones and cardiovascular outcomes in older patients with diabetes. JAMA 2007;298(22):2634-43.
9. Durso SC. Using clinical guidelines designed for older adults with diabetes mellitus and complex health status. JAMA 2006;295(16):1935-40.
10. Kuo HK, Jones RN, Milberg WP, et al. Effect of blood pressure and diabetes mellitus on cognitive and physical functions in older adults: a longitudinal analysis of the advanced cognitive training for independent and vital elderly cohort. J Am Geriatr Soc 2005;53(7):1154-61.
11. McBean AM, Huang Z, Virnig BA, Lurie N, Musgrave D. Racial variation in the control of diabetes among elderly medicare managed care beneficiaries. Diabetes Care 2003;26(12):3250-6.
12. Holt RM, Schwartz FL, Shubrook JH. Diabetes care in extended-care facilities: appropriate intensity of care? Diabetes Care 2007;30(6):1454-8.
13. Bertoni AG, Hundley WG, Massing MW, Bonds DE, Burke GL, Goff DC, Jr. Heart failure prevalence, incidence, and mortality in the elderly with diabetes. Diabetes Care 2004;27(3):699-703.
14. Okereke OI, Kang JH, Cook NR, et al. Type 2 diabetes mellitus and cognitive decline in two large cohorts of community-dwelling older adults. J Am Geriatr Soc 2008;56(6):1028-36.
15. The ADVANCE Collaborative Group. Intensive Blood Glucose Control and Vascular Outcomes in Patients with Type 2 Diabetes. N Engl J Med 2008;358(24):2560-72.
16. The Action to Control Cardiovascular Risk in Diabetes Study G. Effects of Intensive Glucose Lowering in Type 2 Diabetes. N Engl J Med 2008;358(24):2545-59.
17. European Diabetes Working Group for Older People. Clinical Guidelines for Type 2 Diabetes: European Union Geriatrics Medicine Society; 2004.

Texas Diabetes Council Authorship Minimum Practice Recommendations, Algorithms and Reports

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TEXAS DIABETES COUNCIL

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Minimum Standards for Diabetes Care Under Managed Care in Texas. 1995.
www.texasdiabetescouncil.org
Managed Care Work Group of the Texas Diabetes Council.

Minimum Standards for Diabetes Care in Texas. 1999.
www.texasdiabetescouncil.org
Managed Care Work Group of the Texas Diabetes Council.

Minimum Practice Recommendations Flow Sheet. 1998.
www.texasdiabetescouncil.org
Davidson J, Reasner C, Hollander P, Riley W, Falvey T, Spellman CW, Varma S, DeFronzo R, Kurtzman N, Forshay R, Garber A, Sherman L, Fehrenkamp S, Hollander P, Varma S, Kurtzman N, Hale D, Garza-Abijaoude L, Walz B, Plotkin R, DeNino L, Kajander J, Weiss B, et.al.

Minimum Practice Recommendations Flow Sheet. 2005.
www.texasdiabetescouncil.org
Spellman CW, Jackson J, Triplitt C, Hollander P, Sloan L, Walz B, Villagomez E, Garza-Abijaoude L, Varma, S.

Insulin Algorithm for Type 2 Diabetes Mellitus in Children and Adults. 2005.
www.texasdiabetescouncil.org
Jackson J, Spellman CW, Triplitt C, Hollander P, Sloan L, Bakdash M, Varma S, Walz B, Villagomez E, Menchaca J.

Initial Insulin Therapy for Type 2 Diabetes Mellitus in Children and Adults: A Simplified Approach. 2005.
www.texasdiabetescouncil.org
Spellman CW, Triplitt C, Jackson J, Villagomez E, Hollander P, Sloan L, Bakdash M, Varma S, Walz B, Menchaca J.

Exercise Algorithm for IFG/Type 2 Diabetes Prevention and Therapy. 2005.
www.texasdiabetescouncil.org
Walz B, Hollander P, Villagomez E, Jackson J, Spellman CW, Triplitt C, Sloan L, Garza-Abijaoude L.

Weight Loss Algorithm for Overweight and Obese Adults. 2005.
www.texasdiabetescouncil.org
Hollander P, Walz B, Villagomez E. Jackson J, Spellman CW, Triplitt C, Garza-Abijaoude L, Sloan L.

Prevention and Delay of Type 2 Diabetes in Children and Adults with IFG and/or IGT. 2005.
www.texasdiabetescouncil.org.
Hollander P, Jackson J, Spellman CW, Triplitt C, Sloan L, Bakdash M, Varma S, Menchaca J, Villagomez E, Walz B, Garza-Abijaoude L.

Weight Management Algorithm for Overweight Children and Adolescents. 2005.
www.texasdiabetescouncil.org
Hollander P, Triplitt C, Spellman CW, Jackson J, Walz B, Menchaca J, Villagomez E, Garza-Abijaoude L, Sloan L, Bakdash M, Varma S.

Macrovascular Risk Reduction in Diabetes: Antiplatelet Therapy 2006.
www.texasdiabetescouncil.org
Triplitt C, Jackson J, Sloan L, Spellman CW.

Glycemic Control Algorithm for Type 2 Diabetes Mellitus in Children and Adults. 2006.
www.texasdiabetescouncil.org
Jackson J, Triplitt C, Hollander P, Spellman CW, Sloan L, Bakdash M, Varma S, Villagomez E, Walz B, Menchaca J.

Insulin Algorithm for Type 1 Diabetes Mellitus in Children and Adults. 2006.
www.texasdiabetescouncil.org
Jackson J, Triplitt C, Spellman CW, Hollander P, Sloan L, Bakdash M, Varma S, Walz B, Villagomez E.

IV Insulin Infusion Protocol for Critically Ill Adult Patients in the ICU Setting. 2006.
www.texasdiabetescouncil.org
Spellman CW, Jackson J, Triplitt C, Hollander P, Sloan L, Bakdash M, Varma S, Walz B, Villagomez E.

Lipid Treatment Algorithm for Type 1 and Type 2 Diabetes Mellitus in Adults. 2006.
www.texasdiabetescouncil.org
Wyne KL, Spellman CW, Jackson J, Triplitt C, Sloan L, Hollander P.

Medical Nutrition Algorithm IFG/Type 2 Diabetes Prevention & Therapy. 2006.
www.texasdiabetescouncil.org
Garza-Abijaoude L, Villagomez E, Walz B, Hollander P, Spellman CW, Triplitt C, Sloan L.

Diabetic Foot Care / Referral Algorithm. 2006.
www.texasdiabetescouncil.org
Murdoch DP, Jackson J, Spellman CW, Triplitt C, Hollander P, Sloan L, Bakdash M, Harkless L.

Hypertension Algorithm for Diabetes Mellitus in Adults. 2007.
www.texasdiabetescouncil.org
Triplitt C, Sloan L, Hollander P, Spellman CW.

Recommendations for Treatment of Painful Peripheral Diabetic Neuropathy. 2007.
www.texasdiabetescouncil.org.
Triplitt C, Spellman CW, Wyne KL, Greene S, Sloan L, LaFontaine J.

Glycemic Control Algorithm for Type 2 Diabetes in Children and Adults. 2007.
www.texasdiabetescouncil.org.
Spellman CW, Wyne KL, Triplitt C, Greene S, Sloan L.

IV Insulin Infusion Protocol for Critically Ill Adult Patients in the ICU Setting. 2007.
www.texasdiabetescouncil.org
Spellman CW, Triplitt C, Wyne KL, Greene S.

ICU Insulin Orders: IV Insulin Infusion Protocol. 2007.
www.texasdiabetescouncil.org
Spellman CW, Wyne KL, Triplitt C, Greene S.

Lipid Treatment Algorithm for Type 1 and Type 2 Diabetes Mellitus in Adults. 2008.
www.texasdiabetescouncil.org
Wyne KL, Triplitt C, Spellman CW, Greene S, Hollander P.

Transition Algorithm From I.V. to S.Q. Insulin For Patients With Diabetes or Hyperglycemia. 2008.
www.texasdiabetescouncil.org
Spellman CW, Greene S, Wyne KL, Hollander P, Triplitt C, Sloan L.

Orders for Adults with DKA and Hyperglycemic Hyperosmolar State (HHS). 2008.
www.texasdiabetescouncil.org
Spellman CW, Greene S, Wyne KL, Hollander P, Triplitt C, Sloan L.

Screening and Management of Hyperglycemia in the Geriatric Population
www.texasdiabetescouncil.org
Wyne KL, Spellman CW, Triplitt C, Greene S, Hollander P, Sloan L.