



Article

Prevalence of Obesity and Severe Obesity among Professionally Active Adult Population in Poland and Its Strong Relationship with Cardiovascular Co-Morbidities-POL-O-CARIA 2016–2020 Study

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Abstract: For several decades, a steady increase in the percentage of overweight and obese people has been observed all over the world. There are many studies available in the literature emphasizing the relationship of overweight and obesity with the occurrence of other diseases. The aim of this study is to characterize the prevalence of obesity and severe obesity, as well as their changes over time, among professionally active adults who underwent occupational medicine examinations in Poland in 2016–2020, for the POL-O-CARIA 2016–2020 study. In total, the results of 1,450,455 initial, control and periodic visits as part of the occupational medicine certificate were analyzed. Statistical calculations were performed with the use of IBM SPSS Statistics 25. In both groups (men/women), a significant decrease was observed every year for people who had normal body weight. In addition, the tendency to increase in people with I and III degrees of obesity was more strongly observed in the male group. A significant relationship was also observed between BMI categories and the occurrence of all analyzed comorbidities: hypertension, type 2 diabetes, lipid disorders and coronary artery disease ($\chi^2(70) = 12,228.11; p < 0.001$). Detailed results showed that in the group of patients diagnosed with hypertension or lipid disorders, significant differences were observed between all groups; it turned out that as the BMI level increased (I, II, III), there was an increase in the percentage of occurrence of hypertension (38.1%, 41% and 45.3%, respectively) and type 2 diabetes (3.2%, 4.6% and 5.8%, respectively) ($p < 0.001$). Our analysis indicates that the prevalence of adult obesity and severe obesity will continue to increase nationwide, with an accompanying large increase in comorbidities.

Keywords: BMI index; professionally active adult population; cardiovascular diseases; obesity

1. Introduction

For several decades, a steady increase in the percentage of overweight and obese people has been observed all over the world. More and more countries declare problems with controlling this epidemic. This disease affects children as well as adults [1]. According to the WHO definition, obesity is abnormal or excessive accumulation of fat that negatively affects health. Obesity is diagnosed when the BMI level exceeds or is equal to 30 kg/m² [2]. According to data published by WHO in 2014, the percentage of people with obesity in Poland is 25.1% [3]. The main cause of obesity is a long-term imbalance between the amount of calories consumed and the body's demands [4]. Diet, lifestyle and genetics have a significant influence on the occurrence of obesity [5].

1.1. Obesity and Comorbidities

There are many studies available in the literature emphasizing the relationship of overweight and obesity with the occurrence of other diseases. A meta-analysis carried out in 2015 showed that each increase in weight by 5 kg significantly increases the risk of developing post-menopausal breast (11%), endometrial (39%), ovarian cancer (13%) and male colon cancer (9%) [6]. Cohort studies conducted in Europe (Austria, Norway, Sweden) under the Me-Can 2.0 program showed that overweight people up to 40 years of age significantly increase their chance of developing endometrial, male renal cell and male colon cancer [7]. Obesity is a chronic and metabolic disease; therefore, it affects the occurrence of cardiovascular diseases [8]. It affects the structural and functional changes in the cardiovascular system, e.g., causing decreased cardiac output, increased left ventricular mass and wall thickness [9]. The association of obesity with hypertension, coronary artery disease and diabetes is also scientifically confirmed [10,11].

1.2. The Global Obesity Epidemic

For several decades, a steady increase in the percentage of overweight and obese people has been observed. Most countries in the world are affected. Current reports show that more people worldwide die from overweight and obesity than from underweight [12]. Obesity is the main reason for the development of NCDs (non-communicable diseases), which since 2010 have been responsible for 86% of deaths and 77% of other diseases in Europe. Over the past 40 years, there has been a sharp increase in the percentage of people with obesity; since 1975, the percentage of people with obesity has increased from 1% to 6–8%. Women saw an increase from 6% to 15%, while men increased from 3% to 11% [13]. There are four levels of obesity, distinguished on the basis of an analysis of the 30 most populous countries in the world [14]:

- Level 1—characterized by a higher prevalence of obesity in women than men (more often in adults than children) and in people with a higher socioeconomic status. This level is most commonly observed in South Asia and Sub-Saharan Africa.
- Level 2—at this stage there is a significant increase in obesity in the adult group and a decrease in children. The importance of gender and socioeconomic status is not as clear as in level 1. This stage is most often observed in Latin America and the Middle East.
- Level 3—the most characteristic for the inhabitants of Europe. A higher obesity rate is observed more often in the group of people with a low socioeconomic status, but it is worth noting the increase in the percentage of obese people in the group of women with high economic status and in the group of children.
- Level 4—there are few countries classified to this stage. It is characterized by a decrease in the prevalence of obesity. The research results do not allow for an unequivocal determination of the relationship between the prevalence of obesity and gender and socioeconomic status.

The two regions with a dynamic increase in obesity are North America and Europe [14].

1.3. Actions to Reduce the Obesity Epidemic

Obesity is a multidimensional disease that affects many spheres of life. Hence, it is advisable to provide long-term support for patients suffering from this disease. Current activities aimed at controlling and reducing obesity in society focus on the analysis of the occurrence of civilization diseases, followed by body weight. It seems important to focus on the many dimensions of the fight against obesity (diet, physical activity, changes in behavior), which will translate into an improvement in the quality of life. Attention is also paid to the growing interest in surgical methods of obesity treatment [15]. In Europe, the prevalence of overweight increased from 48% in 1980 to 59.6% in 2015; in the case of obesity, the incidence increased from 15.5% in 1980 to 22.9% in 2015. Moreover, a lower probability of obesity was reported among women (in the group of people aged 20 to 44); an inverse relationship was observed in the group of people over 45 years of age.

1.4. Obesity and Professional Activity

Work is recognized as a source that may influence overweight and obesity [16]. Employers take measures to promote healthy eating habits and increase physical activity among employees [17]. Employers increasingly organize free fruits and vegetables in their offices for their employees [18]. The factors that may increase the chance of overweight and obesity in the workplace are sedentary work, stress and sleep problems [19]. Office work and sedentary work increase the likelihood of obesity among employees [20]. The research by Shields and Tremlay (2008) confirmed the existence of a positive relationship between obesity and spending free time sitting (e.g., while using a computer) [21]. There are also several studies that do not confirm the relationship between sedentary work or leisure activities and the prevalence of overweight and obesity [22]. An important factor associated with overweight and obesity is also stress experienced in the workplace [23].

1.5. Aim of the Study

The aim of the study is to characterize professionally active adults who underwent occupational medicine examinations in Poland in 2016–2020. Due to the exploratory nature of the research, the article did not put forward research hypotheses. Instead, research questions were asked that define the main subject of the analysis: how the intensity of obesity changes over time and how it coexists with other diseases [24].

2. Materials and Methods

The article analyzes the results of the POL-O-CARIA 2016–2020 study, concerning adults who are professionally active and visited in the years January 2016–April 2020 as part of occupational medicine. The data for analysis was provided by the LUX MED Group. In total, the results of 1,450,455 initial, control and periodic visits as part of the occupational medicine certificate were analyzed. During the study, sex, age, province of residence, information on the period of the issued medical certificate and data contained in the medical history (subjective assessment of health, smoking) were controlled. Detailed characteristics of the studied patients are presented in Appendix A.

For several decades, a steady increase in the percentage of overweight and obese people has been observed. For this reason, it seems extremely important to monitor the prevalence of obesity in individual social groups. The study of professionally active adults is important for several reasons. It is important to monitor the health condition and forecast the occurrence of specific civilization diseases in a given society. The occurrence of certain diseases (e.g., obesity, hypertension, diabetes) translates into shorter medical certificates enabling employment.

Statistical Analysis

Statistical calculations were performed with the use of IBM SPSS Statistics 25 [25]. Percentage and number of occurrences were used to analyze qualitative data, while the following were used to characterize qualitative data: mean (M), standard deviation (SD), median, skewness, kurtosis, and the minimum and maximum values. Significant statistical results were considered to be those where the probability of making a type I error was lower than 5% ($p < 0.05$). The following were used for statistical calculations: chi-square analysis in cross tables (Bonferroni correction was used to test column proportions) and one-way analysis of variance (Scheffe's post hoc test was used for mean comparisons). The charts were made in the R program [26].

3. Results

3.1. Information on BMI

It was observed that, with successive years of measurement, the percentage of overweight and obesity (regardless of degree) increased, while the percentage of people with normal body weight significantly decreased. Detailed results are presented in Table 1.

Table 3. Cont.

	2016	2017	2018	2019	2020	Total
Men						
underweight	0.8% ^a	0.8% ^{a,b}	0.9% ^{b,c}	0.9% ^c	0.8% ^{a,b}	0.80%
normal body weight	39.3% ^a	38.9% ^b	38.3% ^c	37.9% ^d	35.5% ^e	38.40%
overweight without obesity	42.7% ^{a,b,c,d}	42.8% ^{c,d}	42.7% ^{b,d}	42.4% ^b	43.2% ^{a,c}	42.70%
I degree of obesity	13.6% ^a	14.0% ^b	14.3% ^c	14.7% ^d	15.9% ^e	14.30%
II degree of obesity	2.9% ^a	2.9% ^a	3.2% ^b	3.3% ^b	3.7% ^c	3.10%
III degree of obesity	0.6% ^a	0.7% ^a	0.8% ^b	0.8% ^c	0.9% ^c	0.70%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

¹ Each letter in subscript represents a subset of the year category whose column proportions do not differ significantly at the level of 5%.

Significant differences, regardless of the year of measurement, were observed using a one-way analysis of variance for the age and time for which the measurement was issued (in both cases, the significance of differences between the groups was $p < 0.001$). The exact results are discussed below.

In the case of patients' age, post hoc analysis with Scheffe's correction showed that only between people with II and III degrees of obesity were there no differences for the average age; in other cases, the significance of differences between individual groups was $p < 0.001$. The highest average age was observed for people with obesity, while the lowest was observed for people with underweight or normal weight (see Figure 1).

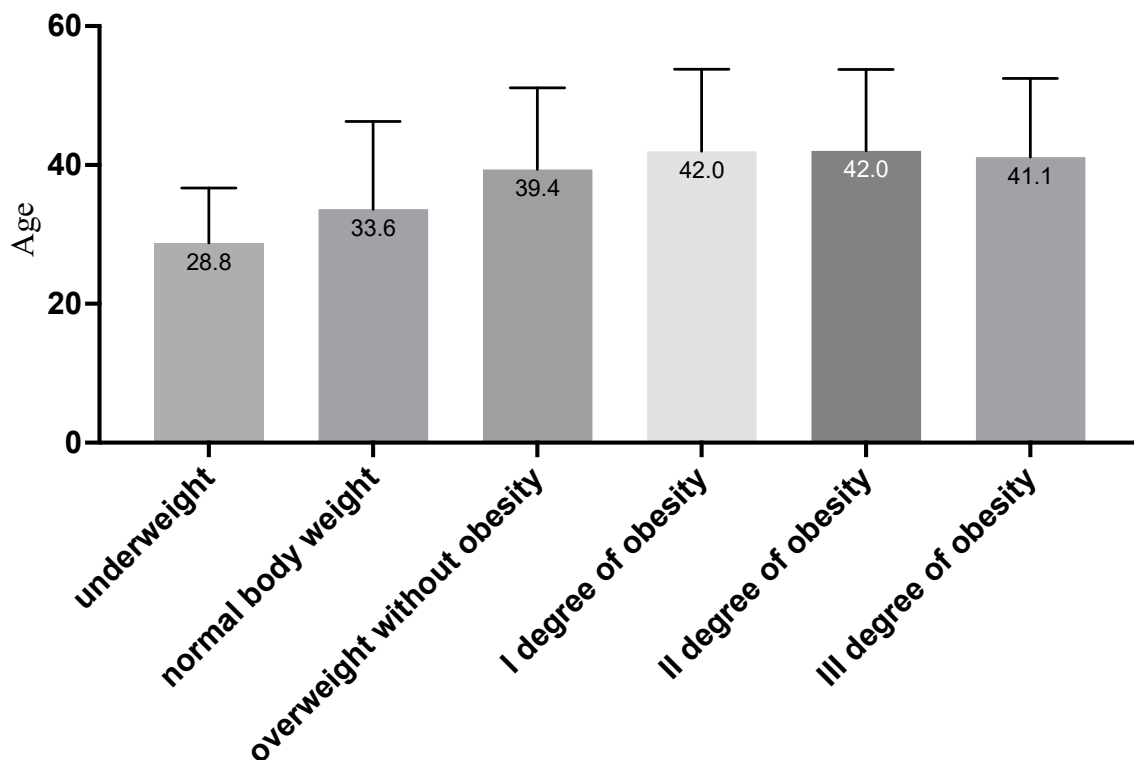


Figure 1. Average age depending on the BMI category (in the figure, all groups are statistically significantly different, at least at the $p < 0.001$ level; due to the number of groups compared, results for differences are not shown in the figure).

Patients with normal body weight most often occurred in the group under 35 years of age, while the percentage of people with obesity (especially I degree) increased significantly in each age category (see Table 4).

Table 4. Relationship between BMI and patients’ age; data presented as percentage of age group ¹.

	<18	18–35	35–54	55–69	>69	Total
underweight	14.3% a	5.1% b	1.4% c	0.5% d	0.6% d	3.30%
normal body weight	61.7% a	60.1% a	41.7% b	27.5% c	26.9% c	50.20%
overweight without obesity	17.5% a	25.6% b	37.8% c	44.8% d	49.9% e	32.00%
I degree of obesity	4.0% a	7.0% b	14.4% c	20.9% d	18.2% e	11.10%
II degree of obesity	1.9% a	1.7% a	3.7% b	5.0% c	4.0% b	2.70%
III degree of obesity	0.5% a,b,c,d	0.5% d	1.1% c	1.2% b	0.4% a,d	0.80%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

¹ Each letter in subscript represents a subset of the year category whose column proportions do not differ significantly at the level of 5%.

Table 5 presents the same data by changing the percentage to the BMI category. The obtained results showed that, together with the higher BMI level, the percentage of people under 35 years of age decreased in each group. In the case of people aged 35–69, it was obtained that they were more often classified into the group with obesity or overweight, compared to groups with normal body weight.

Table 5. Relationship between BMI and age of patients; data presented as percentage of the BMI category ¹.

	Underweight	Normal Body Weight	Overweight Without Obesity	I Degree of Obesity	II Degree of Obesity	III Degree of Obesity	Total
<18	0.2% a	0.1% b	0.0% c	0.0% d	0.0% c	0.0% b,c,d	0.10%
18–35	83.2% a	64.1% b	42.9% c	33.7% d	32.8% e	34.7% f	53.50%
35–54	15.0% a	30.5% b	43.3% c	47.8% d	49.3% e	50.5% f	36.70%
55–69	1.5% a	5.3% b	13.5% c	18.2% d	17.6% e	14.7% f	9.60%
>69	0.0% a	0.1% b	0.3% c	0.3% c	0.2% c	0.1% b	0.20%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

¹ Each letter in subscript represents a subset of the year category whose column proportions do not differ significantly at the level of 5%.

When analyzing the time periods for issuing a medical certificate, significant differences between the groups were also observed. A linear trend was obtained showing that, along with the BMI level, the average number of months of the issued decision decreased. In addition, post hoc analysis with Scheffe’s correction showed that significant differences were observed between all BMI categories. Detailed results are presented below (see Figure 2).

Patients with normal weight or underweight were less likely to smoke than overweight or obese patients. This relationship was observed regardless of the year of measurement (see Figure 3).

The relationship between BMI categories and subjective health assessment was also examined. It was found that people who subjectively assessed their own health as good, less often than people who assessed their health as very good, were classified into the group of people with normal body weight. An inverse relationship was obtained for overweight and obese people. Detailed results are presented below Table 6.

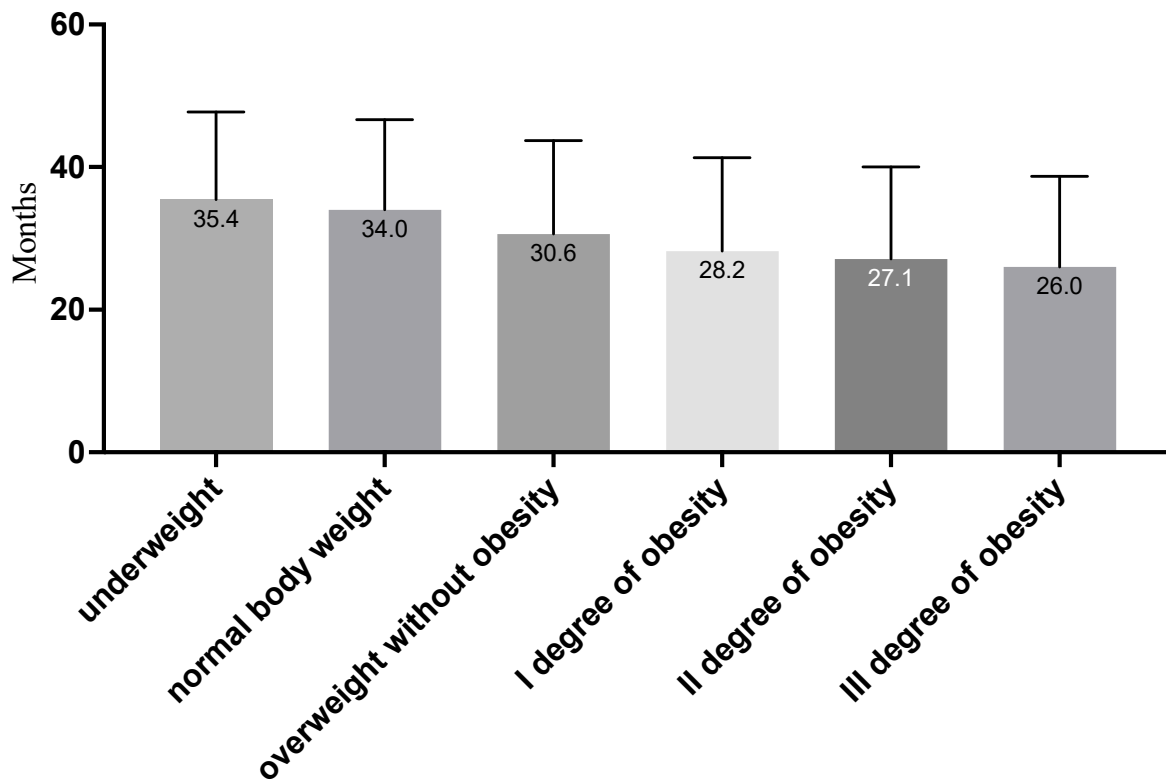


Figure 2. Average number of months for the issued medical certificate depending on the BMI category (in the figure, all groups are statistically significantly different, at least at the $p < 0.05$ level; due to the number of groups compared, results for differences are not shown in the figure).

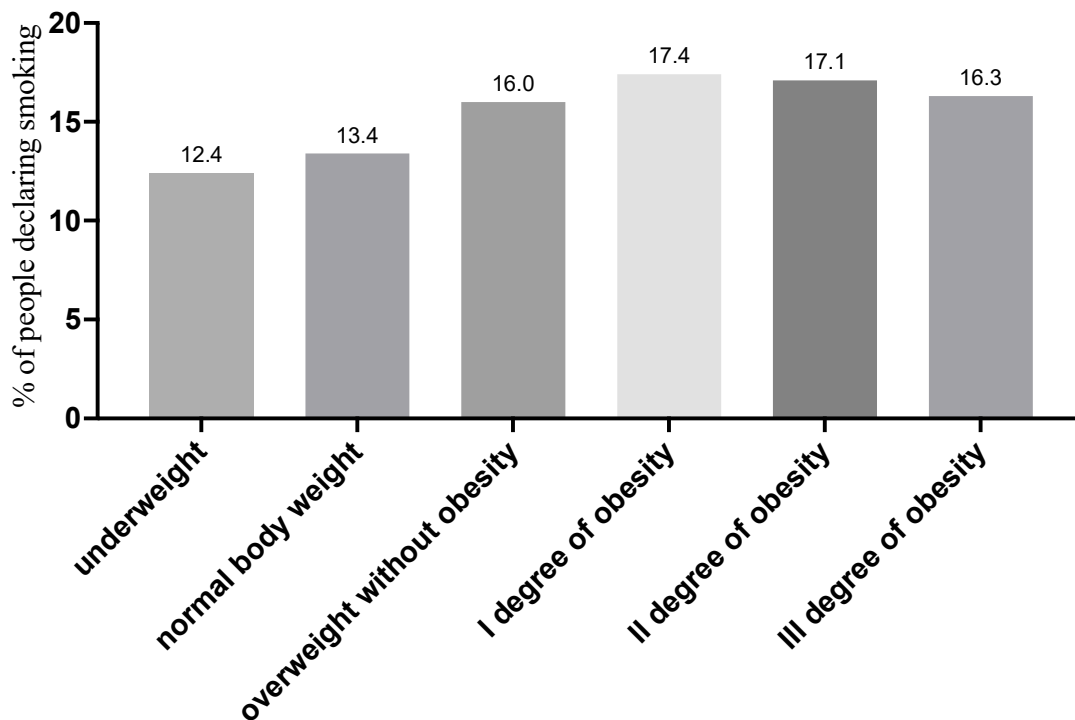


Figure 3. Percentage of people declaring smoking depending on the BMI category (due to the number of groups compared, results for differences are not shown in the figure).

Table 6. Relationship between BMI and subjective assessment of health; data presented as percentage of the health assessment.

	Subjective Health Assessment		Total
	Good	Very Good	
underweight	3.00%	3.80%	3.40%
normal body weight	47.00%	55.20%	50.70%
overweight without obesity	33.10%	30.20%	31.80%
I degree of obesity	12.60%	8.60%	10.80%
II degree of obesity	3.30%	1.80%	2.60%
III degree of obesity	1.00%	0.40%	0.70%
Total	100.00%	100.00%	100.00%

Table 7 shows the relationship between selected diseases and BMI categories. A significant relationship between variables was obtained ($p < 0.001$). The most pronounced differences were observed for hypertension (with increasing BMI level, the percentage of people with this disease increased), and for lipid disorders and type 2 diabetes.

Table 7. Relationship between BMI and the incidence of selected diseases; data presented as percentage of the BMI category ¹.

	Underweight	Normal Body Weight	Overweight without Obesity	I Degree of Obesity	II Degree of Obesity	III Degree of Obesity	Total
Hypertension	29.6% _a	38.4% _b	45.3% _c	50.5% _d	52.3% _e	55.4% _f	44.9%
Type 2 diabetes	8.6% _a	5.8% _b	6.9% _c	10.6% _d	15.6% _e	18.3% _f	8.1%
Lipid disorders	58.9% _a	52.3% _b	43.9% _c	35.1% _d	28.9% _e	23.8% _f	43.4%
Coronary disease	2.9% _{a,b,c,d}	3.4% _d	4.0% _c	3.8% _c	3.2% _{b,d}	2.5% _a	3.7%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

¹ Each letter in subscript represents a subset of the year category whose column proportions do not differ significantly at the level of 5%.

3.3. BMI and Observed Comorbidities

A significant relationship was also observed between BMI categories and the occurrence of comorbidities ($\chi^2(70) = 12,228.11; p < 0.001$). Detailed results showed that in the group of patients diagnosed with hypertension or lipid disorders, significant differences were observed between all groups; it turned out that, as the BMI level increased, the percentage of occurrence of a given disease increases. A comparison of all comorbidities depending on BMI level is shown in the Table 8 below.

Table 8. Relationship between BMI and comorbidities; data presented as percentage of BMI ¹.

	Underweight	Normal Body Weight	Overweight without Obesity	I Degree of Obesity	II Degree of Obesity	III Degree of Obesity	Total
Hypertension	26.1% _a	30.5% _b	33.7% _c	38.8% _d	41.0% _e	45.3% _f	34.1%
Type 2 diabetes	7.8% _a	4.1% _b	2.8% _c	3.2% _d	4.6% _b	5.8% _e	3.5%
Lipid disorders	57.7% _a	47.3% _b	33.0% _c	19.7% _d	11.6% _e	7.5% _f	33.8%
Coronary disease	2.0% _a	1.2% _b	1.0% _c	0.6% _d	0.4% _{d,e}	0.2% _e	0.9%
Hypertension + Type 2 diabetes	0.6% _a	0.9% _a	2.0% _b	4.3% _c	7.7% _d	10.7% _e	2.5%
Hypertension + Lipid disorders	4.2% _a	11.6% _b	19.5% _c	21.9% _d	20.1% _c	17.0% _e	17.3%
Hypertension + Coronary disease	0.3% _a	0.6% _a	0.9% _b	1.0% _b	0.9% _b	1.1% _b	0.8%
Type 2 diabetes + Lipid disorders	0.4% _a	0.7% _a	1.1% _b	1.5% _c	1.8% _d	1.4% _{b,c,d}	1.1%
Type 2 diabetes + Coronary disease	0.1% _{a,b,c}	0.0% _c	0.1% _b	0.1% _a	0.2% _a	0.1% _{a,b,c}	0.1%
Lipid disorders + Coronary disease	0.4% _{a,b,c}	0.7% _c	0.7% _c	0.4% _b	0.3% _{a,b}	0.1% _a	0.6%
Hypertension + Type 2 diabetes + Lipid disorders	0.2% _a	0.9% _b	2.7% _c	5.0% _d	8.1% _e	8.5% _e	2.9%
Hypertension + Type 2 diabetes + Coronary disease	0.1% _{a,b,c}	0.1% _c	0.2% _b	0.4% _a	0.4% _a	0.4% _a	0.2%

Table 8. Cont.

	Underweight	Normal Body Weight	Overweight without Obesity	I Degree of Obesity	II Degree of Obesity	III Degree of Obesity	Total
Hypertension + Lipid disorders + Coronary disease	0.3% _a	1.2% _{b,c}	2.0% _d	2.0% _d	1.5% _c	0.8% _{a,b}	1.7%
Type 2 diabetes + Lipid disorders + Coronary disease	0.1% _{a,b,c,d}	0.0% _{c,d}	0.0% _{b,d}	0.1% _a	0.1% _{a,b,c,d}	0.1% _{a,b,c,d}	0.1%
All		0.2% _a	0.6% _b	1.0% _c	1.3% _d	1.1% _{c,d}	0.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

¹ Each letter in subscript represents a subset of the year category whose column proportions do not differ significantly at the level of 5%.

The cross-tabulation chi-square analysis performed confirmed that there was an association between age and comorbidities ($\chi^2(56) = 16,758.06; p < 0.001$). In the case of hypertension, it was obtained that the prevalence of hypertension was more common in those aged 18–54 compared to other age groups. In addition, the prevalence of lipid disorders was significantly different in each of the age groups; a trend was observed showing that the diagnosis of this disease decreased with age. A detailed comparison of the age groups for the other diseases is shown below Table 9.

Table 9. Relationship between age and comorbidities; data presented as percentage of age group ¹.

	Age					Total
	<18	18–35	35–54	55–69	>69	
Hypertension	66.7% _{a,b,c}	37.7% _c	34.3% _b	31.6% _a	30.2% _a	34.3%
Type 2 diabetes	33.3% _a	6.7% _a	2.8% _b	2.6% _c	2.5% _{b,c}	3.5%
Lipid disorders		44.3% _d	35.8% _c	18.6% _b	7.1% _a	33.2%
Coronary disease		0.5% _c	0.8% _b	1.8% _a	2.0% _a	1.0%
Hypertension + Type 2 diabetes		0.9% _d	2.1% _c	4.8% _b	6.6% _a	2.6%
Hypertension + Lipid disorders		8.7% _d	18.3% _c	22.1% _b	19.0% _{a,c}	17.3%
Hypertension + Coronary disease		0.1% _d	0.5% _c	2.1% _b	4.5% _a	0.8%
Type 2 diabetes + Lipid disorders		0.6% _c	1.1% _b	1.5% _a	1.4% _{a,b}	1.1%
Type 2 diabetes + Coronary disease		0.0% _d	0.0% _c	0.2% _b	0.6% _a	0.1%
Lipid disorders + Coronary disease		0.1% _c	0.5% _b	1.3% _a	1.9% _a	0.6%
Hypertension + Type 2 diabetes + Lipid disorders		0.4% _c	2.2% _b	6.5% _a	8.1% _a	3.0%
Hypertension + Type 2 diabetes + Coronary disease		0.0% _d	0.1% _c	0.6% _b	1.9% _a	0.2%
Hypertension + Lipid disorders + Coronary disease		0.1% _d	1.1% _c	4.3% _b	9.0% _a	1.7%
Type 2 diabetes + Lipid disorders + Coronary disease		0.0% _b	0.0% _b	0.2% _a	0.4% _a	0.1%
All		0.0% _d	0.2% _c	1.8% _b	4.7% _a	0.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

¹ Each letter in subscript represents a subset of the age category whose column proportions do not differ significantly at the level of 5%.

4. Discussion

In this study, we used data from 931,985 unique adult patients and applied an analytical approach that provided estimates of BMI trends. Analyses on the prevalence of obesity in Poland were present in previous years; however, none of them were concerning the current years, and they were not based on such a large group of patients.

Unique in our analysis is also the correlation with the average number of months for the issued medical certificate, and the correlation with the coexistence of other serious diseases, mainly of the cardiovascular system. It is very worrying that, with the increase in BMI, the ability to work is limited, and we did not include patients who, due to obesity and comorbidities, do not try to work at all.

We would like to point out that, in this very large group of patients, we have confirmed the coexistence of diseases that significantly reduce the quality of life of patients, and their coexistence clearly depends on the degree of obesity.

Our data showed that one third of the professionally active women and almost two thirds of the professionally active men are overweight or obese. This result is extremely disturbing. Moreover, we demonstrated a trend showing an increase in the phenomenon over time, which raises concerns in terms of access to medical care and the cost of medical care. The data clearly indicate that the phenomenon is not uniform in all regions of the country. In additional materials, we present unique data indicating the diversification of obesity depending on the region of the country. Although grade II and grade III obesity were once a rare condition, our findings may suggest that they will soon be the most common BMI category in the patient populations. Given that physicians are not well equipped to treat obese patients, the continuing trend will be a major challenge for healthcare as a whole.

5. Conclusions

Further annual assessment of the prevalence of obesity and comorbidities seems necessary to prepare the health care system for treating growing number of obese, professionally active Poles, and to take the most effective measures to inhibit the trend.

Author Contributions: Conceptualization, A.R., W.L., P.P., M.C. and J.D.-K.; Data curation, A.R., I.P. and J.D.-K.; Formal analysis, I.P. and J.D.-K.; Investigation, I.P.; Methodology, A.R. and J.D.-K.; Project administration, A.R., I.P. and J.D.-K.; Supervision, J.D.-K.; Visualization, I.P.; Writing—original draft, I.P. and J.D.-K.; Writing—review & editing, W.L., P.P., M.C. and J.D.-K. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: Ethical review and approval were waived for this study due to REASON: retrospective anonymized analysis.

Informed Consent Statement: Not applicable.

Conflicts of Interest: There is no conflict of interest (all cases). Anna Rulkiewicz, Iwona Pilchowska and Justyna Domienik-Karłowicz are LUX MED employees.

Appendix A. Additional Analyzes

The study included 1,450,455 visits to occupational medicine (collected from 931,985 unique patients) from 2016–2020. The exact number of collected results depending on the year of measurement is presented below.

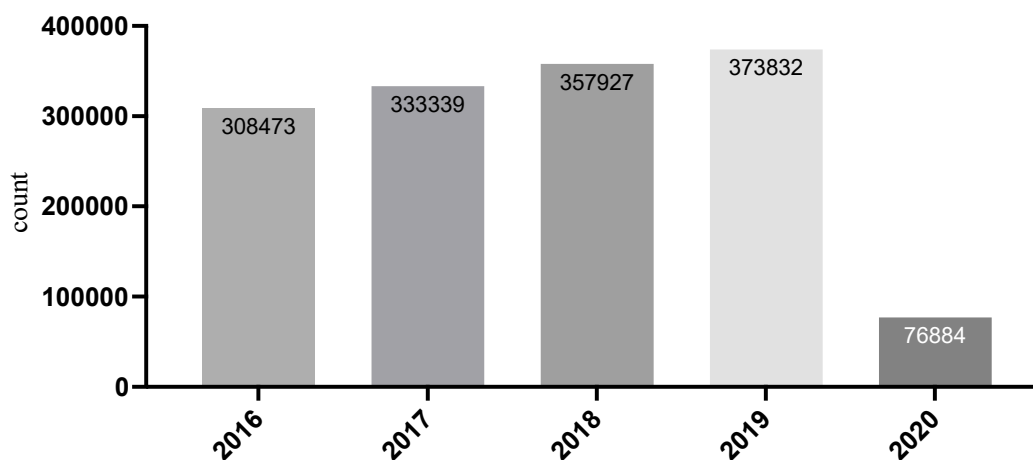


Figure A1. The number of visits analyzed versus the year of measurement.

In terms of sex, the results of the men accounted for a slightly higher percentage (51.6%). Along with the successive stages of the study, the percentage of surveyed men slightly increased (see Figure A2).

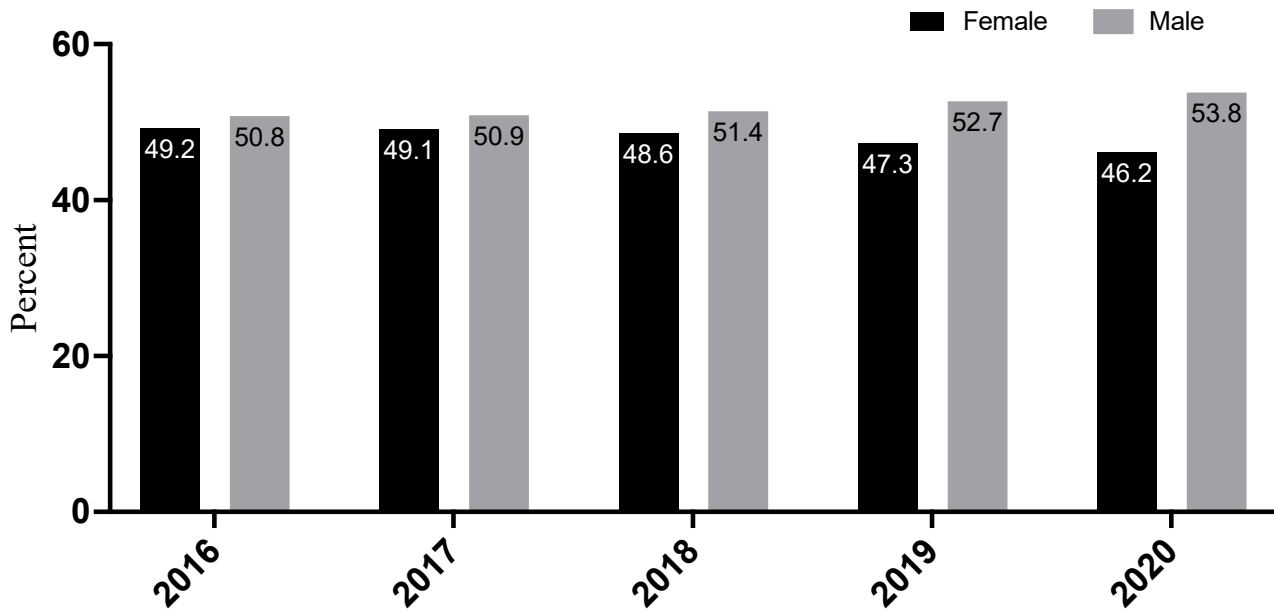


Figure A2. Sex distribution depending on the year of measurement.

The age of the respondents ranged between 14 and 90 years ($M = 36.59$; $SD = 11.56$). A slight trend was observed indicating the mean age of the examined patients slightly increased with each year of measurement (see Figure A3). Clarification: patients can change age categories if their change in age necessitates this; this is not to be misinterpreted for a tautological restatement of the patients aging with time.

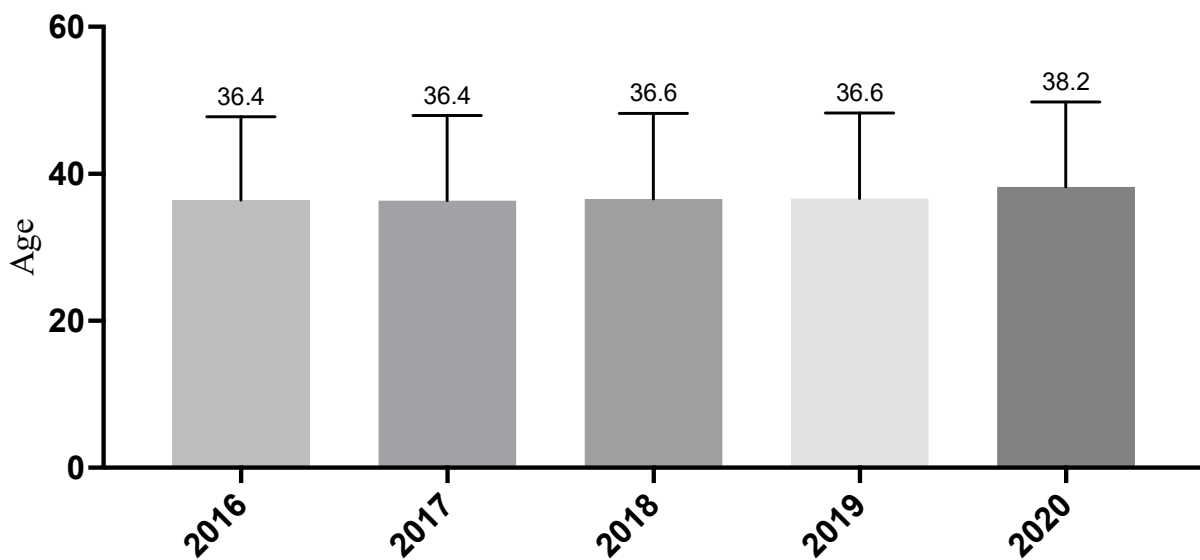


Figure A3. Patient age distribution versus the year of measurement.

The exact distribution of age groups depending on the year of measurement is presented in the table below. It was found that, with successive years of measurement, a decreased percentage of people aged 18–35 and an increased percentage in the age group 35–54 were observed. In the case of the remaining age groups, the trends were not as clear as in the case of these two age categories.

Table A1. Distribution of age groups versus the year of measurement.

	2016	2017	2018	2019	2020	Total
<18	0.00%	0.00%	0.10%	0.10%	0.00%	0.10%
18–35	54.50%	54.30%	53.30%	52.50%	46.80%	53.20%
35–54	35.70%	35.80%	36.70%	37.60%	41.90%	36.80%
55–69	9.60%	9.70%	9.80%	9.70%	11.10%	9.80%
>69	0.10%	0.10%	0.20%	0.20%	0.30%	0.20%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

There were also no significant differences in terms of the distribution of the respondents by year of measurement and the voivodeship of residence (see Table A2).

Table A2. Distribution of voivodeships depending on the year of measurement.

	2016	2017	2018	2019	2020	Total
Lower Silesia	12.60%	13.10%	12.70%	13.00%	13.60%	12.90%
Kuyavian-Pomeranian	3.90%	4.10%	4.10%	3.80%	3.70%	4.00%
Lublin	0.90%	0.90%	0.90%	0.80%	0.70%	0.80%
Lubusz	1.40%	1.40%	1.50%	1.60%	1.90%	1.50%
Lodz	7.20%	7.10%	6.60%	6.70%	6.30%	6.90%
Lesser	10.90%	11.20%	11.80%	11.30%	11.60%	11.30%
Mazowieckie	33.60%	32.00%	30.80%	28.60%	29.00%	31.00%
Opole	1.10%	1.10%	1.10%	1.20%	1.20%	1.10%
Subcarpathian	2.00%	2.40%	3.40%	3.10%	2.80%	2.80%
Podlasie	1.80%	1.90%	1.70%	1.60%	1.50%	1.70%
Pomeranian	6.20%	6.30%	6.80%	7.30%	6.50%	6.70%
Silesian	6.10%	6.20%	6.20%	8.20%	8.30%	6.80%
Świętokrzyskie	0.70%	0.70%	0.70%	0.70%	0.70%	0.70%
Warmia-Masurian	2.10%	1.90%	2.00%	2.10%	2.10%	2.00%
Greater	7.00%	6.80%	6.70%	6.40%	6.70%	6.70%
West Pomeranian	2.60%	3.00%	3.00%	3.50%	3.50%	3.10%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

References

- Ng, M.; Fleming, T.; Robinson, M.; Thomson, B.; Graetz, N.; Margono, C.; Gakidou, E. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: A systematic analysis for the Global Burden of Disease Study 2013. *Lancet* **2014**, *384*, 766–781. [[CrossRef](#)]
- Prospective Studies Collaboration. Body-mass index and cause-specific mortality in 900,000 adults: Collaborative analyses of 57 prospective studies. *Lancet* **2009**, *373*, 1083–1096. [[CrossRef](#)]
- Blundell, J.E.; Baker, J.L.; Boyland, E.; Blaak, E.; Charzewska, J.; De Henauw, S.; Frühbeck, G.; Gonzalez-Gross, M.; Hebebrand, J.; Holm, L.; et al. Variations in the Prevalence of Obesity Among European Countries, and a Consideration of Possible Causes. *Obes. Facts* **2017**, *10*, 25–37. [[CrossRef](#)] [[PubMed](#)]
- Blüher, M. Obesity: Global epidemiology and pathogenesis. *Nat. Rev. Endocrinol.* **2019**, *15*, 288–298. [[CrossRef](#)]
- Yarborough, C.M., III; Brethauer, S.; Burton, W.N.; Fabius, R.J.; Hymel, P.; Kothari, S.; Roslin, M.S. ACOEM Guidance Statement: Obesity in the Workplace: Impact, Outcomes, and Recommendations. *J. Occup. Environ. Med.* **2018**, *60*, 97. [[CrossRef](#)]
- Keum, N.; Greenwood, D.C.; Lee, D.H.; Kim, R.; Aune, D.; Ju, W.; Giovannucci, E.L. Adult weight gain and adiposity-related cancers: A dose-response meta-analysis of prospective observational studies. *J. Natl. Cancer Inst.* **2015**, *2015*, 107. [[CrossRef](#)]
- Björge, T.; Häggström, C.; Ghaderi, S.; Nagel, G.; Manjer, J.; Tretli, S.; Ulmer, H.; Harlid, S.; Rosendahl, A.H.; Lang, A.H.; et al. BMI and weight changes and risk of obesity-related cancers: A pooled European cohort study. *Int. J. Epidemiol.* **2019**, *48*, 1872–1885. [[CrossRef](#)]
- Poirier, P.; Eckel, R.H. Obesity and cardiovascular disease. *Curr. Atheroscler. Rep.* **2002**, *4*, 448–453. [[CrossRef](#)]
- Bastien, M.; Poirier, P.; Lemieux, I.; Després, J.-P. Overview of Epidemiology and Contribution of Obesity to Cardiovascular Disease. *Prog. Cardiovasc. Dis.* **2013**, *56*, 369–381. [[CrossRef](#)]
- Wilson, P.W.; D'Agostino, R.B.; Sullivan, L.; Parise, H.; Kannel, W.B. Overweight and obesity as determinants of cardiovascular risk: The Framingham experience. *Arch. Intern Med.* **2002**, *162*, 1867–1872. [[CrossRef](#)]
- Bastard, J.-P.; Maachi, M.; Lagathu, C.; Kim, M.J.; Caron, M.; Vidal, H.; Capeau, J.; Feve, B. Recent advances in the relationship between obesity, inflammation, and insulin resistance. *Eur. Cytokine Netw.* **2006**, *17*, 4–12. [[PubMed](#)]

12. World Health Organization. Obesity and Overweight. 2016. Available online: <https://www.who.int/mediacentre/factsheets/fs311/en/> (accessed on 1 July 2020).
13. Jaacks, L.M.; Vandevijvere, S.; Pan, A.; McGowan, C.; Wallace, C.; Imamura, F.; Mozaffarian, D.; Swinburn, B.; Ezzati, M. The obesity transition: Stages of the global epidemic. *Lancet Diabetes Endocrinol.* **2019**, *7*, 231–240. [[CrossRef](#)]
14. Chooi, Y.C.; Ding, C.; Magkos, F. The epidemiology of obesity. *Metabolism* **2019**, *92*, 6–10. [[CrossRef](#)] [[PubMed](#)]
15. Ryan, D.H.; Kahan, S. Guideline Recommendations for Obesity Management. *Med. Clin. N. Am.* **2018**, *102*, 49–63. [[CrossRef](#)] [[PubMed](#)]
16. Sorensen, G.; McLellan, D.L.; Sabbath, E.L.; Dennerlein, J.T.; Nagler, E.M.; Hurtado, D.A.; Pronk, N.P.; Wagner, G.R. Integrating worksite health protection and health promotion: A conceptual model for intervention and research. *Prev. Med.* **2016**, *91*, 188–196. [[CrossRef](#)] [[PubMed](#)]
17. Katz, D.; O’Connell, M.; Yeh, M.-C.; Nawaz, H.; Njike, V.; Anderson, L.M.; Cory, S.; Dietz, W. *Public Health Strategies for Preventing and Controlling Overweight and Obesity in School and Worksite Settings: A Report on Recommendations of the Task Force on Community Preventive Services*; Mortality and Morbidity Weekly Report; Department of Health and Human Services, Centers for Disease Control and Prevention: Atlanta, GA, USA, 2005. Available online: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5410a1.htm> (accessed on 1 July 2020).
18. Beresford, S.A.; Thompson, B.; Feng, Z.; Christianson, A.; McLerran, D.; Patrick, D.L. Seattle 5 a Day Worksite Program to Increase Fruit and Vegetable Consumption. *Prev. Med.* **2001**, *32*, 230–238. [[CrossRef](#)]
19. Iii, C.M.Y.; Brethauer, S.; Burton, W.N.; Fabius, R.J.; Hymel, P.; Kothari, S.; Roslin, M.S. Obesity in the Workplace: Impact, Outcomes, and Recommendations. *J. Occup. Environ. Med.* **2018**, *60*, 97–107.
20. Lin, T.-C.; Courtney, T.; Lombardi, D.A.; Verma, S.K. Association between Sedentary Work and BMI in a U.S. National Longitudinal Survey. *Am. J. Prev. Med.* **2015**, *49*, e117–e123. [[CrossRef](#)]
21. Shields, M.; Tremblay, M.S. Sedentary behaviour and obesity. *Health Rep.* **2008**, *19*, 19.
22. Mitchell, J.A.; Bottai, M.; Park, Y.; Marshall, S.J.; Moore, S.C.; Matthews, C.E. A prospective study of sedentary behavior and changes in the body mass index distribution. *Med. Sci. Sports Exerc.* **2014**, *46*, 2244–2252. [[CrossRef](#)]
23. Kottwitz, M.U.; Grebner, S.I.; Semmer, N.K.; Tschann, F.; Elfering, A. Social Stress at Work and Change in Women’s Body Weight. *Ind. Health* **2014**, *52*, 163–171. [[CrossRef](#)] [[PubMed](#)]
24. Bandalos, D.L.; Finney, S.J. *Exploratory and Confirmatory. The Reviewer’s Guide to Quantitative Methods in the Social Sciences*; Routledge: New York, NY, USA, 2010; Volume 93.
25. Field, A. *Discovering Statistics Using IBM SPSS Statistics*; Sage Publications: Thousand Oaks, CA, USA, 2013.
26. Field, A.; Miles, J.; Field, Z. *Discovering Statistics Using R*; Sage Publications: Thousand Oaks, CA, USA, 2012.