ASTHMA INSTITUTE
at University of Pittsburgh Medical Center

Asthma and obesity, implications for treatment and control *observational studies*

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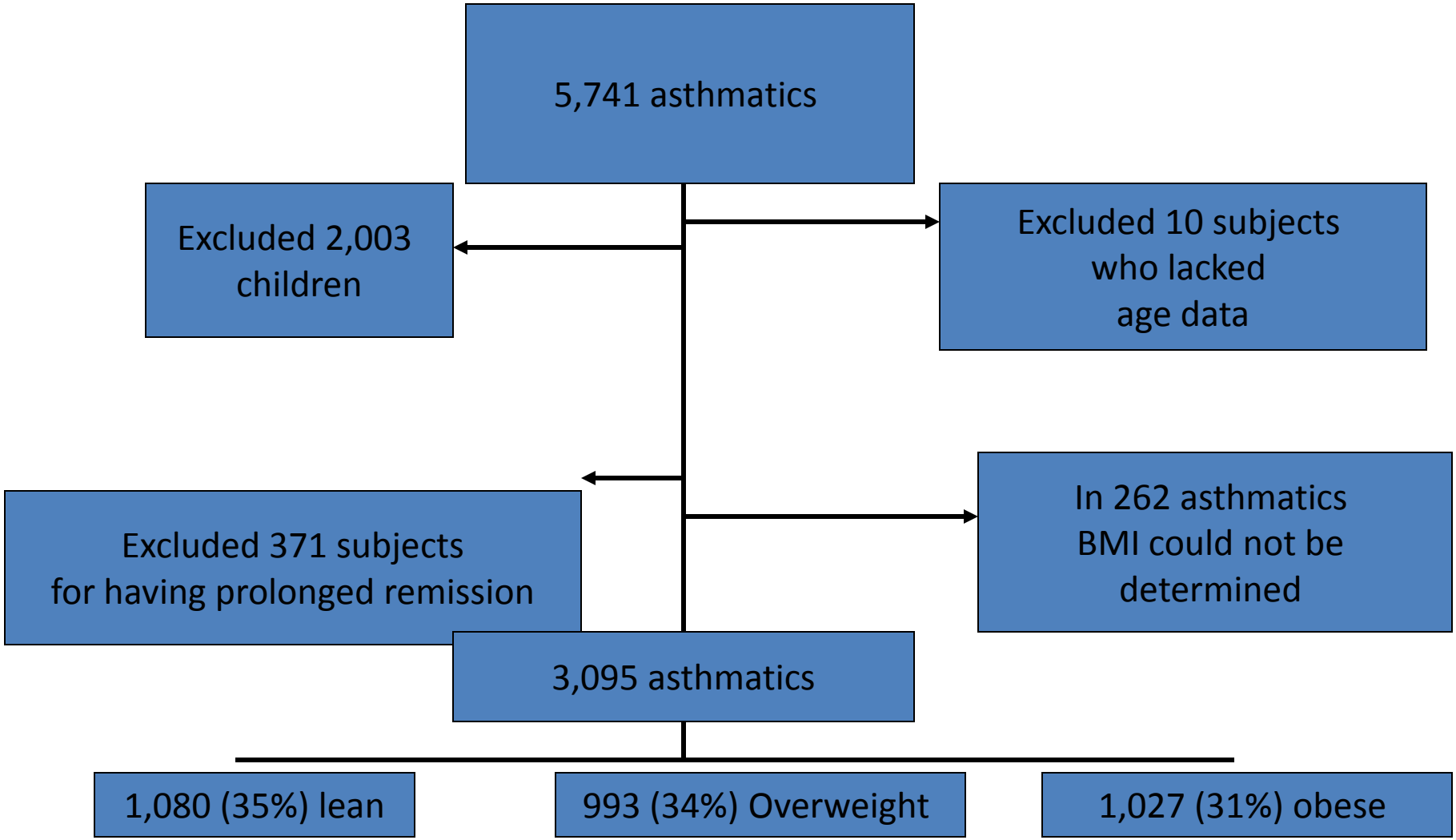
Body Mass Index and Asthma.
Results from the 4-state CDC National Asthma Survey



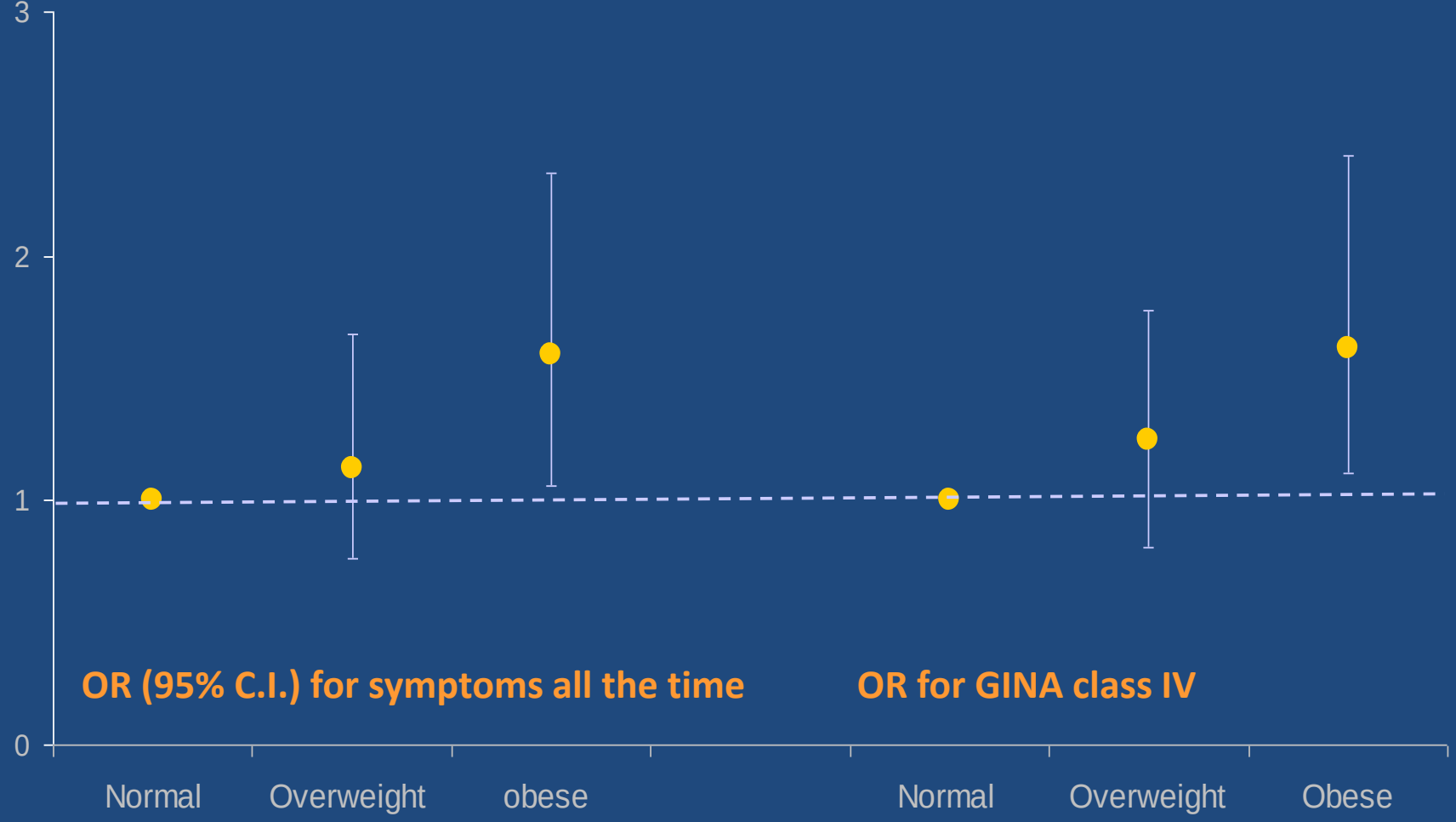
National Asthma Survey
Respiratory Symptoms

	lean	overweight	obese
N days with symptoms Past 30 days	4.4 (3.7 – 5)	4.3 (3.7 – 4.90)	5 (4.3 – 5.7)
Nights with Symptoms Past 30 days	2.7 (2.2 – 3.2)	2.6 (2.1 – 3.1)	4.6 (3.7 – 5)
N attacks Past 90 days	3.1 (2.3 – 3.8)	3.6 (2.6 – 4.6)	4.1 (3 – 5.3)

All p < 0.01;

Taylor et al, Thorax 2007:63; 41-20

Multivariate logistic regression analysis of BMI and measures of asthma severity. 4 state-sample, NAS.



OR adjusted for: age, gender, race, smoking status, income, education, employment status, family history of asthma, state of residence and residence in a metropolitan statistical area.

Obesity and asthma severity, U.S. National Asthma Survey. Health Care Utilization

Weighted estimates	Normal 1,940,746 (35%)	Overweight 1,877,938 (34%)	Obese 1,706,849 (31%)	p
At least 1 ER visit 12 months	**11.9% (8.9 – 14.9)**	**11.6% (9.1 – 14.1)**	**17.7% (14.2 – 21.2)**	**0.01**
ER visits 12 months	**2.0 (1.6 – 2.5)**	**1.9 (1.5 – 2.3)**	**2.5 (2.1 – 3.0)**	**0.01**
Urgent visits 12 months	**0.9 (0.7 – 1.0)**	**1.0 (0.8 – 1.2)**	**1.3 (1.0 – 1.6)**	**0.01**

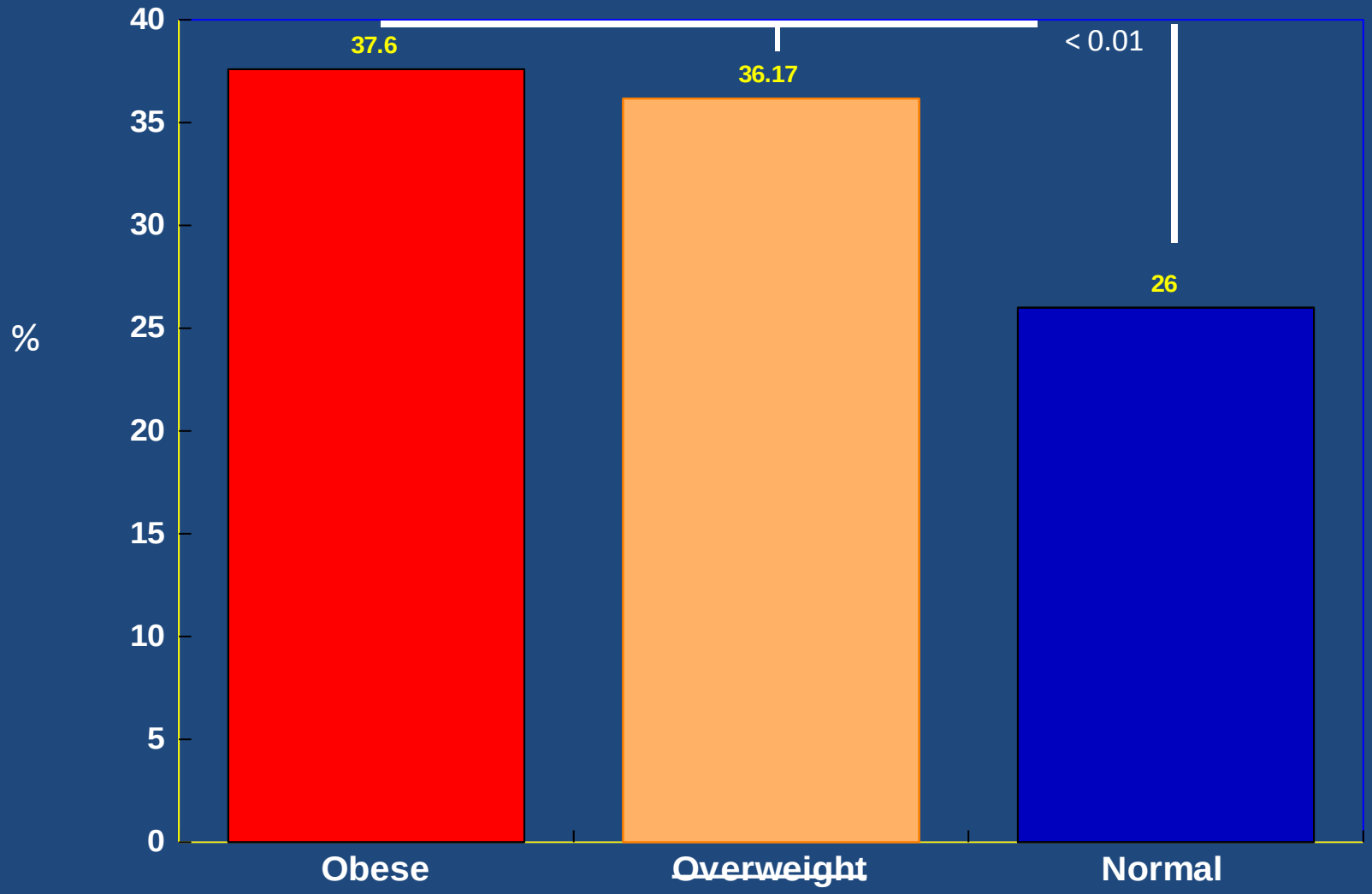
Taylor et al, Thorax 2007

National Asthma Survey
Asthma medications in the last three months

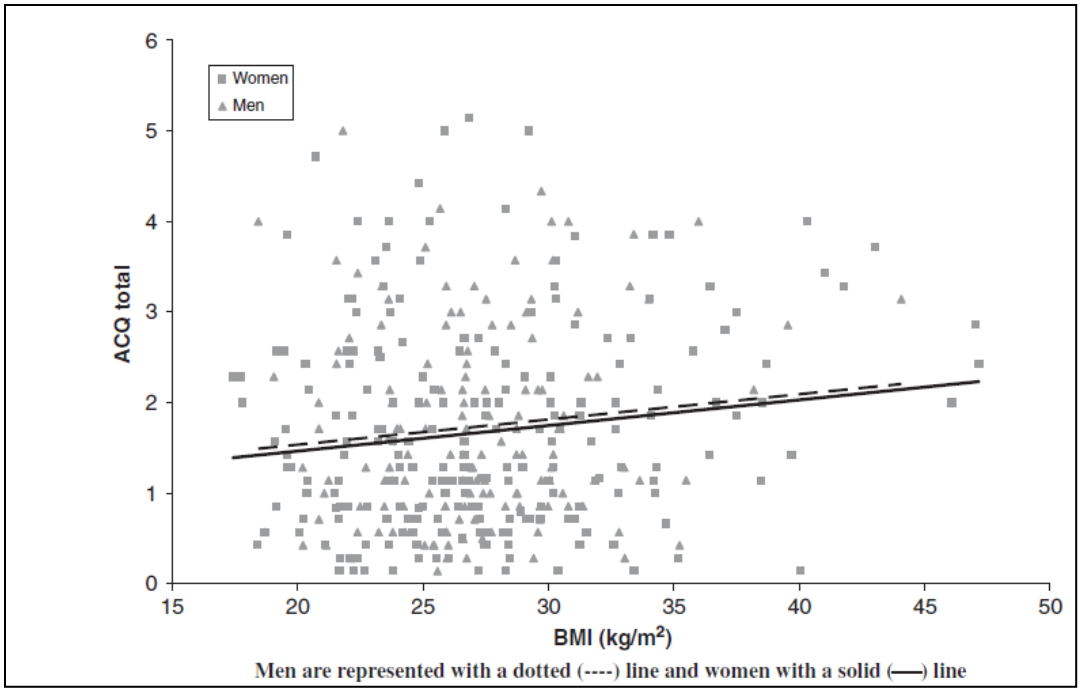
	lean	overweight	obese
Short-acting Beta agonists	ref 1.0	OR 1.2 (0.9 – 1.6)	OR 1.4 (1.06 – 1.8)
Inhaled Steroids	1.0	1.06 (0.8 – 1.4)	1.34 (1.1 – 1.8)
Remission	1.0	0.53 (0.3 – 0.7)	0.56 (0.3 – 0.8)

OR adjusted for: age, gender, race, smoking status, income, education, employment status, family history of asthma, state of residence and residence in a metropolitan statistical area.

Required an oral steroid taper in the last 3 months (all class IV)



National Asthma Survey 4-state sample, weighted sample: 737, 186; x^2 <0.001

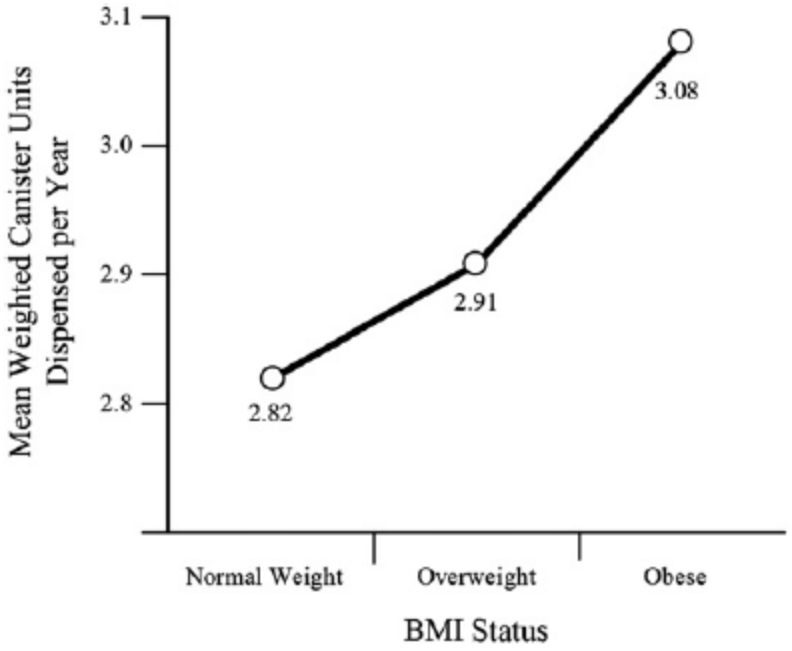


Increasing BMI is associated with worse asthma control in 382 consecutive clinic patients dx with asthma

Lavoie, K et al 2006

Table 3 Asthma control and quality of life as a function of BMI category, controlling for age, sex, and asthma severity.

M (±SEM)	Normal BMI<25 ($n=139$)	Overweight BMI≥25<30 ($n=149$)	Obese BMI≥30 ($n=94$)	F	P
ACQ (total)	1.63±.09	1.60±.08	1.93±.10	5.96	.01
Q 1: Nocturnal waking	1.13±.13	0.90±.12	1.26±.15	1.24	.26
Q 2: Waking symptoms	1.41±.13	1.41±.12	1.64±.15	3.81	.05
Q 3: Activity limitations	1.11±.12	1.23±.11	1.79±.14	16.08	<.001
Q 4: Shortness of breath	1.84±.13	1.82±.12	2.34±.15	11.48	.001
Q 5: Wheezing	1.60±.12	1.55±.12	2.06±.15	6.76	.01
Q 6: Bronchodilator use	1.17±.11	1.02±.11	1.53±.13	3.94	.05
Q 7: % FEV_1	2.83±.13	2.70±.12	2.84±.16	0.23	.63



Among children, OW and obesity are associated with asthma severity and control

Retrospective cohort of 32,321 from the Kaiser Permanente electronic record data.

Asthma: MD diagnosis + dispense of at least 1 controller or rescue

5 – 17 yrs

2004 - 2008

TABLE II. Odds ratios for asthma outcomes based on weight classification

	Outcomes					
	≥6 β-agonist units dispensed per year		Oral corticosteroid dispensed		ED visit or hospitalization	
	OR (95% CI)		OR (95% CI)		OR (95% CI)	
	Crude	Adjusted*	Crude	Adjusted*	Crude	Adjusted*
BMI status						
Overweight‡	1.14 (1.02-1.27)	1.15 (1.02-1.29)	1.18 (1.11-1.26)	1.21 (1.13-1.29)	1.10 (1.03-1.18)	1.07 (0.99-1.15)
Obese†	1.23 (1.12-1.35)	1.17 (1.06-1.29)	1.27 (1.20-1.34)	1.28 (1.21-1.36)	1.12 (1.06-1.19)	1.04 (0.98-1.11)

CDC, Centers for Disease Control; *OR*, odds ratio.

*Adjusted for age, gender, race, parental education level, asthma controller use, GERD diagnosis, DM diagnosis.

Quinto, K; et al 2011

The associations between obesity and asthma, are not universal across age span

From the ALA-CRC, post hoc analysis of 490 pooled patients (2,794 patient-visits)

Outcomes	6-11	12-17	18-44	45-76
Symptoms	Fewer symptoms, primarily males	Trend greater overall; primarily females	No difference	No difference
Spirometry	↓ FEV_1 and FEV_1/FVC	Trend lower[¥], FEV_1 reduced in females	↓ FEV1, primarily females	No difference
EBC pH	No difference	No difference	No difference	No difference
PF variability	Trend lower	Trend higher	No difference	No difference
Symptom perception	Greater perception	Greater perception	Reduced perception	No difference

[¥]- non-significant trend for both genders for reduced FEV_1 ($p=.30$) and FEV_1/FVC ($p=.127$); FEV_1 reduced in obese females ($p<.05$).

Lang, J; et al 2011

Obesity and asthma: An association modified by age of asthma onset

TABLE II. Examination of morbidity association by age of asthma onset with BMI categories

	Late-onset asthma, OR (95% CI)		Early-onset asthma, OR (95% CI)	
	Univariable (n = 506)	Multivariable (n = 435)*	Univariable (n = 543)	Multivariable (n = 468)*
Cough				
Lean	1.0	1.0	1.0	1.0
Overweight	1.3 (0.7-2.2)	1.1 (0.6-2)	1.02 (0.6-1.8)	0.9 (0.5-1.8)
Obese	**1.9 (1.6-4.2)**	**1.7 (1.01-2.9)**	**2.6 (1.6-4.2)**	**2.2 (1.3-3.9)**
Sputum				
Lean	1.0	1.0	1.0	1.0
Overweight	0.7 (0.4-1.3)	0.6 (0.3-1.2)	1.2 (0.7-2.4)	1.2 (0.6-2.4)
Obese	1.3 (0.8-2)	1.1 (0.7-1.9)	**2.8 (1.6-4.7)**	**2.5 (1.3-2.5)**
Chest tightness				
Lean	1.0	1.0	1.0	1.0
Overweight	0.9 (0.5-1.6)	0.8 (0.4-1.6)	1.0 (0.6-1.9)	0.9 (0.5-1.6)
Obese	1.6 (0.9-2.6)	1.4 (0.8-2.4)	**1.4 (1.4-3.5)**	**1.8 (1.05-3)**
Wheeze				
Lean	1.0	1.0	1.0	1.0
Overweight	1.0 (0.5-1.9)	1.1 (0.6-2.5)	1.0	0.7 (0.4-1.4)
Obese	**2.2 (1.3-3.6)**	**2.2 (1.3-3.4)**	**3 (1.9-5)**	**2.7 (1.6-4.7)**
Dyspnea				
Lean	1.0	1.0	1.0	1.0
Overweight	0.8 (0.5-1.3)	0.8 (0.4-1.3)	1.0 (0.6-1.7)	0.8 (0.4-1.4)
Obese	**2.4 (1.5-3.7)**	**1.7 (1.02-3.3)**	**2.4 (1.5-3.7)**	**2 (1.2-3.3)**
Nocturnal symptoms				
Lean	1.0	1.0	1.0	1.0
Overweight	1.0 (0.5-1.9)	0.9 (0.5-1.9)	0.8 (0.4-1.6)	0.7 (0.4-1.3)
Obese	**2 (1.2-3.3)**	**2.1 (1.1-3.6)**	**2.1 (1.4-3.4)**	**1.7 (1.02-3.3)**
Low AQLQ score				
Lean	1.0	1.0	1.0	1.0
Overweight	1.9 (0.9-3.5)	2.3 (1.3-4.7)	0.9 (0.5-1.6)	0.8 (0.4-1.6)
Obese	**2.8 (1.6-4.8)**	**2.8 (1.5-5.4)**	**2.9 (1.8-4.8)**	**2.4 (1.4-4.3)**
Severe asthma				
Lean	1.0	1.0	1.0	1.0
Overweight	1.1 (0.6-1.8)	1.23 (0.7-2.2)	1.1 (0.7-1.8)	0.9 (0.5-1.6)
Obese	**1.9 (1.2-2.9)**	**1.85 (1.1-3)**	**1.9 (1.2-2.9)**	**2.1 (1.3-3.5)**

Adjusted for age, sex, race, atopy, and asthma duration. Boldfaced estimates are significant at a *P* value of less than .05. This significance is for the comparison of either overweight or obese status in reference to the lean category within age of asthma categories. Across age of asthma categories, comparisons were done by using an obesity/age-of-onset interaction in the model. No significant interactions were observed.

Obesity is associated with health-care related outcomes more strongly in early onset asthmatics

	Late-onset asthma, OR (95% CI [n = 435])*		Early-onset asthma, OR (95% CI [n = 468])*	
	Univariable (n = 506)	Multivariable (n = 435)*	Univariable (n = 543)	Multivariable (n = 468)*
≥3 Steroid tapers/y				
Lean	1.0	1.0	1.0	1.0
Overweight	1.2 (0.7-2)	1.04 (0.6-1.5)	1.4 (0.8-2.4)	1.3 (0.7-2.5)
Obese	1.5 (0.9-2.4)	1.11 (0.6-1.9)	**2.7 (1.6-4.4)**	**2.4 (1.3-4.2)**
Visited ED preceding year				
Lean	1.0	1.0	1.0	1.0
Overweight	1.3 (0.8-2.4)	1.6 (0.9-3)	1.2 (0.7-2)	1.06 (0.6-1.9)
Obese	**2.2 (1.3-3.5)**	**2.0 (1.1-3.4)**	**2.4 (1.5-3.9)**	**1.8 (1.5-2.3)**
Spent the night in the hospital for breathing reasons in the preceding year				
Lean	1.0	1.0	1.0	1.0
Overweight	1.6 (0.7-3.4)	1.9 (0.8-4)	2.4 (1.1-5.3)	1.8 (0.8-4)
Obese	**2.6 (1.3-5)**	2.2 (0.9-5)	**4 (1.9-8.3)**	**3.3 (1.5-7)**
Admitted to ICU for asthma reasons/preceding year				
Lean	1.0	1.0	1.0	1.0
Overweight	2.2 (0.6-7)	2.2 (0.6-7)	3 (0.7-11)	2 (0.4-8)
Obese	2.3 (0.7-7)	**1.3 (1.4-5)**	**6.5 (2-22)**	**6 (1.7-22)**
Mechanical ventilation ever				
Lean	1.0	1.0	1.0	1.0
Overweight	1.0 (0.4-2.6)	1.0 (0.4-2.6)	1.3 (0.6-2.8)	1.0 (0.4-2.3)
Obese	1.2 (0.6-2.6)	0.99 (0.2-2.2)	**2.6 (1.4-5)**	**2.08 (1.1-4.3)**
Pneumonia diagnosis ever				
Lean	1.0	1.0	1.0	1.0
Overweight	1.1 (0.6-1.9)	1.1 (0.6-1.9)	1.2 (0.8-2)	1.3 (0.8-2.2)
Obese	**1.6 (1.03-2.5)**	1.5 (0.9-2.4)	**2.4 (1.6-3.4)**	**2.2 (1.4-3.7)**

Holguin, F; et al 2011

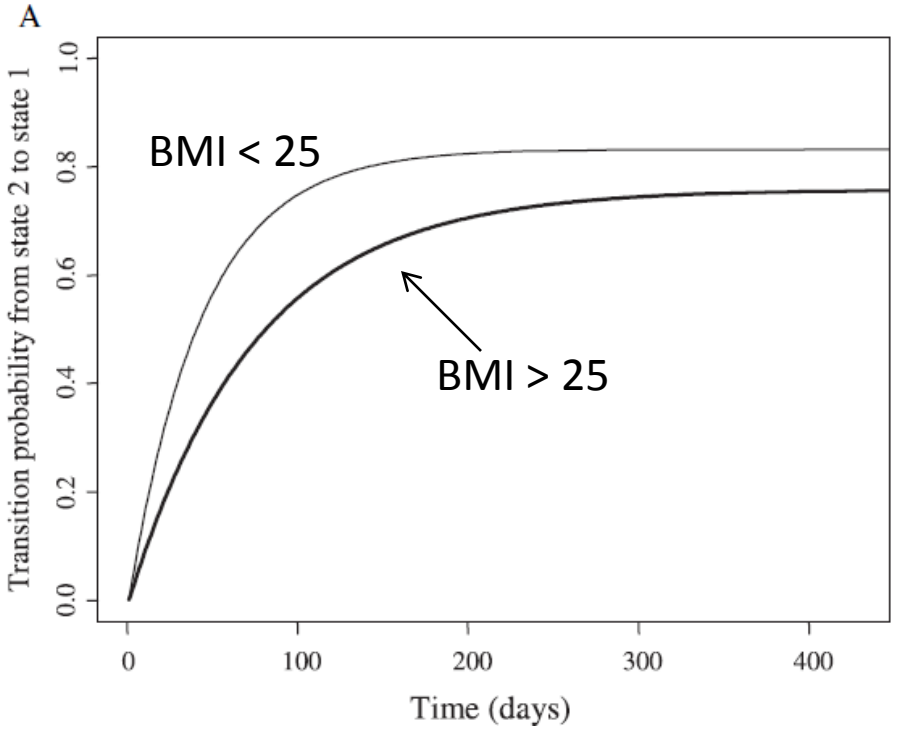
Higher BMI is associated with a reduced probability of achieving asthma control

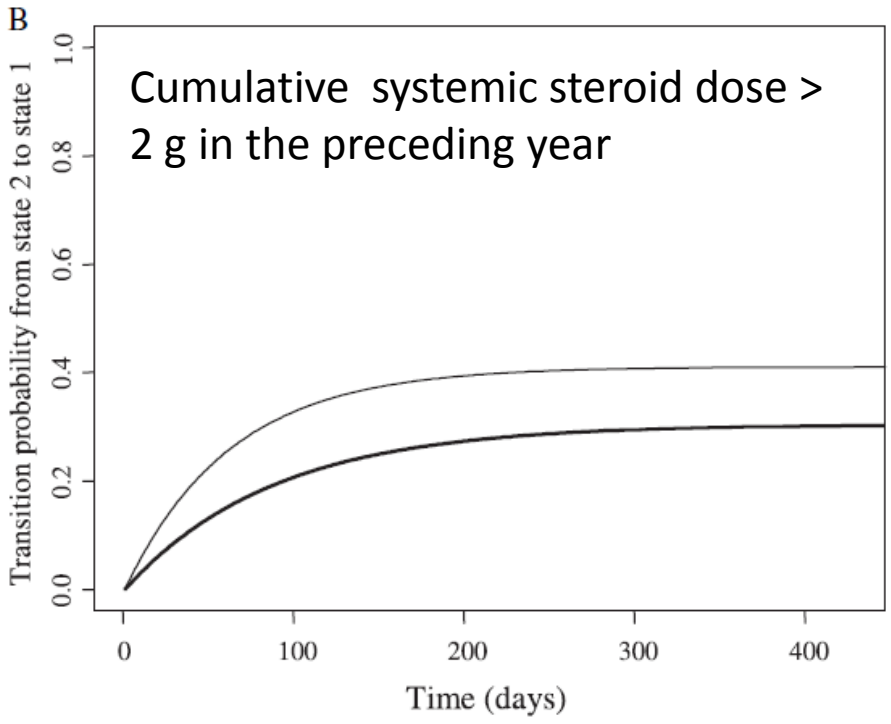
406 asthmatics (> 1300 consultations) for an average period of 180 days

Study modeled the probability of transitioning from unacceptable to acceptable asthma control

All patients were treated according to standard asthma guidelines

		Univariate model, β (SD) (Wald, *P*-value)	Multivariate model, β (SD) (Wald, *P*-value)
Unacceptable to acceptable state (2 to >1)	BMI	−0.801 (0.184) (<0.01)	−0.637 (0.219) (<0.01)
	OCS during last year	−0.852 (0.212) (<0.01)	−0.312 (0.266) (0.24)
	OCS	−1.002 (0.209) (<0.01)	−0.693 (0.248) (<0.01)
	Severity	−0.726 (0.203) (<0.01)	−0.062 (0.255) (0.81)

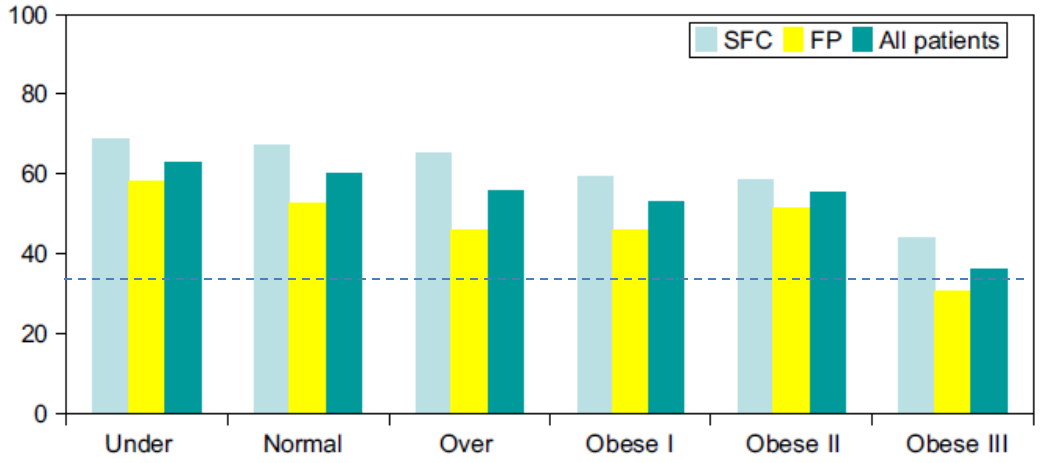




Are weight categories associated with the ability to achieve asthma control at 12 weeks?

Post hoc analysis of 1242 patients from 5 pooled randomized clinical trials

Controlled: based on symptom control , absence of exacerbations over 5 – 7 day period



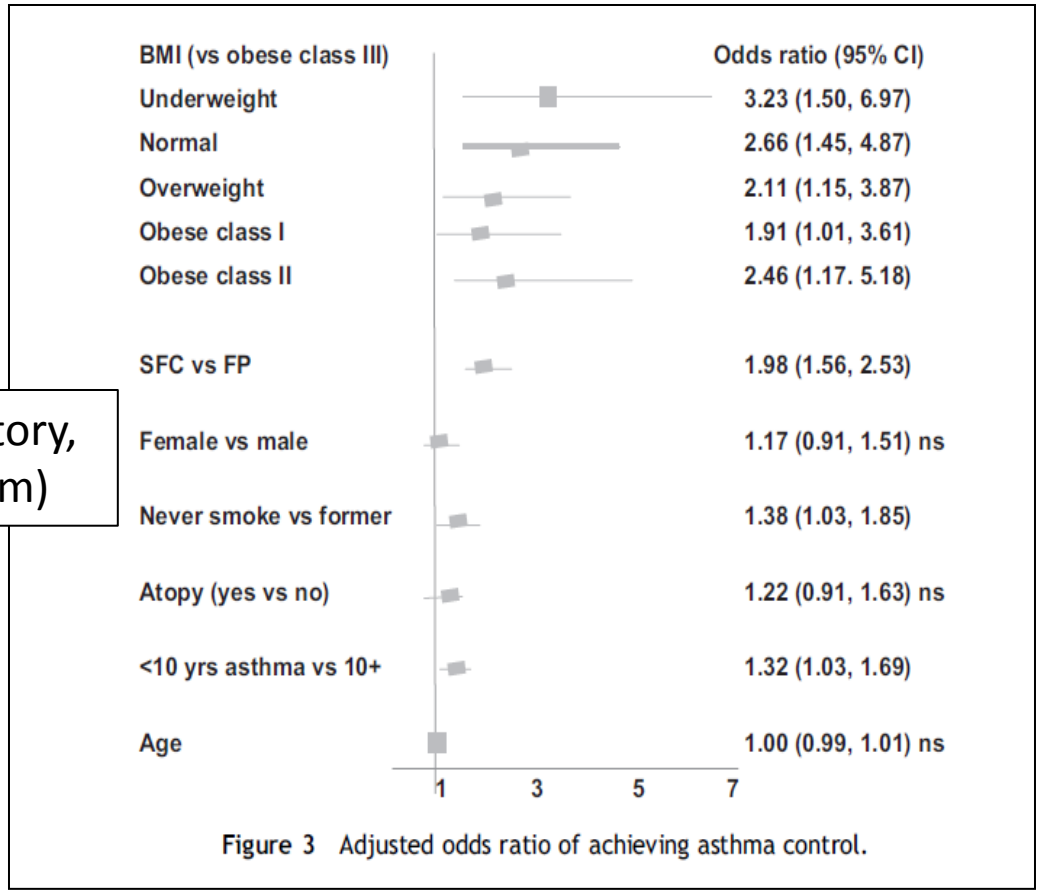
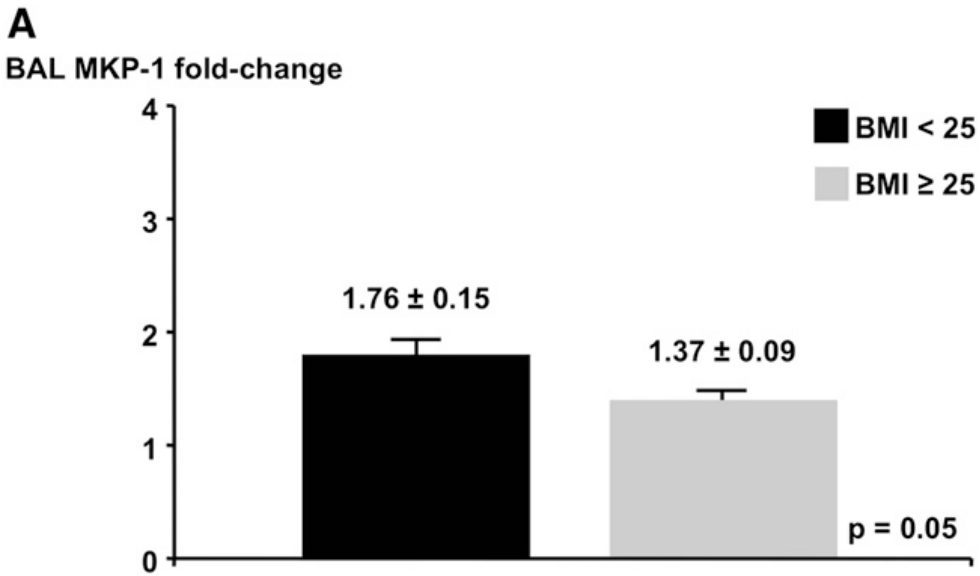
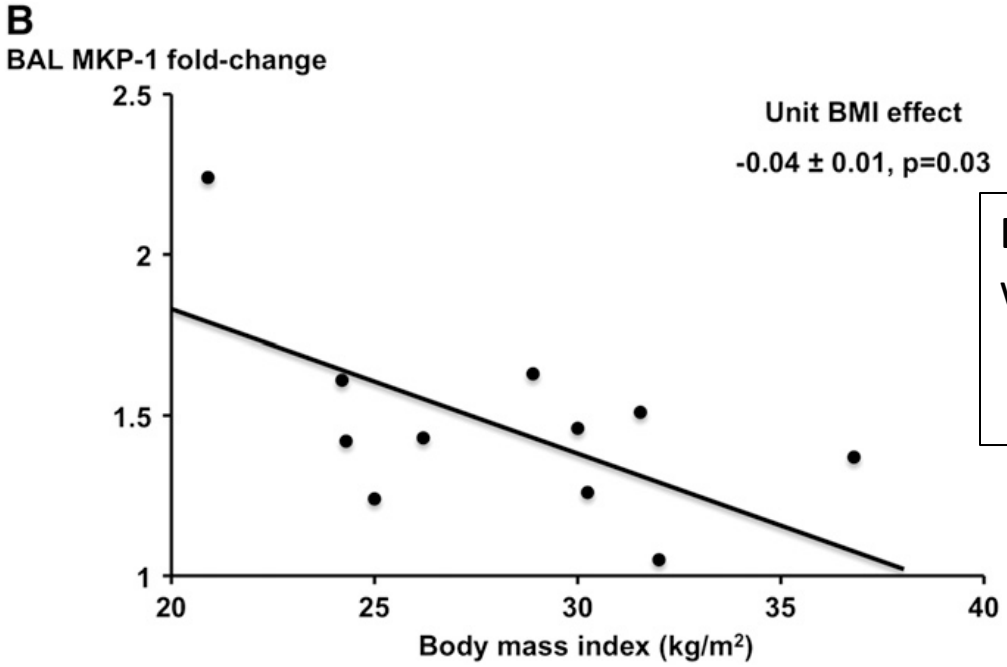


Figure 3 Adjusted odds ratio of achieving asthma control.

OR: Adjusted for age, gender, smoking history, Atopy, asthma duration, treatment (random)

Boulet, L-P et al, 2007

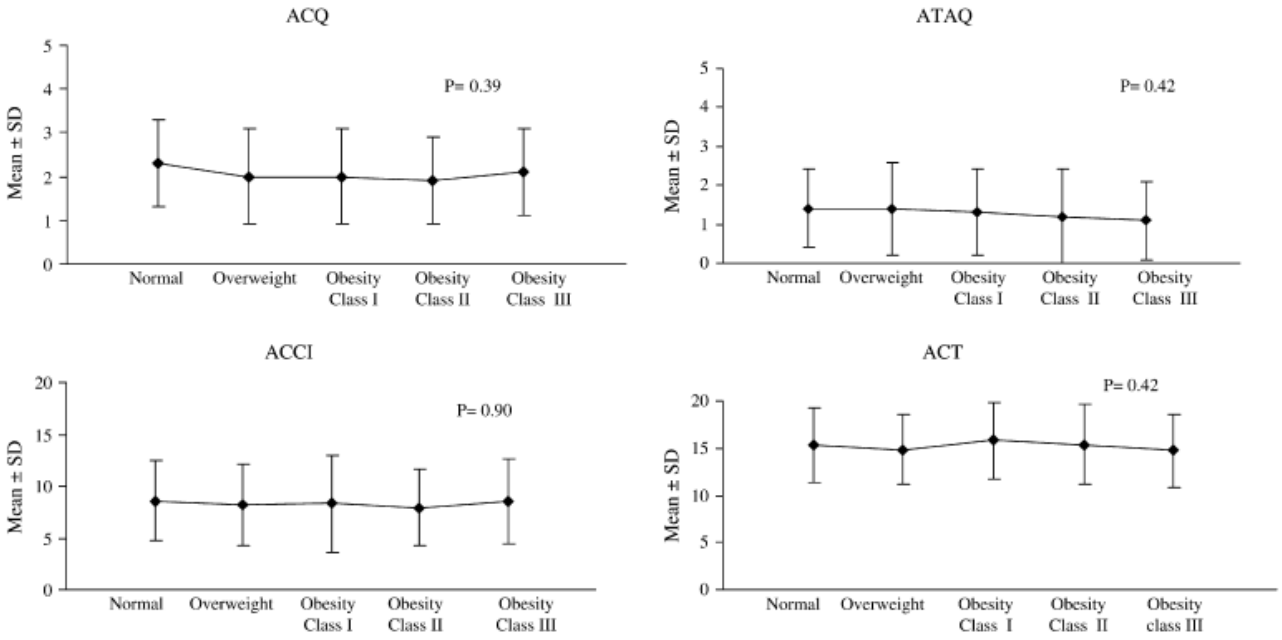




Increased BMI is associated with a blunted *in vitro* glucocorticoid response

DEX-induced PBMC MKP-1 expression was reduced in 3 non-smoking overweight/obese versus lean patients with asthma

Sutherland, R et al , 2008



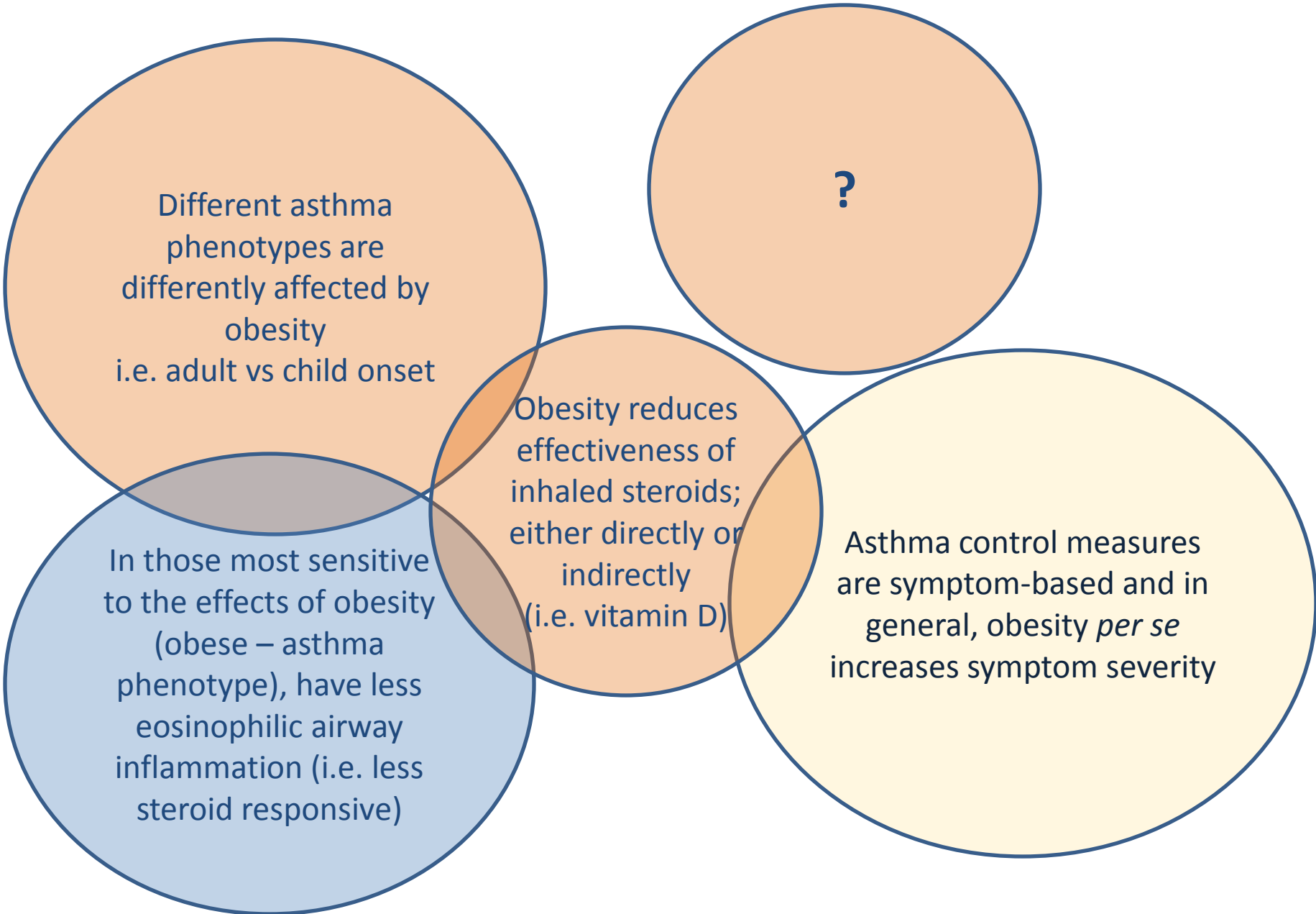
BMI not associated with asthma control in 292 asthmatics.
Urban setting,
>60% obese or OW,
2/3 African American
80% female,
60% smoking prevalence

TABLE IV. Self-reported health care use and prescribed asthma medication by BMI category

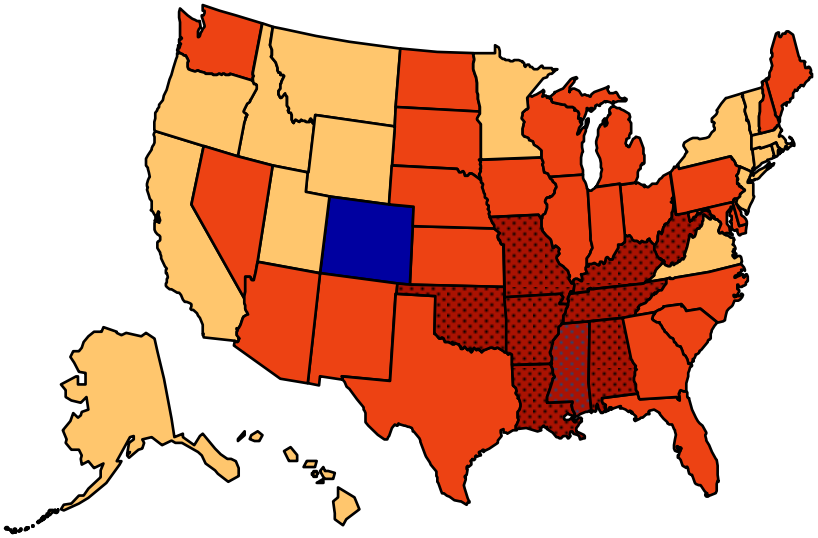
	Overall (n = 292)	Normal weight 18.5-24.9 (n = 44)	Overweight 25-29.9 (n = 65)	Obese I 30-34.9 (n = 62)	Obese II 35-39.9 (n = 50)	Obese III ≥40 (n = 71)	*P* value
Acute care, N (%)							
Hospitalized within the past year	39 (13)	5 (11)	10 (15)	5 (8)	7 (14)	12 (17)	.61
Emergency department visit within the past year	102 (35)	16 (36)	28 (43)	18 (29)	21 (42)	19 (27)	.19
Prescribed inhalers, N (%)							
Short-acting β-agonists	285 (98)	42 (95)	65 (100)	60 (97)	48 (96)	70 (99)	.48
Long-term controllers	184 (63)	22 (50)	40 (62)	40 (65)	32 (64)	50 (70)	.29

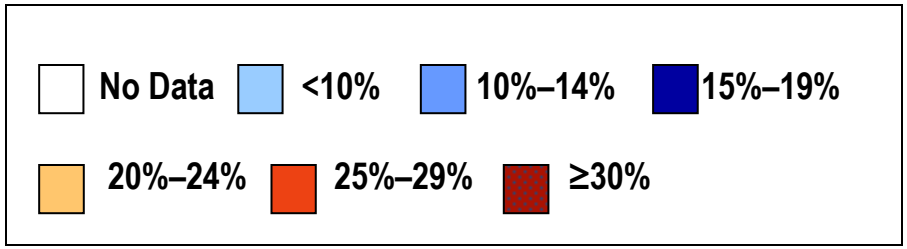
Clerisme – Beaty, et al , 2009

Why does BMI or obesity influence (or not) asthma control?



Obesidad, un problema sin fronteras.

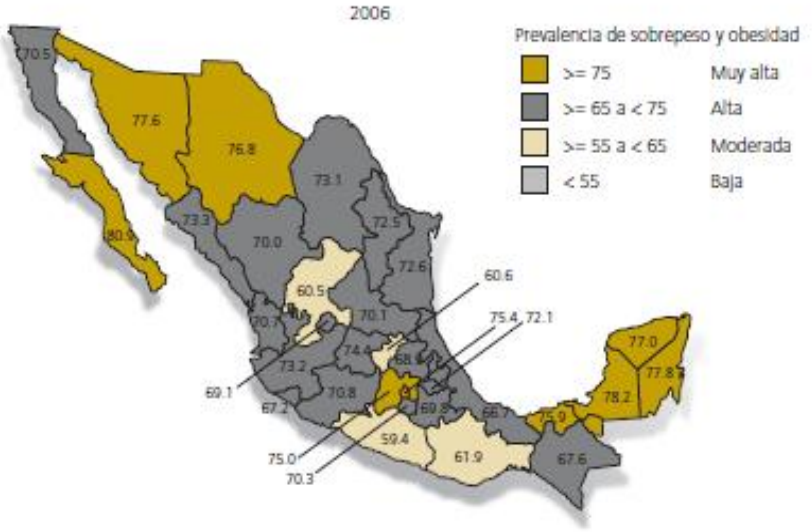




CDC, BRFSS 2009, obesity % in adults

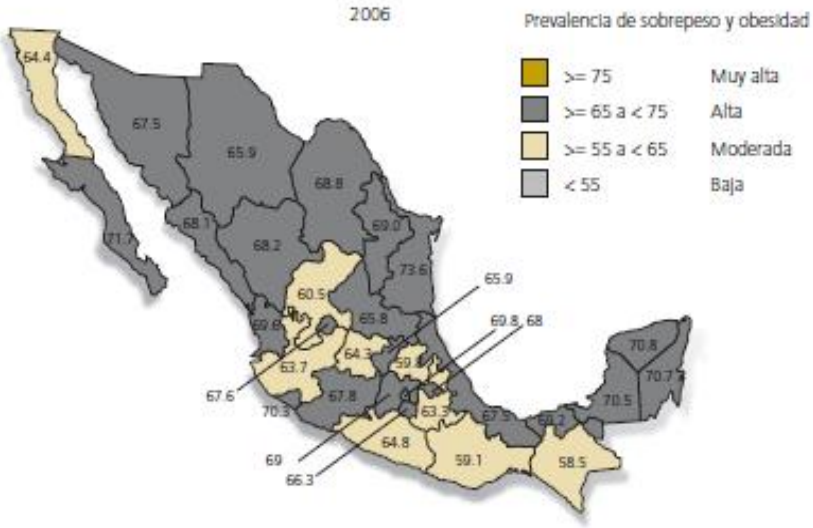
■ Mapa 1.9

Sobrepeso y obesidad en mujeres mayores de 20 años por entidad federativa, ENSANUT 2006



■ Mapa 1.10

Sobrepeso y obesidad en hombres mayores de 20 años por entidad federativa, ENSANUT 2006



2006, Encuesta Nacional de Salud Y Nutricion 2006