

APPENDIX A

Criteria for Testing for Type 2 Diabetes in Children and Adolescents

Testing should be considered for individuals at age 10 or at onset of puberty, if puberty occurs at a younger age. Testing, preferably fasting plasma glucose, should be carried out at least every two years for youth who:

- Are overweight ($\geq 120\%$ of desirable body weight or $\text{BMI} \geq 25 \text{ kg/m}^2$)
- Have a first-degree relative with diabetes
- Are members of a high-risk ethnic population (e.g. African American, Hispanic/Latino American, Native American, Asian American or Pacific Islander)
- Have acanthosis nigricans
- Have recurrent vaginal yeast infections, urinary tract infections, skin infections
- Have delivered a baby weighing $> 9 \text{ lb}$ or have been diagnosed with gestational diabetes (GDM)
- Are hypertensive ($\geq 140/90 \text{ mmHg}$ or in children, higher than normal for the age group)
- Have an HDL cholesterol level $\leq 35 \text{ mg/dl}$ and/or a triglyceride level $\geq 250 \text{ mg/dl}$
- On previous testing, had IGT or IFG

Diagnosis of Diabetes Mellitus

The diagnosis of diabetes mellitus is a fasting plasma glucose of $\geq 126 \text{ mg/dl}$ (7.0 mmol/l) or a random plasma glucose of $\geq 200 \text{ mg/dl}$ (11.1 mmol/l).

Information adapted from the Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, American Diabetes Association, Diabetes Care, 22, 1999, and the Consensus Panel on Type 2 Diabetes in Children and Youth, American Diabetes Association, February 2000.

TYPES OF DIABETES IN CHILDREN AND ADOLESCENTS

The vast majority of cases of diabetes mellitus fall into two broad categories: Type 1 and Type 2. Type 2 is now being increasingly reported in children and adolescents.

Maturity onset diabetes in youth (MODY) is an autosomal dominant inherited condition caused by an abnormality in insulin production. MODY falls into a third category of diabetes mellitus that has a wide variety of other causes such as infection and specific genetic defects.

While it is imperative that a physician diagnose diabetes mellitus, the chart below is a guide to assessing the type of diabetes a pediatric patient might possibly have as an aid in making an appropriate referral.

It should be noted that in the case of suspected Type 1 diabetes mellitus, health care providers should respond immediately. Type 1 symptoms usually have an explosive onset and are rarely subtle or prolonged. A thin patient with no family history of diabetes mellitus and no acanthosis nigricans requires prompt care.

	TYPE 1	MODY	TYPE 2
WEIGHT	THIN	THIN	OBESE
FAMILY HISTORY OF D. M.	UNLIKELY	LIKELY	LIKELY **
ETHNICITY	NONE	NONE	VERY STRONG in: Mexican American African American Native American Asian & Pacific Islander
ACANTHOSIS NIGRICANS	NO	NO	YES
ACUTE PRESENTATION (e.g. ketoacidosis, dehydration)	LIKELY	UNLIKELY	UNLIKELY
CHRONIC SYMPTOMS >1 mo. (e.g. vaginal yeast infection, fatigue)	NO	YES	YES
ASYMPTOMATIC	RARE	POSSIBLE	IN ~ 50% OF CASES
AGE OF ONSET	ANY AGE Unusual > 25 years of age	PREDOMINANTLY PUBERTAL AND POST-PUBERTAL	PREDOMINANTLY PUBERTAL AND POST-PUBERTAL

**Not only a history of diabetes mellitus but also associated with early myocardial infarction (<50 years old), sudden death, hyperlipidemia, hypertension, menstrual irregularity, hirsutism in women and obesity.

Source: Daniel Hale, MD, The University of Texas Health Science Center at San Antonio/Dept. of Pediatrics.

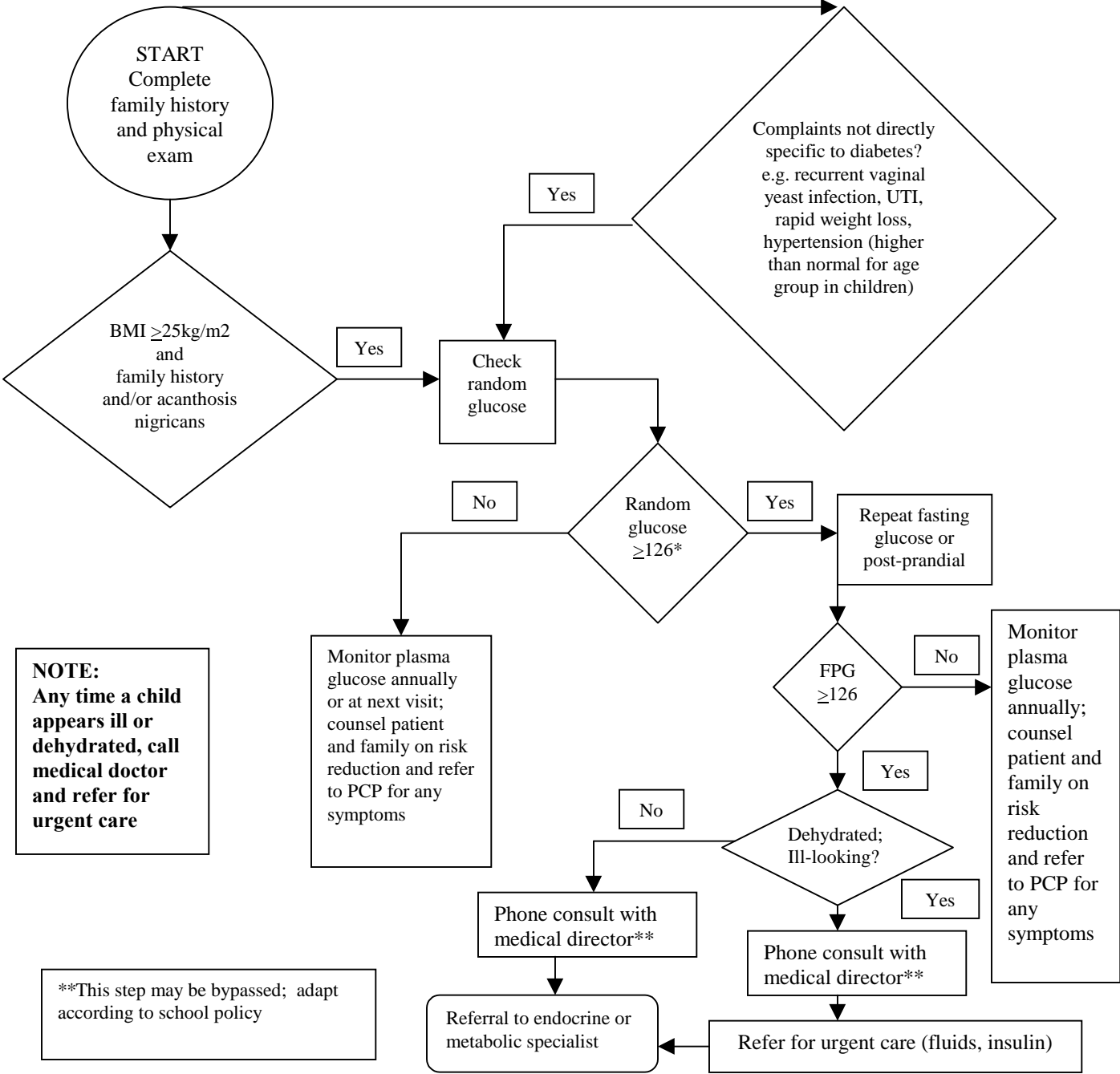
Pediatric Risk Factor Questionnaire:

To be administered by a health professional with a parent or someone knowledgeable about family history

	Rating System	Score
Do any of the following people in the child's family have diabetes:		
Mother, father, brother or sister	2 points if any	
Mother's mother, father, brother or sister	1 point if any	
Father's mother, father, brother or sister	1 point if any	
If they do NOT have diabetes, do any of these relatives have:		
High blood pressure (hypertension) OR High fat in the blood (cholesterol or lipids)	1 point if either/ (maximum of 1 point)	
A heart attack when they were younger than 50 years of age OR A sudden and unexpected death which was not the result of trauma or violence	1 point if either (maximum of 1 point)	
Did the mother have diabetes during pregnancy?*	1 point if yes	
Is the child's body mass index >25 kg/m ² ?	2 points if yes	
Is the child ≥ 10 years of age? OR Have physical signs consistent with puberty?	1 point if either/ (maximum of 1 point)	
Does the child have acanthosis nigricans?	1 point if yes	
Is the child hypertensive (blood pressure >95% for age and sex) OR Has the child/family reported that child has high blood lipids? (e.g. high cholesterol)	1 point if either/ (maximum of 1 point)	
Does the child have a previous history of "abnormal sugar" ?	2 points if yes	
A child scoring ≥ 5 points is at high risk for developing Type 2 diabetes and should be screened with a "finger stick" glucose annually	TOTAL	
*If female youth has been pregnant, gestational diabetes mellitus (GDM) should be considered. Although not part of this scoring system, having GDM puts an individual at risk.		

Source: Daniel Hale, MD, The University of Texas Health Science Center at San Antonio/Department of Pediatrics.

Protocol for Evaluation of Type 2 Diabetes in Individuals 10-18 Years of Age



NOTE:
Any time a child appears ill or dehydrated, call medical doctor and refer for urgent care

**This step may be bypassed; adapt according to school policy

PATIENT NAME: _____		DATE OF BIRTH: _____	
Referrals	Appointment Date	Report In	Treatment Plan
_____	_____	_____	_____
_____	_____	_____	_____

REFERENCE DATA FOR OVERWEIGHT AND OBESITY

Percentiles of Body Mass Index for Children and Youth, Ages 6-19 Years
From the National Health and Nutrition Examination Survey I (NHANES I)

MALES	50 th %tile	75 th %tile	95 th %tile		FEMALES	50 th %tile	75 th %tile	95 th %tile
	Kg/m ²	Kg/m ²	Kg/m ²			Kg/m ²	Kg/m ²	Kg/m ²
Age ↓					Age ↓			
6 yrs.	14.54	16.64	18.02		6 yrs.	14.31	16.17	17.49
7	15.07	17.37	19.18		7	14.98	17.17	18.93
8	15.62	18.11	20.33		8	15.66	18.18	20.36
9	16.17	18.85	21.47		9	16.33	19.19	21.78
10	16.72	19.60	22.60		10	17.00	20.19	23.20
11	17.28	20.35	23.73		11	17.67	21.18	24.59
12	17.87	21.12	24.89		12	18.35	22.17	25.95
13	18.53	21.93	25.93		13	18.95	23.08	27.07
14	19.22	22.77	26.93		14	19.32	23.88	27.97
15	19.92	23.63	27.76		15	19.69	24.29	28.51
16	20.63	24.45	28.53		16	20.09	24.74	29.10
17	21.12	25.28	29.32		17	20.36	25.23	29.72
18	21.45	25.92	30.02		18	20.57	25.56	30.22
19	21.86	26.36	30.66		19	20.80	25.85	30.72

Source: Must, A., Dallal, G.E., and Dietz, W.H. (1991). Reference data for obesity: 85th and 95th percentiles of body mass index (wt/ht²) and triceps skinfold thickness. *American Journal of Clinical Nutrition*, 1991; 53:839-46; adapted from Appendix A.

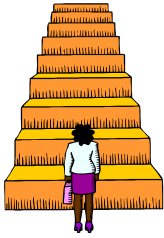
**Blood Pressure Levels for the 95th Percentiles for *Girls*,
Ages 6-17 Years by Percentiles of Height**

Age	Systolic Blood Pressure by Percentile of Height, mmHg				Diastolic Blood Pressure by Percentile of Height, mmHg		
	5 % (Short)	50 % (Avg.)	95 % (Tall)		5 % (Short)	50 % (Avg.)	95 % (Tall)
6 years	108	111	114		71	73	75
7	110	113	116		73	74	76
8	112	115	118		74	75	78
9	114	117	120		75	77	79
10	116	119	122		77	78	80
11	118	121	124		78	79	81
12	120	123	126		79	80	82
13	121	125	128		80	82	84
14	123	126	130		81	83	85
15	124	128	131		82	83	86
16	125	128	132		83	84	86
17	126	129	132		83	84	86

Blood Pressure Levels for the 95th Percentiles for **Boys,
Ages 6-17 Years, by Percentiles of Height**

Age	Systolic Blood Pressure by Percentile of Height, mmHg				Diastolic Blood Pressure by Percentile of Height, mmHg		
	5 % (Short)	50 % (Avg.)	95 % (Tall)		5 % (Short)	50 % (Avg.)	95 % (Tall)
6 years	109	114	117		72	74	76
7	110	115	119		74	76	78
8	111	116	120		75	77	80
9	113	117	121		76	79	81
10	114	119	123		77	80	82
11	116	121	125		78	80	83
12	119	123	127		79	81	83
13	121	126	130		79	82	84
14	124	128	132		80	82	85
15	127	131	135		81	83	86
16	129	134	138		83	85	87
17	132	136	140		85	87	89

Source: *Pediatrics*. Update on the 1987 Task Force Report on High Blood Pressure in Children and Adolescents: A Working Group Report for the National High Blood Pressure Education Program (1996); 98(4): 649-657.



Step-by-Step Management Tool for School Nurses to Aid Students at Risk for Type 2 Diabetes Mellitus

Steps:

1. Obtain weight, height, and blood pressure baseline data.
2. Establish body mass index (BMI) as indicated in Section IV. Assessment.
3. Assess percent normal/abnormal blood pressure. If blood pressure is elevated, repeat blood pressure assessment.
4. Assess for acanthosis nigricans, the cutaneous marker suggestive of insulin resistance (light brown-black coloration, rough, thickened areas of skin). Assess neck, axillae, elbows, knuckles, and knees. **Any acanthosis nigricans is abnormal.**
5. Initiate medical referral. Include elevated blood pressures, signs and symptoms of polyuria, polyphagia, polydipsia, nocturia, fatigue, rapid weight loss or gain, recurrent vaginal yeast infections, urinary tract infections, skin infections, dizziness, and blurred vision, as reported by student, parent, teacher, and/or nurse. Refer to sample medical referral form in Appendix B.
6. Contact parent(s) or guardian and inform of findings. Strongly advise seeking medical attention from primary health care provider.
7. Ascertain health insurance status to refer to private primary health care provider, diabetes clinic or other providers.
8. Complete pediatric risk factor questionnaire with parent and attach to medical referral form.
9. Compile information packet for primary care provider as suggested under Appendix C, "Suggestions for Providing Information to Primary Health Care Providers."
10. As appropriate, provide parent(s) or guardian with the information sheets on insulin resistance, acanthosis nigricans, and Type 2 diabetes found in Appendix B.
11. Follow-up on student's medical evaluation.
12. Obtain physicians' orders and note in student's health record.
13. As appropriate, inform administrator, health services, classroom teachers, P.E. coach, food service staff (if any diet changes), school dietitian, of diagnosis. Provide information sheets, "To the Teacher," "To the Principal," in Appendix C.
14. Prepare emergency management plan for student as appropriate.
15. As appropriate, provide student and family with education on daily nutrition, medication compliance, physical activity, and referral to diabetes resources and services such as support groups.