

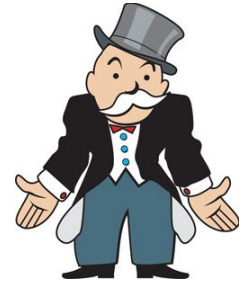
Distinguishing T1D vs. T2D in Childhood: a case report for discussion

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Disclosure



- I have no financial disclosures to report.

OBJECTIVES

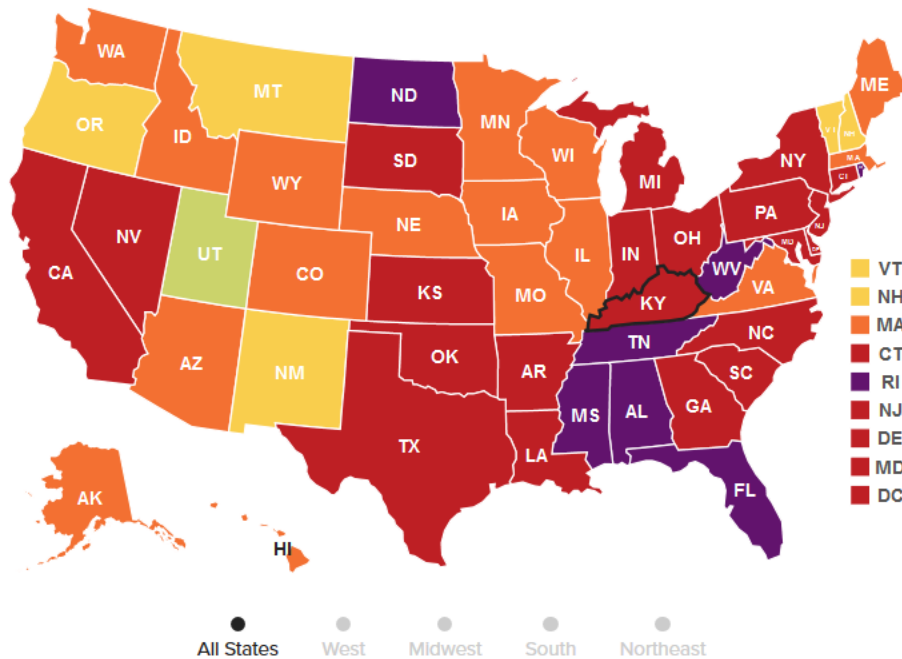
- 1. List 3 clinical and biochemical characteristics typically found in children with new onset type 1 diabetes mellitus.
- 2. Recognize the difficulty in distinguishing between type 1 and type 2 diabetes mellitus in youth given the high prevalence of obesity in this population.
- 3. Enumerate 3 clinical and biochemical characteristics typically found in youth with new onset type 2 diabetes mellitus.

Overweight & Obese Children 10-17, 2016

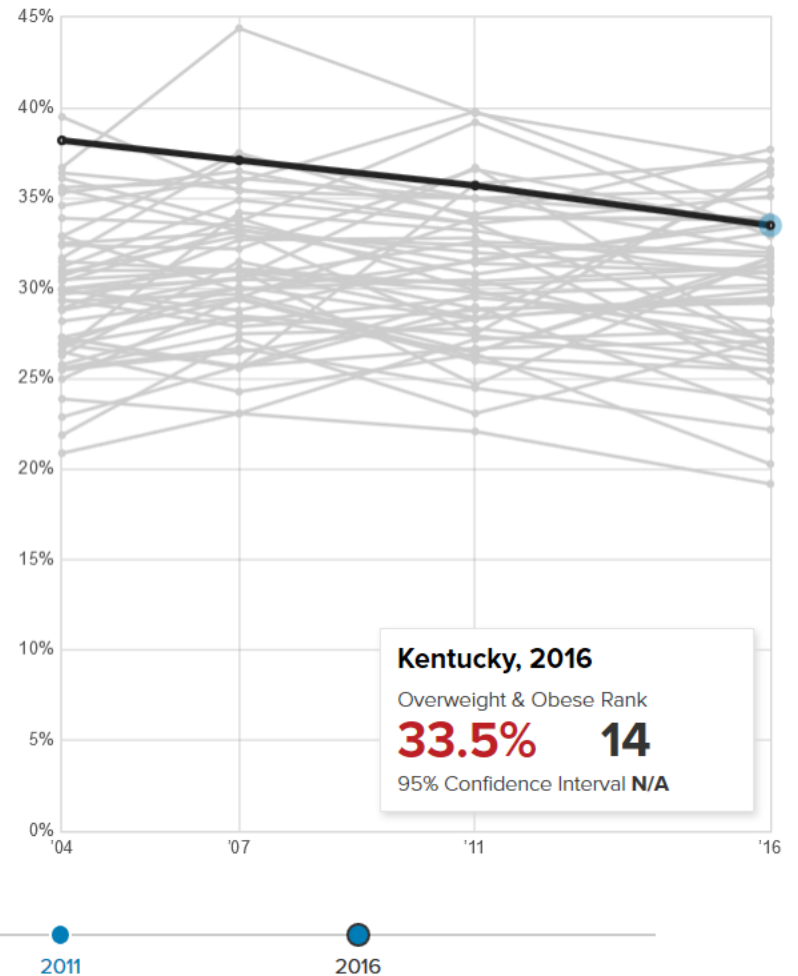
Select years with the slider to see historical data. Hover over states for more information. Click a state to lock the selection. Click again to unlock.

Combined overweight and obese rates, children ages 10 to 17

0 - 9.9% 10 - 14.9% 15 - 19.9% 20 - 24.9% 25 - 29.9% 30 - 34.9% 35%+



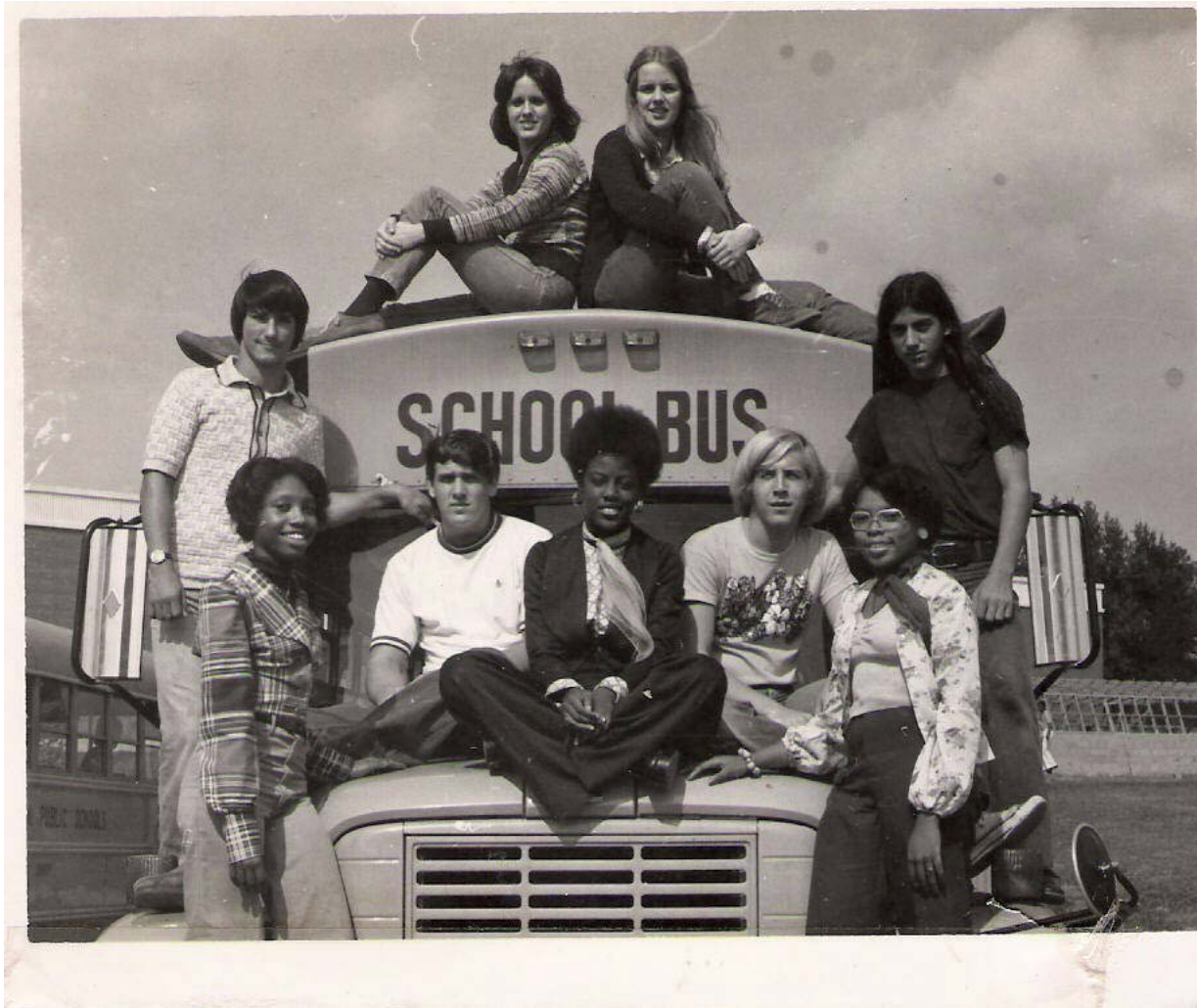
Overweight & Obese 10-17s, 2004 to 2016



Rank ▲	State	Overweight & Obese 10-17s 2016	95% Confidence Interval	Trend 2004 - 2016
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Developed in collaboration with the Child and Adolescent Health Measurement Initiative (CAHMI), Johns Hopkins Bloomberg School of Public Health. For state data see the CAHMI Data Resource Center for Child and Adolescent Health website's 2016 National Survey of Children's Health (NSCH) data query tool.

Seniors 1975



Seniors 2015



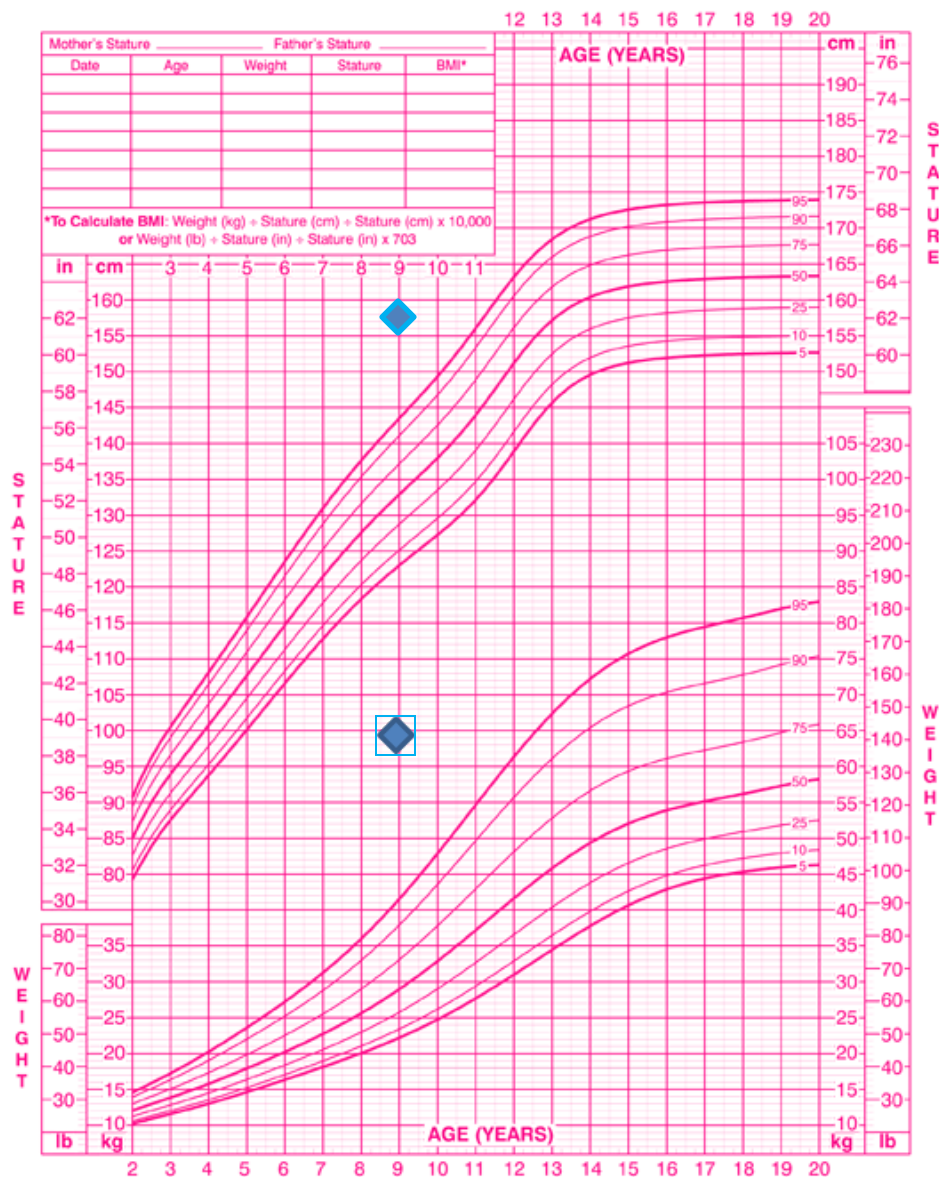
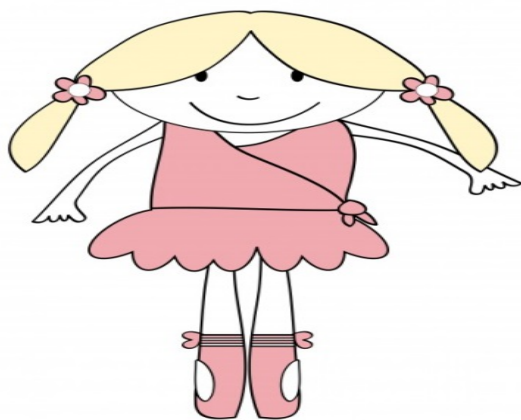
Example Case

- “Dee”- Previously healthy 9 year old female with 4-6 weeks of increased thirst, urination, fatigue. Mother has “Insulin-dependent diabetes” so she checked girl’s BG with her home meter (245 mg/dl)
- Taken to PCP where:
 - Weight: 130 lbs.
 - Height: 5 ft
 - B/P: 110/65
 - HR: 104/min
 - POC BG: 223 mg/dl (fasting)
 - Urine: 1000 glucose, small ketones

2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



Published May 30, 2000 (modified 11/21/00).
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>



CAN WE SAY:

- A. She has type 1 diabetes?
- B. She has type 2 diabetes?
- C. She has diabetes?



What can we say for sure?

- This girl has new onset diabetes
 - Type?
 - Most appropriate initial management?
 - Referral?
 - Education?



More information

- Patient complains of dysuria, perineal pruritus. Has history of eczema, seasonal allergies
- Father takes pills for his blood sugar, mother takes insulin
- Several 2nd degree and more distant relatives with Type 2 diabetes in family
- Physical exam:
 - No acute distress, well hydrated, obese and tall
 - Normal otherwise except for very mild darkening/thickening of skin around neck
 - She is pre-pubertal

What other information?

- Ethnicity
 - Caucasian, Irish- English descent
- Weight loss?
 - Has lost 5-7 lbs in last 2 weeks
- A1c= 9.5% (information not available until day after clinic visit)
- Maternal age at diagnosis and diabetes medications taken
 - Mom was 10 years old at diagnosis, uses an insulin pump for her diabetes care

Our case:

- PCP diagnosed Dee with Type 2 diabetes and started her on Metformin 500 mg by mouth twice daily
- Asked mom to check fingerstick BG 4 times per day and keep records
- Faxed referral to Peds ENDO at UK

Audience?

AGREE



DISAGREE



Management of Newly Diagnosed Type 2 Diabetes Mellitus (T2DM) in Children and Adolescents

Kenneth C. Copeland, Janet Silverstein, Kelly R. Moore, Greg E. Prazar, Terry Raymer, Richard N. Shiffman, Shelley C. Springer, Vidhu V. Thaker, Meaghan Anderson, Stephen J. Spann and Susan K. Flinn

Pediatrics 2013;131;364; originally published online January 28, 2013;

DOI: 10.1542/peds.2012-3494

- Childhood T2DM:
 - disease in the child who typically is **overweight or obese** (BMI \geq 85th–94th and $>$ 95th percentile for age and gender, respectively)
 - has a **strong family history of T2DM**
 - has substantial residual insulin secretory capacity at diagnosis (reflected by normal or elevated insulin and C-peptide concentrations) (?)
 - has insidious onset of disease
 - demonstrates insulin resistance (including clinical evidence of polycystic ovarian syndrome or **acanthosis nigricans**)
 - lacks evidence for diabetic autoimmunity (negative for autoantibodies typically associated with T1DM) (?)

At UK Diabetes clinic- 2 weeks later...

- A1c= 10.3%
- Glucometer data for last 2 weeks show BG range of 150-350 mg/dl
- Symptoms unchanged
- Good compliance with Metformin reported (*)
- Labs?

Decision-making process

Type 1

- Pre-pubertal 9 year old
- Caucasian
- Well defined, “short” course
- Symptoms- polys, fatigue

Type 2

- Obese
- Parent with Type 2 diabetes
- ?? Acanthosis

Dark/ thick skin around neck

Lichenification in chronic eczema



Acanthosis nigricans



Initial management

Insulin

- Used in all ages
- A1c > 9%
- **Useful in all types of diabetes**
- Clear per kg dosing guidelines
- **INJECTIONS/ NEEDLES!!**
- **Hypoglycemia/ education**

Metformin

- FDA approved for age 11+
- Tablets
- Few mild side effects
- Lowers A1c only by 1.5- 2% if used correctly
- Contraindicated in Type 1 diabetes

Work-up

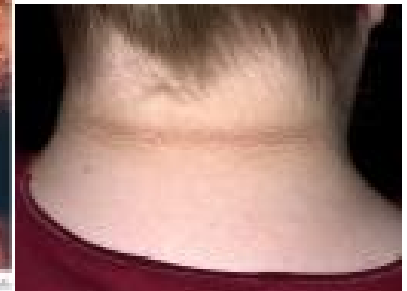
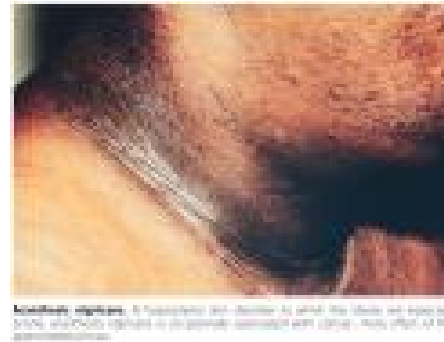
- C-peptide
- GAD-A antibody (Glutamic acid decarboxylase)
- ICA antibody (Islet cell cytoplasmic)
- Zn T8 (Zinc transporter 8 protein)
- IAA (Insulin autoantibodies)
- IA-2 (Insulinoma 2-associated antibodies)

Dee- Results

- GAD +
- IAA +
- Zn Tr8 +
- C-peptide= 0.3 (0.8- 5.3 ng/mL)

Type 2 Diabetes in Youth

- Insulin resistance + impaired β -cell function
=HYPERGLYCEMIA
- Genetic predisposition
- Mother with GDM
 - “Fetal programming”- SGA
 - Metabolic memory
- OBESITY
 - ACANTHOSIS NIGRICANS
- ETHNICITY
 - Hypertension and hyperlipidemia
 - NAFLD



Type 1 vs.

- 11% overweight (up to 22%)
- Shorter, well defined course
- DKA -up to 40%
- 5% with family history T1DM

Type 2

- > 80% **overweight-acanthosis**
- Insidious course, poorly defined
- $\frac{1}{4}$ - $\frac{1}{3}$ with *mild* ketonuria
- Almost **100% with 1st or 2nd degree affected relative**

Differences

Type 1

- Low c-peptide
- Caucasian race
- Higher incidence of other autoimmune disorders
- Presence of beta-cell autoimmunity markers

Type 2

- Normal, high c-peptide/insulin levels
- **Ethnic minority** youth
- Absent autoimmunity markers

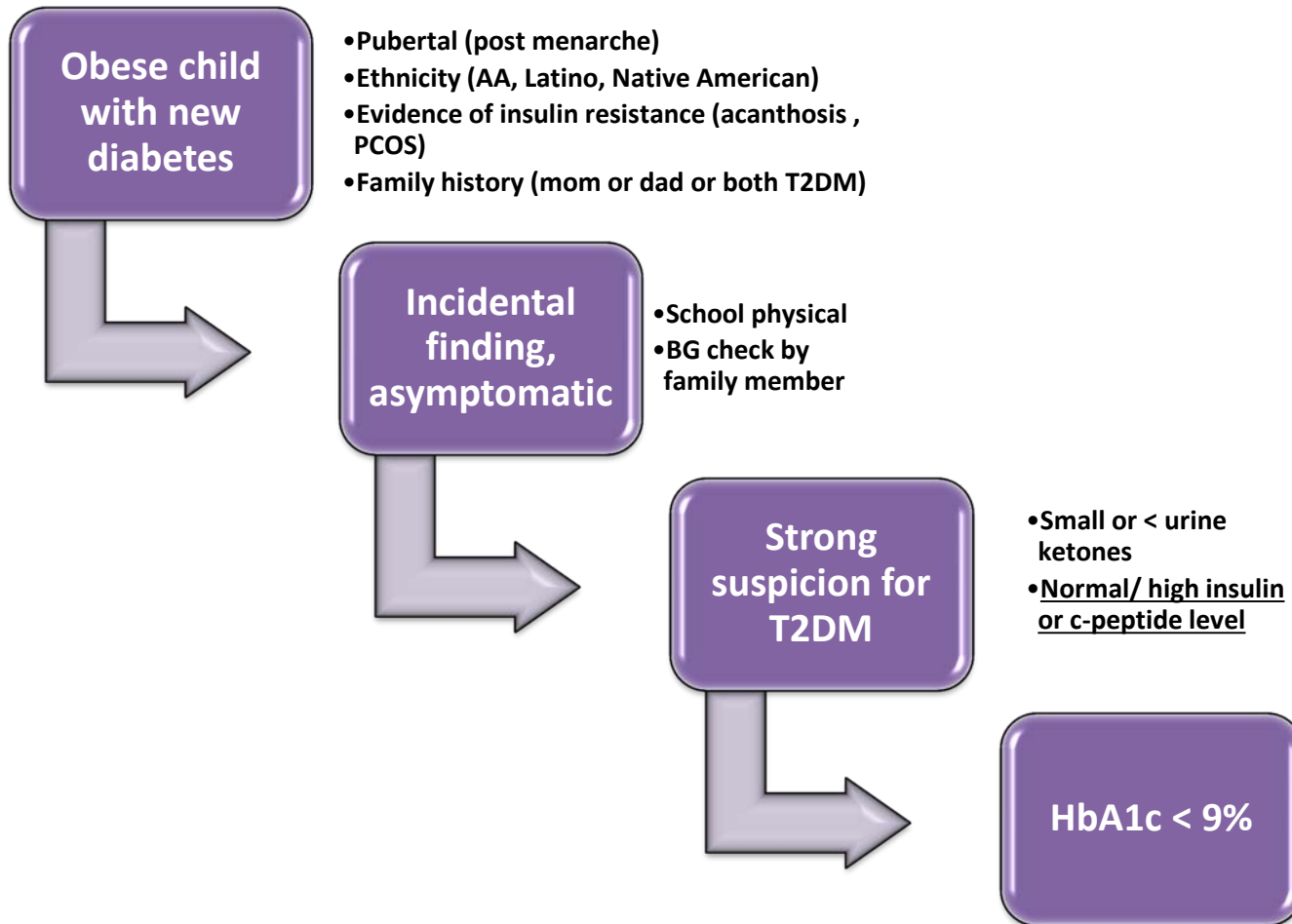
217 consecutive kids with new onset diabetes at KCH (2015-17)

Characteristic	Type 1 diabetes	Type 2 diabetes
Number	201 (93%)	16 (7%)
BMI range	13- 41	25- 59
Age ranges	<p>11 months- 17 years</p> <p>Most frequent age at diagnosis = 12 y</p> <p>2nd most frequent age = 7 y</p>	<p>11 y- 17 y (average age 15)</p> <p>Most frequent age at diagnosis = 16 y</p>

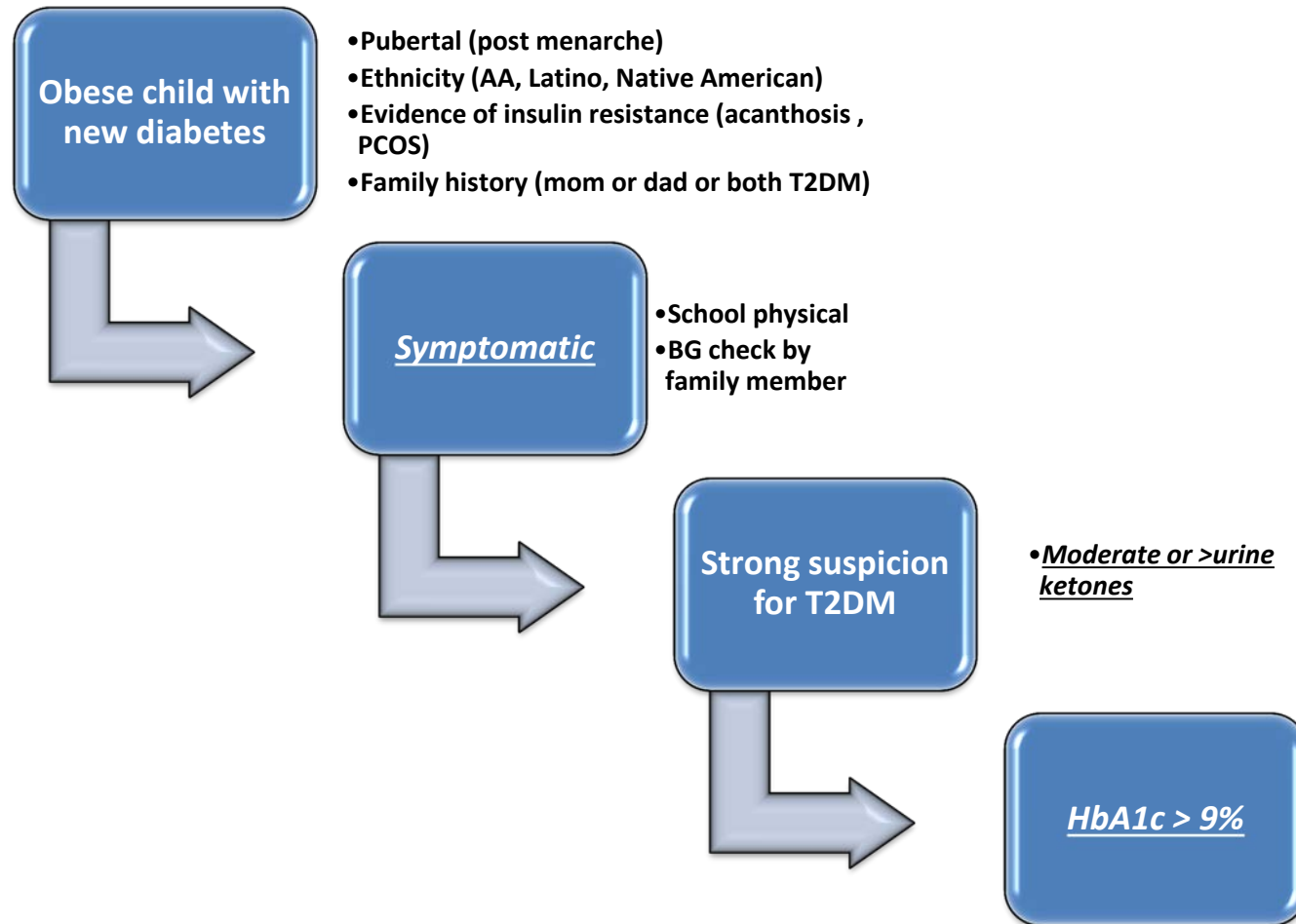
≈ 30% of American youth (10-18) with new onset diabetes have
T2DM:

- 46.1% of Hispanic youth
 - 57.8% of non-Hispanic blacks
 - 69.7% of Asian/ Pacific Islanders
 - 86.2% in Native Americans
 - 14.9% in non-Hispanic whites (3 out of 20 new onset kids)
-
- Dabelea D, Bell RA, D'Agostino Jr RB, Imperatore G, Johansen JM, Linder B, Liu LL, Loots B, Marcovina S, Mayer-Davis EJ, Pettitt DJ, Waitzfelder B; SEARCH for Diabetes in Youth Study Group 2007. ***Incidence of diabetes in youth in the United States. JAMA 297:2716–2724***

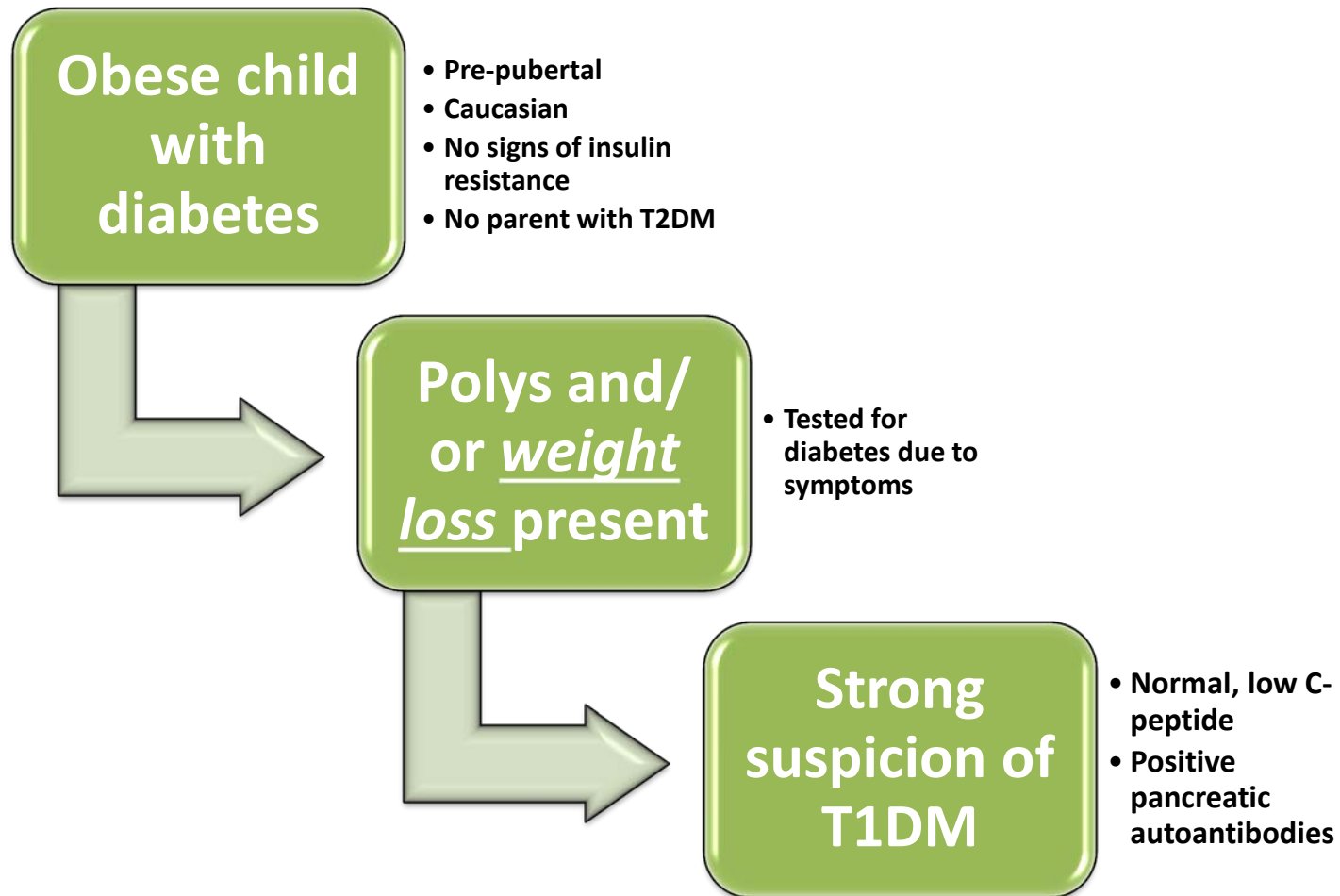
Consider use of Metformin



Consider use of Insulin as first choice



Always Insulin as first choice



References

- Characteristics of Adolescents and Youth with Recent-Onset Type 2 Diabetes: The TODAY Cohort at Baseline. *J Clin Endocrinol Metab* 96: 159–167, 2011
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<http://pediatrics.aappublications.org/content/131/2/e648.full.html>
- Dabelea D, Bell RA, D'Agostino Jr RB, Imperatore G, Johansen JM, Linder B, Liu LL, Loots B, Marcovina S, Mayer-Davis EJ, Pettitt DJ, Waitzfelder B; SEARCH for Diabetes in Youth Study Group 2007. *Incidence of diabetes in youth in the United States. JAMA* 297:2716–2724

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