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Brief Research Report

Social inequity in health among patients with severe obesity and multimorbidity

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ABSTRACT

INTRODUCTION. Obesity adversely affects the health of the individual and impacts society through increased healthcare costs and lost workdays. Individuals in lower socioeconomic groups are more severely affected. Here, we examined people living with severe obesity and comorbidities across educational levels.

METHODS. Individuals with a BMI ≥ 35 kg/m^2 and aged ≥ 16 years from the Danish National Health Survey 2021 were categorised into five educational levels and according to their number of obesity-related comorbidities (0, 1, 2 and ≥ 3).

RESULTS. A total of 5.8% had a BMI ≥ 35 kg/m^{2,} ranging from 2.2% to 10.7% in the 98 municipalities, and from 2.6% to 8.8% according to education level. Among individuals with a BMI ≥ 35 kg/m^2 and the shortest education, 13.4% had no comorbidities, and 45.6% had ≥ 3 comorbidities. In contrast, among individuals with a BMI ≥ 35 kg/m^2 and the longest education, 47.4% had no comorbidities, and 14.6% had ≥ 3 comorbidities. Among those with a BMI ≥ 35 kg/m^2 and ≥ 3 comorbidities, 73.6% had elementary or vocational school as their highest education level, and 3.4% had a long higher education.

CONCLUSIONS. The prevalence of individuals living with a BMI ≥ 35 kg/m^2 differs by 3-5-fold depending on municipality and between the lowest and highest educational level. Additionally, the less educated group living with a BMI ≥ 35 kg/m^2 was three times more likely to have ≥ 3 comorbidities than the most educated group. Hence, more research is warranted to understand the underlying causes and reduce social inequity in health.

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TRIAL REGISTRATION. Not relevant.

Obesity is a global challenge associated with socioeconomic conditions in most geographies. Obesity affects the health of the individual living with obesity and impacts society through increased healthcare costs [1]. In Denmark, severe obesity results in additional annual costs of DKK 10 billion due to lost productivity and DKK 3.8 billion due to the need for treatment, care and medication [2]. In a Danish context, the individuals with the lowest educational level are 1.6 (64.7% versus 40.8%) and 2.8 (27.2% versus 9.8%) times more likely to live with overweight and obesity, respectively, than those with the highest educational level [3]. Obesity is closely linked to cardiometabolic diseases, and these differences contribute to inequity in health. Therefore, it would be important to investigate the distribution among individuals with an even higher BMI and specifically among those with obesity-related comorbidities.

This study aimed to investigate the prevalence of individuals with a BMI ≥ 35 kg/m^2 by educational level and municipality as well as to investigate the number of comorbidities among individuals witha BMI ≥ 35 kg/m^2

byeducational level.

METHODS

All data used in this study are from the Danish National Health Survey 2021, a cross-sectional sample that aims to describe the prevalence and distribution of health and morbidity in the Danish adult population. The questionnaire was sent out to a national and municipality-representative sample of 324,000 individuals (≥ 16 years) and achieved a response rate of 56.7% (n = 183,646).

As part of the questionnaire, all individuals were asked about a long list of comorbidities [4], from which the following 12 obesity-related comorbidities were selected and included in the sum of comorbidities: asthma; type 2 diabetes mellitus (T2DM); hypertension; coronary artery syndrome; chronic bronchitis, chronic obstructive lung disease (COLD); osteoarthritis; rheumatoid arthritis; mental disorder; disc herniation or sciatica; myocardial infarction (current/previous); stroke (current/previous); cancer (current/previous). The comorbidities were categorised into four groups (0, 1, 2, ≥ 3). Self-reported height and weight were included in the questionnaire and used to calculate BMI.

The number of individuals in the Danish population ≥ 16 years with a BMI ≥ 35 kg/m^2 was estimated based on the prevalence in the current cohort multiplied by the Danish population ≥ 16 years of age [5]. The same was done among those ≥ 30 years of age (as this subsample was used in the analyses including educational level to allow sufficient time to obtain a higher education). The population ≥30 years of age were stratified into the highest of five educational levels (elementary school (≤ 10 years); vocational school (11-12 years); higher education, short (13-14 years), medium (15-16 years) or long (≥ 17 years)) [6]. All prevalences were weighted according to weights provided by Statistics Denmark to minimise the problem of selective non-response [3].

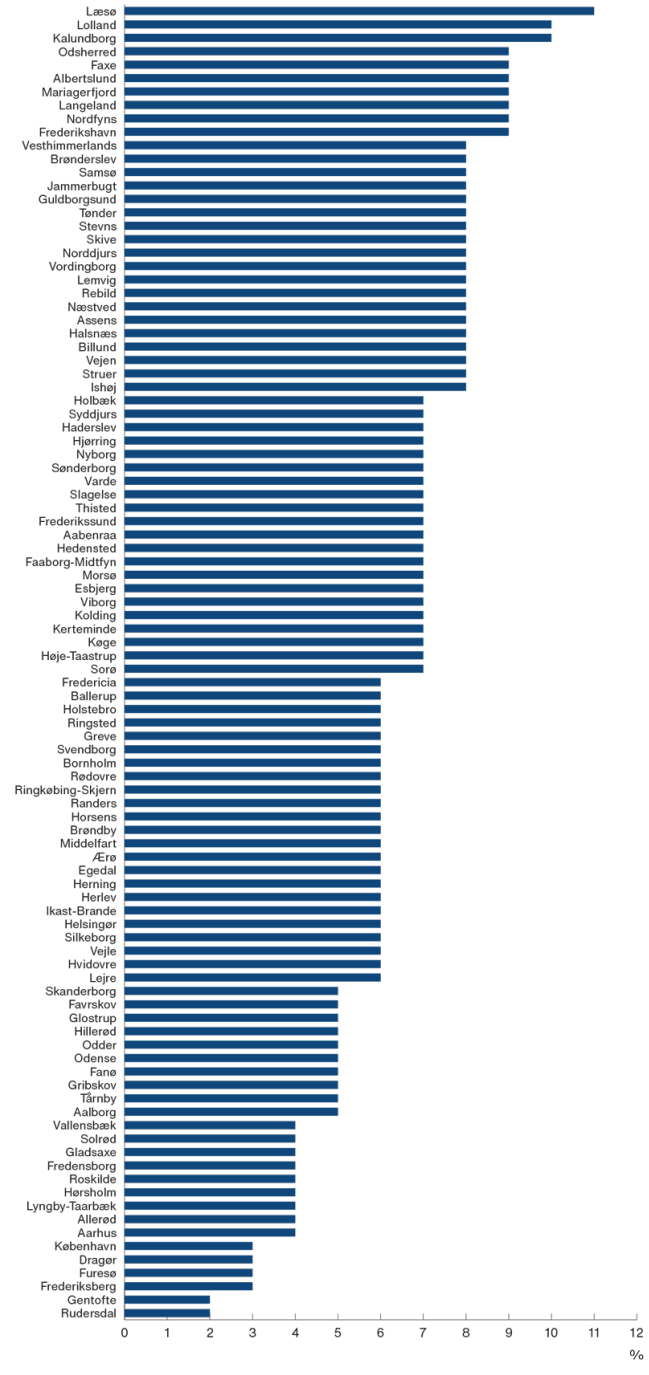
Trial registration: not relevant.

RESULTS

A total of n = 167,573 had sufficient data to be included in the analyses, among whom n = 9,735 (5.8%) had a BMI ≥ 35 kg/m^2. Hence, an estimated 280,500 Danes ≥ 16 years of age live with a BMI ≥ 35 kg/m^2 (6.3% and 216,500 Danes ≥ 30 years of age).

The prevalence of BMI ≥ 35 kg/m^2 in the 98 Danish municipalities ranges from 2.2% to 10.7% (**Figure 1**) and from 2.6% to 8.8% according to education level (≤ 10 years: 8.8%; 11-12 years: 7.7%; 13-14 years: 5.9%; 15-16 years: 5.3%; ≥ 17 years: 2.6%).

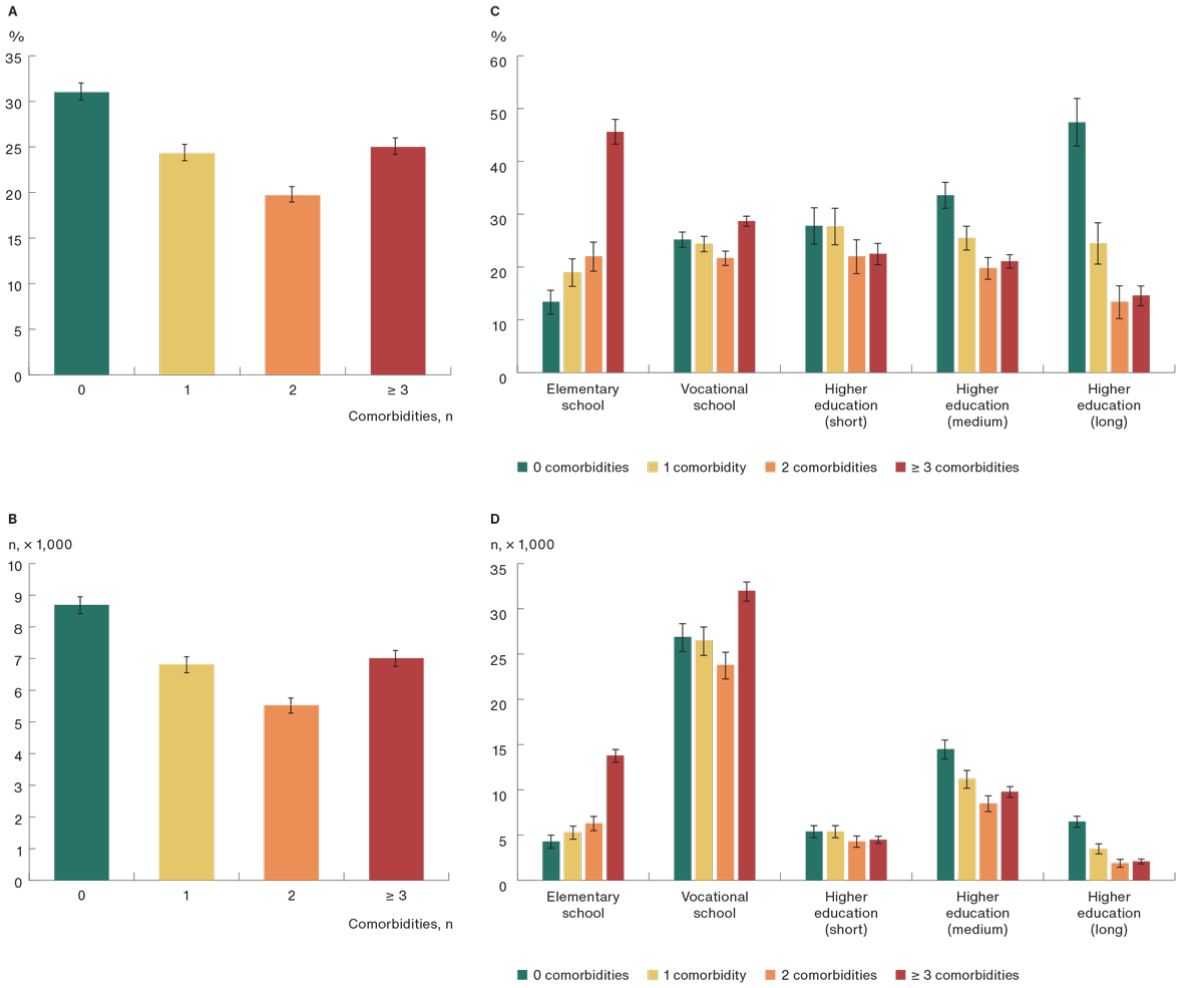
FIGURE 1 Prevalence of a BMI ≥ 35 kg/m² in the 98 Danish municipalities in 2021



Among the individuals with BMI ≥ 35 kg/m^2 and ≥ 30 years of age, a total of 13.7%, 50.5%, 9.1%, 20.3% and 6.5% had the highest education of ≤ 10 years; 11-12 years; 13-14 years, 15-16 years and ≥ 17 years, respectively.

Out of the estimated 280,500 individuals in the Danish population aged ≥ 16 with a BMI ≥ 35 kg/m^2, 31.0% had no comorbidities, whereas the remaining 69.0% had ≥ 1 comorbidity (**Figure 2** A and B). The prevalence for each comorbidity was as follows: hypertension (36.1%), osteoarthritis (32.9%), mental disorder (< 6 mos.: 8.1%; > 6 mos.: 14.9%), disc herniation or sciatica (16.9%), T2DM (14.6%), rheumatoid arthritis (12.5%), asthma (10.9%), cancer (7.0%), chronic bronchitis/COLD (6.9%), myocardial infarction (3.6%); stroke (3.5%) and coronary artery syndrome (2.0%).

FIGURE 2 Comorbidities among individuals with a BMI ≥ 35 kg/m² by educational level. **A**. Percentage of the Danish population (age ≥ 16 years) with a BMI ≥ 35 kg/m² having 0, 1, 2 and ≥ 3 comorbidities. **B**. Number of Danes (age ≥ 16 years) with a BMI ≥ 35 kg/m² having 0, 1, 2 and ≥ 3 comorbidities (n = 280,500). **C**. Percentage of the Danish population (age ≥ 30 years) with a BMI ≥ 35 kg/m² having 0, 1, 2 and ≥ 3 comorbidities presented by educational level. **D**. Number of Danes (age ≥ 30 years) with a BMI ≥ 35 kg/m² having 0, 1, 2 and ≥ 3 comorbidities presented by educational level (n = 216,500). Data are presented as mean with 95% confidence interval.



Among individuals (age ≥ 30) with a BMI ≥ 35 kg/m^2 and elementary school as the highest educational level, 13.4% had no comorbidities, and 45.6% had ≥ 3 comorbidities. In contrast, among individuals with a long higher education, 47.4% had no comorbidities and 14.6% had ≥ 3 comorbidities (Figure 2 C). The educational group with the highest absolute number of individuals with a BMI ≥ 35 kg/m^2 accompanied by comorbidities was vocational school (Figure 2 D). Among those with a BMI ≥ 35 kg/m^2 and ≥ 3 comorbidities, 73.6% (n = 45,800) had elementary school or vocational school as the highest education level, and 3.4% (n = 2,200) had a long higher education, although representing 58% and 7% of the Danish population, respectively.

The difference between individuals with the lowest and highest education level is a factor 3.4 (2.6% versus 8.8%) and 10.6 ((8.8% × 0.456) = 4.0% versus (2.6% × 0.146) = 0.4%) among individuals with a BMI ≥ 35 kg/m^2 and a BMI ≥ 35 kg/m^2 with ≥ 3 comorbidities, respectively.

DISCUSSION

The prevalence of individuals living with a BMI ≥ 35 kg/m^2 differed by 3-5-fold depending on municipality and

educational level. Additionally, the less educated group living with a BMI ≥ 35 kg/m^2 was three times more likely to have ≥ 3 comorbidities than the most educated group. Combined with existing knowledge on overweight and obesity, social inequity in health becomes more pronounced as BMI increases and comorbidities start to emerge.

In a recent survey of more than 5,000 Danish adults, eight out of ten believed that prevention and management of obesity was the individual's responsibility [7], even though research has clearly shown that obesity develops as an interaction between genetic, epigenetic and environmental factors, of which many are poorly understood [8] and likely to be deeply rooted in social inequity. Therefore, the responsibility for the obesity pandemic has been suggested to lie with the 1) national level, 2) food system, 3) education system, 4) medical system, 5) public healthcare system, 6) municipality, 7) society/community, 8) parental level, but only at the 9) individual level when adequate resources are available [9].

Genes alone cannot explain the excessive increase in the number of people living with overweight and obesity or the socio-demographic variations described herein. Changes in food systems (e.g., energy-dense, processed and highly palatable food), exercise habits and potentially also sleep deprivation contribute. Still, the interplay with the person's innate biological and psychological factors likely determines the individual's susceptibility to excessive energy intake and obesity.

Educational level – which is also likely to explain parts of the difference between municipalities – is one of the most pronounced effect modifiers in health research and is often difficult to remove by known contributors such as diet and exercise. Furthermore, educational level is a complex variable that may not fully capture socio-economic status or health literacy, and the relationship between education and obesity is likely bidirectional [10]. Nevertheless, we may gain important insights into novel causal factors of obesity by more carefully studying the differences between individuals with different educational levels. If we enhance our understanding of these differences, we may also improve prevention and management of obesity in the future. This may potentially involve environmental factors such as mental and social stress, sleep, pollutants, diet components, exercise regimens, atmospheric CO_2, noise, ambient temperature, microbial environment, viral infections, drugs and other yet unknown factors with a potential interplay with (epi)genetics, some of which are likely to be deeply rooted in social inequity [11].

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Conflicts of interest Potential conflicts of interest have been declared. Disclosure forms provided by the authors are available with the article at ugeskriftet.dk/dmj

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