

# Severe Obesity and Cardio-Metabolic Comorbidities in Adolescents: Chronology of an Epidemic

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## Aims

- To assess the trend in the prevalence of classes of severe obesity in a nationwide cohort of 2-8 million adolescents during the last five decades.
- To evaluate the association between the severity of obesity and cardio-metabolic morbidities including abnormal blood pressure and type 2 diabetes (T2DM).

## Methods

- Percentages of overweight and obesity class I-III were calculated among of 2,785,227 adolescents who underwent physical examination from 1967 through 2015.
- Approximately 2.4 million had a BMI <85<sup>th</sup> %ile; 373,226 were overweight and obese (BMI ≥85<sup>th</sup> US-CDC %ile for age and sex).
- The study sample was divided into four BMI percentile groups by age and sex :
  - Overweight (≥85<sup>th</sup> to <95<sup>th</sup> %ile).
  - Class I obesity (≥95<sup>th</sup> %ile to <120% of the 95<sup>th</sup> %ile).
  - Class II obesity (≥120% to <140% of the 95<sup>th</sup> %ile, or BMI ≥35 kg/m<sup>2</sup>, whichever was lower).
  - Class III obesity (≥140% of the 95<sup>th</sup> %ile, or BMI ≥40 kg/m<sup>2</sup>, whichever was lower).
- Data on obesity-related morbidities were assessed in a subgroup of 230,639 examinees enrolled from 1997 through 2015.

## Results

### Changing prevalence of obesity

- In 2015, 13% of the adolescents were overweight, 6.4% had class I obesity, 1.6% class II and 0.44% class III obesity.
- The prevalence of overweight in 2015 was similar in males and females, approximately 13%.
- The rates of class I and II obesity among females were lower compared with rates in males, (1.2% and 4.8% respectively, vs 1.9% and 7.6%). Class III obesity was identified in 0.4% of females and 0.5% of males.
- There were an approximately 2, 4, 16 and 45 fold increases in the prevalence of overweight and class I, II, and III obesity, respectively, between the late 1960's and 2013-2015, with an accelerated increase in class II and III obesity during the last two decades (Figure 1).

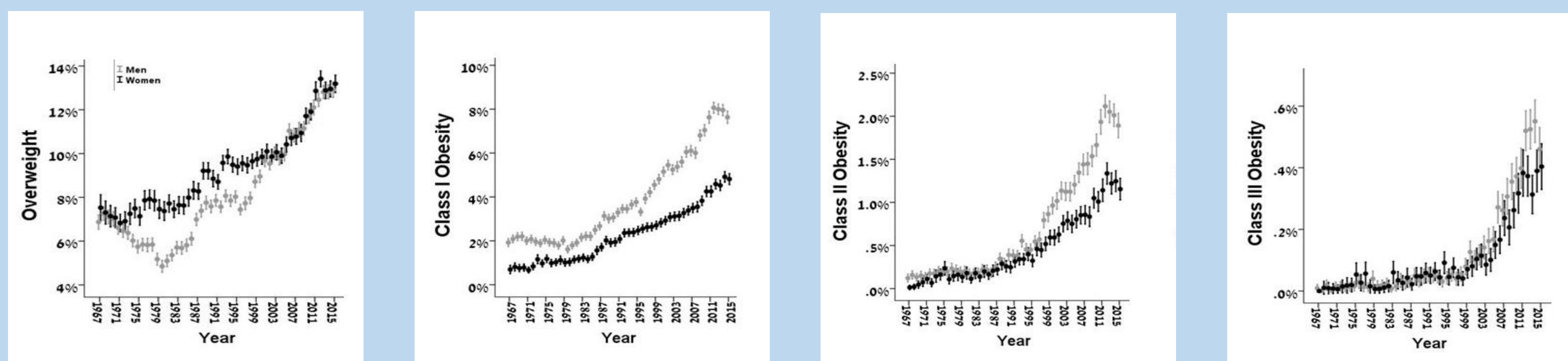
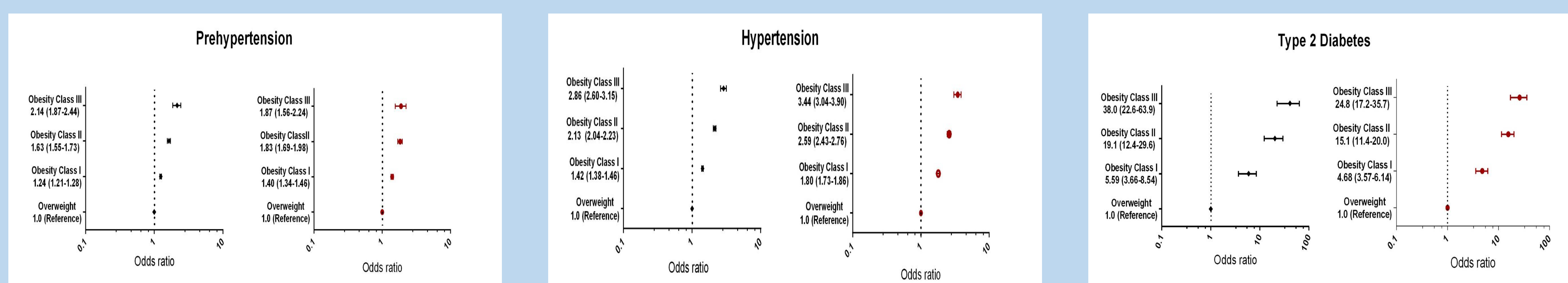


Figure 1: The annual prevalence rates (±95%CI) of overweight and class I-III obesity in males and females.

### Cardio-Metabolic morbidity

- The occurrence of pre-hypertension increased from 20% in males with overweight to 37% in males with class III obesity, and from 15% to 34% among the females.
- The occurrence of hypertensive-range blood pressure increased from 22% among males with overweight to 42% in class III obesity and from 19% to 44% among the females.
- The prevalence of T2DM was 0.03% and 0.08% in males and females with overweight, respectively, and nearly 1.5% in class III obesity in both sexes.
- Compared to the overweight adolescents, the odds ratios (ORs) for hypertension in the class I, II and III obesity groups respectively were 1.4, 2.1, and 2.9 in males, and 1.8, 2.6 and 3.4 in females.
- The OR for T2DM were 5.6, 19.1, 38.0 in males, and 4.7, 15.1, 24.8 fold in females.



## Conclusions

Severe obesity showed a different secular trend and was associated with significantly higher risk for abnormal blood pressure and T2DM than lower degree of obesity, regardless of sex.