ROBERT KOCH INSTITUT

JUNE 2017
ISSUE 2

FEDERAL HEALTH REPORTING
JOINT SERVICE BY RKI AND DESTATIS

Journal of **Health Monitoring**

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Journal of Health Monitoring · 2017 2(2)
DOI 10.17886/RKI-GBE-2017-037
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Health-related behaviour in Europe – A comparison of selected indicators for Germany and the European Union

Abstract

Demographic change, new health threats, but also inequalities in health and health care provision in and between European Union (EU) member states pose major albeit similar challenges to European health systems. Regular information on health and health-related behaviour is essential if member states' health systems are to respond and develop appropriately to these challenges. The 'European Health Interview Survey' (EHIS) is a vital source of data for indicators of health status and health-related behaviour in the EU.

This article presents a comparative review of health-related behaviour at the European level. Health-related behaviour is of particular relevance because an unhealthy diet, physical inactivity, obesity, smoking, and harmful use of alcohol are among the most important determinants associated with non-communicable chronic diseases. Eurostat has used data from EHIS Wave 2 to publish details about the current prevalence of obesity, daily fruit and vegetable intake, health-enhancing aerobic physical activity, smoking and heavy episodic drinking for the EU's member states. In the following, the figures for Germany are compared to the European average. A wide range of prevalences exists between the various EU member states, in some cases stretching to more than 50 percentage points.

In Germany, the prevalence of obesity and smoking remains relatively close to the EU average. Moreover, the results on physical activity are especially welcome. In particular, the proportion of women and men who undertake adequate levels of physical activity decreases more slowly with increasing age compared to the EU average. Nevertheless, the low fruit and vegetable intake, especially among younger generations, and the high proportion of women and men who drink six or more alcoholic beverages on one occasion (heavy episodic drinking) at least once a month pose problems for Germany.

In summary, the results provided by EHIS offer a basis for sharing experiences between EU member states regarding effective measures in health promotion and disease prevention.

OBESITY · DIET · PHYSICAL ACTIVITY · SUBSTANCE USE · EUROPEAN COMPARISON

1. Introduction

1.1 Health in Europe

Demographic change, new health threats, but also inequalities in health and healthcare provision in and between European Union (EU) member states pose major albeit similar challenges to European health systems. The European Health Strategy 'Together for Health' underpins the EU's overall Europe 2020 strategy [1]. The European Health Strategy serves as a starting point for action at the national and EU level and complements member states' health policies. It focuses on increasing cooperation and coordination between member states and developing solutions to the challenges faced by European health systems. In addition, investment in a comprehensive, high-quality healthcare programme and in programmes that promote health is aimed at reducing inequalities and combating social exclusion [2]. If member states' health systems are to respond and develop appropriately, regular information on developments in living conditions, health, health-related behaviour and the healthcare provision offered to the people of Europe is essential. In the future, the existing activities and tools that provide pan-European information on health are to be broadened as part of a European health information system. This includes further developing the European Core Indicators for Health (ECHI) [3] and ensuring they are increasingly implemented within member states' health systems [4].

1.2 Health-related behaviour - selected aspects and public health relevance

This article provides a comparative review of health-related behaviour in Europe using data from the 'European Health Interview Survey' (EHIS). Health-related behaviour is particularly relevant because an unhealthy diet, physical inactivity, obesity, smoking and harmful use of alcohol are among the most important factors associated with non-communicable chronic diseases (NCDs) [5].

The World Health Organization (WHO) estimates that 80% of cardiovascular diseases and strokes, 80% of type 2 diabetes, and 40% of cancer cases could be prevented by following a healthy diet, engaging in sufficient physical activity and non-smoking [6, 7].

According to recent estimates in the 2015 Global Burden of Disease Study, up to 73% of ischaemic heart diseases, 52% of strokes, 84% of lung cancer cases, 55% of colorectal cancer cases, 70% of chronic obstructive pulmonary diseases, 47% of diabetes cases, and 12% of depressive disorders could be avoided by reducing modifiable behavioural risk factors [8]. Despite the improvements in health-related behaviour in Western Europe between 1990 and 2015 which slightly reduced the prevention potential in the field of behavioural risk factors for preventing ischaemic heart disease, stroke, and lung cancer [8, 9], the figures set out above clearly demonstrate that further action is still required.

The WHO's Global Action Plan for the Prevention and Control of NCDs 2013-2020 takes into account a number of modifiable risk factors. The Action Plan is aimed at ensuring the following targets are met by 2025 in

comparison with 2010: a 30% relative reduction in tobacco use, a 30% relative reduction in salt intake, a 10% relative reduction in prevalence of insufficient physical activity, a 10% reduction in harmful use of alcohol, and halt the rise in diabetes and obesity [10]. In order to achieve these targets, health-promoting living conditions are to be created to enable people to live a healthier lifestyle. The Global Strategy on Diet, Physical Activity and Health [11], the WHO European Strategy for Smoking Cessation Policy [12], and the Global Strategy to Reduce Harmful Use of Alcohol [13] are key pillars for meeting the aims that underpin the Action Plan.

The risk factors described above are not only individually problematic; combined, they have a substantial impact on quality of life, healthy aging and mortality [14]. Longitudinal studies convincingly demonstrate that non-smoking, sufficient physical activity, ensuring an adequate intake of fruit and vegetables and moderate alcohol consumption contribute to a better quality of life [15], a healthier aging process, a reduced risk of stroke [17], and a lower risk of mortality by providing up to 14 extra years of life [18, 19].

2. Methodology

In addition to official statistics, routine data, and issue-specific international reporting systems (such as on accidents or drug use), data from surveys are a key source of information for European health indicators. In accordance with EU Regulation 1338/2008 on community statistics on public health and health and safety at work, the European Health Interview Survey (EHIS) (see Health monitoring and health indicators in Europe) is an essential source of data for indicators of health and health-related behaviour. EHIS is to be carried out every five years. The first EHIS wave was conducted between 2006 and 2009, but member states were not obliged to participate in the study at this time. Germany integrated a set of selected EHIS questions into the 'German Health Update' (GEDA 2010), which was conducted by the Robert Koch Institute [21]. Data on selected health indicators were delivered to the Statistical Office of the European Union (Eurostat).

The second wave of EHIS was prepared as part of a process that was conducted over a number of years. It resulted in the adoption of an EU regulation in February 2013 that specified the variables that need to be collected, the reference year, population, and information about the methodological approach [20]. Eurostat has also prepared a detailed methodological manual containing a model questionnaire [22]. However, as each member state implements EHIS independently, the questions used in the survey are sometimes operationalised differently, and data collection modes can vary (paper, telephone, personal interview). EHIS is divided into four modules: health status, health care, health determinants, and core social variables on demography and socioeconomic status. In Germany, EHIS Wave 2 was integrated into GEDA 2014/2015. In addition to the questions posed for EHIS, further questions that were specific to Germany were asked as part of the survey to enable certain trends to be analysed and to gain insights into other relevant aspects of public health. A description of the methodology applied in GEDA 2014/2015-EHIS can be found in

Saß, Lange, and Finger et al. [23]. The methodology applied in EHIS is described in an article by Fehr et al. [2].

Each member state provides the EHIS microdata set to Eurostat. Eurostat uses the quality-assured data it receives to calculate indicators, usually stratifying them according to age, gender, and educational status, before publishing them on its website [24]. This paper focuses on the results of the aggregated data available from the Eurostat database. Therefore, statistical tests for differences cannot be conducted with this data. Moreover, a microdata set that includes results from all countries participating in EHIS Wave 2 will not be available until the end of 2017 at the earliest, when it will be provided by Eurostat on request.

The indicators of health-related behaviour in Europe presented in the following include data from people aged 15 or above, as this reflects the way in which EHIS is implemented throughout the EU. When comparing the prevalences described below with those described in the fact sheets published in this issue of the Journal of Health Monitoring (that use data for Germany from GEDA 2014/2015-EHIS), it is important to remember that the fact sheets focus on data from a slightly different age group: people aged 18 or above. At the same time, different weighting factors were used when analysing data at the European and national levels [25].

The proportion of obese women and men in Germany is close to the EU average.

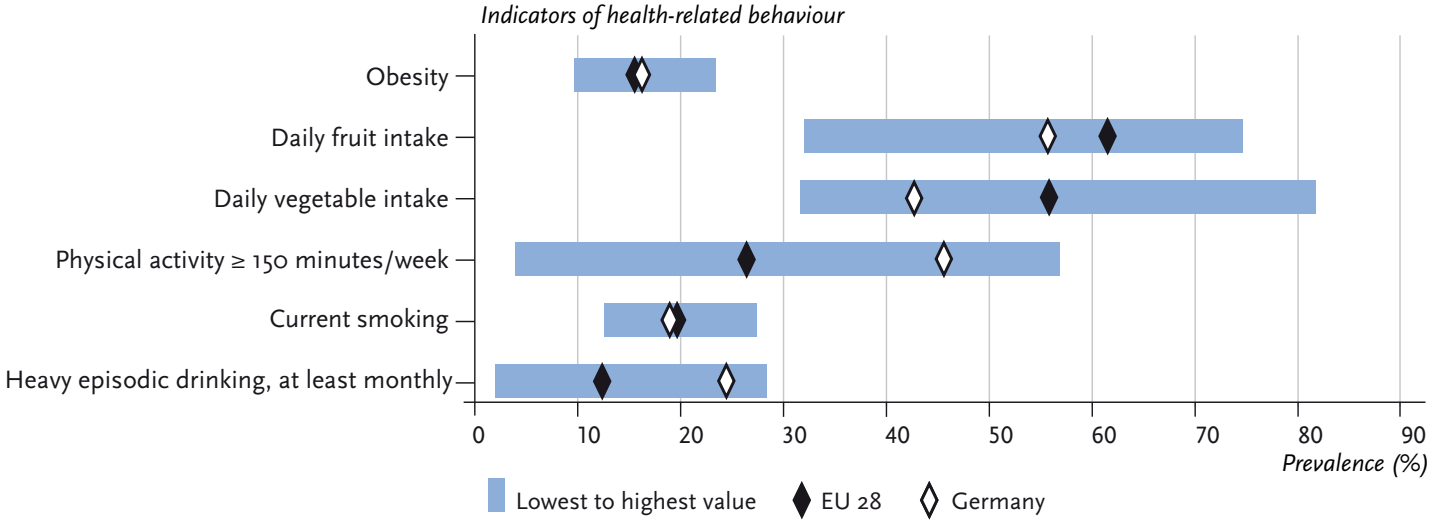
3. Indicators and results

3.1 Obesity

Indicator: Obesity is defined as a large amount of excess weight that results in a body mass index (weight in kg/height in m^2) of over 30 kg/m^2. Obesity is a risk factor associated with a number of chronic diseases such as type 2 diabetes mellitus [26], cardiovascular diseases [27] and some forms of cancer [28]. It is also associated with a higher risk of premature death [29, 30]. Obesity and its consequences pose a major challenge to the health system and constitute an important public health problem, not only in Germany but internationally (see Overweight and obesity among adults in Germany). EHIS Wave 2 collected self-reported data on height and body weight. Respondents were asked to state their weight without clothing and their height without shoes, and pregnant women were asked to state their weight before pregnancy.

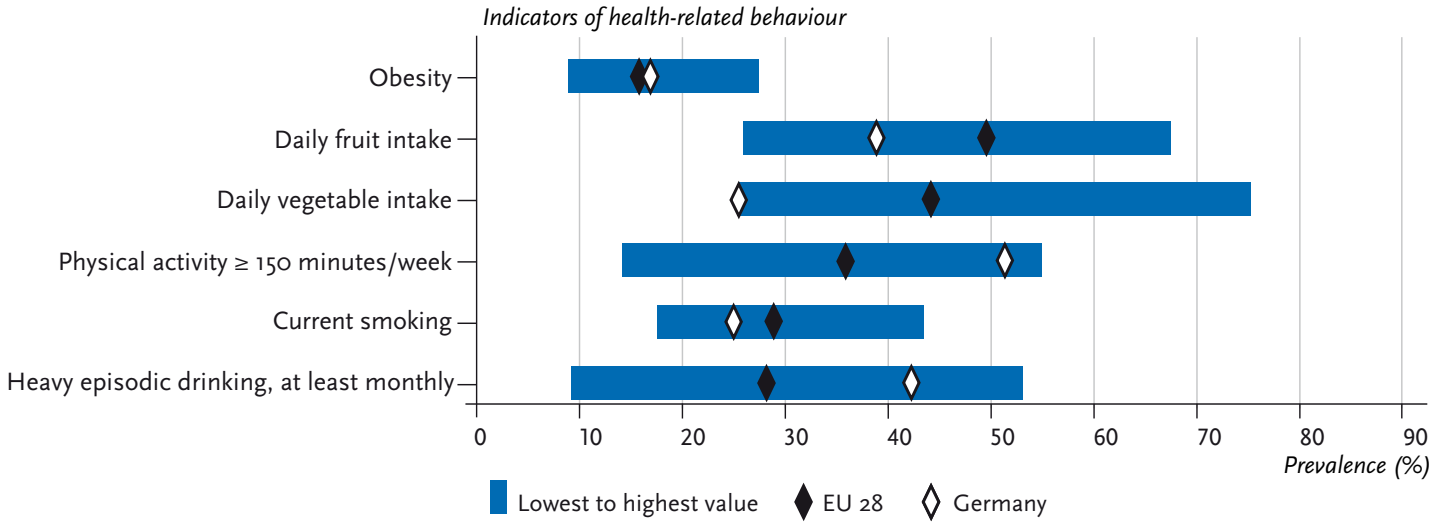
On average, 15.3% of women and 15.6% of men in the EU aged 15 or above are obese. In Germany, the prevalence of obesity is slightly higher in this age group, with 16.1% of women and 16.7% of men classified as obese. No systematic differences were observed between women and men in terms of obesity prevalence [31]. The prevalence of obesity across the EU ranges from 9.4% to 23.2% among women, and 8.7% to 27.2% among men (Figures 1 and 2). It is impossible to estimate the extent to which these differences are influenced by cultural perceptions of height and body weight, or whether they are indeed reflections of actual differences between countries. However, self-reporting frequently leads to an

Figure 1
The prevalence of selected indicators of health-related behaviour among women. Data for Germany compared to the average calculated for the EU 28
Data source: EHIS Wave 2



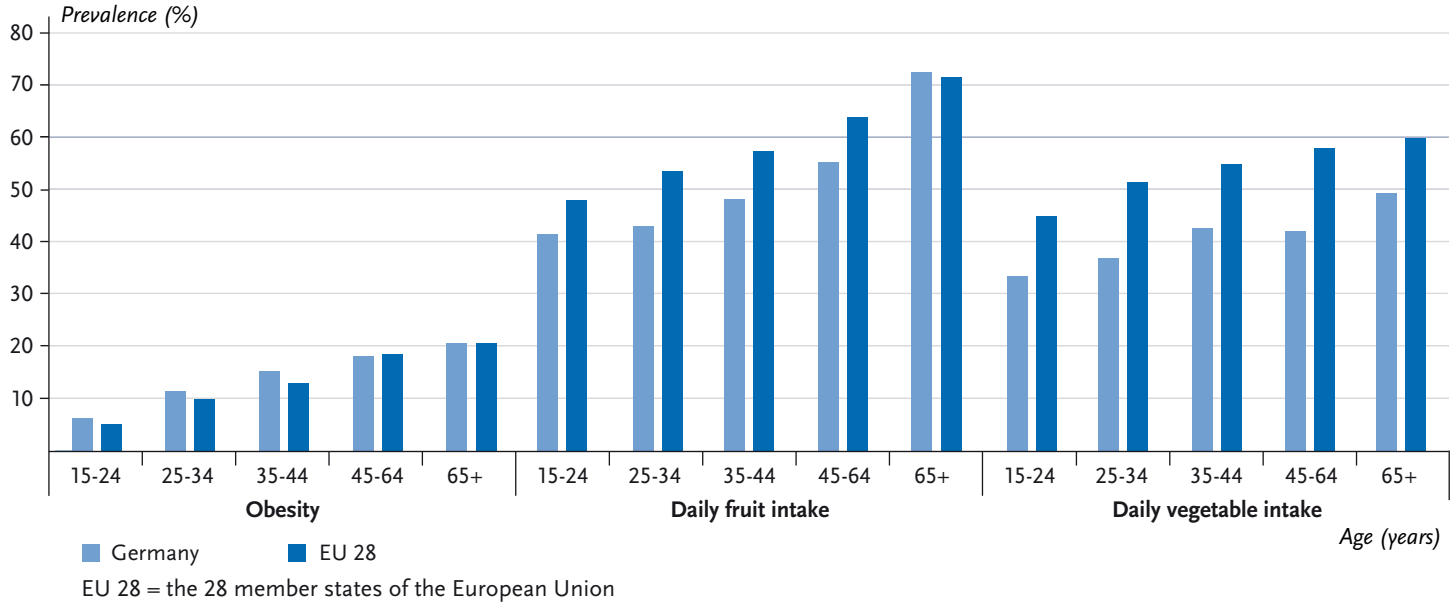
EU 28 = the 28 member states of the European Union

Figure 2
The prevalence of selected indicators of health-related behaviour among men. Data for Germany compared to the average calculated for the EU 28
Data source: EHIS Wave 2



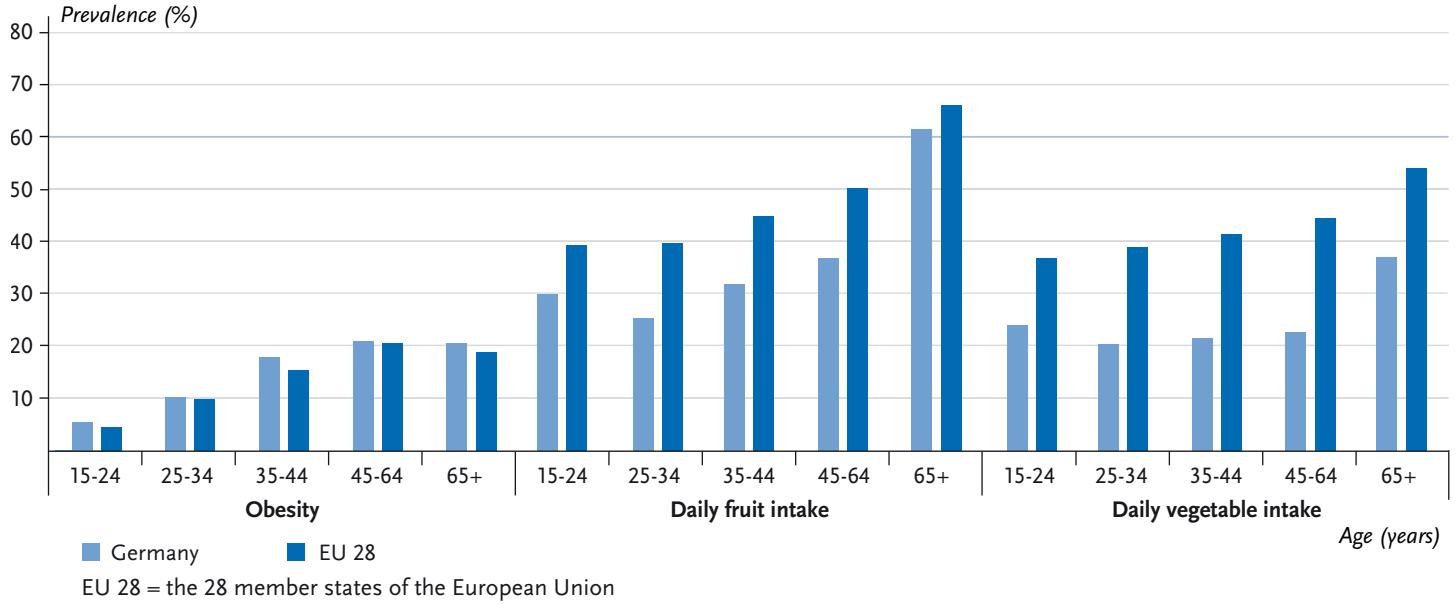
EU 28 = the 28 member states of the European Union

Figure 3
The prevalence of obesity, and fruit and vegetable intake among women by age in Germany compared to the EU 28
Data source: EHIS Wave 2



EU 28 = the 28 member states of the European Union

Figure 4
The prevalence of obesity, and fruit and vegetable intake among men by age in Germany compared to the EU 28
Data source: EHIS Wave 2



EU 28 = the 28 member states of the European Union

underestimated body weight and an overestimated height compared to measured values. As a result, body mass indices calculated using self-reported data are generally lower than those based on direct measurements [32]. The prevalence of obesity increases with age. A comparison of the EU average with the prevalence found in Germany according to age demonstrates an above-average prevalence of obesity among women and men in Germany, particularly among younger age groups (to the age of 44). There is virtually no difference between the prevalence observed in Germany and the EU average among people aged 45 and over (Figures 3 and 4).

Germany is in the bottom third compared to the EU as a whole on fruit and vegetable intake, with men in Germany in last place on vegetable intake.

3.2 Daily fruit intake

Indicator: The prevalence of 'at least daily' fruit intake.

A high intake of fruit and vegetables can help people avoid coronary heart disease, hypertension and stroke, and it can also have a positive impact on the course of these diseases [33-36]. It is also likely that a high fruit intake can help prevent various types of cancer, but the relationship to the overall risk of cancer is low [34, 37-39]. A current meta-analysis has shown that a high fruit and vegetable intake is associated with a lower overall risk of mortality, particularly due to the associated lower risk of cardiovascular mortality [8]. These findings are reflected in recommendations stating that five portions of fruit and vegetables should be eaten daily [40]. Data for the indicator on fruit intake was collected using the question: 'How often do you eat fruit, including freshly pressed juices?', with the possible answers 'Once or more a day', '4 to 6 times a week', '1 to 3 times a week', 'Less than once a week' and 'Never' (see Fruit consumption among adults in German and Vegetable consumption among adults in Germany).

On average, 61.5% of women and 49.4% of men in the EU eat fruit at least once a day. Therefore, the figures in Germany (women: 55.6%; men: 38.7%) are below the EU average. Fruit intake in the EU ranges from 31.8% to 74.5% among women and from 25.7% to 67.3% among men (Figures 1 and 2). This places Germany among the bottom third when compared to the EU as a whole. On average, the proportion of women and men who eat fruit at least daily increases with age, both in Germany and in the wider EU. Although the proportion of people under the age of 65 who eat fruit in Germany is well below the EU average, there is no difference between Germany and the EU average when it comes to women aged 65 or above. There is a similar trend among men: the difference between the figures for Germany and the EU average is lowest among people aged 65 or above (Figures 3 and 4). In summary, the figures on EU average fruit intake demonstrate that people are not eating enough fruit to meet the recommendations [41, 42]. Moreover, fruit intake in Germany is even lower than the EU average and urgently needs to be increased; this particularly applies to younger age groups.

3.3 Daily vegetable intake

Indicator: The prevalence of 'at least daily' vegetable intake was assessed with the question: 'How often do you eat vegetables or salad, excluding potatoes and juice made from concentrate?' The following answer categories were

provided: 'Once or more a day' '4 to 6 times a week', '1 to 3 times a week', 'Less than once a week' or 'Never'.

On average, 55.7% of women and 44.0% of men in the EU eat vegetables at least daily. However, the figures for Germany (women: 42.5%; men: 25.3%) are well below the EU average. In the EU, daily vegetable intake ranges from 31.4% to 81.6% for women and from 25.3% to 75.1% for men (Figures 1 and 2). Men in Germany thus come last in Europe in terms of daily vegetable intake, with women in Germany occupying the fourth from last place in the EU comparison. Moreover, whereas the average proportion of people who eat vegetables at least daily in the EU increases with age, in Germany the proportion of men who eat vegetables daily actually decreases until the 25-to-34 age group before rising again with age. The proportion of women who eat vegetables every day in Germany increases until the 35-to-44 age group but then hardly changes with age. The largest deviation from the EU average among men in Germany occurs among 25-to -64-year-olds: daily vegetable intake by this age group is roughly half of the EU average. A similar tendency is observed among women but it is markedly less pronounced (Figures 3 and 4). Overall, vegetable intake in the EU as a whole remains lower than the recommended levels [41, 42]. Furthermore, a comparison of vegetable intake in Germany with the EU average clearly demonstrates that vegetable intake in Germany is still much lower than the recommended levels, especially among 25-to-64-year-olds. This statement is particularly applicable to men. Therefore, people need to urgently increase the amounts of vegetables that they eat.

The population in Germany, especially older people, is more physically active than other EU citizens.

According to the Global Database on the Implementation of Nutrition Action (GINA), only a few EU countries have implemented policy strategies and national action plans aimed at encouraging healthy eating [43]. However, in EU countries where relevant action plans and strategies have been put in place, such as France (the French National Nutrition and Health Program [44]) or the United Kingdom (the Eatwell Guide [45]), fruit and vegetable intake is either higher than or roughly equal to the EU average [24]. The aim of the '5 a day' campaign, which recommends that people eat five portions of fruit and vegetables every day [40], is met by just under 10% of people living in Germany; in the EU as a whole, 14% of respondents achieved this aim [46]. In contrast, in the United Kingdom, the Netherlands and Denmark, does at least one quarter of the population reach this target [46].

3.4 Physical activity

Indicator: The prevalence of people who meet the WHO's recommendations on aerobic physical activity (endurance activity) [47]. The WHO recommends that adults should undertake a total of at least 150 minutes of moderate-intensity aerobic physical activity per week (such as cycling, jogging, football, or swimming) that increases breathing and heart rate and continues for at least 10 minutes without interruption [48] (see Health-enhancing physical activity during leisure time among adults in Germany). According to a recent meta-analysis of 80 studies, people with the highest levels of physical activity have around a 35% lower risk of all-cause mortality

than those with the lowest level of activity [49]. This indicator was calculated using the version of the European Health Interview Survey – Physical Activity Questionnaire (EHIS-PAQ) that has been validated for Germany [50, 51]. Respondents were asked about the duration of any moderate-intensity aerobic physical activity that they undertake during their leisure time each week (not including work-related activity), including their use of a bicycle for transport.

On average, 26.2% of women and 35.7% of men in the EU meet the WHO's recommendation of at least 150 minutes of moderate-intensity aerobic activity per week. The levels for Germany (women: 45.5%; men: 51.2%) are above the EU average. In the EU, the prevalence of people who meet the WHO's recommendations on aerobic physical activity ranges from 3.7% to 56.7% among women and from 14.0% to 54.8% among men (Figures 1 and 2). This places Germany in the top third in the EU comparison. The proportion of people who engage in aerobic physical activity for at least 150 minutes per week is highest in the youngest age group (15 to 24 years of age) and decreases with age. This trend is observed throughout the EU, including in Germany. However, in contrast to the EU trend, men in Germany aged 65 and over have a slightly higher prevalence of meeting the recommendations compared to the 45-to-64 age group. A similar trend is observed among women in Germany, with the difference from the EU average towards a higher prevalence is highest among women aged 65 and over (Figures 5 and 6).

A comparison with the EU average clearly demonstrates that the prevalence in Germany is above average for this indicator. Traditionally, Germany has had an important publicly organised club-based sport sector [52], which could explain the high levels of sports and exercise undertaken in Germany compared to other EU countries. In a current European comparison of policy approaches with regard to club-based sport, it is striking that, in addition to Germany, the Nordic welfare states such as Denmark and Norway in particular have a large publicly organised sports sector [53]. The data from EHIS Wave 2 also show that women in the Scandinavian countries (Sweden, Finland, Norway, and Denmark) are the only ones more likely to reach the recommended levels of aerobic activity than women in Germany [24].

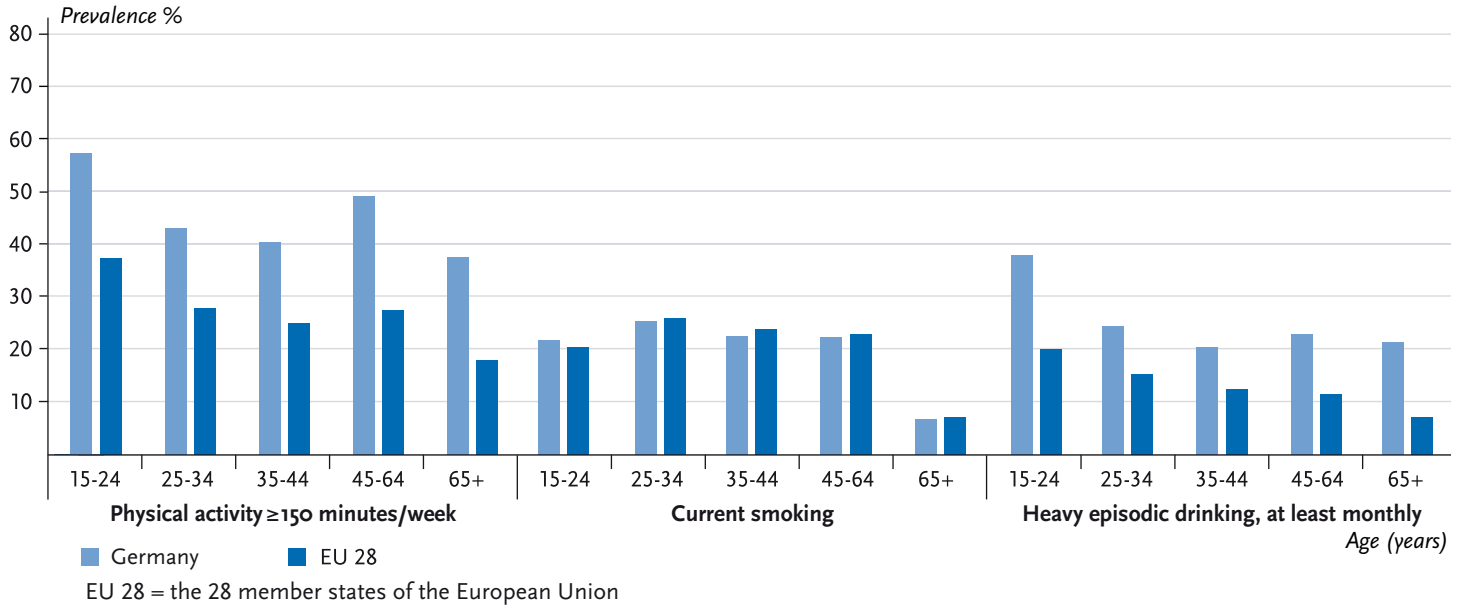
In Germany, young women smoke more than the EU average; men in all age groups in Germany are less likely to smoke than the EU average.

3.5 Current smoking

Indicator: The prevalence of current smoking. The 'current smoking' indicator includes daily or occasional smoking. Smoking continues to represent one of the most harmful risk factors for a wide range of diseases. According to a recent meta-analysis, smokers have an up to 80% higher risk of all-cause mortality compared to non-smokers. The increased risk continues into old age and follows a dose-response relationship [54] (see Smoking among adults in Germany). Data for this indicator was assessed with the question: 'Do you smoke?' (answer categories: 'Yes, daily', 'Yes, occasionally', 'No, not any more', 'I have never smoked').

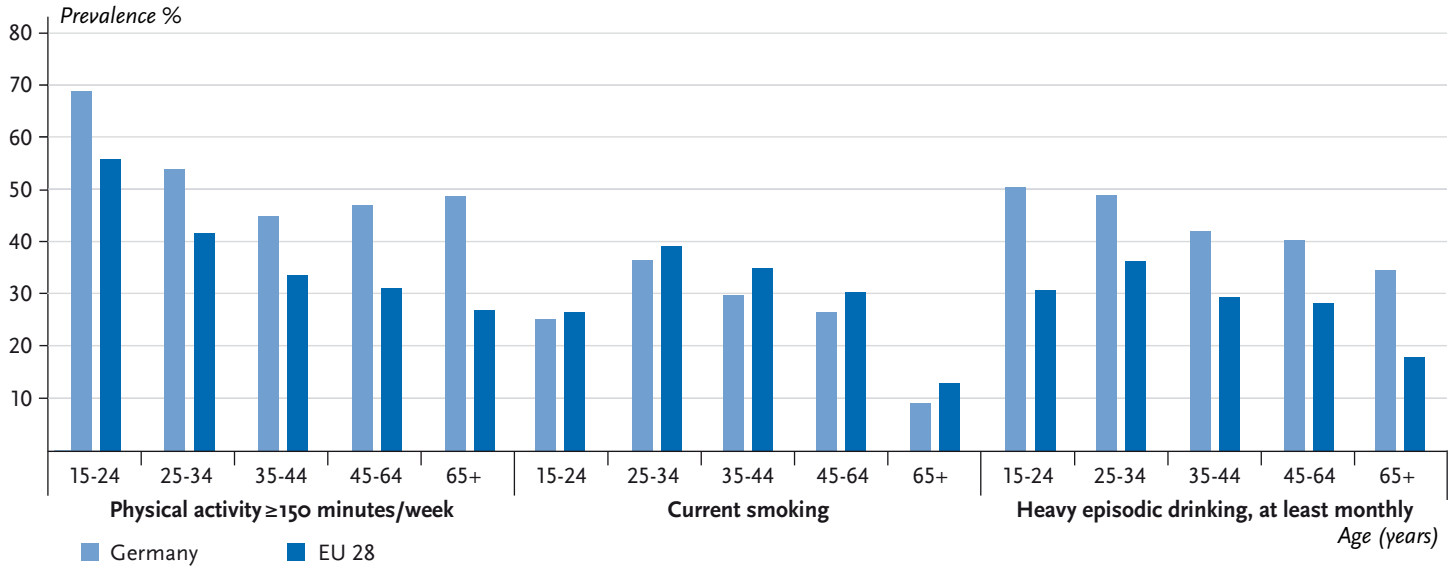
In the EU, the average prevalence of current smoking is 19.5% for women and 28.7% for men. In Germany, smoking rates are below the EU average, both among women (18.8%) and men (24.8%). Current smoking in

Figure 5
The prevalence of physical activity, smoking and drinking among women by age in Germany compared to the EU 28
Data source: EHIS Wave 2



EU 28 = the 28 member states of the European Union

Figure 6
The prevalence of physical activity, smoking and drinking among men by age in Germany compared to the EU 28
Data source: EHIS Wave 2



EU 28 = the 28 member states of the European Union

the EU ranges from 12.3% to 27.2% among women and from 17.4% to 43.3% among men (Figures 1 and 2). This places men in Germany in the bottom third and women in the middle third compared to the EU average. In both Germany and the EU as a whole, the average proportion of people who currently smoke increases until the 25-to-34 age group before decreasing with age. The prevalence of male smokers in all age groups in Germany is significantly lower than the EU average. In contrast, there is no difference between the figures on female smokers in Germany and the EU average in any age group, except for the 15-to-24 age group, where current smoking is actually slightly higher than the EU average (Figures 5 and 6).

Comparing smoking in Germany with the EU average clearly demonstrates that Germany has a comparatively large proportion of smokers and that a further reduction in smoking is needed; this is especially the case with women in the youngest age group. Despite the progress that has been made since 2002 through measures such as increased taxes on tobacco products, stricter age limits on purchasing tobacco products, advertising bans, and laws aimed at protecting non-smokers at the national and federal-state level, there is still room for improvement. In 2016, evaluations made by the Tobacco Control Scale placed Germany second to last (behind Austria). This report compared efforts made by 35 European countries to effectively prevent and control tobacco use [55]. Finally, it remains to be seen whether EU-wide measures aimed at reducing smoking levels, such as the EU Tobacco Products Directive [56], which was to be incorporated into national law by May 2016, will contribute to a change in smoking rates in the EU's member states.

Women and men in Germany are close to the top of the list when it comes to heavy episodic drinking in the EU.

3.6 Heavy episodic drinking

Indicator: The prevalence of heavy episodic (HED) drinking is defined as the consumption of 60 g or more of pure alcohol on a single occasion at least once a month [57]. HED is a particularly harmful pattern of drinking that can cause acute damage such as alcohol poisoning and injuries, and that can also lead to violence. Moreover, in the long term, HED can result in alcohol dependency and a wide range of organic damage. These consequences can even occur if the average level of alcohol consumed is relatively low [57] (see Alcohol consumption among adults in Germany: risky drinking levels). Data was collected for this indicator using the following question: 'In the past 12 month, how often have you had six or more drinks containing alcohol on one occasion? For instance, during a party, a meal, an evening out with friends, alone at home, ...' The nine possible responses were grouped into four categories: 'At least every week', 'Every month', 'Less than once a month' and 'Never'. In accordance with the WHO's definition of HED, this indicator is based on a combination of the categories 'at least every week' and 'every month', which were combined to form the category 'at least monthly heavy episodic drinking'.

On average, the prevalence of monthly HED in the EU is 12.2% for women and 28.0% for men. The prevalence of heavy episodic drinkers in Germany, however, is well above the EU average (women: 24.3%; men 42.1%). Throughout the EU, the prevalence of monthly HED range from 1.7% to 28.1% among women and from 9.0% to 52.9% among men (Figures 1 and 2). This places

German men in the upper third compared to the EU as a whole. Germany also has the largest prevalence of female heavy episodic drinkers after Denmark. The highest prevalence of heavy episodic drinkers is found among the youngest age group (15 to 24 years of age) among both genders. Whereas on average, the prevalence of female heavy episodic drinkers decreases continuously with age throughout the EU, in Germany the prevalence of HED remains high among women 25 years and above (more than one-fifth of women are heavy episodic drinkers in this age group). Among men in Germany, HED is at its highest in the 15-to-24 age group, but these rates decline among people aged 25 and above. In the EU, the prevalence of heavy episodic drinking among men increases until the 25-to-34 age group and then decreases with age. The prevalence of HED among women in younger age groups in Germany is about twice as high than the EU average and almost three times higher among women aged 65 or above. In the case of men in Germany, the prevalence of heavy episodic drinkers in younger age groups is about 50% higher than the EU average, and about twice as high as the EU average among people aged 65 and above (Figures 5 and 6). The comparison with the EU average clearly demonstrates that HED is comparatively widespread in Germany among all age groups, and that the marked decline that occurs with age in the rest of the EU is not as pronounced in Germany. This result also reflects the fact that far fewer regulatory measures to limit alcohol consumption have been put in place in Germany than in other EU countries [58].

4. Discussion and outlook

This comparative review of indicators of health-related behaviour reveals an extremely wide range of prevalences between EU member states. In some cases, the difference constitutes more than 50 percentage points; this is the case with women's daily vegetable intake and the proportion of women who meet the recommendations on aerobic physical activity (although the differences between Germany and the EU average for current smoking – especially among women – and obesity are comparatively small). The extent to which the (at times very large) differences between individual member states can be explained by different cultural perceptions and answers to the standardised EHIS questions [59], or whether they do in fact demonstrate actual differences in prevalence cannot be answered using the macrodata analysed here and published by Eurostat. Comparing the results with national results obtained from other surveys would also only be partially illuminating, since the results acquired particularly from questions on behaviour, such as fruit and vegetable intake, physical activity and alcohol consumption, vary depending on the type of survey instruments employed. In fact, the data on physical activity and alcohol consumption were assessed using instruments that were especially developed for EHIS [51, 60]. Finally, the fact that the data are linked to specific populations and particular age structures represents a further limitation in terms of comparability. Consequently, before making further comparisons, the data would need to be standardised by age in order to compensate for the different age structures found throughout the EU.

Once the microdata set is available for all countries participating in EHIS Wave 2, it will be possible to conduct further cross-sectional analyses that could enable conclusions to be drawn about country-specific response patterns while also taking the different age structures into account.

With these limitations in mind, the results demonstrate that the prevalence of obesity and current smoking in Germany is relatively close to the EU average. The results on physical activity are especially encouraging. In particular, the prevalence of physically active women and men drops significantly less with age in Germany than throughout the EU. This suggests that a considerable proportion of the population in Germany already follows the recommendations on physical activity [61]. However, the very low levels of fruit and vegetable intake, especially among men in the younger age groups, and the very large proportion of female and male heavy episodic drinkers who drink in this manner at least once a month pose a problem. Women in Germany tend to demonstrate a relatively high level of behaviour that has traditionally been attributed to men (such as heavy episodic drinking or physical activity [62]), and in some cases these levels are only surpassed by women from Scandinavian countries. The prevalence of these forms of behaviour among women in Central and Southern European countries is very low.

In closing, the results of the EHIS study can provide a basis for sharing experiences between member states on effective health promotion and prevention measures. EHIS Wave 2 offers the opportunity to use standardised instruments to directly compare the prevalence of health-related behaviour and relate this to the health policies in the respective countries for the first time. Previously, it was only possible to compare frequency distribution patterns and to study basic developments in trends. Moreover, the results provide evidence of the impact of health policy measures. Lastly, EHIS-2 indicators of smoking, obesity, fruit and vegetable intake, physical activity, and heavy episodic drinking are also used alongside other EHIS indicators within the context of the Joint Assessment Framework in the Area of Health (JAFH). This constitutes a first-step screening device aimed at demonstrating the challenges currently faced by health systems in the EU member states [63].

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Imprint

Journal of Health Monitoring

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Conflicts of interest
The authors declared no conflicts of interest.

Funding
The GEDA study was funded by the Robert Koch Institute and the German Federal Ministry of Health.

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

Publisher
Robert Koch Institute
Nordufer 20
D-13353 Berlin, Germany

Editors
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Typesetting
Gisela Dugnus, Alexander Krönke, Kerstin Möllerke

Translation
Simon Phillips/Tim Jack

Please cite this publication as
Lange C, Finger JD (2017) Health-related behaviour in Europe – A comparison of selected indicators for Germany and the European Union. Journal of Health Monitoring 2(2):3–19
DOI 10.17886/RKI-GBE-2017-037

ISSN 2511-2708

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

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Journal of Health Monitoring · 2017 2(2)
DOI 10.17886/RKI-GBE-2017-038
Robert Koch Institute, Berlin

Overweight and obesity among adults in Germany

Abstract

Body weight and height, as well as associated indicators like overweight and obesity, are widespread factors used to describe the health of a population. Over the past decades, the prevalence of overweight and obesity has increased worldwide and has reached significant public health relevance. According to self-reported data on body weight and body height in the GEDA 2014/2015-EHIS study, 54.0% of adults in Germany are overweight or obese (defined as having a body mass index – BMI – of 25 kg/m² or higher). Men are more often affected by overweight than women, with 43.3% of men having a BMI between 25 kg/m² and 30 kg/m², compared to women (28.8%). In Germany, the prevalence of obesity (BMI greater or equal to 30 kg/m²) is 18.1%; there is no significant difference between women and men. The prevalence of overweight, including obesity, is higher among women and men with increasing age. Although the prevalence of overweight, including obesity, has remained at a high level in recent years, the prevalence of obesity has increased compared to the GEDA 2010 study.

OVERWEIGHT · OBESITY · SELF-REPORTING · HEALTH MONITORING · GERMANY

Introduction

Persons are defined as overweight if their body weight exceeds a certain level for a given body height. Excessive overweight is referred to as obesity and classified as a disease by the World Health Organization (WHO) [1]. Obesity is a risk factor linked to chronic diseases such as type 2 diabetes mellitus [2], cardiovascular diseases [3] and some types of cancer [4]. It is also associated with a higher risk of premature death [5, 6]. Finally, obesity and the associated comorbidities are a major challenge to the health system and present an important public health problem not only in Germany but also worldwide.

Against this background, the WHO developed the Global Action Plan for the Prevention and Control of Non-communicable Diseases 2013-2020. One of the 9 voluntary global non-communicable diseases targets addresses the prevalence of obesity. The rise in diabetes and obesity prevalence should be halted until 2025 on the 2010 levels [7]. In accordance to the WHO Global Action Plan, the revision of the Sustainable Development Strategy 2016 of the Federal Government of Germany has the target that until 2030 the proportion of people with obesity in Germany does no longer increase [8].

Indicator

Body Mass Index (BMI) is the most commonly used measure to define overweight and obesity. It is calculated as the ratio of a person's body weight to the square of his body height (kg/m²); it is thus relatively easy to

GEDA 2014/2015-EHIS

Data holder: Robert Koch Institute

Aims: To provide reliable information about the population's health status, health-related behaviour and health care in Germany, with the possibility of a European comparison

Method: Questionnaires completed on paper or online

Population: People aged 18 years and above with permanent residency in Germany

Sampling: Registry office sample; randomly selected individuals from 301 communities in Germany were invited to participate

Participants: 24,016 people (13,144 women; 10,872 men)

Response rate: 26.9%

Study period: November 2014 - July 2015

Data protection: This study was undertaken in strict accordance with the data protection regulations set out in the German Federal Data Protection Act and was approved by the German Federal Commissioner for Data Protection and Freedom of Information. Participation in the study was voluntary. The participants were fully informed about the study's aims and content, and about data protection. All participants provided written informed consent.

More information in German is available at www.geda-studie.de

calculate and to use as a reference measure for individuals as well as study populations. The BMI is no direct measure of body fat as it cannot distinguish between body fat and muscle mass. However, research has shown that at the group level BMI shows a high correlation with direct measurements used to determine body fat. A high BMI can therefore act as an indicator of a high level of body fat. According to the WHO classification system, adults with a BMI of less than 18.5 kg/m² are considered to be underweight. A BMI between 18.5 kg/m² and less than 25 kg/m² is defined as normal weight, a BMI between 25 kg/m² and under 30 kg/m² as overweight and a BMI of 30 kg/m² or more as obese [1].

In order to calculate BMI, studies collect data on body weight and body height either through direct measurement or self-reporting. Self-reporting often leads to underestimated body weights and overestimated body heights compared with directly measured values. A BMI calculated through self-reported information thus tends to be lower than those gained through direct measurements [9]. The prevalence presented here based on the German Health Update (GEDA) study series used self-reported data. Therefore, the prevalence observed in this study differs from the prevalence calculated using data from direct measurements gathered for the National Health Interview and Examination Surveys conducted by the Robert Koch Institute, including the 1998 German National Health Interview and Examination Survey (GNHIES98) and the German Health Interview and Examination Survey for Adults (DEGS1) [10].According to DEGS1 the prevalence of obesity in the age group 18 and 79 years is 23.9% among women and 23.3% among men. For the direct comparison of obesity prevalence from different data sources, such as DEGS1 and GEDA 2014/2015-EHIS, it should be taken into account that the obesity prevalence from self-reported data is lower. Furthermore, comparisons from GEDA 2014/2015-EHIS with previous GEDA waves need to take into account the fact that sampling methods and types of questionnaire (self-administered questionnaire versus telephone interview) have been changed.

As part of the GEDA 2014/2015-EHIS study, respondents were asked: 'How tall are you without shoes (in cm)?'. The question on body weight was: 'How much do you weigh without clothes and shoes (in kg)? Pregnant women should provide their weight before they became pregnant.'

The tables present the prevalence of underweight, normal weight, overweight, obesity as well as overweight including obesity among the German population aged 18 years and older. The results are stratified according to gender, age and level of education, and for obesity additionally, by gender and federal state.

The analyses are based on data from 23,791 participants aged 18 years and older (13,006 women and 10,785 men) with valid data on body weight and height. The calculations were carried out using a weighting factor that corrects for deviations within the sample from the German population (as of 31 December 2014) with regard to gender, age, district type and education. The district type accounts for the degree of urbanisation and reflects the regional distribution in Germany. The International Standard Classification for Education (ISCED) was used to ensure that the responses provided on

educational levels were comparable [11]. A detailed description of the methodology applied in the GEDA 2014/2015-EHIS study can be found in the article German Health Update – New data for Germany and Europe in issue 1/2017 of the Journal of Health Monitoring.

Results and discussion

The results of the GEDA 2014/2015-EHIS study indicate that 46.7% of women and 61.6% of men in Germany have a BMI of more than 25 kg/m² and are thus overweight or obese. 28.8% of women and 43.3% of men have a BMI between 25 kg/m² and less than 30 kg/m², and 18.1% of adults are obese (Table 1 and Table 2). Overall, the prevalence of overweight, including obesity, has remained high in recent years. In 2012, 45.8% of women and 59.7% of men were overweight or obese [12]. The GEDA 2014/2015-EHIS data show no significant difference between women and men, with the prevalence increasing by two percentage points compared to 2010 [12].

The current prevalence and trends in obesity is similar as observed in the German Microcensus which also

47% of women and 62% of men in Germany are overweight or obese; 18% of adults are obese.

Women	Underweight		Normal weight		Overweight		Obesity		Overweight including obesity*	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Women total	**2.9**	**(2.5-3.3)**	**50.4**	**(49.3-51.6)**	**28.8**	**(27.8-29.8)**	**18.0**	**(17.1-18.9)**	**46.7**	**(45.6-47.9)**
18-29 Years	7.5	(6.2-9.0)	66.4	(63.7-68.9)	16.5	(14.5-18.7)	9.7	(8.3-11.3)	26.2	(23.8-28.6)
Low education	10.9	(7.4-15.8)	56.7	(50.6-62.6)	19.3	(14.9-24.6)	13.1	(9.3-18.1)	32.4	(26.9-38.4)
Medium education	6.5	(5.2-8.2)	67.5	(64.1-70.8)	16.3	(13.8-19.3)	9.6	(7.9-11.6)	25.9	(23.0-29.1)
High education	5.4	(3.5-8.3)	77.3	(72.6-81.4)	12.3	(9.5-15.7)	5.0	(3.3-7.5)	17.3	(13.9-21.3)
30-44 Years	2.4	(1.8-3.1)	56.1	(53.7-58.5)	24.2	(22.2-26.3)	17.3	(15.4-19.4)	41.5	(39.1-43.9)
Low education	2.1	(0.8-5.8)	34.5	(28.4-41.1)	31.9	(25.7-38.8)	31.5	(24.7-39.2)	63.4	(56.6-69.6)
Medium education	2.1	(1.4-3.0)	55.2	(52.2-58.2)	25.3	(22.8-28.0)	17.4	(15.2-19.9)	42.7	(39.6-45.8)
High education	3.0	(2.0-4.6)	70.6	(67.5-73.5)	17.3	(15.0-19.9)	9.1	(7.2-11.4)	26.4	(23.7-29.3)
45-64 Years	1.6	(1.2-2.0)	48.3	(46.6-50.0)	30.5	(28.9-32.2)	19.6	(18.3-21.1)	50.1	(48.4-51.9)
Low education	1.4	(0.7-2.9)	43.3	(39.0-47.8)	33.1	(28.9-37.6)	22.2	(18.7-26.0)	55.3	(50.9-59.5)
Medium education	1.6	(1.2-2.1)	46.9	(44.8-49.1)	30.4	(28.4-32.5)	21.1	(19.3-22.9)	51.5	(49.3-53.7)
High education	1.7	(1.1-2.6)	57.4	(54.4-60.2)	28.3	(25.8-30.9)	12.7	(10.9-14.7)	41.0	(38.1-43.9)
≥ 65 Years	2.2	(1.5-3.1)	38.9	(36.6-41.2)	37.6	(35.5-39.8)	21.3	(19.4-23.3)	58.9	(56.5-61.3)
Low education	2.5	(1.5-4.2)	37.7	(34.1-41.5)	37.6	(34.1-41.3)	22.2	(19.1-25.5)	59.8	(55.9-63.6)
Medium education	2.2	(1.4-3.5)	38.2	(34.9-41.6)	38.8	(35.8-41.9)	20.8	(18.3-23.5)	59.6	(56.0-63.0)
High education	0.8	(0.3-2.2)	46.5	(41.3-51.8)	32.0	(27.4-37.1)	20.6	(16.2-25.8)	52.7	(47.4-57.9)
Total (women and men)	**1.8**	**(1.6-2.1)**	**44.1**	**(43.2-45.1)**	**35.9**	**(35.1-36.7)**	**18.1**	**(17.4-18.9)**	**54.0**	**(53.1-54.9)**

CI=confidence interval

* Deviations in the prevalence of 'overweight including obesity' from the sum of the prevalence of 'overweight' and 'obesity' are due to rounding

Table 1
Underweight, normal weight, overweight and obesity among women according to age and educational status (n=13,006)
Source: GEDA 2014/2015-EHIS

uses self-reported data on body weight and height. In 2013, 14.3% of women and 17.1% of men were obese [13]. This is an increase of 3.3 percentage points among women and 5.0 percentage points among men compared to earlier assessments of BMI in the German Microcensus conducted in 1999. At that time, the obesity prevalence was 11.5% among adults (11.0% of women and 12.1% of men) [14]. Current results from the GEDA 2014/2015-EHIS study largely confirm the trends observed from the German Microcensus on trends in obesity prevalence.

The prevalence of overweight, including obesity, rises with increasing age among both women and men. This is also consistent with results of previous surveys [12]. Over time, the prevalence of obesity has increased significantly, particularly among younger age groups. Between 2010 and 2014/2015, the prevalence of obesity among 18- to 29-year-olds increased from 5.5% to 9.7% among women and from 5.4% to 8.9% among men. No further increase was observed during this period among adults aged 65 years and older. This trend also corresponds with results of the National Health Interview and

The prevalence of overweight, including obesity, is higher among both women and men with age.

Men	Underweight		Normal weight		Overweight		Obesity		Overweight including obesity*	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Men total	**0.8**	**(0.6-1.0)**	**37.6**	**(36.3-38.9)**	**43.3**	**(42.1-44.5)**	**18.3**	**(17.3-19.4)**	**61.6**	**(60.3-62.9)**
18-29 Years	3.2	(2.4-4.4)	62.8	(59.7-65.8)	25.1	(22.3-28.0)	8.9	(7.2-10.8)	33.9	(31.0-37.0)
Low education	6.3	(3.9-10.3)	60.6	(53.8-66.9)	23.9	(18.6-30.3)	9.2	(5.8-14.3)	33.1	(27.1-39.7)
Medium education	2.3	(1.5-3.6)	61.5	(57.6-65.3)	26.2	(22.9-29.8)	10.0	(7.8-12.6)	36.2	(32.4-40.1)
High education	1.4	(0.4-4.8)	73.2	(67.9-77.9)	21.8	(17.3-27.1)	3.6	(2.0-6.5)	25.4	(20.7-30.8)
30-44 Years	0.1	(0.1-0.4)	39.9	(37.2-42.6)	42.6	(40.0-45.3)	17.3	(15.3-19.6)	60.0	(57.2-62.7)
Low education	0.3	(0.0-2.3)	37.1	(28.9-46.2)	45.5	(36.8-54.3)	17.1	(11.3-25.0)	62.5	(53.4-70.8)
Medium education	0.0	(0.0-0.2)	36.6	(33.3-40.0)	43.0	(39.6-46.5)	20.4	(17.5-23.5)	63.4	(60.0-66.7)
High education	0.3	(0.1-0.8)	46.8	(43.0-50.8)	41.1	(37.4-44.8)	11.8	(9.6-14.5)	52.9	(49.0-56.8)
45-64 Years	0.2	(0.1-0.4)	29.7	(28.0-31.5)	48.2	(46.3-50.1)	21.9	(20.3-23.6)	70.1	(68.3-71.7)
Low education	0.3	(0.0-2.2)	27.3	(22.4-32.8)	46.8	(41.3-52.4)	25.6	(21.3-30.4)	72.4	(67.0-77.3)
Medium education	0.2	(0.1-0.6)	28.0	(25.9-30.4)	47.9	(45.3-50.6)	23.8	(21.4-26.3)	71.7	(69.4-73.9)
High education	0.1	(0.0-0.5)	33.5	(30.9-36.1)	49.3	(46.7-51.9)	17.2	(15.2-19.3)	66.4	(63.8-69.0)
≥ 65 Years	0.5	(0.3-0.9)	28.2	(26.3-30.3)	50.4	(48.2-52.7)	20.9	(19.0-22.8)	71.3	(69.2-73.2)
Low education	0.6	(0.1-3.6)	25.5	(21.0-30.6)	49.2	(44.0-54.4)	24.7	(20.5-29.5)	73.9	(68.9-78.3)
Medium education	0.4	(0.2-1.0)	26.9	(24.0-30.1)	51.1	(47.4-54.8)	21.5	(18.8-24.5)	72.7	(69.5-75.6)
High education	0.5	(0.2-1.2)	32.0	(29.1-35.1)	49.9	(46.8-53.0)	17.6	(15.1-20.4)	67.5	(64.5-70.3)
Total (women and men)	**1.8**	**(1.6-2.1)**	**44.1**	**(43.2-45.1)**	**35.9**	**(35.1-36.7)**	**18.1**	**(17.4-18.9)**	**54.0**	**(53.1-54.9)**

CI=confidence interval

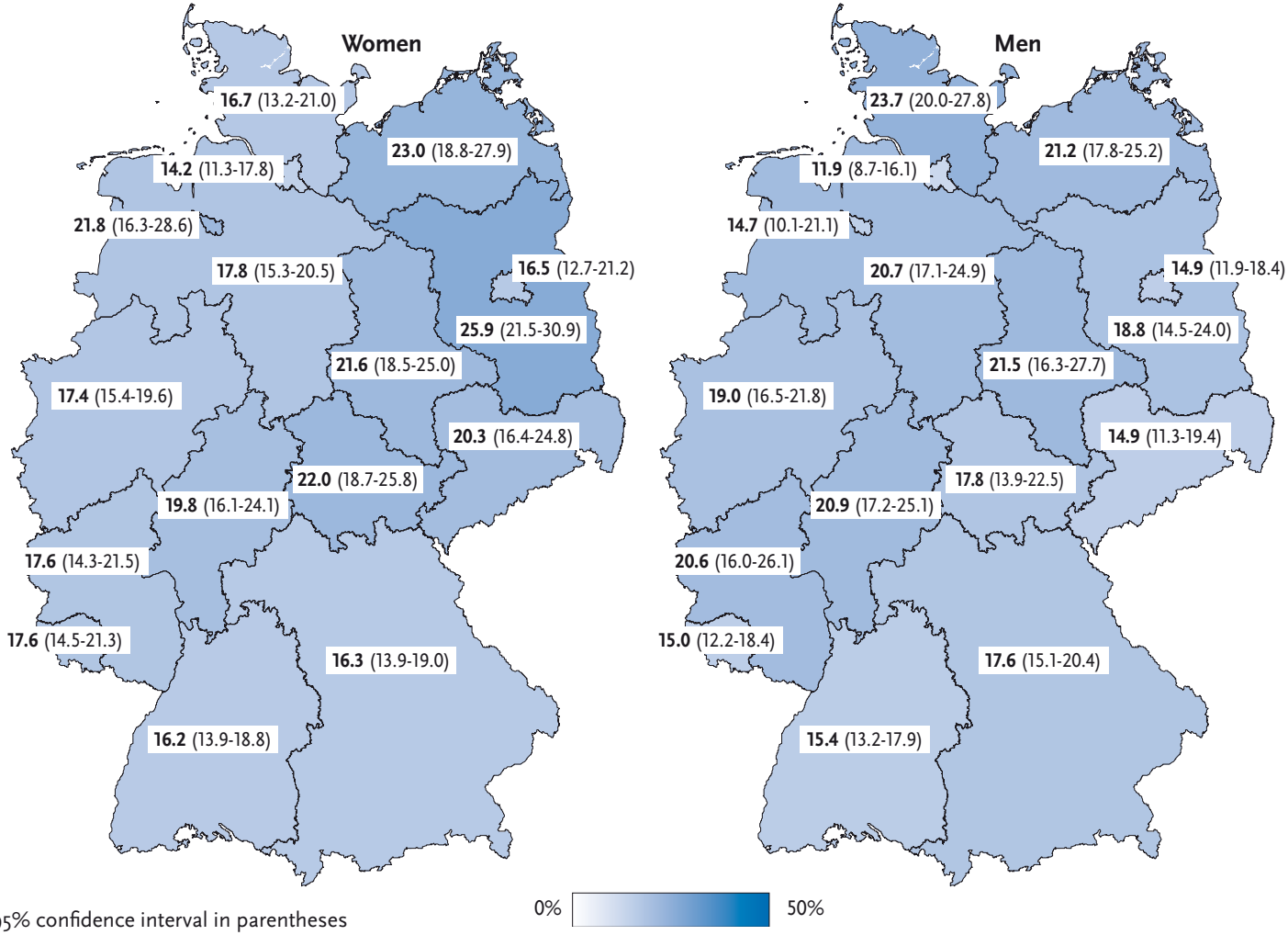
* Deviations in the prevalence of 'overweight including obesity' from the sum of the prevalence of 'overweight' and 'obesity' are due to rounding

Table 2
Underweight, normal weight, overweight and obesity among men according to age and educational status (n=10,785)
Source: GEDA 2014/2015-EHIS

Examination Surveys conducted by the RKI [10]. Furthermore, over 80% of adults with obesity remain obese after 10 years [15] and thus have an increased risk of various health problems and chronic diseases.

The prevalence of obesity also varies according to certain social characteristics: obesity is more common among people with a low level of education compared to those with high education levels. The difference regarding education level is observed among women of all age groups except the 65 year-olds and older (Table 1). Among men, the differences in educational level appear only in the age group 45 years and older (Table 2).

The prevalence of obesity has increased compared with previous surveys. A significant increase is particularly evident among younger age groups.



95% confidence interval in parentheses

Figure 1
Obesity according to gender and German federal state (n=13,006 women; n=10,785 men)
Source: GEDA 2014/2015-EHIS

Compared to the average obesity prevalence over all federal states, the highest prevalence estimates were observed among women in Brandenburg and Mecklenburg-West Pomerania and among men in Mecklenburg-West Pomerania and Schleswig-Holstein. In contrast, women in Hamburg and Baden-Württemberg and men in Hamburg have significantly lower prevalence estimates (Figure 1). Data from the German Microcensus also allow a detailed analysis of the obesity prevalence at regional levels. For all reported years, there is a gradient from the northeast to the southwest, with higher obesity prevalence in Brandenburg and Mecklenburg-West Pomerania and a lower prevalence in Baden-Württemberg [16]. In addition, the German Microcensus can also be used to provide estimates for regions within federal states. These estimates show that the prevalence of obesity among the population within the federal states differs considerably [17].

In summary, the upwards trend of obesity prevalence is continuing. This is in contrast to the targets of the Global Action Plan for the Prevention and Control of Non-communicable Diseases 2013-2020 and the Sustainable Development Strategy 2016 of the Federal Government, both of which aim to halt the rise in obesity prevalence [7, 8].

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Imprint

Journal of Health Monitoring

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Conflicts of interest
The authors declared no conflicts of interest.

Funding
The GEDA study was funded by the Robert Koch Institute and the German Federal Ministry of Health.

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

Publisher
Robert Koch Institute
Nordufer 20
D-13353 Berlin, Germany

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Typesetting
Gisela Dugnus, Alexander Krönke, Kerstin Möllerke

Translation
Simon Phillips/Tim Jack

Please cite this publication as
Schienkiewitz A, Mensink GBM, Kuhnert R et al. (2017) Overweight and obesity among adults in Germany. Journal of Health Monitoring 2(2):20–27. DOI 10.17886/RKI-GBE-2017-038

ISSN 2511-2708

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

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Journal of Health Monitoring · 2017 2(2)
DOI 10.17886/RKI-GBE-2017-039
Robert Koch Institute, Berlin

Work-related physical activity among adults in Germany

Abstract

In GEDA 2014/2015-EHIS the prevalence of work-related physical activity was estimated based on respondents' self-reported data. 47.5% of women and 47.2% of men mostly sit or stand during work. The highest proportion of people who mostly sit or stand during work is found among 18- to 29-year-old women (55.5%) and men aged 30 to 44 (50.2%). A significantly higher proportion of men (14.8%) than women (3.2%) have jobs involving mostly heavy manual labour. For both genders, the higher a person's level of education, the more likely it is that physical activity during work is limited to sitting or standing. The results highlight great potential to promote physical activity.

PHYSICAL INACTIVITY · WORK · SITTING · ADULTS · HEALTH MONITORING

Introduction

Physical activity is any movement by the skeletal muscles that increases the body's energy expenditure beyond the basal metabolic rate (BMR) [1]. Physically non-demanding activities performed whilst sitting or standing hardly raise energy expenditure beyond the BMR [2]. Sitting for long hours, as is normal in office jobs, constitutes a risk factor for non-communicable diseases [3, 4]. According to current estimates, the general mortality risk for adults increases by 2% for every hour spent sitting per day [4]. Where employment involves physical activity, such as for example in agriculture, work-related physical activity is often a person's greatest expenditure of energy, as working days usually comprise eight-hour shifts [5]. Whilst work-related physical activity has health benefits, these are not as great as the health benefits of aerobic physical exercise during leisure time [6-8]. The reason is that work-related physical activity is often repetitive, and usually involves working overhead and carrying heavy objects. This can increase muscular strength, yet hardly improves aerobic endurance capacity [9-11]. Endurance capacity improves during aerobic leisure activities such as jogging and swimming, and is particularly important with regard to preventing non-communicable diseases (such as cardiovascular diseases, certain types of cancer or diabetes) and their underlying cardiometabolic risk factors (such as hypertension, lipometabolic disorders and obesity) [12]. Due to the high relevance of physical inactivity as a contributing factor to disease development, the World Health Organization (WHO), in its Global Action Plan for the Prevention and Control of Non-Communicable-Diseases 2013-2020, established the goal of a 10% relative reduction in prevalence of insufficient physical activity by 2025 (compared with 2010) [13].

GEDA 2014/2015-EHIS

Data holder: Robert Koch Institute

Aims: To provide reliable information about the population's health status, health-related behaviour and health care in Germany, with the possibility of a European comparison

Method: Questionnaires completed on paper or online

Population: People aged 18 years and above with permanent residency in Germany

Sampling: Registry office sample; randomly selected individuals from 301 communities in Germany were invited to participate

Participants: 24,016 people (13,144 women; 10,872 men)

Response rate: 26.9%

Study period: November 2014 - July 2015

Data protection: This study was undertaken in strict accordance with the data protection regulations set out in the German Federal Data Protection Act and was approved by the German Federal Commissioner for Data Protection and Freedom of Information. Participation in the study was voluntary. The participants were fully informed about the study's aims and content, and about data protection. All participants provided written informed consent.

More information in German is available at www.geda-studie.de

Indicator

Using a validated German version of the European Health Interview Survey – Physical Activity Questionnaires (EHIS-PAQ), the German Health Update (GEDA 2014/2015-EHIS) survey for the first time measured work-related physical activity [14, 15]. In GEDA 2014/2015-EHIS, respondents were asked: 'When you work, what best describes what you do? (a) mostly sitting or standing; (b) mostly walking or tasks of moderate physical effort; (c) mostly heavy labour or physically demanding work, or (d) not performing any working tasks.' Work, here, encompasses not only paid but also unpaid work (for example, studying or housework). Respondents were asked to select only one answer. For the purpose of the analysis presented here, these four answers on work-related physical activity for the 18-to-64 age group were stratified by gender, age group, level of education and federal state. A statistically significant difference between groups is assumed when confidence intervals do not overlap.

The analyses are based on the data received from 18,026 participants of working age, aged 18-to-64 (10,146 women and 7,880 men) with valid data in EHIS-PAQ. Calculations were carried out using a weighting factor that corrects for deviations within the sample from the German population (as of 31 December 2014) with regard to gender, age, community type and education. The community type accounts for the degree of urbanisation and reflects the regional distribution in Germany.

The International Standard Classification for Education (ISCED) was used to ensure that the responses provided on educational levels were comparable [16]. A detailed description of the methodology applied in the GEDA 2014/2015-EHIS study can be found in the article German Health Update – New data for Germany and Europe in issue 1/2017 of the Journal of Health Monitoring.

Results and discussion

Nearly half of all women (47.5%) and men (47.2%) of working age (18 to 64) stated that they sit or stand most of the time during work and therefore spend many hours per day physically inactive. Among women, the prevalence of work-related physical inactivity (mostly sitting or standing) is highest in the 18-to-29 age group (55.5%) (Table 1). Among men, it is highest in the 30-to-44 age group (50.2%) (Table 2). Compared with women, men nearly five times as often reported being employed in jobs that involve mostly heavy manual labour. The observed regional and educational differences in work-related physical activity are stronger among men than among women (Table 1 and Table 2; Figure 1). In all age groups, men with higher levels of education responded nearly twice as often as men with lower levels of education that they mostly sit or stand during work. The highest value for mostly sitting or standing during work was found in 30- to 44-year-old men with higher education levels (79.7%). Conversely, men with lower education levels are seven times as likely to state that their work implies heavy manual labour than those with higher levels of education. The same is true for women: the higher their level of education, the more likely they are to work sitting or standing.

For women in Hamburg, the amount of work-related physical inactivity is statistically significantly higher than the German average. For men in Thuringia, Mecklen-

Table 1
Physical activity during work among women according to age and educational status (n=10,146)
Source: GEDA 2014/2015-EHIS

Women	Mostly sitting or standing (physical inactivity)		Mostly walking or tasks of moderate physical effort		Mostly heavy labour or physically demanding work		Not performing any working tasks	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Women total	**47.5**	**(46.1-49.0)**	**40.6**	**(39.0-42.1)**	**3.2**	**(2.8-3.7)**	**8.7**	**(8.0-9.5)**
18-29 Years	55.5	(52.6-58.4)	33.7	(30.9-36.7)	3.9	(2.9-5.0)	6.9	(5.6-8.6)
Low education	43.5	(36.9-50.4)	36.5	(30.0-43.5)	3.3	(1.6-6.6)	16.7	(12.5-22.0)
Medium education	55.9	(52.1-59.5)	34.9	(31.3-38.6)	4.9	(3.6-6.6)	4.4	(3.1-6.1)
High education	73.0	(67.9-77.6)	23.9	(19.6-28.8)	0.8	(0.3-2.1)	2.3	(1.2-4.4)
30-44 Years	49.5	(47.0-51.9)	42.2	(39.7-44.8)	2.9	(2.3-3.8)	5.4	(4.3-6.8)
Low education	29.7	(23.7-36.6)	50.1	(42.8-57.5)	6.3	(3.5-11.0)	13.8	(9.2-20.3)
Medium education	46.3	(43.2-49.3)	45.7	(42.5-48.8)	3.1	(2.3-4.1)	5.0	(3.9-6.5)
High education	67.8	(63.9-71.4)	29.7	(26.2-33.4)	0.7	(0.4-1.4)	1.8	(1.1-3.0)
45-64 Years	42.7	(40.8-44.6)	42.7	(40.8-44.6)	3.1	(2.6-3.7)	11.5	(10.5-12.7)
Low education	24.2	(20.6-28.1)	52.9	(48.5-57.1)	3.8	(2.5-5.9)	19.1	(15.8-22.9)
Medium education	41.7	(39.3-44.0)	43.8	(41.5-46.1)	3.4	(2.7-4.3)	11.2	(9.8-12.7)
High education	62.5	(59.5-65.3)	29.9	(27.4-32.7)	1.4	(0.9-2.1)	6.2	(4.8-8.0)
Total (women and men)	**47.3**	**(46.1-48.6)**	**35.6**	**(34.5-36.7)**	**9.0**	**(8.3-9.8)**	**8.0**	**(7.5-8.6)**

Roughly 47.5% of women and 47.2% of men mostly sit or stand during work.

Table 2
Physical activity during work among men according to age and educational status (n=7,880)
Source: GEDA 2014/2015-EHIS

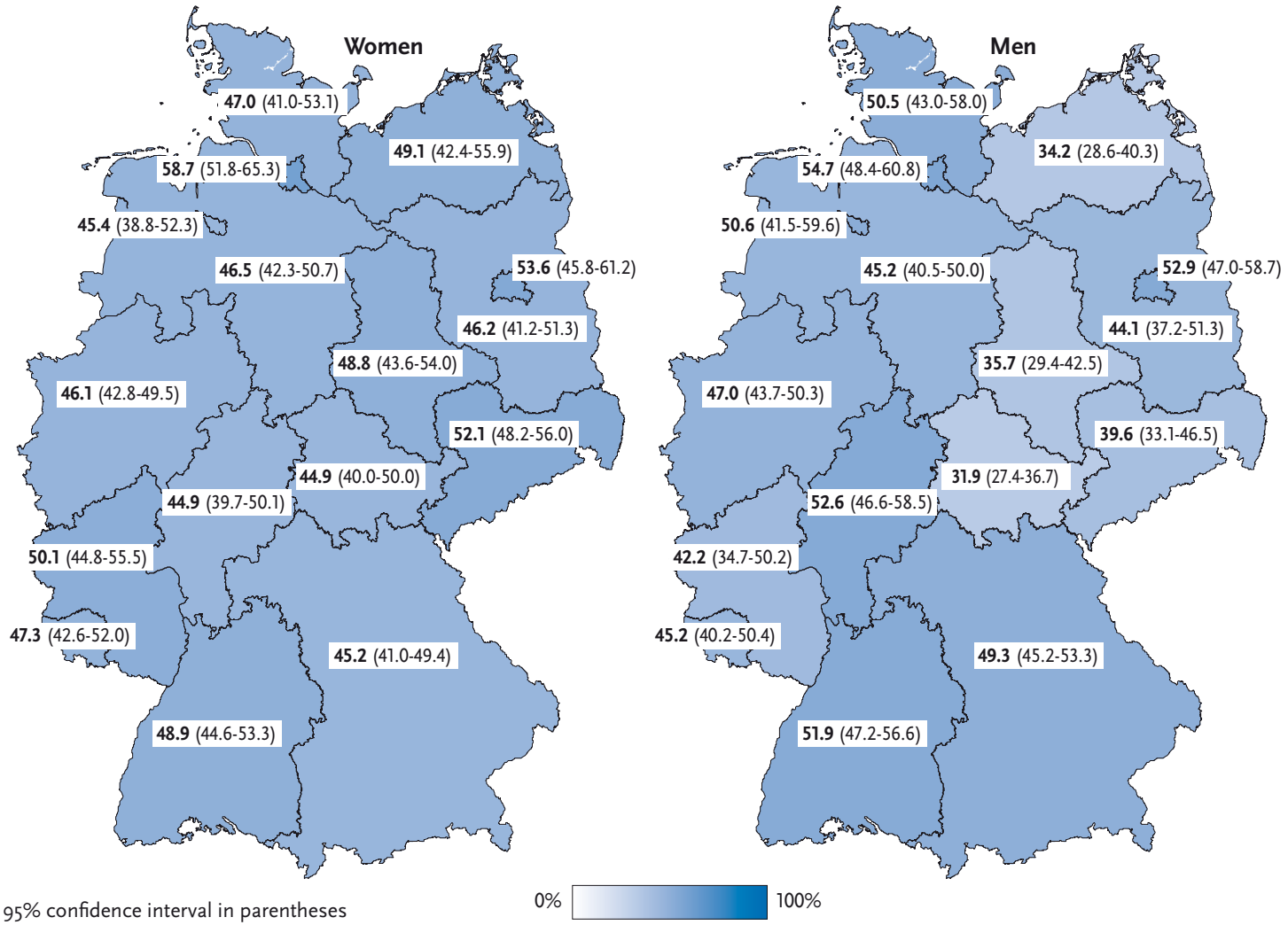
Men	Mostly sitting or standing (physical inactivity)		Mostly walking or tasks of moderate physical effort		Mostly heavy labour or physically demanding work		Not performing any working tasks	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Men total	**47.2**	**(45.6-48.8)**	**30.7**	**(29.3-32.0)**	**14.8**	**(13.5-16.1)**	**7.4**	**(6.6-8.3)**
18-29 Years	46.4	(43.5-49.3)	30.4	(27.5-33.5)	16.7	(14.3-19.5)	6.4	(5.0-8.2)
Low education	35.4	(29.1-42.3)	31.6	(25.9-37.9)	18.0	(13.4-23.6)	15.0	(10.7-20.7)
Medium education	44.2	(40.6-47.9)	33.4	(29.5-37.5)	18.9	(15.5-22.7)	3.5	(2.6-4.9)
High education	77.1	(71.2-82.1)	14.8	(11.0-19.8)	5.1	(3.2-8.1)	2.9	(1.0-8.0)
30-44 Years	50.2	(47.6-52.9)	30.0	(27.7-32.4)	15.9	(13.9-18.0)	3.9	(2.8-5.4)
Low education	28.2	(21.4-36.1)	37.5	(29.9-45.9)	24.1	(17.7-31.9)	10.2	(6.3-16.2)
Medium education	39.3	(36.0-42.6)	36.0	(32.7-39.4)	20.8	(18.0-23.9)	4.0	(2.6-6.0)
High education	79.7	(76.7-82.4)	16.3	(13.9-19.2)	3.2	(2.1-4.7)	0.8	(0.3-1.9)
45-64 Years	45.7	(43.7-47.7)	31.2	(29.4-33.0)	13.2	(11.7-14.8)	10.0	(8.9-11.2)
Low education	29.9	(25.0-35.2)	34.2	(29.1-39.6)	19.8	(16.0-24.3)	16.1	(11.8-21.7)
Medium education	35.2	(32.8-37.8)	36.7	(34.0-39.4)	16.7	(14.4-19.2)	11.4	(9.9-13.2)
High education	70.6	(68.1-72.9)	19.9	(17.8-22.2)	4.3	(3.3-5.6)	5.2	(4.1-6.5)
Total (women and men)	**47.3**	**(46.1-48.6)**	**35.6**	**(34.5-36.7)**	**9.0**	**(8.3-9.8)**	**8.0**	**(7.5-8.6)**

CI=confidence interval

burg-West Pomerania, Saxony-Anhalt and Saxony, the prevalence of work-related physical inactivity is statistically significantly lower than the German average (Figure 1).

People with higher levels of education, who are often physically inactive during work, engage more often in physical exercise during their leisure time and thereby partially compensate for their lack of physical activity at

The highest proportion of women who mostly sit or stand during work is the 18-to-29 age group (55.5%) and of men, the 30-to-44 age group (50.2%).



95% confidence interval in parentheses

Figure 1
Physical activity during work according to gender and German federal state (n=10,146 women; n=7,880 men)
Source: GEDA 2014/2015-EHIS

A significantly higher proportion of men (14.8%) than women (3.2%) have jobs involving mostly heavy manual labour.

In both genders the same pattern applies that the higher a person's level of education, the more likely it is that physical activity during work is limited to sitting or standing.

work [17-19]. However, only high levels of physical activity during leisure time can actually compensate for the negative effects of mostly sitting at work, and the necessary high levels of leisure time physical activity are often not achieved [20]. Integrating physical activity into work routines, for example during breaks and providing exercise classes, should therefore become an important feature of health promotion at the workplace [21]. Those employed in jobs involving heavy manual labour, however, are usually less active during their leisure time [17]. For such people, health-enhancing aerobic physical activities (endurance activities) during leisure time can nonetheless be beneficial, as such type of exercise improves cardiorespiratory fitness, which is only insufficiently promoted by anaerobic manual labour that mainly improves muscular strength. However, people whose work implies heavy manual labour also need to recover physically during their leisure time. The observed regional differences between federal states in terms of work-related physical activity to a certain degree reflect the regional importance of the services industry. In urban agglomerations, the services sector is larger than in less densely populated regions, and the amount of work conducted mostly sitting or standing is higher than in the industrial or agricultural sector. The regional importance of the services sector in 2013 by federal state [22] is more or less congruent with the share of people whose work-related physical activity is limited to sitting or standing in GEDA 2014/2015-EHIS.

With regard to health promotion and prevention, we need to consider that work-related physical activity is primarily determined by individual job requirements. Health promotion at the workplace therefore needs to contribute towards reducing the negative health impacts of work-related physical inactivity. A multi-component approach is recommended, which should include providing exercise classes, changing the workday routine (for example, to include active breaks) and developing exercise-friendly infrastructure (providing bicycle parking, showers, etc.) [21].

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Imprint

Journal of Health Monitoring

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Conflicts of interest
The authors declared no conflicts of interest.

Funding
The GEDA study was funded by the Robert Koch Institute and the German Federal Ministry of Health.

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

Publisher
Robert Koch Institute
Nordufer 20
D-13353 Berlin, Germany

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Typesetting
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Translation
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Please cite this publication as
Finger JD, Mensink GBM, Lange C et al. (2017) Work-related physical activity among adults in Germany. Journal of Health Monitoring 2(2):28–34. DOI 10.17886/RKI-GBE-2017-039

ISSN 2511-2708

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

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Journal of Health Monitoring · 2017 2(2)
DOI 10.17886/RKI-GBE-2017-040
Robert Koch Institute, Berlin

Health-enhancing physical activity during leisure time among adults in Germany

Abstract

Self-reported data from the GEDA 2014/2015-EHIS study was used to calculate the level of compliance among adults in Germany with the World Health Organization's (WHO) recommendations on physical activity. The WHO's recommendations distinguish between 'aerobic activity' and 'muscle-strengthening activity'. In Germany, 42.6% of women and 48.0% of men reported that they conduct at least 2.5 hours of aerobic physical activity per week, and therefore meet the WHO's recommendation on this form of activity. A higher level of education among women and men of all ages is associated with a higher frequency of meeting the WHO's recommendations on aerobic activity. In addition, 27.6% of women and 31.2% of men conduct muscle-strengthening activity at least twice a week, thereby meeting the WHO's recommendations on this form of activity. About one fifth of women (20.5%) and one quarter of men in Germany (24.7%) meet both of these recommendations. In summary, the results point to the value of encouraging people to conduct more physical activity during their leisure time. In fact, inactive people who begin to follow the WHO's recommendations can significantly reduce their long-term risk of premature mortality.

PHYSICAL ACTIVITY · PHYSICAL ACTIVITY RECOMMENDATIONS · ADULTS · GERMANY · HEALTH MONITORING

Introduction

Physical activity is defined as any bodily movement generated by the skeletal muscles that requires more energy to be consumed than the basal metabolic rate [1]. Health-enhancing physical activity includes aerobic activity (endurance activity) such as cycling, jogging, playing football or swimming that increases breathing and heart rate and is undertaken without interruption for at least 10 minutes [2]. Aerobic activity provides an important contribution to the maintenance and recovery of the health of the cardiovascular and metabolic system [3, 4]. Muscle-strengthening activity such as strength training, Pilates and yoga is also beneficial to health, as it increases the performance and health of the human musculoskeletal system, skeletal muscles, joints, bones, tendons and ligaments [2, 4]. In contrast, a lack of physical activity increases the risks of developing the most important non-communicable diseases such as heart disease, type 2 diabetes mellitus, and breast and colorectal cancer, and it also reduces life expectancy [5]. According to the 2015 Global Burden of Disease Study, physical inactivity in Germany contributes to a significant reduction in life expectancy and quality of life. Specifically, physical inactivity was found to be linked to 10% of the years lost due to coronary heart disease, 17% of the years lost due to diabetes mellitus, 15% of the years lost due to colorectal

GEDA 2014/2015-EHIS

Data holder: Robert Koch Institute

Aims: To provide reliable information about the population's health status, health-related behaviour and health care in Germany, with the possibility of a European comparison

Method: Questionnaires completed on paper or online

Population: People aged 18 years and above with permanent residency in Germany

Sampling: Registry office sample; randomly selected individuals from 301 communities in Germany were invited to participate

Participants: 24,016 people (13,144 women; 10,872 men)

Response rate: 26.9%

Study period: November 2014 - July 2015

Data protection: This study was undertaken in strict accordance with the data protection regulations set out in the German Federal Data Protection Act and was approved by the German Federal Commissioner for Data Protection and Freedom of Information. Participation in the study was voluntary. The participants were fully informed about the study's aims and content, and about data protection. All participants provided written informed consent.

More information in German is available at www.geda-studie.de

cancer and 10% of the years lost due to breast cancer [6]. As insufficient levels of physical activity are associated with disease, the World Health Organization (WHO) formulated the goal of reducing the prevalence of insufficient physical activity (defined as less than 2.5 hours of moderate- to vigorous-intensity physical activity per week) as part of the Global Action Plan for the Prevention and Control of Non-Communicable Diseases 2013-2020. The aim is to ensure that levels of insufficient physical activity are 10% lower than 2010 levels by 2025 [7].

Indicator

The WHO's recommendations on physical activity differentiate between 'aerobic activity' and 'muscle-strengthening activity' [2, 8]. Adherence to these recommendations among the population in Germany [8] was assessed with the validated German version of the European Health Interview Survey – Physical Activity Questionnaire (EHIS-PAQ) used for the German Health Update (GEDA 2014/2015-EHIS) survey [9, 10]. As part of this study, respondents were asked about the duration of the physical activity they undertake during a typical week, in the form of both moderate-intensity aerobic physical activity conducted during leisure time and cycling used for transportation, as well as the number of days a week during which they undertake muscle-strengthening activities. Details about the way in which these indicators were constructed have been published elsewhere [10]. The following describes the proportion of respondents who conduct at least moderate-intensity aerobic activities for at least 2.5 hours a week (the first part of the WHO's recommendations on physical activity), as well as those who conduct muscle-strengthening activities on at least two days a week (the second part of the WHO's recommendations), and the proportion of those who meet both parts of the WHO's recommendations (2.5 hours of aerobic activity, as well as muscle-strengthening activities twice a week). The figures are stratified according to gender, age, level of education and federal state. A difference between these groups is interpreted as statistically significant where confidence intervals do not overlap.

The analyses are based on data from 22,959 participants aged 18 years and above (12,511 women, and 10,448 men) with valid EHIS-PAQ data. The calculations were carried out using a weighting factor that corrects for deviations within the sample from the structure of the German population (as of 31 December 2014) with regard to gender, age, community type and education. The community type reflects the degree of urbanisation and corresponds to the regional distribution in Germany. The International Standard Classification for Education (ISCED) was used to ensure the respondents' responses on education were comparable [11]. A detailed description of the methodology applied in GEDA 2014/2015-EHIS can be found in the article German Health Update: New data for Germany and Europe in issue 1/2017 of the Journal of Health Monitoring.

Results and discussion

According to results from the GEDA 2014/2015-EHIS study, 42.6% of women and 48.0% of men meet the WHO's recommendation on aerobic activity (Tables 1 and Table 2). 56.7% of men aged between 18 and 29 meet

the WHO's recommendations on aerobic activity; the same can be said of around 45% of men in other age groups. Among women, compliance with the recommendations is highest in the 45-to-64 age group (47.8%). No uniform pattern can be observed among women in terms of age distribution. A smaller proportion of women (27.6%) and men (31.2%) meet the WHO's recommendation on muscle-strengthening activity. About one fifth of women (20.5%) and one quarter of men (24.7%) meet both recommendations.

An association exists between level of education and health-enhancing aerobic physical activity among women and men of all age groups: the proportion of adults who meet the recommendations on physical activity is lower in groups with lower levels of education compared to those with the higher levels of education (Table 1 and Table 2).

The proportion of women in Thuringia who meet the recommendations on aerobic activity is below the national average; in Hamburg, it is above the national average. The proportion of men in Mecklenburg-West Pomerania and Saxony who meet the recommendations on aerobic activity is below the national average; in Bremen, it is above the national average (Figure 1).

42.6% of women and 48.0% of men in Germany meet the World Health Organization's recommendations on aerobic activity by undertaking at least 2.5 hours of aerobic physical activity per week.

Women	Aerobic activity at least 2.5 hours per week		Muscle-strengthening activity at least 2 times a week		Aerobic and muscle-strengthening activity recommendations compliance	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Women total	**42.6**	**(41.3-43.9)**	**27.6**	**(26.7-28.6)**	**20.5**	**(19.6-21.4)**
18-29 Years	45.2	(42.3-48.2)	34.5	(32.1-37.0)	25.8	(23.6-28.2)
Low education	40.1	(34.2-46.3)	29.5	(24.3-35.3)	21.9	(17.2-27.3)
Medium education	44.4	(40.6-48.2)	35.8	(32.6-39.1)	26.0	(23.1-29.1)
High education	55.0	(49.6-60.2)	35.6	(31.5-40.0)	29.3	(25.1-33.8)
30-44 Years	38.8	(36.7-41.0)	21.1	(19.5-22.9)	16.3	(14.8-17.9)
Low education	34.2	(27.7-41.5)	12.7	(8.9-17.7)	11.1	(7.5-16.1)
Medium education	36.7	(34.0-39.5)	20.2	(18.1-22.5)	15.0	(13.1-17.1)
High education	46.4	(42.9-49.8)	28.1	(25.0-31.3)	22.3	(19.5-25.4)
45-64 Years	47.8	(46.0-49.6)	29.4	(27.9-30.9)	22.7	(21.3-24.2)
Low education	44.3	(39.7-49.1)	26.1	(22.5-30.1)	20.0	(16.7-23.7)
Medium education	46.5	(44.3-48.8)	29.3	(27.4-31.2)	22.4	(20.6-24.2)
High education	55.0	(51.5-58.3)	32.7	(30.2-35.4)	26.2	(23.8-28.7)
≥ 65 Years	36.5	(34.0-39.1)	26.4	(24.4-28.4)	17.4	(15.6-19.3)
Low education	29.0	(25.6-32.6)	20.7	(17.6-24.1)	12.1	(9.6-15.2)
Medium education	39.4	(35.7-43.2)	28.5	(25.7-31.5)	19.2	(16.6-22.1)
High education	51.1	(45.7-56.5)	38.8	(33.7-44.2)	29.0	(24.4-34.0)
Total (women and men)	**45.3**	**(44.2-46.4)**	**29.4**	**(28.6-30.2)**	**22.6**	**(21.8-23.4)**

CI=confidence interval

Table 1
Health-enhancing physical activity during leisure time among women according to age and educational status (n=12,511)
Source: GEDA 2014/2015-EHIS

The research that formed the basis of the WHO's recommendations on aerobic activity leads to the conclusion that people who undertake moderate- to vigorious-intensity aerobic activities for at least 2.5 hours per week have a significantly lower risk of all-cause mortality [4]. However, there is no absolute threshold in terms of risk reduction: some physical activity is good; more physical activity is better [4]. In fact, the most active group has an estimated 30% lower risk of premature mortality than the least active group [4].

Nevertheless, the calculations on compliance with the WHO's recommendations on aerobic activity only consider aerobic activity and transport-related cycling that is undertaken during leisure time; it does not include work-related physical activity [10]. This is important because population groups that are less likely to follow the recommendations on aerobic activity, such as adults with lower levels of education, are generally engaged in more physically active forms of employment [12, 13]. This is also confirmed when the regional differences between work-related and leisure-time physical activity are compared by federal state: in states where a high proportion of people undertake leisure-time physical activity (such as Hamburg), a lower proportion conducts high levels

27.6% of women and 31.2% of men in Germany meet the World Health Organization's recommendations on muscle-strengthening activity by conducting muscle-strengthening activity at least twice a week.

Men	Aerobic activity at least 2.5 hours per week		Muscle-strengthening activity at least 2 times a week		Aerobic and muscle-strengthening activity recommendations compliance	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Men total	**48.0**	**(46.6-49.4)**	**31.2**	**(30.2-32.3)**	**24.7**	**(23.6-25.8)**
18-29 Years	56.7	(53.6-59.8)	43.9	(41.1-46.8)	35.8	(33.1-38.7)
Low education	52.5	(45.4-59.4)	39.7	(33.5-46.2)	31.4	(25.7-37.8)
Medium education	56.3	(52.4-60.1)	44.9	(41.3-48.5)	36.1	(32.7-39.7)
High education	66.5	(59.7-72.7)	49.1	(42.2-56.0)	43.8	(37.0-50.9)
30-44 Years	44.8	(42.1-47.5)	28.5	(26.2-30.8)	22.6	(20.6-24.7)
Low education	36.9	(29.3-45.2)	25.2	(19.0-32.7)	19.9	(14.0-27.3)
Medium education	42.4	(38.7-46.2)	28.2	(25.0-31.6)	22.2	(19.3-25.5)
High education	52.7	(48.9-56.4)	30.6	(27.5-34.0)	24.3	(21.4-27.5)
45-64 Years	45.6	(43.7-47.6)	26.3	(24.7-27.9)	21.1	(19.7-22.7)
Low education	35.7	(30.7-40.9)	23.5	(19.2-28.5)	17.9	(13.9-22.8)
Medium education	43.4	(40.8-46.1)	25.3	(23.2-27.6)	20.3	(18.2-22.5)
High education	53.1	(50.3-56.0)	29.1	(26.6-31.8)	23.7	(21.3-26.3)
≥ 65 Years	48.3	(45.9-50.7)	32.2	(30.2-34.4)	23.6	(21.6-25.7)
Low education	36.3	(30.9-42.1)	27.3	(22.8-32.4)	18.6	(14.5-23.5)
Medium education	47.2	(43.8-50.7)	30.9	(27.9-34.0)	23.0	(20.1-26.2)
High education	55.2	(51.6-58.7)	36.8	(33.4-40.3)	26.7	(23.7-29.9)
Total (women and men)	**45.3**	**(44.2-46.4)**	**29.4**	**(28.6-30.2)**	**22.6**	**(21.8-23.4)**

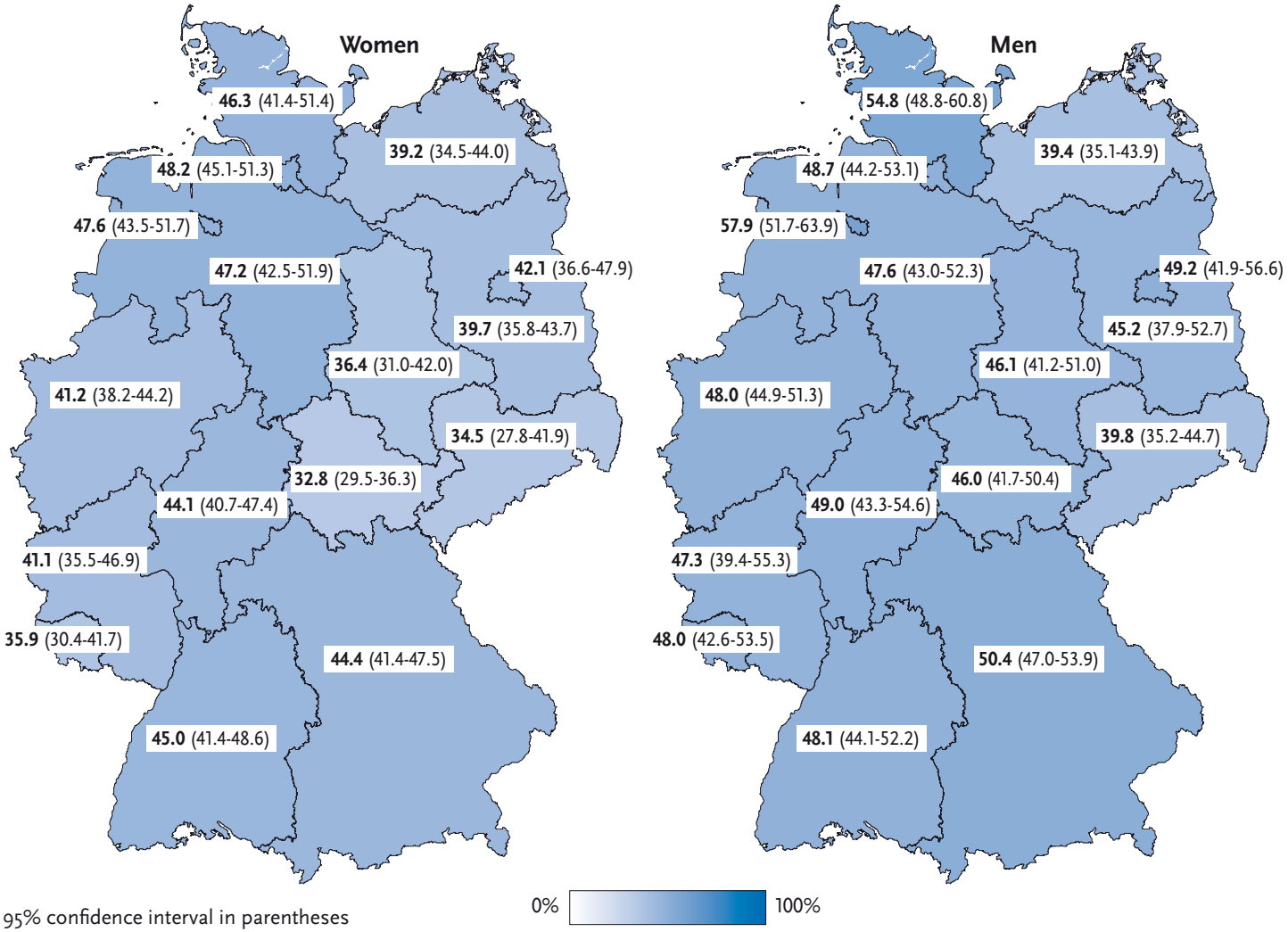
CI=confidence interval

Table 2
Health-enhancing physical activity during leisure time among men according to age and educational status (n=10,448)
Source: GEDA 2014/2015-EHIS

of work-related activity. In contrast, states that demonstrate a high level of work-related activity (such as Thuringia) tend to have a lower proportion of people engaging in leisure-time physical activity [13]. Be this as it may, work-related physical activity does not usually provide the same health benefits as aerobic physical exercise conducted during leisure time [14, 15].

It is not possible to use the results from the GEDA 2014/2015-EHIS study and those of previous GEDA waves to calculate time trends because the physical

Women meet the World Health Organization's recommendations on aerobic activity statistically significantly less often than men.



95% confidence interval in parentheses

Figure 1
Proportion of women and men complying with the World Health Organization's recommendation on aerobic activity according to German federal state (n=12,511 women; n=10,448 men)
Source: GEDA 2014/2015-EHIS

activity questionnaire was changed. The GEDA 2014/2015-EHIS study used EHIS-PAQ, a new survey instrument. EHIS-PAQ was developed in 2010 in order to estimate the compliance with the WHO's recommendations.

Still, another study conducted in Germany confirms that about half of adults in Germany meet the WHO's recommendations [16]. However, again the results of this survey and those of the GEDA 2014/2015-EHIS study can only be compared to a limited extent due to the use of different survey instruments.

Overall, the results set out here point to the importance of encouraging people to conduct more physical activity during their leisure time. More than half of the adult population undertakes less than 2.5 hours per week of at least moderate-intensity aerobic physical activity, and thus fails to meet the core aspect of the WHO's recommendations on physical activity. In view of the costs incurred due to physical inactivity (through time taken off work, illness and premature mortality) [17], increased investment in measures that encourage people to be more physically active is both sensible and necessary. This could include population-based informational approaches, community-based intervention, and political and environmental approaches undertaken within the framework of the German national recommendations on physical activity and physical activity promotion [18].

A higher level of education among women and men of all ages is associated with a higher frequency of meeting the World Health Organization's recommendations on aerobic activity.

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Imprint

Journal of Health Monitoring

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Conflicts of interest
The authors declared no conflicts of interest.

Funding
The GEDA study was funded by the Robert Koch Institute and the German Federal Ministry of Health.

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

Publisher
Robert Koch Institute
Nordufer 20
D-13353 Berlin, Germany

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Translation
Simon Phillips/Tim Jack

Please cite this publication as
Finger JD, Mensink GBM, Lange C et al. (2017) Health-enhancing physical activity during leisure time among adults in Germany. Journal of Health Monitoring 2(2):35–42
DOI 10.17886/RKI-GBE-2017-040

ISSN 2511-2708

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

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Journal of Health Monitoring · 2017 2(2)
DOI 10.17886/RKI-GBE-2017-041
Robert Koch Institute, Berlin

Fruit consumption among adults in Germany

Abstract

Eating fruit is part of a healthy diet and can help prevent various chronic diseases. According to GEDA 2014/2015-EHIS data, 54.2% of women and 38.1% of men eat fruit daily. 38.0% of women and 25.5% of men aged 18 to 29 years eat fruit daily; and in the age group of 65 and older this figure rises to 72.6% for women and 61.1% for men. In the age groups under 65, women with higher levels of education are more likely to eat fruit every day, for men this correlation applies only to those aged between 45 and 64. In Brandenburg, Mecklenburg-West Pomerania, Saxony, Saxony-Anhalt and Thuringia, the proportion of women and men who eat fruit daily is higher than the German average, and in Bavaria and Saarland the proportion of men who eat fruit daily is lower than the German average.

FRUIT · ADULTS · INTERVIEW SURVEY · HEALTH MONITORING · GERMANY

Introduction

Fruit includes the edible fruits and seeds of mostly perennial plants. Like vegetables, there are many different types of fruit and due to global trade the market in Germany is continuously expanding. Fruit can be subdivided into groups such as pomaceous fruit, berries or citrus fruit. Whereas vegetables are usually eaten at meals, fruit is often a dessert or eaten as a snack between meals. Fruit is an important source of vitamins, minerals, trace elements, phytochemicals and fibre, yet has only little fat. Due to the variety of biologically active substances, eating fruit is associated with a number of health benefits. Beyond a high nutrient density, most fruit have high water contents and are therefore relatively low in calories [1]. Moreover, people who eat high quantities of fruit usually eat smaller amounts of physiologically less beneficial foods. A low energy content combined with high satiety means that eating lots of fruit and vegetables can contribute to maintain weight and to prevent obesity [1, 2].

Convincing evidence shows that eating high amounts of fruit and vegetables can help prevent, or positively influence the course, of coronary heart disease, high blood pressure and stroke [1, 3-5]. Probably, eating lots of fruit and vegetables also has a prophylactic effect on various cancers; the observed correlation with the overall cancer risk, however, is low [1, 6-9]. Consuming large amounts of fruit and vegetables is, according to a recent meta-analysis, associated with a lower overall mortality risk, in particular due to a lower cardiovascular mortality risk [8].

For some time now, this has been reflected in the implementation of various health-policy measures aimed at encouraging people to eat more fruit and vegetables.

GEDA 2014/2015-EHIS

Data holder: Robert Koch Institute

Aims: To provide reliable information about the population's health status, health-related behaviour and health care in Germany, with the possibility of a European comparison

Method: Questionnaires completed on paper or online

Population: People aged 18 years and above with permanent residency in Germany

Sampling: Registry office sample; randomly selected individuals from 301 communities in Germany were invited to participate

Participants: 24,016 people (13,144 women; 10,872 men)

Response rate: 26.9%

Study period: November 2014 - July 2015

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The '5 a day' campaign, which recommends that people eat five portions of fruit and vegetables every day, is probably one of the most well-known. A portion of fruit or vegetables may occasionally be replaced by a smoothie or a glass of fruit or vegetable juice; however, the fruit or vegetable content of these drinks should be no less than 100%. A portion is defined as a handful of fruit or vegetables [10, 11].

Indicator

Sufficient consumption of fruit and vegetables is a key element in a balanced and healthy diet. A population representative assessment of fruit consumption as an indicator of a healthy diet is therefore highly relevant for health policy. GEDA 2014/2015-EHIS assessed the frequency of people's fruit consumption by asking: 'How often do you eat fruit, including freshly pressed juices?', with the possible answers 'once or more a day', '4 to 6 times a week', '1 to 3 times a week', 'less than once a week' and 'never'. For the purpose of the analysis presented here, these answers were summarised into three categories (once or more a day, at least once a week and less than once a week). The results were stratified according to gender, age group, education and federal state. A statistically significant difference between groups is assumed when confidence intervals do not overlap.

The analyses are based on the data received from 23,947 participants aged 18 and above (13,104 women and 10,843 men) with valid information on fruit consumption. Calculations were carried out using a weighting factor that corrects for deviations within the sample from the German population (as of 31 December 2014) with regard to gender, age, district type and education. The district type accounts for the degree of urbanisation and reflects the regional distribution in Germany. The International Standard Classification for Education (ISCED) was used to improve the comparability of the responses provided on educational levels [12]. A detailed description of the methodology applied in the GEDA 2014/2015-EHIS study can be found in the article German Health Update – New data for Germany and Europe published in issue 1/2017 of the Journal of Health Monitoring.

Results and discussion

The German Nutrition Society (DGE) recommends eating fruit and vegetables every day [10]. In Germany, many adults do not fulfil this recommendation. According to GEDA 2014/2015-EHIS, 54.2% of women and 38.1% of men eat fruit daily. Thus considerably more women than men eat fruit daily (Table 1 and Table 2). In the GEDA 2012 survey, 69.5% of women and 48.0% of men reported eating fruit daily [13]. Figures for vegetable consumption have also seen a similarly strong decline and this could be partly related to changes in the survey methodology (2014/2015: self-administered questionnaires; 2012: telephone interviews), as well as to different phrasing of questions and possible answers. GEDA 2012 respondents were asked on the telephone 'How often do you eat fruit?' and given the response options 'every day', 'at least once a week', 'less than once a week' and 'never'. In GEDA 2014/2015-EHIS the question was formulated in writing as shown in the Indicator section. In GEDA 2012, people might have been inclined to answer

'every day' even if they only actually consumed fruit five or six times per week. The answer categories in GEDA 2012 may have partly led to the higher reported fruit consumption as compared to GEDA 2014/2015-EHIS.

Daily consumption of fruit among women and men increases with age: Whereas only 38.0% of women and 25.5% of men aged 18 to 29 eat fruit daily, in the age group of 65 and older, the figures are 72.6% for women and 61.1% for men. Previous surveys also registered an increase in fruit consumption with age [13, 14]. Daily consumption of fruit is particularly widespread among the 65-years and older (Table 1 and Table 2). This could be due to the fact that people in this age group are more concerned both with their health and following a healthy diet. Moreover, they are less likely to be employed and, therefore, have more time to choose, buy and prepare their own food.They also cook more often every day or nearly every day than younger people [15]. In the age groups up to 65, women with higher levels of education eat significantly more often fruit every day. For men, a similar correlation between education and fruit consumption is seen only in the 45-to-65 age group. In Bavaria and Saarland, the proportion of men who consume fruit daily is significantly lower than the German

54% of women and 38% of men eat fruit daily.

Women	Once or more a day		At least once a week		Less than once a week	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Women total	**54.2**	**(53.0-55.3)**	**38.5**	**(37.4-39.6)**	**7.3**	**(6.7-8.0)**
18-29 Years	38.0	(35.5-40.7)	50.8	(48.0-53.5)	11.2	(9.5-13.2)
Low education	33.7	(27.4-40.7)	50.7	(44.3-57.1)	15.6	(11.6-20.5)
Medium education	37.5	(34.3-40.8)	51.8	(48.3-55.3)	10.7	(8.6-13.3)
High education	47.1	(42.1-52.2)	46.2	(41.1-51.4)	6.7	(4.3-10.2)
30-44 Years	44.3	(42.0-46.6)	45.6	(43.3-47.9)	10.1	(8.7-11.7)
Low education	38.6	(32.0-45.6)	45.5	(38.2-52.9)	15.9	(11.3-22.0)
Medium education	40.6	(37.7-43.5)	48.4	(45.5-51.3)	11.1	(9.2-13.2)
High education	56.7	(53.6-59.8)	38.5	(35.6-41.6)	4.7	(3.4-6.6)
45-64 Years	53.7	(51.9-55.5)	39.5	(37.8-41.2)	6.8	(6.0-7.8)
Low education	52.8	(48.5-57.2)	38.0	(33.9-42.3)	9.2	(7.1-11.7)
Medium education	51.0	(48.7-53.3)	41.9	(39.7-44.2)	7.1	(5.9-8.5)
High education	63.5	(60.9-66.1)	32.6	(30.0-35.3)	3.9	(3.0-5.0)
≥ 65 Years	72.6	(70.5-74.7)	24.1	(22.3-26.1)	3.3	(2.5-4.3)
Low education	70.1	(66.4-73.4)	25.8	(22.6-29.2)	4.2	(2.8-6.2)
Medium education	73.7	(70.9-76.3)	23.5	(21.1-26.2)	2.8	(1.9-4.1)
High education	77.9	(73.1-82.0)	20.2	(16.1-25.0)	2.0	(1.0-4.0)
Total (women and men)	**46.3**	**(45.4-47.3)**	**43.1**	**(42.1-44.0)**	**10.6**	**(10.0-11.3)**

CI=confidence interval

Table 1
Fruit consumption among women according to age and educational status (n=13,104)
Source: GEDA 2014/2015-EHIS

average. In these states, no significant differences from the German average have been observed for women. In Brandenburg, Mecklenburg-West Pomerania, Saxony, Saxony-Anhalt and Thuringia, the proportion of women and men who consume fruit daily is significantly higher than the German average (Figure 1).

Compared with vegetable consumption, the percentage rates for daily fruit consumption are significantly higher. According to the German National Nutrition Survey II, in 2006, 54% of women and 65% of men did not consume the daily recommended amount of 250 g of fruit (not including juices) [16]. Results from the German Health Interview and Examination Survey for Adults (DEGS1) show that the mean fruit consumption is 1.8 portions for women and 1.2 portions for men per day, with 26.2% of women and 13.9% of men consuming fruit several times per day (excluding juices) [17]. Increasing the consumption of fruit remains desirable, in particular among men, young adults and people with low levels of education.

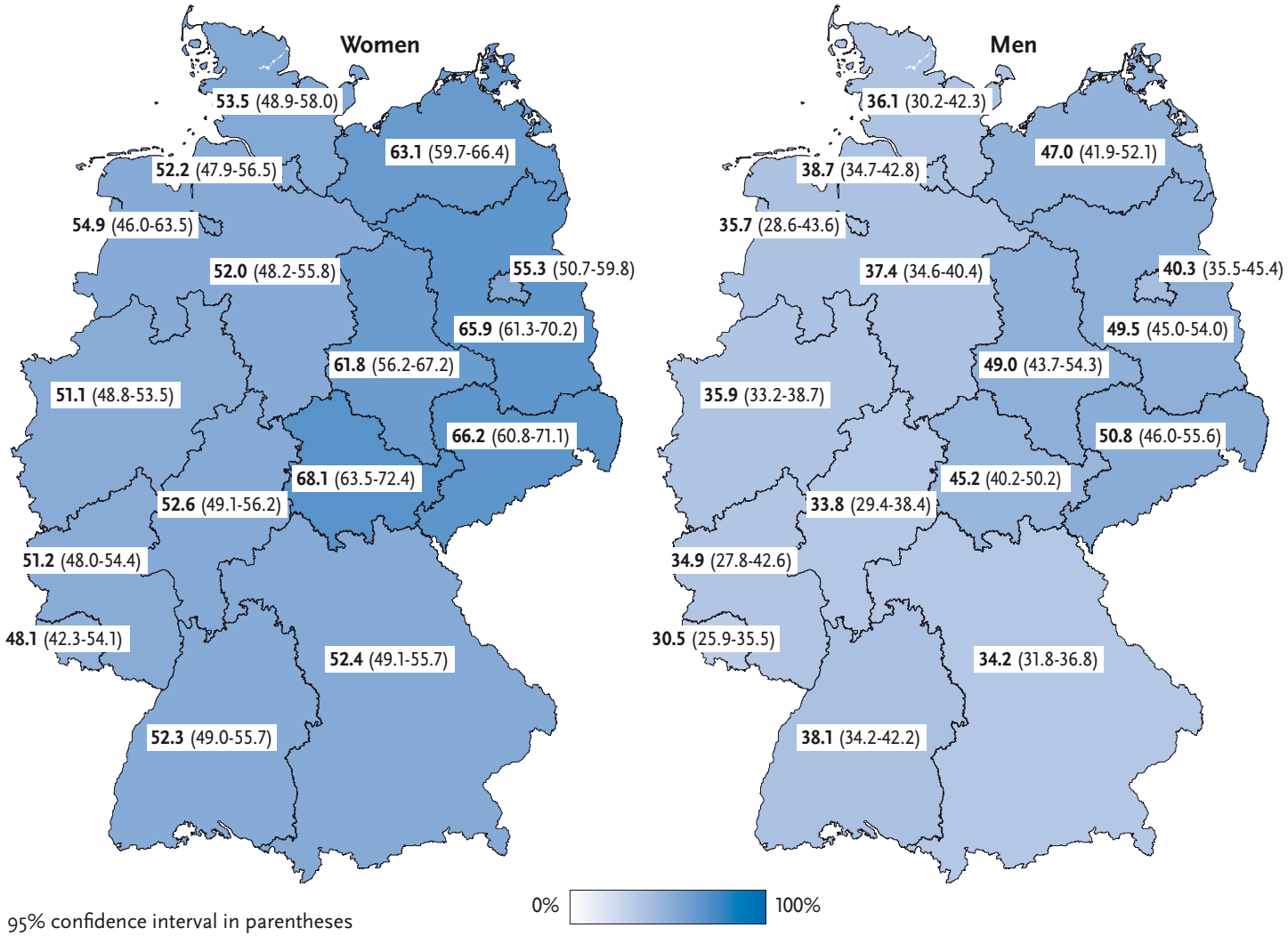
Daily fruit intake is higher with age.

Table 2
Fruit consumption among men according to age and educational status (n=10,843)
Source: GEDA 2014/2015-EHIS

Men	Once or more a day		At least once a week		Less than once a week	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Men total	**38.1**	**(36.9-39.3)**	**47.8**	**(46.5-49.1)**	**14.1**	**(13.2-15.1)**
18-29 Years	25.5	(22.7-28.4)	55.7	(52.7-58.6)	18.9	(16.4-21.6)
Low education	24.7	(19.1-31.4)	53.1	(45.8-60.4)	22.1	(16.8-28.6)
Medium education	25.5	(22.1-29.2)	55.1	(51.4-58.7)	19.4	(16.4-22.8)
High education	25.8	(20.7-31.7)	63.6	(57.3-69.4)	10.6	(7.4-15.0)
30-44 Years	28.4	(26.2-30.8)	52.8	(50.0-55.6)	18.8	(16.5-21.2)
Low education	28.8	(21.6-37.2)	45.2	(36.6-54.1)	26.0	(19.3-34.1)
Medium education	26.5	(23.6-29.6)	53.1	(49.3-56.9)	20.3	(17.3-23.8)
High education	32.4	(28.8-36.1)	55.0	(51.0-58.8)	12.7	(10.3-15.4)
45-64 Years	36.4	(34.4-38.4)	49.6	(47.5-51.7)	14.0	(12.7-15.4)
Low education	30.1	(25.5-35.1)	49.9	(44.4-55.5)	20.0	(16.2-24.5)
Medium education	36.2	(33.3-39.1)	49.1	(46.2-52.1)	14.7	(12.9-16.8)
High education	38.9	(36.3-41.5)	50.6	(48.1-53.1)	10.5	(9.0-12.2)
≥ 65 Years	61.1	(58.9-63.2)	33.2	(31.1-35.4)	5.7	(4.7-6.8)
Low education	63.5	(57.9-68.7)	30.0	(25.3-35.3)	6.5	(4.3-9.6)
Medium education	59.4	(56.3-62.4)	34.2	(31.1-37.4)	6.4	(5.0-8.2)
High education	63.1	(59.7-66.3)	32.9	(29.7-36.2)	4.0	(3.0-5.5)
Total (women and men)	**46.3**	**(45.4-47.3)**	**43.1**	**(42.1-44.0)**	**10.6**	**(10.0-11.3)**

CI=confidence interval

In the age groups up to 65, women with higher levels of education consume significantly more often fruit every day.



95% confidence interval in parentheses

Figure 1
Daily fruit consumption according to gender and German federal state (n=13,104 women; n=10,843 men)
Source: GEDA 2014/2015-EHIS

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Imprint

Journal of Health Monitoring

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Conflicts of interest
The authors declared no conflicts of interest.

Funding
The GEDA study was funded by the Robert Koch Institute and the German Federal Ministry of Health.

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

Publisher
Robert Koch Institute
Nordufer 20
D-13353 Berlin, Germany

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Typesetting
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Translation
Simon Phillips/Tim Jack

Please cite this publication as
Mensink GBM, Schienkiewitz A, Lange C (2017) Fruit consumption among adults in Germany. Journal of Health Monitoring 2(2):43–49. DOI 10.17886/RKI-GBE-2017-041

ISSN 2511-2708

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

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Journal of Health Monitoring · 2017 2(2)
DOI 10.17886/RKI-GBE-2017-042
Robert Koch Institute, Berlin

Vegetable consumption among adults in Germany

Abstract

Vegetables are part of a healthy diet and can help prevent various chronic diseases. According to the GEDA 2014/2015-EHIS study, 40.4% of women and 23.9% of men eat vegetables on a daily basis. The proportion of women who eat vegetables every day increases with age: from 31.9% of 18- to 29-year-olds to 48.3% of women aged 65 and above. Around one fifth of men under the age of 65 eat vegetables daily; this increases to 35.9% of men aged 65 or above. Across all age groups, women with higher levels of education are more likely to eat vegetables on a daily basis; the same can only be said about men in the 45 to 64 age group. Finally, women and men living in Saxony are most likely to eat vegetables every day; however, the differences between the federal states are marginal.

VEGETABLES · ADULTS · SURVEY · HEALTH MONITORING · GERMANY

Introduction

Vegetables are an important source of vitamins, minerals, trace elements, phytochemicals and dietary fibre; they can be defined as the edible parts of what are usually annual plants. A wide variety of vegetables exist, including cabbage, leafy, sprout, fruit, and root vegetables as well as bulbs, tubers and pulses. Mushrooms are also often counted as vegetables. The wide range of biologically active substances that are found in vegetables contributes to the fact that vegetable-rich diets are associated with a number of health benefits. In addition to a high nutrient density, most vegetables also contain a high volume of water and are therefore relatively low in calories [1]. At the same time, people who follow a diet containing a high proportion of vegetables usually eat other, physiologically less beneficial foods less often. Finally, as vegetables have a relatively low energy density, yet still create a substantial feeling of satiety, diets containing a high percentage of vegetables can help prevent weight gain and thus enable people to avoid obesity [1, 2].

There is convincing evidence that diets that include a large proportion of fruit and vegetables can help protect against coronary heart disease, hypertension and stroke; in addition, they can also improve the condition of patients suffering from these illnesses [1, 3-5]. A high vegetable consumption can probably help prevent various types of cancer; however, there is a marginal association between this consumption and the overall risk of cancer [1, 6-9]. Nevertheless, diets that include a large share of fruit and vegetables are associated with a lower overall risk of mortality, in particular, due to a lower risk of cardiovascular mortality [8].

For some time now, this has been reflected in the implementation of various health-policy measures aimed at encouraging people to eat more vegetables and fruit.

GEDA 2014/2015-EHIS

Data holder: Robert Koch Institute

Aims: To provide reliable information about the population's health status, health-related behaviour and health care in Germany, with the possibility of a European comparison

Method: Questionnaires completed on paper or online

Population: People aged 18 years and above with permanent residency in Germany

Sampling: Registry office sample; randomly selected individuals from 301 communities in Germany were invited to participate

Participants: 24,016 people (13,144 women; 10,872 men)

Response rate: 26.9%

Study period: November 2014 - July 2015

Data protection: This study was undertaken in strict accordance with the data protection regulations set out in the German Federal Data Protection Act and was approved by the German Federal Commissioner for Data Protection and Freedom of Information. Participation in the study was voluntary. The participants were fully informed about the study's aims and content, and about data protection. All participants provided written informed consent.

More information in German is available at www.geda-studie.de

The '5 a day' campaign, which recommends that people eat five portions of fruit and vegetables every day, is probably one of the most well-known. A portion of fruit or vegetables may occasionally be replaced by a smoothie or a glass of fruit or vegetable juice; however, the fruit or vegetable content of these drinks should be no less than 100%. A portion is defined as a handful of fruit or vegetables [10, 11].

Indicator

Eating sufficient amounts of vegetables is crucial to achieving a healthy, balanced diet. Population representative estimates of fruit consumption as an indicator of a healthy diet are, therefore, highly relevant for health policy. The GEDA 2014/2015-EHIS study assessed vegetable intake using the question: 'How often do you eat vegetables, including freshly-squeezed vegetable juices? Please do not include potatoes.' The study accepted the following responses: 'Once or more a day' '4 to 6 times a week', '1 to 3 times a week', 'Less than once a week' or 'Never'. For the analysis that follows, these answers were grouped into three categories: once or more a day, at least once a week, and less than once a week. The results are listed according to gender, age, level of education and federal state. Differences between these groups are interpreted as statistically significant if the respective confidence intervals do not overlap.

The following analyses are based on data from 23,937 participants aged 18 and over with valid information on vegetable intake (13,098 women and 10,839 men). The calculations were carried out using a weighting factor that corrects for deviations between the sample and the German population (as of 31 December 2014) with regard to gender, age, district type and education. District type reflects a particular area's degree of urbanisation and accounts for the regional distribution found in Germany. The International Standard Classification of Education (ISCED) was used to improve the comparability of the information that respondents provided about their level of education [12]. A detailed description of the methodology used in the GEDA 2014/2015-EHIS study can be found in German Health Update: New data for Germany and Europe, which was published in Issue 1/2017 of the Journal of Health Monitoring.

Results and discussion

The German Nutrition Society (DGE) recommends that people eat fruit and vegetables every day [10]. However, in Germany, many adults do not meet this recommendation. According to the GEDA 2014/2015-EHIS study, 40.4% of women and 23.9% of men eat vegetables daily. This means that almost twice as many women as men consume vegetables every day (Table 1 and Table 2). In the GEDA 2012 study, 52.5% of women and 35.8% of men reported that they ate vegetables on a day-to-day basis [13]. The substantial decline between the two studies was also observed for fruit consumption and could have partly been caused by the different survey modes that were employed (a self-administered questionnaire was used in 2014/2015, whereas a telephone interview was conducted in 2012) as well as changes that were made to the questionnaire and its associated response categories. During GEDA 2012, respondents were contacted by telephone and asked 'How often do you eat vegetables?

Please do not include potatoes'. If the respondents asked for more detail, they were told: 'Vegetables refers to raw vegetables like salad, cucumber, tomato and cooked vegetables.' The following answers were accepted: 'Every day', 'At least once a week', 'Less than once a week' and 'Never'. In the case of the GEDA 2014/2015-EHIS study, the question was asked in writing (as explained above under 'Indicator'). Importantly, the GEDA 2012 study may have resulted in a tendency among respondents to choose 'Every day', even though they only ate vegetables 5 or 6 times a week. The fact that response categories were specified in this way presumably partly explains why GEDA 2012 produced higher figures for daily intake than GEDA 2014/2015-EHIS.

Women tend to eat more vegetables on a daily basis with increasing age: in the 18-to-29 age group, 31.9% of women consume vegetables daily, with 48.3% doing so in the 65 and above age group (Table 1). About one fifth of men under the age of 65 eat vegetables every day. It is only from the age of 65 that 35.9% of men eat vegetables on a daily basis. This value is considerably higher than the figures observed among men of younger age groups (Table 2). Previous studies have also shown rising levels of vegetable intake with increasing age [13, 14].

40% of women and 24% of men in Germany eat vegetables every day.

Women	Once or more a day		At least once a week		Less than once a week	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Women total	**40.4**	**(39.3-41.5)**	**55.9**	**(54.8-57.1)**	**3.7**	**(3.3-4.1)**
18-29 Years	31.9	(29.6-34.3)	61.8	(59.3-64.2)	6.4	(5.2-7.8)
Low education	29.7	(23.8-36.3)	57.3	(50.8-63.6)	13.0	(9.3-17.9)
Medium education	29.7	(26.9-32.6)	65.2	(62.1-68.1)	5.2	(4.0-6.6)
High education	44.4	(39.2-49.6)	54.4	(49.2-59.6)	1.2	(0.6-2.5)
30-44 Years	38.2	(35.9-40.5)	57.8	(55.6-60.0)	4.0	(3.1-5.0)
Low education	29.6	(23.3-36.6)	60.7	(53.0-67.9)	9.7	(6.1-15.1)
Medium education	34.8	(31.9-37.8)	61.6	(58.7-64.4)	3.6	(2.7-4.8)
High education	51.2	(48.0-54.4)	47.1	(43.9-50.3)	1.6	(1.0-2.7)
45-64 Years	39.7	(38.0-41.4)	57.2	(55.5-58.9)	3.1	(2.6-3.7)
Low education	34.5	(30.4-38.8)	60.5	(56.0-64.7)	5.1	(3.5-7.4)
Medium education	37.0	(34.9-39.1)	60.1	(57.9-62.2)	3.0	(2.3-3.8)
High education	53.3	(50.4-56.3)	44.9	(41.9-47.9)	1.8	(1.1-2.7)
≥ 65 Years	48.3	(46.0-50.6)	49.1	(46.8-51.5)	2.6	(2.0-3.4)
Low education	47.2	(43.3-51.1)	49.8	(46.0-53.6)	3.1	(2.0-4.6)
Medium education	46.7	(43.5-50.1)	50.8	(47.5-54.2)	2.4	(1.6-3.6)
High education	60.9	(55.6-65.9)	37.6	(32.7-42.8)	1.5	(0.6-3.9)
Total (women and men)	**32.3**	**(31.5-33.2)**	**62.1**	**(61.3-62.9)**	**5.6**	**(5.2-6.0)**

CI=confidence interval

Table 1
Vegetable intake among women according to age and educational status (n=13,098)
Source: GEDA 2014/2015-EHIS

In fact, daily vegetable intake is most common in the age group of 65 and older. This could be due to the fact that people in this age group are more concerned both with their health and following a healthy diet. Moreover, they are less likely to be employed and, therefore, have more time to choose, buy and prepare their own food. They also cook more often than younger people, preparing their own meals every day or almost every day [15]. Across all age groups, women with higher levels of education are significantly more likely to eat vegetables on a daily basis. Among men, the only significant difference linked to educational levels is found among 45- to 64-year-olds. For both genders together, vegetable intake in Saxony is significantly higher than the national average; however, for women and men separately there is no significant difference. No other significant differences were identified between the federal states (Figure 1).

Percentage shares of daily vegetable intake are markedly lower than for fruit. According to analyses of the German National Nutrition Survey II, in 2006, 86.3% of women and 88.5% of men did not meet the recommendations made by the German Nutrition Society (an intake of 400 g of vegetables per day, not including juices) [16]. According to the results of the German Health Interview and

Daily vegetable intake among women is higher with age.

Men	Once or more a day		At least once a week		Less than once a week	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Men total	**23.9**	**(22.9-25.0)**	**68.6**	**(67.4-69.7)**	**7.5**	**(6.8-8.3)**
18-29 Years	20.1	(17.9-22.6)	67.6	(64.8-70.2)	12.3	(10.3-14.6)
Low education	23.5	(18.5-29.4)	58.5	(52.2-64.6)	18.0	(13.1-24.1)
Medium education	18.0	(15.3-21.2)	70.5	(67.0-73.8)	11.5	(9.0-14.4)
High education	23.3	(18.5-29.0)	71.2	(65.3-76.4)	5.5	(3.3-9.1)
30-44 Years	19.1	(17.3-21.1)	72.4	(70.3-74.5)	8.5	(7.1-10.1)
Low education	18.6	(13.0-25.8)	68.9	(61.3-75.6)	12.6	(7.9-19.4)
Medium education	16.4	(13.9-19.2)	74.1	(71.0-77.0)	9.5	(7.6-11.8)
High education	24.7	(21.7-28.1)	70.7	(67.1-74.0)	4.6	(3.2-6.5)
45-64 Years	21.6	(20.2-23.0)	71.3	(69.6-72.9)	7.2	(6.3-8.1)
Low education	17.2	(13.8-21.2)	66.9	(62.2-71.2)	15.9	(12.6-19.9)
Medium education	19.3	(17.4-21.3)	73.2	(70.9-75.4)	7.5	(6.3-8.9)
High education	27.0	(24.8-29.4)	69.5	(67.0-71.9)	3.5	(2.7-4.5)
≥ 65 Years	35.9	(33.7-38.3)	60.8	(58.5-63.2)	3.2	(2.5-4.1)
Low education	35.2	(30.5-40.2)	60.7	(55.4-65.7)	4.1	(2.5-6.7)
Medium education	33.5	(30.1-37.0)	63.3	(59.7-66.7)	3.3	(2.3-4.5)
High education	40.9	(37.7-44.2)	56.3	(53.1-59.5)	2.8	(1.9-4.1)
Total (women and men)	**32.3**	**(31.5-33.2)**	**62.1**	**(61.3-62.9)**	**5.6**	**(5.2-6.0)**

CI=confidence interval

Table 2
Vegetable intake among men according to age and educational status (n=10,839)
Source: GEDA 2014/2015-EHIS

Examination Survey for Adults (DEGS1), women in Germany eat an average of 1.0 portions of vegetables per day; for men, the figure stands at 0.8 [17]. Therefore, an even greater increase in vegetable intake needs to be achieved in comparison to fruit intake, especially among men, young adults and people with lower levels of education.

Across all age groups, women with higher levels of education are more likely to eat vegetables on a daily basis.

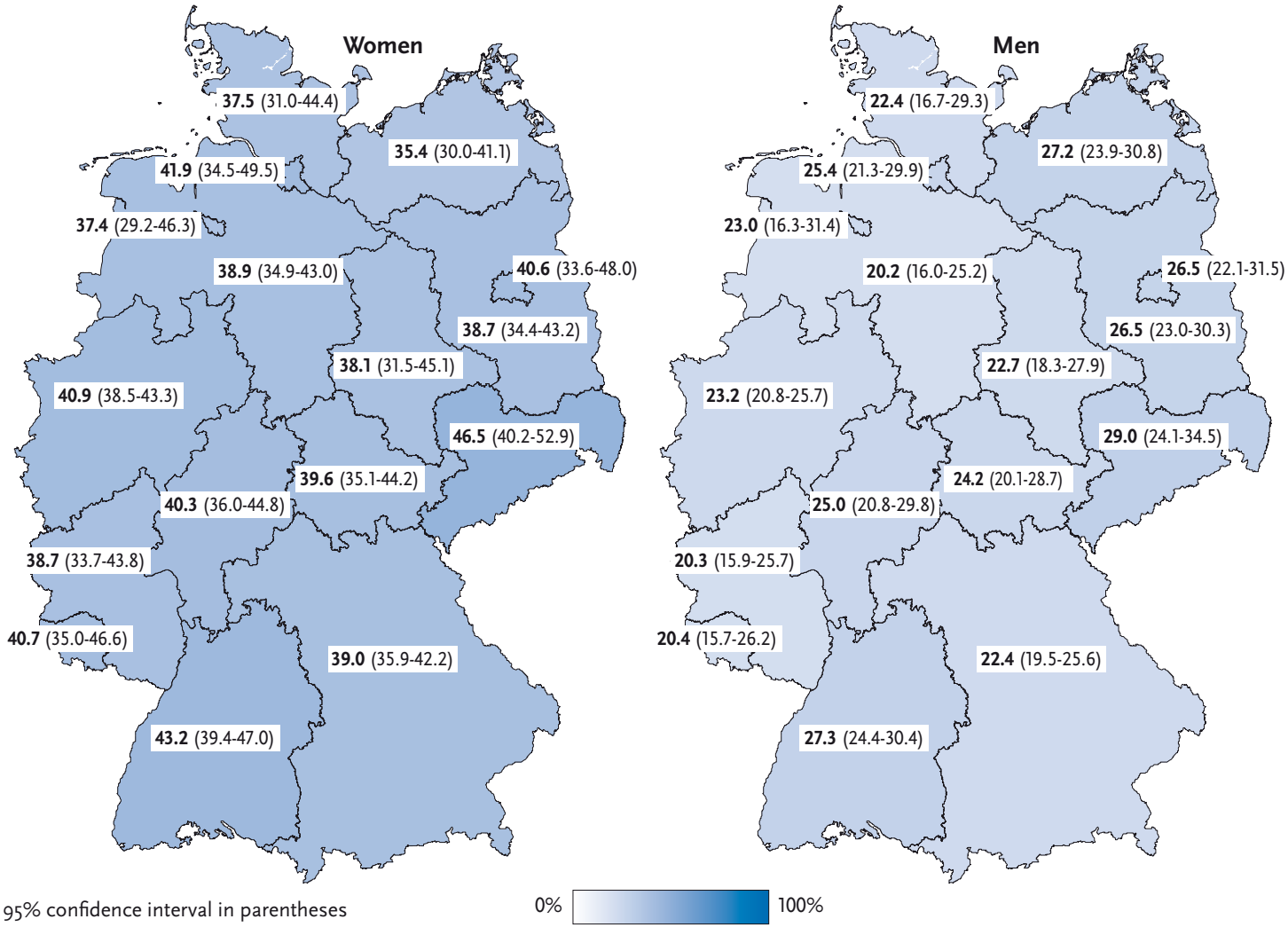

Figure 1
Daily intake of vegetables according to gender and German federal state (n=13,098 women; n=10,839 men)
Source: GEDA 2014/2015-EHIS

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Imprint

Journal of Health Monitoring

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Conflicts of interest
The authors declared no conflicts of interest.

Funding
The GEDA study was funded by the Robert Koch Institute and the German Federal Ministry of Health.

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

Publisher
Robert Koch Institute
Nordufer 20
D-13353 Berlin, Germany

Editors
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Typesetting
Gisela Dugnus, Alexander Krönke, Kerstin Möllerke

Translation
Simon Phillips/Tim Jack

Please cite this publication as
Mensink GBM, Schienkiewitz A, Lange C (2017) Vegetable consumption among adults in Germany. Journal of Health Monitoring 2(2):50–56. DOI 10.17886/RKI-GBE-2017-042

ISSN 2511-2708

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

Authors:
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Journal of Health Monitoring · 2017 2(2)
DOI 10.17886/RKI-GBE-2017-043
Robert Koch Institute, Berlin

Smoking among adults in Germany

Abstract

Smoking poses a considerable health risk and is the leading cause of premature death. Germany has implemented numerous measures (such as tax increases, protection of non-smokers, and cigarette warning labels) to reduce the population's tobacco consumption. According to the GEDA 2014/15–EHIS survey, 20.8% of women and 27.0% of men aged 18 and over smoke at least occasionally. For both genders, the share of smokers is highest among the younger age groups. Among women and men with higher levels of education, smoking is far less common than among those with lower levels of education. Since 2003, the share of smokers in the adult population has decreased. Compared to other European countries, and in spite of making considerable progress in tobacco prevention policy, Germany still has great potential for improvement in many areas, such as bans on tobacco adverts and tobacco taxation.

SMOKING · ADULTS · EDUCATION · HEALTH MONITORING · GERMANY

Introduction

In industrialised countries and a growing number of emerging nations, smoking is the single most important preventable health risk and the leading cause of premature death. Globally, tobacco consumption is responsible for around five million deaths annually; including the deaths caused by the effects of passive smoking, this figure rises to nearly six million [1, 2]. Estimates for Germany reckon with around 121,000 smoking-related deaths in 2013, a 13.5% share of all deaths [3]. Smoking contributes to cardiovascular diseases, respiratory diseases, and cancer, among other illnesses [4].

Over the past twenty years, Germany has implemented numerous measures to reduce the population's consumption of tobacco. Most importantly, between 2002 and 2005, the country significantly increased the tax on tobacco products. Further important steps included legislation to protect people from passive smoking at work, the prohibition of selling tobacco to people under the age of 18, restrictions on tobacco advertising, and federal and state legislation for the protection of non-smokers [5]. Since May 2016, labels on cigarette packs that combine a written warning with what are known as shock pictures have been mandatory in Germany. These must cover 65% of the area on the front and back of cigarette packs. Moreover, laws in Germany regulate the sale and consumption of electronic inhalation products. These measures were accompanied by the national health target for reducing tobacco consumption, an initiative that began in 2003, was evaluated in 2009, and was finally updated in 2015 [6, 7]. Furthermore,

GEDA 2014/2015-EHIS

Data holder: Robert Koch Institute

Aims: To provide reliable information about the population's health status, health-related behaviour and health care in Germany, with the possibility of a European comparison

Method: Questionnaires completed on paper or online

Population: People aged 18 years and above with permanent residency in Germany

Sampling: Registry office sample; randomly selected individuals from 301 communities in Germany were invited to participate

Participants: 24,016 people (13,144 women; 10,872 men)

Response rate: 26.9%

Study period: November 2014 - July 2015

Data protection: This study was undertaken in strict accordance with the data protection regulations set out in the German Federal Data Protection Act and was approved by the German Federal Commissioner for Data Protection and Freedom of Information. Participation in the study was voluntary. The participants were fully informed about the study's aims and content, and about data protection. All participants provided written informed consent.

More information in German is available at www.geda-studie.de

in the context of the country's sustainability strategy, Germany is striving to reduce the share of smokers in the population [8]. At the international level, the WHO's Framework Convention on Tobacco Control (FCTC) came into effect on 2005 as the first global health agreement, which has since been implemented by most countries, including Germany [3, 9].

Indicator

In the GEDA 2014/2015-EHIS questionnaire, the relevant question to measure smoking status is: 'Do you smoke?' (answer categories: 'yes, daily', 'yes, occasionally', 'no, not any more', 'I have never smoked'). Based on these answer categories, the survey subsequently distinguishes between current smokers (daily or occasionally), former smokers, and non-smokers. Previous health surveys determined smoker status in a similar way, which makes it possible to draw conclusions about developments over time and trends [10, 11]. The results are stratified according to gender, age, education, and, for current smokers, according to gender and federal state.

The analyses are based on the data received from 23,960 respondents aged 18 and above (13,108 women, 10,852 men) with valid answers on smoking status. Calculations were carried out using a weighting factor that corrects for deviations within the sample from the German population structure (as of 31 December 2014) with regard to gender, age, district type, and education. The International Standard Classification of Education (ISCED) was used to ensure that the responses provided on educational levels were comparable [12]. A detailed description of the methodology applied in the GEDA 2014/2015-EHIS study can be found in the article German Health Update – New data for Germany and Europe in issue 1/2017 of the Journal of Health Monitoring.

Results and discussion

Currently, 20.8% of women and 27.0% of men in Germany smoke at least occasionally (Table 1 and Table 2). 52.6% of women and 38.0% of men have never smoked. Among both genders, the share of current smokers is highest in the younger age groups. The percentage of male smokers begins to drop at the age of 45. A significant drop in the percentage of female smokers does not occur until age 65. Among both genders, smoking is far less widespread in the groups with higher levels of education than those with lower levels. With the exception of the 65-plus age group, where no significant differences regarding the educational level appear, this clear link between smoking and education is evident across all other age groups. Moreover regional differences exist in the percentage of smokers in the population. The percentage of male smokers is highest in Saxony-Anhalt and lowest in Bavaria. The percentage of female smokers is lowest in Saxony and highest in Bremen. The percentage of smokers tends to be higher in the north than in the south, higher in the east than in the west, and higher in the federal city-states than in the territorial federal states (Figure 1). In EU member state comparison, Germany is in the middle third for female smoking prevalence and the lower third for male smoking prevalence. A more detailed description of the German results in European perspective is included in the article Health-related behaviour in Europe - a comparison of selected indicators

for Germany and the European Union in this issue of the Journal of Health Monitoring [13]. Data from previous Robert Koch Institute (RKI) health surveys reveals that, among the adult population, the percentage of female smokers has dropped by a good eight percentage points and of male smokers by a good eleven percentage points since 2003 [14]. Other surveys, such as the micro census and the Epidemiological Survey of Substance Abuse (ESA), also indicate a decline in the number of adult smokers [15, 16]. Most noteworthy is that ever fewer adolescents are taking up smoking. According to data from the Federal Centre for Health Education, the percentage of 12- to 17-year-old girls who smoke at least occasionally declined from 23% to 8% between 2004 and 2015, and among boys in the same age group from 24% to 8% [17]. Results from the RKI's German Health Interview and Examination Survey for Children and Adolescents (KiGGS) [18, 19] and the international Health Behaviour in School-aged Children (HBSC) survey [20] equally indicate a clear decline in the prevalence of smoking among adolescents. The impact of the increased use of electronic inhalation products (e-cigarettes) and the entry of the large tobacco corporations into this market remains to be seen. For those engaged in tobacco prevention, the damaging or

21% of women and 27% of men aged 18 and over smoke at least occasionally.

Women	Smokers (daily or occasionally)		Former smokers		Non-smokers	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Women total	**20.8**	**(19.9-21.7)**	**26.6**	**(25.6-27.6)**	**52.6**	**(51.4-53.8)**
18-29 Years	28.4	(26.3-30.7)	15.9	(13.9-18.0)	55.7	(53.0-58.4)
Low education	34.7	(28.6-41.4)	16.7	(12.2-22.6)	48.5	(42.2-54.9)
Medium education	28.3	(25.5-31.2)	15.7	(13.4-18.3)	56.1	(52.8-59.2)
High education	19.5	(15.8-23.8)	15.6	(12.2-19.8)	64.9	(59.6-69.8)
30-44 Years	26.9	(24.8-29.1)	27.0	(24.9-29.1)	46.1	(43.9-48.4)
Low education	37.0	(30.5-44.0)	24.0	(18.0-31.2)	39.0	(32.4-46.1)
Medium education	29.8	(27.0-32.8)	27.1	(24.6-29.8)	43.0	(40.2-46.0)
High education	14.2	(11.9-17.0)	28.5	(25.1-32.1)	57.3	(53.2-61.3)
45-64 Years	24.2	(22.8-25.6)	32.4	(30.8-34.0)	43.4	(41.6-45.2)
Low education	29.8	(25.8-34.1)	30.6	(26.8-34.6)	39.7	(35.4-44.0)
Medium education	25.3	(23.5-27.2)	32.8	(30.8-34.9)	41.8	(39.6-44.1)
High education	15.1	(13.3-17.2)	32.7	(30.3-35.3)	52.1	(49.4-54.8)
≥ 65 Years	6.8	(5.8-7.9)	24.9	(22.9-27.0)	68.3	(65.9-70.6)
Low education	5.9	(4.6-7.5)	20.1	(17.4-23.0)	74.0	(70.9-76.9)
Medium education	7.5	(6.1-9.2)	28.3	(25.2-31.5)	64.2	(60.7-67.7)
High education	5.9	(4.0-8.5)	29.4	(24.7-34.6)	64.7	(59.3-69.8)
Total (women and men)	**23.8**	**(23.1-24.6)**	**30.7**	**(29.9-31.5)**	**45.5**	**(44.6-46.4)**

CI=confidence interval

Table 1
Smoker status among women according to age and educational status (n=13,108)
Source: GEDA 2014/2015-EHIS

beneficial effects regarding smoking cessation of this group of products remains a highly controversial issue [21].

In spite of Germany's progress in tobacco prevention policy, much room remains for further progress in numerous fields. Out of the 35 countries assessed in the tobacco control scale, which compares countries with regard to their efforts in tobacco prevention policy, Germany currently ranks second to last [22]. Germany therefore has great potential for improvement, in particular concerning taxation, smoke-free areas, bans on advertising, prevention campaigns, and providing people with support to quit tobacco.

Since 2003, the share of smokers in the German population has decreased.

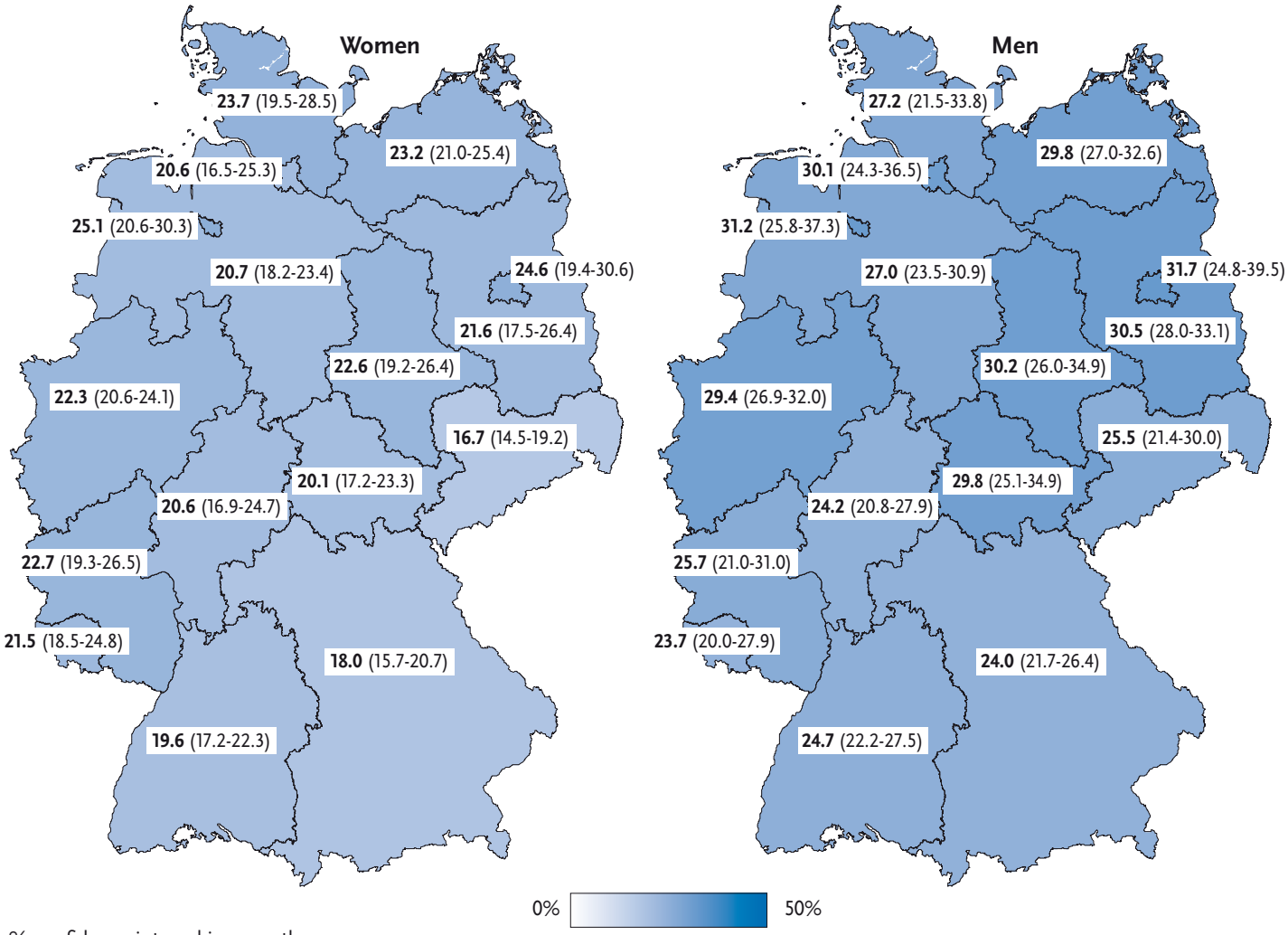
Men	Smokers (daily or occasionally)		Former smokers		Non-smokers	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Men total	**27.0**	**(25.9-28.1)**	**35.0**	**(34.0-36.1)**	**38.0**	**(36.9-39.1)**
18-29 Years	35.1	(32.1-38.3)	12.3	(10.4-14.5)	52.6	(49.4-55.7)
Low education	40.6	(33.7-47.9)	14.8	(10.6-20.2)	44.6	(37.8-51.6)
Medium education	34.5	(30.8-38.4)	11.8	(9.6-14.5)	53.7	(50.0-57.3)
High education	27.4	(22.0-33.6)	9.9	(7.0-13.8)	62.7	(56.2-68.7)
30-44 Years	35.7	(33.2-38.3)	28.3	(25.9-30.8)	36.0	(33.5-38.6)
Low education	48.1	(40.4-56.0)	23.1	(16.9-30.8)	28.7	(21.9-36.7)
Medium education	37.6	(34.2-41.1)	31.4	(28.1-35.0)	31.0	(27.7-34.5)
High education	26.4	(23.2-30.0)	24.8	(21.6-28.4)	48.7	(44.9-52.5)
45-64 Years	28.3	(26.7-30.1)	37.8	(36.1-39.6)	33.8	(32.2-35.6)
Low education	37.5	(32.6-42.7)	36.5	(31.0-42.4)	26.0	(21.5-31.0)
Medium education	31.5	(29.1-34.0)	38.6	(36.0-41.3)	29.9	(27.5-32.5)
High education	19.4	(17.4-21.6)	36.4	(33.8-39.2)	44.2	(41.4-46.9)
≥ 65 Years	9.2	(8.0-10.4)	55.5	(53.2-57.7)	35.4	(33.3-37.5)
Low education	8.6	(5.9-12.2)	54.2	(48.6-59.7)	37.2	(32.1-42.6)
Medium education	9.3	(7.6-11.3)	56.5	(53.2-59.7)	34.2	(31.3-37.3)
High education	9.3	(7.6-11.3)	53.8	(50.4-57.1)	36.9	(33.9-40.0)
Total (women and men)	**23.8**	**(23.1-24.6)**	**30.7**	**(29.9-31.5)**	**45.5**	**(44.6-46.4)**

CI=confidence interval

Table 2
Smoker status among men according to age and educational status (n=10,852)
Source: GEDA 2014/2015-EHIS

Among both genders, the share of current smokers is highest in the younger age groups.

Among both women and men, smoking is much more widespread in groups with lower levels of education.



95% confidence interval in parentheses

Figure 1
Current smokers according to gender and German federal state (n=13,108 women; n=10,852 men)
Source: GEDA 2014/2015-EHIS

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Imprint

Journal of Health Monitoring

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Conflicts of interest
The authors declared no conflicts of interest.

Funding
The GEDA study was funded by the Robert Koch Institute and the German Federal Ministry of Health.

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

Publisher
Robert Koch Institute
Nordufer 20
D-13353 Berlin, Germany

Editors
Susanne Bartig, Johanna Gutsche, Dr. Franziska Prütz, Martina Rabenberg, Alexander Rommel, Dr. Anke-Christine Saß, Stefanie Seeling, Martin Thißen, Dr. Thomas Ziese
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Typesetting
Gisela Dugnus, Alexander Krönke, Kerstin Möllerke

Translation
Simon Phillips/Tim Jack

Please cite this publication as
Zeiher J, Kuntz B, Lange C (2017) Smoking among adults in Germany. Journal of Health Monitoring 2(2):57–63.
DOI 10.17886/RKI-GBE-2017-043

ISSN 2511-2708

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

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Journal of Health Monitoring · 2017 2(2)
DOI 10.17886/RKI-GBE-2017-044
Robert Koch Institute, Berlin

Alcohol consumption among adults in Germany: risky drinking levels

Abstract

Consuming harmful amounts of alcohol is considered a contributing factor in over 200 diseases. Women who drink over 10 g and men who drink more than 20 g of pure alcohol daily are already consuming risky amounts. According to GEDA 2014/2015-EHIS data, 13.8% of women and 18.2% of men consume risky amounts of alcohol at least weekly. The consumption of potentially dangerous levels of alcohol is most widespread in the 45-64 age group. Across all age groups, the prevalence of risky alcohol consumption patterns is higher among highly educated women compared to women with a lower level of education. For men, this pattern only appears in those aged 65 and over. Preventive measures including social and environmental interventions and responsible drinking campaigns should contribute to further reducing risky alcohol consumption among the population.

ALCOHOL · RISKY CONSUMPTION · ADULTS · HEALTH MONITORING · GERMANY

Introduction

Alcohol is a potentially addictive psychoactive substance. Consuming harmful levels of alcohol is considered a contributing factor to over 200 diseases; globally, it is among the five key risk factors for disease, impairment and death [1]. In addition, to the impacts harmful amounts of alcohol can potentially have on a person's health, the World Health Organization (WHO) also highlights the socioeconomic costs for individuals who drink and the consequences for others and society in general [1]. For society, the consequences of people consuming harmful levels of alcohol include the direct costs to the health system, as well as the costs related to the loss of productivity and immaterial costs such as the loss of quality of life. In Germany, alcohol consumption is estimated to cost the economy around EUR 40 billion annually, with around one quarter of this sum being spent directly on the health care system [2, 3]. To reduce harmful levels of consumption among the population, the WHO has developed global and European strategies [4, 5]. In its Global Action Plan for the Prevention and Control of Non-communicable Diseases, the WHO aims to reduce risky consumption by 10 percent by 2025 (with 2010 as a baseline) [6]. Germany's national health target 'Reduce alcohol consumption', initially published in 2015, is in part based on the WHO approach [7]. Statistics for alcohol consumption and trend analyses show alcohol consumption is on the decline in Germany [8]. Nonetheless, this fundamentally positive development cannot conceal the fact that per capita alcohol consumption in

GEDA 2014/2015-EHIS

Data holder: Robert Koch Institute

Aims: To provide reliable information about the population's health status, health-related behaviour and health care in Germany, with the possibility of a European comparison

Method: Questionnaires completed on paper or online

Population: People aged 18 years and above with permanent residency in Germany

Sampling: Registry office sample; randomly selected individuals from 301 communities in Germany were invited to participate

Participants: 24,016 people (13,144 women; 10,872 men)

Response rate: 26.9%

Study period: November 2014 - July 2015

Data protection: This study was undertaken in strict accordance with the data protection regulations set out in the German Federal Data Protection Act and was approved by the German Federal Commissioner for Data Protection and Freedom of Information. Participation in the study was voluntary. The participants were fully informed about the study's aims and content, and about data protection. All participants provided written informed consent.

More information in German is available at www.geda-studie.de

Germany remains far higher than the average of EU member states [9] and that Germany's efforts to implement regulatory measures to reduce harmful levels of drinking are far more tentative than the EU average [10].

Indicator

The consumption of risky amounts of alcohol (risky consumption) is a consumption pattern that implies an increased risk for physical and mental health. 10-12 g of pure alcohol daily for women and 20-24 g for men [11, 12] is considered the limit beyond which alcohol poses a health risk. To survey the frequency and amounts of alcohol being consumed [13] the German Health Update 2014/2015-EHIS (GEDA 2014/2015-EHIS) survey applied an instrument from the European Health Interview Survey (EHIS). Based on the Alcohol Use Disorder Identification Test – Consumption Questions (AUDIT-C) [14], the EHIS instrument first ascertains the frequency of alcohol consumption during the past twelve months and then differentiates this information according to the number of standard drinks consumed on weekdays (Monday to Thursday) and weekends (Friday to Sunday). This information makes it possible to define the amount of pure alcohol consumed per day among those who drink every week, as well as the share of people who drink more (or less) than the defined threshold values (consumption of over 10 g of pure alcohol daily for women and over 20 g for men) (the categories are: risky consumption and non-risky consumption). Moreover, the questionnaire registers the number of people who never drink alcohol or who did not drink alcohol during the past 12 months (category non-drinkers), as well as those, who do not drink alcohol every week (category non-weekly consumption). The results are stratified according to gender, age and education and, for risky consumption, according to gender and federal state. A statistically significant difference between groups is assumed where confidence intervals do not overlap.

The analyses are based on the data received from 23,561 participants aged 18 and above (12,913 women and 10,648 men) who provided valid responses on alcohol consumption. Calculations are weighted to account for disparities between the sample and the overall population structure (as of 31 December 2014) with regard to gender, age, type of municipality and education. The type of municipality category reflects the degree of urbanisation and corresponds to the regional distribution in Germany. To ensure comparability of answers, the International Standard Classification of Education (ISCED) was used [15]. A detailed description of the methodology employed in GEDA 2014/15-EHIS is included in German Health Update – New data for Germany and Europe in issue 1/2017 of the Journal of Health Monitoring.

Results and discussion

16.9% of women and 10.3% of men never drink alcohol. 13.8% of women and 18.2% of men drink risky amounts of alcohol at least weekly. Consuming risky amounts of alcohol is therefore significantly more widespread among men than women. When data are stratified according to age groups, the prevalence is highest among the 45- to 64-year-olds (17.2% of women and 21.7% of men, Table 1 and Table 2). With the exception of the 30-44 age group,

the prevalence of risky consumption is higher among highly educated women than among those with lower levels of education. Results from the German Health Interview and Examination Survey for Adults (DEGS1) [8] and further international surveys [16, 17] provide similar findings. For highly educated men over 65, the same pattern of higher rates of risky consumption is shown as among women. In the 18-64 age group, no notable association between education and risky consumption exists. The prevalence of risky levels of consumption in each of the federal states shows no notable differences to the average prevalence across Germany. Among men, the share of those who consume risky amounts of alcohol is lowest in Schleswig-Holstein (14.7%). With over 22%, this share is significantly higher in Berlin, Saxony and Thuringia. The prevalence of risky levels of consumption among women is significantly higher in Hamburg (16.7%) than in Brandenburg (9.4%) (Figure 1).

Instruments such as the index used in GEDA 2014/2015-EHIS (based on the EHIS instrument) to measure frequency and amounts of alcohol consumed rely on the self-assessment of interviewees, whereby memory, the correct judgement of glass sizes, as well as social pressure to give certain answers (known as

14% of women and 18% of men drink harmfully high levels of alcohol.

Women		Non-drinkers		Non-weekly consumption		Non-risky consumption		Risky consumption	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Women total	**16.9**	**(15.9-17.8)**	**47.1**	**(45.9-48.4)**	**22.2**	**(21.2-23.1)**	**13.8**	**(13.0-14.7)**
18-29 Years	15.0	(12.8-17.4)	56.9	(54.1-59.6)	15.3	(13.6-17.3)	12.8	(11.1-14.7)
Low education	26.5	(20.4-33.6)	55.5	(48.6-62.2)	8.9	(5.9-13.4)	9.1	(6.1-13.4)
Medium education	11.7	(9.6-14.2)	59.7	(56.6-62.7)	15.5	(13.3-18.0)	13.1	(11.0-15.5)
High education	10.7	(7.9-14.2)	47.5	(42.4-52.7)	24.4	(20.1-29.2)	17.4	(14.0-21.4)
30-44 Years	16.5	(14.8-18.3)	52.0	(49.8-54.3)	20.5	(18.6-22.4)	11.0	(9.5-12.8)
Low education	27.8	(21.6-35.0)	53.1	(45.9-60.2)	11.4	(7.7-16.6)	7.7	(4.5-12.7)
Medium education	15.0	(12.9-17.4)	54.1	(51.1-56.9)	20.3	(17.9-22.9)	10.6	(8.9-12.7)
High education	13.6	(11.6-15.9)	46.7	(43.5-50.0)	25.8	(22.9-28.8)	13.9	(11.2-17.2)
45-64 Years	12.5	(11.5-13.7)	44.2	(42.5-45.9)	26.1	(24.7-27.6)	17.2	(15.9-18.6)
Low education	21.5	(18.0-25.3)	45.0	(40.4-49.6)	22.1	(18.1-26.5)	11.5	(8.9-14.7)
Medium education	11.5	(10.2-13.0)	46.6	(44.5-48.7)	25.5	(23.7-27.4)	16.3	(14.7-18.1)
High education	7.9	(6.5-9.6)	35.4	(32.7-38.1)	31.5	(28.8-34.2)	25.3	(22.8-28.0)
≥ 65 Years	24.3	(22.3-26.4)	40.9	(38.8-43.1)	22.5	(20.6-24.5)	12.2	(10.7-13.9)
Low education	32.1	(28.7-35.6)	41.2	(37.6-44.8)	18.0	(15.2-21.2)	8.8	(6.9-11.1)
Medium education	19.5	(17.0-22.2)	41.6	(38.3-45.1)	25.6	(22.8-28.5)	13.3	(11.2-15.9)
High education	17.4	(12.9-23.1)	35.9	(31.1-41.1)	25.3	(21.2-30.0)	21.3	(17.7-25.5)
Total (women and men)	**13.7**	**(13.0-14.4)**	**38.9**	**(38.0-39.8)**	**31.4**	**(30.6-32.3)**	**16.0**	**(15.3-16.6)**

CI=confidence interval

Table 1
Alcohol consumption among women according to age and educational status (n=12,913)
Source: GEDA 2014/2015-EHIS

social desirability bias) may all influence results. Consuming larger amounts of alcohol on one occasion, otherwise referred to as heavy episodic drinking, is another risky form of alcohol consumption; however, this behaviour is not considered in this article. Specific analysis of heavy episodic drinking can be found on the Fact sheet Alcohol consumption among adults in Germany: heavy episodic drinking. As the survey tool and indicator are no longer the same as in previous GEDA survey waves, no conclusions can be drawn concerning trends. Results from other surveys, however, can help contextualise the results. According to data from the Epidemiological Survey of Substance Abuse 2015 for the 18-64 age group, 13.4% of women and 17.0% of men reported drinking risky amounts of alcohol during the past 30 days (consumption of over 12 g of pure alcohol daily for women and over 24 g for men) [18]. According to DEGS1 results, 13.1% of women and 18.5% of men in the 18-79 age group reported drinking over 10 g (women) and 20 g (men) of pure alcohol per day on average during the past four weeks [8]. The association between social status and alcohol consumption, which the survey analysed, is comparable to the results suggested by GEDA data. Even though the corresponding

The prevalence of risky alcohol consumption is highest for women and men in the 45-64 age group (17% of women, 22% of men).

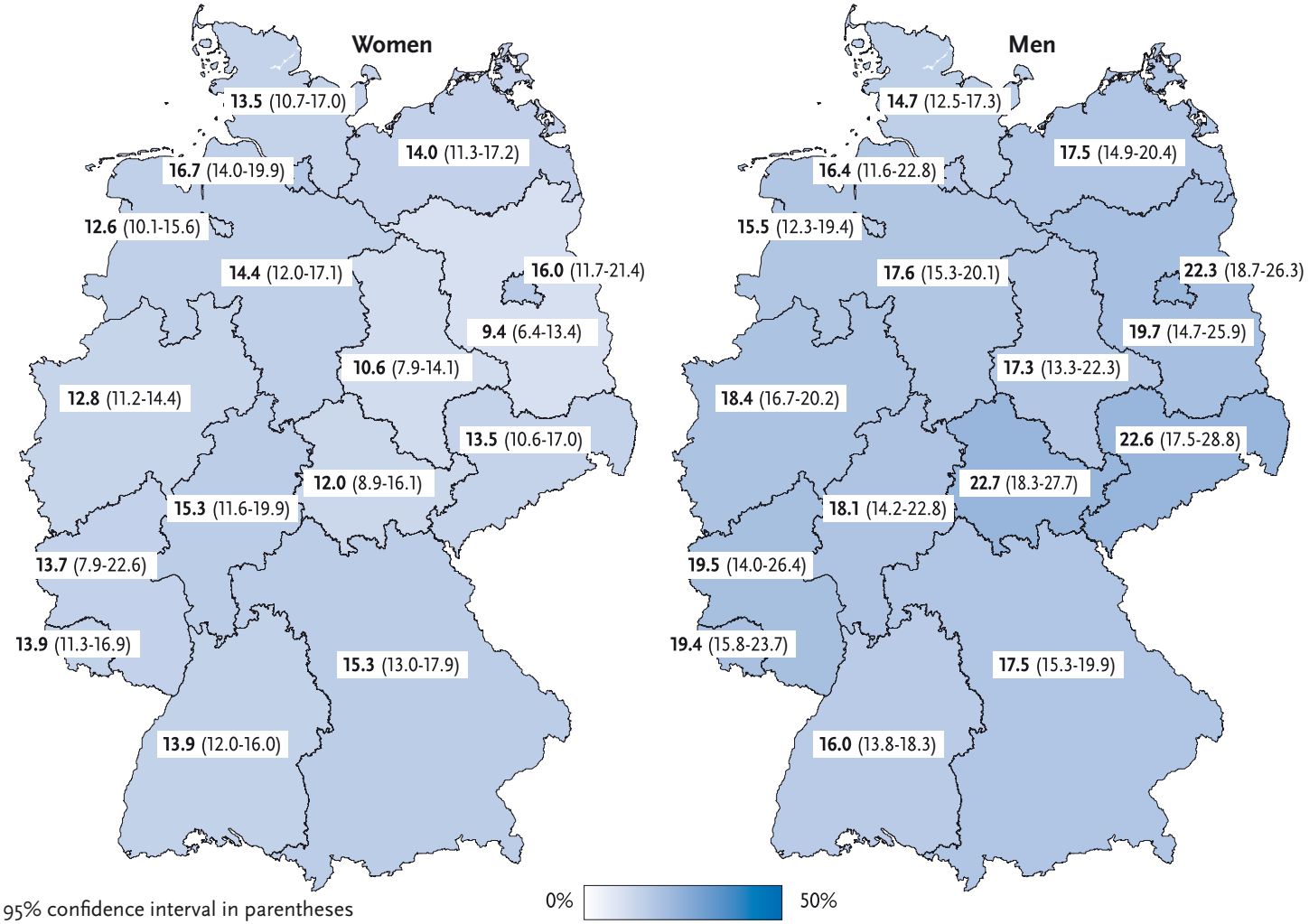
Men	Non-drinkers		Non-weekly consumption		Non-risky consumption		Risky consumption	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Men total	**10.3**	**(9.6-11.2)**	**30.3**	**(29.2-31.5)**	**41.1**	**(39.8-42.5)**	**18.2**	**(17.3-19.1)**
18-29 Years	10.5	(8.5-12.8)	39.2	(36.1-42.4)	33.1	(30.1-36.2)	17.3	(15.2-19.6)
Low education	14.1	(9.9-19.7)	43.2	(36.4-50.3)	24.3	(18.7-30.9)	18.4	(13.4-24.9)
Medium education	10.1	(7.9-12.7)	39.0	(35.4-42.6)	33.4	(29.8-37.2)	17.6	(15.1-20.4)
High education	5.4	(3.0-9.4)	33.5	(28.2-39.2)	47.3	(41.3-53.4)	13.8	(10.2-18.4)
30-44 Years	9.4	(7.9-11.1)	36.9	(34.3-39.5)	40.3	(37.7-42.8)	13.5	(11.8-15.4)
Low education	22.8	(16.5-30.8)	33.5	(26.1-41.8)	26.8	(20.1-34.6)	16.9	(11.6-23.9)
Medium education	8.6	(6.7-10.9)	40.1	(36.4-44.0)	38.5	(34.9-42.2)	12.8	(10.5-15.5)
High education	5.4	(3.9-7.4)	32.1	(28.6-35.8)	49.6	(45.8-53.4)	13.0	(10.6-15.8)
45-64 Years	10.0	(9.0-11.1)	25.3	(23.7-27.0)	43.0	(41.1-44.9)	21.7	(20.2-23.3)
Low education	16.5	(12.8-21.0)	31.2	(26.6-36.1)	30.9	(25.9-36.4)	21.4	(17.7-25.7)
Medium education	11.0	(9.6-12.6)	26.5	(24.2-28.9)	41.7	(39.0-44.4)	20.9	(18.6-23.3)
High education	6.1	(4.9-7.4)	21.1	(19.0-23.4)	49.4	(46.6-52.3)	23.4	(21.3-25.5)
≥ 65 Years	11.8	(10.4-13.4)	24.6	(22.6-26.8)	45.6	(43.3-47.8)	17.9	(16.4-19.6)
Low education	17.3	(13.9-21.3)	30.1	(25.3-35.3)	39.6	(34.2-45.3)	13.0	(9.4-17.7)
Medium education	13.3	(11.2-15.9)	24.6	(21.7-27.8)	45.2	(41.9-48.5)	16.8	(14.5-19.4)
High education	7.0	(5.6-8.7)	21.9	(19.4-24.7)	49.0	(45.9-52.1)	22.1	(19.6-24.8)
Total (women and men)	**13.7**	**(13.0-14.4)**	**38.9**	**(38.0-39.8)**	**31.4**	**(30.6-32.3)**	**16.0**	**(15.3-16.6)**

CI=confidence interval

Table 2
Alcohol consumption among men according to age and educational status (n=10,648)
Source: GEDA 2014/2015-EHIS

survey indicators are not entirely congruent, the results are of the same magnitude: around one in seven women and nearly one in five men consume amounts of alcohol that increase the risk of negative impacts on health. Public policies with the purpose of reducing alcohol consumption are therefore as important as publicly advocating responsible drinking. Through its campaign 'Kenn dein Limit – Bewusst genießen, im Limit bleiben' (Respect your limits – enjoy responsibly and stay below the limit), the Federal Centre for Health Education offers information on low-risk forms of drinking (https://www.kenn-dein-limit.de/).

Rates of risky alcohol consumption are higher among highly educated women than among those with a lower level of education, with the same applying to men aged over 65.



95% confidence interval in parentheses

Figure 1
Risky alcohol consumption according to gender and federal state (n=12,913 women; n=10,648 men)
Source: GEDA 2014/2015-EHIS

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Imprint

Journal of Health Monitoring

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Conflicts of interest
The authors declared no conflicts of interest.

Funding
The GEDA study was funded by the Robert Koch Institute and the German Federal Ministry of Health.

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

Publisher
Robert Koch Institute
Nordufer 20
D-13353 Berlin, Germany

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Typesetting
Gisela Dugnus, Alexander Krönke, Kerstin Möllerke

Translation
Simon Phillips/Tim Jack

Please cite this publication as
Lange C, Manz K, Kuntz B (2017) Alcohol consumption among adults in Germany: risky drinking levels. Journal of Health Monitoring 2(2):64–70. DOI 10.17886/RKI-GBE-2017-044

ISSN 2511-2708

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

Authors:
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Journal of Health Monitoring · 2017 2(2)
DOI 10.17886/RKI-GBE-2017-045
Robert Koch Institute, Berlin

Alcohol consumption among adults in Germany: heavy episodic drinking

Abstract

Consuming harmful amounts of alcohol is considered a contributing factor in over 200 diseases. Heavy episodic drinking is a particularly risky drinking pattern, with possible consequences such as acute alcohol intoxication, injuries and violence. GEDA 2014/2015-EHIS defines heavy episodic drinking as the consumption of six or more alcoholic beverages on one occasion at least once per month. 24.9% of women and 42.6% of men show this drinking pattern at least once per month. Regular heavy episodic drinking is most common among 18- to 29-year-olds. The prevalence of heavy episodic drinking among highly educated women (all age groups) and men (aged over 45) is lower than it is among those with lower levels of education. The prevention of harmful levels of alcohol consumption requires measures including social and environmental interventions as well as targeting the individual behaviour which are focused on young adults as well as the diverse drinking patterns seen among groups with different levels of education.

ALCOHOL · HEAVY EPISODIC DRINKING · ADULTS · HEALTH MONITORING · GERMANY

Introduction

Alcohol is a potentially addictive psychoactive substance. Consuming harmful levels of alcohol is considered a contributing factor to over 200 diseases; globally, it is among the five key risk factors for disease, impairment and death [1]. In addition, to the impacts harmful amounts of alcohol can potentially have on a person's health, the World Health Organization (WHO) also highlights the socioeconomic costs for individuals who drink and the consequences for others and society in general [1]. For society, the consequences of people consuming harmful levels of alcohol include the direct costs to the health system, as well as the costs related to the loss of productivity and immaterial costs such as the loss of quality of life. In Germany, alcohol consumption is estimated to cost the economy around EUR 40 billion annually, with around one quarter of this sum being spent directly on the health care system [2, 3].

Heavy episodic drinking is a drinking pattern which poses a particularly high risk to an individual's health and can lead to acute alcohol intoxication, injuries and violence. On the long-term, it can lead to addiction and damages to multiple organs [4]. Such damage can occur even if a person's alcohol consumption is, on average, relatively low [1]. To reduce the population's consumption of harmful levels of alcohol, the WHO has

GEDA 2014/2015-EHIS

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developed global and European strategies [5, 6]. The WHO Global Action Plan for the Prevention and Control of Non-communicable Diseases strives for a relative 10% reduction of harmful drinking patterns by 2025 (with 2010 levels as a benchmark) [7]. In part, the WHO strategy guides Germany's national health target 'Reduce alcohol consumption', which was initially published in 2015 [8].

Indicator

Heavy episodic drinking (HED) is defined as the intake of 60 g or more of pure alcohol at a single occasion at least once per month [1]. This is the equivalent to six standard drinks containing roughly 10 g of pure alcohol per glass. To assess the frequency and amounts of alcohol people consume, the German Health Update 2014/2015-EHIS (GEDA 2014/2015-EHIS) survey used the instruments provided by the European Health Interview Survey (EHIS) [9]. To assess HED, the survey asked: 'In the past 12 months, how often have you had 6 or more drinks containing alcohol on one occasion? For instance, during a party, a meal, an evening out with friends, alone at home, ...'. To calculate the indicator, the nine possible answers were condensed into four categories: (1) at least once a week (every day or almost every day, 5-6 days a week, 3-4 days a week, 1-2 days a week); (2) every month (on 2-3 days per month, once a month); (3) less than once a month; and (4) never (not in the past 12 months, never in my whole life). Furthermore, the category of at least monthly heavy episodic drinking was established that combines the categories at least once a week and every month. The results are stratified based on gender, age and education, and for at least monthly heavy episodic drinking, according to gender and German federal state. Statistically, where confidence intervals do not overlap, the survey assumes significant differences between groups.

The analyses are based on the data received from 23,704 respondents aged 18 and above (12,953 women, 10,751 men) who gave valid answers on heavy episodic drinking. Calculations were carried out using a weighting factor that corrects for deviations within the sample from the German population (as of 31 December 2014) with regard to gender, age, district type and education. The district type accounts for the degree of urbanisation and reflects the regional distribution in Germany. The International Standard Classification of Education (ISCED) was used to ensure that the responses provided on educational levels were comparable [10]. A detailed description of the methodology applied in the GEDA 2014/2015-EHIS study can be found in the article German Health Update: New data for Germany and Europe in issue 1/2017 of the Journal of Health Monitoring.

Results and discussion

48.8% of women and 29.7% of men responded that they had never, or at least not during the past 12 months, drunk six or more alcoholic beverages on a single occasion. 24.9% of women and 42.6% of men (Table 1 and Table 2) said they engaged in heavy episodic drinking at least once per month. Monthly heavy episodic drinking is most widespread among 18- to 29-year-olds (women 35.6%, men 54.3%). In the other age groups, no notable

differences in the prevalence of heavy episodic drinking among women exist. In the older age groups (≥ 30 years), around one fifth of women drink six alcoholic beverages or more on a single occasion at least once per month. For men, the prevalence of heavy episodic drinking drops with age; yet still over one third of men (35.1%) aged 65 and over engage in heavy episodic drinking at least once per month.

Across all age groups, there are fewer highly educated women who drink six or more alcoholic beverages in a single session than women with a lower or medium level of education. For men in the 18-44 age group, no such association with education appears to exist. For men over 45, the prevalence of heavy episodic drinking among those highly educated is lower than among the group with a lower level of education. Compared to figures for the consumption of risky amounts, the figures for heavy episodic drinking reveal an inverse education gradient. These results are in line with other surveys that indicate the higher prevalence of risky drinking patterns, such as heavy episodic drinking, in socially disadvantaged groups [11]. Moreover, drinking

25% of women and 43% of men engage in heavy episodic drinking at least once per month.

Women	Never (in the past 12 months)		Less than once a month		Every month		At least once week		At least monthly heavy episodic drinking	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Women total	**48.8**	**(47.5-50.0)**	**26.4**	**(25.4-27.3)**	**19.2**	**(18.3-20.1)**	**5.7**	**(5.3-6.2)**	**24.9**	**(23.9-25.8)**
18-29 Years	32.9	(30.3-35.7)	31.4	(28.9-34.1)	28.6	(26.0-31.4)	7.0	(5.6-8.6)	35.6	(32.9-38.4)
Low education	40.7	(34.1-47.7)	23.8	(18.2-30.6)	26.0	(20.3-32.5)	9.5	(6.2-14.2)	35.4	(29.2-42.1)
Medium education	29.5	(26.5-32.6)	32.9	(29.8-36.1)	30.9	(27.8-34.1)	6.8	(5.3-8.7)	37.7	(34.4-41.0)
High education	34.4	(29.3-39.9)	37.8	(32.7-43.2)	23.7	(19.3-28.6)	4.1	(2.6-6.4)	27.8	(23.1-33.0)
30-44 Years	47.2	(44.7-49.6)	30.8	(28.8-32.9)	17.6	(15.9-19.5)	4.4	(3.6-5.4)	22.0	(20.0-24.2)
Low education	46.2	(38.9-53.6)	32.2	(25.8-39.4)	17.8	(13.0-24.0)	3.8	(1.9-7.6)	21.6	(16.1-28.4)
Medium education	43.8	(40.8-46.8)	31.4	(28.9-34.0)	19.7	(17.3-22.3)	5.2	(4.0-6.7)	24.9	(22.2-27.8)
High education	55.9	(52.1-59.7)	28.8	(25.5-32.4)	12.5	(10.5-14.8)	2.8	(1.9-4.0)	15.3	(13.1-17.6)
45-64 Years	50.2	(48.3-52.0)	26.0	(24.5-27.5)	18.3	(16.9-19.7)	5.6	(4.9-6.4)	23.9	(22.4-25.5)
Low education	47.1	(42.8-51.4)	23.5	(20.0-27.5)	20.7	(17.6-24.3)	8.6	(6.4-11.5)	29.3	(25.5-33.5)
Medium education	50.1	(47.8-52.5)	26.3	(24.4-28.2)	18.3	(16.5-20.2)	5.3	(4.4-6.4)	23.6	(21.7-25.7)
High education	52.9	(50.2-55.7)	27.2	(24.8-29.6)	16.0	(14.0-18.3)	3.9	(2.9-5.2)	19.9	(17.8-22.3)
≥ 65 Years	58.0	(55.8-60.3)	20.1	(18.4-21.9)	15.8	(14.2-17.5)	6.1	(5.1-7.3)	21.9	(20.1-23.8)
Low education	60.9	(57.1-64.6)	16.0	(13.4-19.0)	17.3	(14.7-20.2)	5.8	(4.0-8.2)	23.1	(19.9-26.6)
Medium education	54.5	(51.3-57.8)	23.5	(21.0-26.2)	15.3	(13.2-17.8)	6.7	(5.2-8.4)	22.0	(19.4-24.8)
High education	64.8	(59.9-69.3)	19.6	(16.1-23.7)	10.8	(8.1-14.3)	4.8	(3.2-7.0)	15.6	(12.4-19.5)
Total (women and men)	**39.4**	**(38.4-40.4)**	**27.0**	**(26.4-27.7)**	**23.7**	**(22.9-24.5)**	**9.8**	**(9.4-10.3)**	**33.5**	**(32.7-34.4)**

CI=confidence interval

Table 1
Heavy episodic drinking among women according to age and educational status (n=12,953)
Source: GEDA 2014/2015-EHIS

the same amount of alcohol can cause more severe health problems in socioeconomically deprived population groups than among privileged groups, an effect known as the alcohol harm paradox [11]. As alcohol poses a greater risk to women and men with lower levels of education in the long term [12], preventive measures should be specifically focused on these groups.

Compared to the German average, the prevalence of heavy episodic drinking among men is significantly higher in North Rhine-Westphalia and significantly lower in Baden-Württemberg. For women, variance between federal states and in comparison with the German average is low. The prevalence of heavy episodic drinking among women is lowest in Brandenburg (20.7%) and significantly higher in North Rhine-Westphalia (27.5%) (Figure 1).

The GEDA 2014/2015-EHIS figures are thereby notably higher than those surveyed in the German Health Interview and Examination Survey for Adults (DEGS1) [13] and GEDA 2012 [14]. As data collection methods and survey instruments have changed since DEGS1 and earlier GEDA waves, the data cannot be used to

Among 18- to 29-year-olds, more than half of all men and over a third of all women drink six or more units on one occasion at least once per month.

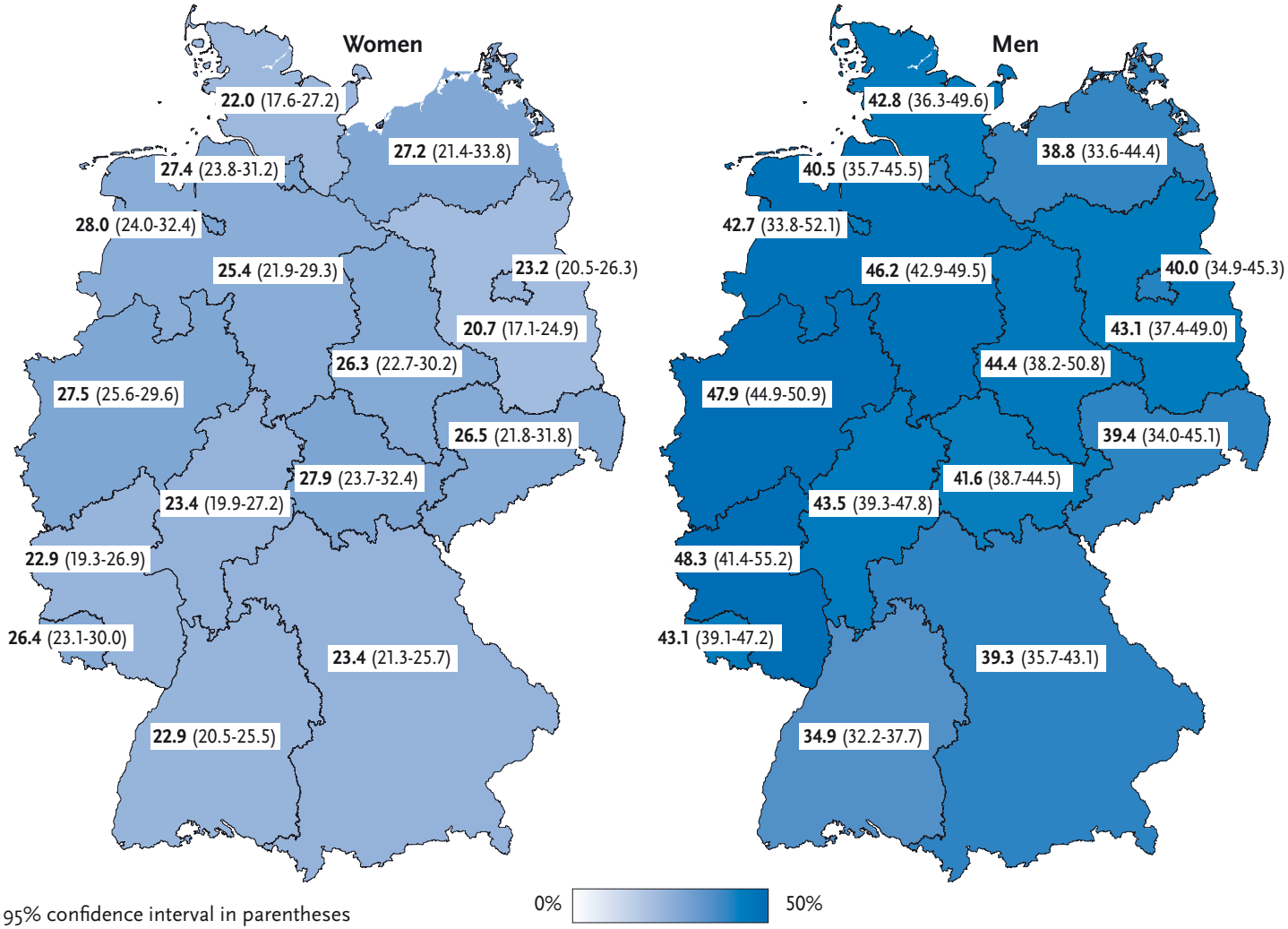
Men	Never (in the past 12 months)		Less than once a month		Every month		At least once week		At least monthly heavy episodic drinking	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Men total	**29.7**	**(28.5-31.0)**	**27.7**	**(26.6-28.8)**	**28.4**	**(27.3-29.6)**	**14.1**	**(13.3-15.0)**	**42.6**	**(41.2-43.9)**
18-29 Years	19.9	(17.4-22.6)	25.9	(23.4-28.5)	33.9	(31.2-36.8)	20.4	(17.8-23.1)	54.3	(51.2-57.3)
Low education	26.3	(20.4-33.1)	22.6	(17.4-28.8)	25.1	(19.4-31.9)	26.0	(20.0-33.0)	51.1	(44.2-58.0)
Medium education	18.6	(15.8-21.7)	26.6	(23.1-30.3)	36.4	(33.1-39.9)	18.4	(15.5-21.7)	54.8	(51.1-58.6)
High education	13.9	(9.8-19.2)	27.9	(22.5-34.0)	40.1	(33.9-46.6)	18.2	(14.0-23.3)	58.3	(51.4-64.8)
30-44 Years	26.0	(23.8-28.3)	30.9	(28.6-33.3)	31.4	(29.1-33.7)	11.8	(10.1-13.6)	43.1	(40.6-45.7)
Low education	35.7	(28.4-43.8)	20.5	(14.6-27.8)	26.0	(19.5-33.8)	17.8	(12.1-25.4)	43.8	(35.8-52.2)
Medium education	24.5	(21.6-27.6)	31.9	(28.7-35.3)	32.1	(29.1-35.2)	11.5	(9.4-14.0)	43.6	(40.2-47.1)
High education	24.9	(21.9-28.0)	32.9	(29.6-36.3)	32.5	(29.1-36.1)	9.8	(7.7-12.3)	42.3	(38.4-46.3)
45-64 Years	30.2	(28.4-32.0)	28.8	(27.1-30.6)	27.5	(25.7-29.3)	13.5	(12.3-14.9)	41.0	(39.0-43.0)
Low education	32.2	(27.8-37.0)	19.9	(16.5-23.8)	26.3	(22.2-30.7)	21.7	(17.8-26.1)	47.9	(43.0-52.9)
Medium education	29.8	(27.5-32.3)	28.6	(26.2-31.1)	27.7	(25.3-30.2)	13.9	(12.2-15.8)	41.6	(38.9-44.3)
High education	30.2	(27.8-32.7)	32.3	(30.1-34.7)	27.4	(25.0-29.9)	10.1	(8.6-11.8)	37.5	(34.9-40.0)
≥ 65 Years	40.8	(38.4-43.3)	24.1	(22.2-26.1)	22.5	(20.8-24.2)	12.6	(11.2-14.1)	35.1	(33.0-37.2)
Low education	37.3	(32.2-42.8)	21.9	(18.0-26.5)	24.6	(20.0-29.9)	16.2	(12.4-20.7)	40.7	(35.5-46.2)
Medium education	40.7	(37.0-44.5)	23.5	(20.7-26.6)	22.8	(20.1-25.6)	13.0	(11.2-15.2)	35.8	(32.8-38.9)
High education	43.0	(39.8-46.3)	26.2	(23.2-29.5)	20.7	(18.3-23.3)	10.1	(8.4-12.1)	30.8	(28.0-33.7)
Total (women and men)	**39.4**	**(38.4-40.4)**	**27.0**	**(26.4-27.7)**	**23.7**	**(22.9-24.5)**	**9.8**	**(9.4-10.3)**	**33.5**	**(32.7-34.4)**

CI=confidence interval

Table 2
Heavy episodic drinking among men according to age and educational status (n=10,751)
Source: GEDA 2014/2015-EHIS

calculate trends. Nonetheless, the data consistently show that heavy episodic drinking is most common in the 18 to 29 age group. Recent data from the Epidemiological Survey of Substance Abuse also reveal a similar age pattern [15]. This highlights the need to offer measures including social and environmental interventions as well as targeting the individual behaviour of this age group. Such measures would need to consider the diverse consumption patterns according to education levels. The campaign 'Kenn dein Limit – Eine Kampagne

For those aged 65 or over, more than one third of men and around one fifth of women engage in heavy episodic drinking at least once per month.



95% confidence interval in parentheses

Figure 1
Heavy episodic drinking according to gender and federal state (n=12,953 women; n=10,751 men)
Source: GEDA 2014/2015-EHIS

für Jugendliche zum Thema verantwortungsbewusster Umgang mit Alkohol' (Respect your limits – a responsible drinking campaign for young people, http://www.kenn-dein-limit.info/) run by Germany's Federal Centre for Health Education (BZgA) is targeted specifically at adolescents and young adults. For adults, the campaign 'Kenn dein Limit – Bewusst genießen, im Limit bleiben' (Respect your limits – enjoy responsibly and stay below the limit) provides information and recommendations for low-risk drinking (https://www.kenn-dein-limit.de/).

As a behavioural pattern, heavy episodic drinking is less frequent among highly educated women than among those with lower levels of education. In men, the same pattern is shown for those aged over 45.

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Imprint

Journal of Health Monitoring

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Conflicts of interest
The authors declared no conflicts of interest.

Funding
The GEDA study was funded by the Robert Koch Institute and the German Federal Ministry of Health.

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

Publisher
Robert Koch Institute
Nordufer 20
D-13353 Berlin, Germany

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Typesetting
Gisela Dugnus, Alexander Krönke, Kerstin Möllerke

Translation
Simon Phillips/Tim Jack

Please cite this publication as
Lange C, Manz K, Kuntz B (2017) Alcohol consumption among adults in Germany: heavy episodic drinking. Journal of Health Monitoring 2(2):71–77. DOI 10.17886/RKI-GBE-2017-045

ISSN 2511-2708

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

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Journal of Health Monitoring · 2017 2(2)
DOI 10.17886/RKI-GBE-2017-046
Robert Koch Institute, Berlin

Trends in tobacco sales in Germany

Abstract

Based on data from the tobacco tax revenue statistics provided by Germany's Federal Statistical Office, we analyse the development of sales of various tobacco products. In 2016, per capita consumption of tobacco products taxed in Germany was 918 manufactured cigarettes, 37 cigars/cigarillos, 308 g fine cut (equivalent to 462 cigarettes), and 31 g of (water) pipe tobacco. Between 1991 and 2016, the sale of manufactured cigarettes decreased by nearly half, while the sale of fine cut increased by around two thirds. If the amount of fine cut is expressed as cigarette equivalents (whereby 1kg of fine cut equals 1,500 cigarettes) and added to the number of manufactured cigarettes sold, then cigarette sales have decreased by one third since 1991. Numerous facts indicate that measures implemented in the context of a more restrictive tobacco control policy, such as tax increases and smoking bans, have contributed to this decrease in tobacco sales.

TOBACCO · CIGARETTES · SMOKING · TRENDS · TOBACCO TAX REVENUE STATISTICS

Introduction

Smoking is a health hazard that increases the risk of contracting severe diseases and dying prematurely [1, 2]. Reducing the population's consumption of tobacco therefore remains a fundamental health policy goal [3, 4]. The planning and evaluation of tobacco prevention and control policy measures requires meaningful, regularly gathered data on the spread of tobacco use in the population [3, 5]. Conclusions about the spread of tobacco consumption usually depend on representative population surveys (see the Smoking among adults in Germany fact sheet based on data from GEDA 2014/15-EHIS in this issue of the Journal of Health Monitoring). The available surveys show that the share of smokers in Germany has decreased over the past years, a fact that holds particularly true for adolescents and young adults, with a more marked decrease among men than women [5-10].

Along with population surveys, data from the statistics on tobacco tax revenue from Germany's Federal Statistical Office helps estimate tobacco consumption. This data provides information on sales and the prices of tobacco products, as well consumer expenditure and tax revenue. After energy, the levy on tobacco is Germany's most important excise. In 2016, Germany raised EUR 14.1 billion in tobacco tax revenue [11]. Beyond producing revenue, however, tobacco also results in high costs to the economy. The direct annual healthcare costs for treating tobacco-related diseases and health problems amount to an estimated EUR 25.4 billion. To this we must add the indirect costs of people unable to work due to sickness, early retirement, and premature death.

Estimates therefore reckon with total annual costs to the economy of around EUR 79.1 billion [1, 12].

Indicator

The data provided in the following comes from the statistics of the German Federal Statistical Office on tobacco tax revenue [11, 13, 14]. Germany's tobacco taxation law defines the content and form of this data. Data on tobacco tax revenue is collected based on the tax declarations (ordered and returned excise stamps) of companies that produce or import tobacco products. The central excise stamp agency in the city of Bünde prepares the data from tax declarations and transmits it to the Federal Statistical Office for analysis and general publication.

Statistics on tobacco tax revenue provide quarterly and annual data on the number of (1) manufactured cigarettes, (2) cigars and cigarillos, (3) fine cut, and (4) pipe tobacco (including water pipe tobacco) taxed in Germany. In the following we provide an analysis of the development of sales for each of these four products in Germany from 1991 to 2016. Figures for the number of cigarettes, cigars, and cigarillos sold are given in billions, for fine cut and pipe tobacco in tonnes (Figure 1). Moreover, figures for cigarettes, cigars, and cigarillos are also given as units per person, and for fine cut and pipe tobacco as grams per person (per capita consumption, Table 1). To calculate total cigarette consumption, one kilogramme of fine cut is considered equivalent to 1,500 manufactured cigarettes. Fine cut consumption is subsequently converted into an equivalent amount of cigarettes and this figure is then included in the cigarette total [15, 16].

In 2016, around 112.8 billion cigarettes (including fine-cut tobacco) were sold in Germany, roughly 1,380 cigarettes per capita.

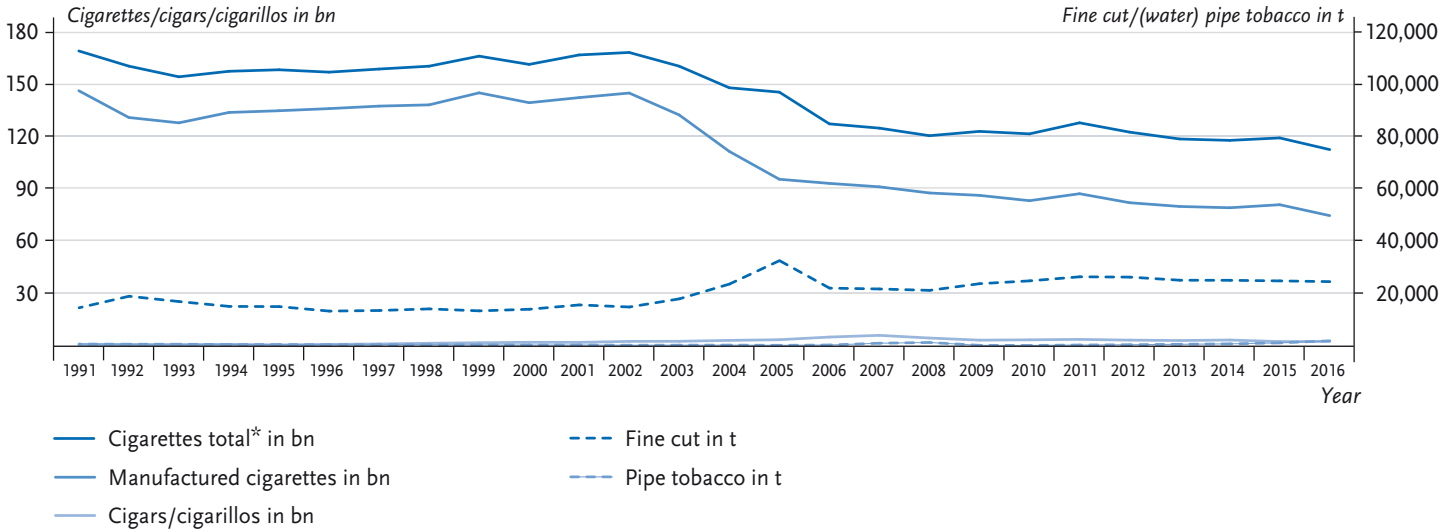

Figure 1
Absolute number of taxed tobacco products in Germany (1991 to 2016)
Source: Tobacco tax revenue statistics [11, 13, 14]

* Cigarettes total = manufactured cigarettes plus fine-cut cigarettes; fine cut calculated as cigarette equivalents (1 cigarette = gram x 1.5; assumption: 1 kilogramme of fine cut is equal to 1,500 manufactured cigarettes)

Results and discussion

According to the statistics on tobacco tax revenue, around 112.8 billion cigarettes were sold in Germany in 2016. This figure includes 75.0 billion manufactured cigarettes and 25,188 tonnes of fine cut (Figure 1) [11]. Per capita, this translates into an average of 918 cigarettes and 462 cigarettes made from fine cut (308 g of fine cut per capita, Table 1). Cigars and cigarillos accounted for 3.0 billion units (37 per capita). Moreover, 2,521 tonnes of pipe tobacco were sold (31 g per capita, Figure 1, Table 1).

Over the past 25 years, the total amount of taxed cigarettes in Germany has dropped by around one third.

Year	Manufactured cigarettes	Cigars/cigarillos	Fine cut (cigarettes)	Pipe tobacco
	Per capita	Per capita	Grams (units**) per capita	Grams per capita
1991	1,831	17	190 (285)	16
1992	1,627	16	243 (365)	15
1993	1,578	14	149 (224)	15
1994	1,646	17	139 (209)	14
1995	1,654	13	137 (206)	13
1996	1,664	17	136 (204)	13
1997	1,678	19	142 (213)	13
1998	1,687	24	148 (222)	12
1999	1,770	28	154 (231)	12
2000	1,699	31	155 (233)	11
2001	1,731	31	168 (252)	11
2002	1,760	37	188 (282)	10
2003	1,607	38	225 (338)	11
2004	1,355	44	294 (441)	11
2005	1,162	49	403 (605)	10
2006	1,135	67	276 (414)	11
2007	1,112	79	272 (408)	20
2008	1,071	61	266 (399)	23
2009	1,058	46	298 (447)	10
2010	1,022	49	312 (468)	9
2011	1,092	53	337 (506)	11
2012	1,025	47	335 (503)	13
2013	995	44	319 (479)	15
2014	982	48	317 (476)	17
2015	995	36	312 (468)	21
2016***	918	37	308 (462)	31

* Current population estimates: 1991-2010 based on earlier census data; 2011-2016: based on the 2011 census

** Fine cut expressed as cigarette equivalents (1 cigarette = gram x 1.5; assumption: 1 kilogramme of fine cut is equivalent to 1,500 manufactured cigarettes)

*** Preliminary results

Table 1
Taxed tobacco products in Germany per capita (1991 to 2016)
Source: Tobacco tax revenue statistics [11, 13, 14], current population estimate*

Increasing taxes on tobacco led to a 34% cut in cigarette sales between 2002 and 2005 alone.

Between 1991 and 2002, sales of manufactured cigarettes and fine cut, the most important tobacco products with regard to the amounts consumed, remained relatively stable (Figure 1). Following the massive increase in levies on tobacco, which led to a significant increase in the price of cigarettes between 2002 and 2005, cigarette consumption dropped by around one third within three years, from 145.2 to 95.8 billion cigarettes (-34.0%). Simultaneously, sales of fine cut, to which a lower tax rate applied, more than doubled, rising from 15,473 to 33,232 tonnes (+114.8%). In 2006, when Germany adjusted the levies applied to fine cut, sales initially collapsed, then recovered between 2008 and 2011 and have remained relatively stable since. Manufactured cigarette sales did not recover after their collapse and instead continued to decrease, albeit more slowly than between 2002 and 2005.

During the phase between 1991 and 2016, the total amount of taxed cigarettes in Germany decreased by one third, from 169.2 to 112.8 billion. This figure includes manufactured cigarette sales, which were nearly cut in half, dropping from 146.5 to 75.0 billion (Figure 1). Sales of fine cut increased by nearly two thirds during this time. In spite of this absolute increase in the amount of fine cut sold, per capita consumption of cigarettes dropped from 2,116 to 1,380 (-736 units or -34.8%, Table 1).

As a share of the total amount of tobacco sold, the consumption of cigars, cigarillos, and pipe tobacco is negligible. Only 1.2% (EUR 168 million) of net tobacco tax revenue resulted from the sale of cigars, cigarillos, and pipe tobacco [5, 11]. During the period analysed, consumption of these tobacco products was subject to fluctuation, yet it increased overall (Table 1). Over the past years, the increased popularity of water pipes (also known as shisha or hookah) among adolescents and young adults in Germany has probably led to the increased demand for special water pipe tobacco [1, 17, 18].

Since the data from the statistics on tobacco tax revenue counts only the tobacco products taxed in Germany, actual tobacco consumption is probably higher than these figures suggest. These statistics do not include tobacco products imported illegally (or legally) into Germany but taxed outside of Germany. The ratio of tobacco products that are not taxed in Germany to total tobacco sales according to tobacco tax revenue statistics is largely unknown. A so-called 'discarded cigarette pack' study by the tobacco industry estimates that one in five to one in six cigarettes smoked in Germany are not taxed in the country [19]. For 2016, an estimated 18% of cigarettes were not taxed in Germany, with great differences between western and eastern Germany (12.2% compared to 39.5%) [19]. How reliable these estimates are and how high the percentage of smuggled cigarettes among the cigarettes not taxed in Germany is remains controversial. The survey methodology has been criticised, with many doubting the survey's representativeness [20, 21]. Overall, tobacco tax revenue data points to a significant decrease in cigarette sales in Germany over the past 25 years. Considering the declining prevalence of smoking in the population, such a trend seems plausible [5, 6, 8]. The degree to which the spread of electronic inhalers, the most prominent of which is the electronic cigarette, has contributed to decreasing tobacco cigarette sales is unclear. But even though the effect of individual measures is hard to quantify, tobacco prevention measures and control policies

The German population today smokes 736 cigarettes fewer per capita than in 1991.

have, since the early 2000s, certainly contributed significantly to this development [1, 3, 5]. In particular, a pronounced decrease in cigarette sales accompanied the sharp increase in the tax levied on tobacco products between 2002 and 2005. Even though some smokers ended up switching to fine cut and rolling their own cigarettes because of the lower tax rate that applied to fine cut, total cigarettes sales still dropped. Further important measures to reduce smoking included legislation to protect non-smokers from secondhand smoke in the workplace (2002), the ban on selling tobacco products to minors under 18 (2007), and federal and state legislation for the protection of non-smokers (after 2007). Finally, since the revision of the EU's Tobacco Products Directive, implemented by Germany in 2016, at least two thirds of the front and back surface of cigarette packs need to be printed with pictures and warnings, i.e. a combination of written warnings and what are called shocking images in Germany that highlight the health consequences of smoking [5]. German tobacco control policy, notwithstanding the measures already implemented, is considered to be only tentative, at least in international comparison [22]. Within this context, the recommendations made by important stakeholders to reduce demand for tobacco products need to be discussed further and considered as options for future action. The German Cancer Research Center [1] and the German Alliance against Non-communicable Diseases [23] recommends further tax increases and measures such as a ban on tobacco advertisements in public spaces, the elimination of exceptions to smoking bans at the federal state level (in gastronomy, for example), and the expansion of tobacco cessation programmes.

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Cigars, cigarillos, and pipe tobacco remain a niche market, while sales of water pipe tobacco have increased over the past years.

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Imprint

Journal of Health Monitoring

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Conflicts of interest
The authors declared no conflicts of interest.

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

Publisher
Robert Koch Institute
Nordufer 20
D-13353 Berlin, Germany

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Typesetting
Gisela Dugnus, Alexander Krönke, Kerstin Möllerke

Translation
Simon Phillips/Tim Jack

Please cite this publication as
Kuntz B, Zeiher J, Lange C et al. (2017) Trends in tobacco sales in Germany. Journal of Health Monitoring 2(2):78–84.
DOI 10.17886/RKI-GBE-2017-046

ISSN 2511-2708

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

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Journal of Health Monitoring · 2017 2(2)
DOI 10.17886/RKI-GBE-2017-047
Robert Koch Institute, Berlin

Factors influencing childhood obesity – the establishment of a population-wide monitoring system in Germany

Abstract

Obesity poses a danger to childhood health and can continue to have a negative impact on health into adulthood. Currently, about 15% of children and adolescents in Germany are overweight or obese. Moreover, significant data on the multifactorial causes of childhood obesity that is systematically recorded, regularly updated and obtainable at the nationwide level are not yet available in Germany. As such, the Robert Koch Institute is establishing a population-wide system to monitor the factors that are relevant to childhood obesity (AdiMon). AdiMon will be available by the end of 2017. This paper outlines the methodological approach that is being used to establish AdiMon and describes the current results of the project (the development of an initial set of core indicators).

The project began by undertaking a systematic literature review aimed at piecing together the latest knowledge on factors that influence childhood obesity. The factors that were identified were then sorted according to relevance, and appropriate indicators were selected. This was followed up by research into data sources that – as far as possible – provide significant data that are regularly collected but that also provide for regional differentiation. Work is currently underway to analyse these indicators and data sources. Once this work has been completed, the indicator set will be finalised and the results published on the internet.

Population-wide monitoring of factors relevant to childhood obesity takes the following types of indicators into account: behavioural factors (such as physical activity), biological factors (such as genetic predisposition), prenatal and early-childhood factors (such as breastfeeding), psychosocial factors (such as parents' health consciousness), environmental factors (such as playgrounds in the local area), contextual factors (such as a migrant background) and prevention measures as well as measures to promote health (such as expenditure by statutory health insurers). The population-wide monitoring uses the following data sources: epidemiological studies, social sciences surveys, official statistics and geo-information systems, as well as routine, economic and media data.

This paper demonstrates that population-wide monitoring can provide significant information about the distribution and causes of obesity in childhood, and thus enable the need for action to be recognised at an early stage, initial approaches for preventive measures to be identified and developments to be tracked over time.

OBESITY · INDICATORS · HEALTH MONITORING · CHILDREN · PREVENTION

Info box 1: Definition Monitoring
Monitoring is the continuous or periodic systematic collection of data for the surveillance of processes and results [9].

AdiMon is a population-wide monitoring system that examines factors that influence childhood obesity.

1. Introduction

Obesity is one of the greatest public health policy challenges of the 21st century [1]. In fact, it can even endanger health in childhood and can continue to have a negative impact on health into adulthood [2, 3]. As early as 2003, Germany launched its own public health initiative 'growing up healthy', which contributes to the prevention of childhood obesity by encouraging exercise and a healthy diet [4]. In 2014, the European Commission launched the EU Action Plan on Childhood Obesity [5]. Similarly, a group of organisations, including the World Health Organization (WHO) and the European Commission, are calling for the implementation of comprehensive monitoring measures to counter the distribution of obesity in childhood [5, 6].

About 15% of children and adolescents in Germany are classified as overweight or obese [7]. Nevertheless, systematically recorded, regularly updated, significant datasets on the multifactorial causes of childhood obesity are still not available at the national level in Germany. As such, the Robert Koch Institute is establishing a population-wide monitoring system of factors that influence childhood obesity (AdiMon; with focus from 0 to 6 years of age). The system is being funded by the Federal Ministry of Health and it will be available by the end of 2017. AdiMon focuses on 0- to 6-year-olds because this stage of life is crucial in obesity prevention [8]. On the one hand, some influencing factors (such as breastfeeding) are only relevant during this stage of life; on the other, additional factors (such as dietary behaviour) are considerably shaped during this period. In addition, as there is a marked increase in the prevalence of obesity among children of school age, it is important to assess the causes of childhood obesity in children below this age [7]. The indicator system developed for population-wide monitoring is intended to lead to a pool of scientifically supported information about the causes and distribution of childhood obesity, and thus the opportunity to recognise the need for action at an early stage, identify initial approaches to preventive measures and track developments over time. This paper describes the methodological approach used to develop AdiMon and explains the current status of the project (the development of a set of core indicators).

2. Methods

The following describes the methodological approach used to establish the population-wide monitoring of factors that influence childhood obesity. The approach can be divided into eight steps (Figure 1).

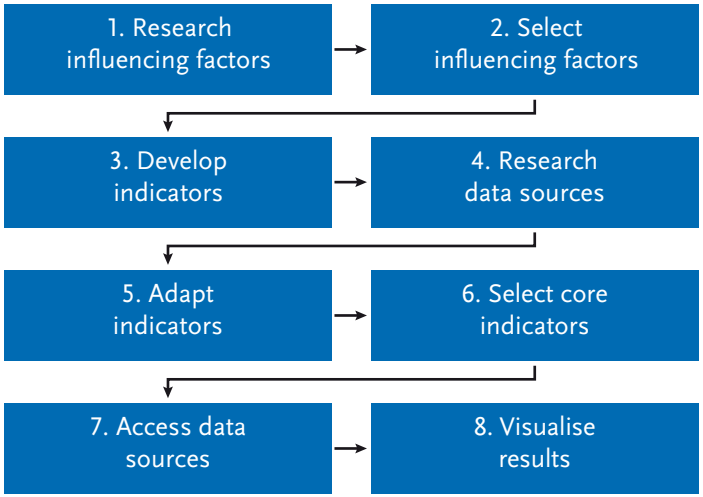


Figure 1
The steps used to develop a population-wide monitoring system of factors that influence childhood obesity
Source: own diagram

Info box 2: Definition Indicator

An indicator is an empirically measurable, observable or analysable dimension. Indicators are useful in assessing (usually complex) situations that cannot be directly measured or evaluated [9].

AdiMon provides information about more than 60 factors that influence childhood obesity.

2.1 Research into influencing factors

A systematic literature review was carried out in order to bring together current knowledge about factors that influence childhood obesity. Detailed information on the literature review and the subsequent selection of influencing factors can be found in Zeiher et al. [10]. Both risk-related and protective factors were considered so as to provide the most comprehensive overview possible of the multifactorial causes of childhood obesity. Factors were considered if they are causally associated with obesity in childhood, or where they are linked to childhood obesity but the causal relationship has yet to be sufficiently explored.

2.2 Selection of influencing factors

Four criteria of exclusion were developed so that influencing factors relevant to monitoring could be selected. Factors were not taken into account if they only affected small parts of the population (such as genetic disorders), if they had little bearing on the age group in question (0 to 6 years – such as medicine intake), were not important for Germany (such as climate), or if a majority of the studies included in the systematic literature reviews had been unable to demonstrate any relationship between the factor in question and the development of childhood obesity (such as milk consumption).

2.3 Developing the indicators

The selected influencing factors were supplemented by 'ideal type' indicators. Ideal type indicators are formulated independently of a particular data source and describe the corresponding influencing factor in the best possible manner. Work on formulating the indicators also took into account the ZWERG guidelines (central importance, economic efficiency, simplicity, timeliness, accuracy) [11]. These guidelines stipulate that indicators should provide significant information that reflects the aim of the work being undertaken, be generally understandable, plausible, collectable using a reasonable amount of resources, available at an appropriate time and constitute reliable benchmarks.

2.4 Research into the data sources

A search was conducted for suitable data sources that could equip the indicators with the necessary data. To this end, a range of areas were investigated. First, the usual sources of data used in health reporting were examined. These include epidemiological studies (such as the 'German Health Interview and Examination Survey for Children and Adolescents' – the KiGGS study [12]), social scientific surveys (such as 'Growing up Healthy in Germany: Everyday life AID:A Study' [13]), official statistics (such as microcensuses [14]) as well as routine data (such as from the Prevention Report published by statutory health insurers [15]). Furthermore, a review of scientific databases (Scopus, PubMed and Google Scholar) was conducted to find publications

Info box 3: Selecting a core indicator
The consumption of sweetened beverages soft drinks is one of the core indicators related to behavioural factors (Table 1). This indicator was selected because it complied best with the selection criteria and was viewed as particularly relevant by external experts at a workshop. The indicator is based on convincing evidence [16] and the data source (the KiGGS study) provides population-based, significant and regularly collected data. In addition, it is easily understandable (for example, compared to daily energy intake), significant (as an indicator of unhealthy dietary habits), dynamic (it clearly shows changes in consumption habits) and is found widely among the population.

AdiMon comprises over 100 indicators and, at the current time, 26 core indicators.

with references to relevant data sources. Grey literature was identified using the Google search engine, and geo-information systems (such as OpenStreetMap) were analysed for relevant content. If several suitable data sources were available for the same indicator, the source that provided the most relevant data - that was regularly collected and which permitted regional differentiations to be made - was chosen.

2.5 Adaptation of the indicators

If a data source was available for an influencing factor, but the ideal-type indicator could not be used, the indicator was adapted accordingly. For example, an age restriction was placed on an indicator if a data source provided no information about the entire agegroup (0-6 years).

2.6 Selection of the core indicators

In order to highlight indicators that are particularly important and to enable quick access to the indicator system, a set of core indicators was selected for the population-wide monitoring system. Core indicators were selected according to the following criteria: strong evidence of a relation to obesity; the availability of significant data that was collected regularly in a population-wide manner and that provided for regional differentiation; the factor demonstrated a high distribution among the population in question, and had a high level of significance for its particular field of influence; as well as clarity and a timely response to changes. At a workshop with external experts, these criteria were used to develop a selection of core indicators that could serve as a basis for the population-wide monitoring.

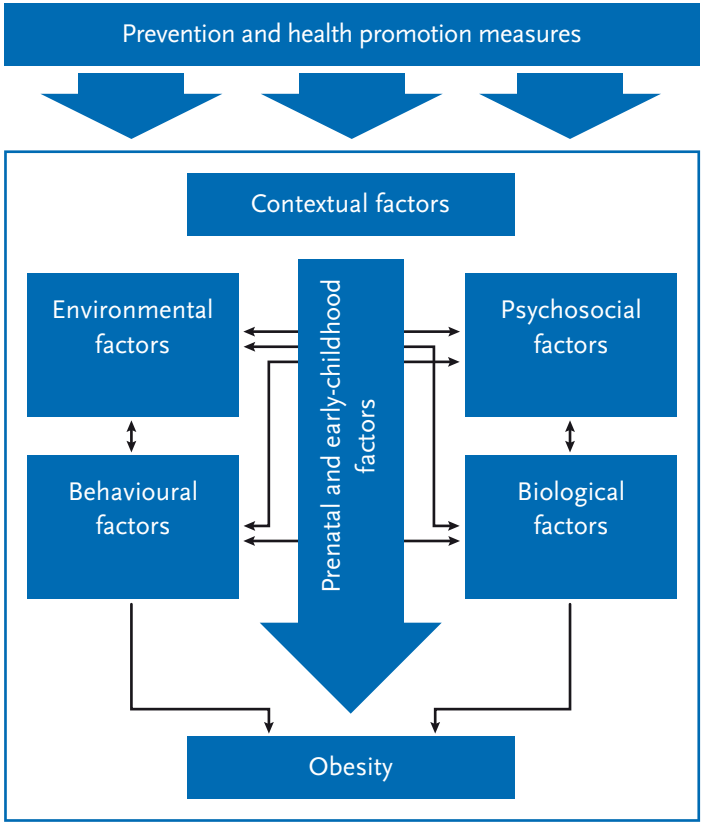
2.7 Access the data sources

Work on extracting the data from the data sources will have been completed by August 2017. This work represents part of the penultimate phase of the project. Currently, relevant data is still being extracted and evaluated from freely available data sources, and requests for supplementary information from the data holders for specific indicators are being sent out (February 2017).

2.8 Visualisation of the results

The indicator system is due to be published online at the end of 2017. AdiMon will be made freely accessible via the Robert Koch Institute's main website (www.rki.de/adimon). The website will provide users with comprehensive information about the distribution and causes of childhood obesity, enable the need for action to be recognised at an early stage, as well as help identify initial approaches to preventive measures and trends over time. The website is being designed to reflect the needs of its users to ensure that the results can be visualised in a user-friendly manner. The content-related, formal and graphical requirements of websites of this kind were discussed at a workshop with external experts from the scientific community and from municipal and regional health reporting. Wherever possible, the website will provide a gender-specific representation and description

Figure 2
Simplified cause-and-effect model of childhood obesity
Source: own diagram



Regional comparisons are possible, even partly at the district level.

of the indicators. In addition, links to the data sources are to be made available in order to provide access to the latest data. After the project has ended, indicators that are based on periodic surveys will be kept up-to-date.

3. Results

A systematic literature review led to the identification of more than 60 influencing factors that are relevant to the development of childhood obesity [10]. These factors were used to construct a simplified cause-and-effect model of childhood obesity (Figure 2). In accordance with this model, obesity is caused by behavioural factors (such as physical activity) and biological factors (including genetic predisposition). Prenatal factors (such as maternal weight gain) and early-childhood factors (such as breastfeeding) also influence childhood obesity. Furthermore, psychosocial factors (such as parents' health consciousness), environmental factors (such as playgrounds in the local area) and contextual factors (including a migrant background) also have an impact. Finally, measures in prevention and health promotion are also relevant for the distribution of obesity in childhood.

More than 100 indicators were developed for population-based monitoring that provide information about numerous influencing factors and the distribution of childhood obesity. Of these, 26 core indicators were selected and are presented below following the domains of the simplified cause-and-effect model.

3.1 Behavioural factors

A balanced diet [16], physical activity [17], and adequate sleep [18] help prevent the development of childhood obesity. Core indicators in terms of behavioural factors are the 'proportion of children who drink sweetened refreshments daily', the 'proportion of children who eat fruit and vegetables daily', the 'proportion of children who meet the WHO's recommendations on physical activity levels' and 'the number of hours children sleep

Info box 4: Definition Childhood obesity
Obesity in childhood is often determined using the Body Mass Index (BMI). The BMI is calculated using a child's height and weight (BMI=kg/m²) which is then compared to age- and gender-specific reference values. If a child's BMI is above this reference value, they are regarded as obese. In Germany the Kromeyer-Hauschild reference values are generally used (with obesity defined as a BMI higher than the 97th percentile) [50].

per day' from the KiGGS study [12], as well as the 'the daily amount of time spent by children watching television', which is collated by the Arbeitsgemeinschaft Fernsehforschung (AGF) [19] (Table 1).

3.2 Biological factors

Genetic factors (such as genetic predisposition [20]) and hormonal factors (such as leptin resistance [16]), microbiological factors (including intestinal flora [21]) and certain illnesses (such as those caused by Adenoviruses [21]) can encourage the development of obesity in childhood. Due to the lack of suitable data sources, no indicators could be formulated that appropriately described biological factors. Nevertheless, the indicator 'proportion of parents who are overweight or obese', which stems from the microcensus [14] and is located within the field of environmental factors to describe the family environment, provides information on genetic predispositions (Table 1).

3.3 Prenatal and early childhood factors

During the crucial prenatal and early-childhood phase, a normal increase in the weight of the mother during pregnancy [22], and breastfeeding [23] help prevent childhood obesity. The 'proportion of mothers who had a high weight gain during pregnancy (> 30%)' from evaluations conducted by the Institute for Quality Assurance and Transparency in Healthcare (IQTIG) [24] and the 'proportion of children who were ever breastfed', taken from the KiGGS study [12] (Table 1), were therefore selected as provisional core indicators of prenatal and early childhood influencing factors.

3.4 Psychosocial factors

Psychosocial factors that encourage the development of obesity in children include specific personality traits (such as low self-regulation [25]), emotional regulation mechanisms (such as reactions to stress [26]) and a lack of protective factors (such as insufficient social resources [27]). In addition, parental psychosocial factors are also associated with the development of childhood obesity. These include a lack of health literacy [28], psychological disorders (such as depression [29]) and parental perceptions of a child's body weight [30]. Due to insufficient or unsuitable data sources, only a few psychosocial influencing factors could be mapped properly with indicators. Core indicators in terms of psychosocial factors are the 'proportion of parents who place a high or very high level of importance on their personal health' and the 'proportion of parents who have been diagnosed with depression or depressive moods during the last 12 months' from the 'German Health Update' (GEDA) [31], as well as the 'proportion of parents who do not judge their obese child to be overweight' from the KiGGS study [12] (Table 1).

3.5 Environmental factors

Access to a balanced diet [32, 33], opportunities for age-appropriate exercise [27], as well as health-promoting conditions in nurseries [34] and the family environment

Model area	Core indicator	Data Source
Obesity	Proportion of 3- to 6-year-old children who are overweight or obese	KiGGS study [12]
Behavioural factors	Proportion of 3- to 6-year-old children who drink sweetened refreshments daily	KiGGS study [12]
	Proportion of 3- to 6-year-old children who eat fruit and vegetables daily	KiGGS study [12]
	Proportion of 3- to 6-year-old children who meet the WHO's recommendations on physical activity levels	KiGGS study [12]
	The daily amount of time spent by 3- to 5-year-old children watching television	AGF evaluation [19]
	The number of hours 0- to 6-year-old children sleep per day	KiGGS study [12]
Prenatal and early childhood factors	Proportion of mothers who had a high weight gain during pregnancy (> 30%)	IQTIG evaluation [24]
	Proportion of 0- to 6-year-old children who were ever breastfed	KiGGS study [12]
Psychosocial factors	Proportion of parents of 0- to 6-year-old children who place a high or very high level of importance on their personal health	GEDA study [31]
	Proportion of parents of 0- to 6-year-old children who have been diagnosed with depression or depressive moods during the last 12 months	GEDA study [31]
	Proportion of parents of 3- to 6-year-old children who do not judge their obese child to be overweight	KiGGS study [12]
Environmental factors	Number of fast-food restaurants per 10,000 inhabitants	OpenStreetMap [39]
	Consumer price index for fruit, vegetables and confectionery	Consumer price index [40]
	Proportion of recreational areas in urban areas	Area statistics [38]
	Number of playgrounds per 10,000 inhabitants	OpenStreetMap [39]
	Consumer price index for sports and recreational services	Consumer price index [40]
	Proportion of children's nurseries whose catering adheres to external quality standards	VeKiTa study [41]
	Proportion of parents who eat fruit and vegetables daily	GEDA study [31]
	Proportion of parents who take part in sports	GEDA study [31]
	Proportion of parents who are overweight or obese	Microcensus [14]
	Proportion of parents who go to the playground with their child several times a week	AID:A study [13]
Contextual factors	Educational level of parents of 0- to 5-year-old children	Microcensus [14]
	Proportion of 0- to 6-year-old children who live in households that receive benefits in accordance with SGB II	Social security statistics [44]
	Proportion of 0- to 5-year old children with a migrant background	Microcensus [14]
Measures of prevention and health promotion	Implemented policy measures	NOURISHING database [48]
	Expenditure by statutory health insurers on preventive measures in nurseries	Prevention report [15]

KiGGS=German Health Interview and Examination Survey for Children and Adolescents; AGF=Arbeitsgemeinschaft Fernsehforschung; IQTIG=Institute for Quality Assurance and Transparency in Healthcare; GEDA=German Health Update; WHO=World Health Organization; VeKiTa=Catering in Nurseries; AID:A=Growing up Healthy in Germany: Everyday life; SGB=German Social Code

Table 1
Core indicators in population-wide monitoring of factors influencing childhood obesity (as of February 2017)
Source: own diagram

[35, 36] help to counteract the development of obesity in childhood. In contrast, environmental factors such as advertising for certain foods [37] can have a negative effect on childhood obesity. The following were selected as core indicators of environmental factors: the 'proportion of recreational areas in urban areas' from area statistics [38], the 'number of playgrounds per 10,000 inhabitants' and the 'number of fast-food restaurants per 10,000 inhabitants' from OpenStreetMap [39]. In addition, the 'consumer price index for fruit, vegetables and confectionery' and the 'consumer price index for sports and recreational services' were sourced from calculations made by the Federal Statistical Office (Table 1) [40]. The 'proportion of nurseries whose catering adheres to external quality standards', drawn from the Catering in Nurseries study (VeKiTa) [41], was chosen as a core indicator as it provides insights into health-promoting conditions in nurseries. A child's family environment is described by the following core indicators: the 'proportion of parents who eat fruit and vegetables daily', the 'proportion of parents who take part in sport' both from the GEDA study [31], the 'proportion of parents who are overweight or obese', from the microcensus [14], and the 'proportion of parents who go to the playground with their child several times a week' from the AID:A study [13].

3.6 Contextual factors

In addition to the influencing factors mentioned so far, population-wide monitoring also takes into account contextual factors that are related to childhood obesity. These factors include socio-demographic [42] and cultural factors [43]. 'Parental educational level' and 'proportion of children with a migrant background' from the microcensus [14], as well as the 'proportion of children who live in households that receive benefits in accordance with SGB II' from the social security statistics provided by the German Federal Employment Agency [44] were selected as provisional core indicators in this case (Table 1).

3.7 Measures in prevention and health promotion

Population-wide monitoring needs to supply information about prevention and health promotion measures that can be used to counteract childhood obesity [45]. These include policy- [46] and setting-related measures [34, 47]. The indicators 'implemented policy measures' (such as drawing up appropriate statutory provisions at the national level to implement the EU School Fruit and Vegetables Scheme), from the World Cancer Research Fund International's NOURISHING framework [48], as well as 'expenditure by statutory health insurers on prevention measures in nurseries' from the Prevention Report compiled by statutory health insurers [15] were selected as preliminary indicators (Table 1).

3.8 Obesity

The distribution of childhood obesity is described by the core indicator 'proportion of 3- to 6-year-old children who are overweight or obese' (Table 1) from the KiGGS study [12]. In addition, a core indicator based on the

AdiMon will be made freely available via the internet at the end of 2017.

physical examinations that are undertaken when children begin school is planned so as to provide small-scale findings about the distribution of obesity at the end of the preschool phase. However, it will only be possible to implement this once it has become clear that the relevant data can be used promptly and regularly for population-wide monitoring.

4. Discussion

The population-wide monitoring of factors influencing childhood obesity comprises more than 100 indicators, 26 of which constitute core indicators at the present time. In order to provide significant information about the distribution and causes of childhood obesity, data is being extrapolated from sources covering several disciplines. Similar forms of monitoring in the fields of nutrition and exercise have been conducted in countries such as Switzerland [51]. In these cases, established indicators from various institutions were combined and in some situations new indicators were developed. For several years now, this has provided Switzerland with comprehensive information about the nutrition and physical activity situation of its entire population, and the data it has resulted in are now being used to develop preventive measures.

Population-wide monitoring of factors relevant to childhood obesity faces a limitation due to varying evidence levels behind the considered influencing factors [10]. Whereas numerous high-quality studies are available for certain influencing factors (such as breastfeeding), other influencing factors have only been investigated to a limited extent (for example, intestinal flora). Furthermore, there are also large differences in the availability of suitable data sources. As data sources were not available for some indicators, AdiMon cannot adequately describe certain areas that are influenced by particular factors (such as biological factors). A further limitation is caused by differences in the quality of data sources that are available. It was impossible to find data sources that were based on valid measurement instruments and large samples for all indicators. In addition, some data are not collected continuously or after short intervals, and others do not provide for small-scale comparisons. For example, OpenStreetMap is a data source that provides population-wide information on environmental influencing factors, but its validity is dependent on the number and activity of its members who provide user-generated content; thus, validity varies regionally. Therefore, in the course of further analysis of the data sources and the ongoing development of the indicator system, it is possible that some of the indicators presented in this paper will not be included in the final indicator set.

5. Conclusion and outlook

Despite these limitations, AdiMon will provide important information about the causes and distribution of obesity in childhood. Therefore, it will enable the need for action to be recognised at an early stage, initial approaches for preventive measures to be identified and developments to be tracked over time.

AdiMon is to be published on the Robert Koch Institute's website by the end of 2017. For this purpose,

supplementary information for individual indicators has been requested from data holders. In addition, a customised website structure is being designed so that the results of monitoring can be represented visually in a user-friendly manner. The freely accessible monitoring system is intended to provide current data and therefore contribute towards the development of further measures aimed at preventing childhood obesity. AdiMon is also intended as a means of mapping long-term population-wide developments within childhood obesity and its influencing factors. Finally, the health monitoring conducted by the Robert Koch Institute provides an important data basis that has been linked to high-quality and innovative data sources as part of the AdiMon project, and this will enable comprehensive and substantial monitoring of the factors influencing childhood obesity to be undertaken.

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Imprint

Journal of Health Monitoring

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Conflicts of interest
The authors declared no conflicts of interest.

Funding notice
This work was supported by funding from the Federal Ministry of Health (Funding code 2515KIG004).

Acknowledgements
We would like to express our gratitude to the 26 experts who participated in two workshops where they examined the selection of influencing factors and indicators, and collated ideas for the monitoring website.

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

Publisher
Robert Koch Institute
Nordufer 20
D-13353 Berlin, Germany

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Typesetting
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Translation
Simon Phillips/Tim Jack

Please cite this publication as
Varnaccia G, Zeiher J, Lange C et al. (2017) Factors influencing childhood obesity – the establishment of a population-wide monitoring system in Germany. Journal of Health Monitoring 2(2):85–97. DOI 10.17886/RKI-GBE-2017-047

ISSN 2511-2708

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health

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Journal of Health Monitoring · 2017 2(2)
DOI 10.17886/RKI-GBE-2017-048.2
Robert Koch Institute, Berlin

Regional health differences – developing a socioeconomic deprivation index for Germany

Abstract

For Germany, regional differences for various health indicators, which are also associated with socioeconomic factors, have been documented. This article aims to develop a regional socioeconomic deprivation index for Germany that (1) can be used to analyse regional socioeconomic inequalities in health and (2) provides a basis for explaining regional health differences in Germany.

The core data stem from the INKAR (indicators and maps on spatial and urban development in Germany and Europe) database compiled by Germany's Federal Institute for Research on Building, Urban Affairs and Spatial Development. Factor analysis is used for indexing and the weighting of indicators for the three dimensions of education, occupation and income. The German Index of Socioeconomic Deprivation (GISD) is generated at the levels of associations of municipalities, administrative districts and administrative regions for the years 1998, 2003, 2008 and 2012. Aggregate data and individual data from the German Health Update 2014/2015-EHIS (GEDA 2014/2015-EHIS) study are used to analyse associations between the index and selected health indicators. For around two thirds of the causes of death, the German Index of Socioeconomic Deprivation reveals significant socioeconomic inequalities at the level of Germany's administrative regions. At district level, life expectancy in the bottom fifth of districts presenting the highest levels of deprivation is, depending on the observation period, 1.3 years lower for women and 2.6 years lower for men in comparison to the upper fifth of districts presenting the lowest levels of deprivation. The index can explain 45.5% and 62.2% of regional differences in life expectancy for women and men, respectively. Moreover, the population in regions characterised by high levels of deprivation has significantly higher rates of smokers, engages less frequently in leisure-time physical activities and is more often obese.

The German Index of Socioeconomic Deprivation illustrates regional socioeconomic differences at different spatial levels and contributes to explaining regional health differences. This index is intended for use in research as well as by federal and federal state health reporting systems and should enable access to new sources of data for investigating the links between social inequalities and health in Germany.

SOCIAL DEPRIVATION · HEALTH INEQUALITIES · GERMAN INDEX OF SOCIOECONOMIC DEPRIVATION (GISD) · FACTOR ANALYSIS

This article has been corrected as of October 18, 2018 (see corrigendum, page 114)

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1. Introduction

The German Index of Socioeconomic Deprivation reflects regional socioeconomic differences at different spatial levels.

To provide the most comprehensive and precise picture of health in Germany, Federal Health Reporting (GBE) uses numerous sources of data. In addition to health surveys carried out by the Robert Koch Institute, as well as sociological and epidemiological studies, these include official statistics and process-produced data from social insurers [1]. Robust conclusions depend on representative, valid and reliably processed information. Moreover, to reflect trends, this information should be collected continuously. Regional and social health disparities are a focus of health reporting [1].

This approach of the GBE fulfils the requirements of the World Health Organization (WHO), which regards continuous monitoring of the scale of health inequalities and providing evidence of measures to reduce such inequalites as a central task for public health [2]. Numerous international surveys have demonstrated that access to healthcare, disease risks and also life expectancy are distributed unequally in most countries [3]. Socially disadvantaged individuals tend to view their health as being poorer than those who are better off, they do also display riskier behaviour with regard to their health and face higher disease burdens and mortality. These inequalities in health chances are also present in Germany [4-6]. Moreover, regarding various health indicators, pronounced regional health differences exist in Germany that are also related to social characteristics of particular regions [5, 7, 8].

Frequently, the description of social inequality is based on measures of socioeconomic status (SES) for individuals or households. The underlying assumption here is that socioeconomic status is, in most cases, related to particular social advantages and disadvantages defined as individual access to scarce resources highly valued in society, such as money, wealth, power, social prestige, education and knowledge [9]. Education, occupational status and income are seen to constitute the central defining factors for socioeconomic status and the core dimensions of social inequality [10, 11]. Social and health surveys therefore collect this information to define the socioeconomic status of respondents. This is done both by using the single indicators (education, occupation and income) separately and by using composite status indices [12-14].

Numerous data sources for health reporting, however, provide hardly any information on the individual socioeconomic situation of the people included. This makes analysing social inequalities in health very difficult. In Germany, this particularly applies to the data concerning life expectancy and causes of death, cancer registries, statistics regarding absences from work, as well as diagnosis data from outpatient and inpatient care. Due to strict data protection regulations, some of these data sources often only provide regionally aggregated data. In order to be able to analyse social inequalities in health, such data are then often related to regional socioeconomic indicators. Such indicators can pinpoint a region's social conditions. Possible indicators include the at-risk-of-poverty rate [15], unemployment rates, household income per capita [8] or multidimensional indices [17, 18].

Multidimensional indices at the regional level offer the benefit of highlighting not merely individual aspects,

but the overall set of socioeconomic advantages and disadvantages of a region. Within this context, international research often uses the term social or socioeconomic deprivation. Applied to individuals, the concept describes a relative lack of material resources; compared to others, the person in question has so few resources at their disposal that their participation in social activities is potentially limited [19, 20]. When applied to regions, however, the term deprivation highlights the fact that socio-spatial resources and burdens can also impact social participation. Measures of regional deprivation have been used in England since the 1980s to make compare regions regarding their associated need for healthcare [20]. Most indices thereby build on the concepts developed by Townsend [19], Carstairs [21] and Jarman [22]. Beyond socioeconomic indicators, more recent indices on so called "multiple deprivation" [23] consider further indicators, such as the life expectancy of the population. Whilst multiple deprivation approaches are better at explaining regional differences in care needs, they are of limited value to epidemiological research because, at a conceptual level, they do not clearly discriminate between health determinants and the consequences of diseases [20].

The index implements eight indicators from the three core dimensions of social inequality – education, occupation and income.

This article aims to develop a regional deprivation index for Germany that is capable of demonstrating regional socioeconomic inequalities. The index uses internationally established indicators and is based on the concept of socioeconomic status as it is used in social epidemiology to describe the social situation of individuals and households [14]. The following sections describe the key elements of the socioeconomic deprivation index and provide an analysis of statistical associations between the index and several health indicators at different regional levels. Finally, we discuss the index's potential and limitations with regard to research and health reporting.

2. Data and method

2.1 Data sources

The data source for regional socioeconomic information is the INKAR (indicators and maps on spatial and urban development) database compiled by Germany's Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) [24]. INKAR is an interactive online database containing regional statistics for Germany and Europe. Indicators are available for different regional levels. This makes comparisons between European regions, German federal states, districts, central areas and associations of municipalities possible. Most statistics date back to 1995 and analyse a consistent territory (as of 31 December 2014). Currently, the database contains around 600 indicators providing information on population, labour market, income and earnings, housing, education, social and medical care, transport and accessibility, land use and the environment, as well as public finances and budgets.

Regional health information for initial relation analysis was also acquired from the INKAR database, as well as from the statistical office of the European Union (Eurostat). Regional data are available for different spatial levels (Table 1). The INKAR database provides data on life expectancy at birth for the 402 rural districts and

Table 1
Administrative levels in Germany
Source: BBSR [24]

Level	Number of areas	Average population	Range of population figures	
			Minimum	Maximum
Associations of municipalities (GVB)	4,504	17,878	338	3,375,222
Districts and towns not attached to an administrative district (districts)	402	200,308	34,064	3,375,222
Spatial planning regions (ROR)	96	838,789	203,544	3,375,222
NUTS-2	39	2,064,711	518,289	5,081,061

NUTS-2= Nomenclature of territorial units for statistics, EU statistical regions, level 2, basic regions, corresponds to administrative districts or statistical regions of federal states. Territorial units and population as of 31 December 2012

In parts of the East German federal states, but also in the Saarland, North Rhine-Westphalia and Lower Saxony, levels of socioeconomic deprivation are higher.

towns not attached to an administrative district (termed districts in the following sections). Eurostat provides age-standardised information on mortality differentiated according to ICD-10 chapters (International Statistical Classification of Diseases and Related Health Problems, tenth revision) for the European administrative divisions NUTS-2 (Nomenclature of territorial units for statistics). According to official European statistics, for Germany this administrative level comprises 39 administrative or statistical regions.

Regionalised health information based on individual data was taken from the 2014/2015 German Health Update study (GEDA 2014/2015-EHIS). GEDA is part of health monitoring at the Robert Koch Institute (RKI) and has been regularly conducted as a cross-sectional health survey of adults (aged over 18) since 2009 [25]. The sample was conceived as a two-step cluster sample. In a first step, 301 municipalities and associations of municipalities stratified by federal state and BIK classification were selected randomly out of all the municipalities in Germany [26]. The probability of a municipality being drawn was thereby proportional to the size of its population [27]. In the selected municipalities, random samples from the residents' registration office were taken. The response rate was 27.7%. The statistical analysis was carried out using weighting factors that correct deviations of the sample from the German population (as of 31 December 2014) with regard to gender, age, district type and education. In total, data from 24,016 women and men aged over 18 were used. A detailed description of the methodology applied in the GEDA 2014/2015-EHIS survey can be found in the article German Health Update – New data for Germany and Europe in issue 1/2017 of the Journal of Health Monitoring.

2.2 Indicators to develop the socioeconomic deprivation index

To select suitable indicators for the German Index of Socioeconomic Deprivation (GISD), we conducted a comprehensive research of literature in the Pubmed and Google Scholar databases, which yielded 372 international articles on regional deprivation. After excluding double and irrelevant hits, 49 articles to extract indicators remained. To be shortlisted, an indicator had to be closely connected to one of the three central dimensions

of socioeconomic status (education, occupation and income) [10]. In a final step, we verified the availability of the corresponding indicators in the INKAR database and selected indicators that are available at the district or associations of municipalities level for the period from 1998 to 2012. Unfortunately, regarding the dimensions of education and occupation, only very few indicators fulfilled these criteria. Slightly more data are available for the dimension of income.

Unemployment rates in a region, the average gross wage of employees and the employment rate were selected as indicators for the dimension of occupation. Gross wage is used as an indicator for the mean occupational status of employees in a region as it is the best indicator available. The dimension of education used the share of employees with a university degree and the share of those who leave school without a certificate. The indicators for monthly mean net household income, debtor quotas and tax revenue were used for the dimension of income (Table 2). For those indicators for which no complete data sets for the years 1998 to 2012 exist, missing values at the district level were estimated based

Life expectancy is lower, mortality is higher and the health risks are greater in regions with higher levels of socioeconomic deprivation.

Category	Indicator	Statistical source	Availability
Unemployed	Proportion of people unemployed as share of working age residents in %	Statistics of the Federal Employment Agency	Associations of municipalities for the years 1998, 2003, 2008, 2012
Employees at place of residence with university degree	Proportion of employees with social insurance at place of residence with university degree as share of employees with social insurance at place of residence in %	Statistics of the Federal Employment Agency	Districts for the years 1999, 2003, 2008, 2012
Employment quota	Proportion of employees with social insurance at place of residence per 100 working age inhabitants	Statistics of the Federal Employment Agency	Associations of municipalities for the years 2003, 2008, 2012, districts for 1998
Gross wages and salaries	Gross wage and salary in EUR per employee	Official federal and federal state employment statistics	Districts for the years 2000, 2003, 2008, 2012
Net household income	Average household income in EUR per inhabitant	National Accounts Working Group (Arbeitskreis Volkswirtschaftliche Gesamtrechnung der Länder)	Districts for the years 2000, 2003, 2008, 2012
School leavers without certificate	Proportion of school leavers without school-leaving certificate out of all school leavers in %	Statistics on the schools of general education	Districts for the years 1998, 2003, 2008, 2012
Debtor quota	Private debtors per 100 inhabitants aged 18 and above	Statistics from creditreform e.V. associations	Districts for the years 2004, 2008, 2012
Tax revenue	Tax revenue in EUR per inhabitant	Comparison of federal and federal state taxation on real estate and working assets	Associations of municipalities 2003, 2008, 2012, districts for 1998

Table 2
Indicators of socioeconomic deprivation
Source: INKAR [24]

on regression analysis (linear random intercept model time series). For the five indicators that were only available at the district level, values for associations of municipalities were estimated by regression analysis based on other available indicators (Table 2). This means that at the level of associations of municipalities the index is associated with greater uncertainties than at the district level. Furthermore, the index for 1998 is less precise than for the following years as for this particular year data were unavailable for several indicators.

2.3 Index development

Analogous to the approach adopted in international literature, during index development, a factor analysis was performed to weight the indicators for the three dimensions of socioeconomic deprivation [28-31]. Rotated factor loadings were used and a single factor solution indicated for each dimension. The three generated factors were given equal weighting in the resulting index, i.e. each contributing one third (Table 3). For the dimension of education, there were only two indicators, which meant a factor analysis was not applicable. Because employees represent a notably larger proportion of the population, the indicator education status of employees was given twice the weight of the indicator proportion of people who leave school without a certificate based on school statistics. This was done in consideration of the fact that the ratio of employees (education status of employees) compared to households of adults with children (school leavers without certificates) is roughly two to one. In the absence of conclusive indicators for education at the regional level, values are approximate estimates.

The index was standardised for each survey year and each spatial level (associations of municipalities, districts, administrative regions [NUTS-2], spatial planning regions), which means that the regional socioeconomic deprivation index can vary between 3 (lowest degree of deprivation/highest socioeconomic status) and 21 (highest degree of deprivation/lowest socioeconomic status). Standardisation aimed to ensure the comparability of the variation range with the composite index of individual socioeconomic status developed for the health

The German Index of Socioeconomic Deprivation is available for research and health reporting on different spatial levels and for various years.

Table 3
Weighting of indicators for socioeconomic deprivation in the three subdimensions of the German Index of Socioeconomic Deprivation
Data sources: INKAR, own calculations

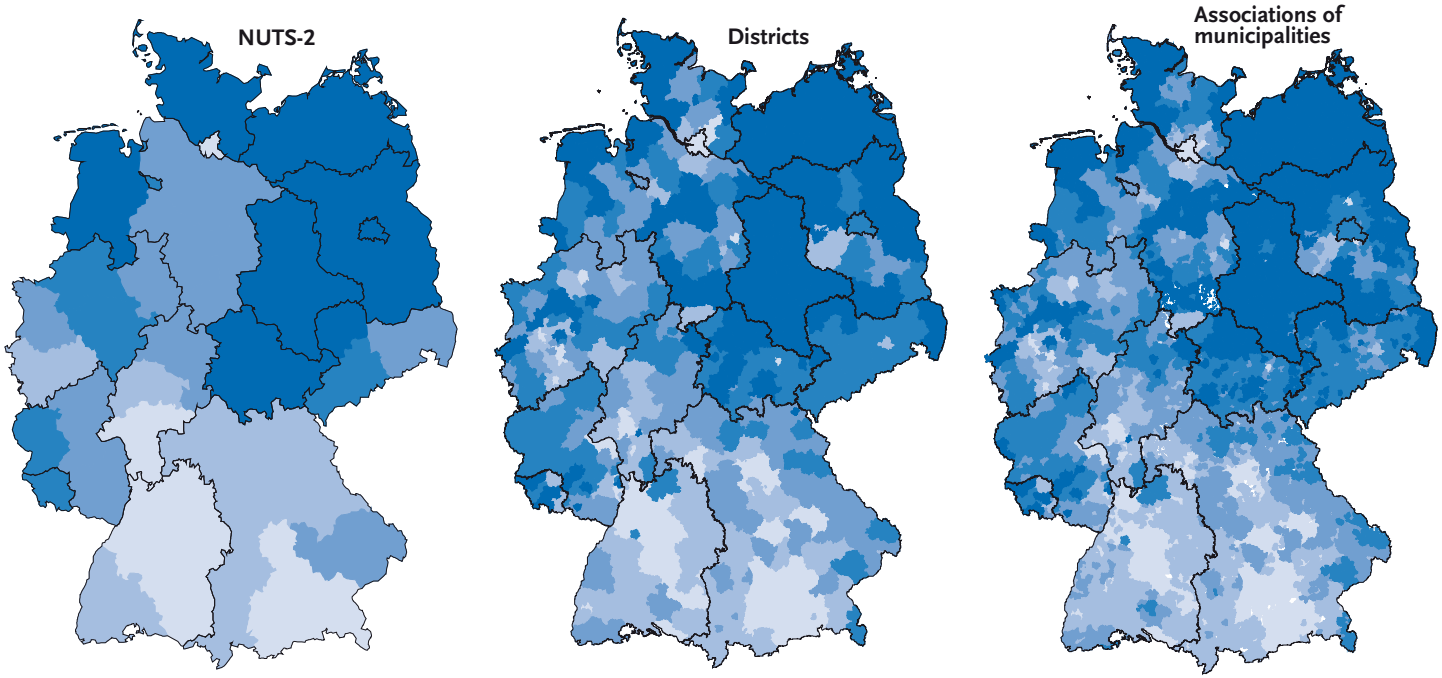
Dimension (Proportion of GISD)	Indicator (z-standardised)	Factor loading	Correlation of indicators with dimension (Pearson)
Education (33.3%)	School leavers without certificate	-0.33	0.76
	Employed at place of residence with university degree	+0.66	-0.74
Occupation (33.3%)	Unemployed	-0.61	0.89
	Gross income and wage	+0.27	-0.63
	Employment quota	+0.50	-0.55
Income (33.3%)	Debtor quota	-0.41	0.70
	Net household income	+0.52	-0.88
	Tax revenue	+0.39	-0.55

surveys conducted by the Robert Koch Institute. Moreover, the units of the mentioned spatial levels, i.e. the corresponding regions, were weighted according to the population for further analysis of the distribution of index values for each year and categorised in two ways. First, they were divided into groups of 20% (quintiles, fifths) weighted by their population. These quintiles were then used to differentiate between regions with low (lowest quintile), medium (middle three quintiles) and high (highest quintile) levels of socioeconomic deprivation. The variation range of 3 to 21 points and category development was guided by the development of individual socioeconomic status in population-wide epidemiological surveys in the context of health monitoring conducted by the Robert Koch-Institute [14].

2.4 Analysis strategy

The following section presents the regional distribution of the index and results on associations between regional socioeconomic deprivation and average life expectancy as well as the individual health indicators smoking, leisure-time physical inactivity and obesity. Moreover, the associations between regional socioeconomic deprivation and individual socioeconomic status are highlighted.

The index provides the field of health reporting with new data sources to analyse health inequilities.



NUTS-2 = Nomenclature des unités territoriales statistiques
1 = lowest levels of deprivation ... 5 = highest levels of deprivation

Figure 1
Regional levels of socioeconomic deprivation (in quintiles) by spatial levels in Germany 2012
Data sources: INKAR, own calculations

The German Index of Socioeconomic Deprivation was linked to district identifiers. As a measure to quantify the association between the index and health indicators, the Relative Index of Inequality (RII) was calculated [32]. This regression-based measure takes into account the entire distribution of a socioeconomic variable. In the following, the RII can be interpreted as the estimated rate ratio between people living in regions with the highest and those living in regions with the lowest level of socioeconomic deprivation. A value of 1 translates as no regional socioeconomic inequalities; values greater than 1 indicate an increased rate in deprived regions, whereas values between 0 and 1 indicate a lower rate in deprived regions. In contrast, the Slope Index of Inequality (SII) was used to analyse associations between regional socioeconomic deprivation and life expectancy. Analogous to the Relative Index of Inequality, it describes the absolute difference in life expectancy [32]. The SII was required because no age-standardised mortality figures to calculate the RII were available at the district level. All analysis was conducted using the Stata SE 14.1 statistical package.

3. Results

Figure 1 shows the distribution of the German Index of Socioeconomic Deprivation at the level of associations of municipalities, districts and administrative regions or statistical regions according to the official European statistics (NUTS-2) for 2012. Overall, the figures show that levels of socioeconomic deprivation are spread unevenly between the West German and the East German federal states (also known as the new federal states). Many associations of municipalities presenting high values for socioeconomic deprivation are located in the new federal states; however, further concentrations can also be

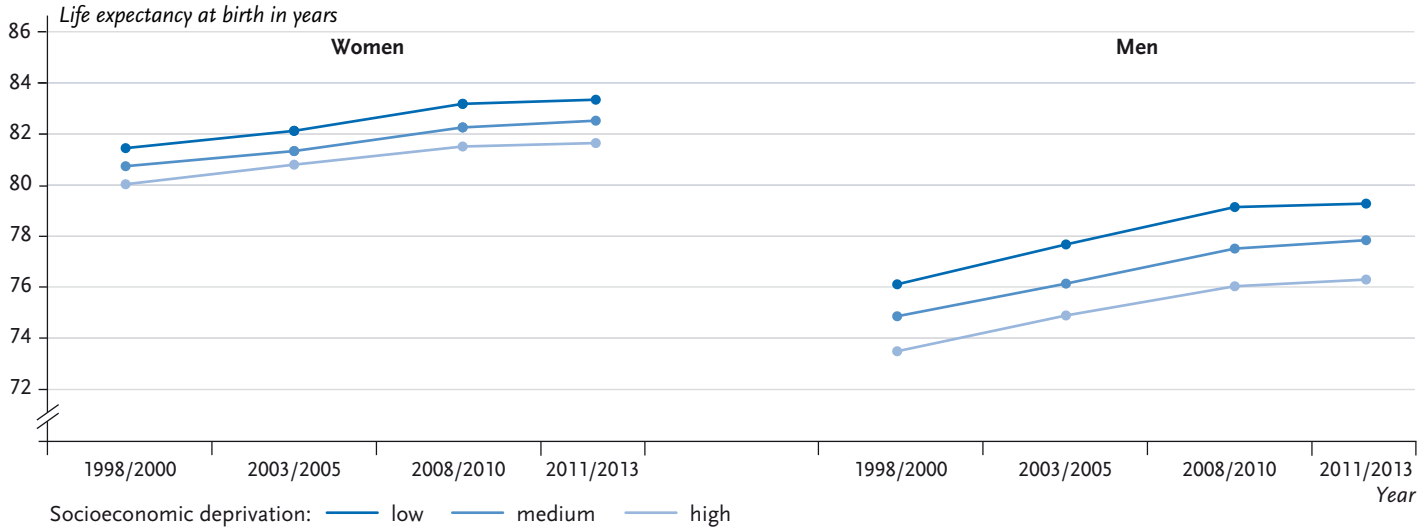


Figure 2
Regional levels of socioeconomic deprivation (in categories at the district level) and life expectancy
Data sources: indicators and maps on spatial and urban development (INKAR); own calculations

found in the Saarland, North Rhine-Westphalia and rural areas of Lower Saxony. Areas where the levels of socioeconomic deprivation tend to be low are found mainly in Bavaria, Baden-Württemberg, Hesse and parts of North Rhine-Westphalia, such as in Düsseldorf and the Cologne/Bonn region.

Figure 2 shows the differences in life expectancy at the level of districts for the years 1998/2000 through to 2011/2013. Socioeconomic deprivation is classified into the three categories low, medium and high. For the observation period, men from districts with low levels of deprivation had a mean life expectancy that was 2.9 years higher than for men from the most deprived districts (SII=3.44). For women, the corresponding mean difference was 1.5 years (SII=1.86). Over the entire observation period, the regional socioeconomic inequalities in mean life expectancy measured using the SII increased significantly by 27.7% for women and 20.2% for men. Expressed in years, the difference in life expectancy between districts with high and low levels of deprivation increased from 1.4 to 1.7 years for women and 2.6 to 3.0 years for men during the period of observation. The German Index of Socioeconomic Deprivation can statistically explain 45.5% (adjusted R^2) of regional differences in life expectancy for women and 62.2% for men.

Table 4 shows the causes of death (ICD-10 disease chapters) where regional socioeconomic inequalities in mortality at the level of administrative and statistical regions were particularly large between 2008 and 2010. The Relative Index of Inequality reveals significant socio-spatial disparities with regard to total mortality and diseases of the circulatory system (I00–I99), for neoplasms (C00–D48), diseases of the respiratory system (J00–J99) and diseases of the digestive system (K00–K93, only for men) and, therefore, for 80.7% of all deaths in the period considered.

Beyond the described statistical associations at the regional level, data from the Robert Koch Institute's GEDA 2014/2015-EHIS survey can provide a link between regional values for socioeconomic deprivation and the individual health of respondents. In the 255 associations of municipalities in which GEDA respondents lived, the three health risks smoking (answering the question 'Do you smoke?' with 'yes, daily' or 'yes, occasionally'), leisure-time physical inactivity (<10 minutes of leisure-time physical activity per week) and obesity (body mass index ≥30 kg/m²) are significantly more prevalent in associations of municipalities with higher levels of socioeconomic deprivation than in those with comparatively low levels of deprivation (Figure 3). With the exception of obesity, the link with levels of socioeconomic deprivation is similarly strong for women and men. When comparing associations of municipalities with the highest levels of socioeconomic deprivation to those with the lowest, the Relative Index of Inequality is 1.5 to 1.7. For male obesity, it is 1.9.

Moreover, GEDA reveals the varying statistical importance of individual socioeconomic status and regional socioeconomic deprivation for the spread of health risks. Table 5 shows the results from four gradually calculated regression models for the considered health risks. In a first step, the general regional variation of health risks at the level of associations of municipalities (M0) is considered. In the following steps, the links with regional

Cause of death according to the main groups listed in the ICD-10 and arranged based on the proportion of age-standardised deaths		Share in causes of death	Standardised mortality rate per 100,000 residents	By socioeconomic deprivation (GISD)		Relative Index of Inequality (RII) by gender		
Code	**Description**	**Total**	**Total**	**Low**	**High**	**Total**	**Women**	**Men**
A-R, V-Y	Total mortality excluding chapters S, T and Z	100.0%	1063.8	977.9	1135.2	1.19	1.15	1.24
I00-I99	Diseases of the circulatory system	42.2%	449.2	396.8	507.3	1.26	1.24	1.29
C00-D48	Neoplasms	26.0%	276.3	261.0	285.8	1.15	1.08	1.24
J00-J99	Diseases of the respiratory system	7.6%	80.3	67.6	81.6	1.22	1.19	1.29
K00-K93	Diseases of the digestive system	4.9%	52.4	50.2	55.4	-	-	1.17
V01-Y98	External causes of morbidity and mortality	3.6%	38.8	43.3	41.2	-	-	-
E00-E90	Endocrine, nutritional and metabolic diseases	3.3%	35.6	35.0	41.1	-	-	-
F00-F99	Mental and behavioural disorders	2.7%	28.3	27.2	26.5	-	0.77	-
R00-R99	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	2.4%	25.9	20.9	22.7	2.46	2.42	2.54
G00-G95	Other diseases of the nervous system	2.4%	25.9	27.0	24.6	-	-	-
N00-N99	Diseases of the genitourinary system	2.3%	24.4	21.3	27.2	1.27	1.31	1.24
A00-B99	Certain infectious and parasitic diseases	1.7%	18.3	17.5	13.3	-	-	-
M00-M99	Diseases of the musculoskeletal system and connective tissue	0.3%	3.2	4.4	2.8	-	0.50	-
D50-D89	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	0.3%	3.2	3.4	3.5	-	-	-
L00-L99	Diseases of the skin and subcutaneous tissue	0.1%	1.1	1.2	1.0	-	-	-
Q00-Q99	Congenital malformations, deformations and chromosomal abnormalities	0.1%	0.9	1.0	1.1	-	-	-
O00-O99	Pregnancy, childbirth and the puerperium	0.0%	0.1	0.1	0.1	-	-	-
P00-P96	Certain conditions originating in the perinatal period	0.0%	0.0	0.0	0.0	-	-	-

Legend:
GISD=German Index of Socioeconomic Deprivation; ICD-10=International Statistical Classification of Diseases and Related Health Problems, 10th Revision; RII=Relative Index of Inequality; "–"=nonsignificant results
Eurostat statistics do not record data for ICD-10 codes S00-T98 and Z00-99. Total excluding codes O00-O99.
Standardised mortality rates per 100,000 residents: age-standardised deaths per 100,000 residents (revision of the European Standard Population 2013).
Standardised mortality rates by socioeconomic deprivation: mortality rate at NUTS-2 level (nomenclature of territorial units for statistics) differentiated by levels of socioeconomic deprivation (in categories).
Relative Index of Inequality according to GISD=Relative Index of Inequality of mortality rates by levels of socioeconomic deprivation.

Table 4
Socioeconomic deprivation (in categories at the level of administrative and statistical regions) and deaths (2008-2010) by cause of death
Data sources: Statistical Office of the European Union (Eurostat) [33]; own calculations

Figure 3
Regional levels of socioeconomic deprivation (in categories at the level of associations of municipalities) and behaviour-related individual risk factors
Data sources: GEDA 2014/15-EHIS; INKAR; own calculations

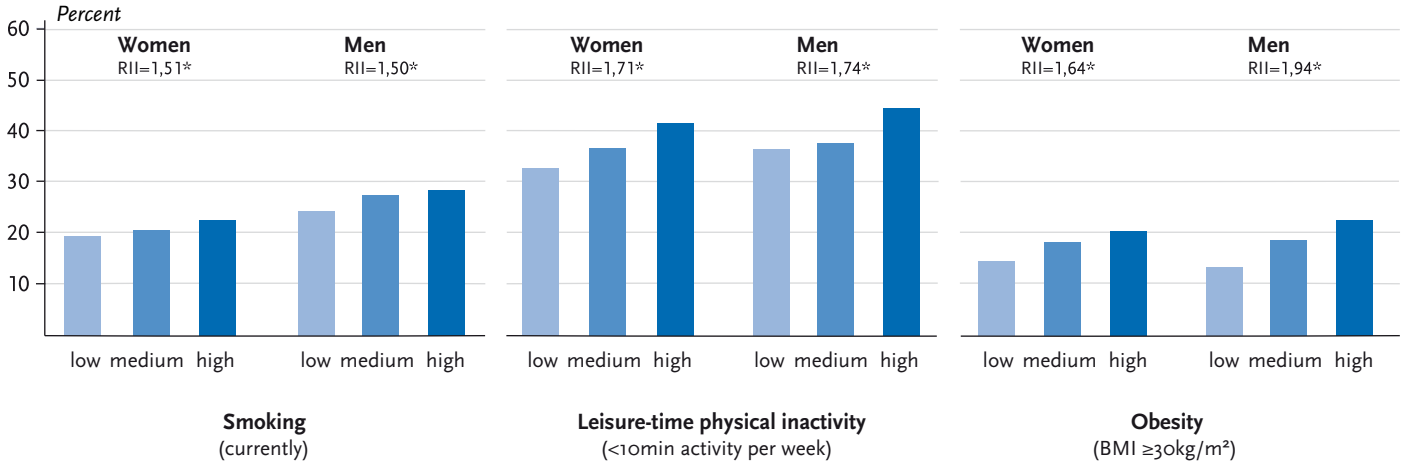


Table 5
Link between individual and regional socioeconomic deprivation and behaviour-related risk factors; results from multilevel logistic regression modelling
Data sources: GEDA 2014/15-EHIS; own calculations

	Smoking		Physical inactivity		Obesity	
	Women	Men	Women	Men	Women	Men
M0: Basic model						
MOR(GVB)	1.18*	1.13*	1.19*	1.29*	1.29*	1.31*
M1: Deprivation						
RII(GISD)	1.51*	1.50*	1.71*	1.74*	1.64*	1.94*
MOR(GVB)	1.12*	1.03	1.10*	1.22*	1.23*	1.22*
M2: Deprivation and SES						
RII(GISD)	1.24*	1.25*	1.38*	1.32*	1.38*	1.66*
RII(SES)	0.25*	0.36*	0.21*	0.19*	0.27*	0.41*
MOR(GVB)	1.18*	1.07	1.00	1.20*	1.18*	1.19*
M3: Deprivation and SES interaction						
RII(GISD)	1.60*	1.42*	1.58*	1.18	1.21	1.31
RII(SES)	0.33*	0.41*	0.24*	0.17*	0.23*	0.32*
RII(GISD)*RII(SES)	0.61°	0.78	0.77	1.23	1.31	1.58
MOR(GVB)	1.17*	1.06°	1.00	1.20*	1.18*	1.19*

Controlled for age (metric and squared) levels: associations of municipalities and individual. Significant impact of variables and/or variation at spatial level
*= p<0.05 or marginally significant °=p<0.10.
SES=individual socioeconomic status; GISD=German Index of Socioeconomic Deprivation; RII=Relative Index of Inequality; MOR=Median Odds Ratio for levels of associations of municipalities.

socioeconomic deprivation (M1), individual socioeconomic status (SES) (M2), as well as the interaction between both of these factors (M3) are taken into account. When interpreting results, SES index and German Index of Socioeconomic Deprivation scores must be interpreted inversely. High SES index scores point to a better individual socioeconomic situation, high scores in the German Index of Socioeconomic Deprivation point to a worse regional socioeconomic situation. The results therefore show that both regional levels of socioeconomic deprivation and individual socioeconomic status have significant and independent links to health risks. The higher an individual's socioeconomic status is, the lower the prevalence of smoking, leisure-time physical inactivity and obesity. Yet, in regions characterised by high levels of socioeconomic deprivation, these risk factors are generally more prevalent, independent of individual socioeconomic status. Moreover, results from the interaction model (M3) indicate that a person's individual socioeconomic status has no significant impact on this link between regional socioeconomic deprivation and health risks. One exception is smoking among women, where a marginally significant interaction effect ($p<0.10$) was observed.

4. Discussion

This study introduces a new index for regional socioeconomic deprivation in Germany. The German Index of Socioeconomic Deprivation (GISD) operationalises regional deprivation multi-dimensionally at the population level based on the three equally weighted dimensions of education, occupation and income. Initially generated for the years 1998, 2003, 2008 and 2012, the index will be updated regularly every few years. Initial association analysis revealed a certain degree of statistical link between regional differences in life expectancy, major causes of death and behavioural health risks with levels of regional socioeconomic deprivation. Further analysis suggested that, to a certain extent, individual socioeconomic status can mediate the relation between regional deprivation and behavioural health risks: Statistically controlling for individual socioeconomic status substantially reduces the effect of regional deprivation, but in most cases does not totally explain its effect. Overall, the results indicate that individual socioeconomic status is not an effect modifier because there is no significant difference in the statistical link between regional deprivation and behavioural health risks among women and men with a low socioeconomic status compared to those with a higher status.

The findings are in line with German and international literature. Health in regions with higher levels of socioeconomic deprivation tends to be worse, as does behaviour with regard to health [34-40]. Similar studies in countries such as England and New Zealand have also shown lower life expectancy at birth and the reduction of later life expectancy with increasing levels of socioeconomic deprivation in specific regions [34-36]. Corresponding links regarding regional unemployment rates, average income and at-risk-of-poverty rates have also been documented in Germany [5, 6, 16]. Moreover, a link with regional deprivation markers and mortality was shown: mortality rates in deprived regions are higher

than average [37, 38]. In terms of individual health outcomes, in Germany increasing degrees of deprivation translate into higher rates of obesity [39], smoking and physical inactivity [40].

In terms of methodology, the utilized approach is in line with the discussion taking place internationally. For example, the New Zealand Deprivation Index (NZDep) [28, 29], the Deprivation Index for Quebec and Canada (INSPQI) [41-43], the French small-area index of socioeconomic deprivation [30], the Deprivation index for small areas in Spain [44] and the Danish Deprivation Index (DANDEX) [31] also use factor analysis to weight indicators within the different dimensions of regional socioeconomic deprivation.

The approach has certain advantages but also limitations. Many deprivation indices that build on the work by Townsend [19], Carstairs [21] and Jarman [22] are based on census data. For Germany, however, census data are only available in irregular intervals. Process-produced data were therefore mainly used to be able to regularly update the index. However, this means that, overall, there are only scant conclusive indicators, in particular at the level of associations of municipalities. Moreover, some standard of life indicators, such as passenger car density, were not used to increase the comparability of index values between urban and rural regions [45-48].

Applying the index at the level of associations of municipalities increases the socioeconomic homogeneity of units compared to the district level and decreases the risk of false conclusions due to the effect of administrative boundaries (modifiable areal unit problem) [49]. Factor analysis allows a better use of the available information than if it were weighted equally [19, 21] and the approach is less prone to systematic bias than subjective weighting by experts as is occasionally applied in some countries [22, 50]. However, compared to individual socioeconomic status, the applicability of deprivation indices is limited. They can be used to identify socioeconomically deprived regions, but allow no conclusions on individual socioeconomic status [18, 19, 51, 52] or the extent of health inequalities in a determined region [53].

In our view, the generated deprivation index is a useful additional tool for research and health reporting. Limiting the index to socioeconomic indicators ensures a clear interpretation of statistical associations. The index thereby complements data on individual socioeconomic status and allows for conclusions on independent explanations of regional socioeconomic deprivation and interactions with individual socioeconomic status. Where an individual operationalisation of socioeconomic status is not possible (for example, in the data of the cause of death statistics in Germany), the index, at least to a certain degree, reveals the extent of health inequalities and provides additional reasons to collect individual data [41]. Moreover, the results can be used as a basis for health policy initiatives and for the development of health promotion and prevention strategies to achieve substantial change in regions with high levels of socioeconomic deprivation. As regional analyses have the potential to promote a targeted allocation of financial resources, they also have the potential to promote health equality [28, 31].

The GISD is provided free to use for research and health reporting at the data archive datorium of the German GESIS [54].

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Corrigendum, page 107

In the original article, in Table 4 'Socioeconomic deprivation (in categories at the level of administrative and statistical regions) and deaths (2008-2010) by cause of death' some of the values for standardised mortality rates by socioeconomic deprivation (GISD) were switched in the columns 'Low' and 'High'. In the current version, the table has been corrected.

Imprint

Journal of Health Monitoring

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Conflicts of interest
The authors declared no conflicts of interest.

Funding
The GEDA study was funded by the Robert Koch Institute and the German Federal Ministry of Health.

Note
External contributions do not necessarily reflect the opinions of the Robert Koch Institute.

Publisher
Robert Koch Institute
Nordufer 20
D-13353 Berlin, Germany

Editors
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Typesetting
Gisela Dugnus, Alexander Krönke, Kerstin Möllerke

Translation
Simon Phillips/Tim Jack

Please cite this publication as
Kroll LE, Schumann M, Hoebel J et al. (2017) Regional health differences – developing a socioeconomic deprivation index for Germany. Journal of Health Monitoring 2(2):98–114.
DOI 10.17886/RKI-GBE-2017-048.2

ISSN 2511-2708

The Robert Koch Institute is a Federal Institute within the portfolio of the German Federal Ministry of Health