



*Early Screening for Diabetes,  
Hypertension, and Depression*

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CMO

**Our Mission**  
*Building healthier communities by preventing  
diabetes and obesity through healthcare and research*

# Disclaimer

- **The views and opinions expressed in this presentation and on any materials provided herewith are solely those of the presenter[s] and do not necessarily reflect the official policy or position of TennCare.**
- **The speakers for Early Screening for Diabetes, Hypertension, and Depression are not employed by or agents of TennCare.**



# Fundamental Questions

- Why The Concern?
- Scope of the Problem
- Current Screening Recommendations
- What Are We Screening For?
  - Disease Prevention
  - Timely Diagnosis
  - Preventing Complications
  - Management of the Disease and its Complications
- Lifedoc Population health initiative
  - Characterization of the Population
  - Understanding Risk Profiling
  - Identifying Gaps of Care
- Conclusions & Recommendations

# Why The Concerns?

## DEPRESSIVE DISORDER (DD)

- ✓ In 2015, 16.1 million over the age of 18 reported  $\geq 1$  DD episode in the past year.
- ✓ 3.7% of all U.S. disability-adjusted life years.
- ✓ Increased lifetime risk of suicide
- ✓ The yearly estimated cost is \$210.5B
- ✓ Despite high prevalence, only 5% of adults are screened at PCP

## TYPE 2 DIABETES (T2D)

- ✓ In 2020 13% of all US adults have T2D, & 34.5% (88M) prediabetes
- ✓ 21.4% of Pts were not aware and only 15.3% were aware of Pre-T2D.
- ✓ 7<sup>th</sup> leading cause of death in the US in 2017.
- ✓ In 2017 total cost = \$327 billion and diabetes-related medical expenditures nearly \$404 billion.
- ✓ Early intervention reduces both all-cause and T2D-related mortality, as well as MI risk after 10-20 years of intervention

## HYPERTENSION (HTN)

- ✓ Affects approx. 47% (116 million of US adults)
- ✓ 46% of adults with HTN are unaware they have it.
- ✓ Only ~42% of the Adults with HTN are Diagnosed and Treated
- ✓ In 2020, >670,000 US deaths had HTN as the primary cause.
- ✓ HTN costs about \$131B a year.
- ✓ There is strong evidence that screening for HTN reduces the incidence of cardiovascular events.

*American Family Physician*, October 15, 2018, Volume 98, Number 8,  
*JAMA* August 24/31, 2021 Volume 326, Number 8

*Endocrinol Metab Clin North Am.* 2021 September ; 50(3): 369–385  
*American Family Physician*



# How we have been doing?

## Prevalence of Hypertension by State in 2013 and 2020

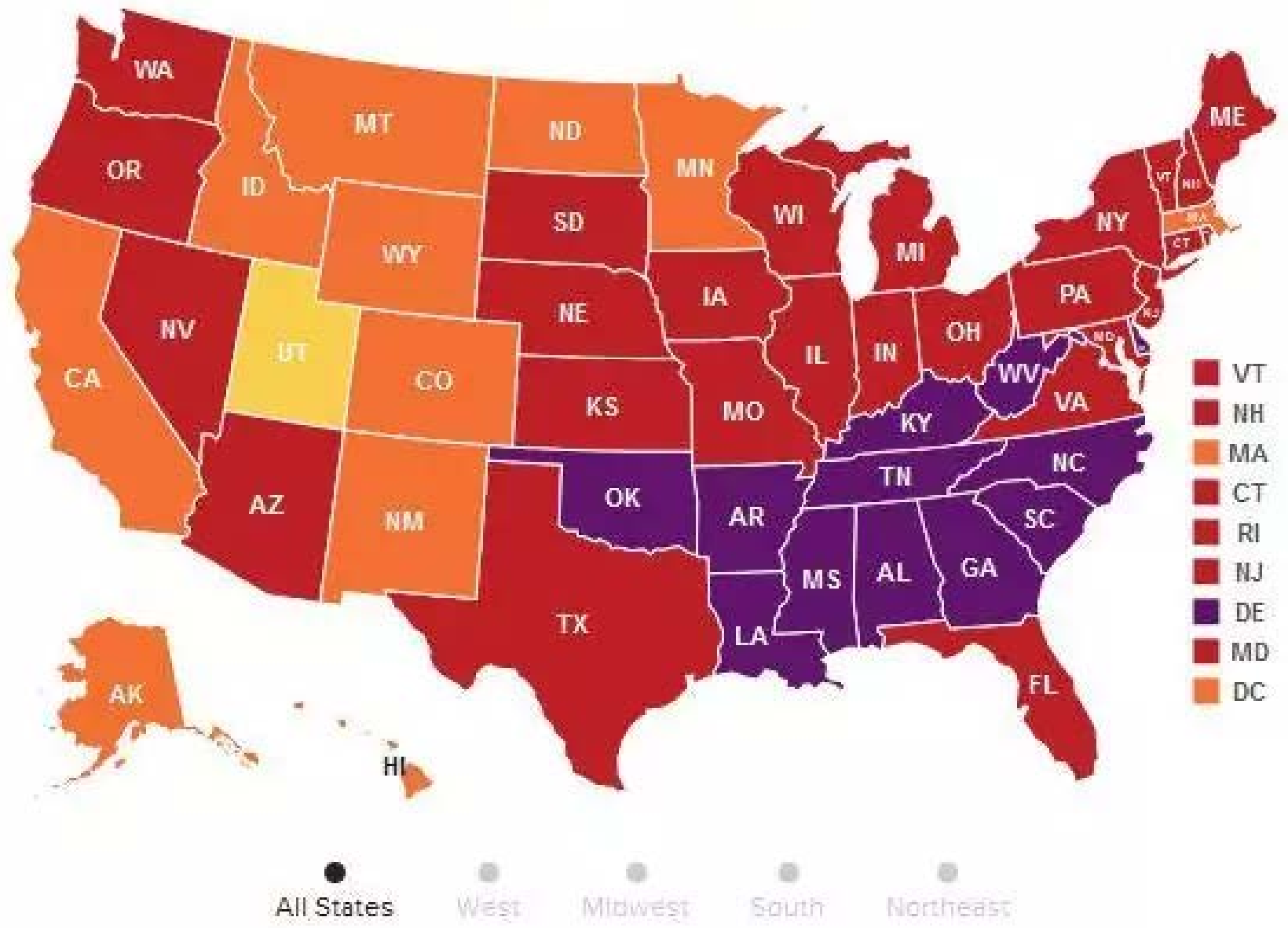


### Hypertension Rate by State, 2013

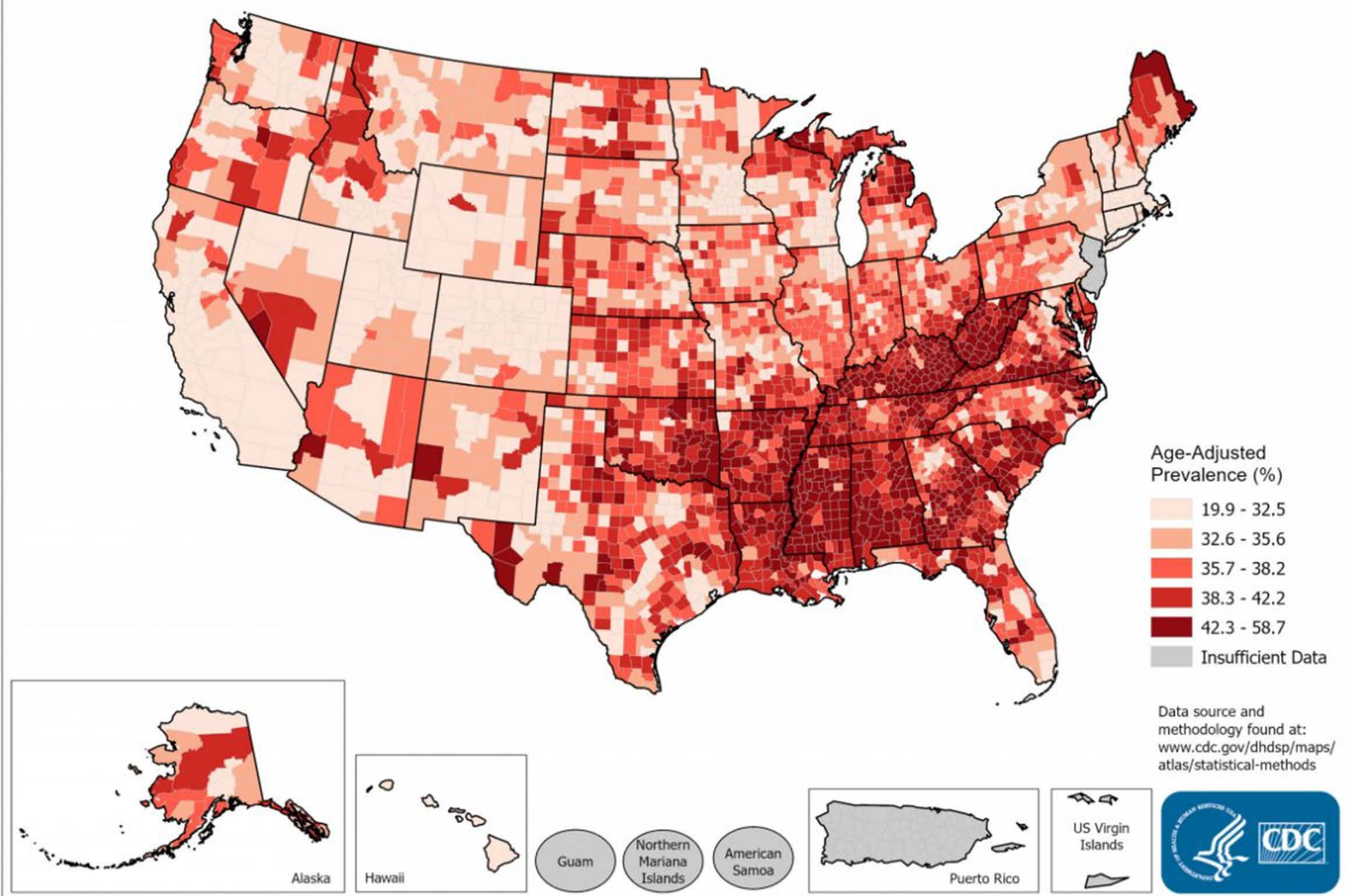
Select years with the slider to see historical data. Hover over states for more information. Click a state to lock the selection. Click again to unlock.

#### Percent of adults with hypertension

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



### Hypertension Prevalence, 2018 - 2020 Adults, Ages 18+, by County



Age-Adjusted Prevalence (%)  
19.9 - 32.5  
32.6 - 35.6  
35.7 - 38.2  
38.3 - 42.2  
42.3 - 58.7  
Insufficient Data

Data source and methodology found at: [www.cdc.gov/dhdsp/maps/atlas/statistical-methods](http://www.cdc.gov/dhdsp/maps/atlas/statistical-methods)



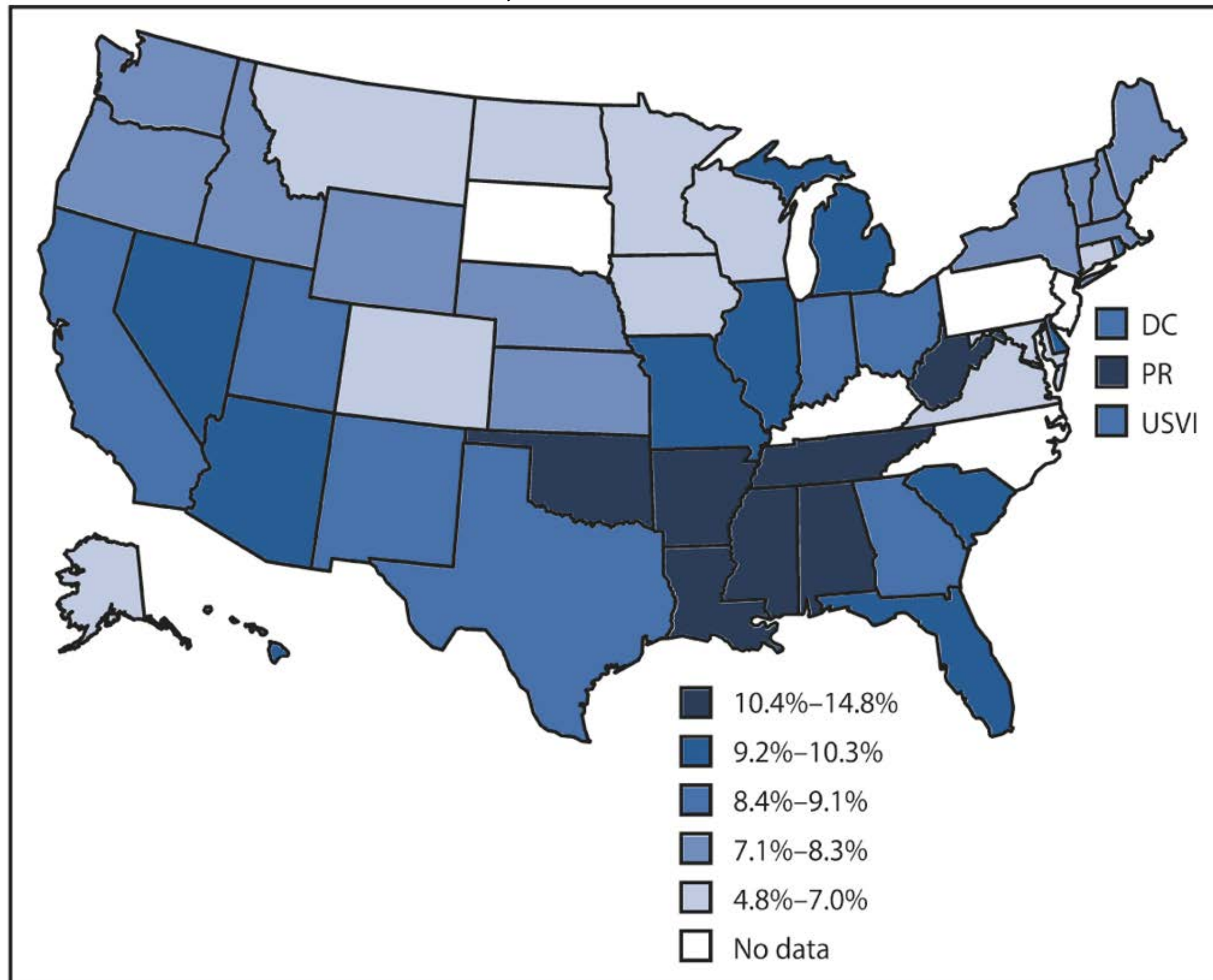


# How we have been doing?

Age-standardized Percentage of Adults Meeting Criteria for Depression By State

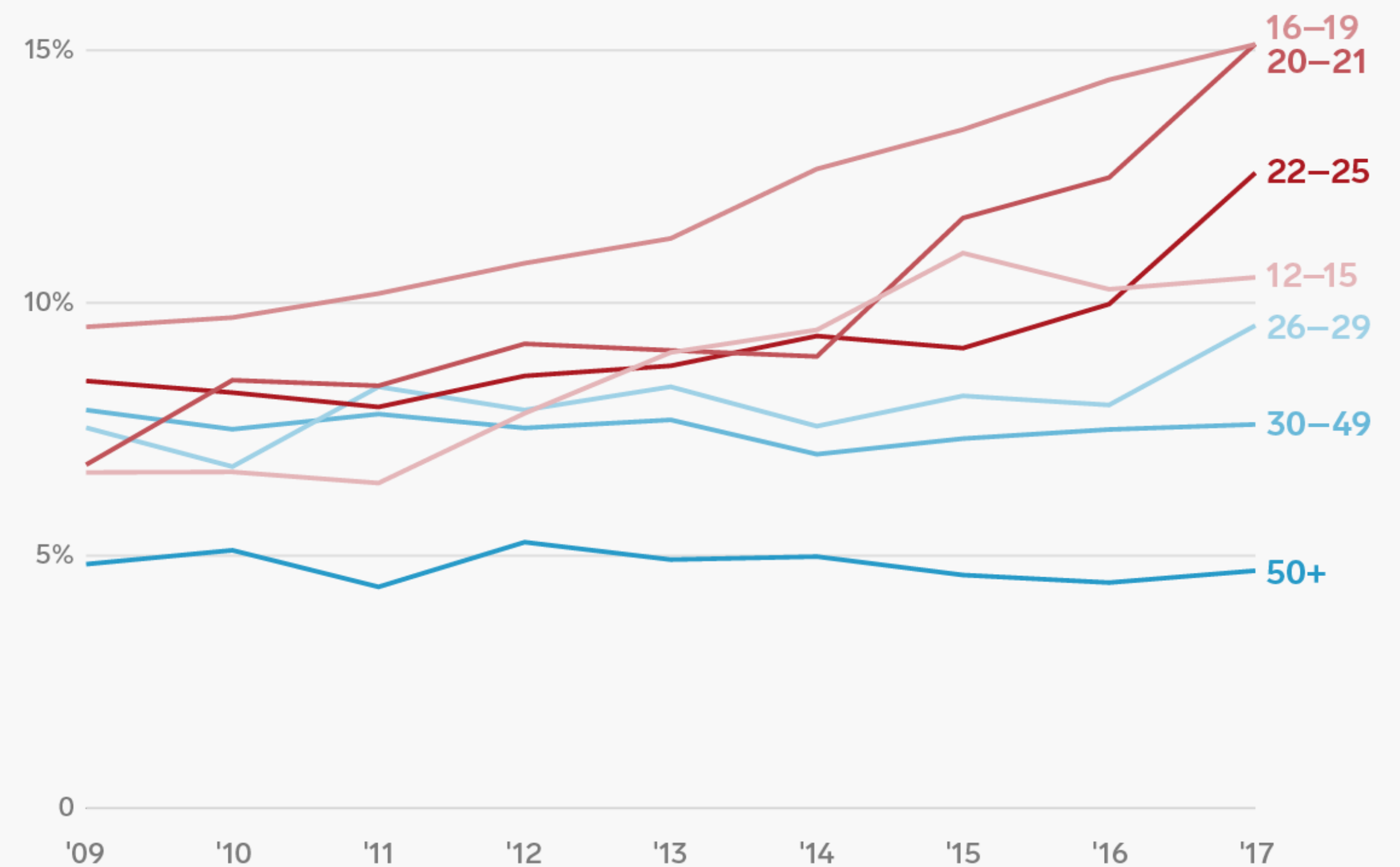


BRFSS USA, 2006 and 2008



## Depression rates by age, 2009–2017

Percent of population in each age group that has reported a Major Depressive Episode



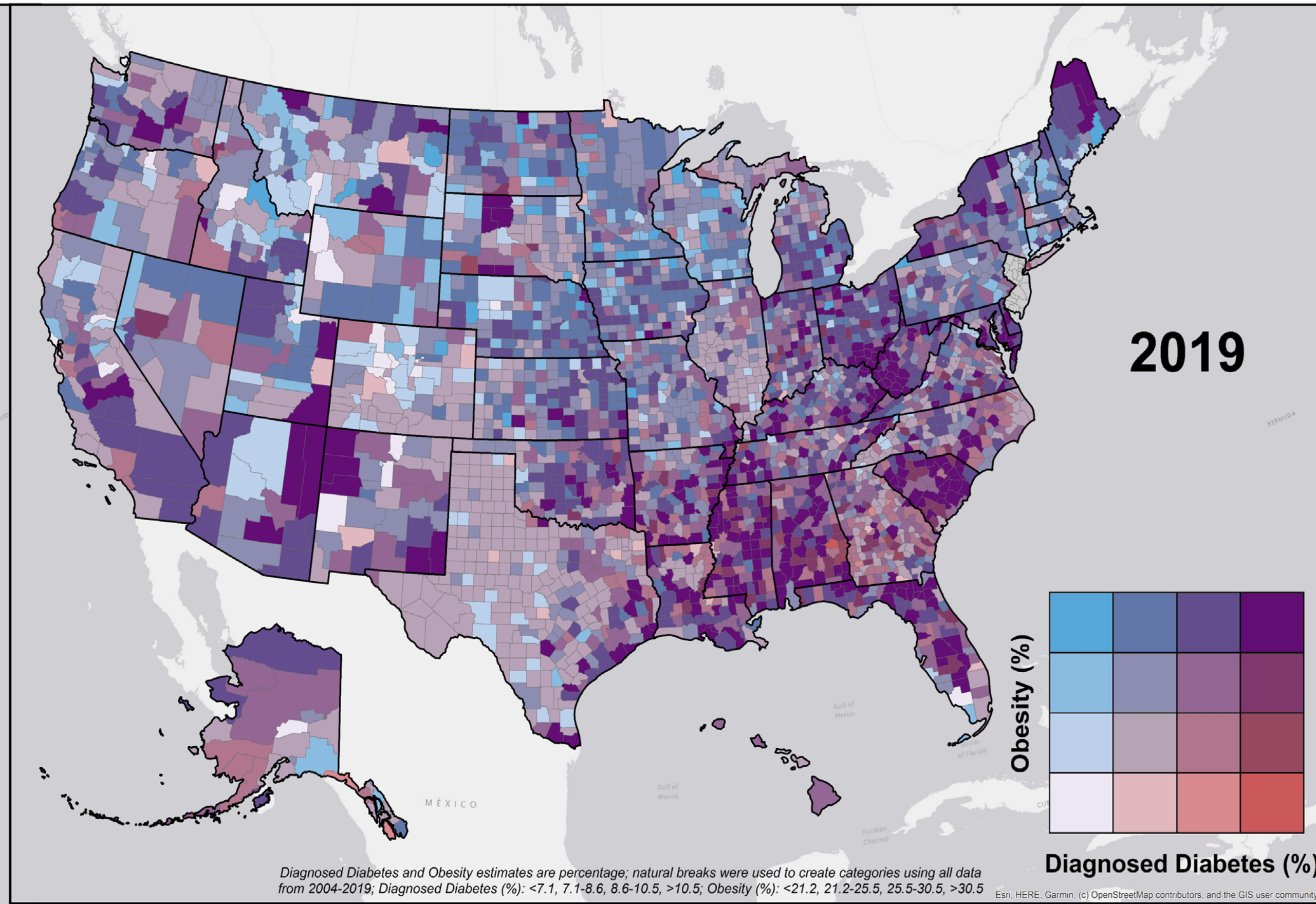
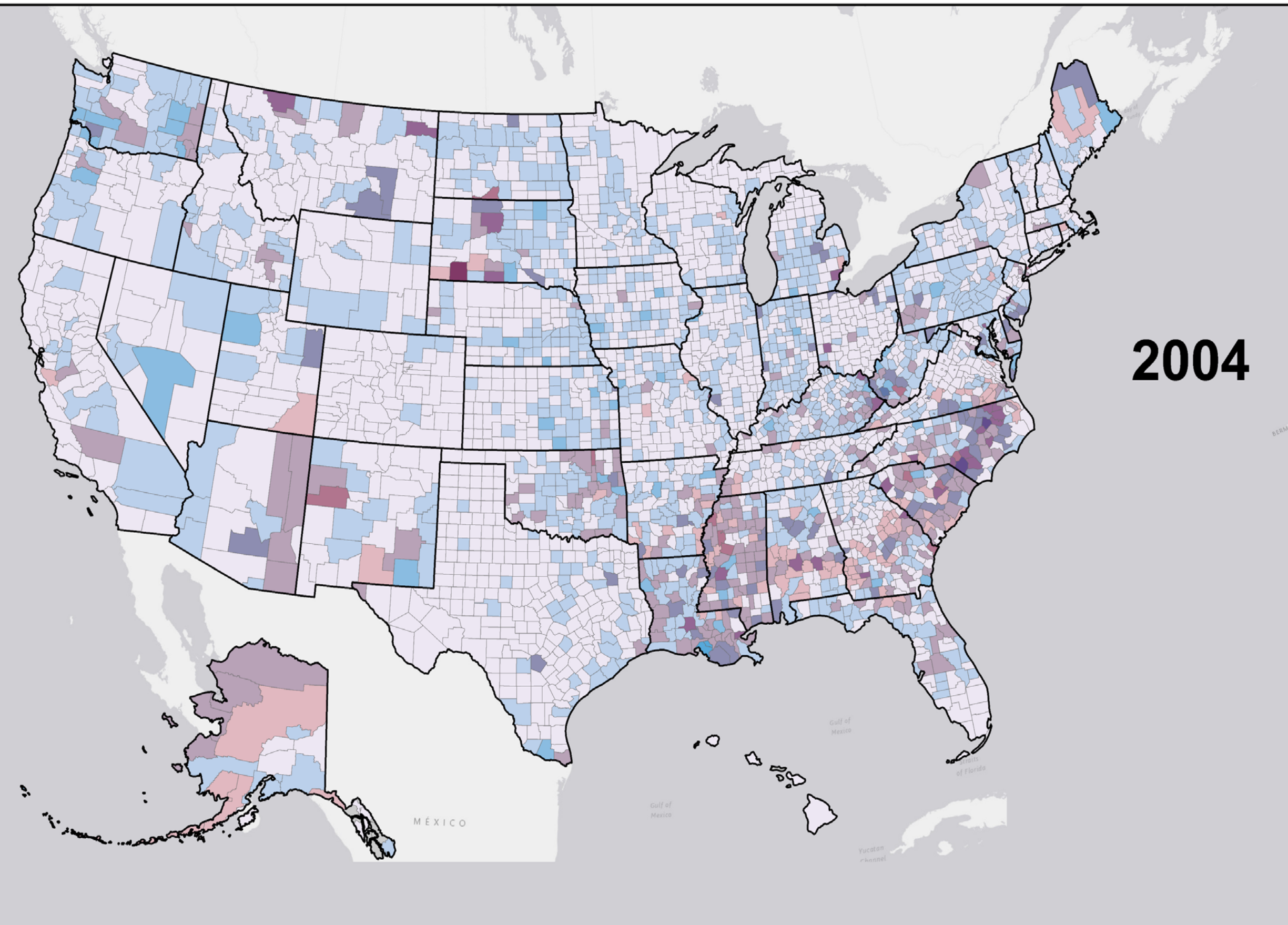
Source: Journal of Abnormal Psychology, Twenge et al.

Insider Inc.



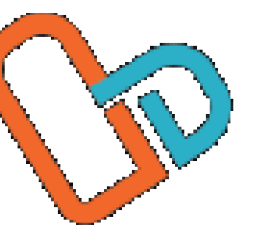
# How we have been doing?

Prevalence of Diagnosed Diabetes and Obesity in Adults  
by State/County 2004 to 2019





# Current Screening Recommendations





# What are we screening for?

## Recommendations for Depression Screening in Practice



<b>A.</b>	<b>Should be implemented in all adults, pregnant women and adolescents 12-18 yr. with adequate systems in place to ensure accurate diagnosis, treatment, and follow-up</b>
<b>B.</b>	<b>The PHQ-2 is an accepted initial screening all ages. If positive, the PHQ-9 or interview is recommended.</b>
<b>C.</b>	<b>Pregnant women should be screened at least once during pregnancy and again 4-8 wks. after EPDS or PHQ-9.</b>
<b>D.</b>	<b>Older adults can be screened using PHQ-2, PHQ-9, Cornell Scale for Depression in Dementia, or Geriatric Depression Scale.</b>
<b>E.</b>	<b>When screening is positive, the diagnosis should be confirmed using criteria from the DSM-MD, 5th ed.</b>

### PHQ-2 Screening Instrument for Depression

Over the past two weeks, how often have you been bothered by any of the following problems?

	Not at all	Several days	More than half the days	Nearly every day
Little interest or pleasure in doing things	0	1	2	3
Feeling down, depressed, or hopeless	0	1	2	3

**Scoring:** A score of 3 or more is considered a positive result. The PHQ-9 (Table 3) or a clinical interview should be completed for patients who screen positive.

PHQ = Patient Health Questionnaire.

# RECOMMENDATIONS FOR DEPRESSION SCREENING IN PRACTICE. *What are we screening for?*



What are we screening for?

## “Depression Disorder”

- Minimal = 1-4
- Mild = 5-9
- Moderate = 10-14
- Moderately Severe = 15-19
- Severe = 20-27

Confirming with DSM-5 criteria

What are we preventing? *Complications.*

### PHQ-9 Screening Instrument for Depression

Over the past two weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
Little interest or pleasure in doing things	0	1	2	3
Feeling down, depressed, or hopeless	0	1	2	3
Trouble falling or staying asleep, or sleeping too much	0	1	2	3
Feeling tired or having little energy	0	1	2	3
Poor appetite or overeating	0	1	2	3
Feeling bad about yourself—or that you are a failure or have let yourself or your family down	0	1	2	3
Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
Moving or speaking so slowly that other people could have noticed; or the opposite—being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

**Scoring:** 1 to 4 points = minimal depression, 5 to 9 points = mild depression, 10 to 14 points = moderate depression, 15 to 19 points = moderately severe depression, 20 to 27 points = severe depression.

PHQ = Patient Health Questionnaire.



# Screening Recommendations for Diabetes or Prediabetes in Asymptomatic Adults & Youth



	Prediabetes	Diabetes
A1C	5.7-6.4% (39-47 mmol/mol)*	≥6.5% (48 mmol/mol)†
FPG	100-125 mg/dL (5.6-6.9 mmol/L)*	≥126 mg/dL (7.0 mmol/L)†
2-hour plasma glucose during 75-g OGTT	140-199 mg/dL (7.8-11.0 mmol/L)*	≥200 mg/dL (11.1 mmol/L)†
Random plasma glucose	–	≥200 mg/dL (11.1 mmol/L)‡

\* For all three tests, risk is continuous, extending below the lower limit of the range and becoming disproportionately greater at the higher end of the range

† Diagnosis requires two abnormal test results from the same sample or in two separate samples.

‡ Only diagnostic in a patient with classic symptoms of hyperglycemia or hyperglycemic crisis

**1. In adults with overweight or obesity who have one or more of the following risk factors**

- First-degree relative with diabetes
- High-risk race/ethnicity (e.g., AA, H/L, NA, Asian, PI)
- History of CVD
- Hypertension
- Low HDL cholesterol (<35 mg/dL) or High triglyceride (>250 mg/dL)
- Physical inactivity
- Conditions associated with insulin resistance (e.g., PCOS, severe obesity, AN)

**2. People with prediabetes (A1C ≥5.7% [39 mmol/mol], IGT, or IFG) should be tested yearly.**

**3. People who were diagnosed with GDM should have lifelong testing at least every 3 year**

**4. Other people testing should begin at age 35 years**

**5. People with HIV.**

**1. In Youth should be considered if they have OW or OB and 1 additional risk :**

- a. Maternal history of diabetes or GDM
- b. Family history of T2D in first- or second-degree relative
- c. Race/ethnicity
- d. Signs of insulin resistance or related-conditions (AN, HTN, HLD, PCOS or low birth weight)

# Screening Recommendation for Hypertension in Adults



USPSTF Recommendation: Screening for Hypertension (HTN) in Adults	
<p><b>To whom does this recommendation apply? How often?</b></p>	<p><b>Adults 18 years or older without known HTN.</b></p> <ul style="list-style-type: none"> <li>• <u>Yearly</u> screening in subjects <math>\geq 40</math> years or adults with increased risk (i.e. those with overweight or obesity, Black/African-American or with high BP).</li> <li>• Screening every 3-5 years in adults 18-39 years not at increased risk for HTN</li> </ul>
<p><b>How to implement this recommendation?</b></p>	<ol style="list-style-type: none"> <li><b>1. Screen:</b> Measure blood pressure with an OBPM .</li> <li><b>2. Confirm:</b> Take blood pressure measurements outside of the clinical setting to before starting treatment. <ul style="list-style-type: none"> <li><b>Ambulatory blood pressure monitoring.</b></li> <li><b>Home blood pressure monitoring</b></li> </ul> </li> </ol> <p>Blood pressure measurements should be taken at the brachial artery in a seated position after 5 minutes of rest</p>
<p><b>Benefits of Early Detection and Intervention</b></p>	<p>USPSTF concludes with high certainty that screening for hypertension in adults has substantial net benefit</p>



**In 2013, U.S. P.S.T.F & the AAFP  
cited insufficient evidence to  
recommend screening for High BP  
in average-risk children.**

*Ann Intern Med. 2013;159(9):613-619. <https://www.aafp.org/patient-care/clinical-recommendations/all/hypertension.html>. Accessed April 21, 2023*

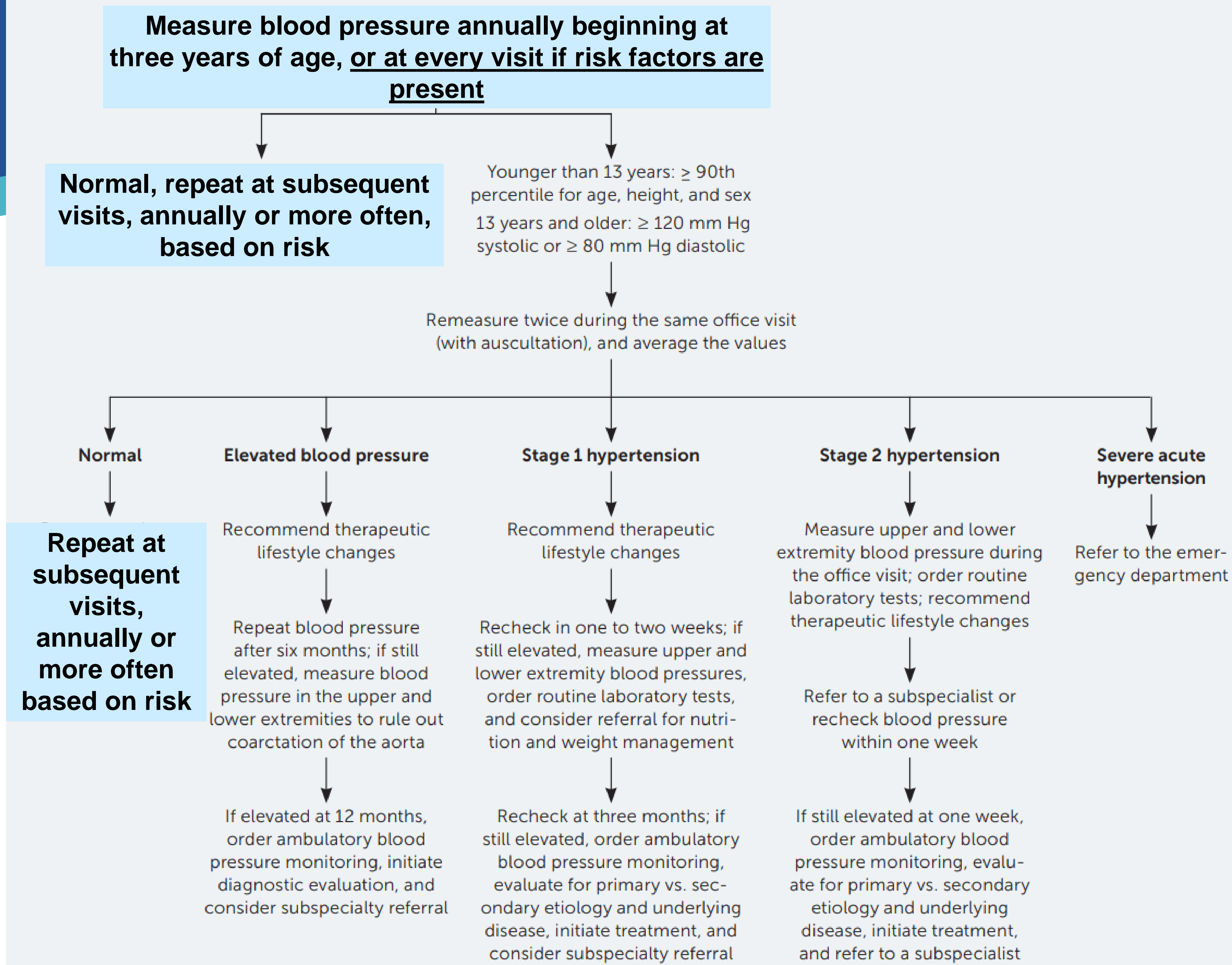
## **Risk Factors**

**1. Increased BMI, or abdominal circumference**

**2. Other conditions with risk of HTN include:**

- Disordered sleep (i.e., OSA, primary snoring, sleep fragmentation)
- Chronic kidney disease.
- Race and ethnicity (H and B)
- Family history of CVD
- Male sex
- Low birth weight
- Maternal smoking during pregnancy

# Algorithm for Management of Elevated BP in Children & Adolescents





# Screening BP Values Requiring Further Evaluation



	Boys		Girls	
	Systolic	DBP	Systolic	DBP
1	98	52	98	54
2	100	55	101	58
3	101	58	102	60
4	102	60	103	62
5	103	63	104	64
6	105	66	105	67
7	106	68	106	68
8	107	69	107	69
9	107	70	108	71
10	108	72	109	72
11	110	74	111	74
12	113	75	114	75
≥13	120	80	120	80

## For children aged 1-13 y

Normal BP: < 90th percentile

Elevated BP: ≥ 90th percentile to < 95th percentile or 120/80 mm Hg to < 95th percentile (whichever is lower)

Stage 1 HTN: ≥ 95th percentile to < 95th percentile + 12 mm Hg, or 130/80 to 139/89 mm Hg (whichever is lower)

Stage 2 HTN: ≥ 95th percentile + 12 mm Hg, or ≥ 140/90 mm Hg (whichever is lower)

## For children aged ≥ 13 y

Normal BP: < 120/< 80 mm Hg

Elevated BP: 120/< 80 to 129/< 80 mm Hg

Stage 1 HTN: 130/80 to 139/89 mm Hg

Stage 2 HTN: ≥ 140/90 mm Hg

# WHAT ARE WE SCREENING FOR?

Disease Prevention  
Timely Diagnosis  
Preventing Complications  
Managing Disease and Complications

Critical Period: a time when the risk of onset, persistence, progression or complication of a condition is increased





# What Type of Risk are we Screening for?

Critical Period	Type of Risk	Type of Subjects	Aiming	Type of Outcome
1	High Lifetime Risk to Develop a disease	At risk subjects (Pre-disease)	Modify risk profile and Behaviors	Primordial prevention of the disease
2	Risk of Clinically Silent Disease	High risk for disease (Subclinical)	Modify progression	Primary Prevention, risk stratification & prevent Complications
3	Risk of Subclinical Complications	Sick Subjects (Early disease)	Control Disease	2 <sup>nd</sup> Prevention, Decrease development of complication
4	Risk of severe complications	Subject with established disease	Intervene disease & Complications	3 <sup>rd</sup> Prevention, Stabilize Complication decrease progression

# How early should we screen?

Risk Factors of Development of Depression	
<b>Internal factors</b>	<b>Adverse life events</b>
Female sex History of anxiety Low self-esteem Older age Mem ( $\geq 75$ yr.) Neuroticism* Social Isolation	<ul style="list-style-type: none"> <li>• Childhood sexual abuse</li> <li>• Chronic medical conditions</li> <li>• Disturbed family environment</li> <li>• Nursing Home Residents</li> <li>• History of divorce</li> <li>• Lifetime trauma</li> <li>• Low educational status</li> <li>• Low social support</li> <li>• Parental loss</li> <li>• Death of a spouse</li> <li>• uncontrolled pain &amp; insomnia</li> <li>• Cognitive &amp; functional impairments.</li> </ul>
<b>External factors</b>	
Conduct disorder Substance use	

Risk Factors of Development Obesity, Diabetes, HTN	
Prenatal Risk Factors	Postnatal Risk Factor
<ul style="list-style-type: none"> <li>• Placental Insufficiency</li> <li>• Food deprivation in early Preg.</li> <li>• Gestational diabetes</li> <li>• Weight Gain during Pregnancy.</li> <li>• Parental History of Obesity</li> <li>• Small for gestational age</li> <li>• Prematurity</li> <li>• Large for gestational age</li> </ul>	<ul style="list-style-type: none"> <li>• Rapid weight gain initial 4 months</li> <li>• Infant overnutrition</li> <li>• Bottle feeding</li> <li>• Early adiposity rebound</li> <li>• Drug-induced weight gain</li> <li>• Presence of Chronic Conditions</li> <li>• Overweight adolescence</li> </ul>

**Depression, HTN and Diabetes are present since childhood.**

**We should be screening for modifiable risk factors and behaviors and aiming to intervene earlier (pre-disease/subclinical) based on the subjects' risk category**



# Evaluating and Comparing the Cardiovascular Risk Profile in Children and Adults Stratified by Age and Severity of Overweight

**759 pts without health-related conditions other than OW or OB. 36.1% M, 62.1% B, 28.4% H and 9.5% W**  
**Pre-Adol. (<11y): 34.1%;**  
**Adol. (11-18y): 39.0%;**  
**Adult (>18y): 26.9%**

## Subjects underwent:

H&P  
 75g OGTT Glucose, Insulin levels  
 Laboratory: Lipids (TC, HDL, LDL, TG), and  
 CRP-hs (LabCorp, NC).

## Subjects were classified:

NGM or IGM = (IGT, IGF, or DM by ADA)  
 Pre-HTN or HTN by 2014 AHA/AAP  
 Lipids abnormalities NCEP ATP-III  
 Cumulative Number of CMRF (Range 0-8).

	RBMI ≤ 150				RBMI > 150			
	PRE_AD (73)	ADOLES (43)	ADULTS (126)	TOTAL (242)	PRE_AD (186)	ADOLES (253)	ADULTS (78)	TOTAL (517)
Age (Yrs.)	8.08 ± 0.25*	14.15 ± 0.30*	39.4 ± 1.09	25.4 ± 1.10	8.59 ± 0.14*	13.86 ± 0.12*	35.54 ± 1.33	15.23 ± 0.45
RBMI	135.96 ± 1.53	130.53 ± 2.11	121.93 ± 1.36	127.69 ± 1.00	179.76 ± 2.05	196.71 ± 2.29	186.30 ± 4.20	189.04 ± 1.52
Female (%)	63.0**	60.5**	69.0*	65.7**	59.1**	59.3**	84.6	63.1*
AA (%)	46.6	46.5	38.1	42.1	66.7	78.7	75.6	73.9
CISI	4.86 ± 0.43	3.63 ± 0.35	3.64 ± 0.36	4.00 ± 0.23	3.00 ± 0.19	2.68 ± 0.12	2.66 ± 0.29	2.79 ± 0.10
IGM (%)	4.1	4.7	21.4	13.2	6.5	17.0	10.3	12.2
HTN (%)	8.2	7.0	37.5	21.8	25.1	30.7	57.4	32.3
#CMRF	1.92 ± 0.16	2.33 ± 0.21	2.82 ± 0.12	2.46 ± 0.09	3.41 ± 0.11	3.82 ± 0.10	3.43 ± 0.16	3.61 ± 0.07

	PRE-ADOLESCENT				ADOLESCENT				ADULT			
	≥1	≥2	≥3	≥4	≥1	≥2	≥3	≥4	≥1	≥2	≥3	≥4
#CMRF												
RBMI ≤150	86.3	57.5	27.4	15.1	93.0	72.1	37.2	18.6	100.0	84.1	53.2	28.6
RBMI >150	97.8	92.5	72.0	46.8	100.0	91.3	77.9	58.5	100.0	94.1	75.6	39.7
P	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	NS	0.021	0.001	0.099

# Association Demography & The Cardiometabolic Risk Profile in Black & Hispanic Adolescents

(n: 2332, Period 2018-2020)



**59% of subjects have overweight/obese**

✓ **25% have obesity**

✓ **14% have severe obesity**

✓ **55.8% of Severe obese were AA**

✓ **56.5 % of severe Obese were male**

• **20.8% Elevated BP or HTN**

• **18 % A1c suggest pre-diabetes or T2D**

• **34.1% Metabolic Syndrome**

• **46.2 % Dyslipidemia**

• **92% Vitamin D insufficiency**



# Association Demography & The Cardiometabolic Risk Profile in Black & Hispanic Adolescents

(n: 2332, Period 2018-2020)



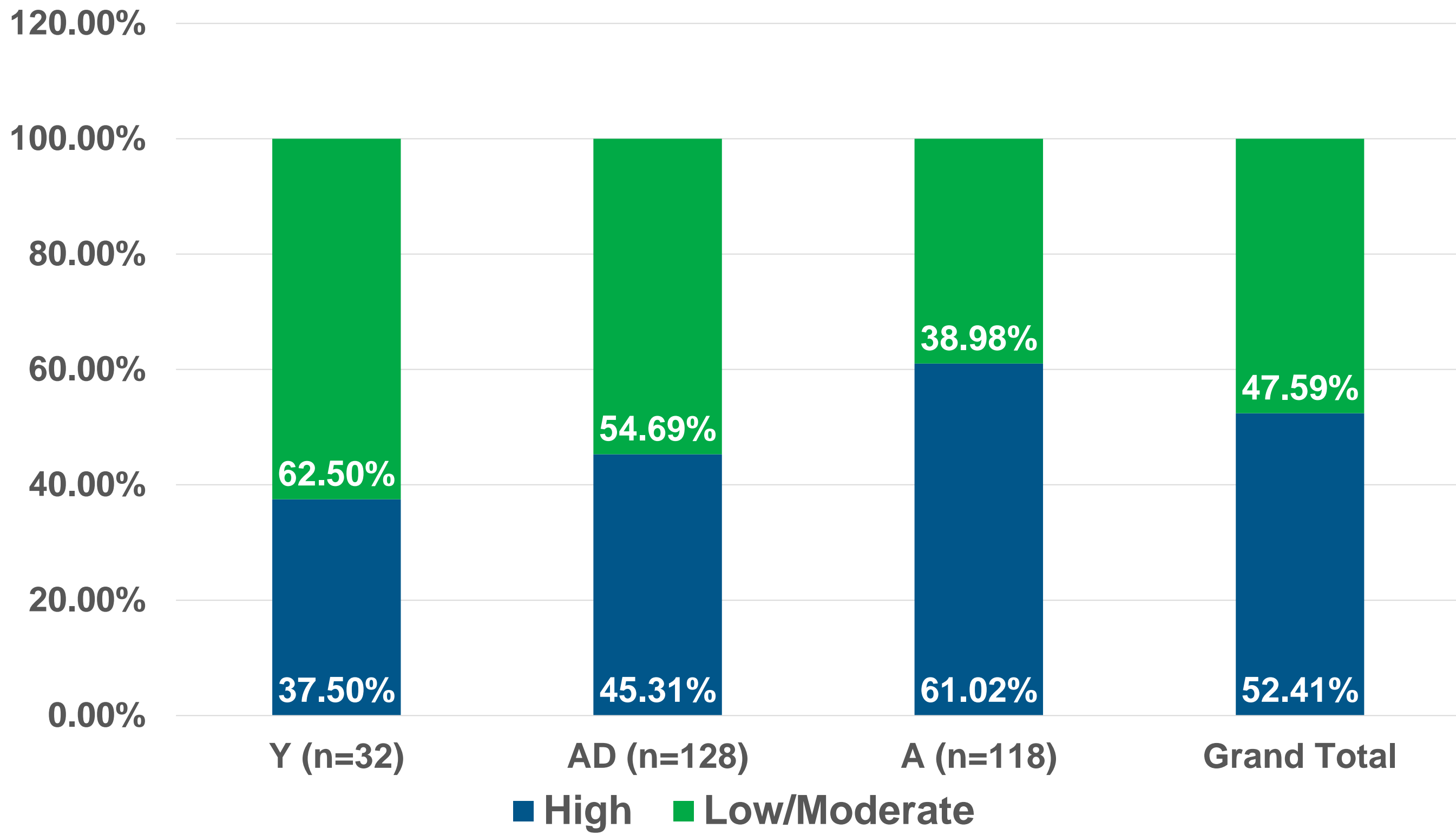
	IGM	High BP	High TC	Low HDL	High LDL	High TG	High AST/ALT NAFLD	Inflammation.	Vitamin D Insufficiency.	
Sex	Male	1	1	1	1	1	1	1	1	
	Female	0.88 (0.63-1.23)	<b>0.48 (0.39-0.60)</b>	0.8 (0.54-1.2)	<b>0.54 (0.42-0.7)</b>	0.97 (0.61-1.56)	<b>0.63 (0.5-0.81)</b>	<b>0.36 (0.25-0.52)</b>	<b>2.51 (1.85-3.39)</b>	<b>1.75 (1.15-2.65)</b>
Race	H	1	1	1	1	1	1	1	1	
	AA	<b>3.01 (2.09-4.32)</b>	1.13 (0.83 - 1.53)	0.87 (0.54-1.40)	<b>0.58 (0.43-0.79)</b>	1.16 (0.68-1.98)	<b>0.12 (0.08-0.18)</b>	<b>0.17(0.19-0.27)</b>	0.80 (0.56-1.15)	1.3 (0.75-2.26)
Age (yrs.)	12-14	1	1	1	1	1	1	1	1	
	15-17	1.27 (0.89-1.81)	<b>3.38 (2.69- 4.24)</b>	<b>1.68 (1.11-2.54)</b>	1.00 (0.75-1.32)	<b>1.83 (1.14-2.95)</b>	1.05 (0.79-1.38)	<b>1.65 (1.13-2.4)</b>	1.17 (0.83-1.65)	1.33 (0.8-2.19)
BMI %ile	NW	1	1	1	1	1	1	1	1	
	OW	<b>3.43 (1.34-8.79)</b>	<b>2.17 (1.56-3.03)</b>	1.5 (0.82-2.76)	<b>2.12 (1.39-3.23)</b>	1.43 (0.68-2.99)	<b>1.82 (1.27-2.61)</b>	1.88 (0.98-3.61)	<b>6.33 (1.85-21.61)</b>	1.6 (0.97-2.65)
	OB	<b>6.58 (2.79-15.52)</b>	<b>5.23 (3.92-6.98)</b>	1.49 (0.85-2.59)	<b>5.11 (3.54-7.37)</b>	1.28 (0.65-2.53)	<b>3.62 (2.61-5.01)</b>	<b>4.9 (2.84-8.46)</b>	<b>16.6 (4.98-55.19)</b>	<b>3.45 (2.02-5.9)</b>
	SVOB	<b>11.3 (4.79-26.82)</b>	<b>11.5 (8.35- 5.96)</b>	<b>2.45 (1.38-4.38)</b>	<b>7.17 (4.77-10.76)</b>	<b>2.84 (1.47-5.49)</b>	<b>5.91 (3.94-8.86)</b>	<b>10.5 (5.84-18.81)</b>	<b>62.9 (18.39-215.22)</b>	<b>7.15 (2.97-17.23)</b>

Data represent odd ratio (OR) and 95% confidence intervals (95% CI). Logistic regression analysis adjusted for sex and age

# Characterization of Lifestyle Risk Profile (per LSQ) by Age

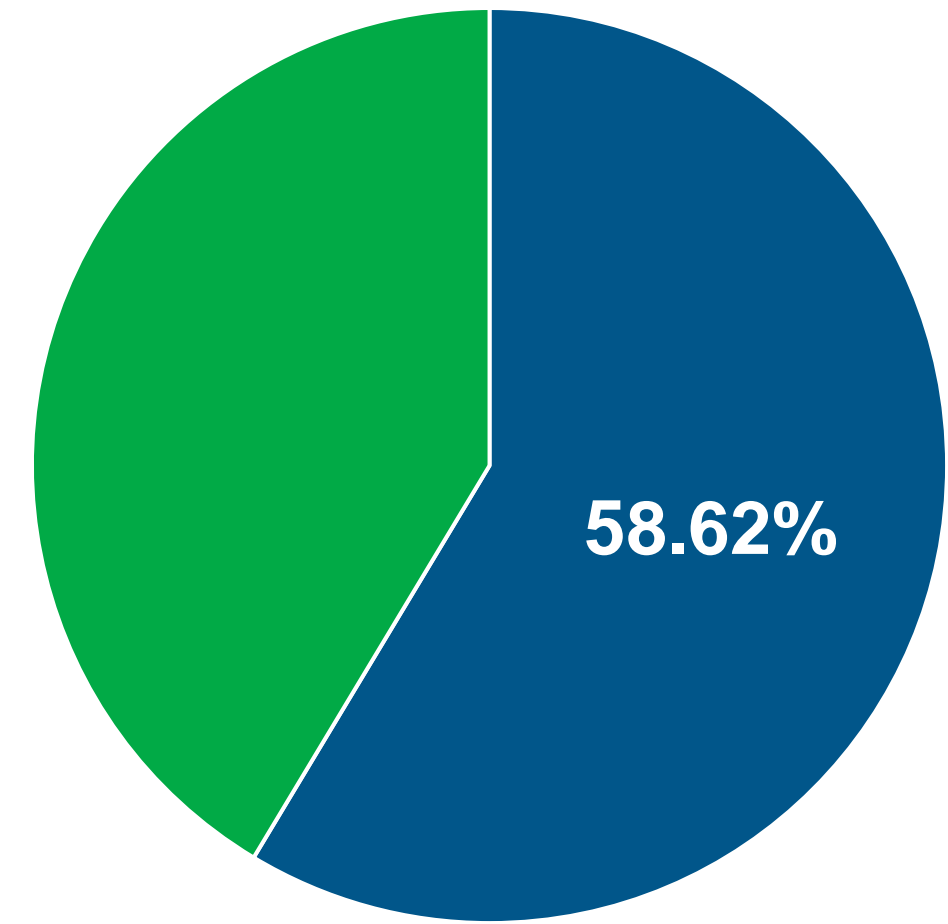
*Pilot project at Green Dot's Community 2019*

*(n=290)*

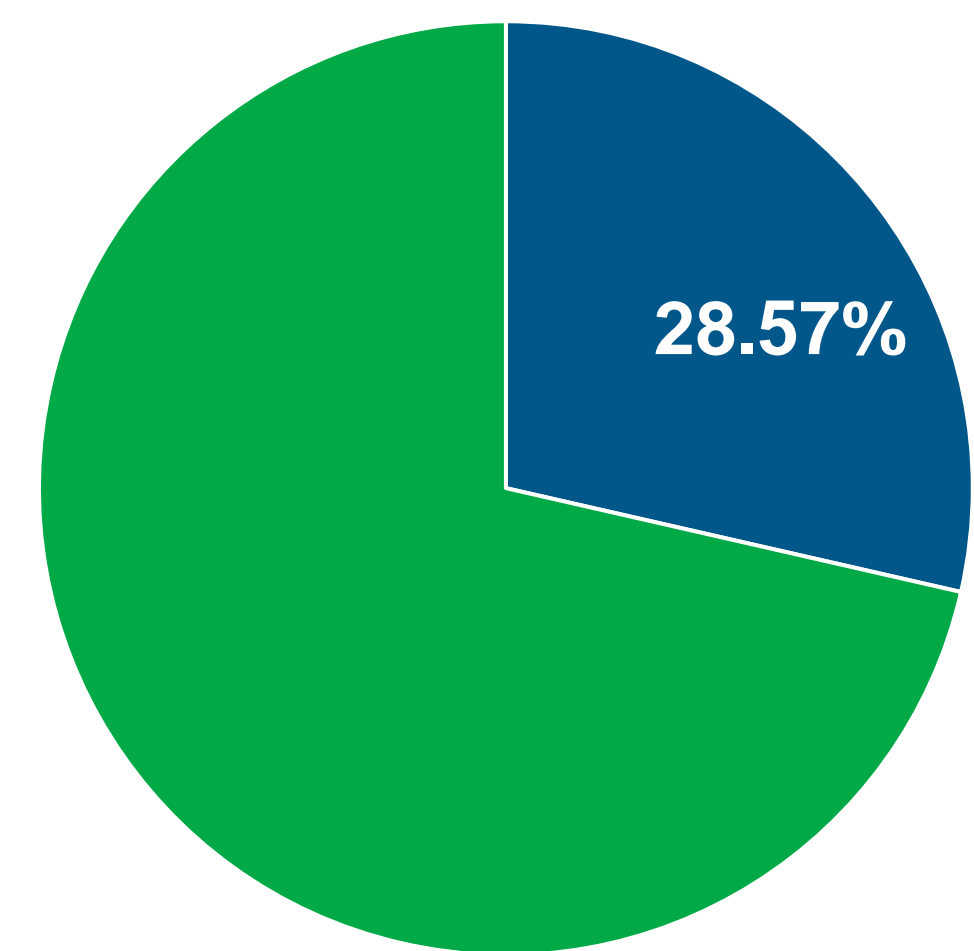


**Abbreviations Youth (Y), Adolescents (AD), Adults (A)**

Percentage of Families with At Least 1 Member with a 'High Risk' Score Point (n=145)



Percentage of 2+ Person Families with 2 or More High Risk Participants (n=126)



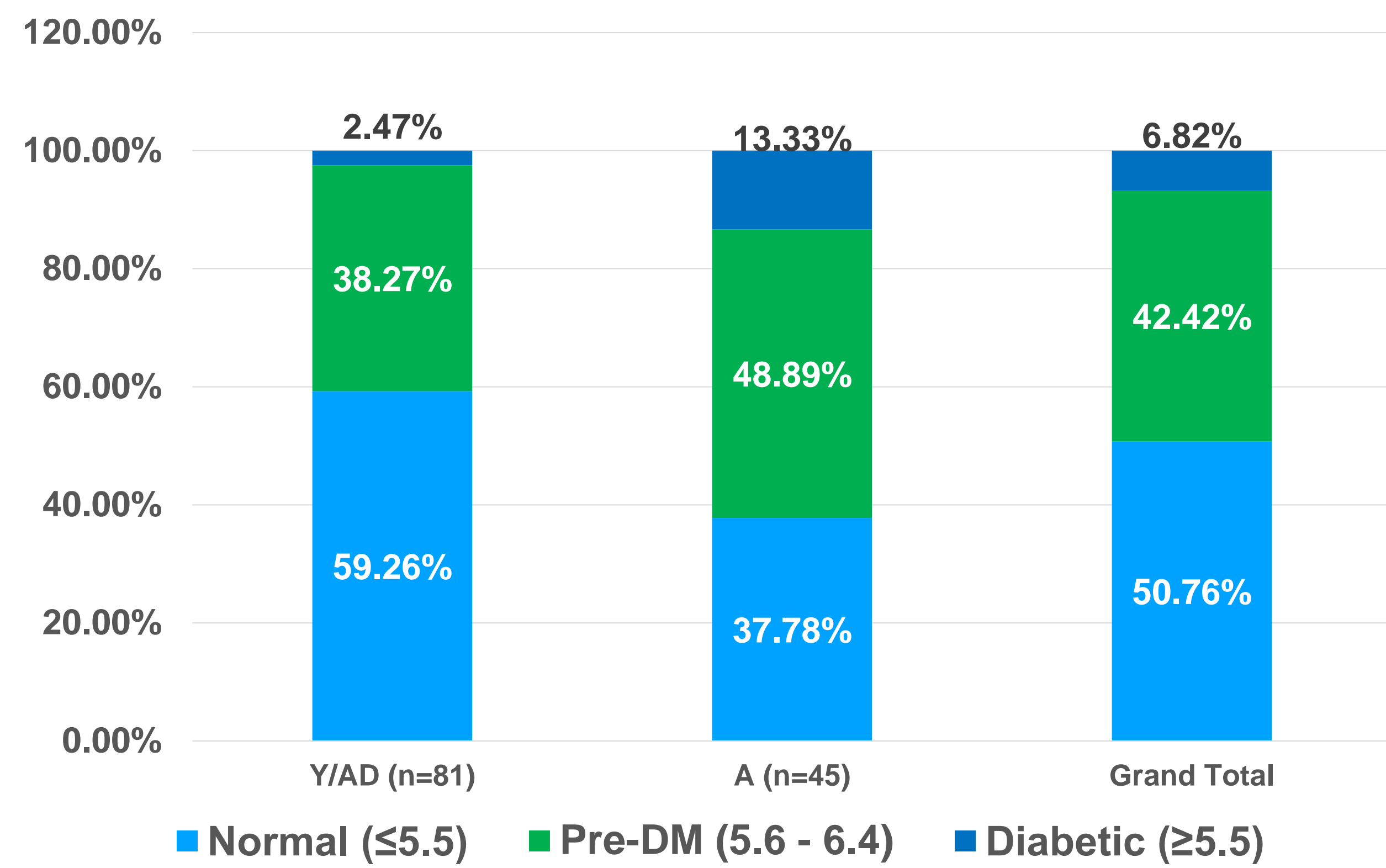


# Prevalence of T2D, Prediabetes and Obesity by Age

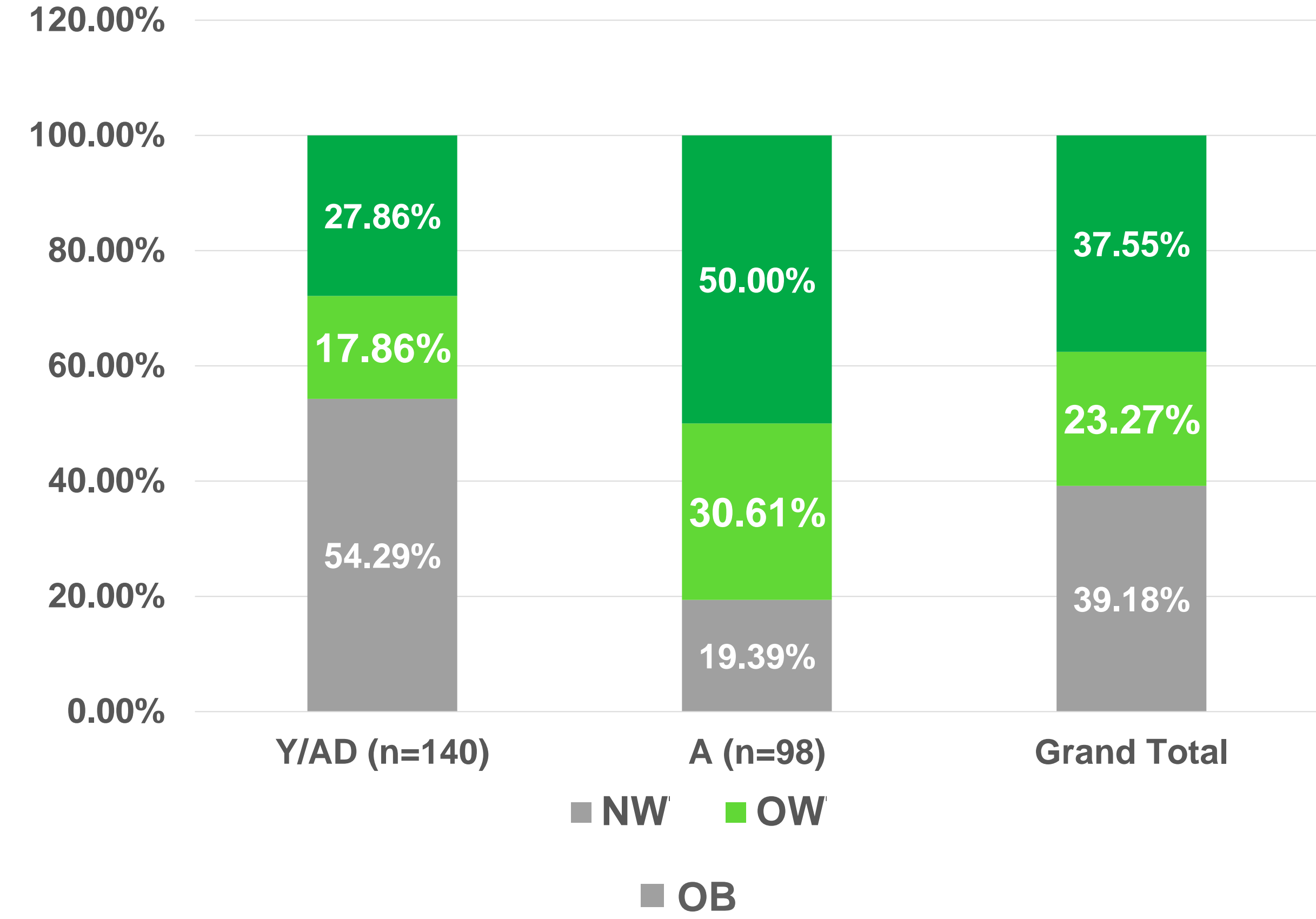
*Pilot at Green Dot Public Schools*



### Prevalence of Diabetes and Prediabetes (n =132)



### Prevalence of Overweight and Obesity (n =238)



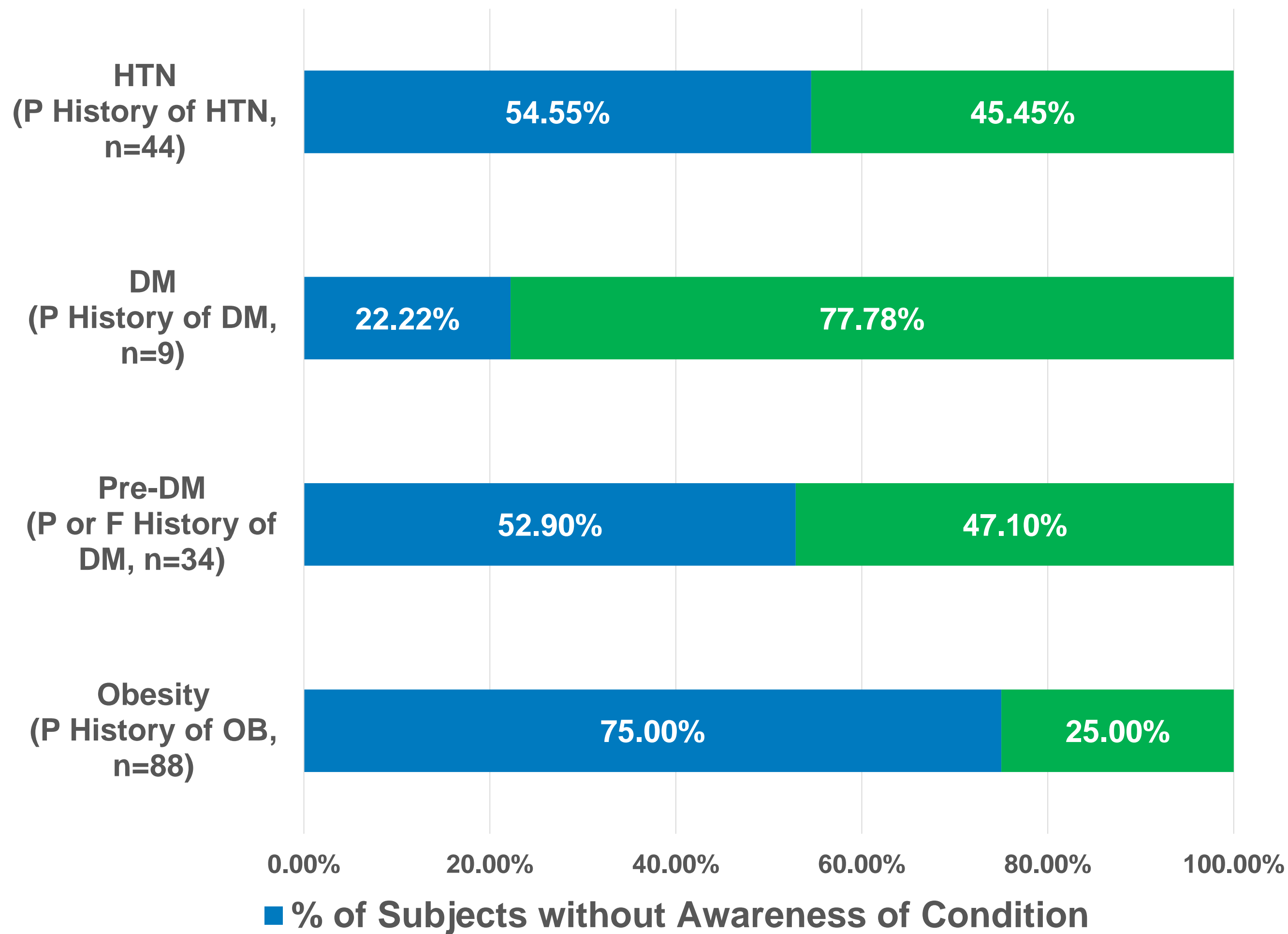
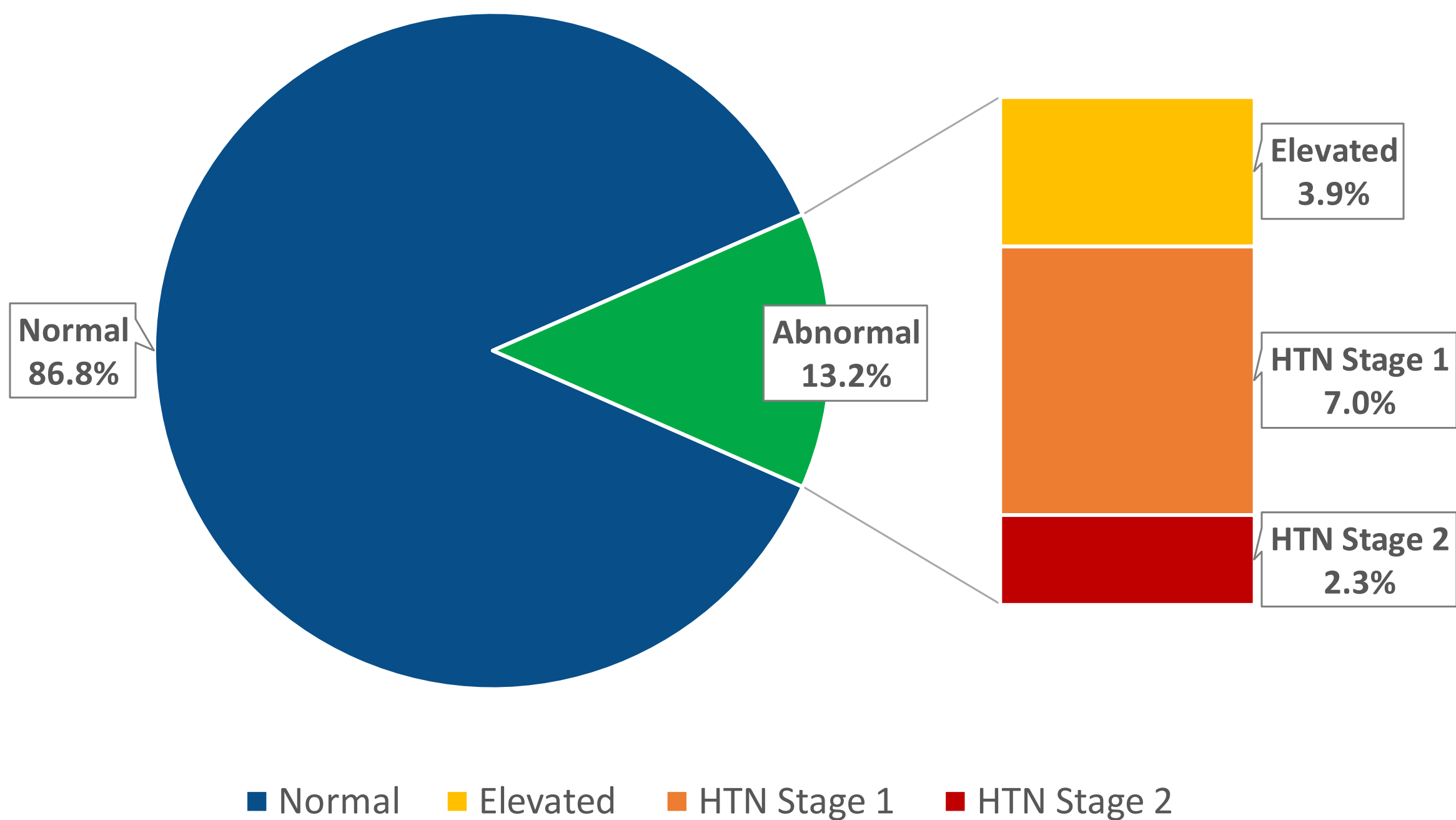
**Abbreviations Youth+ Adolescents (Y/AD), Adults (A)**

# Prevalence of Hypertension & Patient Awareness of Conditions

*Pilot Project at Green Dot Public Schools*



## Pediatric BP Classes Among Students <18y

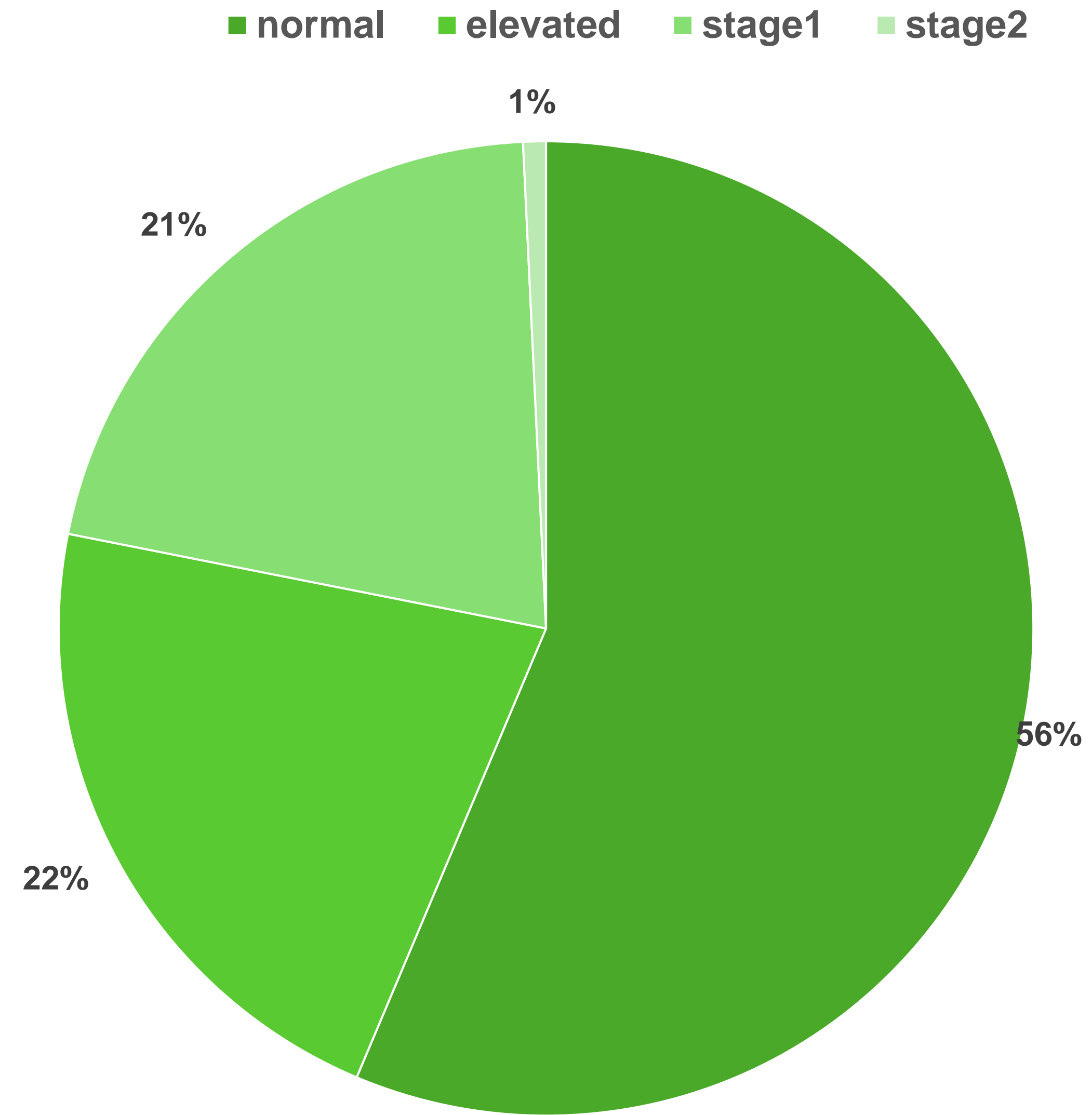
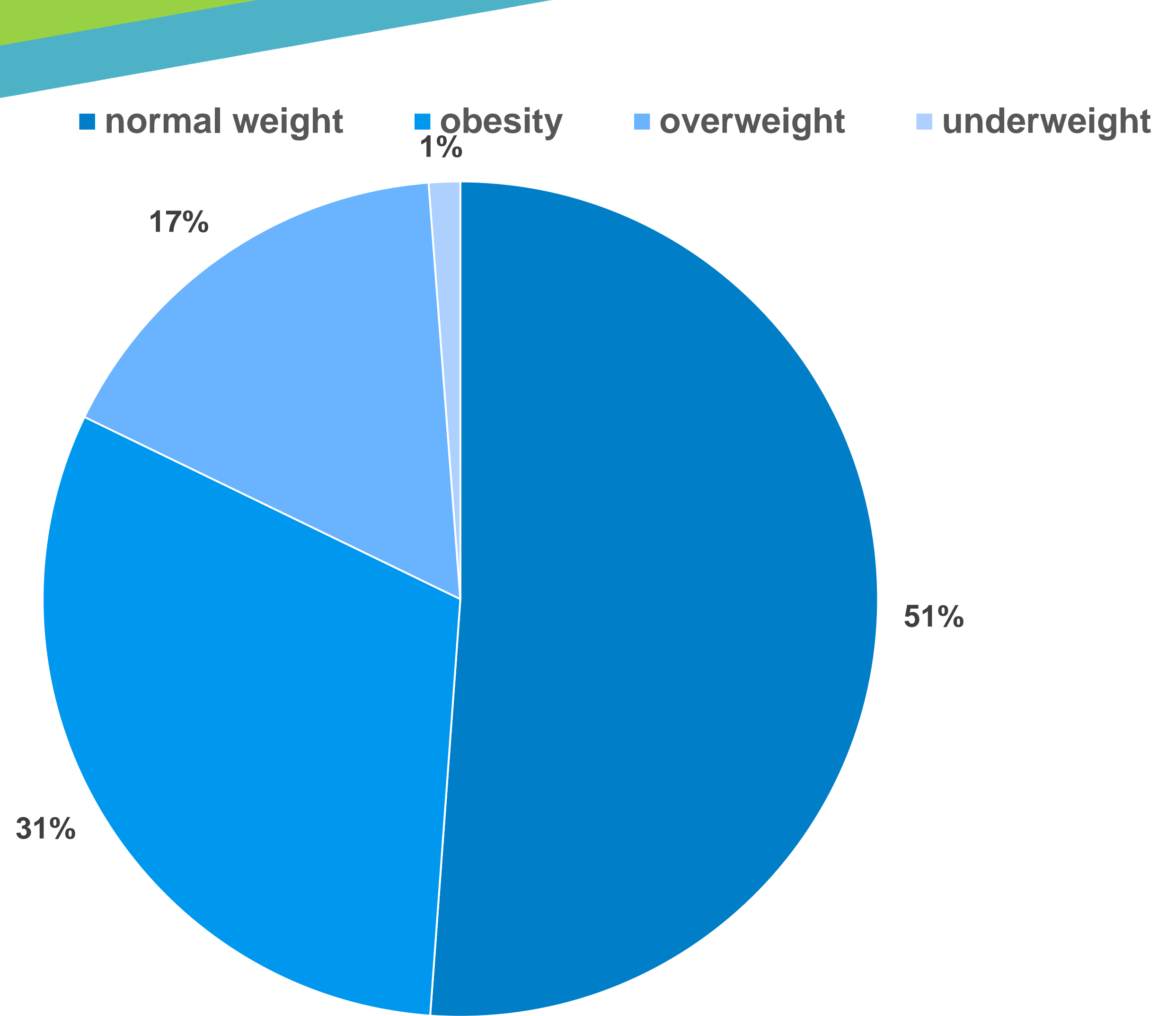


**Abbreviations** Hypertension (HTN- BP/BP %ile), Obesity by BMI/BMI %ile, Prediabetes or Diabetes (Pre-DM/DM by A1c Range)



# WELL CHILD EVALUATION (2023)

## Adiposity and Blood Pressure Status



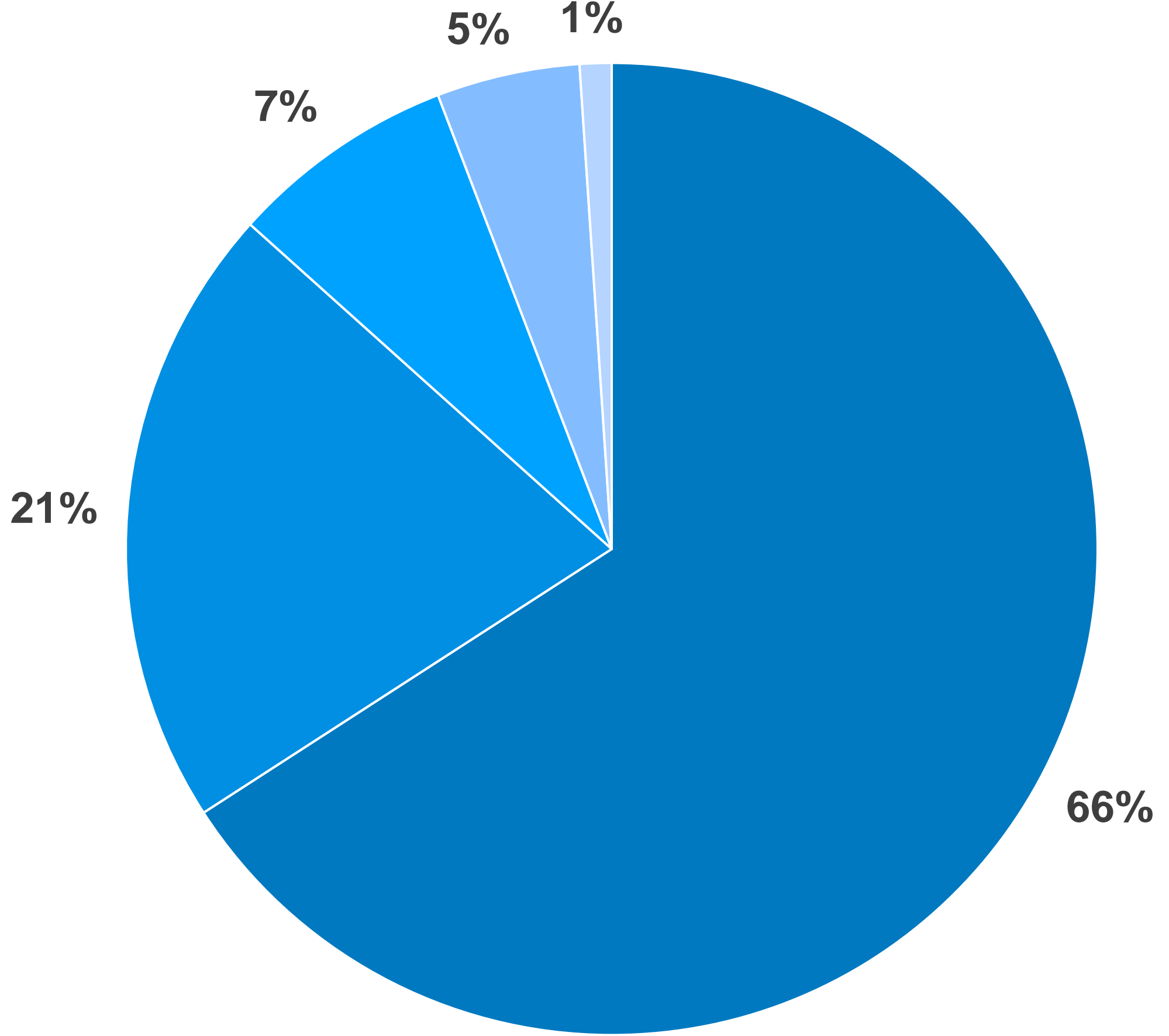
# WELL CHILD EVALUATION in 2023

## DEPRESSION, HEARING, VISION SCREENING RESULTS



- no depression
- Moderate depression
- severe depression
- mild depression
- moderately severe depression

ICD Description name	%
Failed vision screen	29%
Failed hearing screening	29%
Elevated blood pressure reading	17%
Depression	12%
Asthma	5%
Attention deficit hyperactivity disorder (ADHD)	3%
Suicidal ideations	2%
Marijuana use	1%





# CONCLUSIONS & RECOMMENDATIONS:



- 1. The epidemics of prediabetes, diabetes, depression and hypertension and their progression are major concerns for clinicians and healthcare stakeholders. These are equally impacting life expectancy and QoL of youth and adult subjects.**
- 2. Minority youth populations living in underserved communities are at higher risk for prediabetes, diabetes, hypertension and depression, with a significant proportion unaware of their conditions. Earlier screening for modifiable risk factors and behaviors should be implemented.**
- 3. Current screening recommendations neither promote earlier identification and intervention of biological and behavioral risk factors, nor address ethno-racial and cultural disparities on their risk profile. They are more focused on diagnosing diseases to impact complications. Therefore, we are not impacting the epidemic progression of such conditions.**
- 4. Characterization of the population health status, stratification of their risk profile and promotion of risk awareness are the cornerstone of a proactive clinical setting. This allows the implementation of earlier screening protocols during the predisease critical periods to effectively impact progression, improve QoL, life expectancy and cost of care.**



*“To build healthier communities...”*