

# How does body mass index impact self-perceived health? A pan-European analysis of the European Health Interview Survey Wave 2

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## ABSTRACT

**Background** Obesity remains a major global public health issue, despite numerous attempts to address it. Health behaviour theories suggest that a misconception of how excess weight affects general health may be preventing individuals from taking action towards addressing it. The present study explores this relationship in European countries.

**Methods** This study analysed cross-sectional secondary data collected as part of the European Health Interview Survey Wave 2 (2013–2015), with a total sample of 299 846 participants. The association between body mass index and self-perceived health was analysed using logistic regression models. Age, sex, country, degree of urbanisation and level of education were included in the model to determine excess weight's independent contribution to self-perceived health over and above these variables.

**Results** The majority of the sample was in the excess weight category (52.92%; n=155 812), with only Austria and Luxembourg reporting a higher proportion of normal weight than excess weight. An analysis of self-perceived health revealed that most individuals perceived themselves to be in good health (42.88%; n=128 579). Logistic regression results show that overweight individuals were more likely to report being in poorer self-perceived health (OR=1.27, 95% CI 1.25 to 1.29) compared with normal weight individuals. The same effect was observed for individuals in the obese class I (OR=2.00, 95% CI 1.96 to 2.05), obese class II (OR=3.00, 95% CI 2.88 to 3.13) and obese class III (OR=4.38, 95% CI 4.07 to 4.71) categories. However, this study did not find a rigid pattern of association between excess weight and self-perceived health across European countries.

**Conclusion** In general, a higher body mass index category is associated with poorer self-perceived health, suggesting that the majority of the study population have a correct perception of how their weight affects their health. However, in some key countries this relationship is not observed and should be further explored.

## INTRODUCTION

Obesity, classified as a disease by WHO, and associated with a myriad of chronic conditions, has for decades remained a major health burden.<sup>1</sup> WHO defines overweight as a body

### WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Health behaviour theories postulate that perception of disease plays a crucial role in determining actions towards it.

### WHAT THIS STUDY ADDS

⇒ In general, individuals associate a higher body mass index with poorer self-perceived health, although not in a rigid pattern.

### HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Misunderstanding of how excess weight impacts general health is an unlikely driver for obesity in most countries. However, a review of current policies on obesity is advisable.

mass index (BMI) greater than or equal to 25 and obesity as a BMI greater than or equal to 30.<sup>2</sup> In 2016, WHO reported 1.9 billion overweight adults and 650 million obese adults globally, equating to 39% and 13% of adults, respectively.<sup>2</sup> The Organisation for Economic Co-operation and Development (OECD) estimated that approximately 3 million premature deaths per year will be due to excess weight by 2050.<sup>1</sup> Furthermore, overweight and obesity represent a significant economic burden, on par with that of smoking or armed violence, war and terrorism.<sup>1,2</sup> A recent study estimated that approximately US\$311 billion will be spent yearly by OECD countries to treat diseases caused by excess weight (equating to 8.4% of the total health spending).<sup>3</sup> In addition, obesity negatively affects employment rates, increases early retirement rates and absenteeism.<sup>3</sup> This complex, yet preventable, condition is predicted to continue rising with severe forms of obesity becoming increasingly more prevalent.<sup>3,4</sup> Numerous policies have been implemented over the past four decades in an attempt to reduce the burden of obesity. However, the continually increasing rate of

overweight and obesity illustrates the need for further research in order to better understand the obesity epidemic, its drivers and how to better address it.<sup>5</sup>

A survey carried out in seven European countries in 2015 by the European Association for the Study of Obesity found that 18% of the surveyed population in European countries perceived obesity to be a disease and individuals underestimated their own risk of being overweight or obese.<sup>6</sup> Further studies reported challenges in recognising obesity as a disease, both within countries' general populations but also in medical/governmental bodies (particularly in Poland and Italy).<sup>7,8</sup> The health belief model (HBM) suggests that individuals will take action to address a disease if they perceive themselves to be susceptible to that disease, if they perceive the disease could produce serious consequences and if they believe the action's benefits outweigh its barriers.<sup>9</sup> In his work, Rosenstock also theorises that health decisions are affected by a number of factors, both individual and environmental, meaning that throughout the decision-making process, individual perception plays a part, rather than it being the single deciding factor, in health behaviour.<sup>6</sup> However, he explains, perception can interfere with the decision-making process at key points where an individual may be successfully encouraged to take action. It seems plausible then, according to the HBM, that perception plays a key role in informing and encouraging an individual's actions towards health and disease, and therefore understanding how certain conditions are perceived by individuals is vital in comprehending the disease itself and controlling it.<sup>6,10</sup> Literature supporting this concept revealed that obese patients seeking help were aware of obesity being a disease and its risks.<sup>11</sup> Conversely, obese individuals who did not seek help had misconceptions regarding obesity.<sup>10</sup> According to these theories, a misconception of obesity as a disease and the risks it carries could prevent individuals from taking action and further drive the obesity epidemic or obstruct attempts to address it.

Although previous studies have identified and explored the relationship between excess weight and self-perceived health (SPH), the body of evidence on the subject remains limited and with narrow scope.

These studies focused on how the association between weight and SPH was influenced by gender, age and cultural background, rather than quantifying the association itself.<sup>12–16</sup> In addition, these studies had narrow scope and therefore low generalisability. They focused on small samples of highly specific populations. The results of these studies are not likely to be applicable to different contexts and populations (eg, study on immigrant Polynesian population living in Hawaii may not be generalisable to other populations resident in Hawaii or other Polynesian populations living elsewhere).

The aim of this study is to analyse the relationship between excess weight and SPH. Furthermore, this study will provide an additional insight into a large sample of pan-European data. This information will generate European-wide evidence, but also highlight specific

countries where a change in public health policy may be necessary, ultimately enabling a holistic and effective approach to European obesity policy.

## METHODS

### Design and data set

This study, based on data from Eurostat, analysed cross-sectional secondary data collected as part of the European Health Interview Survey Wave 2 (EHIS 2), carried out between 2013 and 2015. The data set, with a sample of 299 846 participants, measured sociodemographic background, health status, lifestyle and healthcare service use within 30 European countries. The Census Database was used to select a sampling frame, followed by a two-stage stratified cluster sample on national and regional levels. The sample was stratified using the administrative regions in the country and individuals' place of residence. At the first stage, clusters were selected with a probability proportional to their size; at the second stage, through a systematic selection, households were identified. Individuals aged 15 and over in selected households were interviewed face to face and completed a self-administered questionnaire. The final sample size was 265 692 participants due to exclusion of participants under the following exclusion criteria: participants under 20 years old, as BMI is interpreted differently in children and teenagers (ie, aged 2–19 years)<sup>17</sup>; and participants diagnosed with skeletal dysplasia (ie, achondroplasia), with a cut-off height of 147 cm.<sup>18</sup> In addition, 17 156 participants were excluded due to missing data on main variables (BMI and self-reported health). Countries where a maximum value was applied for height/weight were also excluded from analyses, as results were not a true representative sample of the population (ie, Ireland and Italy).

### Data availability statement

Data used in this study are classified as sensitive. For this reason, these data are not available on an open access repository and an access request (RPP 69/2021—EHIS) was made to Eurostat to access it. More information on how to access the data set can be found on Eurostat's web page,<sup>19</sup> <https://ec.europa.eu/eurostat/web/microdata>

### Patient and public involvement

It was not possible to involve patients or the public in the design, conduct, reporting or dissemination plans of our research due to anonymisation regulations, strict reporting methods and time constraints.

### Variables

This study focused on three main variables: self-reported weight, height and perceived health. The predictor variable was BMI (self-reported and calculated as a ratio of weight (kg) and the square of height (m)— $\text{kg/m}^2$ ), as a categorical variable with five levels which have a natural order ('Healthy weight'—BMI 18.5–24.9, 'Overweight'—BMI 25–29.9, 'Obesity Class I'—BMI 30–34.9, 'Obesity

Class II—BMI 35–39.9 and ‘Obesity Class III’—BMI 40 and over).<sup>20</sup> The outcome variable SPH was used as a categorical variable with five levels, which have a natural order, ranging from ‘Very Good’, ‘Good’, ‘Fair’, ‘Bad’ to ‘Very Bad’.

Additional variables were included to determine excess weight’s independent contribution to SPH over and above these variables. These variables were selected on account of both being mentioned in previous literature as potential modifiers and identified as factors that impact SPH by Eurostat.<sup>21</sup> They included demographic data (age and sex) and sociodemographic data (country, degree of urbanisation and level of education). Age was categorised and collated into 5-year groups, for confidentiality reasons, by Eurostat. Sex was classified into ‘Male’ or ‘Female’. Country was classified using two digits based on the Nomenclature of Territorial Units for Statistics. Degree of urbanisation was classified into three categories: ‘Densely-populated area’, ‘Intermediate-populated area’ and ‘Thinly-populated area’. Educational attainment was categorised into nine levels according to the International Standard Classification of Education (2011) as follows: ‘0—Early childhood development, pre-primary education’, ‘1—Primary education’, ‘2—Lower secondary education’, ‘3—Upper secondary education’, ‘4—Post-secondary but non-tertiary education’, ‘5—Tertiary education; short-cycle’, ‘6—Tertiary education; bachelor level or equivalent’, ‘7—Tertiary education; master level or equivalent’ and ‘8—Tertiary education; doctoral level or equivalent’.

### Analysis

A total of 265 692 participants were included in the analysis. Due to the study’s extremely large sample size, p value is an unreliable measure of significance (as it approaches zero at minimal effect, regardless of significance), therefore this study relies on effect size and CIs. Where p value significance is not achieved, the result in question will be followed by the symbol ‘n’,<sup>22</sup>

The association between excess weight and SPH was analysed using ordered logistic regression models and generalised ordinal models. CIs and statistical significance were calculated, and the log odds was converted into ORs for easier comprehension. Secondary variables (age, sex, country, degree of urbanisation and level of education) were included in the model to determine excess weight’s independent contribution to SPH over and above these variables.

One of the assumptions of the model is that there must be no multicollinearity between two or more independent variables. For this reason, any variables colinear with BMI were excluded. In the case of proportional odds assumptions not being fulfilled, a generalised ordinal model was used in place of an ordered logistic regression model, using non-proportional variables as nominal.<sup>23</sup> If proportional odds assumption remained unfulfilled, despite using non-proportional variables as nominal, the variable in question was dropped. In countries where

the variable not fulfilling the proportional odds assumption was a main variable (ie, BMI), a generalised ordinal model was used in place of an ordered logistic regression model, using BMI as a nominal variable (online supplemental appendix table 1). In cases where proportional odds assumptions were not met for main variables despite the use of BMI as nominal, countries were excluded from individual country analyses (ie, Bulgaria, Slovakia and Romania). Results were reported in the form of ORs and corresponding 95% CIs.

Tables displaying the results of regression analysis for each individual country are present in the online supplemental appendix tables 2–26.

### RESULTS

Descriptive statistics for demographic characteristics of the EHIS-28 study sample are presented in table 1. The highest proportion of the sample perceive themselves to be in ‘good’ health (42.50%; n=112 932), followed by ‘fair’ SPH with 24.94% (n=66 271) and ‘very good’ SPH with 19.98% (53 079). The majority of the study sample is in the excess weight (‘Overweight’ and ‘Obesity I, II and III’ combined) category (52.71%; n=140 040), followed by normal weight (41.11%; n=109 230).

#### Excess weight in the EHIS-28

Online supplemental appendix figure 1 shows the country-specific proportion of excess weight (‘overweight’ and ‘obesity’ combined) and obesity in the EHIS-28 sample. The country with the highest excess weight was Malta (63.48%), followed by Czechia (61.68%) and Croatia (60.66%). The proportion of obesity in the EHIS-28 cohort was 16.91%. Again, Malta had the highest obesity (27.40%), followed by Latvia (23.04%) and Czechia (21.66%). Contrarily, the countries with the lowest excess weight were Austria (47.96%), Luxembourg (48.68%) and France (49.03%), and the countries reporting the lowest obesity were Romania (9.94%), Sweden (13.58%) and Norway (13.66%).

Online supplemental appendix figure 2 shows a comparison in proportion of normal weight and excess weight per country.

Austria and Luxembourg were the only countries in this sample where the proportion of excess weight did not exceed the proportion of normal weight, though in the case of Luxembourg the proportion of normal weight exceeded the proportion of excess weight by only 0.11%. In all remaining countries, excess weight exceeded normal weight. The country with the largest discrepancy between normal weight and excess weight was Malta, with excess weight (63.48%) exceeding normal weight (35.14%) by 28.34%.

#### SPH in the EHIS-28

Online supplemental appendix figure 3 presents the distribution of proportions of SPH categories per country. The country with the highest ‘very good’ SPH was Cyprus



**Table 1** Descriptive statistics for demographic characteristics of the study sample (n=265 692)

Characteristic	% (n)
<b>Age</b>	
20–24	5.89 (15 651)
25–29	6.18 (16 420)
30–34	7.18 (19 083)
35–39	8.10 (21 530)
40–44	8.69 (23 076)
45–49	9.11 (24 205)
50–54	9.28 (24 653)
55–59	9.18 (24 387)
60–64	9.06 (24 062)
65–69	8.57 (22 772)
70–74	6.83 (18 135)
75+	11.94 (31 718)
<b>Sex</b>	
Male	45.44 (120 742)
Female	54.56 (144 950)
<b>Degree of urbanisation</b>	
Densely populated area	35.84 (95 231)
Intermediate populated area	28.87 (76 710)
Thinly populated area	35.16 (93 429)
Missing (don't know, refusal)	0.12 (322)
<b>Highest level of education completed (educational attainment)</b>	
Early childhood development, preprimary education	2.93 (7777)
Primary education	11.42 (30 355)
Lower secondary education	14.94 (39 682)
Upper secondary education	39.40 (104 674)
Postsecondary but non-tertiary education	3.83 (10 175)
Tertiary education; short cycle	6.82 (18 129)
Tertiary education; bachelor level or equivalent	9.39 (24 961)
Tertiary education; master level or equivalent	9.63 (25 592)
Tertiary education; doctoral level or equivalent	0.88 (2332)
Missing (don't know, refusal)	0.76 (2015)
<b>Self-perceived general health</b>	
Very good	19.98 (53 079)
Good	42.50 (112 932)
Fair	24.94 (66 271)
Bad	7.46 (19 824)
Very bad	1.89 (5062)
Missing (don't know, refusal)	3.22 (8560)
<b>Body mass index</b>	
Underweight	1.61 (4268)
Normal weight	41.11 (109 230)
Overweight	36.10 (95 925)

Continued

**Table 1** Continued

Characteristic	% (n)
Obese class I	12.54 (33 308)
Obese class II	3.06 (8119)
Obese class III	1.01 (2688)
Missing (don't know, refusal)	4.57 (12 154)

(43.50%), followed by Austria (36.54%) and Iceland (32.61%). The countries reporting 'Very good'/'Good' SPH were Austria (79.81%), followed by Norway (79.37%) and Malta (77.31%).

Lithuania had the lowest reported 'Very good'/'Good' SPH combined, with a total proportion of 40.68%.

The countries reporting 'Bad'/'Very bad' SPH were Croatia (18.77%), Portugal (17.13%) and Lithuania (16.98%). The country with the highest 'very bad' SPH was Croatia (4.28%), followed by Portugal (4.25%) and Lithuania (3.93%). The country with the lowest 'Bad'/'Very bad' SPH (bad and very bad combined) was Malta, with a total proportion of 2.81%.

The total sample reported 65.34% for 'Very good'/'Good' SPH, 9.42% for 'Bad'/'Very bad' SPH and 25.25% for fair health.

### Effect of BMI on SPH in the EHIS-28

Controlling for demographic characteristics such as age, sex, degree of urbanisation and educational attainment, the results (table 2) show that overweight individuals are more likely to report being in poorer SPH (OR=1.27, 95% CI 1.25 to 1.29). The same effect is observed for individuals in 'Obesity class I' (OR=2.00, 95% CI 1.96 to 2.05), 'Obesity class II' (OR=3.00, 95% CI 2.88 to 3.13) and 'Obesity class III' (OR=4.38, 95% CI 4.07 to 4.71).

There are also additional patterns in the relationship between SPH and age (as age increases, SPH decreases), educational attainment (a lower educational attainment is associated with poorer SPH) and sex where women are more likely to report being in poorer perceived health than men (OR=1.25, 95% CI 1.23 to 1.27).

Table 3 presents the results of ordered/generalised ordinal logistic regressions (where BMI was analysed as an ordered variable) in each country analysed. The results showed that individuals with higher BMI were more likely to report being in poorer perceived health when compared with individuals with normal BMI. However, this pattern was not observed in all countries. In Malta, Netherlands and Slovenia, individuals with 'Obesity Class II' were more likely to report being in poorer perceived health than individuals with 'Obesity Class III', when compared with individuals with normal BMI. In Lithuania and Greece, there was no significant difference in the likelihood of reporting poorer perceived health between individuals with 'Overweight', when compared with individuals with normal BMI.

Online supplemental appendix table 1 presents the results of ordered/generalised ordinal logistic regression

**Table 2** Effect of BMI on self-perceived health (EHIS-28)—ORs and 95% CIs of ordered logistic regressions (n=277 556)

Variable	OR	95% CI
<b>Age</b>		
25–29	1.26	1.20 to 1.32
30–34	1.55	1.49 to 1.62
35–39	1.85	1.77 to 1.92
40–44	2.24	2.15 to 2.33
45–49	2.87	2.76 to 2.99
50–54	3.87	3.71 to 4.03
55–59	5.16	4.95 to 5.38
60–64	5.83	5.59 to 6.07
65–69	6.64	6.36 to 6.92
70–74	8.53	8.16 to 8.91
75+	13.80	13.28 to 14.34
<b>Sex</b>		
Female	1.25	1.23 to 1.27
<b>Degree of urbanisation</b>		
Intermediate populated area	1.01*	0.99 to 1.03
Thinly populated area	1.09	1.07 to 1.11
<b>Highest level of education completed (educational attainment)</b>		
Primary education	0.73	0.70 to 0.77
Lower secondary education	0.51	0.49 to 0.54
Upper secondary education	0.41	0.39 to 0.43
Postsecondary but non-tertiary education	0.46	0.43 to 0.49
Tertiary education; short cycle	0.27	0.25 to 0.28
Tertiary education; bachelor level or equivalent	0.27	0.26 to 0.29
Tertiary education; master level or equivalent	0.25	0.24 to 0.27
Tertiary education; doctoral level or equivalent	0.17	0.16 to 0.19
<b>Body mass index</b>		
Overweight	1.27	1.25 to 1.29
Obese class I	2.00	1.96 to 2.05
Obese class II	3.00	2.88 to 3.13
Obese class III	4.38	4.07 to 4.71

\*P value significance not achieved.  
 BMI, body mass index; EHIS, European Health Interview Survey.

(where BMI was analysed as a nominal variable) in each country analysed. In the generalised ordinal model an independent variable is classified as nominal, so that variable loses its ordered nature. The dependent variable's levels are then analysed comparatively. The 'Very good, Good or fair vs Bad or Very bad' output column was

selected as the column of interest, as it best depicts the wanted comparison between good and bad SPH (represented in black font in online supplemental appendix tables 2–26; output categories of no interest in this study are represented in grey font). Due to this model's nature, ORs are interpreted as the likelihood of the population in question being in better SPH versus poorer SPH, contrary to the original ordered logistic regression model, where the ORs are interpreted as the likelihood of being in poorer SPH.

The results show that individuals with higher BMI were less likely to report being in better perceived health when compared with individuals with normal BMI.

Exceptions to this pattern were the cases of Hungary and Poland, where individuals in the overweight category were more likely to report being in better perceived health when compared with individuals with normal BMI. In Czech Republic, Germany, Spain, Finland, France, Latvia and Portugal, there was no significant difference in the likelihood of reporting better perceived health when compared with individuals with normal BMI.

## DISCUSSION

Overweight and obesity remain some of the most highly significant and challenging issues in current global public health. In an attempt to address it, countries have implemented policies ranging from increasing taxation on unhealthy foods to providing subsidies to encourage the consumption of healthy foods, with little to no improvement in outcomes.<sup>24</sup>

The present study is the first to specifically explore the association between excess weight and SPH in a large sample, inclusive of multiple European countries, investigating a possible link affecting health behaviour. Interestingly, in the EHIS-28 sample and in most individual country cases, as BMI increases, individuals report poorer SPH; however, this relationship does not follow a rigid pattern. These results suggest that a disconnect between BMI and SPH is most likely not the driver for the obesity epidemic. However, in some individual countries, and as hypothesised in a number of health behaviour theories, a disconnect may play a role in furthering the rise of obesity.<sup>6 25</sup>

In Greece, Lithuania, Czech Republic, Germany, Spain, Finland, France, Latvia and Portugal, there were no meaningful differences in the likelihood of individuals reporting poorer perceived health in the 'Overweight' category, when compared with individuals in the 'Normal' BMI category, despite the well-explored and described risk being overweight poses.<sup>3</sup> The results also show that in Hungary and Poland, individuals in the overweight category are more likely to report better perceived health, when compared with those in the normal BMI category. This may be due to a sociocultural effect where higher body weight is associated with increased wealth and health status.<sup>26</sup> Alternatively, and as previously mentioned, particularly in the case of Poland, this may

**Table 3** Effect of BMI on self-perceived health—OR and 95% CIs of regression models (BMI as ordered variable)

Setting	Overweight	Obesity class I	Obesity class II	Obesity class III	Regression model
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	
Austria	1.80 (1.68 to 1.93)	3.28 (2.96 to 3.62)	5.55 (4.56 to 6.75)	9.11 (6.54 to 12.71)	Ordered logistic regression: non-proportional variables dropped (age and educational attainment).
Belgium	1.73 (1.55 to 1.93)	2.83 (2.42 to 3.32)	3.67 (2.74 to 4.91)	4.85 (3.00 to 7.86)	Generalised ordinal model: non-proportional variables dropped (age and educational attainment), degree of urbanisation as nominal variable.
Cyprus	1.29 (1.12 to 1.48)	1.53 (1.26 to 1.86)	2.48 (1.76 to 3.49)	5.20 (2.85 to 9.49)	Generalised ordinal model with sex as nominal variable.
Denmark	1.45 (1.28 to 1.64)	2.48 (2.08 to 2.96)	3.80 (2.78 to 5.20)	5.44 (3.48 to 8.50)	Ordered logistic regression.
Estonia	1.22 (1.07 to 1.38)	1.57 (1.33 to 1.84)	3.32 (2.56 to 4.32)	4.26 (2.89 to 6.28)	Ordered logistic regression.
Greece	1.08* (0.97 to 1.08)	1.62 (1.41 to 1.86)	2.25 (1.77 to 2.87)	2.67 (1.60 to 4.46)	Ordered logistic regression.
Croatia	1.20 (1.05 to 1.36)	1.66 (1.40 to 1.97)	2.08 (1.54 to 2.80)	2.37 (1.27 to 4.42)	Generalised ordinal model with sex as nominal variable.
Iceland	1.20 (1.04 to 1.38)	1.67 (1.38 to 2.02)	2.55 (1.87 to 3.49)	4.47 (2.51 to 7.96)	Generalised ordinal model: non-proportional variables dropped (educational attainment), sex as nominal variable.
Lithuania	1.03* (0.90 to 1.17)	1.63 (1.36 to 1.95)	2.52 (1.88 to 3.38)	3.41 (2.01 to 5.80)	Generalised ordinal model with degree of urbanisation as nominal variable.
Luxembourg	1.40 (1.20 to 1.62)	2.45 (1.98 to 3.04)	2.78 (1.95 to 3.95)	6.49 (3.67 to 11.52)	Ordered logistic regression.
Malta	1.39 (1.18 to 1.64)	2.06 (1.69 to 2.51)	2.92 (2.15 to 3.97)	2.18 (1.34 to 3.55)	Generalised ordinal model: non-proportional variables dropped (degree of urbanisation), educational attainment as nominal variable.
Netherlands	1.43 (1.29 to 1.59)	2.51 (2.15 to 2.93)	5.10 (3.80 to 6.84)	4.36 (2.61 to 7.25)	Ordered logistic regression: non-proportional variables dropped (educational attainment).
Norway	1.55 (1.40 to 1.70)	2.97 (2.57 to 3.45)	4.84 (3.63 to 6.46)	7.35 (4.25 to 12.71)	Generalised ordinal model: non-proportional variables dropped (educational attainment), age as nominal variable.
Sweden	1.56 (1.39 to 1.75)	3.08 (2.58 to 3.68)	5.00 (3.64 to 6.86)	7.65 (4.49 to 13.03)	Ordered logistic regression: non-proportional variables dropped (educational attainment).
Slovenia	1.35 (1.20 to 1.52)	1.91 (1.63 to 2.23)	3.08 (2.33 to 4.08)	2.97 (1.82 to 4.86)	Generalised ordinal model: non-proportional variables dropped (educational attainment), sex as nominal variable.

\*P value significance not achieved.  
BMI, body mass index.

be the result of country-wide challenges in recognising obesity as a disease.

The analysis of the effect of BMI on SPH showed that in Malta, Netherlands and Slovenia, individuals in the ‘Obesity Class II’ category were more likely to report poorer perceived health than individuals in the ‘Obesity Class III’ category. It is not clear why this effect was observed within this data set, particularly since it is not supported by previous research. The study should be repeated in these contexts to explore whether this effect is replicated.

Two specific countries of interest are Malta and Hungary. Malta was as the country with the highest level of excess weight, yet counterintuitively, it was also

the country with the lowest proportion of poorer SPH. A change in lifestyle, which led to an increase in sedentarism, has been named as a possible cause for the rising proportion of overweight in Malta. However, there is no literature to support the combined high rate of excess weight and good SPH observed in this country.<sup>26 27</sup>

Likewise, Hungary distinguishes itself from the remaining countries due to its pattern of association between BMI and SPH. Hungary reports that overweight individuals are 38% more likely to report better perceived health than individuals with healthy BMI. Further complicating this pattern, Hungary reported no significant difference in SPH in individuals in the Obesity class I and II categories, when compared with individuals with

'Normal' BMI. This is a concerning pattern that supports the theory of a disconnect between BMI and SPH in this country.

Additionally, the results show that the overwhelming majority of countries in the EHIS-28 sample have a higher proportion of excess weight and largely report good SPH, which confirms findings from previous studies.<sup>28 29</sup>

There is also a clear pattern in the relationship between SPH and age; as age increases, SPH decreases. Previous research suggested that this is most likely linked to alterations in intrinsic capacity, rather than age itself.<sup>30</sup> Furthermore, these results verify that lower educational attainment is associated with poorer perceived health.<sup>21</sup> Finally, this study confirms that women are more likely to report poorer perceived health than their male counterparts, a disparity in Europe also reported in previous studies.<sup>21</sup>

The present study shows that a higher BMI category is associated with poorer SPH in the study sample as a whole; however, this relationship differs when countries are analysed individually. In countries where significant deviation from the European pattern was reported, intervention may be advised and further studies should be carried out to better explore this relationship, in order to create a robust evidence base that can inform effective policies to address the issue of overweight and obesity.

### Limitations

This study has significant results that must be acknowledged and further explored. However, it also has limitations.

First, the use of BMI as a measure of body weight has been contested in previous studies as an imperfect method with poor sensitivity and specificity, particularly when weight and height values are self-reported.<sup>31</sup> Though this is recognised, BMI is also the most widely used measure of excess weight (due to its ease of use and its close association with obesity risks), and the one present in most data sets.<sup>3 32</sup>

Another limitation is the use of self-reported data, though previous studies have shown self-reported data to be a reliable source of information.<sup>33 34</sup>

There are also limitations associated with the use of this specific data set. Different anonymisation rules were used for different countries. Additionally, the data set uses cross-sectional data, thus associations cannot be interpreted as predictive.<sup>35</sup> Finally, due to a number of countries failing to fulfil proportional odds assumptions, different regression models were used, hence, caution must be applied when comparing results between countries or generalising the findings of this study to a different sample.

### CONCLUSION

In summary, the present study provides a comprehensive analysis of the relationship between excess weight and SPH in a large sample inclusive of 28 European countries. The results show that, in the general cohort, as BMI

increases, individuals report poorer SPH. However, this pattern is not rigid across all countries. This suggests that most individuals associate excess weight with poorer general health. Contrarily, in countries where this pattern is not observed, a misperception and subsequent unawareness of how excess weight and general health are associated may be present. These findings indicate that there is a need for further investigation and monitoring of this issue, combined with the implementation of education policies, particularly in Malta and Hungary. Additionally, the results highlight the need for improved evidence-based policies to effectively address the growing issue of obesity.

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