

Prevalence of Cardiometabolic Conditions Across Body Mass Index Categories: The Distinct Burden of Severe (Class III) Obesity

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INTRODUCTION

- Cardiovascular-kidney-metabolic (CKM) conditions, such as type 2 diabetes (T2D), cardiovascular disease (CVD, including atherosclerotic heart disease or heart failure), chronic kidney disease (CKD), and metabolic dysfunction-associated steatotic liver disease [MASLD, including metabolic dysfunction-associated steatohepatitis (MASH), fibrosis, and cirrhosis] are recognized complications of obesity¹
- Obesity amplifies the development of multimorbidity²
- However, the comparative burden of CKM conditions among patients with severe (class III) obesity is less well characterized

OBJECTIVE

- To evaluate the association between body mass index (BMI) category and the prevalence of individual CKM conditions and multimorbid CKM condition combinations among US adults, including variations in prevalence as a function of obesity severity

METHODS

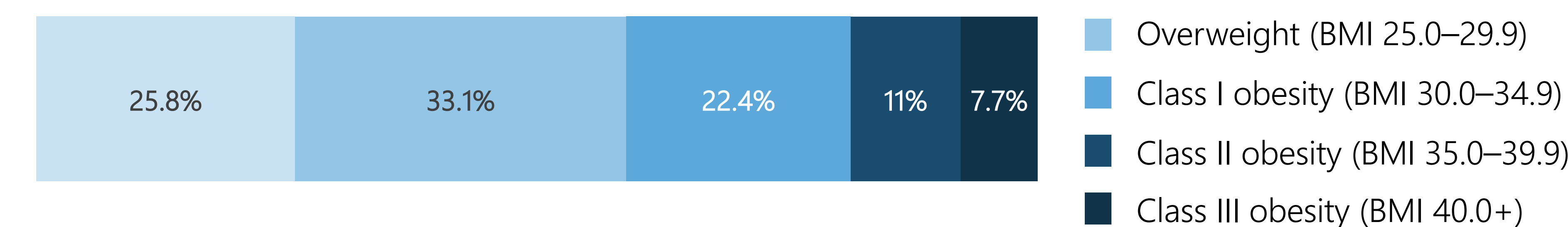
- Nationally representative cross-sectional sample of US adults age 20 and older with complete data for BMI and CKM conditions (defined below) in the 2017–2020 National Health and Nutrition Examination Survey (NHANES), the most recent survey with comprehensive condition coverage³
- CKM conditions were defined as:
 - Cardiovascular disease (CVD): A self-reported diagnosis of atherosclerotic CVD (myocardial infarction, stroke, or coronary heart disease) or heart failure
 - Chronic kidney disease (CKD): Laboratory measurement of eGFR <60 or urine albumin >30 mg/g
 - Type 2 diabetes (T2D): A self-reported diagnosis of diabetes or a serum glycated hemoglobin >6.5%
 - Metabolic dysfunction-associated liver disease (MASLD): Defined as a controlled attenuated parameter score ≥ 285 dB/m, liver fibrosis (≥ 8 kPa) or FibroScan-AST (FAST) score >0.67 without excessive alcohol consumption and hepatitis⁴

- The prevalence of individual and multimorbid CKM conditions were evaluated based on patient body mass index (BMI, kg/m²), with patients categorized as normal weight (BMI 18.5–24.9), overweight (BMI 25.0–29.9), obesity class I (BMI 30.0–34.9), obesity class II (BMI 35.0–39.9), and obesity class III (BMI 40.0 and higher)
- Individuals with BMI <18.5 were excluded
- Population-representative prevalence estimates were derived using NHANES sampling weights, and distributions were evaluated with χ^2 and F-tests

RESULTS

- In the NHANES weighted sample (n=162,031,595) mean age was 47.7 years with 50.3% males and 35.1% non-white
- The plurality of patients were obese (41.1%) with nearly 12.5M adults with class III obesity (Figure 1)

Figure 1 – BMI distribution



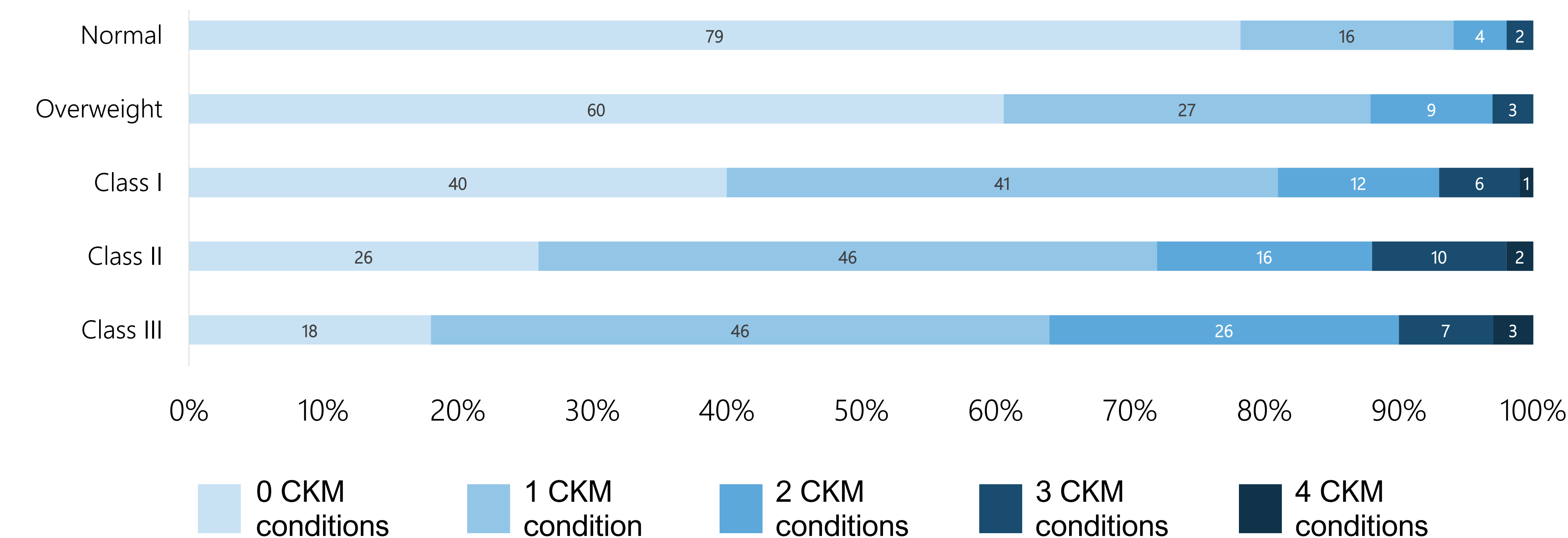
- The prevalence of CKM conditions generally increased in a near linear fashion across BMI groups such that burden of individual CKM conditions was greatest among patients with class III obesity (Table 1 and Figure 2)

Table 1 – CKM Conditions and Risk Factors by BMI category

	Normal weight	Overweight	Obesity				p-value*
			Class I	Class II	Class III	Overall	
N	41,815,929 (25.8%)	53,707,486 (33.1%)	36,218,085 (22.4%)	17,813,083 (11.0%)	12,477,011 (7.7%)	66,508,180 (41.1%)	
CKM condition prevalence							
Liver disease	9.0%	25.8%	47.3%	67.9%	77.1%	58.4%	<0.001
T2DM	4.7%	9.8%	17.5%	21.2%	28.4%	20.5%	<0.001
Chronic kidney disease	10.6%	12.3%	15.0%	17.3%	15.4%	15.7%	0.008
Cardiovascular disease	4.9%	7.7%	9.0%	9.6%	9.0%	9.2%	0.027
Count of CKM conditions							
Mean	0.3	0.6	0.9	1.2	1.3	1.0	<0.001
Median	0	0	1	1	1	1	<0.001
CKM risk factor prevalence							
Hypertension	33.1%	49.3%	61.8%	68.4%	70.3%	65.1%	<0.001
Dyslipidemia	25.5%	45.9%	52.5%	55.6%	52.0%	53.3%	<0.001
Obstructive sleep apnea	7.2%	10.9%	12.8%	18.9%	21.5%	16.1%	<0.001
Metabolic syndrome	7.1%	26.4%	49.2%	57.5%	67.9%	54.9%	<0.001
Count of CKM risk factors							
Mean	0.7	1.3	1.8	2.0	2.1	1.9	<0.001
Median	0	1	2	2	2	2	<0.001

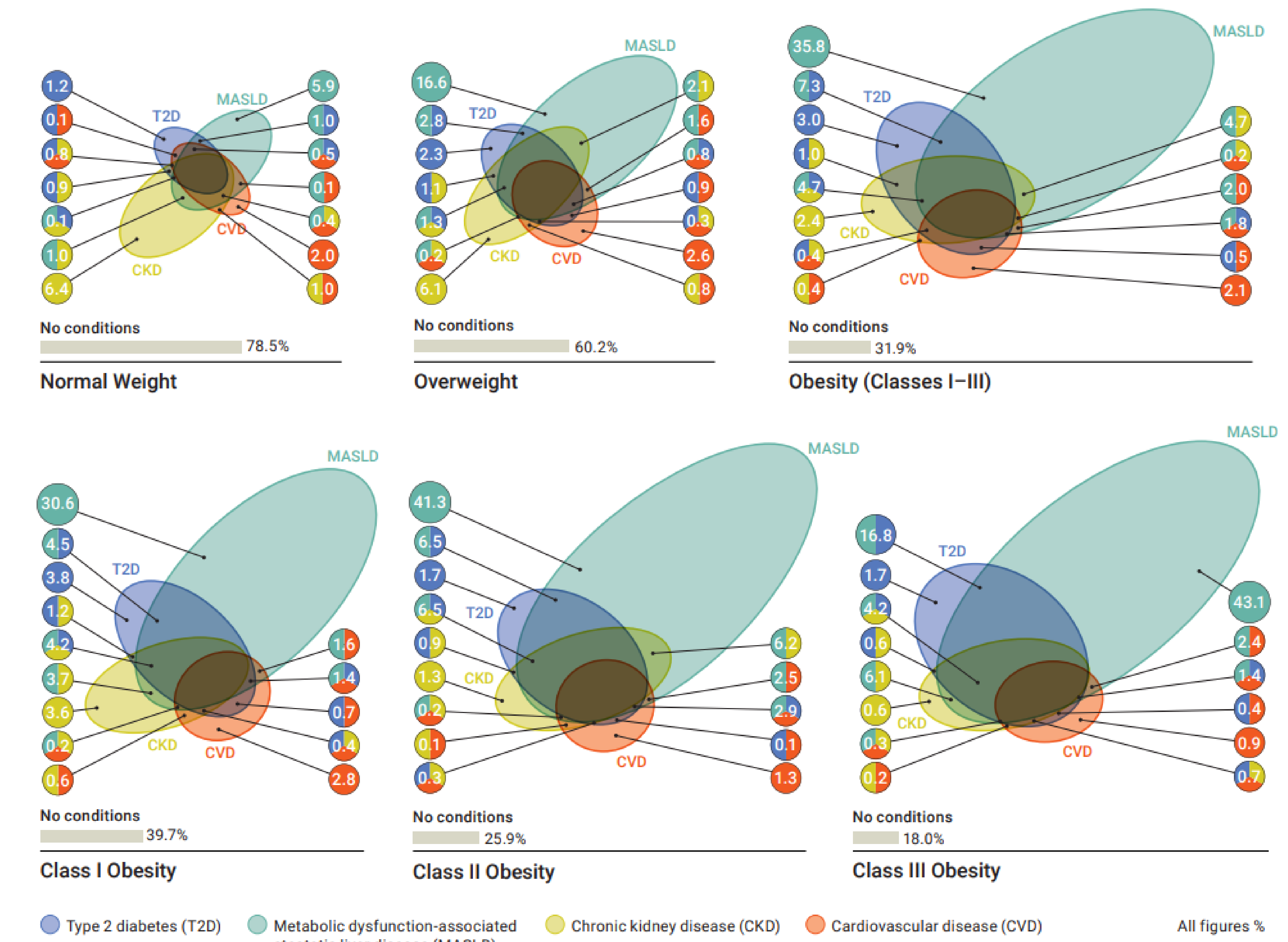
*P-values are from χ^2 and F-tests of joint equality of observed proportions or means across BMI categories (normal weight through Class III obesity; overall obesity category not included in the test)

Figure 2 – Number of CKM conditions by BMI category



- There was a similar increase in proportion of overlapping conditions across higher levels of obesity as opposed to any distinct disease combination cluster (Figure 3)

Figure 3 – Co-occurrence of CKM conditions by BMI category



CONCLUSION

- The burden of CKM conditions increases with severity of obesity and is greatest among patients with class III obesity, with patients experiencing an average of 1.3 CKM conditions compared with 0.3 among normal weight patients

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DISCLOSURES

KC and BL are employees of Viking Therapeutics, Inc. AE is and at the time of the study YA was an employee of Medicus Economics, which received funding from Viking Therapeutics, Inc.