Steady increase of obesity prevalence in Austria: Analysis of three representative cross-sectional national health interview surveys from 2006 to 2019

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Summary

Background Obesity is associated with adverse health consequences throughout life. Monitoring obesity trends is important to plan and implement public heath interventions adapted to specific target groups. We aimed to analyze the development of obesity prevalence in the Austrian population using data from the most recent representative Austrian Health Interview Surveys.

Methods The three cross-sectional Austrian health interview surveys from 2006/2007, 2014 and 2019 were used ($n = 45{,}707$). Data correction for self-reported body mass index (BMI) was applied. Sex, age, education level, employment status, country of birth, urbanization, and family status were used as sociodemographic factors. Logistic regression models were applied.

Results Prevalence of obesity increased in both sexes in the study period (men 13.7% to 20.0%, women 15.2% to 17.8%, $p < 0.001$). Adjusted odds ratios (95% confidence interval [CI]) for the increase in obesity prevalence was 1.47 (95% CI: 1.38–1.56). In men, obesity prevalence almost doubled from 2006/2007 to 2019 in subgroups of 15–29-year-olds (4.8% to 9.0%), unemployed (13.5% to 27.6%), men born in non-EU/non-EFTA countries (13.9% to 26.2%), and not

being in a relationship (8.1% to 15.4%). In women, the largest increase was found in subgroups of 30–64-year-olds (15.8% to 18.7%), women born in non-EU/non-EFTA countries (19.9% to 22.8%) and in women living in the federal capital Vienna (16.5% to 19.9%).

Conclusion Obesity prevalence in the Austrian population continues to rise significantly. We identified distinct subgroups with a fast-growing obesity prevalence in recent years, emphasizing the importance of regular long-term data collection as a basis for sustainable and target group-specific action planning.

Introduction

Obesity is a risk factor for many noncommunicable diseases, such as cardiovascular diseases, metabolic diseases like diabetes mellitus and dyslipidemia, musculoskeletal diseases, and mental disorders, ultimately leading to increased mortality [1]. The growing prevalence of obesity has been shown to be an increasing problem for society in a large number of epidemiological studies over the last decades [2]. Consequently, the World Health Organization has declared obesity a global epidemic, with at least 2.8 million people dying each year as a result of being overweight or obese [1].

The continuous increase of obesity shows impressively that we are still lacking targeted and sustainable strategies in the fight against obesity. A better understanding of the complex behavioral and cultural dependencies in the development of overweight and obesity is necessary to overcome this obvious shortcoming. Regular surveys are important not only to

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monitor obesity trends, but also to identify communities particularly vulnerable for developing obesity. These epidemiological data are a prerequisite for targeted and successful preventive measures.

In Austria, health interview surveys have been conducted since 1973. The latest trend analysis for obesity in the general adult population was undertaken for the time span of 1973–2014 [3]. In this time period, six representative health surveys were carried out. Analysis showed an overall increase in obesity prevalence in Austria, following a global trend. In 2019, the latest representative health survey was conducted.

The present study analyzed the development of obesity prevalence in the Austrian population using data of the most recent representative Austrian health interview surveys from 2006/2007, 2014 and 2019, including more than 45,000 adult participants in total.

Material and methods

For the analyses three waves of the Austrian Health Interview Survey (ATHIS), 2006/2007 [4], 2014 [5, 6], and 2019 [7] were used. These surveys were carried out by Statistik Austria, the national statistics agency for Austria, on behalf of the Austrian Ministry of Health. The ATHIS is the Austrian version of the European Health Interview Survey (EHIS), which is regularly performed by the member states of the European Union [8, 9]. The basis for the samples was the entire Austrian population aged ≥15 years registered in the national central population register. The population was stratified into 32 geographical regions, and in all the regions the same number of participants were included, with a higher number for the regions of Vienna, the capital of Austria. Missing values were imputed after fundamental analyses of the nonresponses, based on the factors sex, age, education and region of residence. Additionally, analyses were carried out with weighted data, with sociodemographic factors as weighting factors. ATHIS 2006/2007 was carried out applying computer-assisted personal interviewing (CAPI), ATHIS 2014 was carried out via computer-assisted telephone interviewing (CATI), and ATHIS 2019 was carried out using a combination of CAPI and a web-based questionnaire. Net sample sizes for the 3 waves were 14,474, 15,771, and 15,461 persons, with response rates of 61.1%, 40.7%, and 50.5%, in the respective waves. To increase the response rates, participants were repeatedly reminded, and given a gift voucher as an incentive.

Body mass index (BMI) was calculated in kg/m^2 with the self-reported data on body weight and body height. Since self-reported data for body weight and height usually lead to an underestimation of the actual BMI (due to underestimation of the body weight and overestimation of the body height), we applied correcting factors for both sexes in four different age groups, which are based on an Austrian validity study on self-reported body weight and height [10]. The corrected BMI was categorized according to national and international guidelines as underweight (BMI <18.5), normal weight (BMI 18.5–24.9), overweight (BMI 25–29.9), and obesity grade I (BMI 30–34.9), obesity grade II (BMI 35–39.9), and obesity grade III (BMI ≥40) [11].

Sex, age, education level, employment status, country of birth, urbanization, and family status were used as sociodemographic factors. Regarding sex, ATHIS only distinguishes between male and female. Age was used in three categories, 15–29 years, 20–64 years, and ≥65 years. Education was categorized into three levels, compulsory education up to the age of 15 years (primary education), apprenticeship and vocational school, professional and commercial schools, and high schools (secondary education), university and universities of applied sciences (tertiary education). Employment status was categorized as gainfully employed, unemployed, and not gainfully employed (which includes formal education, housewives and househusbands, maternity or paternity leave, military or civilian service, and retirement). Country of birth was documented with three categories: Austria, EU or EFTA states (comprising the 27 European member states for the years 2006/2007, or the 28 member states for 2014 and 2019, plus the 4 EFTA states, except Austria), and non-EU/non-EFTA states. Urbanization was in two categories, namely living in Vienna, the only Austrian city with more than 1 million inhabitants or living in any other federal state. Regarding relationship status, the categorization was made as either being in a relationship (including being married) or not in a relationship. Additionally, the presence of a chronic disease was obtained with the question "Do you have a chronic disease or a chronic health problem?" and categorized as at least one chronic disease or no chronic disease.

Statistics

Bivariate analyses were computed with cross-tabulations, with the proportion of persons with a certain characteristic in the respective waves of the ATHIS (Table 1), or the proportion of obese persons with a certain characteristic in the respective waves of the ATHIS (Tables 2 and 3). Group differences were assessed with Pearson's χ^2-tests. In order to test for the interaction between the year of evaluation and sociodemographic parameters or chronic diseases on the likelihood of obesity, binary logistic regression analyses were carried out with obesity as the dependent variable, the year of the survey, the respective sociodemographic or health-related parameter, the product of the year, the respective sociodemographic or health-related parameter, and all other sociodemographic and health-related variables as the independent variables. The *p*-values for the product of the year*respective sociodemographic or health-related

Table 1 Sociodemographic and health-related characteristics of the participants of the Austrian Health Interview Survey 2006/2007, 2014, and 2019

	2006/2007	2014	2019	P-value[a]
Sex				
Male	48.2	48.6	48.9	0.465
Female	51.8	51.4	51.1	
Age (years)				
15–29	22.1	21.5	20.1	<0.001
30–64	57.9	57.5	57.8	
≥65	20.0	21.0	22.0	
Education level				
Primary	27.1	22.3	19.5	<0.001
Secondary	63.6	64.3	64.1	
Tertiary	9.4	13.4	16.4	
Employment status				
Gainfully employed	52.6	52.3	53.8	<0.001
Unemployed	3.5	5.1	4.4	
Not gainfully employed	43.9	42.6	41.8	
Country of birth				
Austria	84.2	82.9	80.4	<0.001
EU/EFTA	5.5	10.7	9.1	
Non-EU/non-EFTA	10.3	6.5	10.5	
Urbanization				
Vienna	20.3	20.8	21.2	0.165
Other federal states	79.7	79.2	78.8	
Family status				
In a relationship	65.8	65.4	60.5	<0.001
Not in a relationship	34.2	34.6	39.5	
Chronic disease				
≥1 chronic disease	37.1	36.0	38.3	<0.001
No chronic disease	62.9	64.0	61.7	
Body Mass Index[b]				
Underweight	2.6 (2.0)	2.8 (2.2)	2.5 (2.0)	<0.001
Normal weight	49.8 (46.5)	50.5 (46.5)	46.3 (42.6)	
Overweight	35.2 (37.0)	32.4 (35.1)	34.5 (36.6)	
Obesity grade I	9.9 (11.3)	11.0 (12.1)	12.3 (13.5)	
Obesity grade II	2.0 (2.5)	2.6 (2.9)	3.2 (4.0)	
Obesity grade III	0.4 (0.6)	0.7 (1.1)	1.2 (1.4)	

Values are given as percentage (%)
[a]P-values as results of the χ^2-test between 2006/2007 and 2019
[b]Percentages for categories derived from the corrected BMI values are indicated (values in brackets indicate categories derived from the crude BMI data)

parameter is presented as the *p*-value for the interaction (Tables 2 and 3). Finally, we calculated binary logistic regression analyses with obesity as the dependent variable, and all sociodemographic and health-related variables as the independent variables. The estimates of the logistic regression models with all the mutually adjusted sociodemographic and health-related variables on the likelihood of obesity is presented as odds ratio (OR) and 95% confidence interval (95% CI). All analyses were carried out using IBM SPSS

Statistics V22 (IBM Corporation, New Orchard Road, Armonk, NY, USA).

Results

Table 1 shows the sample characteristics of the three surveys. There was a gradual increase in age from the first to the last survey, also the proportion of people with higher education rose gradually. The proportion of persons not gainfully employed decreased significantly, while the highest proportion of unemployed people and the lowest proportion of gainfully employed was found in the survey of 2014. The proportion of people born in Austria declined gradually from the first to the last survey, and so did the proportion of people being in a relationship. The proportion of people with at least one chronic disease was found to be highest in the last survey. The proportion of obese persons increased gradually from the first to the latest survey. This was the case in all grades of obesity.

There was a significant interaction between the year of the survey and sex on the prevalence of obesity, thus the prevalence of obesity increased to a significantly higher amount in men compared to women. Due to this interaction, the following findings are presented stratified by sex. In men the prevalence of obesity increased from 13.7% to 17.2% and to 20.0% from the surveys 2006/2007 to 2014 and 2019, respectively (Table 2). In the same period the proportion of women with obesity increased from 15.2% in the surveys 2006/2007 and 2014 to 17.8% in 2019 (Table 3).

Tables 2 and 3 show the prevalence of obesity for men and women, respectively, with respective sociodemographic and health-related characteristics. In men, in all three age groups prevalence of obesity increased significantly from 2006/2007 to 2019, in women this was only the case in the younger and in the middle age group. There was a significant interaction between the year of the survey and age on the prevalence of obesity: in both sexes, the highest increase was in the age group 30–64 years, in men aged 15–29 years prevalence of obesity almost doubled in the observed period. In both sexes, there was also a significant increase of obesity in people with lower education, all groups of employment (except in unemployed women), in all groups of country of birth, grade of urbanization, and relationship status. On the other hand, no significant interaction was seen between the year of the survey and the aforementioned factors on the prevalence of obesity. In men, prevalence of obesity significantly increased in both those with at least one chronic condition, and those with no chronic condition. In women, however, a significant increase in the prevalence of obesity was only found in those with at least one chronic condition, with a significant interaction between this factor and the year of the survey on the prevalence of obesity.

Table 2 Proportion of males with obesity in the Austrian Health Interview Survey 2006/2007, 2014, and 2019

	2006/2007	2014	2019	Gain 2006/2007–2019	P-value year[a]	P-value Interaction[b]
Total	13.7	17.2	20.0	+6.3	<0.001	
Age (years)						
15–29	4.8	8.9	9.0	+4.2	<0.001	0.035
30–64	16.0	18.7	22.9	+6.9	<0.001	
≥65	17.7	22.3	23.1	+5.4	0.001	
Education level						
Primary	13.2	19.8	20.4	+7.2	<0.001	0.152
Secondary	14.6	17.8	22.0	+7.4	<0.001	
Tertiary	7.9	10.7	11.1	+3.2	0.062	
Employment status						
Gainfully employed	12.6	15.7	19.1	+6.5	<0.001	0.056
Unemployed	13.5	22.3	27.6	+14.1	<0.001	
Not gainfully employed	15.6	18.8	20.4	+4.8	<0.001	
Country of birth						
Austria	13.6	17.5	19.5	+5.9	<0.001	0.103
EU/EFTA	14.4	11.7	17.1	+2.7	0.019	
Non-EU/Non-EFTA	13.9	19.9	26.2	+12.3	<0.001	
Urbanization						
Vienna	13.4	18.3	20.7	+7.3	<0.001	0.188
Other federal states	13.7	16.9	19.8	+6.1	<0.001	
Family status						
In a relationship	16.1	18.9	22.7	+6.6	<0.001	0.169
Not in a relationship	8.1	13.0	15.4	+7.3	<0.001	
Chronic disease						
≥1 chronic disease	18.4	25.9	26.6	+8.2	<0.001	0.996
No chronic disease	11.2	12.8	16.2	+5.0	<0.001	

Values are given as percentage (%)
[a]*P*-values as results of χ^2-test between 2006/2007 and 2019
[b]*P*-values as results of binary logistic regression analyses

Table 4 shows the association between the sociodemographic and health-related factors with obesity. In the multivariate model, the chance of being obese was significantly higher in the ATHIS 2014, and even more so in the ATHIS 2019, when compared to the ATHIS 2006/2007. There was a significantly higher chance for obesity in men and in older age groups. Additionally, lower education, not being gainfully employed, being born in non-EU/non-EFTA states, and living in Vienna were significantly associated with the chance of being obese. Not being in a relationship was associated with a significantly lower chance of being obese. Furthermore, having at least one chronic disease was also associated with a significantly higher chance of being obese.

Discussion

In this study, we confirm the general trend showing a further increase in obesity rates in the Austrian population. We identified distinct subgroups with a fast-growing obesity prevalence in recent years, emphasizing the importance of regular long-term data collection as a basis for more targeted, precision public

health measures. Particularly, we found a significant interaction between the year of the survey and age on the prevalence of obesity in both sexes, and between the year of the survey and presence of chronic disease on the prevalence of obesity in women. This means, that the prevalence of obesity developed differently in people within a certain age group or in women with or without chronic diseases. The development of obesity in women and men with certain characteristics are discussed in the following paragraphs in more detail.

Development in women

Women showed a surprisingly stable obesity prevalence in the first observation period between the years 2006 and 2014. This changed in the subsequent years from 2014 to 2019, where we found a significant increase in obesity prevalence in almost every subgroup studied. The largest increase of obesity between 2014 and 2019 was seen in women with a migration background from non-EU/non-EFTA countries (+9.4%) and in women living in Vienna (+5.2%). Other subgroups with high increases in

Table 3 Proportion of females with obesity in the Austrian Health Interview Survey 2006/2007, 2014, and 2019

	2006/2007	2014	2019	Gain 2006/2007–2019	P-value year[a]	P-value Interaction[b]
Total	15.2	15.2	17.8	+2.6	<0.001	
Age (years)						
15–29	5.0	6.1	7.3	+2.3	0.024	0.027
30–64	15.8	14.9	18.4	+2.6	<0.001	
≥65	23.2	24.1	24.7	+1.5	0.557	
Education level						
Primary	22.4	21.9	25.6	+3.2	0.011	0.198
Secondary	12.5	14.3	17.7	+5.2	<0.001	
Tertiary	6.0	6.0	7.1	+1.1	0.472	
Employment status						
Gainfully employed	10.1	10.7	12.5	+2.4	0.004	0.584
Unemployed	25.5	25.6	27.2	+1.7	0.873	
Not gainfully employed	18.9	18.5	22.1	+3.2	<0.001	
Country of birth						
Austria	15.0	15.1	17.2	+2.2	<0.001	0.595
EU/EFTA	11.5	17.2	16.7	+5.2	0.012	
Non-EU/Non-EFTA	19.9	13.4	22.8	+2.9	<0.001	
Urbanization						
Vienna	16.5	14.7	19.9	+3.4	<0.001	0.353
Other federal states	14.9	15.4	17.2	+2.3	0.001	
Family status						
In a relationship	15.0	15.5	18.7	+3.7	<0.001	0.052
Not in a relationship	15.5	14.8	16.5	+1.0	0.182	
Chronic disease						
≥one chronic disease	21.5	22.1	26.4	+4.9	<0.001	0.049
No chronic disease	11.1	10.9	12.0	+0.9	0.203	

Values are given as percentage (%)
[a]P-values as results of the χ^2-test between 2006/2007 and 2019
[b]P-values as results of binary logistic regression analyses

prevalence of obesity were women between the ages of 30 and 64 years (+3.8%) and women with at least one chronic disease (+4.3%). Women with a non-EU migration background could be influenced by post-migration socioeconomic factors and mental health issues [12], both of which are well-documented predictors in the development of obesity. The percentage of people with migration background living in Austria increased from 17.4% in 2008 to 24.4% in 2020 [13]. In the capital city of Vienna, home to 1.9 million people, this percentage grew by a considerably larger extent (41.3% in 2020) [14]. A comprehensive analysis of the diversity management of the City of Vienna from 2019 shows that about two thirds of the population from non-EU/non-EFTA countries were living in 20% of the lowest-income households in Vienna and had significantly lower education and more unskilled or semi-skilled jobs compared to native Austrian residents [15]. Moreover, Viennese with a foreign background rate their health status significantly lower (poor or very poor) compared to native Austrian residents (24% vs. 7%, respectively) [15]. This might also play a part in the observed increase of obesity in women living in Vienna, since the men-

tioned migration-related factors are predictors of an increase in the prevalence of obesity. In ATHIS 2014 and 2019 the interview was terminated in the event of insufficient knowledge of German. This might bias the results towards an underrepresentation of people with a foreign background, thus underestimating the effect of migration on obesity [7]. Other possible causes that might explain the strong increase of obesity prevalence in Vienna are still unclear at the present. Although the relationship between obesity in urban environments has been discussed in the literature [16], typical negative (sub)urban influences, such as low connectivity, high automobile dependency and "food deserts" do not apply to Vienna. Thus, more insight is necessary to further interpret this trend.

Development in men

Men experienced a drastic increase in obesity between 2006/2007 and 2014. In the study's second observation period, from 2014 to 2019, the overall prevalence of obesity continued to increase, although no longer at such a rapid pace. Subgroups with disturbingly large increases were young men, men with low ed-

Table 4 Association between various sociodemographic and health-related factors with obesity in the pooled datasets of the Austrian Health Interview Surveys 2006/2007, 2014, and 2019

	OR	95% CI
Year of survey		
2006/2007	1	–
2014	1.20	1.13–1.28
2019	1.47	1.38–1.56
Sex		
Male	1.18	1.12–1.25
Female	1	–
Age (years)		
15–29	1	–
30–64	2.85	2.61–3.12
≥65	2.83	2.55–3.13
Education level		
Primary	3.10	2.78–3.46
Secondary	2.26	2.04–2.49
Tertiary	1	–
Employment status		
Gainfully employed	1	–
Unemployed	1.63	1.45–1.83
Not gainfully employed	1.23	1.15–1.32
Country of birth		
Austria	1	–
EU/EFTA	0.94	0.85–1.03
Non-EU/non-EFTA	1.13	1.03–1.23
Urbanization		
Vienna	1.16	1.09–1.24
Other federal states	1	–
Family status		
In a relationship	1	–
Not in a relationship	0.86	0.81–0.91
Chronic disease		
≥ one chronic disease	1.74	1.65–1.84
No chronic disease	1	–
R^2	0.088	–

Result of a binary logistic regression analysis, all variables are mutually adjusted for each other. Results are shown in odds ratio (OR) and 95% confidence interval (95% CI)

are needed to shed light on possible reasons for this trend in Austrian men, dynamics on the mental health status, socioeconomic factors due to migration and lifestyle changes as possible facilitators in this subgroup should be discussed. Two well-studied mental health problems are depression and anxiety, both of which are strongly associated with the development of obesity [23–27]. In Austria, the number of people receiving a disability pension due to mental health issues in Austria increased markedly from 36.1% to 57.4% between 2011 and 2020 [28, 29]. Among men, there was a strikingly larger increase (28.9% vs. 39.8%) than among women (51.9% vs. 57.4%) [28, 29]. This growing mental health burden in the population may facilitate an increase in obesity prevalence. Secondly, socioeconomic factors might have changed due to an increase of migration into Austria, as already discussed above in the development of obesity in women [13]. Thirdly, ATHIS 2019 could show that young men meet the WHO targets for physical exercise by 6% less than in 2014 (35.2% vs. 42%, respectively) [7], implicating that lifestyle changes might play a role in the observed increase of obesity prevalence in men. This is in accordance with a study from Dorner, compiling all existing national data regarding the prevalence of obesity in Austria until 2016, where an increase in physical inactivity and unhealthy diet in the Austrian population over the last years was demonstrated.

Social factors

In addition to the dynamic trends discussed, it is important to highlight subgroups that show an overall high prevalence (>25%) for obesity in Austria. These groups are men and women without employment, migration background or a low level of education and people with at least one chronic disease. Women seem to be more at risk from the negative influence of socioeconomic factors on the development of obesity than men [30]. Socioeconomic factors such as low income, unemployment or low educational level are known to have a large impact on lifestyle and may promote negative behavior that fosters obesity [31]. Our data thus underscore the view of obesity as a socioeconomic phenomenon.

Chronic diseases

The second group with high obesity prevalence were people with one or more chronic diseases. Due to the nature of cross-sectional data collection, we can only speculate on a potential impact of a primary existing chronic disease on obesity prevalence. In a recent analysis of obesity epidemiology in Austria, Dorner discussed the complex interactions between disease-dependent lifestyle modifications and the unpredictable effects of a chronic disease on the BMI itself. A causal relationship between a chronic disease and the development of a high BMI is thus very

ucation, unemployed, and men who were not in a relationship. Overall, among the subgroups of 15–29-year-olds, unemployed, migrant background, and single men, obesity prevalence almost doubled over the past 12 years. Although men were significantly less obese than women in 2006/2007, men already overtook women in 2014 and further extended this lead in 2019 (20% men vs. 17.8% women total prevalence).

The increase in obesity among Austrian men could recently be shown in the context of fitness examinations for the Austrian Armed Forces [17]. This has also been observed by several other studies, which consistently show a higher prevalence for obesity in men than in women [18–22]. While more data

difficult to establish. Conversely, the impact of obesity with consecutive development of a chronic disease has been described in numerous studies [32–34]. Another possible explanation could be the well-described relationship between chronic disease and anxiety or depression [35], the latter in a strong correlation with the development of obesity [23–27]. For Austria, depressive symptoms have been shown to interact with physical activity and their combination leads to a higher need for health care [36]. Again, causal relationships are difficult to establish, since chronic disease and depression or anxiety can be independent or interrelated. In contrast to other mentioned subgroups with high obesity prevalence, people with chronic diseases are likely to show up in the medical care system. This might present a window of opportunity to implement strategies against overweight and obesity in this group.

Limitations

Since all data were acquired via surveys, no measured data were available. To compensate for self-reported data on body height and body weight a correcting factor for sex and different age groups was applied. Although measurement properties were similar during the study period, surveys were carried out by different interview techniques (personal, telephone or web-based questionnaire). This may influence the comparability of our results. Information about the socioeconomic status was only based on the educational level and occupational status, additional variables such as income were not part of the surveys.

Future development

Since the end of 2019, the COVID-19 pandemic has been raging around the world with various measures taken to counteract the spread, including a mixture of lockdowns and openings. This had a substantial impact on lifestyle, particularly in terms of high calorie diets [37–39] and lack of physical activity [40–42]. Coupled with the deterioration in mental health, the limitations on social interactions, economic consequences for individuals, and changes in social coherence, this has led to an increase in obesity prevalence in many countries [43–46]. It is therefore to be expected that the obesity prevalence will continue to increase in Austria in the futureand, therefore, a continuation of the monitoring of obesity epidemiology is of enormous importance.

Consequences

The fact that the prevalence of obesity has been increasing almost inexorably for decades, regardless of all the preventive measures that have been taken so far, shows that significantly more efforts are needed in the prevention of obesity. To date, not a single country has successfully been able to curb the accumulating burden of overweight and obesity in any population [47]. One explanation for the lack of progress in curbing obesity is that most approaches focus on the symptoms and consequences of obesity rather than prevention. Secondly, even those public health initiatives that are directed at obesity prevention and management show little evidence of success and efficacy at the population-level [48]. Hence, a novel approach to combat overweight and obesity is imperative. This requires both individual measures and precision public health measures. Precision public health integrates precision and population-based strategies to provide "the right intervention to the right population at the right time" [49]. In addition, it also requires new care structures that are not only dedicated to the treatment of obesity but also to prevention and health promotion more generally. As demonstrated by this and other studies, the development of obesity is multifactorial and cannot be answered by simply promoting better diets and more physical activity. It needs a holistic, person-centered approach, which addresses both the physical and mental health, as well as the social and living circumstances, health literacy and the feasibility of making sustainable lifestyle changes [50]. This is only possible, if the family, workplace and environment are taken into account when coming up with a shared care plan for the individual. On a system level, precision public health needs to involve the different population groups more actively to create healthy communities and make active commuting or healthy nutrition viable and affordable choices. Using long-term epidemiological datasets found the basis for the evaluation of the effects of current public health policies and the development of new approaches to better answer to the needs of those most at risk.

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