

Optimizing Management of Type 2 Diabetes in the School Setting

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2024 School Nurse Conference

PEDIATRIC ENDOCRINOLOGY



2024 Virtual Diabetes Management Conference for School Nurses

Provided by Texas Children's Hospital

NURSING CONTINUING PROFESSIONAL DEVELOPMENT

Texas Children's Hospital is approved with distinction as a provider of nursing continuing professional development (NCPD) by the Texas Nurses Association, an accredited approver by the American Nurses Credentialing Center's Commission on Accreditation.

REQUIREMENTS FOR SUCCESSFUL COMPLETION

To receive contact hours for this nursing continuing professional development activity, the participant must:

- Register for the continuing professional development activity
- Attend at least one session of the professional development activity
- Complete the pre-conference survey
- Complete the post-conference survey online

Print your contact hour "Certificate of Successful Completion" once you have completed the post-conference survey online .

LEARNING OUTCOME

As a result of this professional development activity, 90 % of attendees will be able to name one concept learned on the post conference survey as it relates to care of the child with diabetes as well as attendees will demonstrate increased knowledge as evidenced by an increase in scores on the post conference survey when compared to the pre-conference survey.

RELEVANT FINANCIAL RELATIONSHIPS

Explanation: a relevant financial relationships occurs when an individual has an opportunity to affect or impact educational content with which he or she may have a relationship with an ineligible company or a potentially biasing relationship of a financial nature. All planners and presenters/authors/content reviewers must disclose the presence or absence of a relevant financial relationship relative to this activity. All potential relationships are mitigated prior to the planning, implementation, or evaluation of the continuing education activity. All activity planning committee members and presenters/authors/content reviewers have had their relevant financial relationships assessed, identified and mitigated by Activity Director & the nurse planner.

The activity's Nurse Planner has determined that no one who has the ability to control the content of this nursing continuing professional development activity – planning committee members and presenters/authors/content reviewers – has a relevant financial relationship.

DISCLOSURES

- I have no relevant financial relationships with any ineligible company to disclose.
- I do not intend to discuss unlabeled or unapproved use of drugs or products in this presentation.

OBJECTIVES

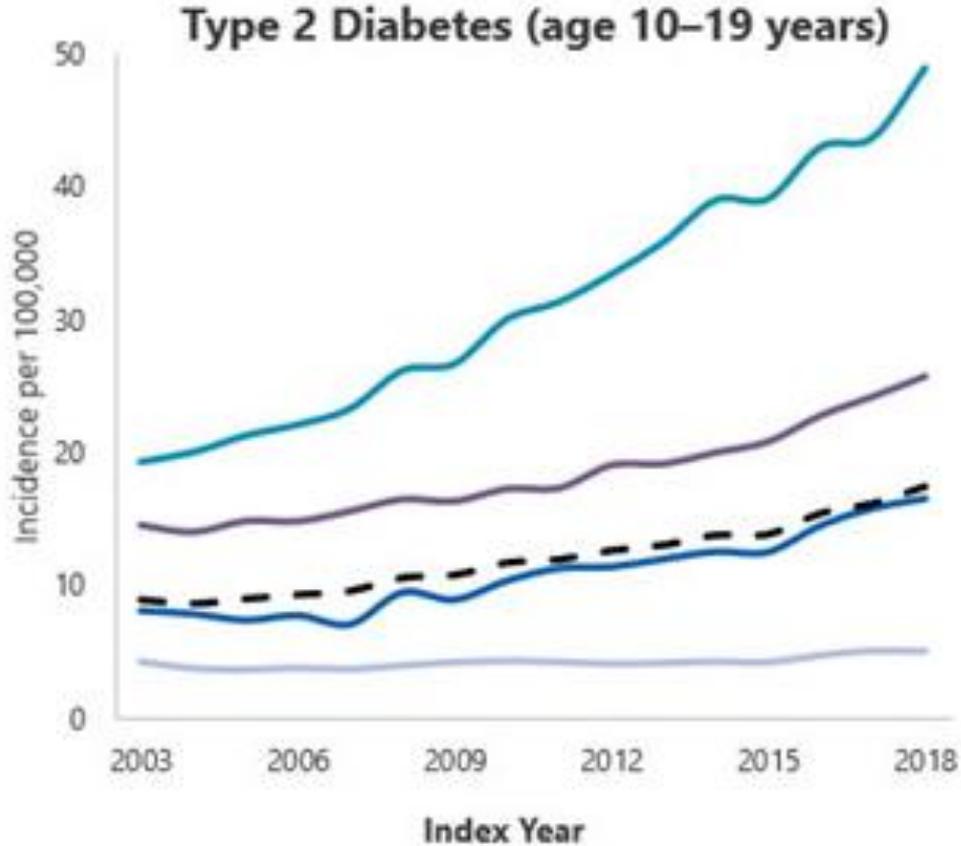
- Describe basic pathophysiology of type 2 diabetes
- Discuss risk factors for Type 2 diabetes in youth
- Discuss management of type 2 diabetes including healthy eating, exercise, pharmacologic therapy, surgery
- Discuss mechanism of action and potential side effects of pharmacologic therapy

TYPE 2 DIABETES

Characterized by hyperglycemia, insulin resistance, and relative impairment in insulin secretion

- The pancreas makes insulin but the body is not able to use it properly due to insulin resistance
- The body makes extra insulin to make up for this but then over time it may not be able to make enough insulin to keep blood sugars normal

TRENDS IN INCIDENCE



— White, non-Hispanic — Black, non-Hispanic — Hispanic — Asian/Pacific Islander, non-Hispanic - - Overall

Figure from cdc.gov

RISK FACTORS FOR CHILDHOOD-ONSET T2DM -OBESITY

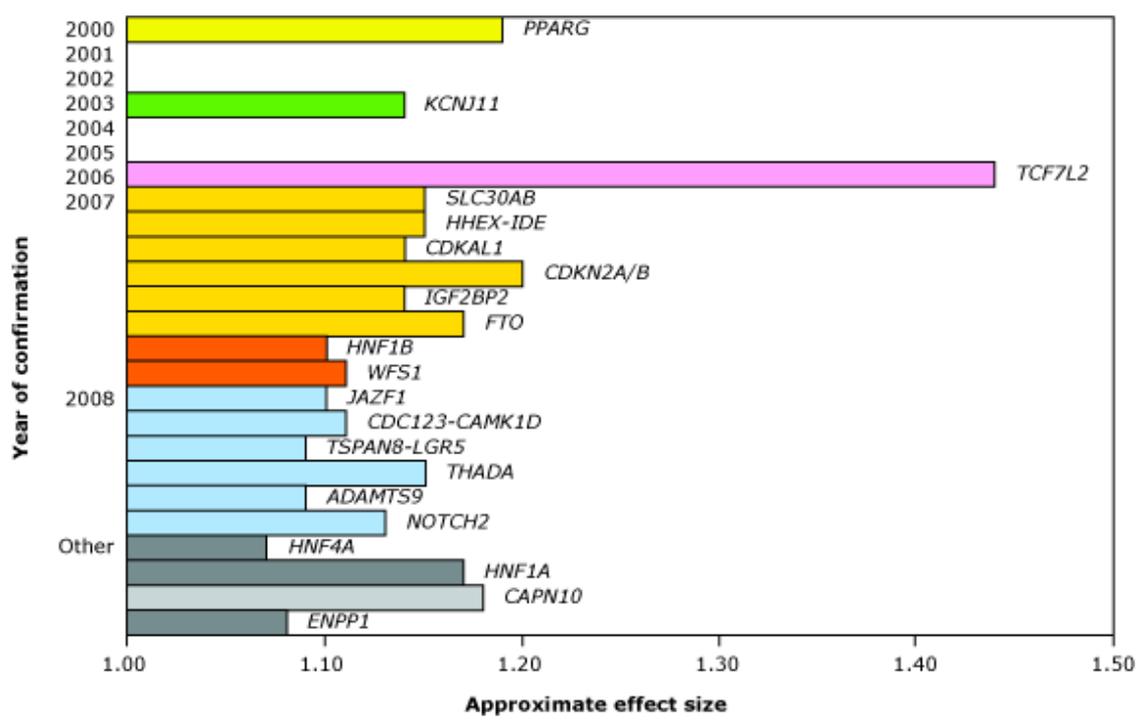
- - BMI $\geq 95^{\text{th}}$ %
- SEARCH study showed that nearly 80% of youth with T2DM were obese and an additional 10% were overweight
- - Predisposes to T2DM by increasing peripheral resistance to insulin-mediated glucose uptake

RISK FACTORS FOR CHILDHOOD-ONSET T2DM

GENETIC SUSCEPTIBILITY

- Risk of T2DM is significantly increased in close relatives of an affected patient
- 50-75% of children/adolescents have at least one affected parent
- In monozygotic twins, the other twin has a 90% chance of developing diabetes
- Several candidate genes have been linked to T2DM
 - Involved in pancreatic development, insulin synthesis, secretion, or action

GENETIC LOCI ASSOCIATED WITH T2DM



RISK FACTORS FOR CHILDHOOD-ONSET T2DM – ETHNICITY

More common in Native American, African American, Asian American, and Pacific Islander Children

RISK FACTORS FOR CHILDHOOD-ONSET T2DM – FEMALE GENDER

- Girls are 1.3-1.7 times more likely than boys to develop T2DM during adolescence
- Possibly due to increased risk of insulin resistance, as seen in girls with PCOS

RISK FACTORS FOR CHILDHOOD-ONSET T2DM – AGE AND PUBERTAL STATUS

- Many patients with childhood onset T2DM present at the onset or during puberty
- Physiologic insulin resistance

RISK FACTORS FOR CHILDHOOD-ONSET T2DM – CONDITIONS ASSOCIATED WITH INSULIN RESISTANCE

- Low Birth Weight
- Gestational Diabetes
- Polycystic Ovarian Syndrome

ADA RISK-BASED SCREENING FOR TYPE 2 DIABETES OR PREDIABETES IN ASYMPTOMATIC CHILDREN AND ADOLESCENTS

Screening should be considered in youth who have overweight (≥ 85 th percentile) or obesity (≥ 95 th percentile) PLUS

Maternal history of diabetes or GDM during the child's gestation

Family history of type 2 diabetes in first- or second-degree relative

Race and ethnicity (e.g., Native American, African American, Latino, Asian American, Pacific Islander)

Signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, polycystic ovary syndrome, or small-for-gestational-age birth weight)

COMPLICATIONS OF TYPE 2 DIABETES IN YOUTH

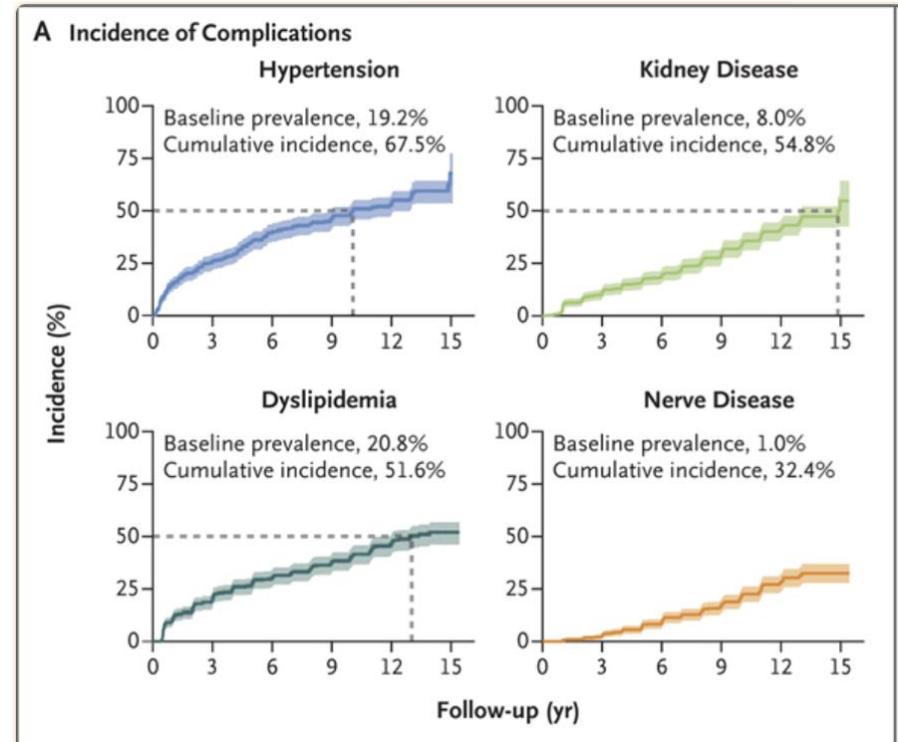
- Youth-onset type 2 diabetes is associated with significant microvascular and macrovascular risk burden
- Substantial increase in the risk of cardiovascular morbidity and mortality at an earlier age than those individuals diagnosed later in life
- Diabetes comorbidities appear to be higher than in youth with type 1 diabetes despite shorter diabetes duration and lower A1C

COMPLICATIONS AND RELATED CONDITIONS

- Macrovascular
 - Stroke/MI
- Microvascular
 - Nephropathy
 - Neuropathy
 - Retinopathy
- Non alcoholic fatty liver disease
- Obstructive sleep apnea
- Dyslipidemia
- Hypertension
- PCOS

TODAY STUDY – HIGH INCIDENCE OF COMPLICATIONS

- Incidence of all microvascular and macrovascular complications increased by 15 years
- 15 year cumulative incidence of any microvascular complication was 80% at mean age 26 years



TODAY Study Group, et al. Long-Term Complications in Youth-Onset Type 2 Diabetes. *N Engl J Med.* 2021

SYMPTOMS OF DIABETES

- Excessive thirst
- Frequent urination
- Fatigue/sleepiness
- Unintentional/unexplained weight loss
- Blurry vision
- Sometimes, the presenting complaint is fungal infection

MANAGING TYPE 2 DIABETES: LIFESTYLE

Participation in at least 60 min of moderate to vigorous physical activity daily (with muscle and bone strength training at least 3 days/week) and decreasing sedentary behavior

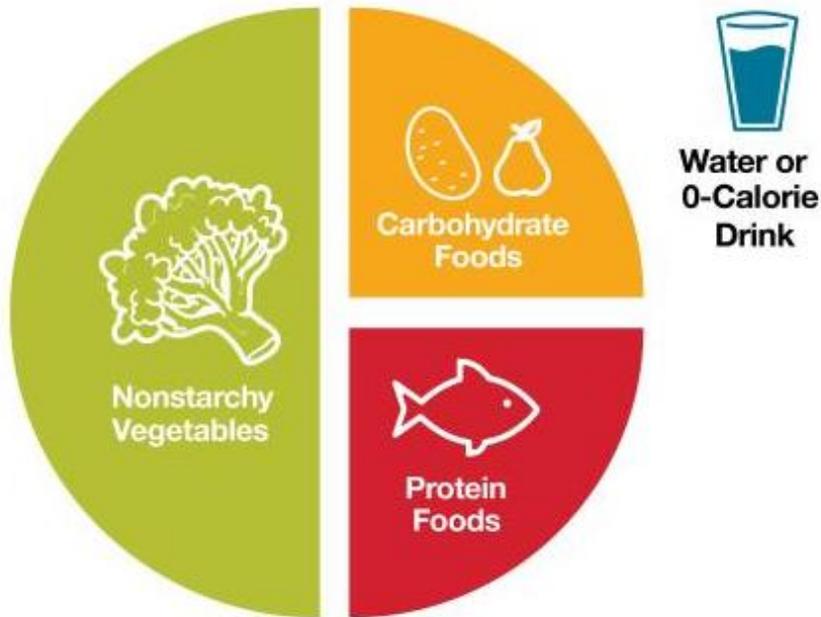


Nutrition should focus on healthy eating patterns that emphasize consumption of nutrient-dense, high-quality foods and decreased consumption of calorie-dense, nutrient-poor foods, particularly sugar-added beverage



PEDIATRIC ENDOCRINOLOGY

THE PLATE METHOD

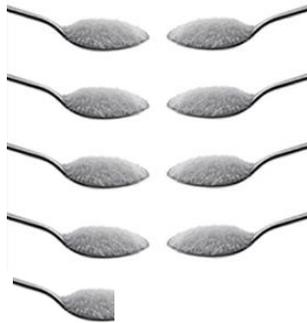


- Fill $\frac{1}{2}$ of the plate with non starchy vegetables
- Fill $\frac{1}{4}$ with lean protein/plant based sources of protein
- Fill $\frac{1}{4}$ with carbohydrate
- Water or a low calorie drink

HOW MUCH SUGAR IS IN OUR DRINKS?



20 fl oz



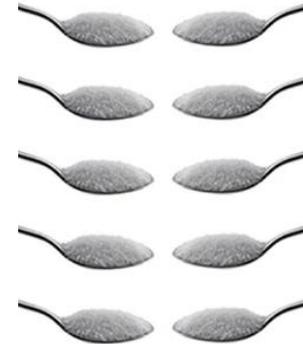
12 fl oz



12 fl oz



12 fl oz



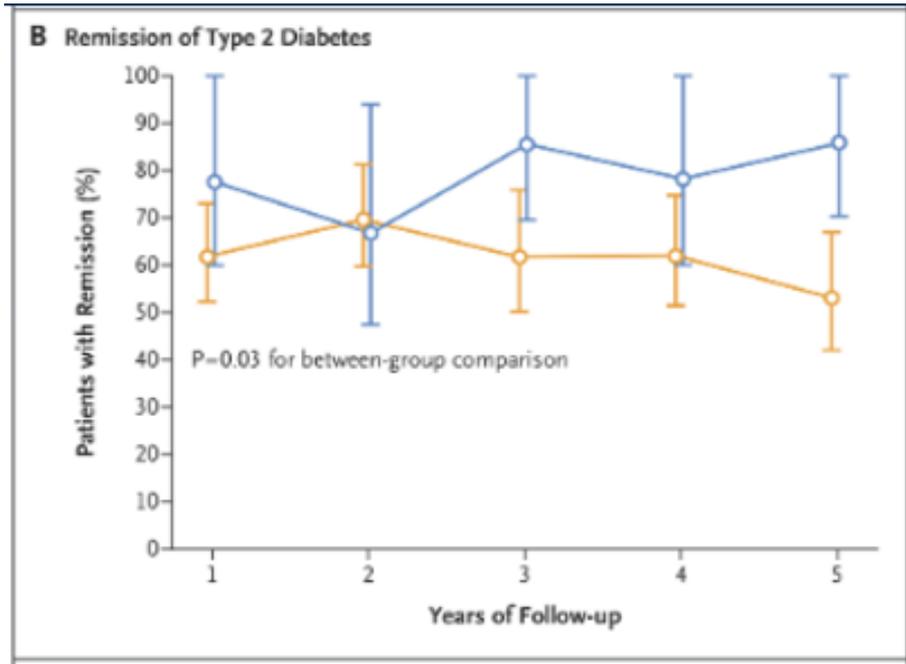
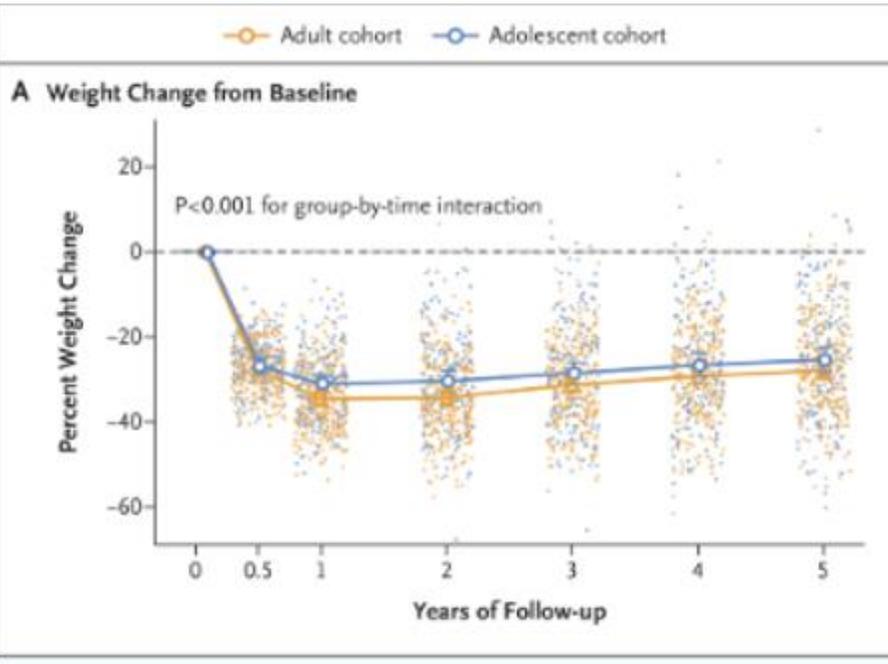
CURRENT PHARMACOLOGIC TREATMENT OPTIONS FOR YOUTH ONSET TYPE 2 DIABETES

1. Metformin
2. GLP1 receptor agonists: Liraglutide, Exenatide, Dulaglutide
3. SGLT2 inhibitor: Empagliflozin
4. Insulin

2024 ADA STANDARDS OF CARE

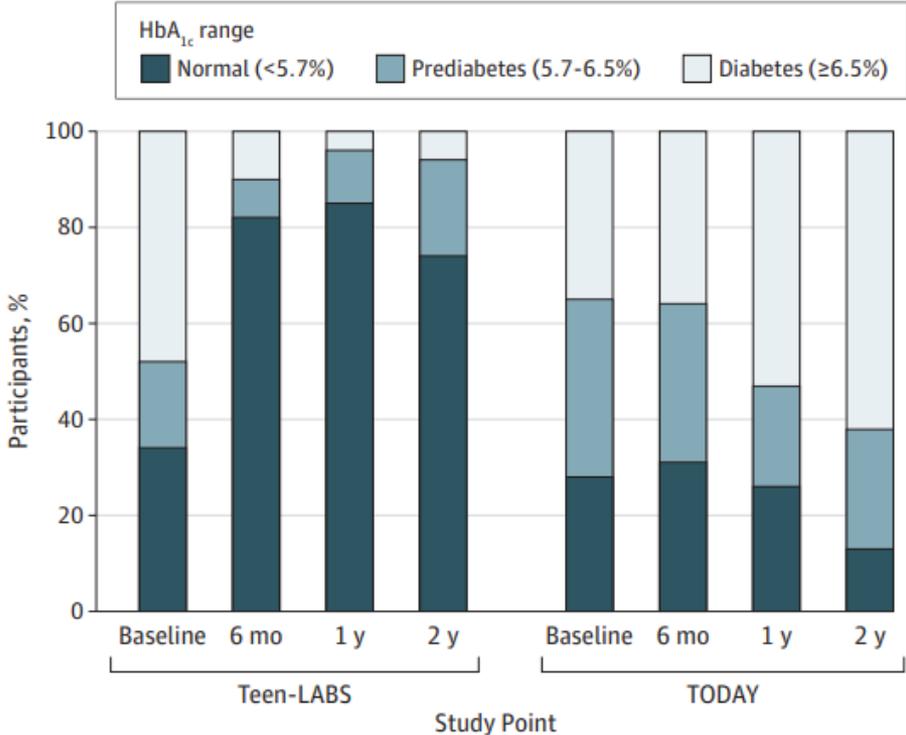
- Metabolic surgery may be considered for the treatment of adolescents with type 2 diabetes who have class 2 obesity or higher (BMI >35 kg/m² or 120% of 95th percentile for age and sex, whichever is lower) and who have elevated A1C and/or serious comorbidities despite lifestyle and pharmacologic intervention

BARIATRIC SURGERY



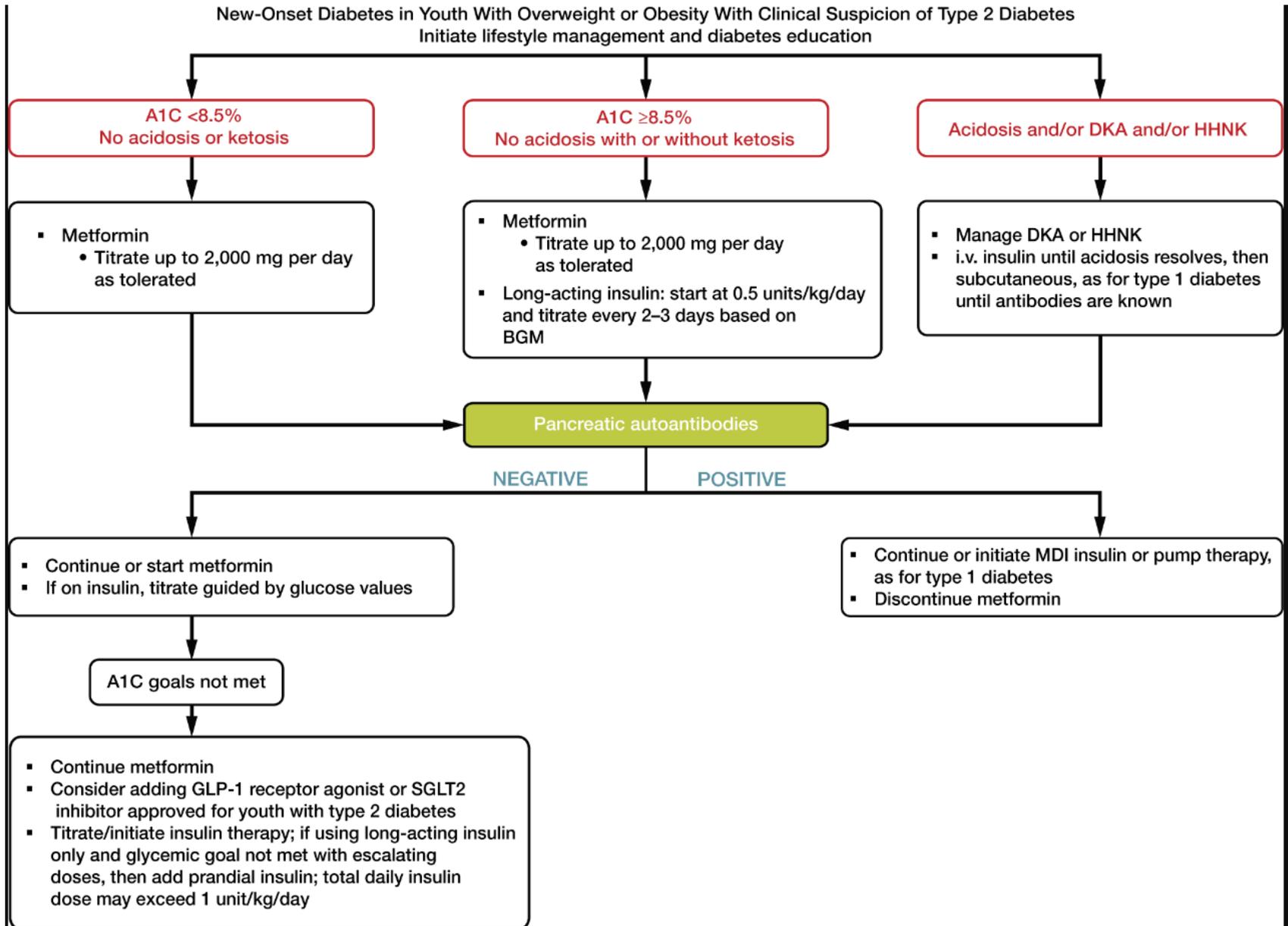
BARIATRIC SURGERY

Figure 2. Changes in the Proportion of Participants With Hemoglobin A_{1c} (HbA_{1c}) Concentrations



Teen-LABS indicates Teen-Longitudinal Assessment of Bariatric Surgery; TODAY, Treatment Options of Type 2 Diabetes in Adolescents and Youth.

2024 ADA STANDARDS OF CARE



METFORMIN (GLUCOPHAGE)

- Dose 500-2000mg in twice per day or once per day (XR)
- Metformin decreases hepatic glucose output by inhibiting gluconeogenesis and increases insulin mediated glucose utilization in peripheral tissues particularly after meals
- Also has an antilipolytic effect, which lowers free fatty acids, which reduces substrate for gluconeogenesis
- It has been shown to decrease foods intake and body weight

SIDE EFFECTS OF METFORMIN

- Nausea, vomiting
- Diarrhea/loose stools
- Metallic taste in mouth
- Reduced B12 absorption
- Contraindicated with history of lactic acidosis

GLP 1 RECEPTOR AGONIST: LIRAGLUTIDE (VICTOZA)

- Approved for type 2 diabetes ages 10 years and up
- Dose is 0.6mg-1.8mg daily subcutaneous injection
- How Liraglutide works:
 - Enhances glucose dependent insulin secretion
 - Suppresses glucagon secretion
 - Slows gastric emptying which leads to glucose control, decreased food intake and enhanced satiety.

SIDE EFFECTS OF LIRAGLUTIDE

- GI: Nausea, vomiting, diarrhea, constipation, abdominal pain
- Hypoglycemia – risk is low when Liraglutide is used with metformin but higher when used with insulin
- Headache
- Dyspepsia
- Fatigue
- Dizziness
- Increased lipase – acute pancreatitis has been reported

GLP 1 RECEPTOR AGONIST: EXENATIDE (BYDUREON) OR DULAGLUTIDE (TRULICITY)

- Approved for type 2 diabetes ages 10 years and up
- Exenatide dose is 2mg weekly
- Dulaglutide dose is 0.75 or 1.5mg weekly
- Same mechanism of action as Liraglutide
- Side effect profile is the same as Liraglutide

EMPAGLIFLOZIN (JARDIANCE)

- FDA approved in June 2023 for ages 10 years and older with Type 2 diabetes
- Dose: 10-25mg by mouth daily in the morning
- Works by increasing the excretion of glucose in the urine thereby lowering elevated blood glucose

SIDE EFFECTS AND CONSIDERATIONS WITH EMPAGLIFLOZIN

- Hypoglycemia, if patient is on other therapies that cause hypoglycemia
- Female fungal infections and urinary tract infections
- Hypotension/volume depletion (tends to be in elderly)
- Ketoacidosis has been reported -
 - Plasma glucose and urine ketones may be lower than typically expected in classic presentation of DKA which can lead to misdiagnosis and prevent timely initiation of treatment

INSULIN

- Basal insulin:
 - Lantus, Basaglar, Semglee, Toujeo (glargine)
 - Tresiba (degludec)
 - Levemir (detemir)
- Short acting: Humalog, Novolog, Apidra, Fiasp, Lyumjev
- Insulin pump

INSULIN

Patients may be on a variety of insulin regimens including:

- Basal only
- Basal + Correction factor/sliding scale only
- Basal + fixed mealtime dose + correction factor
- Basal + insulin to carb ratio + correction factor
- Correction factor only with meals

HOW OFTEN TO CHECK BLOOD SUGARS

- General guidelines:
- If on metformin alone – check fasting and 2 hours after a meal, twice per week
- If on long acting insulin with or without metformin – check fasting and before lunch or dinner
- If on both long acting and rapid acting insulin – check fasting, before meals, and at bedtime

TAKE HOME POINTS

- Incidence of youth onset T2DM is increasing and ethnic minorities are being disproportionately affected
- Youth onset T2DM is clinically more aggressive in terms of progression and complications
- Lifestyle modification is very important to glycemic control
- Pharmacotherapy in youth is limited to metformin, insulin, a few GLP1 RAs, one SGLT2 inhibitor
- Bariatric surgery is a therapeutic option

REFERENCES

- Silva Arslanian A et al, Evaluation and Management of Youth-Onset Type 2 Diabetes: A Position Statement by the American Diabetes Association. *Diabetes Care* 1 December 2018; 41 (12): 2648–2668. <https://doi.org/10.2337/dci18-0052>
- ElSayed N et al; on behalf of the American Diabetes Association, 14. Children and Adolescents: *Standards of Care in Diabetes—2023*. *Diabetes Care* 1 January 2023; 46 (Supplement_1): S230–S253
- Inge TH, Laffel LM, Jenkins TM, et al. Comparison of Surgical and Medical Therapy for Type 2 Diabetes in Severely Obese Adolescents. *JAMA Pediatr.* 2018;172(5):452–460. doi:10.1001/jamapediatrics.2017.5763
- Inge TH, Courcoulas AP, Jenkins TM, et al. Five-Year Outcomes of Gastric Bypass in Adolescents as Compared with Adults. *N Engl J Med.* 2019;380(22):2136-2145. doi:10.1056/NEJMoa1813909
- Kirwan JP, Sacks J, Nieuwoudt S. The essential role of exercise in the management of type 2 diabetes. *Cleve Clin J Med.* 2017 Jul;84(7 Suppl 1):S15-S21. doi: 10.3949/ccjm.84.s1.03. PMID: 28708479; PMCID: PMC5846677
- TCH Type 2 Diabetes Education handbook
- Up to date: Management of type 2 diabetes mellitus in children and adolescents

Thank you!

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COMMENTS/QUESTIONS?