

# The SEARCH for Diabetes in Youth Study

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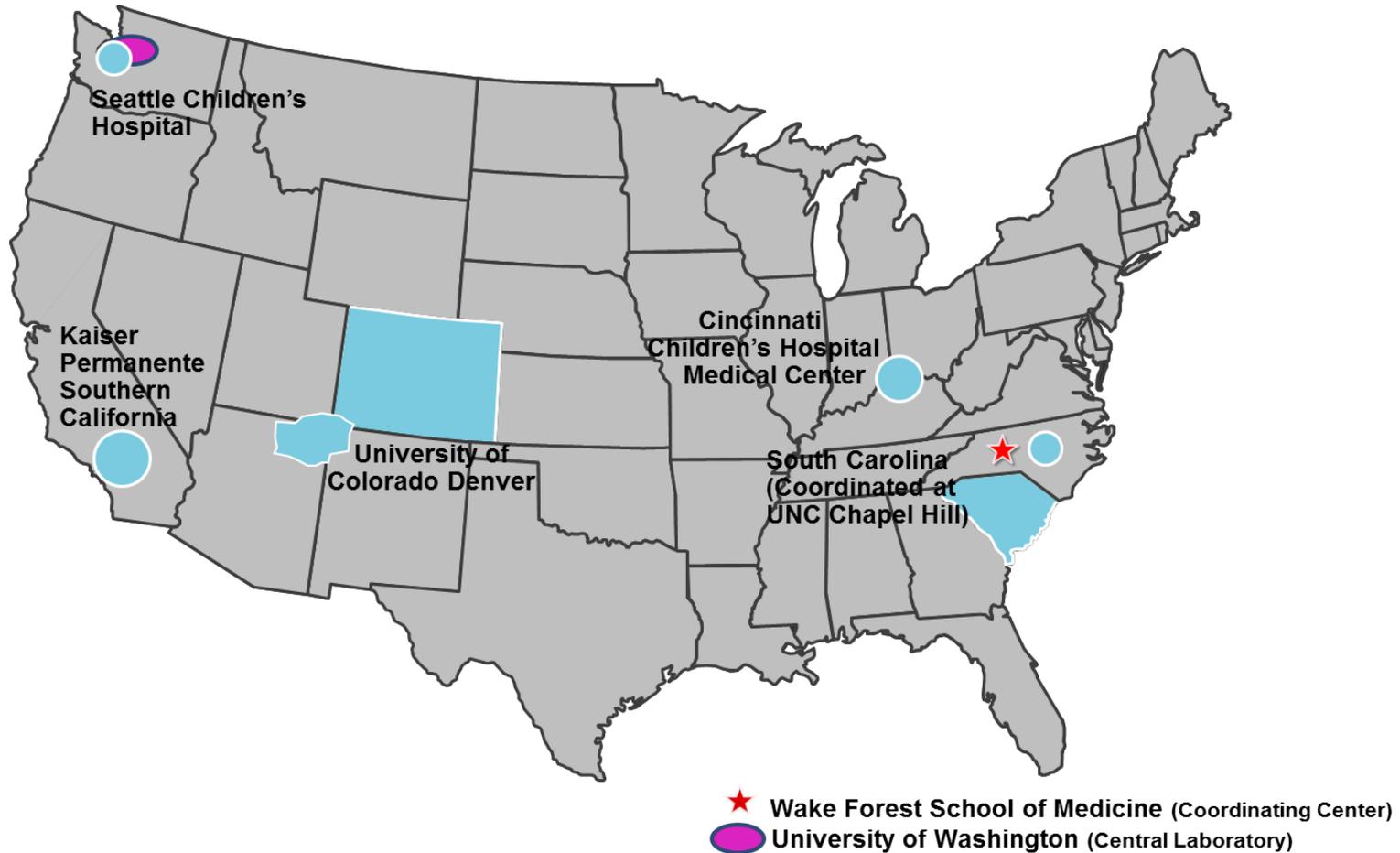
# Outline of Presentation

- Scientific rationale
- SEARCH study design
- SEARCH contributions:
  - Burden of diabetes in youth
  - Defining diabetes type
  - Characteristics of youth with diabetes
  - Quality of care
  - Risk factors for chronic complications
- Plans for the future
- Informing Interventions

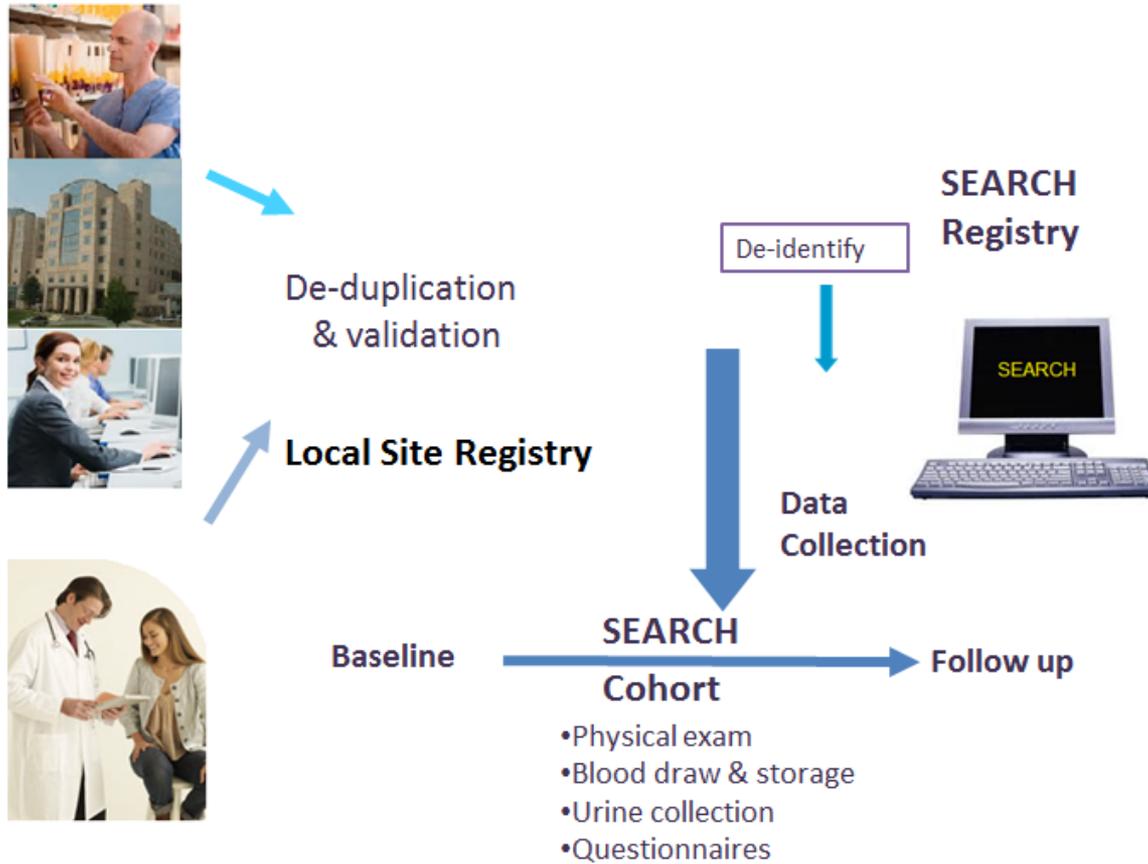
# Scientific Rationale

- Increase in T2D in youth in several populations – especially minority
- Increase in T1D incidence reported worldwide – limited US data
- Reports of “atypical” diabetes with mixed phenotypes in youth

# SEARCH Study Sites



# SEARCH Design



# **POPULATIONS UNDER SURVEILLANCE**

# Denominator: Youth Under Surveillance

Center	Annual #
California (health plan site)	792,188
Colorado	1,405,205
Native American Sites	91,542
Ohio	558,911
South Carolina	1,182,077
Washington	966,045
<b>TOTAL</b>	<b>4,995,968</b>

# Networks of Providers and Facilities

Clinical Site	Pediatric Endocrinologists	Other Case Sources
California	9 Pediatric Endocrinologists	Kaiser Permanente Southern California clinical and administrative data systems (electronic health records)
Colorado	2 Pediatric Endocrinology practices	Hospitals (8) Other (pediatricians, adult endocrinologists, CDEs) (~10) Community Health Centers (4) Navajo Nation: 8 Indian Health Service units
Ohio	Pediatric Endocrinology practice in Cincinnati Children's Hosp (92%)	Hospitals (15) Other (adult endocrinologists, CDEs) (~10) Third-party payers (5) Cincinnati Health Dept
South Carolina	6 Pediatric Endocrinology practices	Hospitals (6) Other (adult endocrinologists, FQHC, other) (~10)
Washington	3 Pediatric Endocrinology practices	Hospitals (9) Other (adult endocrinologists, community clinics, CDEs) (~10)

FQHC = Federally qualified health center; CDE = certified diabetes educator

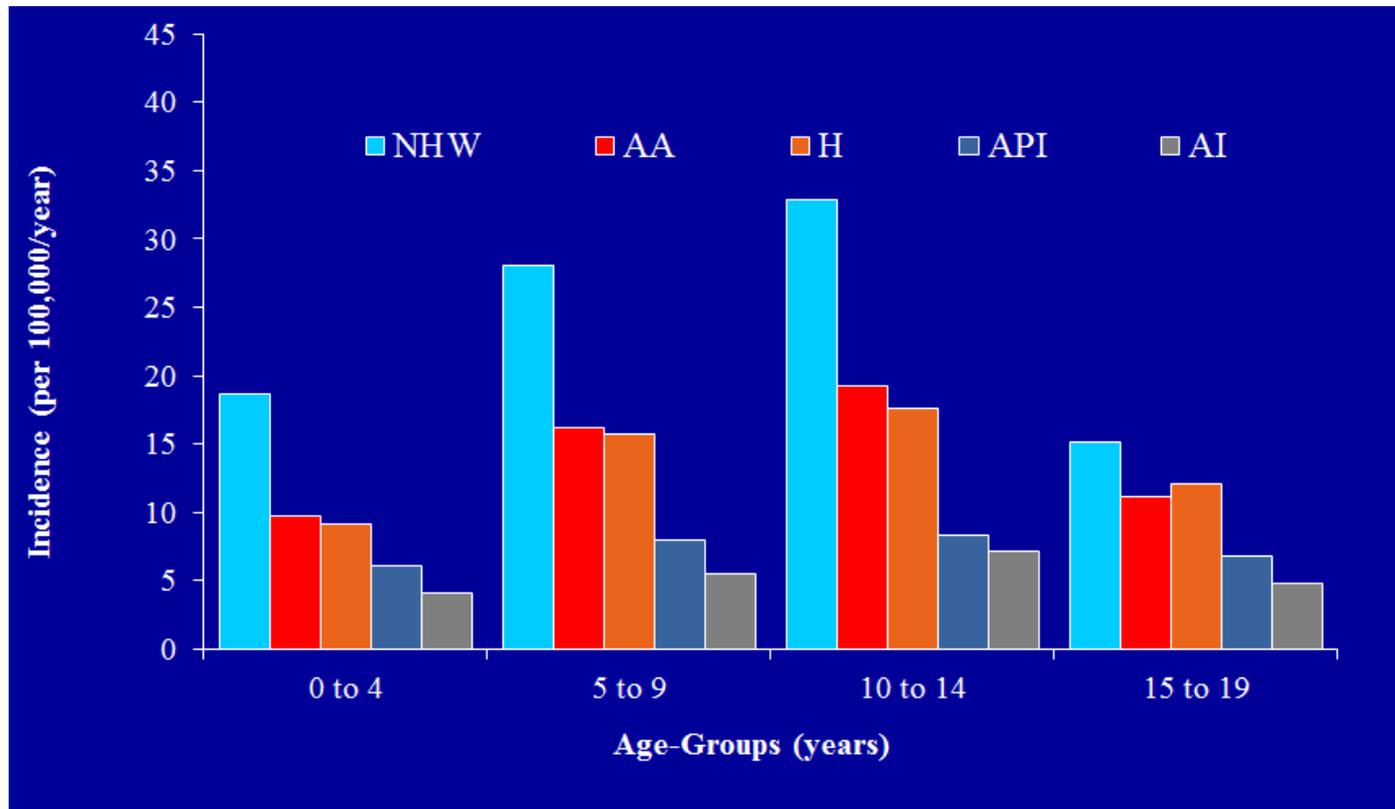
# Numerator: Eligibility

- Persons with physician diagnosed diabetes
- Aged less than 20 in 2001 and 2009 (prevalence) or age less than 20 at diagnosis in 2002 onwards (incidence)
- Residents of the population defined or members of health plans or users of the IHS
- Not active duty military, not institutionalized
- Not gestational diabetes mellitus (GDM) only

# **SEARCH CONTRIBUTION**

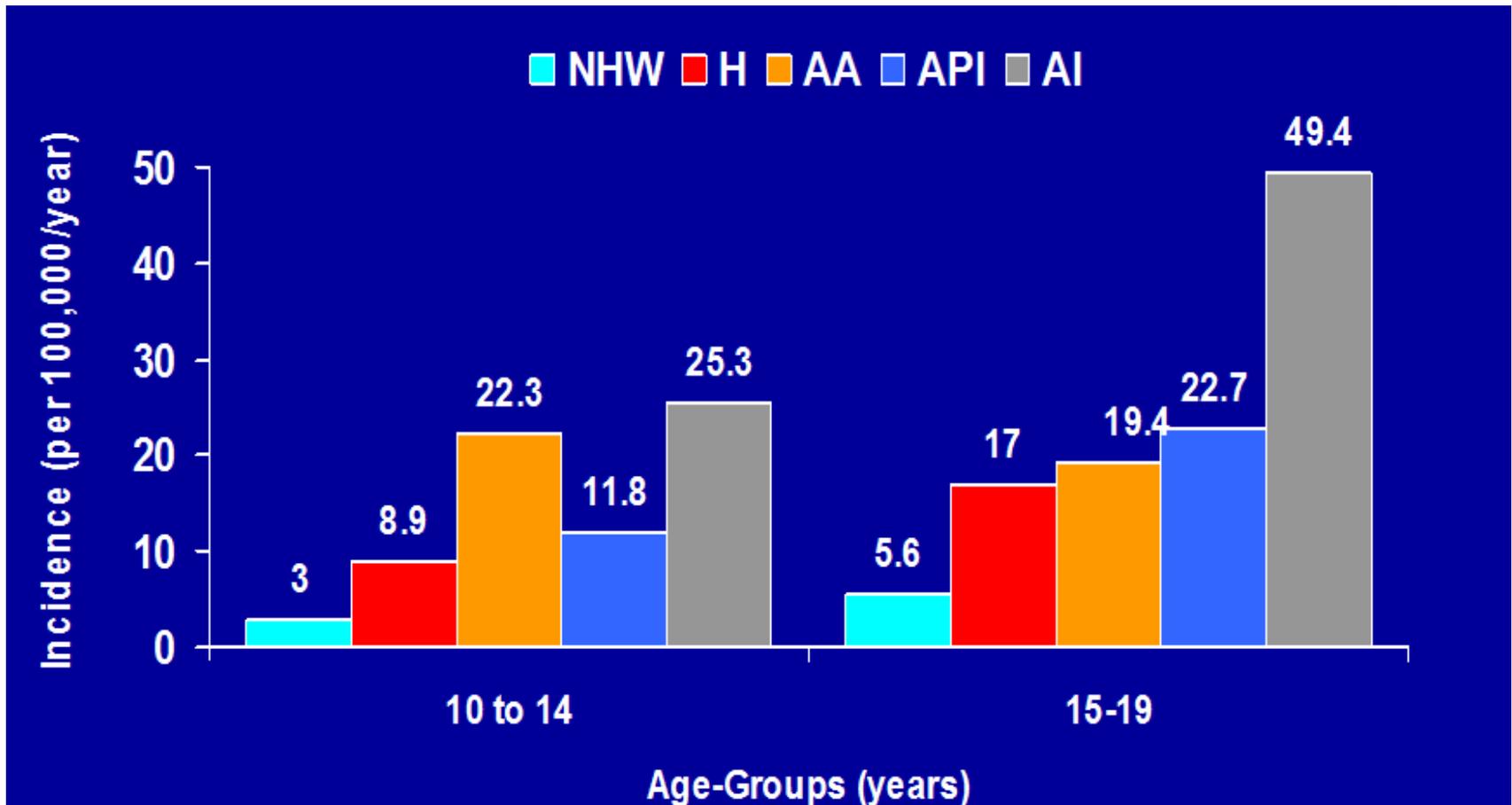
Burden of Diabetes in Youth

# Incidence of Type 1 Diabetes in 2000-2003, by Age and Race/Ethnicity

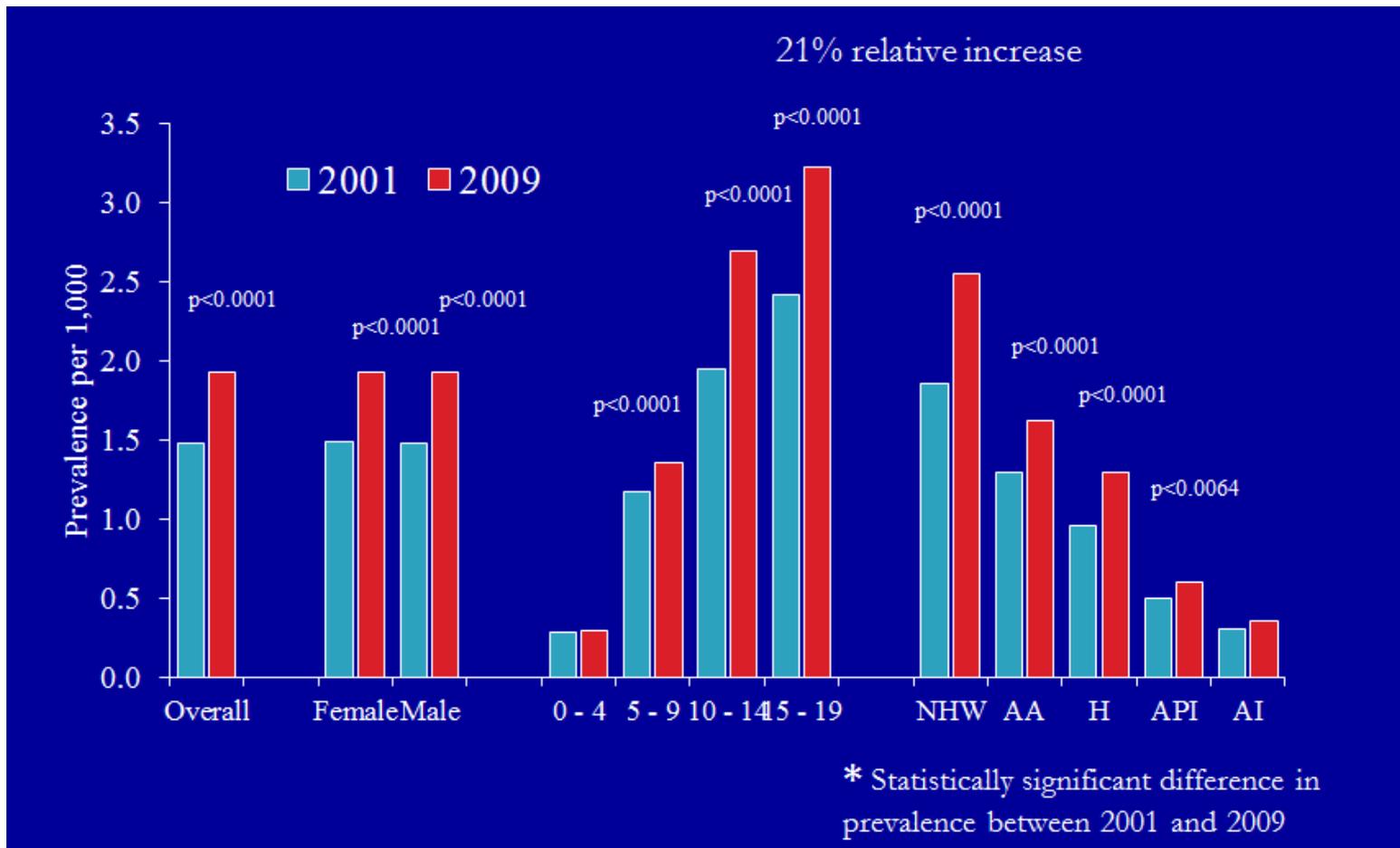


SEARCH Study Group, JAMA 297(24), 2716, 2007

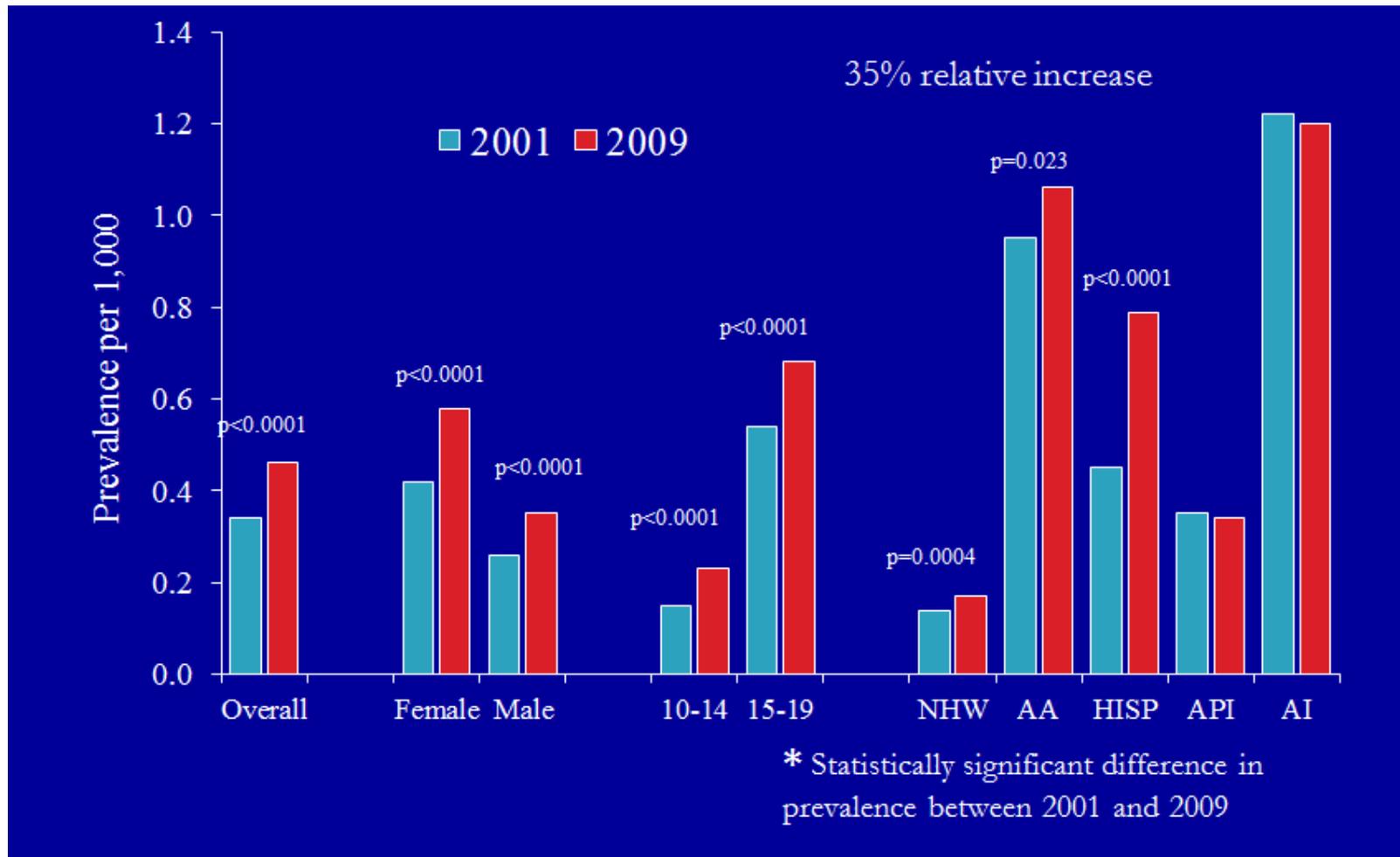
# Incidence of Type 2 Diabetes in 2002 -2003, by Age and Race/Ethnicity



# Trends in T1D Prevalence, 2001-2009, by Sex, Age and Race/Ethnicity



# Trends in T2D Prevalence, 2001-2009, by Sex and Age and Race/Ethnicity

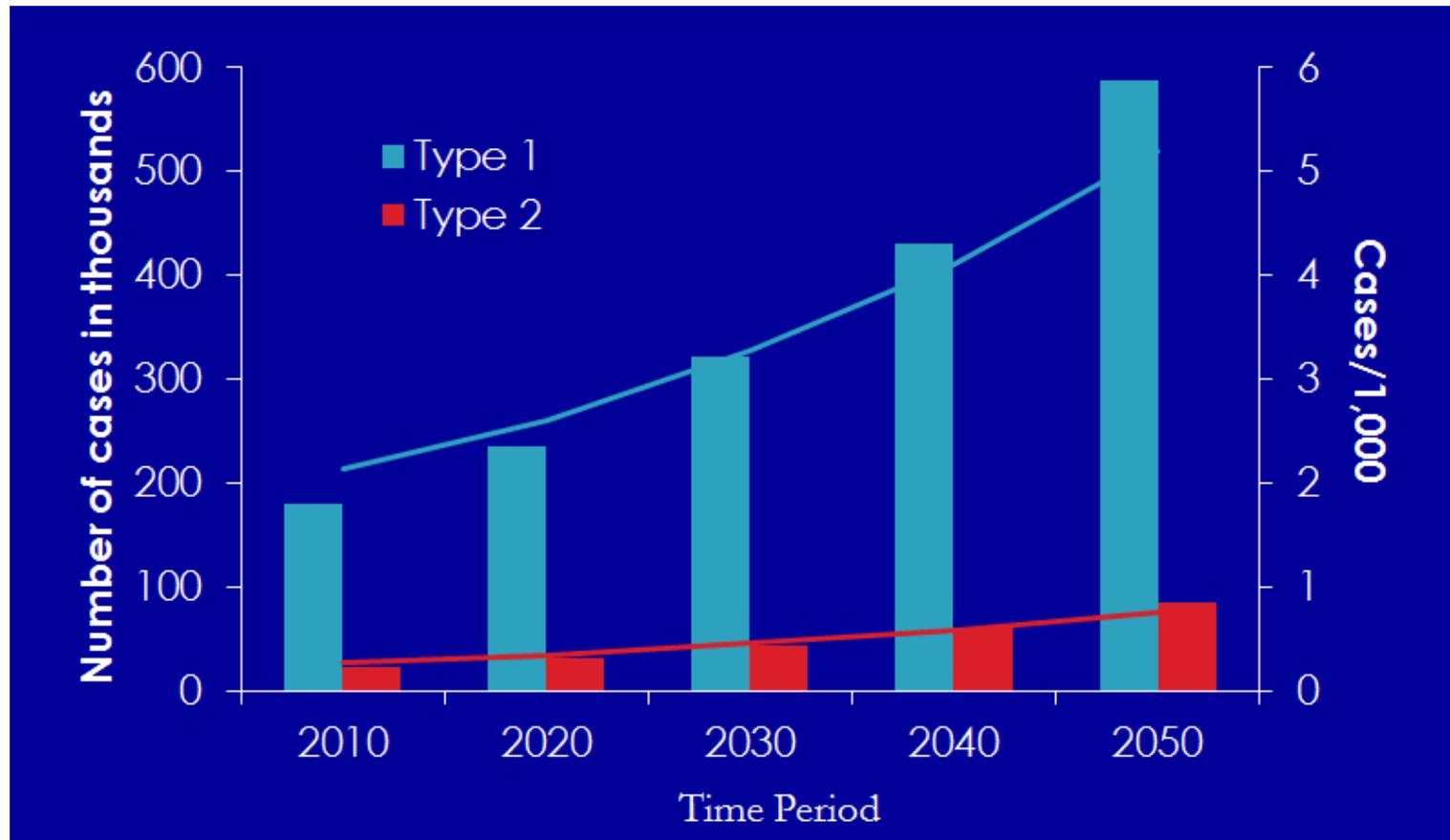


# Burden of Diabetes in US Youth

- Applied to US Census data, SEARCH estimated:
- 191,986 youth in the US had physician-diagnosed diabetes in 2009
- 166,984 with T1D; 20,262 with T2D; 4,740 with 'other' types
- ~18,400 youth are diagnosed with T1D each year
- ~5,100 youth are diagnosed with T2D each year

Pettitt DJ et al., *Diabetes Care* 37: 2014; SEARCH Study Group, *JAMA* 2007; Lawrence et al, *Diabetes*, 2014

# Projected Number (bars) and Prevalence (line) of T1D and T2D in People aged <20 Years

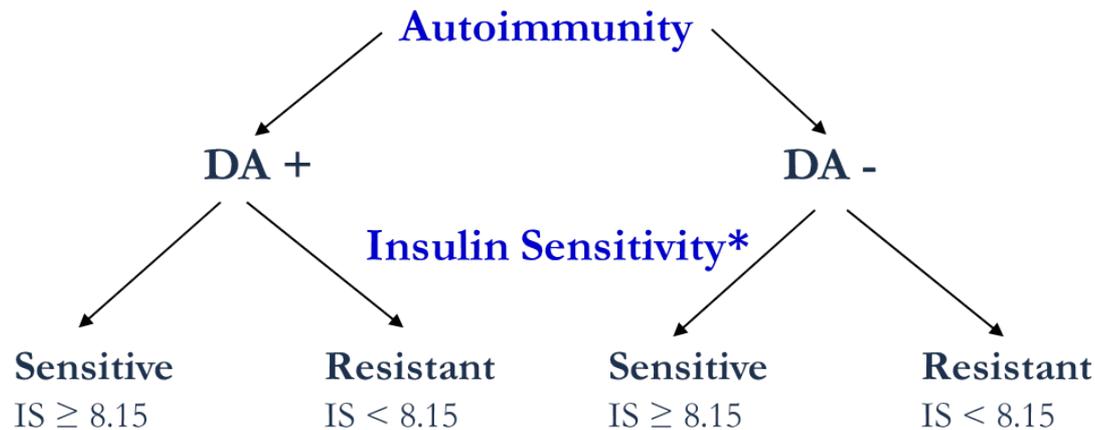


Imperatore G, et al. *Diabetes Care* 2012

# **SEARCH CONTRIBUTION DEFINING DIABETES TYPE**

With increasing obesity, youth with T1D may be overweight or obese, causing confusion about the correct diagnosis

# Classification of Diabetes Type based on Autoimmunity and Insulin Sensitivity



DA+ Positive for IA2 or GAD65 autoantibody (measured using NIDDK standardized assay)

\* Insulin Sensitivity =  $\exp [4.64725 - 0.02032 * (\text{waist, cm}) - 0.09779 * (\text{HbA1c, \%}) - 0.00235 * (\text{TG, mg/dl})]$ ;

Resistant = IS index below the 25th percentile for NHANES youth (IS < 8.15)

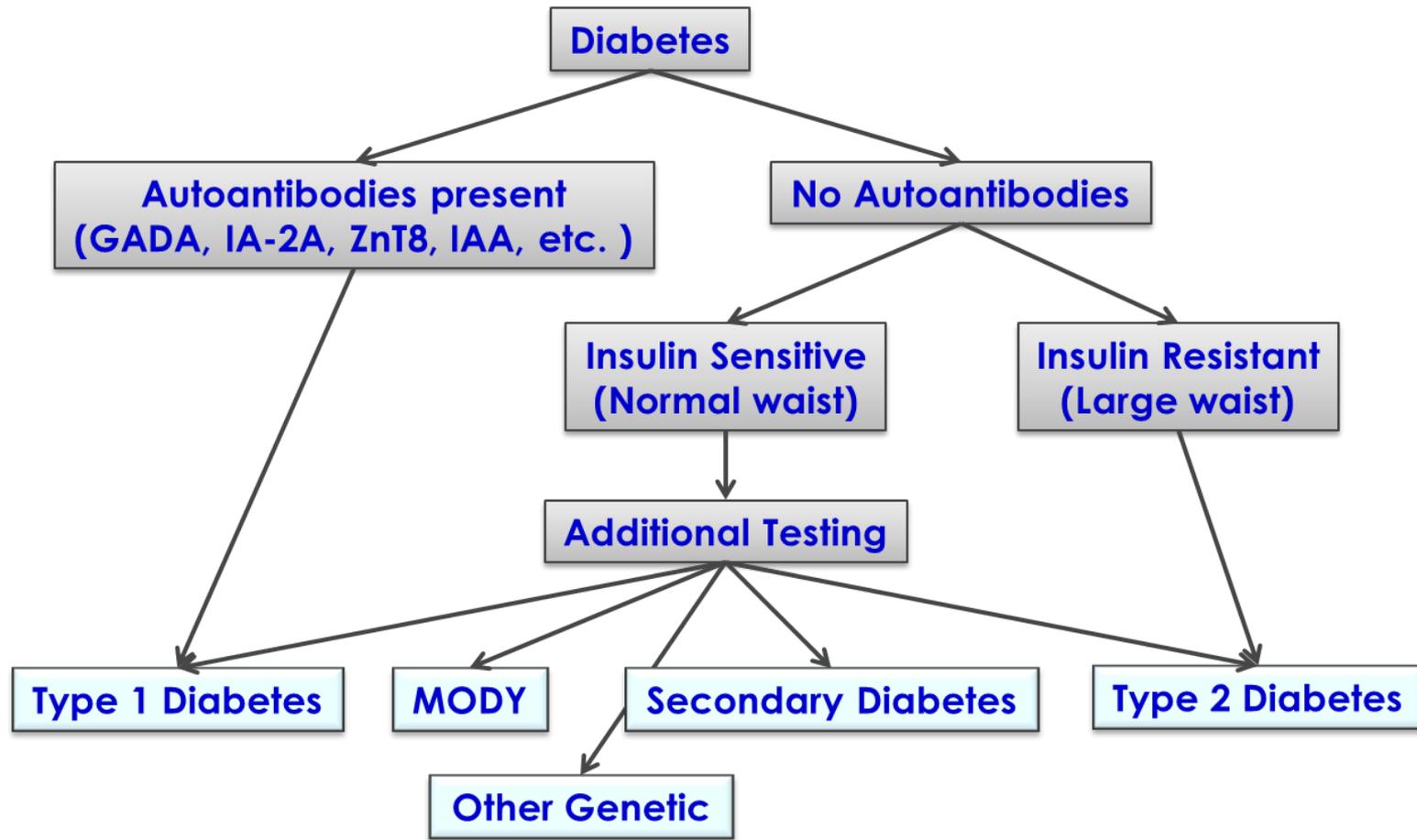
Sensitive = IS index > the 25th percentile for NHANES youth (IS > 8.15)

Dabelea et al, *Diabetologia* 54: 78, 2011

# Classification of Diabetes Type based on Autoimmunity and Insulin Sensitivity (cont.)

- Autoimmune +IS (54.5%) or non-autoimmune +IR (15.9%) categories align with traditional descriptions of T1D or T2D.
- The autoimmune + IR group (19.5%) likely represents individuals with T1D autoimmune diabetes and obesity.
- The non-autoimmune + IS group (10.1%) represents an etiologically mixed category & requires further testing.
- For the purpose of public health surveillance, the provider-assignment of diabetes type agrees well with the etiological assessment.

# Algorithm for Classification of Pediatric Diabetes

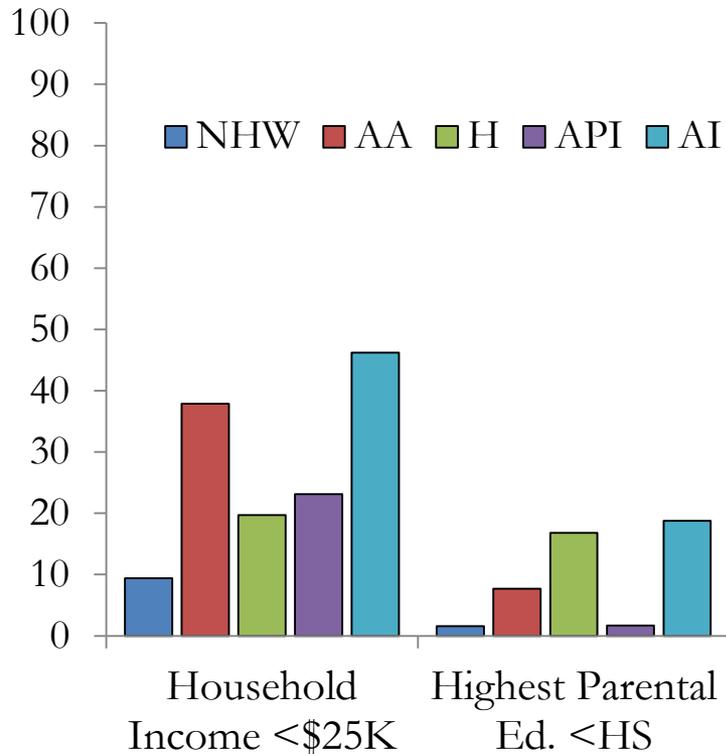


# **SEARCH CONTRIBUTION**

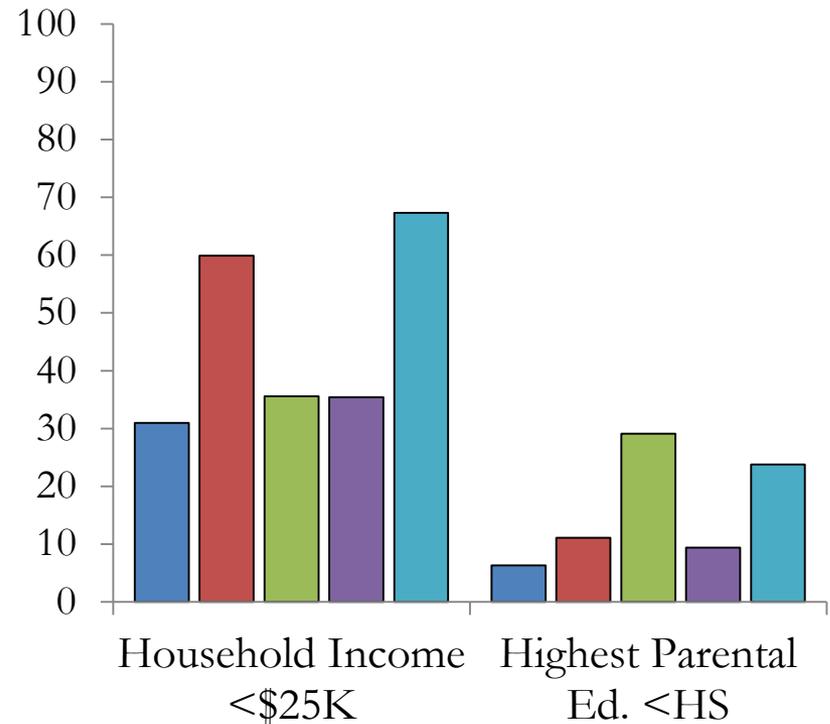
Characteristics of Youth with Diabetes

# Prevalence of Socioeconomic Indicators

## Type 1

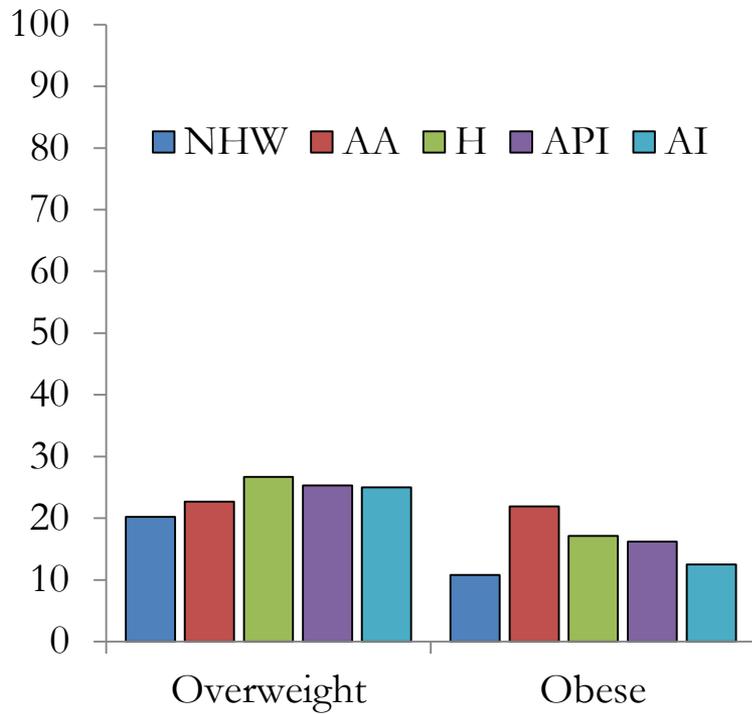


## Type 2

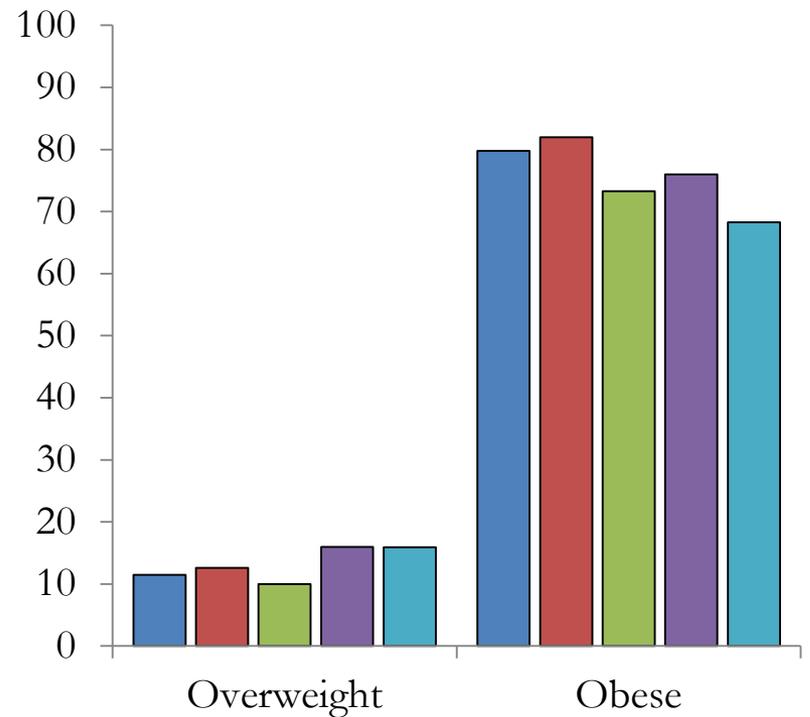


# Prevalence of Overweight and Obesity

## Type 1

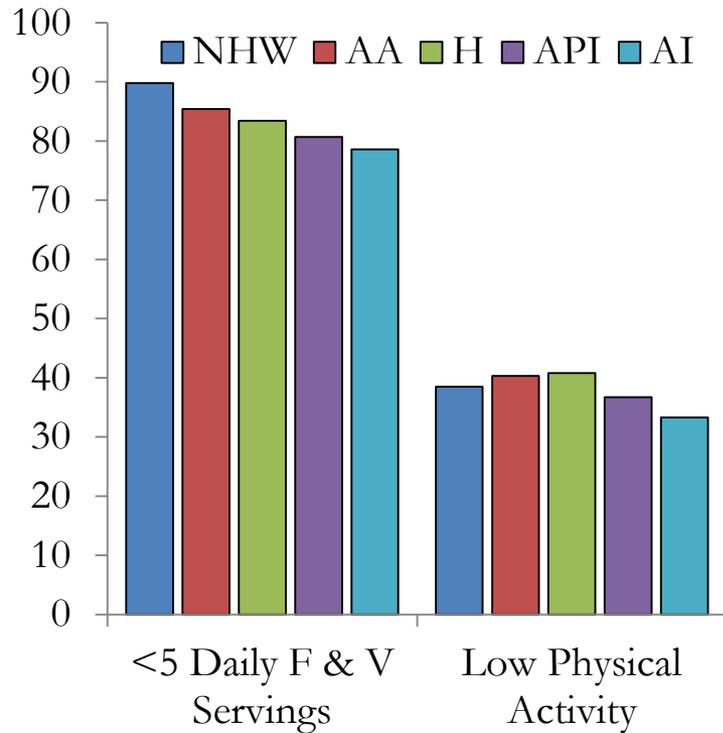


## Type 2

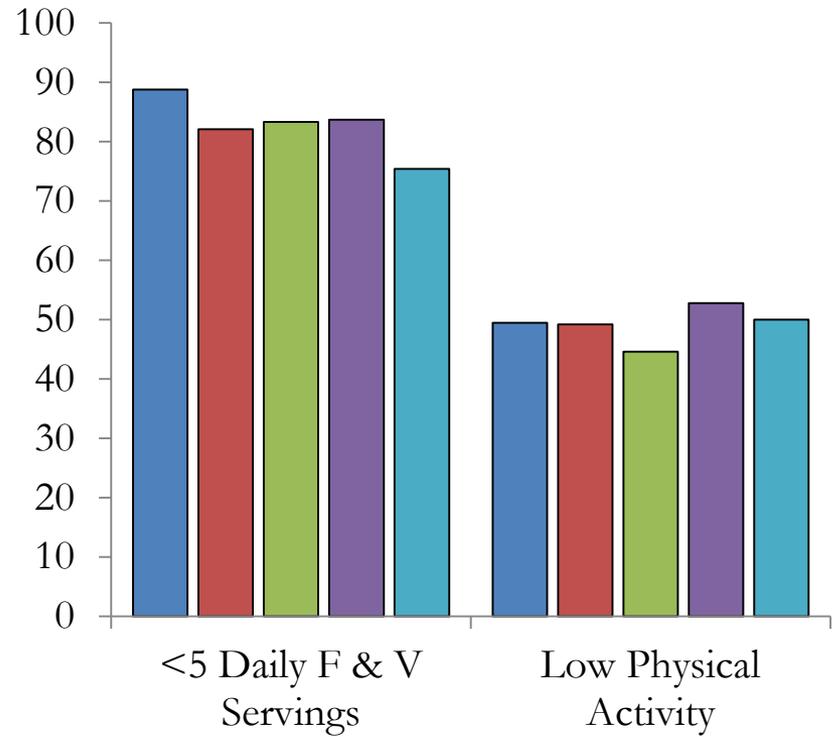


# Prevalence of Selected Health Behaviors

## Type 1



## Type 2



# SEARCH CONTRIBUTION

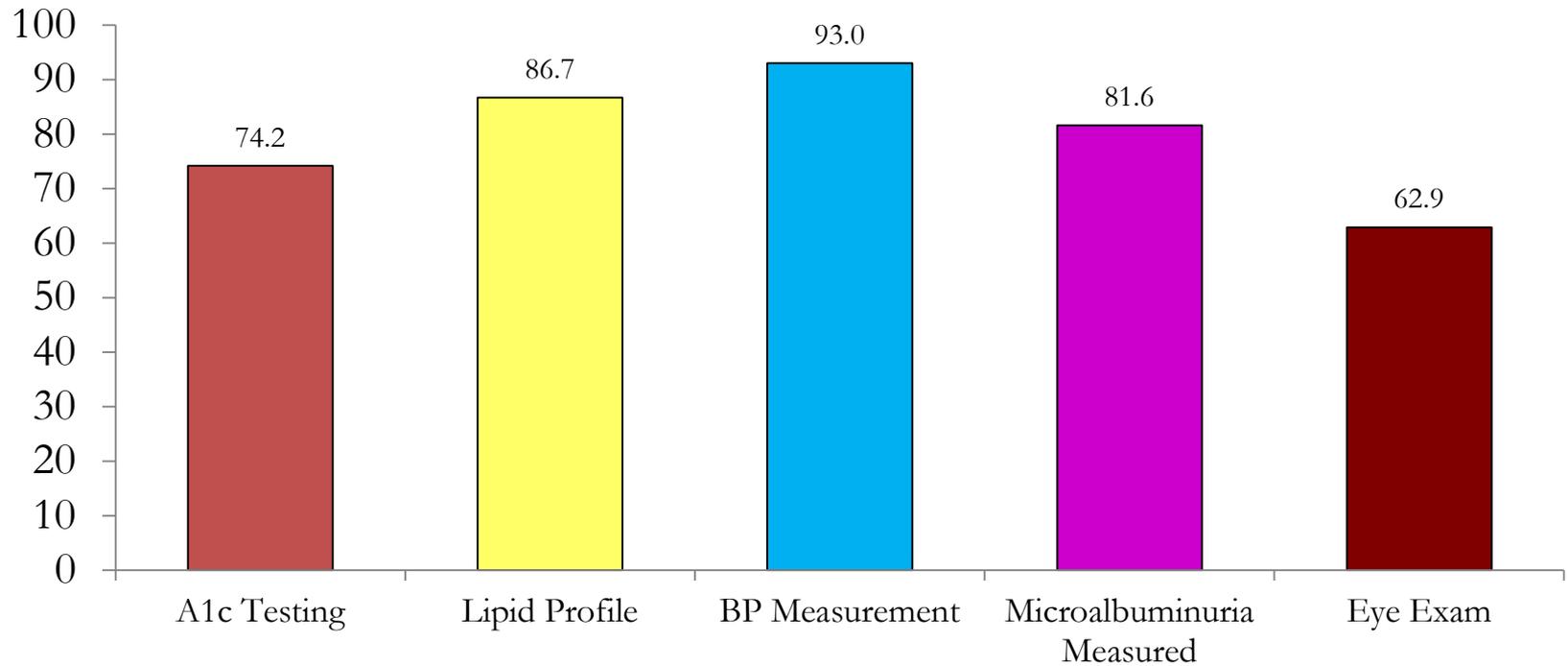
Quality of Care

# Prevalence of Poor Glycemic Control (A1c $\geq$ 9.0%)

Race/Ethnicity	Type 1 (%)	Type 2 (%)
Non-Hispanic White	12.3	12.2
African American	35.5	22.3
Hispanic	27.3	27.4
Asian/Pacific Islander	26.0	36.4
Native American	52.2	43.8

Petitti et al, *J Pediatrics*, 2009

# Percentage of Youth Reporting Receipt of Test/Measurement

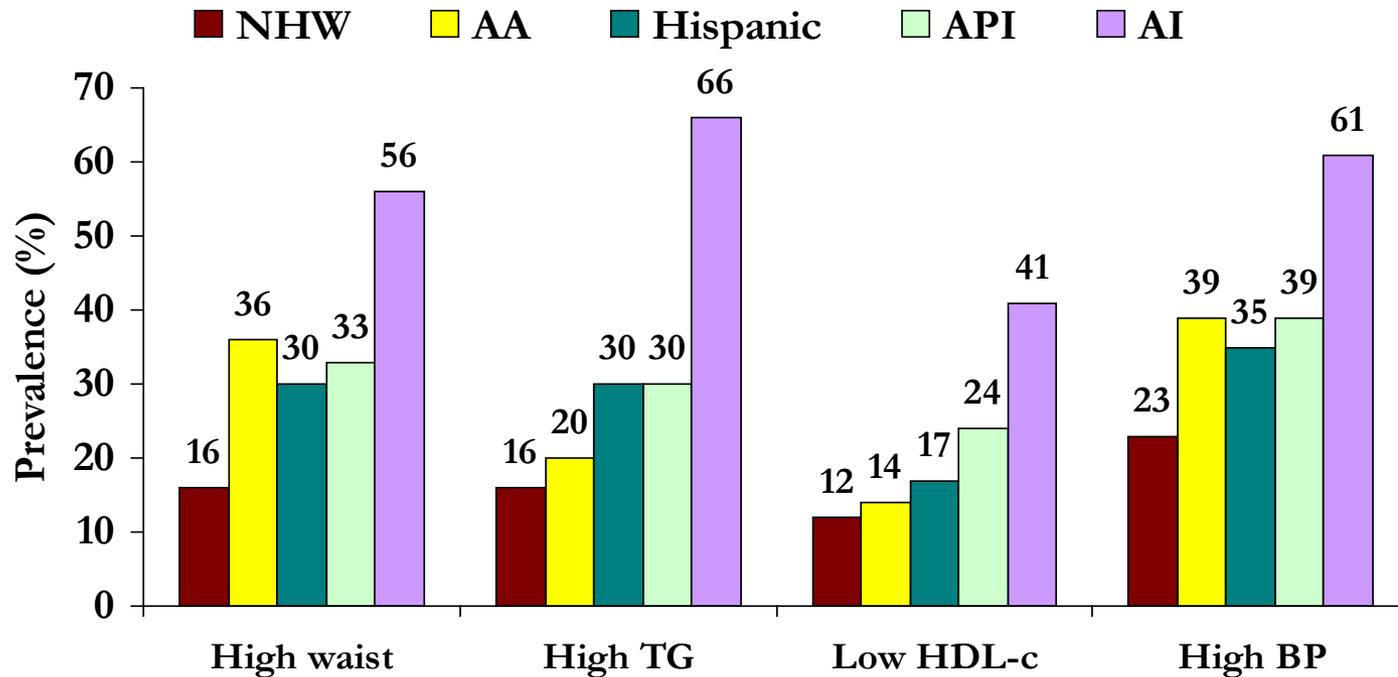


Waitzfelder et al, *Pediatrics*, 2012

# **SEARCH CONTRIBUTION**

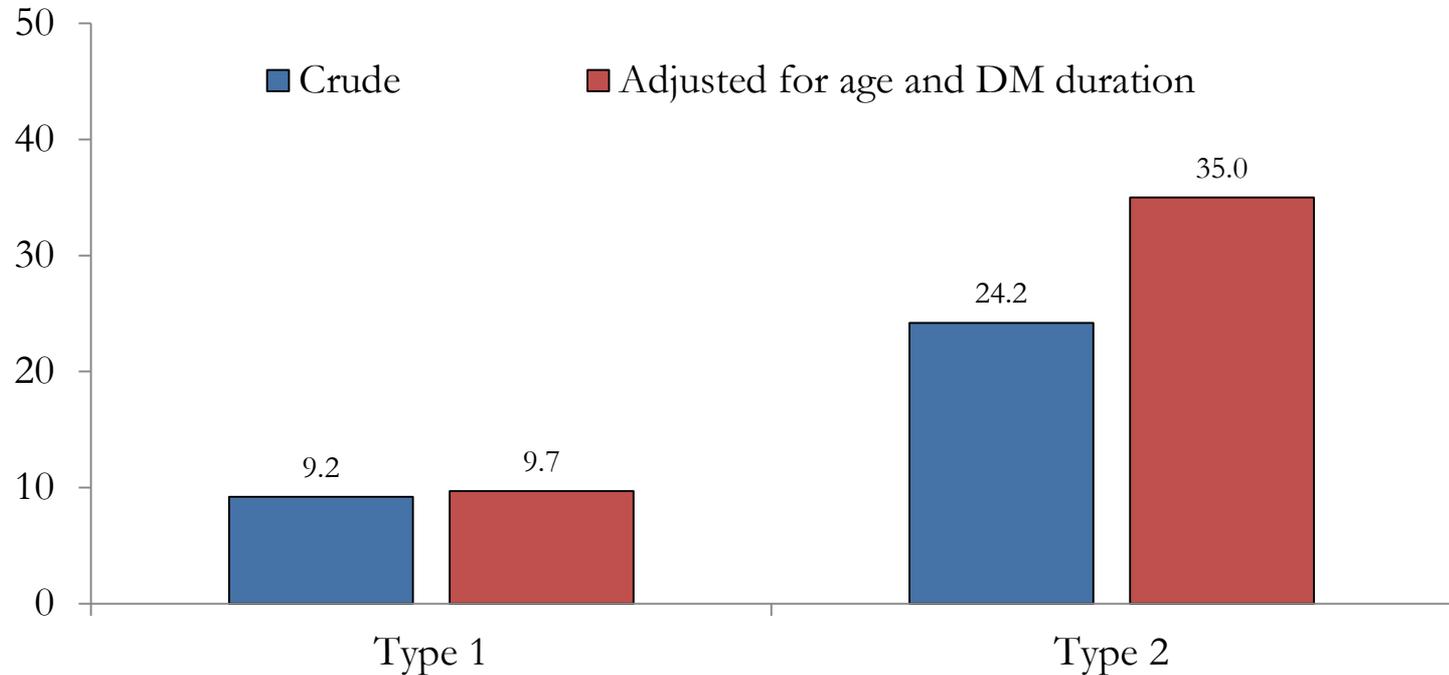
Risk of Chronic Complications

# Prevalence of Cardiovascular Risk Factors, by Race/Ethnicity



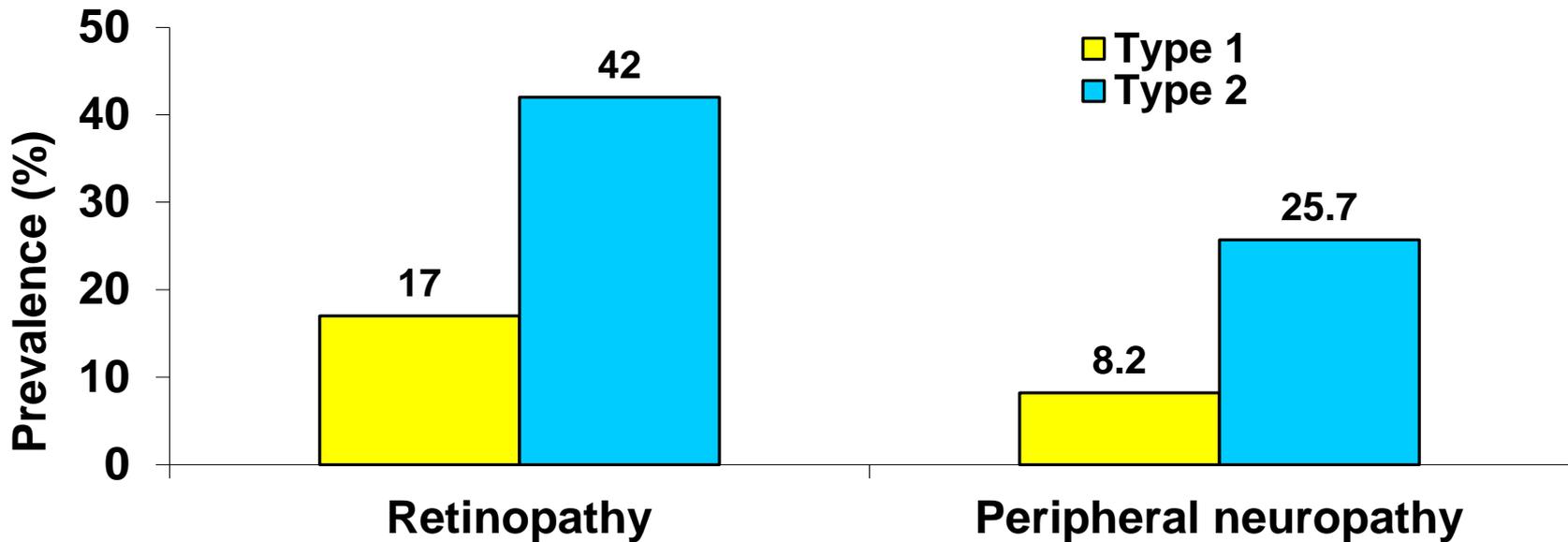
Rodriguez B, *Diabetes Care* 2006;

# Prevalence of Elevated Albumin: Creatinine Ratio (ACR) by Diabetes Type



Maahs et al., *Diabetes Care* 2007

# Prevalence of Other Microvascular Complications\* by Diabetes Type: Pilot Study



\*Retinopathy : any evidence in either eye

Neuropathy: Michigan Neuropathy Screening Instrument score >2

Mayer-Davis et al., *Diabetic Med.* 2012; 29:1148-1152

Jaiswal M et al., *Diabetes Care* 2013 36:3903 – 3908

# SEARCH-Navajo Study: Example of American Indian participation in SEARCH



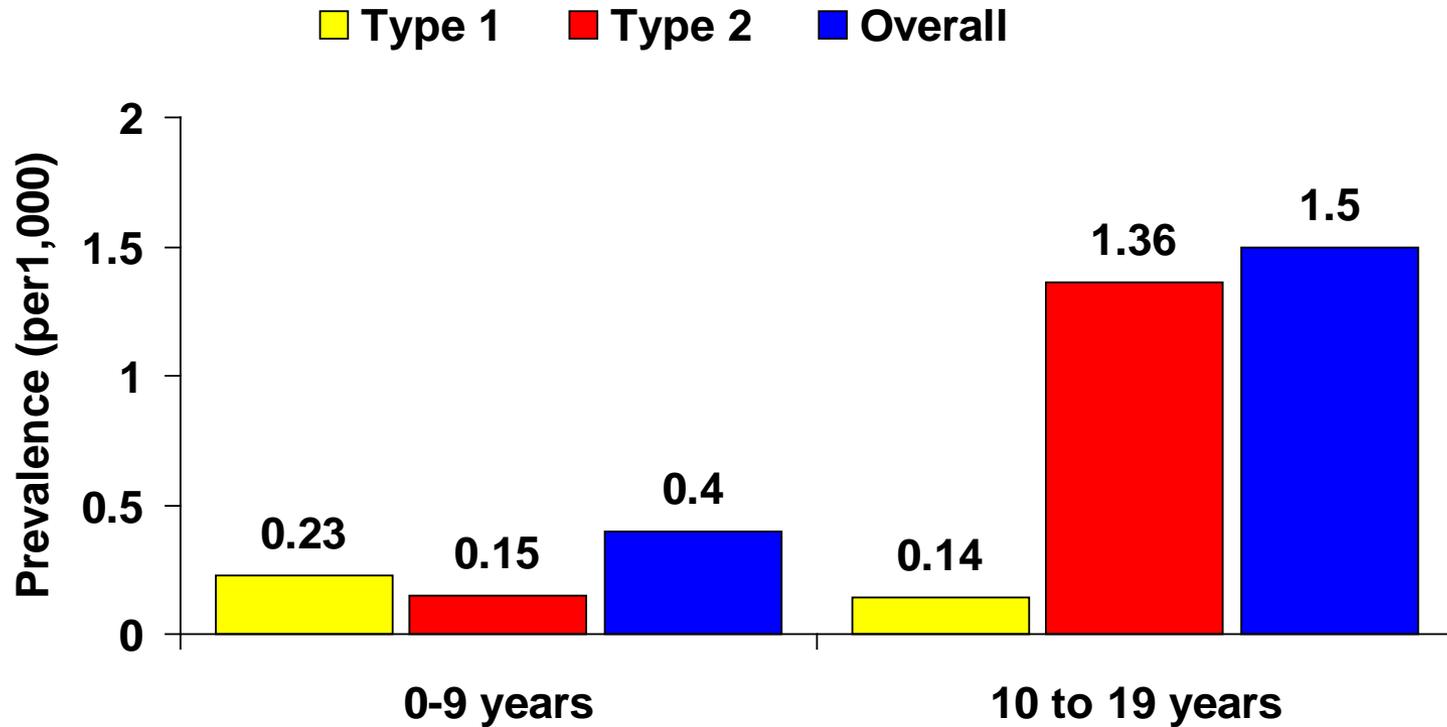
# Who is Eligible for SEARCH-Navajo?

- Patients with **physician diagnosed** diabetes (NOT GDM)
  - Age less than 20 on December 31 of the year of diagnosis (incidence) or age < 20 on December 31 of prevalent year (2001, 2009)
- **Active users of the Indian Health System** (users in the past 3 years)
- Not active duty military, not institutionalized in prevalent year / at diagnosis

# SEARCH-Navajo Case Ascertainment

Service Unit	Denominator	RPMS Prevalent 2001 Incident 2002 Cases	Valid/Registered Prevalent and 2002 Incident Cases
Crownpoint	8,351	12	11
Chinle	15,552	28	11
Ft. Defiance	10,987	32	15
Gallup	17,683	44	15
Kayenta	8,202	45	10
Shiprock	21,098	50	30
Tuba City	9,871	20	11
Winslow	6,272	12	9
<b>Total</b>	<b>98,016</b>	<b>233</b>	<b>112</b>

# Prevalence of DM in 2001 (per 1,000) among Navajo Youth

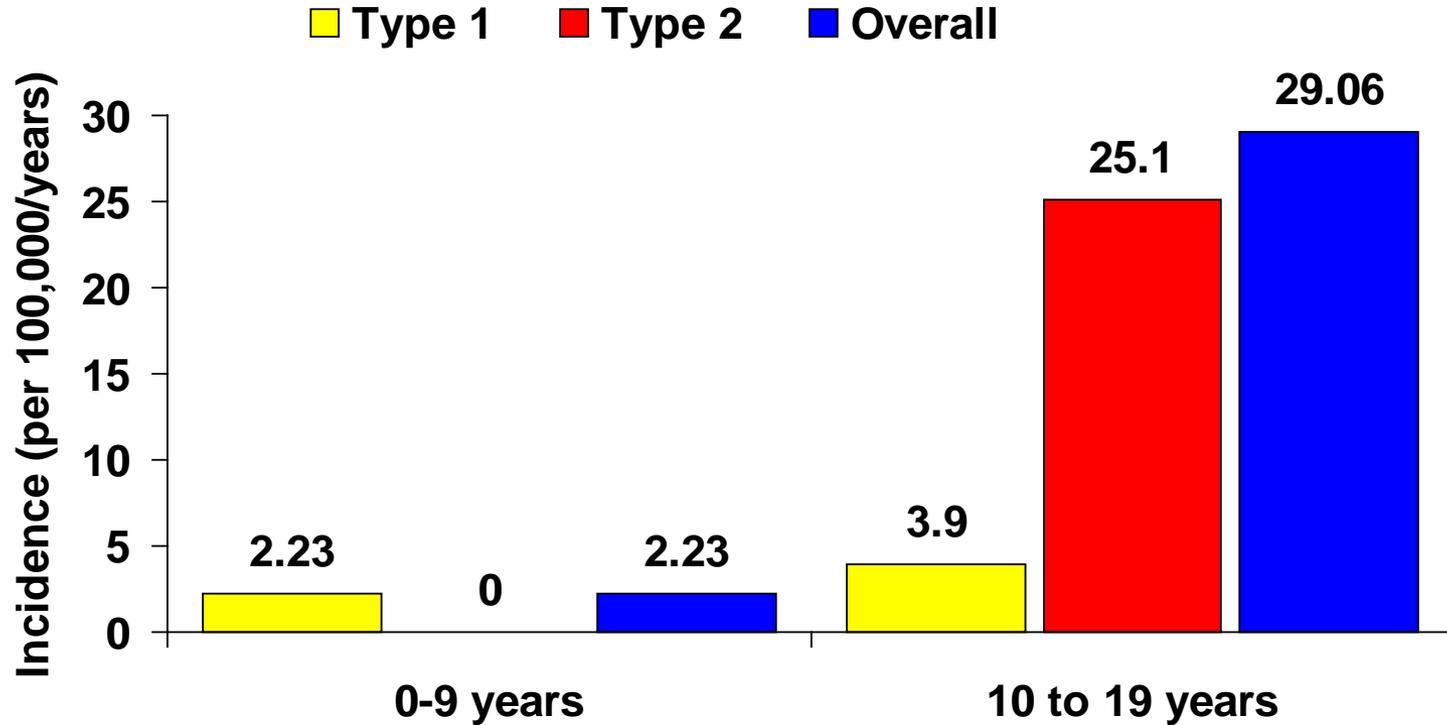


Dabelea et al. *Diabetes Care* 2009

# Prevalence of DM in Other American Indian/Alaska Native Youth

- AI/AN youth, based on RPMS data, no medical record validation (*Acton K, Am J Pub Health 92; 2002*)
  - <15 years: 1.2/1,000
  - 15-19 years: 5.4/1,000

# Incidence of DM in 2002-2004 (per 100,000/year), among Navajo Youth



Dabelea et al. *Diabetes Care* 2009

# Characteristics of Navajo Youth with Diabetes, By Diabetes Type

	Type 1	Type 2
Age at visit (years): mean (range)	15.3 (7-20)	17.4 (11.8-21.6)
Duration of Diabetes (years): mean (range)	6.2 (0.3-15.8)	3.6 (0.1-8)
FCP (ng/ml): mean (range)	0.7 (0.2-3.5)	3.7 (0.2-11.4)
% High CESD scores ( $\geq 24$ )	14.3%	21.9%
% High waist ( $\geq 90$ th percentile)	33%	81%
% BMI $\geq 95$ th percentile	26.7%	67.2%
% High blood pressure	13.3%	58.6%
% Microalbuminuria	6.7%	25.8%
% Poor glycemic control (HbA1c $\geq 9.5\%$ )	53%	41%
% High Triglycerides ( $\geq 110$ mg/dl)	53%	72%
% Low HDLc ( $\leq 40$ mg/dl)	27%	40%

# Treatment Patterns of Navajo Youth with Type 1 and Type 2 Diabetes

	Type 1	Type 2
DM Treatment (%)	33.3%	20.7%
Insulin 1-2 inj/day	66.6%	6.8%
Insulin 3+ inj/day	0%	72.5%
Oral agents only		
On Metformin (%)	6.6%	68.9%
Lipid Lowering Treatment (%)	0%	5.2%
HTN Treatment (%)	0%	25.8%

# PLANS FOR THE FUTURE

## SEARCH 4

# Registry Study

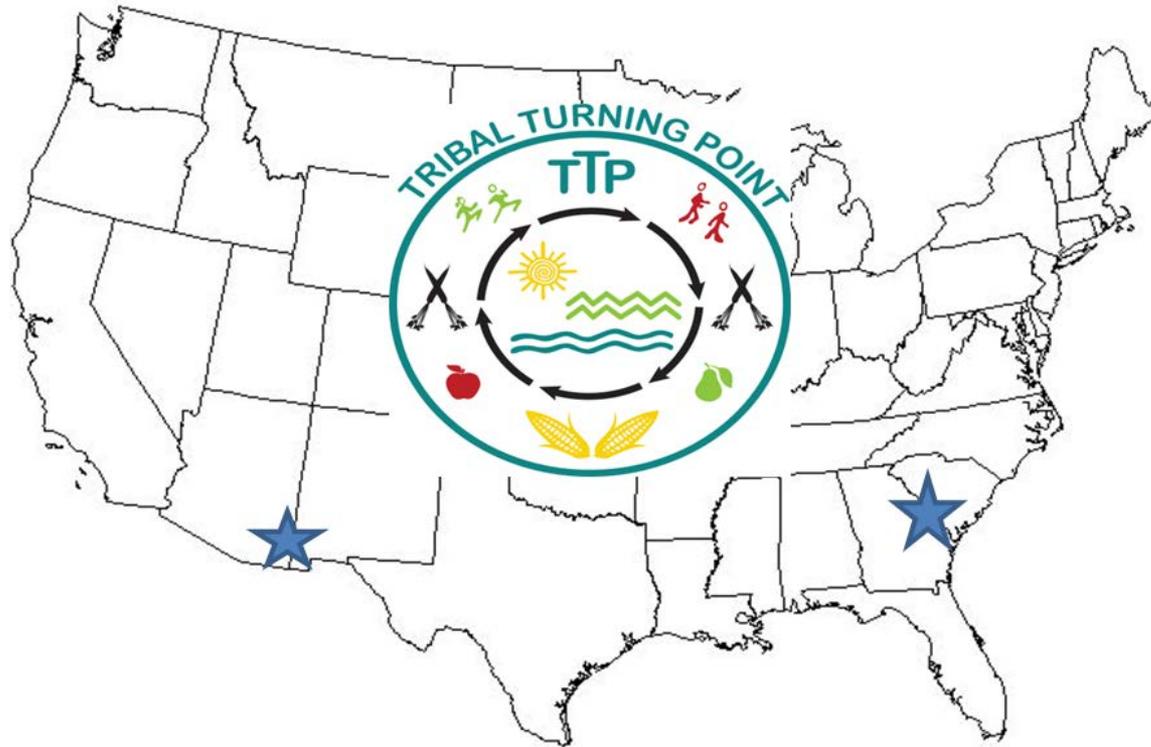
- **Continue to conduct sentinel surveillance of diabetes:**
  - SEARCH Registry study can be utilized to provide national estimates of prevalence, incidence, presentation, temporal trends, mortality, without the need for a national system
  - Can SEARCH be expanded to include other AI tribes/IHS participation?
- **Major Research questions:**
  - Will the incidence of T1D continue to rise or will there be a leveling off, as recently reported in Scandinavian countries?
  - Will the incidence of T2D rise, or will there be a leveling off, particularly in the highest risk groups (e.g., AI)?

# Cohort Study

- **Continue the longitudinal follow up** of SEARCH inception cohort of young adults with T1D and T2D
- **Major Research Questions:**
  - What is the clinical evolution of acute and chronic early complications of diabetes among youth and young adults with T1D or T2D diagnosed in childhood?
  - What are the drivers of early complications of diabetes diagnosed in childhood, and do these drivers differ for T1D and T2D?

# **INFORMING INTERVENTIONS**

# Reducing Risk for Type 2 Diabetes in American Indian Youth



Partnership: UNC Chapel Hill (Beth Mayer-Davis), UC Denver (Dana Dabelea), East –Band Cherokee and Navajo Nation

# A compelling need in AI communities

- High risk for development of T2D
- SEARCH for Diabetes in Youth Study
  - AI youth had highest T2D incidence and prevalence
- Higher overweight prevalence in AI schoolchildren than other subgroups
- Majority of AI adults in west and southwest affected by overweight/obesity

# Previous Efforts

- Strong data from efforts to prevent T2D in adults with lifestyle modification
  - Diabetes Prevention Program
    - Key mediators: weight loss, lower percent calories from fat, increased physical activity
  - Native Lifestyle Balance (NLB) Program
    - Applied to AI group-based community settings
- Data from youth interventions is limited, with mixed results
  - The HEALTHY Study, The Pathways Project
- Success in multi-component programs that provide physical activity and support for dietary change, while involving families and key community partners

# Overarching Goal...

...to develop, deliver and rigorously evaluate a novel three-component intervention designed to reduce risk factors for T2D in Cherokee and Navajo AI youth.

The intervention is designed for eventual broad, sustainable dissemination for AI and other high-risk communities.

# Research Aims

- Aim 1 – to further develop the TTP intervention through Community-Based Participatory Research process
- Aim 2 – To implement to TTP intervention in an 8-month pilot and feasibility trial in Cherokee, NC and Shiprock, NM

# Intervention Development

## 3 Components

### **Active Learning: 10 classes**

- Hands-on activities
- Physical activity
- Goal tracking

### **Toolbox materials**

- Resources to be used as-needed by staff, based on needs of participating families
- Follows Social Ecological Model

### **Motivational Interviewing (MI)**

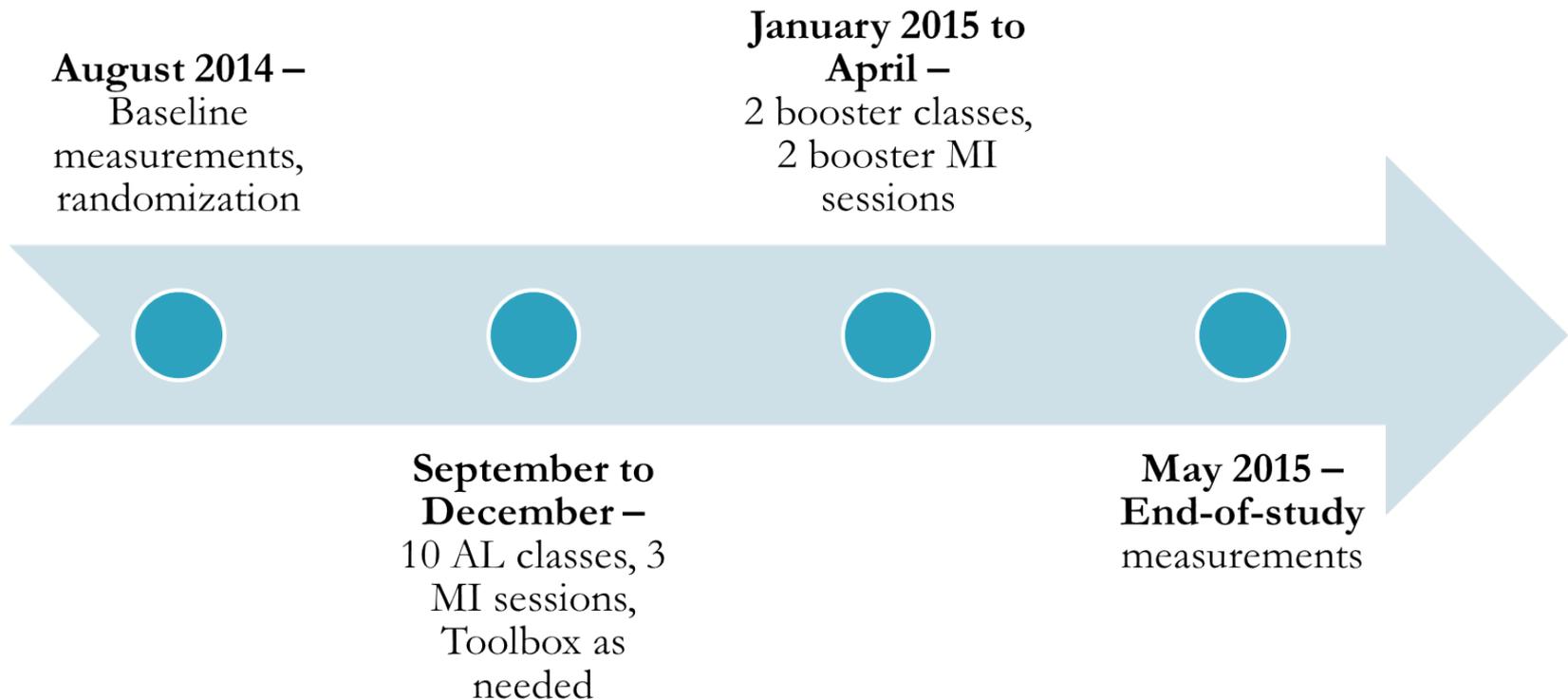
- Person-centered counseling technique
- Used to strengthen an individual's motivation and commitment for change by eliciting that individual's own arguments for change (problem solving skills)

# Intervention Development

- Basis for physical activity
  - At least 60 min. per day
  - Fitness-focused, age-appropriate suitable for overweight or obese, unfit children
  - Culturally relevant
- Basis for diet & weight loss
  - Traffic Light Guide
  - 5-2-1-0 campaign
    - 5 F&V
    - <2 hr screen time
    - 1 hr physical activity
    - 0 SSBs



# Intervention Development



# Aim 2: Implementing pilot study

- August 2014 – May 2015
- 2 sites – Cherokee, NC and Shiprock, NM
- 30 youth enrolled at each site
  - (15 control/15 intervention)

# Pilot Study - Outcomes

- Primary outcomes
  - Change in BMI
  - Change in fasting insulin
- Secondary outcomes
  - Change in HbA1c
  - Change in fasting glucose
- Other measures
  - Intervention acceptability
  - Changes in diet/physical activity behaviors

# Thank You

- The SEARCH for Diabetes in Youth Study is indebted to the many youth and their families, and their health care providers, whose participation made this study possible.