The prevalence of comorbidities in Danish patients with obesity – a Danish register-based study from 2002 to 2018

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Aim

- To study the burden of disease in Danish people with obesity.
- To assess which comorbidities were most prevalent and to establish the effect of increasing BMI on the risk of having comorbidities.

Introduction

- In Denmark, nearly 17% of the adult population are living with obesity (defined as having a BMI≥30 kg/m^{2}) (1). It is well known that obesity is associated with a high number of comorbidities (2).

- In this study, we used the Danish national health registers to conduct a study on obesity-related comorbidities that includes all Danish citizens who have been diagnosed with obesity at a Danish hospital. To our knowledge, this is the first large-scale study identifying relevant comorbidities among individuals with obesity in Denmark.

Methods

- The study population comprised all Danish citizens (≥ 18 years) who have been registered with a primary or secondary diagnosis of obesity in the Danish National Patient Register (DNPR) between 2002 and 2018 (ICD-10 diagnosis codes: E660B-E660H).

- We applied adjusted logistic regression to estimate the odds ratio (OR) of having one of the following predefined comorbidities for people in obesity class II and III compared with people in obesity class I:
  - Obstructive sleep apnoea (OSA)
  - Non-Alcoholic Steatohepatitis and non-alcoholic fatty liver disease (NASH/NAFLD)
  - Type II diabetes (T2D)
  - Hip and knee osteoarthritis (OA)
  - Asthma
  - Ischemic heart disease (IHD)

- Comorbidities were defined from relevant ICD-10 diagnosis codes and uptake of prescription medicines. The OR estimates were adjusted for gender, age and region of residence.

Results

- We identified 102,156 Danish citizens registered with a primary or secondary diagnosis of obesity (BMI≥30 kg/m^{2}), excluding women who had only received an obesity diagnosis in relation with pregnancy and childbirth, in the DNPR between 2002 and 2018.

- Based on diagnosis codes from the DNPR, the population was categorised into obesity class I (N = 52,578), obesity class II (N = 31,916) and obesity class III (N = 17,662).

- **Table 1** shows the unadjusted risk of having a specific type of comorbidity by obesity class from five years prior to the person's first obesity-related hospitalisation to 15 years after.

- The most prevalent comorbidity in our sample was T2D across all three obesity categories.

- Moreover, 59.5% of persons with a BMI in obesity class III had been diagnosed with at least one of the six predefined comorbidities.

Table 1: 60% of people with BMI in obesity class III had been diagnosed with at least one of the comorbidities
Unadjusted risk of having comorbidities by type of comorbidity and obesity class

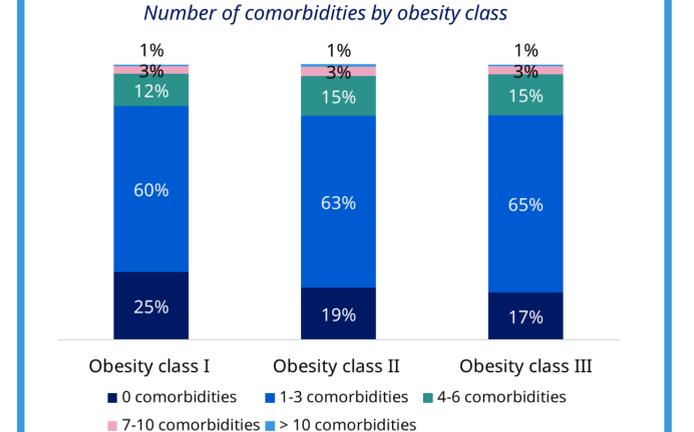|	Obesity class I	Obesity class II	Obesity class III
OSA	5.7%	10.6%	16.3%
T2D	19.1%	28.1%	28.6%
NASH/NAFLD	0.08%	0.09%	0.10%
OA	17.3%	20.0%	17.7%
Asthma	17.3%	20.0%	19.3%
IHD	7.4%	7.0%	5.0%
One of the above	48.5%	58.3%	59.5%

- **Table 2** presents the estimates of the OR from a logistic regression of the risk of having the specific type of comorbidity for people with a BMI in obesity class II and III relative to people with a BMI in obesity class I.

- We found that the risk of having had comorbidities increased statistically significantly with obesity class for five out of six predefined comorbidities.

- Specifically, we estimated the OR of having at least one of the predefined comorbidities as 1.52 (95% CI: 1.48 – 1.57) for people with a BMI in obesity class II and 2.22 (95% CI: 2.13 – 2.31) for people with a BMI in obesity class III relative to people with a BMI in obesity class I.

- We identified OSA as the comorbidity that was the most affected by obesity class.
  - Controlling for sociodemographic factors, we estimated an OR of 3.34 (95% CI: 3.14 – 3.53) for having OSA for people with a BMI in obesity class III relative to people with a BMI in obesity class I.
  - The estimated OR for people with a BMI in obesity class III was 72% higher than the estimated OR for people with a BMI in obesity class II.

- For IHD, we found no statistically significant increase in the adjusted risk for people with a BMI in obesity class III (OR = 0.98; 95% CI: 0.90 – 1.06).

- Similarly, we found no statistically significant increase in the OR of having been hospitalised with IHD for people with a BMI in obesity class II relative to people in obesity class I (OR = 1.05; 95% CI: 0.99-1.11).

Table 2: People with a BMI in obesity class III have a threefold risk of having OSA
OR of having a specific type of comorbidity for people with a BMI in obesity class II and III relative to people in obesity class I

	Obesity class II	Obesity class III
OSA	1.93 (1.83 - 2.04)	3.34 (3.14 - 3.54)
T2D	1.74 (1.68 - 1.81)	2.45 (2.34 - 2.56)
NASH/NAFLD	1.22 (1.05 - 1.42)	1.39 (1.15 - 1.67)
OA	1.33 (1.28 - 1.38)	1.64 (1.56 - 1.73)
Asthma	1.15 (1.11 - 1.19)	1.36 (1.30 - 1.42)
IHD	1.05 (0.99 - 1.11)	0.98 (0.90 - 1.06)
One of the above	1.52 (1.48 - 1.57)	2.22 (2.13 – 2.31)
None of the above	0.66 (0.64 - 0.68)	0.45 (0.43 - 0.47)

- In addition to the six comorbidities of primary interest, we defined a total of 50 comorbidities, including cancers, cardiovascular diseases and non-cardiovascular diseases*.

- **Figure 2** presents the population by the number of comorbidities (out of the 50 defined comorbidities) that people with obesity have been identified with during the period from five years prior to the person's first obesity-related hospitalisation to five years after.

- We estimated that people with a BMI in obesity class I, II and III had a mean of 1.84, 2.12 and 2.13 different comorbidities, respectively. This implied that people with a BMI in obesity class III on average had 15.4% more comorbidities than people with a BMI in obesity class I.

Figure 1: 78% of people with obesity have one or more comorbidities
Number of comorbidities by obesity class   **Key result**

Discussion

- People with a BMI in obesity class II and III were found to have an increased risk of almost 50% and 120% of having one of the six predefined comorbidities, respectively.

- This highlights the importance of early interventions in the course of the disease to limit the costs associated with treating future comorbidities.

Conclusion

- People with obesity had an average of 1.97 comorbidities, documenting a substantial disease burden in people with obesity.

- The risk of OSA, T2D NASH/NAFLD, OA and asthma significantly increased with increasing BMI, highlighting the value of treating early in the course of the disease.

References:
(1) Sundhedsstyrelsen. Danskernes sundhed 2017; 1-134; (2) Yuen et al. Obesity week 2016.

*Myocardial infarction, ischemic heart disease, unstable angina, angina pectoris, atrial fibrillation, heart failure, stroke (including haemorrhage and ischemic strokes), transient cerebral ischaemic attacks, peripheral artery disease, dyslipidaemia, HFpEF, heart failure, hypertension, gout asthma, atherosclerosis chronic kidney disease, depression, dementia, diabetes type I, gallstones, gastroesophageal reflux, hidradenitis suppurativa, idiopathic intracranial hypertension, knee/hip osteoarthritis, PCOS, female infertility, psoriasis, pancreatitis, disorder of the urinary system, non-alcoholic steatohepatitis, non-alcoholic fatty liver disease, gastric cardia cancer, liver cancer, pancreas cancer, corpus uteri cancer, ovary cancer, kidney cancer, colorectal cancer, breast cancer, endometrial cancer, diabetes type II, diabetic mono-/polyneuropathy, diabetic eye complication, diabetic kidney disease and diabetic foot complication.