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How is Germany doing in Europe? Results from the European Health Interview Survey (EHIS) 2

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Editorial: Better and comparable data on population health in Europe

DATA ON POPULATION HEALTH · EHIS 2 · EUROPEAN COMPARISON

The European Union (EU) was established with great purpose as a project of peace and to strengthen democratisation and the economy. The institution was founded in 1993 by twelve Member States and has grown steadily since its inception. During this period, the health of the EU population has also improved significantly: life expectancy has increased, living conditions have improved, and progress has been made in health behaviour and provision of health care. Nevertheless, the growing burden associated with noncommunicable diseases, demographic change and health-related inequalities poses challenges to public health and national healthcare systems across Europe. In order to respond to these challenges adequately, reliable representative data are required on the living conditions, health status, health behaviour and the use of health services within each of the countries making up the EU.

Towards the end of the 1990s, the EU decided to establish a set of harmonised health indicators for a common European health information and knowledge system. The ECHI shortlist (European Core Health Indicators) was the result of a number of successive projects and consists of 88 indicators. Figures from international data sources are available for 67 of these indicators. The provision of comparable health data enables comparisons with other EU Member States. The comparison of health data is also aimed at encouraging mutual learning.

The European Health Interview Survey (EHIS), which is focused on noncommunicable diseases, is an important data pool for indicators of health status and health behaviour. The first wave of EHIS was carried out voluntarily by EU Member States between 2006 and 2009. The second wave was prepared as part of a multi-year process of development and discussion. All 28 Member States were legally obliged to conduct the second wave and did so between 2013 and 2015. On the website Statistics Explained, Eurostat provides information on various health topics based on EHIS data, but also on many other topics. In addition to extensive statistical data, the website also provides explanations and background information, as well as analyses of EHIS data in tabular format.

This issue of the Journal of Health Monitoring is based on data from the second wave of EHIS. The articles that follow are also compatible with two previous issues of the Journal of Health Monitoring (1/2017 and 2/2017) in which selected indicators for Germany and the EU were compared. However, the aggregated data on which earlier results were based provide for more restricted analyses. In contrast, the articles in this issues are based on microdata (anonymised original data collected for the EHIS survey from the

EU Member States), which were used to evaluate various aspects of health and to spotlight where Germany stands in terms of population health compared with the rest of Europe.

The first article is entitled Partnership, parenthood, employment and self-rated health in Germany and the EU. Most middle-aged women and men adopt one of three central roles in life. This article demonstrates the impact that each of these roles has on self-rated health and reveals the significance of employment within this context. In Germany, no differences were identified for self-rated maternal health by employment status; a finding that also applies to single mothers.

The second article describes Educational differences in the prevalence of behavioural risk factors in Germany and the EU. Educational differences in health behaviour contribute significantly to the development of educational differences in mortality. In Germany and in most other EU Member States, behavioural risk factors are more prevalent among people in lower education groups than among those in higher education groups. This article describes the extent of these educational differences in relation to five risk factors. Overall, the figures place Germany in the mid-range compared with rest of the EU.

In addition to inequalities in health, demographic change is one of the challenges currently facing the EU. Gaertner et al. analyse limitations in activities of daily living in old age. These limitations are studied with the help of two instruments: ADL (activities of daily living) and iADL (instrumental activities of daily living). People in Germany report fewer limitations in their activities of daily living than the EU average. This applies to ADL limitations (for example in walking, eating and using the toilet) and to iADL limitations (such as in shopping, banking and housekeeping).

The article Depressive symptoms in a European comparison describes the age-standardized prevalences of depressive symptoms over the last two weeks. It relies on self-reported data collected from EHIS participants using a country-specific version of the Patient Health Questionnaire (PHQ-8). The prevalence of depressive symptoms in Germany is higher than the EU average. However, when severity is taken into account, the differences between Germany and the EU average only hold true for mild depressive symptoms. In Germany, a depressive symptomology among younger people is identified more frequently than the EU average, while older people reporting depressive symptoms less frequently than the EU average.

The final article European Health Interview Survey (EHIS) 2 – Background and study methodology describes the methodology implemented in EHIS. The article shows that data collection for EHIS is harmonised between EU Member States and, thus, the data collected for the study demonstrates a high degree of comparability. Nevertheless, this contribution also notes the importance of accounting for country-specific issues such as socioeconomic and cultural factors when interpreting the results. As such, it is quite possible that cultural differences between EU Member States play a role when people rate their health or assess limitations and illnesses.

Eurostat publishes a range of health-related data such as national Causes of death statistics from EU Member States on its website. In addition to absolute figures, it also details raw and standardised mortality rates. Furthermore,

in addition to EHIS data, Eurostat also publishes data from the EU statistic on income and living conditions (EU-SILC).

EU-wide comparable data on health can contribute towards the development of national strategies aimed at addressing health challenges that also exist in other European countries. Moreover, these data can also be used to identify best practices for policy measures in various countries. However, this relies on a sustainable flow of information and the continual development of health data in the EU.

As the EHIS survey is mandatory throughout the EU, it constitutes an important milestone in improving the health-related information available at the EU level. However, the EU still lacks a sustainable structure or institution with the competence for noncommunicable diseases and their determinants, such as the European Centre for Disease Prevention and Control (EDCD) has in the case of infectious diseases. Many of the monitoring and indicator systems for noncommunicable diseases described above have been implemented during temporary projects. Although such projects generate targeted approaches, they provide no basis with which to deliver sustainable health information and expertise. As such, a sustainable health information system is required that can bring together the EU's health information. Ideally, this would include the provision of health-related information at the data level, at the informational level in terms of indicators, and at the level of knowledge with regard to the provision of summary reports and assessments. This would improve the basis for developing appropriate and evidence-based public health measures aimed at improving the health of the EU population.

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Partnership, parenthood, employment and self-rated health in Germany and the EU – Results from the European Health Interview Survey (EHIS) 2

Abstract

Partnership, parenthood and employment constitute three main social roles that people adopt in middle adulthood. Against the background of the discussion about multiple roles and the reconciliation of family and work, this article analyses the association between the combination of social roles and self-rated health in Germany and the European Union (EU).

The analysis is based on data from the second wave of the European Health Interview Survey (EHIS 2), which was conducted in all EU Member States between 2013 and 2015. The final sample included 62,111 women and 50,719 men aged between 25 and 59. Using logistic regression models, predictive margins for fair to very bad health in different family and employment constellations were calculated for the EU and Germany (in the case of men only for the EU in total).

A difference was identified according to employment status in all family groups for women and men at the EU level: non-employed people rated their health as fair or bad more often, followed by part-time and full-time workers. Smaller differences by employment status were found for mothers with a partner in terms of the proportion of mothers who self-rated their health as bad compared to women in other family groups. No differences in health by employment status were found in Germany among mothers. This applies also to single parents. Different patterns of associations were identified between groups of EU Member States with diverse welfare systems.

COMPATIBILITY OF FAMILY AND WORK · SELF-RATED HEALTH · EUROPEAN COMPARISON

1. Introduction

Partnership, parenthood and employment are the three main social roles that people adopt in middle adulthood. Numerous studies have shown that all three roles are important determinants of health. While a large number of studies have shown that employment or partnership has a positive impact on health [1-5], the results for parenthood are less consistent [6-8]. However, the three social roles are interdependent and do not function in isolation from one another. This is also evident in the debate about family and labour market policies that is taking place in many European countries. The debate is aimed at improving the work-life balance, now that women – and mothers in particular – are becoming more active in the labour market.

GEDA 2014/2015-EHIS (for international comparisons)

Data holder: Robert Koch Institute

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

Method: Questionnaires completed on paper or online

Population: People aged 15 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: 24,824 people (13,568 women, 11,256 men)

Response rate: 27.6%

Study period: November 2014 - July 2015

More information in German is available at www.geda-studie.de and Lange et al. 2017 [9]

Role theory discusses and analyses the associations between combinations of partnership, parenthood and employment with health under the heading of 'multiple roles' [10-12]. In simplified terms, two opposing hypotheses can be distinguished: the 'multiple role burden hypothesis' states that the demands associated with partnership, parenthood or employment are often incompatible, especially for women, and thus contribute to stress, overload and, ultimately, to health impairments. According to the 'multiple role attachment hypothesis', several social roles enrich the lives of women and men by providing social and economic resources and by balancing burdens in one area of life with resources from another. In addition to the causal effects of the three social roles on health, there are also selection effects which mean that healthy women and men are more likely to enter into a partnership, start a family or work [13, 14]. Causal and selection effects are by no means mutually exclusive, but can interlock and reciprocally reinforce health inequalities [13].

Current research on the association between the combination of these three social roles and health is quite heterogeneous. This is partly due to the fact that the studies analysed different health indicators. However, the results also differ with regard to self-rated health – the global indicator and valid predictor of well-being, morbidity, mortality and the utilisation of medical services that has been selected for this analysis [15-17].

Until now, the association between partnership, parenthood, employment and health has rarely been analysed for men. Among other reasons, this may be due to the fact that the compatibility of family and work is discussed to a greater extent in debates about women. With regard to self-rated health, an Australian study [10] has shown that non-employment among men is associated with worse general health regardless of their partner or parental statuses. In Germany, [18] there is also a strong association between non-employment and bad self-rated health among men. However, while part-time work is associated with bad health for men without children, there are no significant differences between men who work part-time or full-time and have children [18].

For women, the association between the three social roles and self-rated health has been studied more frequently [10, 18-27]. While in all studies in childless women non-employment is associated with bad general health, women with children show clear differences in the results: while most studies conclude that employed mothers provide a more positive self-assessment of their health than non-employed mothers [19, 23-26], some studies have found no differences in self-rated health between mothers according to employment status [18, 26]. Furthermore, other studies have found that mothers in full-time employment provide a more negative rating of their health than non-employed mothers [10]. The results also differ in terms of the extent of employment: whereas some studies report no differences between full-time and part-time workers [18, 19], other studies show better general health for part-time employed mothers than for full-time employed mothers [10, 22]. There are no differences in self-rated health between full-time and part-time employed women in Germany [18]. This applies regardless of whether children or a partner live in the household. In the case of mothers with a partner, non-employment is not associated with a higher probability of bad health, but non-employment is associated with bad

health in the case of single mothers and childless women in Germany [18].

This heterogeneity in the results – in addition to differences in the study design, the age of the study participants or the date of the survey – is discussed against the background of different family policies and welfare systems in the countries under consideration. It is assumed that these enable family and working life to be reconciled in different ways [26, 28]. As yet, no comparative studies of the association between partner, parental, and employment status and health at the level of the European Union (EU) have been conducted. Only one study, by Artazcoz et al. [29], has examined the association between paid working hours and self-rated health in different groups of EU Member States. Artazcoz et al. considered partnered female and male employees and also took parental status into account. However, the study does not combine employment and parenthood, but treats them as co-existing individual factors. The study concludes that self-rated health does not vary with parental status or the number of weekly working hours in Nordic, Eastern and Southern European countries, but does so in Continental European and Anglo-Saxon countries.

All in all, a large number of international studies analyse the association between partner, parental and employment statuses and self-rated health; however, most only do so at the level of individual countries.

This is the first analysis to compare the association between partnership, parenthood and employment with self-rated health against the background of different family policies and welfare systems in the EU. For this purpose, a scientifically established typology of countries is used, according to which the EU Member States can be assigned to five groups with similar welfare systems [29-31]. The main characteristics of the five types can be outlined as follows [30, 32]:

- In the Nordic European countries – Denmark, Finland and Sweden – family policy is aimed at gender equality and the compatibility of family and work. Countries of this type are characterised by a high maternal employment rate, high birth rates and a well-developed public childcare system. However, due to high taxes, both parents usually have to work to earn an average family income.
- Family policy in Continental European countries – including Germany as well as Belgium, France, Luxembourg, the Netherlands and Austria – is aimed primarily at providing financial support to married people and families through direct cash benefits. The tax system promotes the traditional male breadwinner model, so that despite extensive childcare facilities, mothers tend to have low employment rates, especially with regard to full-time work. France is an exception, with strong support for the integration of women into the labour market.
- The Southern European countries – Greece, Italy, Malta, Portugal, Spain and Cyprus – are characterised by a family policy that is accompanied by a comparatively low level of social protection by the state and low expenditure on family policy measures. As a result, women bear a great deal of responsibility for family tasks. Childcare rates and mothers' full-time employment rates are nevertheless at medium levels.
- The social security system in the Anglo-Saxon countries, which includes the United Kingdom and Ireland, is based on the guiding principle of basic provision in the event of need and thus primarily aims to combat poverty. The

reconciliation of family and work is promoted to a rather limited extent by the state. Statutory parental leave is comparatively short and is partly compensated by individual parental leave granted by the employer.

- In Eastern European countries – Bulgaria, Estonia, Latvia, Lithuania, Poland, Hungary, Romania, Slovakia, Slovenia and the Czech Republic – large variations exist with regard to family policy measures. A common characteristic is that family policies have remained relatively underdeveloped in the course of post-communist transformation processes. Despite the support of dual-earner couples and high proportions of mothers in full-time employment in some countries, to a large extent, a more traditional division of domestic and family work exists between women and men.

Against the background of these differing political contexts, it is assumed that the association between the combination of partnership, parenthood and employment with health will also vary between the groups of EU Member States.

This paper examines the following questions in detail:
Are there any associations between combinations of the three social roles (partnership, parenthood, employment) and self-rated health? If so, do these associations vary

a) between women and men throughout the EU?
b) among women in Germany and the EU in total?
c) among women in EU Member State groups characterised by different welfare systems?

The majority of men in the EU work full-time. Therefore, in a representative survey, the case numbers of men who are not in employment or part-time employed are correspondingly low. Men are therefore not included in the differentiated analyses of differences within Germany and between Member State groups (see questions b and c).

2. Methodology

2.1 Study design

The analysis presented here is based on data from the second wave of the European Health Interview Survey (EHIS 2) which was collected in all 28 EU Member States between 2013 and 2015 (Info box). The survey included people aged 15 or over who live in private households. In order to ensure a high degree of harmonisation between the survey results from the various Member States, a handbook was provided with recommendations and guidelines on survey methodology, as well as a model questionnaire [33]. In Germany, EHIS forms part of the health monitoring undertaken at the Robert Koch Institute. EHIS 2 has been integrated into the German Health Update (GEDA 2014/2015-EHIS) [9, 34]. The EU Member States each selected a nationally representative sample for EHIS 2, based on population registers, censuses, residential registers or other statistical sources. On average, data collection took eight months across all EU Member States. A quality report provides detailed methodological information for each Member State [35]. A detailed description of the methodology applied in EHIS 2 can be found in the article by Hintzpeter et al. [36] in this issue of the Journal of Health Monitoring. In Germany, the survey was based on a two-stage stratified cluster sample which was randomly drawn from population registers. The survey was conducted between November 2014 and July 2015 [9].

Info box: European Health Interview Survey (EHIS)

The European Core Health Indicators (ECHI) were jointly developed by EU Member States and international organisations, taking into account scientific and health policy requirements. The indicators provide a framework in European health reporting for population-based health surveys and analyses, and health care provision at the European and national level. The European Health Interview Survey (EHIS) is a key element in this regard. The first EHIS wave (EHIS 1), which was not mandatory, was conducted between 2006 and 2009. 17 Member States and two non-EU countries participated in EHIS 1. Participation in the second wave of EHIS (EHIS 2), which was conducted between 2013 and 2015 in all EU Member States (as well as in Iceland, Norway and Turkey) was legally binding and is based on Commission Regulation (EU) No 141/2013 of 19 February 2013. It provides essential information about the ECHI indicators. In Germany, EHIS is carried out as part of health monitoring at the Robert Koch Institute. During the EHIS 2 survey period, the EU had 28 Member States.

Further information is available at:
https://ec.europa.eu/eurostat/web/microdata/european-health-interview-survey

2.2 Variables

Self-rated general health status was assessed using the question 'How is your general state of health?' The five response categories of the outcome variable were summarised into 'very good/good' and 'fair/bad/very bad'.

The predictor variable 'partner, parental and employment status' was formed from a combination of the variables according to household type and employment status, and has twelve subgroups (Table 1).

EHIS 2 uses a household type variable for partner and parental status that can be expressed as a 'one-person household', a 'single parent with child(ren) aged less than 25', a 'couple with child(ren) aged less than 25', a 'couple without child(ren) aged less than 25' and 'other type of household'. The term 'couple' includes everyone living in the same household with a partner, regardless of marital status. The children referred to are the participants' own children – including stepchildren and adopted children – up to the age of 24 who have their habitual residence in the household of the person interviewed. The category 'other type of household' refers to any household that includes people other than partners or children aged less than 25 [33]. As it is impossible to clearly identify which individuals live in these households, this category was excluded from the analysis. For the age groups 25 to 59, this was the case for 33,429 people. In the following, the combination of partner and parental status is also referred to as family status.

With regard to employment status, a differentiation was made between 'employed full-time', 'employed part-time', and 'non-employed'. The participants were able to define themselves as either full-time or part-time workers. Employed participants who had not classified themselves as full-time or part-time were excluded from the analysis (2,271 individuals). The category 'non-employed' includes the unemployed as well as homemakers (including care of children and people in need of assistance or care) and others. School pupils, students, people undertaking compulsory military or community service, those in retirement or who are permanently disabled were also excluded from the study (10,715 individuals). No further differentiation was made between people classed as non-employed ('unemployed' versus 'homemakers'), as the number of cases in some family subgroups was very small. A sensitivity analysis showed that the association for unemployed individuals and homemakers were not contradictory, so that the combination of both seemed justified.

The EU Member States were introduced as a moderator variable and grouped in line with the typology of family policies and welfare systems described above. This was necessary because case numbers in many EU Member States were too small to permit a differentiated analysis of family and employment status. The Member State groups comprised the Continental European countries (Belgium, Germany, France, Luxembourg, the Netherlands and Austria), the Southern European countries (Greece, Italy, Malta, Portugal, Spain and Cyprus), the Nordic European countries (Denmark, Finland and Sweden), the Eastern European countries (Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovakia and Slovenia) and the Anglo-Saxon countries (the United Kingdom). The data from Ireland were excluded due to implausible values for the employment status of women and men with children.

Table 1
Sample description EU total, Germany and EU Member State groups (n=62,111 women, n=50,719 men)
Source: EHIS 2 (2013-2015)

	EU total[1]		Germany	Continental Europe[2]	Southern Europe	Nordic Europe	Eastern Europe	Anglo-Saxon Europe[3]
	Women	Men	Women	Women	Women	Women	Women	Women
Total (n)	62,111	50,719	6,434	19,223	18,408	3,839	16,572	4,069
Self-rated health (n)								
Very good/good	48,257	41,021	5,024	15,572	13,878	3,053	12,390	3,364
Fair/bad/very bad	13,854	9,698	1,410	3,651	4,530	786	4,182	705
Partner, parental and employment status (n)								
No partner, no child(ren), non-employed	1,239	1,727	101	285	560	63	269	62
No partner, no child(ren), employed part-time	1,131	563	192	605	254	76	111	85
No partner, no child(ren), employed full-time	5,755	7,478	706	1,530	1,805	394	1,686	340
Partner, no child(ren), non-employed	3,782	1,404	194	762	1,950	105	846	119
Partner, no child(ren), employed part-time	2,909	573	671	1,718	475	194	236	286
Partner, no child(ren), employed full-time	9,669	11,058	1,375	2,934	2,258	803	3,106	568
No partner, child(ren), non-employed	1,438	152	48	355	561	33	321	168
No partner, child(ren), employed part-time	1,274	62	223	685	223	41	100	225
No partner, child(ren), employed full-time	3,335	796	181	677	1,074	232	1,151	201
Partner, child(ren), non-employed	8,912	2,266	540	2,257	3,506	283	2,441	425
Partner, child(ren), employed part-time	7,285	863	1,606	4,255	1,252	374	469	935
Partner, child(ren), employed full-time	15,382	23,777	597	3,160	4,490	1,241	5,836	655
Partner, parental and employment status (%)								
No partner, no child(ren), non-employed	1.6	2.9	1.6	1.7	2.0	1.6	1.3	1.1
No partner, no child(ren), employed part-time	1.5	1.3	2.9	2.7	1.3	2.2	0.6	1.7
No partner, no child(ren), employed full-time	8.5	14.1	11.7	9.6	6.6	9.9	9.0	8.2
Partner, no child(ren), non-employed	5.6	2.7	2.8	3.7	11.0	2.6	4.6	2.3
Partner, no child(ren), employed part-time	5.1	1.3	9.9	7.8	3.2	4.8	1.1	6.1
Partner, no child(ren), employed full-time	15.3	22.3	21.1	16.2	12.5	19.0	17.3	14.7
No partner, child(ren), non-employed	2.4	0.3	0.8	2.2	2.5	0.9	1.8	4.3
No partner, child(ren), employed part-time	2.5	0.2	3.3	3.2	1.3	1.2	0.5	5.5
No partner, child(ren), employed full-time	4.5	1.4	2.5	3.7	4.3	6.1	6.3	4.7
Partner, child(ren), non-employed	15.4	4.5	9.6	11.2	23.6	8.1	16.6	12.1
Partner, child(ren), employed part-time	14.8	2.0	25.6	21.5	8.7	10.6	3.1	23.6
Partner, child(ren), employed full-time	15.3	47.0	8.3	16.5	23.1	33.1	37.8	15.6

n=unweighted number of participants, %=weighted proportion
[1] EU=average of EU Member States for which data are available (excluding Ireland)
[2] Including Germany
[3] Excluding Ireland

The largest differences in self-rated health in the EU are between women and men who are in full-time employment and women and men who are non-employed.

A participant's age was included in the analysis as a control variable, and it is available in the data as a grouped variable in five-year steps. Moreover, the models were controlled for survey modes to compensate for differences in response behaviour. The variable encompassed the following aspects: 'face-to-face', 'postal', 'telephone', 'internet' and 'mixed-mode' (a combination of several survey modes). Furthermore, the age of the youngest child in the household (child under seven years of age in the household: yes/no) was considered as was the participants' highest level of education (low, medium, high education group), which was measured using the 2011 International Standard Classification of Education (ISCED) [37].

2.3 Statistical analyses

The analysis was limited to the age range spanning 25 to 59. The gross sample of 25- to 59-year-olds included 85,939 women and 74,404 men. Due to the inclusion criteria for partner, parental and employment statuses, 44,334 cases were excluded on a case-by-case basis (Chapter 2.2). The lack of data on self-rated health (n=2,769) and education level (n=410) resulted in a net sample of 112,830 participants (exclusion on a case-by-case basis). Table 1 provides an overview of the sample.

In the statistical analysis, separate binary logistic regression models were calculated for women and men with the outcome of fair to very bad health status. These models included family and employment status, Member State groups, the interaction between family and employment status and Member State groups, age, the interaction between age and Member State, the survey method, age of the youngest child and education. Based on these models, (adjusted) predictive margins with 95% confidence intervals were calculated for the EU in total as well as for the five groups of Member States. For men, only the result for the EU in total is reported, as the numbers of non-employed men or men working part-time within the family status groups were too small to provide a separate calculation for each group of Member States. A separate model that did not apply country-specific control variables was used for the calculation for Germany. Adjusted Wald tests were undertaken to statistically substantiate any differences in association patterns between family and employment status with health status. These tests used the models with interaction terms between family and employment status and a) sex, b) Germany (yes/no) and c) EU Member State groups. A statistically significant difference is assumed if the corresponding p-value is less than 0.05.

The analyses have been performed with a weighting factor to ensure that each EU Member State was taken into account in proportion to its population size. In contrast to the data analyses with GEDA 2014/2015-EHIS for Germany [9], the weighting factor for the European comparison does not account for education level; this follows current Eurostat recommendations. However, the inclusion of education and the interaction of age and Member State in the statistical models controls for differences in education and age across EU Member States. The household indicator variable is used as the cluster variable for the following analyses. The analyses were conducted with Stata SE 15.1. Survey procedures were used in all analyses to adequately account for participant clustering and weighting when calculating confidence intervals and p-values.

3. Results

3.1 Family and employment patterns among women and men

In the EU, men are strongly clustered in a few family and employment status groups (Table 1). For example, 47.0% of men are engaged in all three social roles (partner, father, full-time employment). A further 36.4% of men belong to the group of 'no child(ren) and in full-time employment' regardless of partner status.

Women in the EU, on the other hand, show much more heterogeneous family and employment statuses (Table 1). The comparison between Germany and the EU in total shows that a remarkably large proportion of mothers in Germany work part-time. A comparison of the Member State groups also reveals clear differences: whereas part-time employment is most common among women with children in Continental Europe and Anglo-Saxon Europe, it is rare in Southern Europe and even more so in Eastern Europe. Whilst women in Eastern Europe are predominantly in full-time employment irrespective of their family status, women from Southern Europe are non-employed comparatively often. This is particularly true if they live in a partner household. In Nordic European countries, a large proportion of women (including mothers) are in full-time employment.

The patterns of association between combinations of partner, parental and employment statuses and self-rated health vary among women in different groups of EU Member States.

3.2 Association between family and employment status and self-rated heath

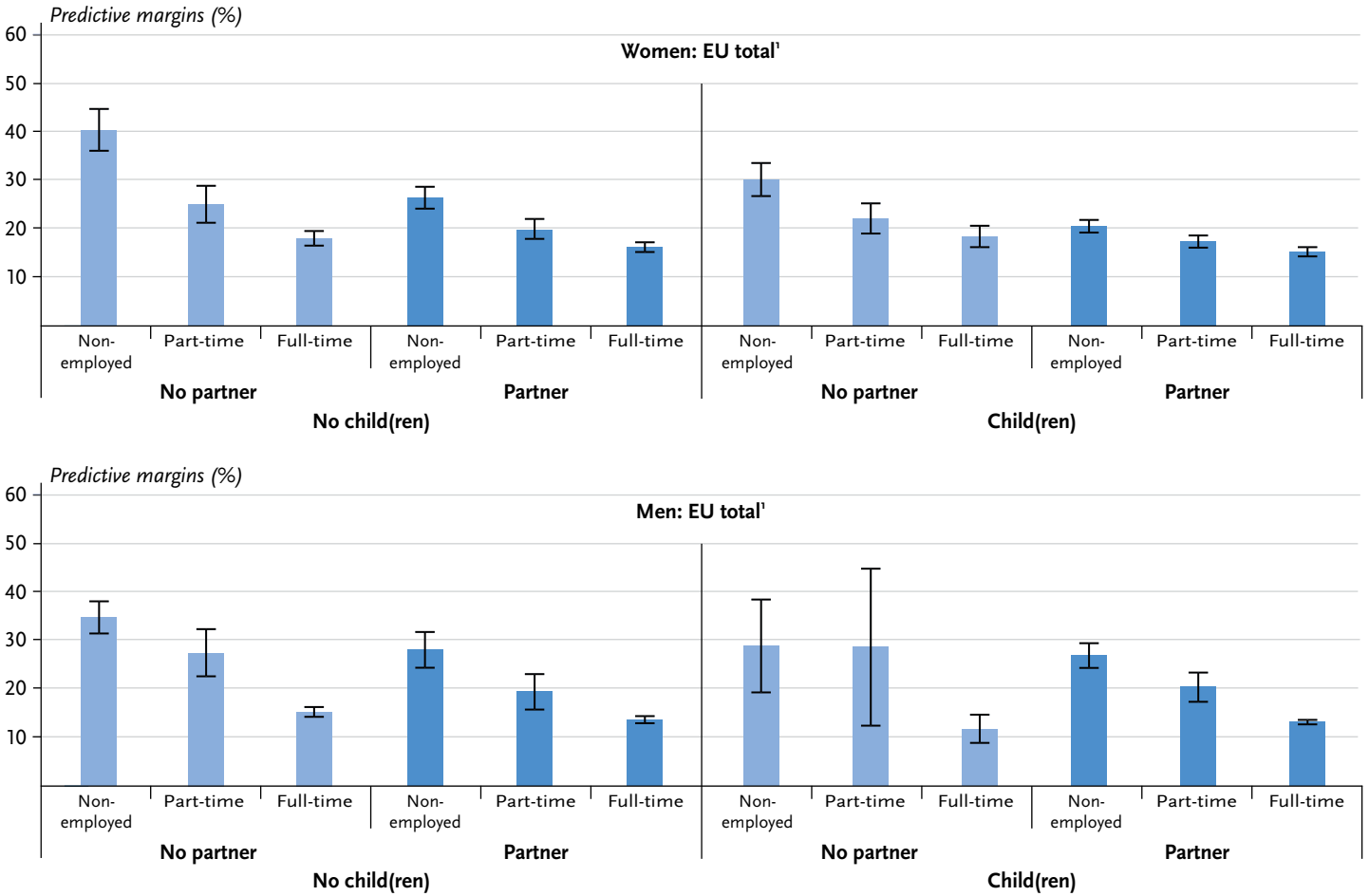
A gradient in prevalence exists among men in the EU (Figure 1 and Annex Table 1) as men in full-time employment are the least likely to rate their health as fair to very bad, followed by part-time employed men. In contrast, non-employed men rate their health as fair, bad or very bad more often. This pattern was identified for all family statuses. Moreover, non-employed, childless men without a partner have the highest predicted prevalence of bad self-reported health.

A similar gradient exists for women in the EU (Figure 1 and Annex Table 1) in terms of employment status and the prevalence of bad self-rated health. The highest predicted prevalence of bad health is also found among non-employed women who do not have a partner and who are living without children. It is striking, however, that the differences in health status by employment status among women with a partner and children are less pronounced than among women in other family statuses. Non-employed women with a partner and children thus are much less likely to rate their health as fair to very bad as is the case with non-employed women in other family statuses.

The statistical comparison of women and men reveals significant differences (p-value=0.002). However, this only applies to either non-employed women and men living with a partner and children, where it occurs to the detriment of men; and to women and men in full-time employment without a partner (irrespective of whether they have children), where it occurs to the detriment of women. In all other subgroups, the prevalence of bad health is almost similar for women and men.

With regard to the predicted prevalences for Germany (Figure 2 and Annex Table 2), it is particularly noticeable that the differences in self-rated health by employment and partner status among women with children are significantly smaller than in the EU in total (Figure 1). In Germany, there

Figure 1
Predictive margins and 95% confidence intervals for fair to very bad general health status among women and men in the EU by parental, partner and employment status (n=62,111 women, n=50,719 men)
Source: EHIS 2 (2013-2015)



[1] EU total = average of EU Member States for which data are available (excluding Ireland)

are neither significant differences in health between full-time, part-time and non-employed mothers, nor among mothers with or without a partner. Even in the case of childless women living in a partner household, there are no differences in health between full-time and part-time employees, but there are differences among women living alone. The association pattern between the three social roles and health status in Germany differs significantly from that in the EU in total (excluding Germany) (p-value=0.002).

A statistical comparison of the association patterns between family and employment status and self-rated health in the five groups of EU Member States shows that there are significant differences between the groups (p-value<0.001) (Figure 2 and Annex Table 2).

In Continental Europe (including Germany), the association pattern is similar to that of the EU in total. The group of women that does not hold any of the three social roles has the highest predicted prevalence of fair to very bad health. The statistical comparison of the association patterns among women in Germany and Continental Europe (excluding Germany) confirms that the pattern in Germany is significantly different from that in the rest of Continental Europe (p-value=0.002).

In Southern Europe, it is striking that the differences in the prevalences predicted for fair to very bad health are comparatively small. Similar to Germany, the differences in the prevalences for each employment status group among mothers living in partner households in Southern

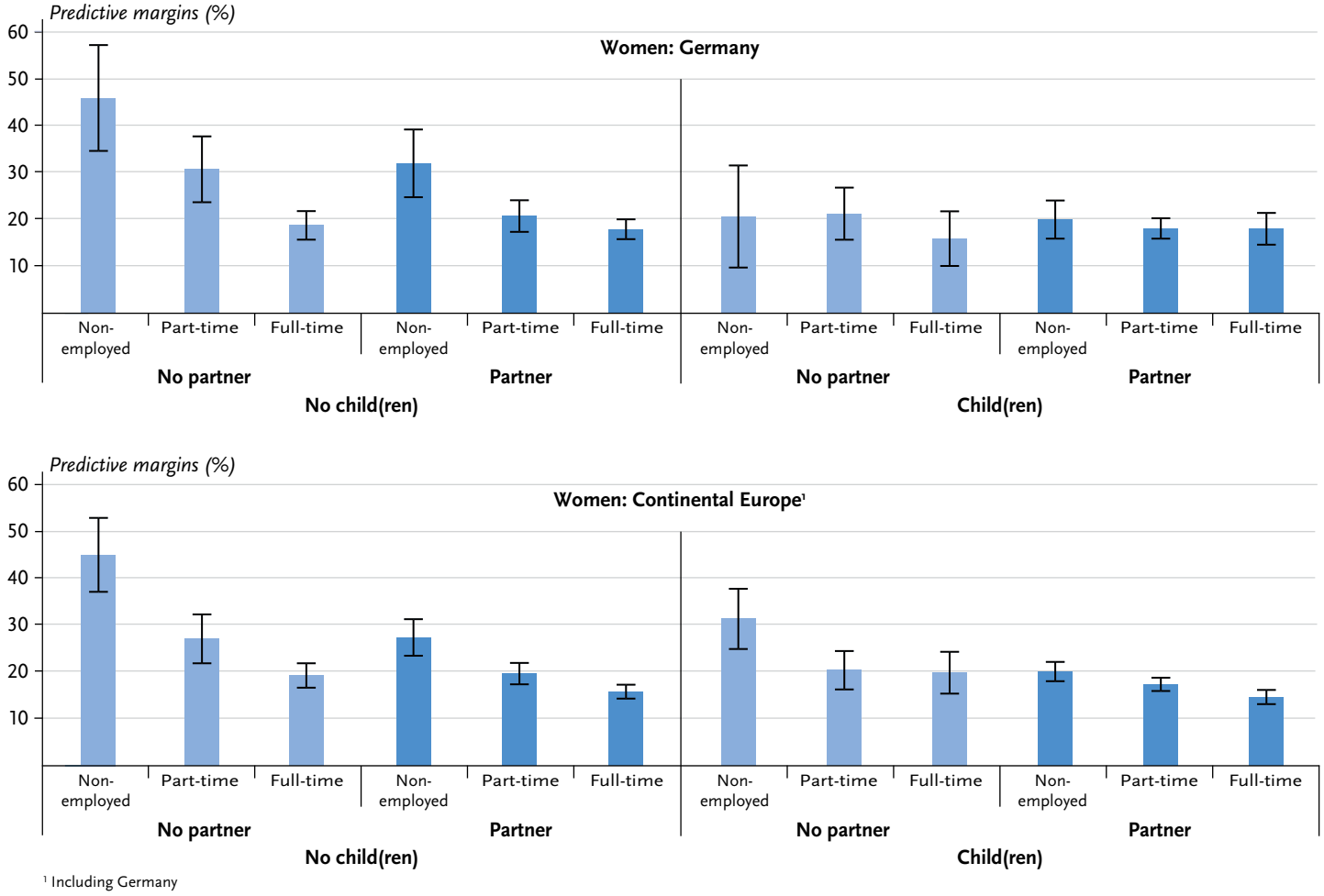
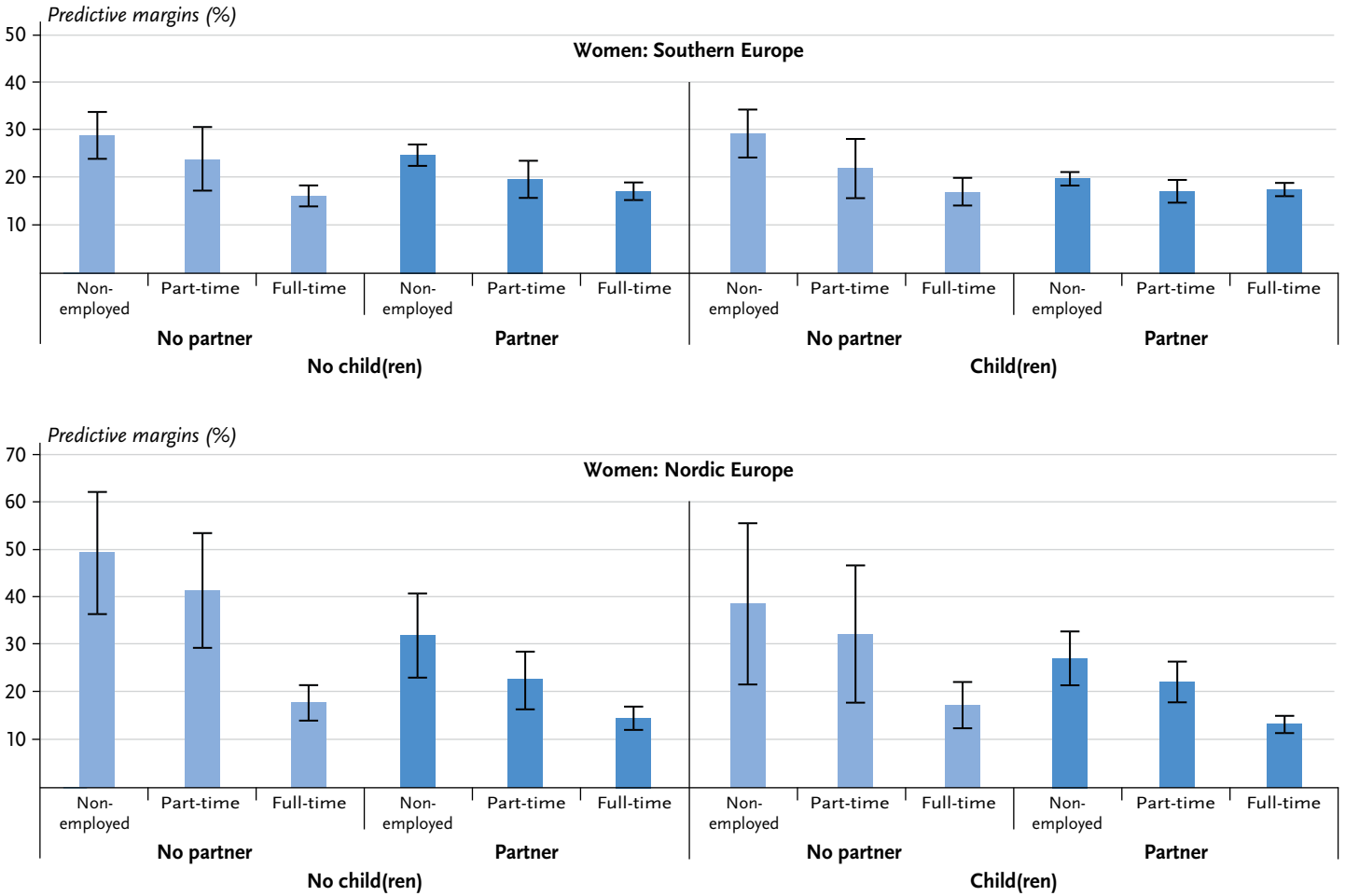


Figure 2
Predictive margins and 95% confidence intervals for fair to very bad general health status among women in Germany and in EU Member State groups by parental, partner and employment status (n=62,111 women)
Source: EHIS 2 (2013-2015)

Figure 2 *Continued*
Predictive margins and 95% confidence intervals for fair to very bad general health status among women in Germany and in EU Member State groups by parental, partner and employment status (n=62,111 women)
Source: EHIS 2 (2013-2015)



Europe are not significant. Among single mothers and childless women, on the other hand, graduating differences according to employment status can be observed as there are significant differences in health between women who are non-employed and women who are full-time employed.

Nordic Europe shows a comparatively strong gradient by employment status: the prevalence of fair to very bad health is highest among non-employed women, followed by part-time employed women. The prevalences for full-time employees are lowest and are at the same level in all family status groups. While the differences in health between full-time and non-employed women are significant in all family status groups except for single mothers (due to the small number of cases), there are also significant differences

between part-time and full-time employment among not-partnered childless women and partnered mothers.

In Eastern Europe, no significant differences in health status were found between non-employed and part-time employed women in any of the four family status groups. In all four family groups, full-time employed women are the least likely to rate their health as fair to very bad. Among not-partnered mothers, however, the differences are not

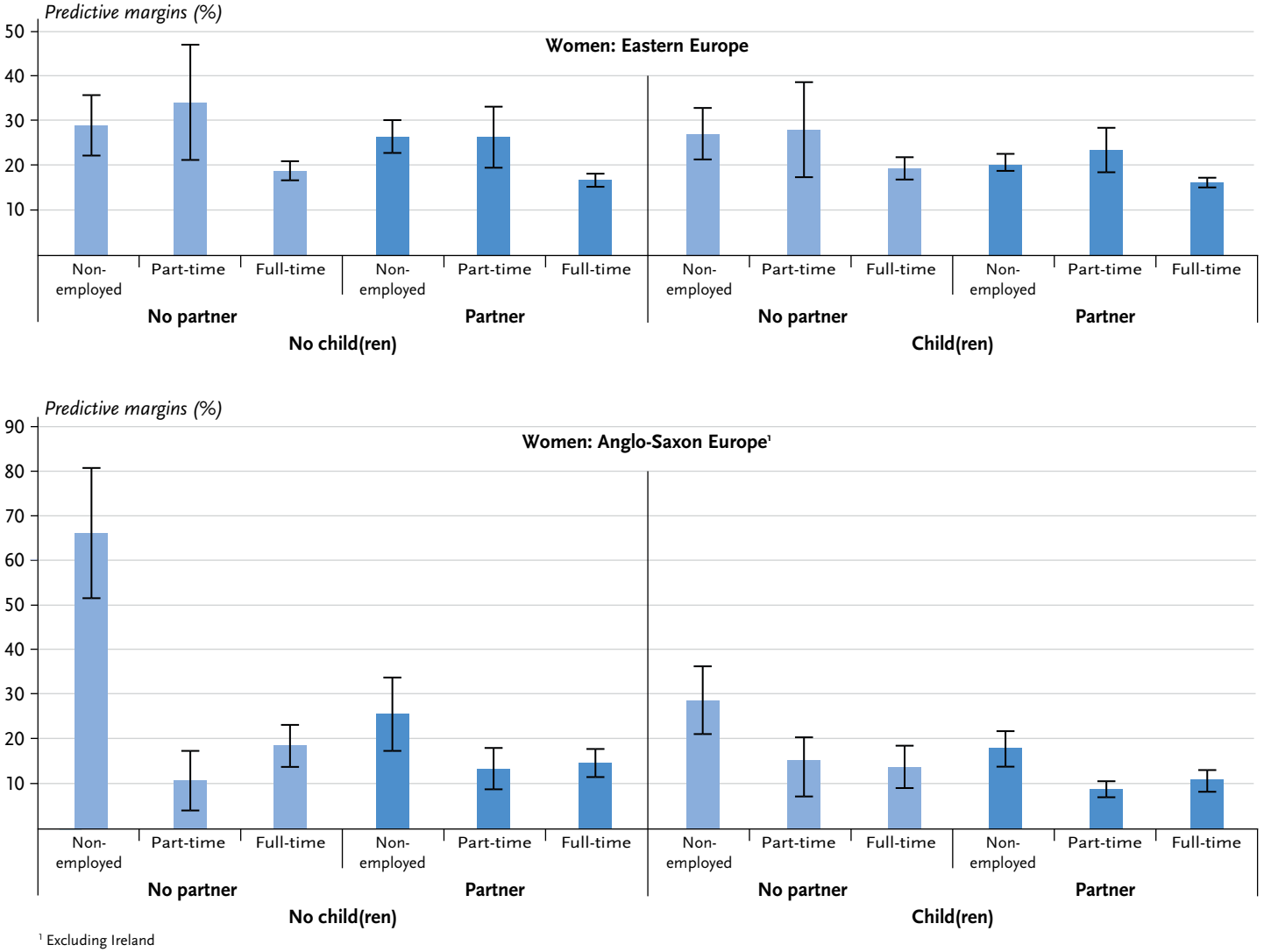


Figure 2 *Continued*
Predictive margins and 95% confidence intervals for fair to very bad general health status among women in Germany and in EU Member State groups by parental, partner and employment status (n=62,111 women)
Source: EHIS 2 (2013-2015)

statistically significant. Overall, differences in health status between family and employment status groups are moderate, and, therefore, similar to Southern Europe.

In Anglo-Saxon Europe (only the United Kingdom was considered), a different pattern can be discerned: there are no differences in health status between full-time and part-time employed women in any of the four family status groups. In all family subgroups, however, non-employed women more often report fair to very bad health, although the differences among childless women with partners and not-partnered parents are not significant. On the other hand, the group of women not engaged in any of the three social roles stands out with a very high predicted prevalence.

Women in each of the EU Member State groups who are not engaged in any of the three social roles are more likely to self-assess their health as fair to very bad.

4. Discussion

This paper is the first to analyse the association between the combination of partner, parental and employment status and the self-rated health of women and men in the EU. The strongest association with health was found for employment status, whereas differences in partner and parental status are lower by comparison. However, the strength of the association between employment status and self-rated general health varies among women both in terms of partner role and parent role. In general, the results provide no evidence that the combination of partnership, parenthood and employment is associated with health impairments. This is true for both women and men. Even among mothers – and this includes single mothers – there is no indication of an impaired subjective health status among full-time employees. This result is evident in all groups of Member States.

Furthermore, women who are not engaged in any of the three social roles have a comparatively high prevalence of fair to very bad health status throughout the EU, as well as within their respective Member State groups, and in Germany. This is also generally true for men in the EU.

With regard to the discussion about multiple roles, the results thus support the 'multiple role attachment hypothesis' rather than the 'multiple role burden hypothesis'. However, they can also be interpreted in the sense of the selection hypothesis in the way that women and men with health impairments are less likely to start a family or work. The associations found in this analysis, therefore, are largely consistent with current international research [19, 23-26].

Even though the association patterns between social roles and self-rated subjective health for women and men are generally quite similar, it is important not to overlook the fact that social roles – and the combination of parenthood and employment in particular – are often associated with different demands in the everyday life of women and men. This is already evident from the results regarding the distribution of family and employment groups. The vast majority of men work full-time, whereas women – and especially mothers – are more likely to work part-time or to be non-employed. However, these interrelations vary widely between the groups of EU Member States.

The results for Germany show no differences in self-rated health according to employment or partner status for women with children. This is largely consistent with results from an earlier analysis based on the pooled GEDA data collected between 2009 and 2012 [18], which also found no differences in self-rated health status among mothers living with a partner. In contrast, non-employed mothers

without a partner reported fair or bad health more often than full-time employed mothers with a partner. The results presented here suggest that different socially accepted models exist with regard to the employment status of mothers in Germany today, and that these models are not associated with health inequalities. Since women's participation in the labour market in Germany has strongly increased in recent years [38], the group of non-employed mothers now probably mainly consists of women who have consciously – at least temporarily – chosen to remain at home. At the same time, a traditional division of social roles that includes a non-employed mother is financially more strongly protected, particularly in Germany, than in many other European Member States through family policy measures, such as income tax splitting for married couples.

In comparison, working mothers in each of the EU Member State groups tended to rate their general health positively, but differences exist in self-rated health between Member State groups according to level of employment.

The comparison of EU Member State groups shows that the largest differences in the predicted prevalences of fair to very bad health between non-employed and employed women are found in the Nordic and in Anglo-Saxon countries. In Eastern and Southern Europe, on the other hand, differences in health by employment status groups are much smaller. These different patterns of associations are largely consistent with current international research. For example, a study on differences between welfare state groups in the association between unemployment and self-rated health also found the largest differences between employed and unemployed women in Nordic and Anglo-Saxon countries, whereas the associations were much weaker in Eastern and Southern Europe. Continental Europe was placed in the middle range [31].

The orientation in Nordic Europe towards the dual-earner model and the political promotion of the reconciliation of family and work may explain the result that employed women with or without children are more likely to self-assess their own health as good than non-employed women. What is striking, however, is that non-employed mothers in Nordic Europe rate their health significantly more frequently as fair or bad compared to non-employed mothers in the other EU Member State groups. However, it should be noted that non-employed women are a relatively small group in Nordic Europe. On the one hand, it can be assumed that non-employment in societies with high female and maternal employment rates is experienced as a greater burden and, therefore, can have a particularly negative effect on health. On the other hand, it is probable that some of the women in the relatively small group of non-employed women in Nordic Europe are unable to work because of health impairments. This seemingly paradoxical result – greater health inequality in Nordic countries with highly developed welfare systems – has already been described in other studies [39-41].

In view of the relatively strong association between employment and self-rated health in the Anglo-Saxon countries compared to the rest of Europe, Bambra and Eikemo [31] assume that the poor level of social security provided to the unemployed in the UK can lead to health impairments. Our findings suggest that this is particularly the case when no partner lives in the household to compensate for any financial burden. In contrast, single parents in the UK, receive comparatively high monetary social security benefits irrespective of their employment status [42].

In Eastern Europe, it is striking that there are hardly any differences in health status between women who are non-employed and those who are employed part-time.

It can be assumed that women who work part-time are a highly selective group, as Eastern European Member States have very little legislation that allows women to reduce their working hours [43]. This can also be observed in the relatively low rate of women in part-time employment in Eastern Europe compared to other European Member States. It can be assumed that employers are more willing to enable women to reduce their working hours through individual agreements due to health impairments.

The comparatively small differences in health status between family and employment status groups in Southern and Eastern Europe may also be related to the fact that many countries with respective welfare state regimes have experienced economic crises in recent years that have led to significant increases in unemployment [44]. As a result, comparatively healthy people have also lost their jobs, weakening the association between employment and health status [44]. Moreover, it can be assumed that in Southern and Eastern Europe, regions with more traditional family models, non-employed family members receive more family support than in other welfare state regimes [31].

Comparing the groups of EU Member States, the differences in the predicted prevalences of fair to very bad health found for women in Continental Europe are at medium levels. Bambra and Eikemo [31] found a similar result for women in Continental Europe with regard to the association between unemployment and self-rated health in a comparison of the EU country groups. However, in their study the differences in self-rated health between employed and unemployed men in Continental Europe were much more pronounced. This was explained by the fact that the male breadwinner model is still predominant in Continental Europe.

In Germany, there are no differences in self-rated health between employed and non-employed mothers or between mothers with or without a partner.

4.1 Strengths and limitations

The strength of this analysis is that it is the first to analyse the association between the combination of employment, partner and parental status and health for the EU. Moreover, the study is based on a large sample size and uses the harmonised data on health indicators and social determinants from all EU Member States that were collected for EHIS 2.

However, the interpretation of the results must take into account the fact that different sampling and survey methods were used by various EU Member States. In addition, the quality of data from each Member State can only be assessed to a limited extent. For example, the number of missing values for self-rated health was very high in some Member States. Moreover, a relatively large group of women and men had to be excluded as no precise information about household composition was available. The results should therefore be interpreted with caution. In this paper, this is reflected in the focus on a discussion of association patterns rather than the level of each prevalence estimator.

Due to the small number of cases, no differentiation was made between people who were 'unemployed' or 'undertaking domestic or family work'. A critical aspect of this approach is that the two forms of non-employment are distributed differently among family groups. It can be assumed, for example, that mothers often consciously forego gainful employment for a certain phase of childcare or due to a lack of or an inability to pay for childcare services, whereas women without children are more frequently unemployed. With regard to men, a differentiation between

full-time employment and overlong weekly working hours also seems useful [45]. In addition, it must be noted that the participants categorised themselves as in full-time or part-time employment and this was not done on the basis of a fixed number of hours per week. It is possible that the definition of part-time and full-time employment varies between EU Member States.

Furthermore, the data do not contain information about the distribution of gainful employment and domestic or family work within a partnership. In addition, other social roles such as caring for relatives have not been taken into account in this analysis. Plaisier et al. [46] point out that the quality of a social role (e.g. partnership quality) is also of great importance for health.

It should also be borne in mind that the results do not provide any direct information about conflicts between family and work. Available studies show that large differences in health exist within the group of working parents depending on the difficulty that parents have of reconciling family and work [47, 48].

Another important limitation is due to the cross-sectional design as this means that conclusions cannot be made about the direction of the association between social roles and health. However, it can be assumed that both causal and selection effects play a role.

Furthermore, no indicators describing family policies were included in the analysis; instead, the significance of family and social policies was only deduced on the basis of differences in health status between country groups. The grouping of EU Member States also has its weaknesses. The Member States do not all correspond equally to the types of welfare state that they have been assigned to, and the categories do not enable differences between individual countries to be made clear. Moreover, the typology used is only partly based on current data on family and social policy. In Germany, for example, recent policy measures aimed at improving the compatibility of family and work – especially the parental allowance introduced in 2007 and parents' legal entitlement to childcare for children aged two or above since 2013 – have gained in importance [30]. Such shifts in the objectives and orientation of family and labour market policy measures are also evident in other Member States [49].

4.2 Conclusion and outlook

With regard to women's health, partnership, parenthood and employment are not independently associated with self-rated health. By comparing interrelationships in the EU, initial conclusions can be drawn about the importance of family and labour market policies for health. In future, country-specific indicators of family and labour market policy, such as labour market participation (maternal employment rate), legal regulations (parental leave, child care services) and demographic factors (age at birth of first child, divorce rate) should also be included in further analyses. These indicators are available from the Organisation for Economic Cooperation and Development (OECD). In this way, tangible social policy measures could be evaluated regarding their impact on the health of women and men. The country comparative description of the association between partnership, parenthood, employment and health can thus constitute an important component in national and European health reporting.

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Data protection and ethics

Data for the European Health Interview Survey (EHIS) is collected by national surveys. GEDA 2014/2015-EHIS is subject to strict compliance with the data protection provisions set out in the Federal Data Protection Act (BDSG). The study was reviewed and approved by the German Federal Commissioner for Data Protection and Freedom of Information (BfDI). Participation in the study was voluntary. The participants and/or their parents/legal guardians were also informed about the aims and contents of the study, and about data protection. Depending on the survey mode, informed consent was obtained in writing or electronically.

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Conflict of interest

The authors declared no conflicts of interest.

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Annex Table 1
Predictive margins and 95% confidence intervals for fair to very bad general health status among women and men in the EU by parental, partner and employment status (n=62,111 women, n=50,719 men)
Source: EHIS 2 (2013-2015)

EU total[1]		Women		Men
Child(ren)/Partner/Employment	%	(95% CI)	%	(95% CI)
No child(ren)				
No partner				
Non-employed	40.5	(36.2-44.8)	35.0	(31.5-38.5)
Part-time	25.2	(21.4-29.0)	27.6	(22.6-32.7)
Full-time	18.2	(16.7-19.7)	15.4	(14.2-16.6)
Partner				
Non-employed	26.6	(24.3-28.8)	28.3	(24.4-32.2)
Part-time	20.0	(17.9-22.0)	19.6	(15.9-23.4)
Full-time	16.2	(15.2-17.2)	13.8	(12.9-14.7)
Child(ren)				
No partner				
Non-employed	30.1	(26.7-33.5)	29.1	(19.4-38.9)
Part-time	22.1	(19.0-25.2)	28.8	(12.4-45.3)
Full-time	18.4	(16.2-20.6)	11.9	(8.8-14.9)
Partner				
Non-employed	20.5	(19.2-21.8)	27.1	(24.4-29.9)
Part-time	17.3	(16.1-18.6)	20.5	(17.3-23.8)
Full-time	15.3	(14.3-16.2)	13.3	(12.6-13.9)

[1] EU total = average of EU Member States for which data are available (excluding Ireland)
CI = Confidence interval

Annex Table 2
Predictive margins for fair to very bad general health status among women in Germany and in EU Member State groups by parental, partner and employment status (n=62,111 women)
Source: EHIS 2 (2013-2015)

Women	Germany	Continental Europe[1]	Southern Europe	Nordic Europe	Eastern Europe	Anglo-Saxon Europe[2]
Child(ren)/Partner/ Employment						
No child(ren)						
No partner						
Non-employed	46.0%	45.0%	29.0%	49.4%	29.1%	66.0%
Part-time	30.8%	27.0%	24.1%	41.5%	34.3%	10.8%
Full-time	18.8%	19.2%	16.3%	17.8%	19.0%	18.6%
Partner						
Non-employed	32.1%	27.3%	24.9%	32.0%	26.6%	25.7%
Part-time	20.8%	19.6%	19.8%	22.6%	26.5%	13.5%
Full-time	17.9%	15.8%	17.3%	14.6%	16.9%	14.8%
Child(ren)						
No partner						
Non-employed	20.7%	31.3%	29.4%	38.7%	27.3%	28.8%
Part-time	21.3%	20.4%	22.0%	32.2%	28.2%	17.5%
Full-time	15.9%	19.8%	17.1%	17.3%	19.5%	15.9%
Partner						
Non-employed	20.0%	20.1%	19.9%	27.2%	20.9%	20.5%
Part-time	18.1%	17.3%	17.3%	22.2%	23.7%	10.1%
Full-time	18.0%	14.6%	17.6%	13.3%	16.4%	12.3%

[1] Including Germany
[2] Excluding Ireland

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Educational differences in the prevalence of behavioural risk factors in Germany and the EU – Results from the European Health Interview Survey (EHIS) 2

Abstract

This article examines educational differences in the prevalence of behavioural risk factors among adults and compares the results for Germany with the average from the European Union (EU). Data were derived from the second wave of the European Health Interview Survey, which took place between 2013 and 2015 (EHIS 2). Analyses were conducted using a regression-based calculation of relative and absolute educational differences in the prevalence of behavioural risk factors, based on self-reported data from women and men aged between 25 and 69 (n=217,215). Current smoking, obesity, physical activity lasting less than 150 minutes per week, heavy episodic drinking and non-daily fruit or vegetable intake are more prevalent among people with a low education level than those with a high education level. This applies to Germany as well as the EU average. Overall, the relative educational differences identified for these risk factors place Germany in the mid-range compared to the EU average. However, relative educational differences in current smoking and heavy episodic drinking are more manifest among women in Germany than the EU average, with the same applying to low physical activity among men. In contrast, relative educational differences in non-daily fruit or vegetable intake are less pronounced among women and men in Germany than the average across the EU. Increased efforts are needed in various policy fields to improve the structural conditions underlying health behaviour, particularly for socially disadvantaged groups, and increase health equity.

HEALTH BEHAVIOUR · EDUCATIONAL DIFFERENCES · ADULTS · GERMANY · EUROPEAN COMPARISON

1. Introduction

Considerable social differences exist with regard to mortality in Germany and other European Union (EU) Member States, with socially disadvantaged groups being at higher risk of premature death than those who are better off [1, 2]. Furthermore, although there is evidence that absolute inequalities in mortality between socioeconomic groups have decreased since the 1990s, relative inequalities have continued to increase in some European countries [2]. Non-communicable diseases (NCDs) such as cardiovascular diseases, cancers, chronic obstructive pulmonary disease (COPD) and diabetes mellitus account for approximately 90% of deaths and 84% of the disease burden in Europe; such diseases also have a negative impact on the general well-being of the population and pose a challenge to health

GEDA 2014/2015-EHIS (for international comparisons)

Data holder: Robert Koch Institute

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

Method: Questionnaires completed on paper or online

Population: People aged 15 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: 24,824 people (13,568 women, 11,256 men)

Response rate: 27.6%

Study period: November 2014 - July 2015

More information in German is available at www.geda-studie.de and Lange et al. 2017 [9]

systems and economic development [3]. According to calculations made for the 2017 Global Burden of Disease Study, coronary heart disease (CHD) continues to be the leading cause of death in Western Europe, accounting for 15.9% of total mortality. Furthermore, CHD also has the greatest impact on developments in social inequalities in mortality in Europe [2, 4]. The governments of EU Member States have therefore set themselves the goal of reducing premature deaths from NCD by one third (compared to 2010 levels) by 2030 [5]. Behavioural risk factors are partially responsible for many of these deaths. Attributable risk is a means of identifying the proportion of deaths that are associated with a particular risk factor. The attributable risk associated with deaths from CHD has been calculated at 11.4% for low vegetable intake, 7.3% for low fruit intake, 14.2% for smoking, 11.7% for low physical activity and 17.5% for a high body mass index (BMI) [4]. Smoking has been shown to be responsible for 70.4% of lung cancers and 44.3% of deaths due to COPD [4]. High alcohol intake has been shown to be associated with a 20.2% attributable risk of bowel cancer [4]. A recent European study, which was based on the pooled data set used by the 2014 European Social Survey gained and collected from 21 European countries, found considerable educational differences in risky health behaviour in Europe [6].

From a health-policy perspective, it is therefore essential that social differences be analysed with regard to prevalence of key behavioural risk factors both in Germany and in the EU as a whole. Doing so provides a foundation with which to develop and evaluate the effectiveness of evidence-based policy strategies and measures. Comparing results from Germany with the rest of the EU can help identify the potential for disease prevention and highlight health policy areas where action is needed so that health equity can be improved in Germany. The second wave of the European Health Interview Survey, which was carried out between 2013 and 2015 (EHIS 2), provides up-to-date, European-wide comparable data with which to describe and compare social differences in the frequency (prevalence) of behavioural risk factors among adults in Germany and the EU.

2. Methodology

2.1 Sample design and study implementation

As part of the European Health Interview Survey (EHIS), all EU Member States collect data on the health status, health care, health determinants and the socioeconomic situation of their populations (Info box 1). The survey targets people aged 15 or over who live in private households. The first EHIS wave (EHIS 1) was conducted between 2006 and 2009, but Member States were not obliged to participate in the study at this time. Data acquisition for the second EHIS wave (EHIS 2) took place between 2013 and 2015 in all 28 EU Member States. In order to ensure a high degree of harmonisation between the survey results from the various Member States, a handbook was provided with recommendations and guidelines on methodology and implementation, as well as a model questionnaire [7]. In Germany, EHIS forms part of the health monitoring undertaken at the Robert Koch Institute. EHIS 2 has been integrated into the German Health Update (GEDA 2014/2015-EHIS) [8, 9]. A detailed description of the methodology applied in GEDA 2014/2015-EHIS can be found in Lange et al. [9].

Info box 1:
European Health Interview Survey (EHIS)

The European Core Health Indicators (ECHI) were jointly developed by EU Member States and international organisations, taking into account scientific and health policy requirements. The indicators provide a framework in European health reporting for population-based health surveys and analyses, and health care provision at the European and national level. The European Health Interview Survey (EHIS) is a key element in this regard. The first EHIS wave (EHIS 1), which was not mandatory, was conducted between 2006 and 2009. 17 Member States and two non-EU countries participated in EHIS 1. Participation in the second wave of EHIS (EHIS 2), which was conducted between 2013 and 2015 in all EU Member States (as well as in Iceland, Norway and Turkey) was legally binding and is based on Commission Regulation (EU) No 141/2013 of 19 February 2013. It provides essential information about the ECHI indicators. In Germany, EHIS is carried out as part of health monitoring at the Robert Koch Institute. During the EHIS 2 survey period, the EU had 28 Member States.

Further information is available at:
https://ec.europa.eu/eurostat/web/microdata/european-health-interview-survey

Each EU Member State chose a nationally representative sample for EHIS 2 based on data from population registers, censuses, housing registers or other statistical sources. Data acquisition was planned to last at least three months and include at least one autumn month (September to November). The average length of data collection across all EU Member States was eight months. A quality report was to be produced by each participating Member State following specific criteria. These reports provide detailed information about the methodology implemented by a respective country [10]. A more detailed description of the methodology applied in EHIS 2 is available in Hintzpeter et al. in this issue of the Journal of Health Monitoring [11]. In Germany, the survey used a two-stage stratified cluster sample that was randomly drawn from local population registers and was conducted between November 2014 and July 2015 [9].

2.2 Indicators

Smoking

Data on a participant's smoking status were collected using the question 'Do you smoke?' The following answer categories were provided: 'Yes, daily', 'Yes, occasionally', 'No, not any more' and 'I have never smoked' [12]. Current smoking was defined as daily or occasional smoking.

Obesity

Body height and weight were determined using the following questions: 'How tall are you without shoes?' and 'How much do you weigh without clothes and shoes?' [12]. BMI was calculated using the formula: body weight in kilogrammes divided by height in metres squared. Obesity was defined as BMI ≥ 30kg/m² in line with the classification used by the World Health Organization (WHO).

Physical activity

The duration of aerobic physical activity was determined using the EHIS-Physical Activity Questionnaire (EHIS-PAQ) [12-14]. The questionnaire covers physical activity conducted during leisure, work, or for transport. In drawing up the indicator, consideration was given to aerobic physical activity undertaken during leisure time as well as cycling for transportation. In line with WHO categories, low physical activity during leisure time was defined as aerobic physical activity amounting to less than 150 minutes per week.

Alcohol intake

Data were collected on heavy episodic drinking of 60g or more of pure alcohol on one occasion using the following question: 'In the past 12 months, how often have you had 6 or more drinks containing alcohol on one occasion?' [12]. Heavy episodic drinking was defined as the consumption of six or more alcoholic drinks on one occasion at least once a month.

Fruit and vegetable intake

Data on the participants' fruit and vegetable intake were collected separately for fruit and vegetables before being combined into one variable: 'How often do you eat fruits/vegetables or salad, including freshly squeezed fruit/vegetable juices?' [12]. Non-daily fruit or vegetable intake was defined as the consumption of less than one portion of fruit or vegetables per day.

Education

Participants' education level was assessed according to the 2011 version of the International Standard Classification of Education (ISCED) [15]. The ISCED system takes both educational and vocational qualifications into account and enables international comparative analyses to be undertaken of groups of people with differing levels of education in countries with different educational systems. For the purpose of this article, ISCED levels 0 to 2 were merged into a low education group, ISCED levels 3 to 4 into a medium education group, and ISCED levels 5 to 8 into a high education group.

2.3 Statistical analyses

The analyses are based on data from a total of 217,215 participants (116,895 women, 100,320 men) aged between 25 and 69 from EU Member States (Table 1). The age limitation

	Women		Men	
	%	n	%	n
Education level				
Low education group	24.9	29,922	23.6	25,030
Medium education group	43.6	50,147	46.1	46,764
High education group	31.5	36,129	30.3	27,900
Risk factor				
Current smoking (daily or occasional)	22.9	25,676	32.4	32,797
Obesity (BMI ≥ 30)	15.9	18,919	17.1	17,299
Physical activity (< 150 min/week)[1]	66.4	71,723	60.2	56,380
Heavy episodic drinking (at least once a month)[2]	13.3	11,185	32.5	25,066
Fruit/vegetable intake (non-daily)	28.5	32,661	41.1	39,255
Countries				
Austria	1.7	7,147	1.7	5,632
Belgium	2.0	3,353	2.0	3,180
Bulgaria	1.5	2,343	1.5	2,245
Croatia	0.8	1,925	0.9	1,823
Cyprus	0.2	1,848	0.2	1,671
Czech Republic	2.2	2,523	2.2	1,990
Denmark	1.1	2,202	1.1	1,812
Countries (Continued)				
Estonia	0.3	2,155	0.3	1,697
Finland	1.0	2,445	1.1	1,920
France	12.2	5,888	11.7	5,314
Germany	16.0	9,732	16.5	7,805
Greece	2.2	3,329	2.1	2,312
Hungary	2.0	2,195	2.0	1,937
Ireland	0.9	4,426	0.9	3644
Italy	12.2	9,036	12.2	8,597
Latvia	0.4	2,707	0.4	2,050
Lithuania	0.6	2,093	0.5	1,404
Luxembourg	0.1	1,690	0.1	1,415
Malta	0.1	1,549	0.1	1,396
Netherlands	3.2	2,821	3.3	2653
Poland	8.1	9,513	7.9	7,981
Portugal	2.1	6,927	2.0	5,691
Romania	4.0	6,030	4.1	5,690
Slovakia	1.1	2,207	1.1	1,853
Slovenia	0.4	2,386	0.4	2,028
Spain	9.5	8511	9.6	7,892
Sweden	1.8	2,070	1.9	2,237
United Kingdom	12.2	7,844	12.2	6,451

% = weighted proportion, n = unweighted number of participants
[1] Excluding Belgium and the Netherlands (no data available)
[2] Excluding France, Italy and the Netherlands (no data available)

Table 1
Characteristics of the study population by sex (n=116,895 women, n=100,320 men)
Source: EHIS 2 (2013-2015)

Info box 2: Calculating and interpreting absolute and relative differences using the Slope Index of Inequality (SII) and the Relative Index of Inequality (RII)

The SII and RII are regression-based measures that take into account the entire distribution of socioeconomic variables such as education and the size of socioeconomic groups [17, 18]. In the analyses undertaken for this article, linear probability models were used to calculate the SII and log-binomial models were used to calculate the RII. This involved converting the education variable to a metric scale ranging from 0 (the highest level of education) to 1 (the lowest level of education) by means of ridit analysis [21]. Education was then included as an independent variable in the regression models [22]. The resulting regression coefficients indicate SII or RII, depending on the model. Age-standardisation was applied during the calculation of both indices. SII is a measure of the prevalence difference (absolute inequality), whereas RII indicates the prevalence ratio (relative inequality) between individuals with the lowest and highest level of education. For example, an SII of 0.15 indicates that a 15 percentage-point difference exists between people at the bottom of the educational scale and those at the top. An SII of 0.00 means that no prevalence difference exists between these individuals. An RII of 2.00 indicates that people at the very bottom of the educational scale are twice as likely to face a particular risk factor compared to those at the very top of the educational scale. An RII of 1.00 indicates that no relative risk difference exists between these individuals.

was put in place to reduce potential bias from younger cohorts who are still to gain educational qualifications and from older cohorts who received their education prior to educational expansion, i.e. the increased participation of post-war generations in secondary and tertiary education. The following numbers of participants were excluded as they lacked data for the respective indicators: 3,313 participants for smoking, 8,102 for obesity, 20,836 for physical activity (no data were available from the Netherlands or Belgium), 41,007 for heavy episodic drinking (no data were available from France, the Netherlands or Italy) and 5,751 for fruit or vegetable intake.

The analyses were performed with a weighting factor to ensure that each EU Member State was considered in proportion to its population size. In contrast to the analyses undertaken for GEDA 2014/2015-EHIS for Germany [9], education was not taken into account during weighting for the European comparison; this follows current recommendations of the Statistical Office of the European Union (Eurostat). The household indicator variable was used as the cluster variable in the following analyses. All analyses were performed using Stata 15.1.

Prevalences with 95% confidence intervals (95% CI) stratified by education and sex were estimated for each of the observed behavioural risk factors. Prevalences are estimates, the precision of which can be assessed through their CI; wide CI indicate that a particular outcome has a greater level of statistical uncertainty. Prevalences were calculated for all EU Member States as a whole, and separately for Germany. Prevalence differences occur in cases where the CI of prevalence estimates do not overlap. In order to provide for an adequate comparison of prevalence estimates, direct age standardisation was applied. In each case, the age structures of the samples in Germany and other EU Member States were adjusted to reflect the 2013 revision of the European Standard Population (ESP) [16]. In the analyses that were stratified by education, age standardisation was also applied to education groups within each country. Age standardisation provides for a direct comparison of prevalence estimates as it corrects for differences in the age structure of a population or subpopulation. The Slope Index of Inequality (SII) and the Relative Index of Inequality (RII) were used to examine the extent of absolute and relative educational differences in the prevalence of behavioural risk factors [17, 18]. Whereas the SII quantifies the extent of absolute prevalence differences between education groups (absolute inequality), the RII provides a measure of the extent of the prevalence ratio (relative inequality) that exists between education groups (Info box 2). As studies that merely use absolute or relative differences can produce one-sided, selective conclusions, the literature recommends calculating both absolute and relative measures of inequality [19, 20]. This is particularly important when target variables appear on different overall levels, as is the case with this analysis of the prevalence of behavioural risk factors. SII and RII were calculated for all EU Member States together (including Germany) and separately for each Member State in order to provide for an analysis of where the values for Germany stand in terms of the range of results gained from the various Member States.

In order to provide a clear overview of the indicators, the individual values that were calculated for each of the 28 EU Member States are not set out in Figure 2 or Figure 3.

Table 2
Age-standardised prevalence of behavioural risk factors by sex
Source: EHIS 2 (2013-2015)

	Women		Men	
	%	(95% CI)	%	(95% CI)
Current smoking (daily or occasional)				
Germany	22.1	(21.2-23.1)	28.4	(27.2-29.5)
EU	22.9	(22.6-23.3)	32.3	(31.9-32.7)
Obesity (BMI ≥ 30)				
Germany	16.6	(15.8-17.5)	18.6	(17.6-19.5)
EU	15.8	(15.5-16.1)	17.2	(16.9-17.5)
Physical activity (< 150 min/week)				
Germany	45.1	(43.9-46.2)	44.4	(43.2-45.7)
EU	66.3	(65.9-66.7)	60.3	(59.8-60.7)
Heavy episodic drinking (at least once a month)				
Germany	21.7	(20.8-22.7)	41.8	(40.6-43.1)
EU	13.4	(13.1-13.7)	32.5	(32.0-33.0)
Fruit/vegetable intake (non-daily)				
Germany	38.4	(37.3-39.5)	58.3	(57.0-59.5)
EU	28.6	(28.2-28.9)	41.0	(40.6-41.5)

CI=Confidence interval, EU=Average of EU Member States for which data are available (physical activity does not include Belgium and the Netherlands; heavy episodic drinking does not include France, Italy and the Netherlands)

Marked educational differences exist in behavioural risk factors in Germany and most other EU Member States.

Instead, the figures provide the lowest and highest values from the EU Member States for which data are available, the EU average for the Member States under study, and the prevalence for Germany.

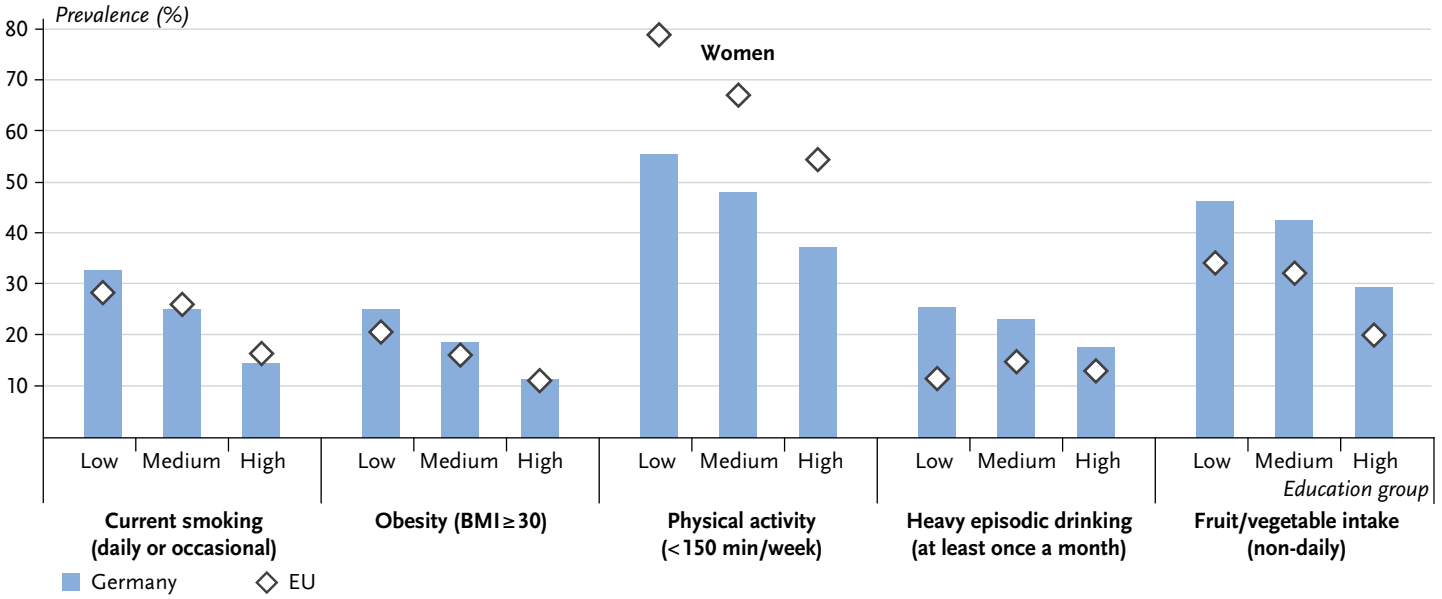
3. Results

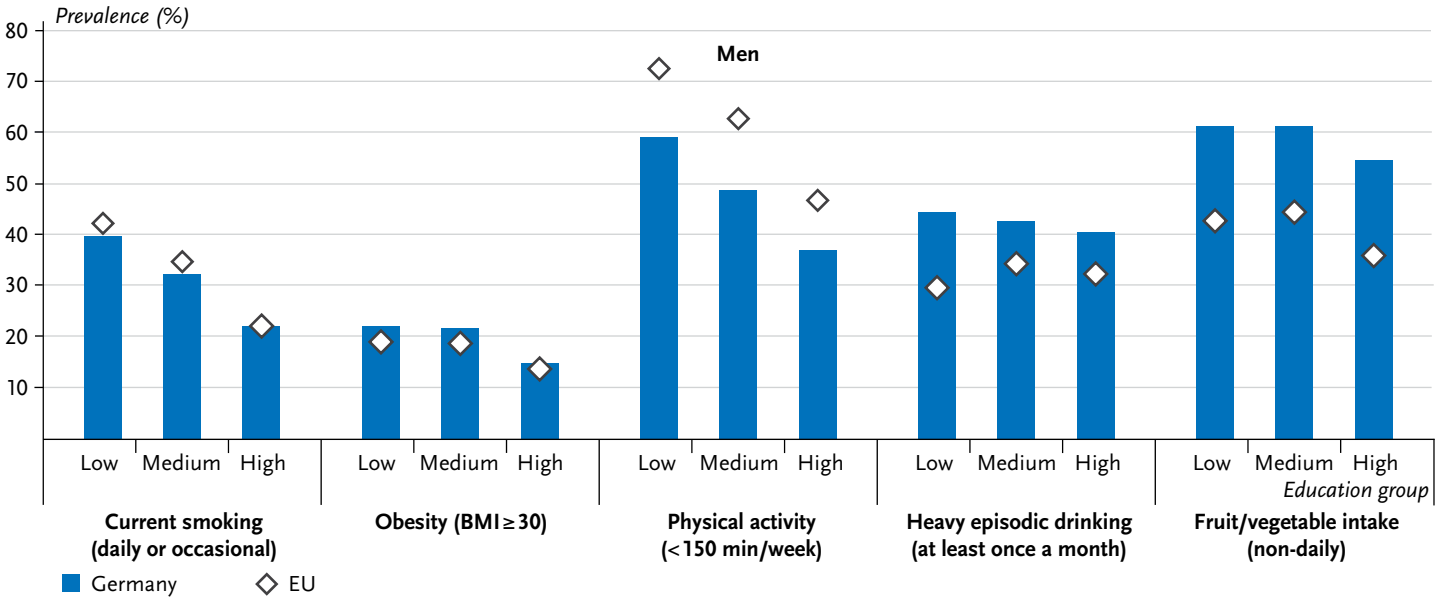
Data from EHIS 2 show that low physical activity in leisure time and non-daily fruit or vegetable consumption are among the most prevalent risk factors for women and men aged between 25 and 69. This applies both to the population living in Germany and to the EU average (Table 2). A comparison of the age-standardised prevalence of risk factors in Germany with EU averages shows that the distribution of heavy episodic drinking and non-daily fruit or vegetable intake among women and men in Germany is well above the EU average. Obesity prevalence among men in Germany also slightly exceeds the average EU level. The prevalence of smoking, on the other hand, is lower among men in Germany than the average across the EU. Obesity and smoking prevalence among women in Germany are at the same level as the EU average. Low physical activity in leisure time, on the other hand, is less common among women and men in Germany than the EU average.

With the exception of low physical activity during leisure time, a comparison of women's and men's age-standardised prevalences shows that the risk factors under consideration are more common among men than women. This is particularly the case with regard to heavy episodic drinking and non-daily fruit or vegetable intake and applies both to Germany as well as the EU average. No differences were found between the sexes with regard to the prevalence of low physical activity in Germany, but the prevalence is higher among women than men on average throughout the EU.

When the results are differentiated according to education, significant differences become evident in the distribution of behavioural risk factors between education groups. In Germany, the lower the education level, the higher the age-standardised prevalence of smoking, obesity, low physical activity, and non-daily fruit or vegetable intake (Figure 1). This also reflects the EU average. However, the educational gradient for non-daily fruit or vegetable intake is not as pronounced for men as it is for women.

Figure 1
Age-standardised prevalence of behavioural risk factors by sex and education level
Source: EHIS 2 (2013-2015)

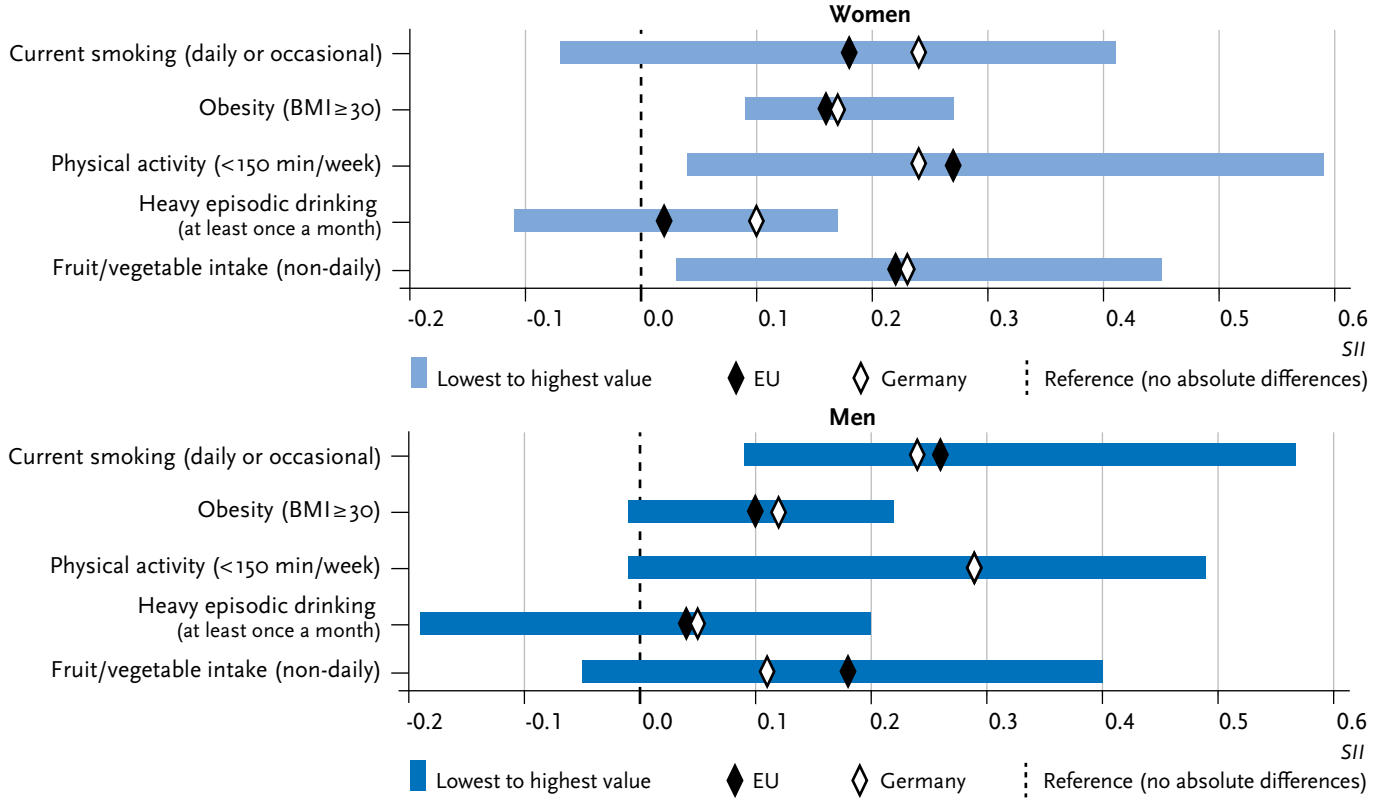




BMI = Body Mass Index, EU = Average of the EU Member States for which data are available
(physical activity does not include Belgium and the Netherlands, heavy episodic drinking does not include France, Italy and the Netherlands)

The EU average prevalence of age-standardised heavy episodic drinking poses an exception. No consistent educational gradient was identified for the EU average among women or men. However, an educational gradient was identified for Germany, particularly among women: women from lower education groups show a higher prevalence of heavy episodic drinking.

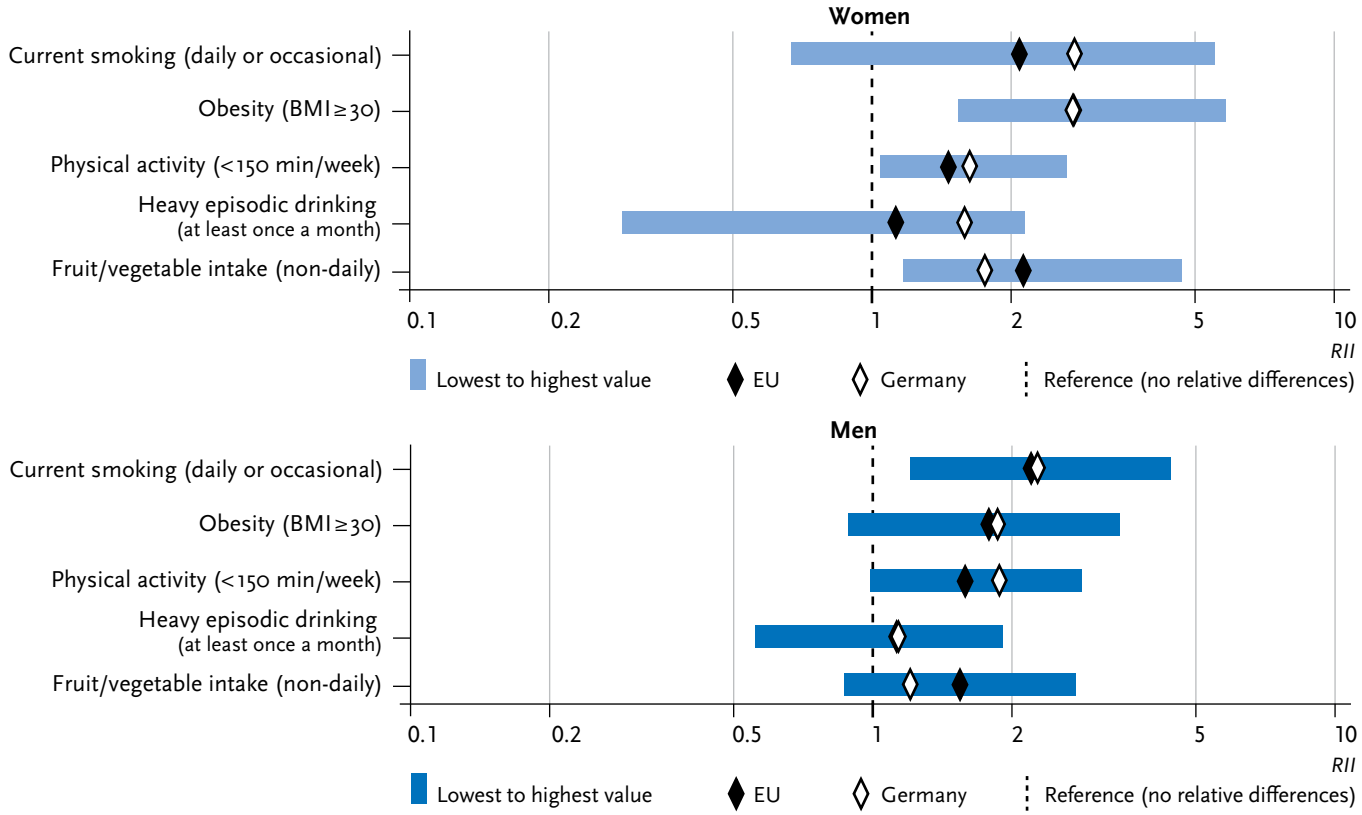
More detailed analyses not only reveal whether educational differences exist in the prevalence of behavioural risk factors, but also how stark these differences are in Germany compared to the EU average. Figure 2 shows the extent of absolute differences in education (the difference in prevalence between persons with lowest and highest education status) whereas Figure 3 shows the extent of relative education differences (the prevalence ratio between persons with lowest and highest educational status) for each of the five risk factors. The diamonds in both figures mark the SII or RII for Germany (white) and the EU average (black). The blue bars illustrate the range between the EU Member State with the highest and lowest value.



BMI = Body Mass Index, EU = Average of the EU Member States for which data are available
(physical activity does not include Belgium and the Netherlands, heavy episodic drinking does not include France, Italy and the Netherlands)

Figure 2
Absolute educational differences (SII) in the prevalence of behavioural risk factors (age-standardised) by sex
Source: EHIS 2 (2013-2015)

Figure 3
Relative educational differences (RII) in the prevalence of behavioural risk factors (age-standardised) by sex
Source: EHIS 2 (2013-2015)



BMI = Body Mass Index, EU = Average of the EU Member States for which data are available
(physical activity does not include Belgium and the Netherlands, heavy episodic drinking does not include France, Italy and the Netherlands)

Whereas absolute and relative educational differences for smoking among women in Germany are greater than the EU average, the differences among men in Germany are very close to the EU average. Educational differences in obesity prevalence in Germany are roughly the same as the EU average for women and men in both absolute and relative terms. No significant educational differences were identified between Germany and the EU average for low physical activity in leisure time. No differences between Germany and the EU average were found for men in terms of the extent of educational differences in heavy episodic drinking. However, educational differences for heavy episodic drinking among women in Germany are greater than the EU average. Educational differences in non-daily fruit or vegetable intake in Germany are lower than the average across the EU. This is true for relative differences between the sexes and is predominantly the case among men with regard to absolute differences. Strikingly, an analysis of

the extent of educational differences in the prevalence of behavioural risk factors across the EU (the blue bars in Figure 2 and Figure 3) generally places Germany in the middle range compared to other EU Member States.

4. Discussion

4.1 Main results

Educational differences in smoking among women in Germany are greater than the EU average.

In Germany and most other EU Member States, behavioural risk factors are more prevalent among lower education groups than higher education groups. Whereas differences in smoking prevalence among women in Germany are greater than the EU average, educational differences in obesity prevalence in Germany correspond to the average EU level. Similarly, although educational differences in heavy episodic drinking among women in Germany are greater than the EU average, educational differences in non-daily fruit or vegetable intake in Germany are lower than the average across all EU Member States. To the best of our knowledge, this study represents the first population-based analysis of absolute and relative educational differences of behavioural risk factors among adults that compares Germany with the EU average.

4.2 Interpretation and discussion of the results

Recent reviews indicate that the vast majority of published studies have found significant links between education and mortality [23, 24]. Galamar et al. [24] highlight two causal paths to explain this association. First, greater educational attainment leads to higher incomes and wealth over a person's lifetime, which in turn provides them with better access to health resources, and leads to healthier behaviour and patterns of consumption. Second, greater educational attainment fosters the development of health-promoting skills such as health literacy and access to quality health services [24]. International findings also demonstrate that educational differences in health behaviour (or behavioural risk factors such as smoking, physical inactivity and obesity) significantly contribute to educational differences in mortality [25-28]. As such, it is essential to consider the fact that patterns of behaviour are embedded within specific conditions, in other words, they are shaped, or at least influenced, by people's living and working conditions, as well as the associated psychosocial factors [28, 29].

Current smoking

Tobacco use is the most common single cause of premature mortality in the EU. According to the European Commission, nearly 700,000 EU citizens die as a result of smoking every year [30]. Women in Germany smoke as frequently as the European average, with men in Germany doing so less frequently. This finding corroborates the results of other comparative European studies [31]. One finding that is particularly striking, however, is the fact that the educational gradient for smoking among women in Germany is much more marked than the European average. The educational gradient for tobacco use among women in southern European countries, for example, is much smaller [32, 33]. It is possible that this is because Germany and other northern and central European countries are currently in a later phase of the 'smoking epidemic' [33, 34, 35]: smoking is said to initially become widespread among privileged sections of the population, especially among men.

Educational differences in the prevalence of obesity and low physical activity in Germany correspond to the EU average.

Over time, men from lower status groups adopt the habit, followed by high-status women. Eventually, smoking also becomes common among women with a low socioeconomic status [33, 36].

Trend analyses demonstrate that the educational gradient in smoking behaviour in Germany has not only remained undiminished since the turn of the millennium, but also that it has actually increased slightly among men [37]. Moreover, this has occurred despite the numerous tobacco control measures that have been introduced during this period [38]. This demonstrates that preventive measures with the potential to further reduce smoking need not necessarily be associated with a decline in social inequality [39]. When establishing new measures, therefore, it is important to ensure that they do not exacerbate existing socioeconomic-related health inequalities and cause intervention-generated inequality [40]. Despite the falling prevalence in smoking [35] and a smoking rate that is average by European standards, there is still considerable room for improvement in Germany with regard to smoking prevention policy: a European comparison of different areas of tobacco control places Germany second from bottom [41].

Obesity

People who are obese are more likely to suffer from chronic diseases such as type 2 diabetes, cancer or cardiovascular disease and generally have a lower life expectancy than those with a normal weight [42, 43]. The prevalence of obesity has increased dramatically worldwide in recent decades [44]. This also poses a major challenge – not least for the health sector – that looks set to continue for years to come as obesity prevalence is predicted to rise in the future [44].

Although obesity prevalence is higher in Germany than the EU average, educational differences in obesity are similar to the EU average. There is a clear gradual reduction in obesity levels associated with higher education level. Previous surveys have also identified a clear gradient for obesity prevalence and socioeconomic status among adults in Germany [45]. A recent study analysed temporal changes in educational differences in obesity between 1990 and 2010 in 15 European countries [46]. Overall, the study observed an increase in obesity prevalence over time but the extent of this increase varied between the countries under study. Moreover, this increase was greater in absolute terms among people with a low education level. There has, however, been no increase in relative educational differences [46]. These differences associated with socioeconomic or education level are primarily due to long-term differences in nutrition and physical activity. Although it is very difficult for population studies to describe this situation precisely, it is reflected, among other factors, in the observed differences in physical activity as well as fruit and vegetable intake.

Low physical activity during leisure time

People who follow the recommended minimum of at least 150 minutes of aerobic physical activity per week have a 40% lower risk of premature mortality compared to people who are physically inactive [47]. In Germany, low physical activity in leisure time (less than 2.5 hours a week) is much less common among women and men than across the EU average. However, pronounced educational differences do exist in the prevalence of low physical activity in leisure time both in Germany and the EU average. These differences can be mapped as a gradient that demonstrates the

lower the education level, the higher the prevalence of low physical activity. This observation also reflects the results of an analysis based on the pooled data set used by the 2014 European Social Survey which were calculated for 21 European countries. The results identified a gradient with regard to physical activity and education on at least three days a week to the detriment of lower education groups [6].

The relative educational differences in the prevalence of low physical activity in leisure time are similar to the EU average for women in Germany and slightly above the EU average for men. The slightly greater educational differences among men in Germany compared to the EU average could be due to Germany's relatively large service sector as it contributes to high levels of physical inactivity at work among men with a high education level [48, 49]. Men with a high education level, however, may compensate for work-related inactivity with greater physical activity during leisure time [50]. By contrast, men with a medium or low education level are more active at work and engage less frequently in physical activities during leisure time [48, 49].

A recent trend analysis of relative educational differences in sporting activity among adults in Germany points out that differences increased after the turn of the millennium. These differences can be explained by a strong increase in the prevalence of physical activity among adults with high education levels compared to those with a low education status [51]. In Germany as well as in the EU as a whole, additional evidence-based measures are needed to promote aerobic physical activity at the population level, reduce social differences in aerobic physical activity, and counteract the development of health inequalities [52]. The Global Activity Plan on Physical Activity and Health 2018-2030 recommends a multi-component approach that focuses on the systemic, social, environmental and individual levels [53]. The proposed measures are aimed at reducing the prevalence of inadequate levels of physical activity by 15% (compared to 2010 levels) by 2030 [53].

Educational differences in heavy episodic drinking among women in Germany are greater than the EU average.

Heavy episodic drinking

In Germany, heavy episodic drinking – in other words, drinking 60g or more of pure alcohol on one occasion – is significantly more widespread among women and men than the European average [54]. Heavy episodic drinking is a particularly risky form of drinking which, in addition to the long-term effects of excessive alcohol consumption, such as alcohol dependency and organ damage, can also result in acute damage due to alcohol intoxication, cause people to injure themselves or others, and even lead to violence [55].

A social gradient for heavy episodic drinking exists among women in Germany that is not found in the EU average. Heavy episodic drinking is less prevalent among women in Germany with a high education level than among women with a low education level. However, there is a large range of differences between countries that even includes partially reversed gradient in some Member States. Another European study that covered heavy episodic drinking found clear educational differences between countries with regard to alcohol consumption [6]. However, it only identified a slight gradient for Germany and this was not associated with a particular sex.

In contrast to heavy episodic drinking, a number of German studies on risky alcohol consumption, defined as more than 10g (for women) or more than 20g (for men) of pure alcohol in one day, found no gradient associated with men's

social or education level, and a reversed gradient in this case among women [56-58].

Harmful alcohol consumption is not associated with the same consequences in all status groups. Similar levels of alcohol intake cause greater damage to the health of disadvantaged population groups than privileged groups; this difference is referred to as the alcohol harm paradox [59]. Alcohol intake is more likely to cause problems for women and men with low education level. These individuals are also often less able to compensate for the related social and health difficulties [60]. This is particularly problematic because heavy episodic drinking appears to be particularly widespread among women in groups with low education level. In Germany, far fewer regulatory measures have been introduced to limit the population's alcohol consumption than in many other EU countries [61]. For example, taxes on alcoholic beverages in Germany are much lower than the EU average [61].

Educational differences in non-daily fruit or vegetable intake in Germany are smaller than the EU average.

Non-daily fruit and vegetable intake

Non-daily fruit or vegetable intake is much more common in Germany than the EU average. However, Germany also has a less pronounced educational gradient in this regard. A low fruit and vegetable intake is a risk factor associated with coronary heart disease, hypertension and stroke [62]. The Global Burden of Disease Study estimates that in 2017, approximately two million deaths worldwide were associated with low fruit intake and approximately 1.5 million deaths were associated with low vegetable intake [63]. For this reason, among others, recommendations encourage people to eat fruit and vegetables on a daily basis. However, the German Health Interview and Examination Survey for Adults (DEGS1, 2008-2011) shows that many adults in Germany, especially adults with a low socioeconomic status, do not follow this recommendation [64]. Data from EHIS 2 were used to calculate the percentage of adults that consume at least five portions of fruit and vegetables per day in each EU Member State stratified by education group [65]. The resulting indicator paints a picture that corroborates the results of this study: both the percentage in Germany and the educational differences for Germany are lower than the EU average [65]. Further comparable European-wide studies have mostly found that people with a higher education level have a greater or more frequent fruit and vegetable intake than people with a lower education level, with the exception of some southern and eastern European countries [6, 65-67]. However, these studies also found considerable variations in educational differences between the EU states [6, 65-67]. As such, significant differences exist in fruit and vegetable intake within the EU and these differences are influenced by many aspects, including culture. Measures to increase fruit and vegetable intake, therefore, should take educational differences and regional influences into account.

4.3 Strengths and limitations

EHIS 2 has a number of strengths. The study is based on a large number of cases as more than 200,000 people participated throughout the EU. The study also expected high standards to be put in place for the sampling framework drawn up by each country. As such, EHIS 2 enables representative findings to be made for individual countries and the EU as a whole. The high degree of standardisation and

harmonisation of the EHIS questionnaire and the resulting data, which enable individual countries to be compared with the EU as a whole, should also be stressed in this context [10, 68]. However, when interpreting the results of the study, it is important to note that the data from Germany are also included in the EU average. At the same time, significant differences not only exist in the prevalence of behavioural risk factors within the EU, but also between countries when it comes to factors such as economic performance and structure, as well as a country's welfare system, social stratification and degree of urbanisation. In addition, as the data collected for the study were self-reported, they are subject to unavoidable limitations such as reporting bias, recall bias, and the provision of socially desirable responses [69, 70]. Data collection periods did not always cover an entire year nor were they always conducted for the same length of time in each country. As such, seasonal variations, which do affect some of the behavioural risk factors under study, may have influenced the results. The cross-sectional study design of EHIS means that no causal inferences can be deduced from the observed associations between education level and behavioural risk factors. Finally, it is not altogether impossible that the results only provide limited generalizability due to sample bias or the unavailability of data for specific indicators in individual countries.

4.4 Conclusion

Compared to the EU average, Germany appears in the middle range of a comparison of relative educational differences for five behavioural risk factors. Relative educational differences in current smoking, heavy episodic drinking among women and low physical activity in leisure time among men are more pronounced in Germany than in the EU average. However, the relative educational differences identified in fruit and vegetable intake among women and men are less distinct in Germany than in the EU average. The observed educational gradient, whereby people with a lower education level have a higher prevalence of behavioural risk factors, is consistent with the significant gap in life expectancy that has been identified between lower and higher education groups in Germany and the EU [2, 71]. Against this backdrop, non-governmental organisations are vehemently demanding the implementation of health policy measures aimed at improving health equity. Such measures should focus on conditional factors and follow the 'health in all policy fields' approach. In other words, they should be implemented at the systemic, social, environmental and meta-population levels, and particularly prioritise disadvantaged groups so as to make 'healthy choices easy choices' [72, 73].

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Data protection and ethics

Data for the European Health Interview Survey (EHIS) is collected by national surveys. GEDA 2014/2015-EHIS is subject to strict compliance with the data protection provisions set out in the Federal Data Protection Act (BDSG). The study was reviewed and approved by the German Federal Commissioner for Data Protection and Freedom of Information (BfDI). Participation in the study was voluntary. The participants and/or their parents/legal guardians were also informed about the aims and contents of the study, and about data protection. Depending on the survey mode, informed consent was obtained in writing or electronically.

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Conflict of interest

The authors declared no conflicts of interest.

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Limitations in activities of daily living in old age in Germany and the EU – Results from the European Health Interview Survey (EHIS) 2

Abstract

The health status of older people in Germany can be compared with the health of older people in other European Union (EU) Member States using data on the distribution of limitations in activities of daily living. This concept covers basic limitations in activities of daily living (ADL) such as eating, as well as limitations in instrumental activities of daily living (iADL) such as shopping and managing finances. The second wave of the European Health Interview Survey (EHIS 2) collected data on five ADLs and seven iADLs for people aged 65 or above. An ADL or iADL limitation was defined if a participant reported at least a lot of difficulty in at least one ADL or iADL, respectively. On average, 8.4% of the EU population reported an ADL limitation, with 25.2% reporting an iADL limitation. However, prevalences vary widely between EU Member States and are lower in Germany than the EU average (ADL limitation 6.3%, iADL limitation 14.0%). In general, women, people aged 75 or above, and lower education groups have a higher prevalence of ADL and iADL limitations.

ACTIVITIES OF DAILY LIVING · GENERAL POPULATION · AGE · EUROPEAN COMPARISON

Introduction

The health status of older people can be described using data on limitations in activities of daily living. These limitations mainly caused by health problems make it difficult or impossible for people to live an independent life. The literature distinguishes between basic activities of daily living (ADL) [1], which includes limitations in eating, mobility – in the sense of being able to get in or out of a bed or chair – and personal care; and instrumental activities of daily living (iADL) [2], such as housework, shopping and managing finances (Info box 1). In accordance with the International Classification of Functioning, Disability and Health (ICF) [3, 4], activities of daily living constitute an important aspect of a person's functional status.

Limitations in activities of daily living illustrate older people's care and support needs. Limitations in ADL or iADL are associated with a lower quality of life [6, 7], poorer health [8] and increased mortality [9]. Data on limitations in ADL and iADL, therefore, can be used to demonstrate which population subgroups are particularly affected, and to design prevention and rehabilitation programmes that enable older people to remain independent as long as possible. This is particularly important in the context of demographic change.

Until now, previous European studies have focused on single or selected European Union (EU) Member States, and they used different instruments or different definitions of limitations [10-13]. As such, no data has been available to conduct European-wide comparisons of lim-

This article has been corrected as of February 03, 2020 (see corrigendum, page 56)

GEDA 2014/2015-EHIS (for international comparisons)

Data holder: Robert Koch Institute

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

Method: Questionnaires completed on paper or online

Population: People aged 15 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: 24,824 people (13,568 women, 11,256 men)

Response rate: 27.6%

Study period: November 2014 - July 2015

More information in German is available at www.geda-studie.de and Lange et al. 2017 [17]

itations in activities of daily living for people aged 65 or above. The second wave of the European Health Interview Survey (EHIS 2), therefore, is the first to provide harmonised data from all EU members. Data are primarily used for European standard analyses [14] and can be used for further statistical comparisons, as in this article.

Indicator

As part of the European Health Interview Survey (EHIS) framework, all EU Member States collect data on their population's health status, health care provision, health determinants and socioeconomic situation (Info box 2).

The EHIS survey focuses on people aged 15 or over living in private households, irrespective of their state of health. In order to achieve a high degree of harmonisation of measurement between the Member States, guidelines on survey methodology and implementation were provided in form of a manual, which also included a sample questionnaire [15]. Data collection for EHIS 2 took place between 2013 and 2015 in all 28 EU Member States. In Germany, EHIS is part of the health monitoring conducted at the Robert Koch Institute, and EHIS 2 has been integrated into the German Health Update (GEDA 2014/2015-EHIS) [16, 17]. A detailed description of the methodology applied in GEDA 2014/2015-EHIS can be found in Lange et al. [17].

Data collection was planned to last for at least three months and include a minimum of one autumn month (September to November). The average length of data collection across all EU Member States was eight months. At the time when EHIS 2 was undertaken, the EU consisted of 28 members. A more detailed description of the methodology applied in EHIS 2 is available in the EHIS quality report [18] and in Hintzpeter et al. [19], which is published in this issue of the Journal of Health Monitoring.

Participants were asked whether they normally faced difficulties when undertaking certain tasks without help. The study focused on five ADLs (eating and drinking, getting in or out of a bed or chair, dressing and undressing, using the toilet, and bathing or showering) and seven iADLs (preparing meals, using the telephone, doing the shopping, managing medication, undertaking light housework, undertaking occasional heavy housework, and organising financial/everyday administrative matters) [20]. The questions were based on Katz et al. [1] and Lawton et al. [2]. Ad Hoc data quality assurance measures not included in standard Eurostat analyses [14] were used. The response categories provided for ADL and iADL were 'No difficulty', 'Some difficulty', 'A lot of difficulty' and 'Cannot do at all/Unable to do'. For iADL, an additional response category 'Not applicable (never tried it or do not need to do it)' was provided, which was recorded as 'no iADL limitation' [21]. Moreover, valid data on at least three ADLs or iADLs were required for the identification of an ADL or iADL limitation, respectively. An ADL or iADL limitation was defined as a response indicating that a person faced at least a lot of difficulty conducting at least one ADL or iADL, respectively.

Sociodemographic data on sex, age (age group 65 to 74 and over 75) and education (low, medium and high education group) were collected in accordance with the International Standard Classification of Education (ISCED) 2011 [22].

The analyses are based on data from a total of 79,822 participants (45,657 women, 34,165 men) aged 65 or over from EU Member States. Valid responses were available for

Info box 1: Basic and instrumental activities of daily living (ADL/iADL)

The International Classification of Functioning, Disability and Health (ICF) defines limitations in activities of daily living as cases where people find it difficult or impossible to perform specific tasks.

To assess limitations in activities of daily living in research and practice, two questionnaires are used that measure limitations in basic activities of daily living (ADL) and limitations in instrumental activities of daily living (iADL).

ADLs comprise the fundamental activities that people have to undertake to meet their basic needs. This includes walking, climbing stairs, eating, personal hygiene, dressing and using the toilet. The most commonly used indices were published by Katz et al. in 1963 [1] and by Mahoney and Barthel in 1965 [5].

iADLs encompass broader areas of daily living that pose more complex challenges. These include tasks such as using the telephone, shopping, managing finances and day-to-day administrative matters, taking medication and using transport. iADLs are measured using a score based on work published by Lawton and Brody in 1969 [2].

79,014 people on ADL limitations and for 79,054 people on iADL limitations.

The results are presented as totals or stratified by sex, age and education group, showing prevalences with 95% confidence intervals (95% CI). The precision of prevalences can be estimated based on 95% confidence intervals (95% CI). A wide 95% CI indicates greater statistical uncertainty of the results. Deviations of the estimated prevalence for Germany from the EU average are used to calculate statistically significant differences. A statistically significant difference between groups can be assumed if the corresponding p-value is smaller than 0.05.

In order to provide a clear overview of the indicators, the individual values that were calculated for each of the 28 EU Member States are not set out in Figures 1 or Figure 2. Instead, the figures provide the lowest and highest values from the Member States, the EU average for the countries under consideration, and the prevalence for Germany.

The analyses were performed with a weighting factor to account for the relative population size of each EU Member State. The data are stratified by age and sex, and the study uses the European Standard Population (ESP) in its 2013 revised form. Prevalences have also been stratified by education group, with prevalences for each education group standardised by age. This improves the comparability of health indicators [23] in the Member States by accounting for possible differences in age structure. The household indicator is used as the cluster variable in the following analyses.

Results and discussion

On average, 8.4% of people aged 65 or above in the EU report an ADL limitation and 25.2% report an iADL limitation in EHIS 2 (Table 1). Prevalences vary widely among the Member States (with ADL limitations ranging from 3.3% in Denmark to 15.3% in Belgium; and iADL limitations ranging from 11.8% in Sweden to 38.8% in Latvia). In Germany, prevalences are below the EU average (ADL limitation 6.3%, iADL limitation 14.0%).

Women are more frequently affected by ADL and iADL limitations than men (Table 1, Figure 1 and Figure 2). This also applies to Germany, albeit to a lesser extent. Men in Germany have the lowest prevalence of iADL limitation in the EU.

However, the prevalences of ADL or iADL limitations in the upper age group (75 or above) are increasing both in the EU as a whole and in Germany (Figure 1 and Figure 2). Wide variation with regard to age is also found across Member States. Prevalences for Germany remain below the EU average.

Education differences are also identified for ADL and iADL limitations (Figure 1 and Figure 2): ADL and iADL limitations are reported more frequently by people in the lower education group in Germany and across all Member States, with decreasing prevalences in higher education groups. The prevalences of ADL and iADL limitations differ among education groups within Member States with a wide variation across the Member States. The prevalence of ADL limitation for medium and high education groups in Germany is below the EU average, whereas the prevalence of iADL limitation in Germany is below the EU average for all education groups.

As previous studies have shown [10, 24, 25], the prevalences of ADL and iADL limitations differ widely between European countries despite the fact that harmonised instru-

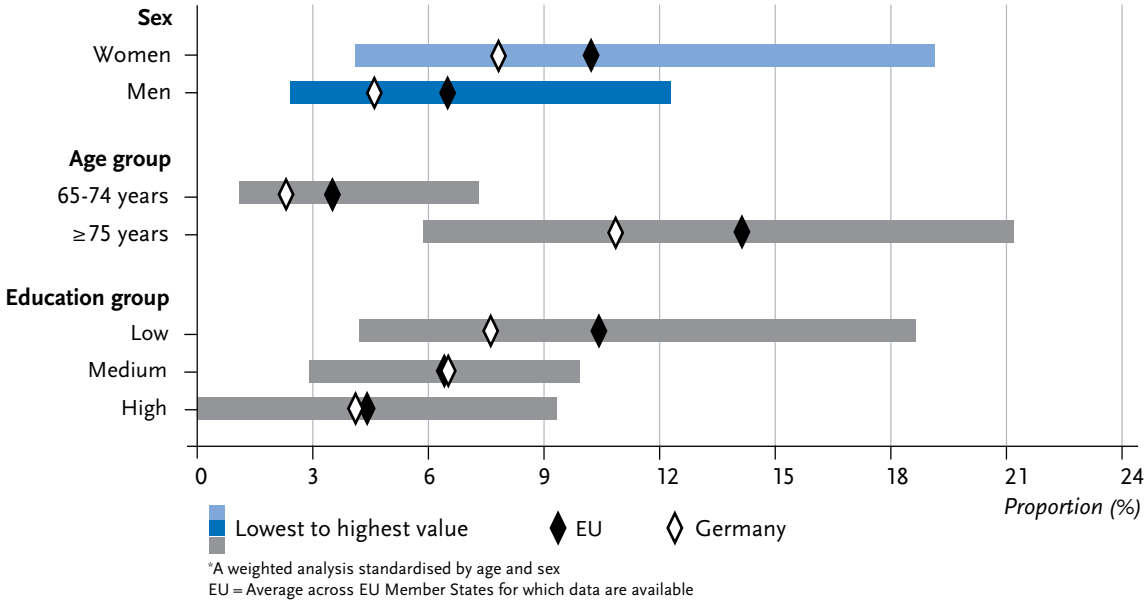
Table 1
Prevalence of ADL and iADL limitations (standardised by age and sex) as totals and by sex and EU Member States
Source: EHIS 2 (2013-2015)

	ADL limitation[1]						iADL limitation[2]					
		Women (n=45,197)		Men (n=33,817)		Total (n=79,014)		Women (n=45,230)		Men (n=33,824)		Total (n=79,054)
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Austria	5.9	(4.3-8.1)	2.4	(1.5-3.9)	4.2	(3.2-5.5)	21.2	(18.3-24.4)	10.4	(7.7-14.0)	15.9	(13.9-18.3)
Belgium	19.1	(15.9-22.7)	11.3	(8.8-14.3)	15.3	(13.2-17.7)	39.5	(35.4-43.7)	24.4	(20.8-28.3)	32.2	(29.3-35.3)
Bulgaria	14.9	(12.8-17.3)	12.3	(9.9-15.2)	13.6	(12.0-15.5)	40.5	(37.5-43.6)	32.7	(29.2-36.5)	26.8	(34.2-39.4)
Croatia	12.0	(9.8-14.6)	6.8	(5.0-9.2)	9.5	(8.0-11.3)	33.7	(30.3-37.3)	22.2	(18.7-26.0)	28.2	(25.6-31.0)
Cyprus	13.6	(10.5-17.4)	6.5	(4.5-9.2)	10.2	(8.3-12.5)	49.1	(44.7-53.5)	27.3	(23.2-31.7)	38.6	(35.3-41.9)
Czech Republic	11.4	(9.6-13.5)	10.2	(8.1-12.9)	10.8	(9.4-12.5)	39.5	(36.8-42.3)	30.7	(27.3-34.3)	35.2	(33.0-37.5)
Denmark	4.1	(2.9-5.9)	2.5	(1.6-4.1)	3.3	(2.5-4.5)	16.5	(14.0-19.2)	12.4	(10.1-15.1)	14.4	(12.7-16.3)
Estonia	9.7	(7.9-11.9)	6.5	(4.4-9.6)	8.3	(6.8-10.0)	28.3	(25.4-31.5)	20.7	(17.0-25.1)	24.9	(22.5-27.4)
Finland	6.8	(5.3-8.6)	4.8	(3.3-7.0)	5.8	(4.7-7.2)	17.8	(15.5-20.3)	14.7	(12.0-17.8)	16.3	(14.5-18.2)
France	9.9	(8.4-11.7)	5.9	(4.7-7.3)	8.0	(7.0-9.1)	29.5	(27.1-32.0)	15.8	(13.9-18.0)	23.0	(21.3-24.7)
Germany[3]	**7.8**	**(6.7-9.2)**	**4.6**	**(3.8-5.6)**	**6.3**	**(5.5-7.1)**	**16.6**	**(15.0-18.3)**	**11.2**	**(9.9-12.8)**	**14.0**	**(12.9-15.1)**
Greece	12.7	(10.9-14.7)	9.7	(7.8-11.9)	11.2	(9.9-12.7)	38.7	(36.0-41.5)	24.6	(21.7-27.8)	32.0	(29.9-34.1)
Hungary	13.0	(10.7-15.6)	8.8	(6.4-12.0)	11.0	(9.3-13.0)	39.8	(36.3-43.5)	23.4	(19.5-27.7)	32.1	(29.4-34.9)
Ireland	6.8	(5.6-8.4)	6.0	(4.7-7.8)	6.4	(5.5-7.5)	23.3	(21.1-25.7)	19.1	(16.8-21.7)	21.3	(19.6-23.0)
Italy	12.7	(11.7-13.8)	7.3	(6.4-8.4)	10.1	(9.4-10.9)	35.2	(33.6-36.8)	20.6	(19.1-22.1)	28.2	(27.0-29.3)
Latvia	11.6	(10.0-13.4)	8.0	(6.0-10.5)	10.0	(8.7-11.4)	43.1	(40.4-45.9)	33.6	(29.8-37.5)	38.8	(36.6-41.2)
Lithuania	13.2	(11.3-15.4)	8.4	(6.2-11.2)	11.0	(9.5-12.7)	39.8	(36.8-42.9)	29.6	(25.7-33.9)	35.2	(32.7-37.7)
Luxemburg	4.9	(2.8-8.5)	5.5	(3.4-8.8)	5.2	(3.6-7.5)	20.3	(15.8-25.7)	13.2	(9.9-17.5)	16.8	(13.8-20.2)
Malta	6.6	(4.6-9.2)	3.8	(2.3-6.3)	5.2	(3.9-6.9)	34.0	(30.0-38.2)	19.2	(15.6-23.5)	26.6	(23.9-29.6)
Netherlands	13.3	(11.1-15.8)	10.3	(8.3-12.9)	11.8	(10.3-13.6)	35.6	(32.4-38.9)	23.5	(20.5-26.7)	29.6	(27.4-31.9)
Poland	10.7	(9.5-12.0)	9.0	(7.6-10.7)	9.9	(9.0-10.9)	40.7	(38.8-42.7)	27.8	(25.6-30.1)	34.5	(33.0-36.1)
Portugal	13.3	(11.6-15.3)	6.6	(5.3-8.2)	10.2	(9.0-11.4)	46.2	(43.7-48.8)	14.4	(12.5-16.5)	31.3	(29.6-33.1)
Romania	6.6	(5.6-7.8)	5.2	(4.1-6.4)	5.9	(5.2-6.8)	38.5	(36.4-40.7)	29.4	(27.1-31.7)	34.1	(32.4-35.8)
Slovakia	12.0	(9.7-14.7)	10.8	(7.8-14.6)	11.4	(9.5-13.6)	43.1	(39.5-46.8)	33.7	(29.0-38.7)	38.6	(35.6-41.6)
Slovenia	11.5	(9.3-14.1)	9.1	(6.5-12.7)	10.3	(8.5-12.4)	34.7	(31.4-38.3)	25.0	(21.3-29.2)	30.0	(27.4-32.6)
Sweden	4.9	(3.3-7.3)	3.1	(1.9-5.0)	4.0	(2.9-5.4)	12.2	(9.6-15.4)	11.4	(9.0-14.4)	11.8	(10.0-14.0)
Spain	13.4	(12.2-14.7)	7.8	(6.6-9.1)	10.6	(9.8-11.6)	40.3	(38.4-42.2)	23.3	(21.5-25.3)	32.0	(30.7-33.4)
United Kingdom	6.8	(6.0-7.8)	3.8	(3.1-4.6)	5.4	(4.8-6.0)	23.1	(21.5-24.7)	14.3	(12.9-15.8)	18.8	(17.7-19.9)
EU	**10.2**	**(9.8-10.6)**	**6.5**	**(6.2-6.9)**	**8.4**	**(8.2-8.7)**	**30.8**	**(30.2-31.3)**	**19.2**	**(18.7-19.8)**	**25.2**	**(24.8-25.6)**

CI=Confidence interval, EU=Average across EU Member States for which data are available
[1] ADL limitation=At least a lot of difficulty in at least one of five ADLs (activities of daily living)
[2] iADL limitation=At least a lot of difficulty in at least one of seven iADLs (instrumental activities of daily living)
[3] Statistically significant differences in ADL limitations: total for Germany vs EU (p<0.001), women in Germany vs EU (p<0.01), men in Germany vs EU (p<0.01); Statistically significant differences in iADL limitations: total for Germany vs EU (p<0.001), women in Germany vs EU (p<0.001), men in Germany vs EU (p<0.001)

The prevalences of limitations in activities of daily living vary widely between EU Member States.

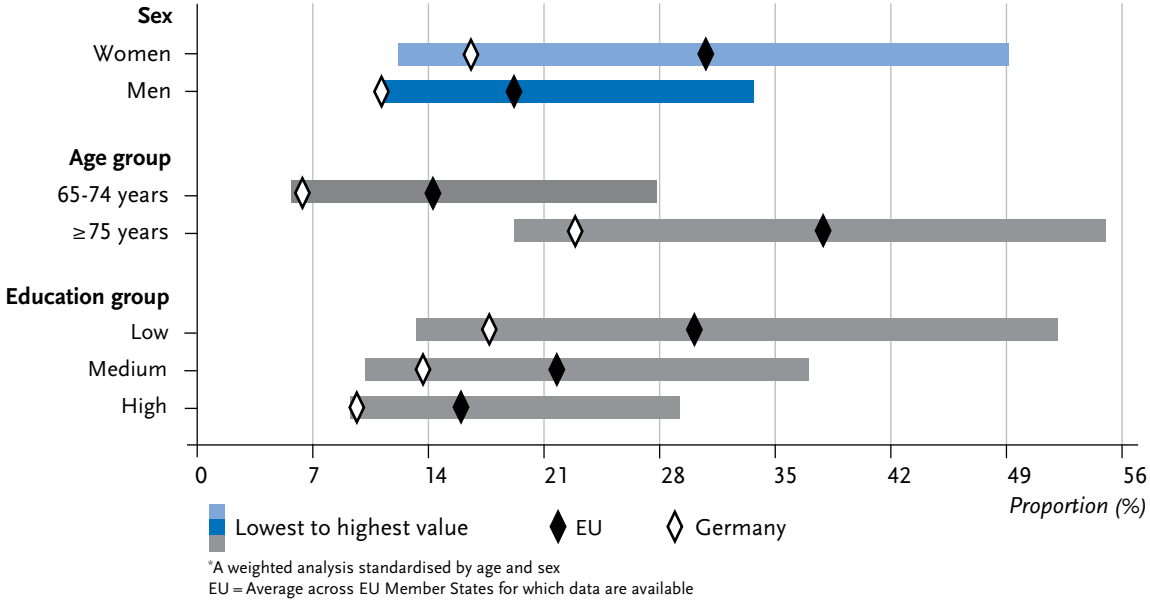
Figure 1
Limitations in basic activities of daily living (ADL) by sex, age and education status (n=45,197 women, n=33,817 men)*
Source: EHIS 2 (2013-2015)



*A weighted analysis standardised by age and sex
EU = Average across EU Member States for which data are available

The prevalences of limitations in activities of daily living are lower in Germany than the EU average.

Figure 2
Limitations in instrumental activities of daily living (iADL) by sex, age and education status (n=45,230 women, n=33,824 men)*
Source: EHIS 2 (2013-2015)



*A weighted analysis standardised by age and sex
EU = Average across EU Member States for which data are available

Info box 2: European Health Interview Survey (EHIS)

The European Core Health Indicators (ECHI) were jointly developed by EU Member States and international organisations, taking into account scientific and health policy requirements. The indicators provide a framework in European health reporting for population-based health surveys and analyses, and health care provision at the European and national level. The European Health Interview Survey (EHIS) is a key element in this regard. The first EHIS wave (EHIS 1), which was not mandatory, was conducted between 2006 and 2009. 17 Member States and two non-EU countries participated in EHIS 1. Participation in the second wave of EHIS (EHIS 2), which was conducted between 2013 and 2015 in all EU Member States (as well as in Iceland, Norway and Turkey) was legally binding and is based on Commission Regulation (EU) No 141/2013 of 19 February 2013. It provides essential information about the ECHI indicators. In Germany, EHIS is carried out as part of health monitoring at the Robert Koch Institute. During the EHIS 2 survey period, the EU had 28 Member States.

Further information is available at:
https://ec.europa.eu/eurostat/web/microdata/european-health-interview-survey

ments have been used to measure these indicators. People in Germany report an ADL or iADL limitation for EHIS 2 less frequently than the EU average.

The EHIS 2 study is the first to provide self-reported limitations in activities of daily living for people aged 65 or above living in private households for an EU-wide comparison. However, the study faces the limitation that although the EHIS 2 questionnaire was largely harmonised [15], permissible methodological differences did occur during sampling, participant acquisition and in the methods used for data collection [18]. For example, not all countries permitted the use of proxy interviews, and, in cases where proxy interviews were permitted, the option was not used to the same rate. This may have led to differences in the extent to which some countries were able to reach people aged 65 or above with severely impaired health and limitations in independent living. Moreover, these methodological differences may have contributed to the wide variation in prevalences identified in ADL and iADL limitations throughout the EU [26]. Second, due to the survey's cross-sectional design descriptive results presented here should not be used to draw conclusions about the causes of ADL or iADL limitations, nor should they be used in attempts to explain, for example, whether gender-based differences in conducting daily activities are due to biological differences or gender roles [27, 28]. Third, iADL limitations are particularly dependent on the structure of outpatient care and the services available in a specific country. However, as the study used self-reported indicators, no data were collected on these factors. More objective indicators, such as those associated with frailty measurements, may be more appropriate to assess the heterogeneous state of the health of older community-dwelling people [29, 30]. Finally, an additional age group over 80 or 85 would also have been desirable for a better overall presentation of the results. However, data protection requirements led countries to provide information on age by different age groups; as such, a breakdown of the older age group was not available from all countries.

Nonetheless, the data from EHIS 2 constitute an important source of information for national and European health policies [15]. They provide estimations of care structures and support services that older people require and of how accessible these structures and services are to this population group. Furthermore, data from EHIS 2 also enable analyses of existing social inequalities and, thus, provide a basis with which to enact EU policies [31, 32]. In line with other countries [24, 25], Germany needs to improve prevention and care services, particularly for women, people aged 75 or over, and for people from lower education groups.

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Women report more often limitations in activities of daily living than men, and people aged 75 or above report more often limitations in activities of daily living than those aged between 65 and 74.

People in the lower education group have higher prevalences of limitations in activities of daily living compared with those from higher education groups.

The German version of the article is available at:
www.rki.de/journalhealthmonitoring

Data protection and ethics

Data for the European Health Interview Survey (EHIS) is collected by national surveys. GEDA 2014/2015-EHIS is subject to strict compliance with the data protection provisions set out in the Federal Data Protection Act (BDSG). The study was reviewed and approved by the German Federal Commissioner for Data Protection and Freedom of Information (BfDI). Participation in the study was voluntary. The participants and/or their parents/legal guardians were also informed about the aims and contents of the study, and about data protection. Depending on the mode of data collection, informed consent was obtained in writing or electronically.

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Conflict of interest

The authors declared no conflicts of interest.

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Corrigendum, page 48 and page 50
In the original version of the article, on pages 48 and 50, the prevalence of iADL limitation among men in Germany was reported instead of the prevalence of iADL limitation for Germany as a whole: 'However, prevalences vary widely between EU Member States and are lower in Germany than the EU average (ADL limitation 6.3%, iADL limitation 11.2%)' and 'In Germany, prevalences are below the EU average (ADL limitation 6.3%, iADL limitation 11.2%)'.
The correct sentences read: 'However, prevalences vary widely between EU Member States and are lower in Germany than the EU average (ADL limitation 6.3%, iADL limitation 14.0%)' and 'In Germany, prevalences are below the EU average (ADL limitation 6.3%, iADL limitation 14.0%)'. The article has been corrected accordingly.

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Depressive symptoms in a European comparison – Results from the European Health Interview Survey (EHIS) 2

Abstract

Depression is associated with a significant individual and social burden of disease. The European Health Interview Survey (EHIS) provides data that can be used to compare the situation in Germany to that of other European countries. Data was evaluated from 254,510 interviewees from Germany and 24 additional Member States of the European Union (EU). Depressive symptoms as defined by the Patient Health Questionnaire (PHQ-8) were used as an indicator of depression. The prevalence in Germany (9.2%) is higher than the European average (6.6%). However, when the severity of depression is taken into account, only the prevalence of mild depressive symptoms is higher (6.3% versus 4.1%). In Germany, young people display depressive symptoms more frequently (11.5% versus 5.2%) than older people (6.7% versus 9.1%). These results should be discussed against the backdrop of differences in age and social structure and point toward a need for prevention and provision of care targeting younger people in Germany, in particular.

DEPRESSIVE SYMPTOMS · DEPRESSIVE SYMPTOM SEVERITY · SEX AND AGE · EUROPEAN COMPARISON

Introduction

Depression is associated with a significant individual and social burden of disease [1-4]. A reduction in quality of life and productivity are not only observed in individuals with manifest depression, but also in people with depressive symptoms [1, 5]. Although depression has become a focus of national and European public health measures, an actual comparison of the prevalence of depression in Germany with the other European countries is scarse [6]. Aiming at developing possible approaches for targeted national and European public health activities that go beyond the country-specific prevalence of depressive symptoms, this article also considers sex and age differences and the severity of depressive symptoms.

Indicator

In the European Health Interview Survey (EHIS), all Member States of the European Union (EU) collect data on health, healthcare, health determinants and the socioeconomic situation of their populations (Info box). The target group are people aged at least 15 years living in private households. A manual containing recommendations and guidelines on methodology and data collection is available to ensure a high degree of harmonisation among survey results [7]. Data for the second wave of EHIS (EHIS 2) was collected between 2013 and 2015 and, on average, took eight months. During the EHIS 2 survey period, the EU had 28 Member States. The EHIS quality report [8] and the article by Hintzpeter et al. [9] in this issue present the methodology of EHIS 2 in more detail.

GEDA 2014/2015-EHIS (for international comparisons)

Data holder: Robert Koch Institute

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

Method: Questionnaires completed on paper or online

Population: People aged 15 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: 24,824 people (13,568 women, 11,256 men)

Response rate: 27.6%

Study period: November 2014 - July 2015

More information in German is available at www.geda-studie.de and Lange et al. 2017 [11]

In Germany, EHIS is carried out as part of health monitoring at the Robert Koch Institute. EHIS 2 was integrated into the German Health Update (GEDA 2014/2015-EHIS) [10, 11]. A detailed description of the methodology applied in GEDA 2014/2015-EHIS can be found in Lange et al. [11].

Depressive symptoms were assessed using a country-specific version of the internationally established 8-item Patient Health Questionnaire (PHQ-8) [12]. The PHQ-8 comprises symptoms of a major depression during the last two weeks in line with the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV, 4th edition [13]): depressed mood, diminished interest, significant weight loss or poor appetite, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or excessive or inappropriate guilt, diminished ability to think or concentrate. Each of these items was rated on a scale ranging from 0 (not at all), 1 (on individual days), 2 (more than half of the days) to 3 (nearly every day). Answers are summarized to a sum score and values greater 10 indicate a depressive symptomatology. Whereas values between 10 and 14 indicate a 'mild' depressive symptomatology, values greater 14 indicate a 'moderate to severe' depressive symptomatology [12].

The findings on depressive symptoms are based on the answers provided by 254,510 participants (139,614 women, 114,896 men) in the age groups 15 to 29 years, 30 to 44 years, 45 to 64 years and ≥ 65 years. Twenty-five out of the 28 EU Member States (excluding Belgium, the Netherlands and Spain) provided valid data.

Prevalences are stratified by sex and EU Member State. The precision of prevalences can be estimated based on 95% confidence intervals (95% CI). A wide 95% CI indicates greater statistical uncertainty of the results. A statistically significant difference between groups can be assumed if the corresponding p-value is smaller than 0.05. Differences between the EU average and the individual EU Member States were assessed using regression analyses (with Germany as the reference category). The analyses differentiated between (1) the prevalence of depressive symptoms and (2) the severity of symptoms. To control for systematic differences between EU Member States, analyses were performed in control of age, sex, education and income status and, moreover, was the clustering of individual data within each Member State taken into account.

In order to present the indicators more clearly, Figure 1 does not provide individual values for each EU Member State; instead, it describes the minimum and maximum values from the EU countries that provide data. Figure 1 also displays the average for the included EU Member States and the prevalence in Germany.

The analyses applied a weighting factor to account for each EU Member State proportionally according to the size of its population. In line with the recommendations by Eurostat, education was not used as a weighting factor for the comparison of European countries [11]. This leads to differences from previously reported German prevalences based on data from GEDA 2014/2015-EHIS [14]. In order to enable greater comparability of health indicators, values are standardised by age and sex in accordance with the revised European standard population (ESP) for 2013. This corrects for possible differences between the age structures found in the various countries and, therefore, enhances the comparability of health indicators [15]. The following analyses used the household indicator variable as a cluster variable.

Info box
European Health Interview Survey (EHIS)

The European Core Health Indicators (ECHI) were jointly developed by EU Member States and international organisations, taking into account scientific and health policy requirements. The indicators provide a framework in European health reporting for population-based health surveys and analyses, and health care provision at the European and national level. The European Health Interview Survey (EHIS) is a key element in this regard. The first EHIS wave (EHIS 1), which was not mandatory, was conducted between 2006 and 2009. 17 Member States and two non-EU countries participated in EHIS 1. Participation in the second wave of EHIS (EHIS 2), which was conducted between 2013 and 2015 in all EU Member States (as well as in Iceland, Norway and Turkey) was legally binding and is based on Commission Regulation (EU) No 141/2013 of 19 February 2013. It provides essential information about the ECHI indicators. In Germany, EHIS is carried out as part of health monitoring at the Robert Koch Institute. During the EHIS 2 survey period, the EU had 28 Member States.

Further information is available at:
https://ec.europa.eu/eurostat/web/microdata/european-health-interview-survey

Results and discussion

The prevalence of depressive symptoms in Germany (9.2%) is higher than the European average (6.6%) and higher than in most EU Member States, with the exceptions of Luxemburg, Sweden and Portugal (Table 1).

In the majority of EU Member States, women are more frequently affected by depressive symptoms than men. In Germany, 10.8% of women show depressive symptoms while the prevalence of men is considerably lower with 7.6% (Table 1). Moreover, the average prevalence across the EU for both women (7.9%) and men (5.2%) is lower than in Germany. Prevalences did not differ significantly between women and men in Finland, Ireland, Croatia, Luxemburg, Romania, Slovakia, Austria and the Czech Republic (Table 1).

In Germany, as well as in other EU Member States such as Ireland, Luxemburg and Sweden, adolescents and young adults (15- to 29-year-olds) show the highest prevalence of depressive symptoms. In Germany, the prevalence in this age group (11.5%) is significantly higher than the EU average (5.2%) (Figure 1). In other EU Member States such as Italy, Portugal and Romania, the prevalence is the highest among persons aged 65 and older (11.6%, 14.7% and 13.9%, respectively). The prevalence in this oldest age group (6.7%) is lower in Germany as compared to the EU average (9.1%).

As shown in Figure 1, the prevalence of mild depressive symptoms is higher in Germany (6.3%) than the EU average (4.1%) and represents the European peak value. Only Luxemburg has a comparably high prevalence (6.1%). Regarding the prevalence of moderate to severe depressive symptoms, Germany (2.9%) is close to the EU average (2.5%). Higher prevalences than in Germany can be found in Bulgaria (3.5%), Luxemburg (3.8%), Portugal (3.2%), Hungary (3.0%) and the United Kingdom (3.3%). However, these differences are not statistically significant.

The Europe-wide collection of PHQ-8 data in EHIS 2 enables a simultaneous comparison of the prevalence of depressive symptoms among individuals covering the adult life span for the first time. The results for Germany indicate a particularly high prevalence of depressive symptoms. In addition, findings from other German national surveys suggest an increase of depressive symptoms [14] and the risk of depression faced by younger women, as well as depression-related impairments [16] over time. The increasing importance of depression is also substantiated by data from German healthcare provision [17]. The present results point toward a particular need for public health action in terms of prevention measures and provision of care in Germany. Thereby, the risk of developing manifest depressive disorders could be reduced.

Strengthening prevention and the treatment of depression has been a national health target since 2006 [18]. In Germany, working environments are considered as one starting point for prevention measures addressing (mild) depressive symptoms [19]. Following a decision by Germany's Federal Labour Court in 2008, the 'mental and psychological integrity of workers and employees' became a criterion in workplace hazard assessments (12 August 2008, 9 AZR (case number for the appeal) 1117/06). Since the embodiment of paragraph 5 point 6 of the Occupational Safety and Health Act, 'psychological stress at work', in 2013, the prevention of mental distress in workplaces and the consideration of mental health has gained more attention as a transversal issue in several social areas. Accord-

Table 1
Age standardised prevalence of depressive symptoms (PHQ-8 ≥ 10 points) during the last two weeks by sex and EU Member State (n=139,614 women, n=114,896 men)
Source: EHIS 2 (2013-2015)

Member State	Women		Men		Total	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Austria	5.1	(4.5-5.8)	3.4	(2.8-4.2)	4.3	(3.8-4.8)
Bulgaria	8.0	(7.1-9.1)	6.0	(5.1-7.1)	7.1	(6.3-7.9)
Croatia	3.4	(2.8-4.1)	3.4	(2.8-4.3)	3.4	(2.9-4.0)
Cyprus	5.2	(4.3-6.3)	3.0	(2.3-3.9)	4.1	(3.5-4.9)
Czech Republic	3.4	(2.8-4.1)	2.0	(1.5-2.7)	2.7	(2.3-3.2)
Denmark	9.5	(8.4-10.6)	5.3	(4.4-6.3)	7.4	(6.7-8.2)
Estonia	8.0	(7.0-9.0)	5.0	(4.1-6.0)	6.6	(5.9-7.3)
Finland	6.4	(5.6-7.3)	5.7	(4.8-6.8)	6.0	(5.4-6.7)
France	9.0	(8.3-9.8)	5.2	(4.6-5.8)	7.2	(6.7-7.7)
Germany[1]	**10.8**	**(10.2-11.4)**	**7.6**	**(7.1-8.2)**	**9.2**	**(8.8-9.6)**
Greece	3.8	(3.3-4.5)	2.5	(1.9-3.3)	3.2	(2.8-3.7)
Hungary	9.6	(8.7-10.7)	7.1	(6.1-8.3)	8.5	(7.7-9.3)
Ireland	8.8	(7.8-10.0)	6.6	(5.7-7.7)	7.8	(7.0-8.5)
Italy	5.6	(5.2-6.0)	3.5	(3.2-3.9)	4.6	(4.3-4.9)
Latvia	5.8	(5.0-6.6)	3.3	(2.7-4.1)	4.7	(4.2-5.3)
Lithuania	4.1	(3.5-4.8)	2.3	(1.7-3.1)	3.3	(2.9-3.8)
Luxemburg	11.7	(10.3-13.2)	8.2	(7.0-9.6)	10.0	(9.0-11.0)
Malta	4.4	(3.6-5.4)	2.2	(1.6-3.0)	3.3	(2.8-3.9)
Poland	5.5	(5.0-6.0)	4.0	(3.5-4.5)	4.8	(4.4-5.1)
Portugal	12.9	(11.9-13.9)	4.7	(4.1-5.4)	9.1	(8.5-9.7)
Romania	5.1	(4.6-5.6)	4.7	(4.2-5.4)	4.9	(4.5-5.3)
Slovakia	3.4	(2.8-4.2)	2.3	(1.7-3.1)	2.9	(2.4-3.4)
Slovenia	7.3	(6.4-8.2)	4.0	(3.2-4.8)	5.6	(5.1-6.3)
Sweden	11.2	(10.0-12.4)	6.5	(5.7-7.4)	8.8	(8.1-9.6)
United Kingdom	8.6	(7.9-9.3)	6.1	(5.5-6.8)	7.4	(6.9-7.9)
EU	**7.9**	**(7.7-8.1)**	**5.2**	**(5.1-5.4)**	**6.6**	**(6.5-6.8)**

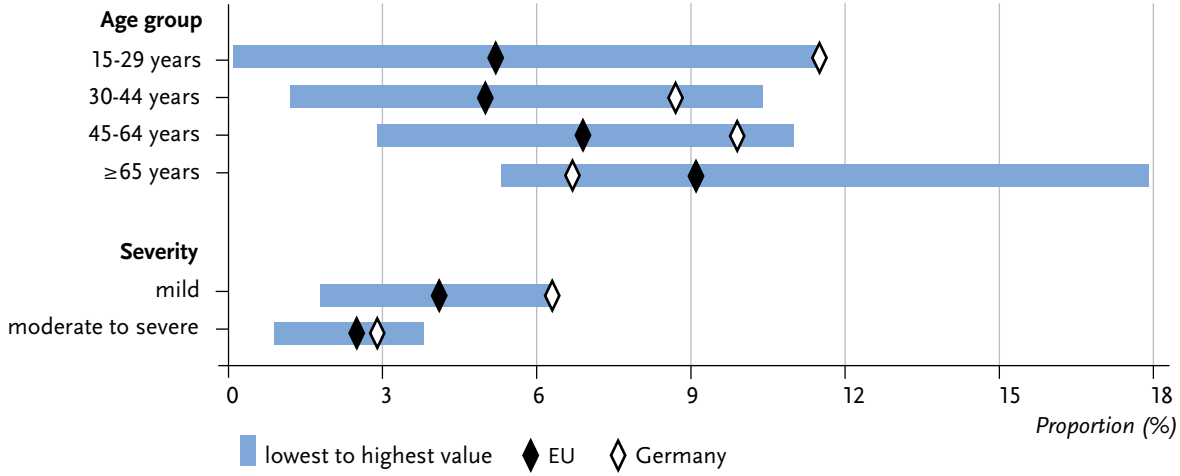
[1] Statistically significant differences: total Germany vs. EU ($p<0.01$), women Germany vs. EU ($p<0.01$), men Germany vs. EU ($p<0.01$)
CI = Confidence interval, EU = Average of the EU Member States for which data is available (excluding Belgium, the Netherlands and Spain)

The prevalence of depressive symptoms in Germany is higher (9.2%) than the European average (6.6%).

ingly, the European Joint Action for Mental Health and Wellbeing defined 'Mental Health in all Policies' and 'Mental Health at Workplaces' as two out of five action fields for intervention.

However, when stratified by severity, the differences between Germany and the EU average only apply to mild depressive symptoms. One possible explanation, beyond potential differences in morbidity, refers to differences in health competence regarding mental well-being ('mental health literacy' [20]). Varying levels of mental health literacy are associated with differences in willingness to report mental health symptoms, and, therefore, can influence the

Figure 1
Age standardised prevalence of depressive symptoms during the last two weeks by age and severity (mild depressive symptoms: PHQ-8 10-14 points; moderate to severe depressive symptoms: PHQ-8 >14 points)
Source: EHIS 2 (2013-2015)



EU=Average of the EU Member States for which data is available (excluding Belgium, the Netherlands and Spain)

Significant differences between Germany and the EU average pertain to the prevalence of mild, but not moderate or severe depressive symptoms.

responses that participants provide in the respective countries [21-23]. Increasing knowledge and improved understanding of the symptoms of mental health problems in the population may also lead to greater sensitivity towards depressive symptoms [22].

Furthermore, the present results indicate that in Germany – as well as in most of the other EU Member States – women are affected more frequently by depressive symptoms than men. This difference between the sexes is consistent with other international results [24, 25]. Beside biological factors, the higher prevalence of women is currently discussed in terms of cumulating psycho-social stressors.

In addition, particularly German young adults show a higher prevalence of depressive symptoms than the EU average. Results are also in line with previous findings of a higher prevalence of depressive symptoms among older adults in southern European nations such as Italy, Portugal and Romania as compared to Germany [26]. Possible explanations include regional differences in social structure such as education, income and unemployment rate [27, 28], health care availability, for example an 'over-diagnosis' of elderly people [29], and cultural differences such as (self)stigmatisation [30]. Future surveys also need to consider possible differences in data collection methodology [8].

At the national level, differences in the frequency of depressive symptoms have already been discussed against the backdrop of a region's age and social structure, the spatial distribution of risk and protective factors, as well as the degree of urbanisation [14]. However, the reason why especially young adults show such a high prevalence in Germany and the health policy measures and contexts that could or should be used to reach them, remains an open question – particularly, because healthcare services in Germany identified depression rather often among the elderly [31].

Equally to the majority of other EU Member States, depressive symptoms in Germany are more frequent among women as compared to men.

Depressive symptoms are more frequent among young people in Germany than the EU average (11.5% compared to 5.2%) and less frequent among older people than the EU average (6.7% compared to 9.1%).

Finally, it is also important to emphasise that the results based on the PHQ symptom questionnaire have to be interpreted as one possible indicator of the prevalence of depressive symptoms. In addition, (mild) depressive symptoms cannot be equated with a diagnosis of depressive disorder; consequently, it is not possible to draw valid conclusions about the (subjective) need for treatment. A differentiated comparison of mental health requires the comprehensive surveillance of multiple indicators and data sources at the national and European level.

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Data protection and ethics

Data for the European Health Interview Survey (EHIS) is collected by national surveys. GEDA 2014/2015-EHIS is subject to strict compliance with the data protection provisions set out in the Federal Data Protection Act (BDSG). The study was reviewed and approved by the German Federal Commissioner for Data Protection and Freedom of Information (BfDI). Participation in the study was voluntary. The participants and/or their parents/legal guardians were also informed about the aims and contents of the study, and about data protection. Depending on the survey mode, informed consent was obtained in writing or electronically.

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Conflict of interest

The authors declared no conflicts of interest.

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European Health Interview Survey (EHIS) 2 – Background and study methodology

Abstract

The scientific assessment of health issues, the design and further development of political guidelines as well as the targeted planning of measures in the European Union (EU) require data on population health. For this reason, all EU Member States regularly collect data on the health status, provision of healthcare, health determinants and socioeconomic situation of their respective populations in the European Health Interview Survey (EHIS). Participants are at least 15 years old and live in private households. The second wave of EHIS (EHIS 2) was conducted between 2013 and 2015. For EHIS 2, each EU Member State drew a nationally representative population sample from population registers, censuses, dwelling registers or other statistical or administrative sources. Data collection modes within individual EU Member States were used, according to nationally established methods, including the use of mixed-mode surveys. Across all EU Member States, data collection took an average of eight months to complete. Member States made considerable efforts to achieve the highest possible response rates. The harmonised EHIS data collected are highly comparable and constitute an important information base for European health policy and health reporting.

STUDY METHODOLOGY · EHIS 2 · EUROPEAN COMPARISON · EU · HEALTH MONITORING

1. Introduction

The European Union (EU) has evolved from a number of predecessor organisations. The present EU was founded on 1 November 1993 with twelve Member States. Since then, the number of Member States has steadily increased [1]. At the point of data collection for the second wave of the European Health Interview Survey (EHIS 2), the EU had 28 Member States (EU 28) and around 507 million inhabitants (in the year 2014) [2]. The present article describes the study methodology applied in EHIS 2, on which the analyses in the present issue of the Journal of Health Monitoring are based.

Current health challenges faced by the EU include not only outbreaks of disease but also longer-term developments such as urbanisation, demographic changes, food insecurity, climate change and imbalances in the provision of care within and between EU Member States [3]. Political decision-makers require reliable and up-to-date data on health. Standardised data collections based on European health indicators are of key importance to the design of national and European-level research and health policies. Moreover, data is also required for the scientific assessment of health issues and the targeted planning of specific measures. In the face of these challenges, European compari-

GEDA 2014/2015-EHIS (for international comparisons)

Data holder: Robert Koch Institute

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

Method: Questionnaires completed on paper or online

Population: People aged 15 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: 24,824 people (13,568 women, 11,256 men)

Response rate: 27.6%

Study period: November 2014 - July 2015

More information in German is available at www.geda-studie.de and Lange et al. 2017 [14]

sons of health status, provision of healthcare, health determinants and socioeconomic situation play an important role. In terms of national health reporting, the EHIS results are an important data source for the comparative evaluation and classification of chronological developments.

Health data are held by Eurostat [4], the Statistical Office of the European Union, the Organization for Economic Cooperation and Development (OECD) and the World Health Organization (WHO) [5, 6]. These data are published at regular intervals. The OECD Health at a Glance report [7], for example, is published every two years, while the European Health Report is published every three years [8]. The latter is published jointly by the WHO's Regional Office for Europe and the European Commission. European health monitoring is supported by a diverse set of indicator systems, including the European Core Health Indicators (ECHI) [9], the EU social indicators and the health-related indicators from the European Sustainable Development Strategy [10]. The European Health Interview Survey (EHIS), which is described in the present article provides around one-quarter of the ECHI indicators implemented [11, 12].

All the EU Member States collect data for the EHIS on the health, provision of healthcare, health determinants and socioeconomic situation of their respective populations (Info box). EHIS is a population-based, cross-sectional survey based on the self-report of participants. Each Member State is free to decide on the survey method used and the way in which the survey is conducted. The EHIS can, for example, be conducted as a stand-alone survey, or be embedded within a national health survey, as it is the case in Germany. Both the target population (persons aged 15 and above living in private households residing in the territory of the Member State at the time of the data collection) and the sample size to be achieved by each Member State (around 195,000 participants across all EU Member States) are mandatory. The (first) voluntary survey (EHIS 1) was conducted between 2006 and 2009 [13]. Representatives from several Member States established a taskforce to develop a model questionnaire, guidelines and recommendations for translation. Wide-ranging experience in national health surveys contributed to this process. Seventeen Member States including Germany participated in EHIS 1.

Data collection for EHIS wave 2 (EHIS 2), which was legally binding for all 28 Member States (including Norway, Iceland and Turkey), was carried out between 2013 and 2015 [10, 14]. A quality report, to be completed by each participating country according to pre-defined criteria contains detailed information on their chosen methodological approach. As there is no data available from Turkey in the quality report, the current article predominantly uses data from the remaining 30 participating countries in EHIS 2 [15].

In Germany, EHIS is part of the health monitoring that takes place at the Robert Koch Institute [14]. EHIS 2 was integrated into the German Health Update (GEDA 2014/2015-EHIS). The survey was based on a two-stage cluster sample, randomly drawn from population registers. GEDA 2014/2015-EHIS was conducted between November 2014 and July 2015, using a sequential mixed-mode design with online and paper questionnaires. Lange et al. 2017 contains a detailed description of the methodology applied in GEDA 2014/2015-EHIS [14].

Info box:
European Health Interview Survey (EHIS)

The European Core Health Indicators (ECHI) were jointly developed by EU Member States and international organisations, taking into account scientific and health policy requirements. The indicators provide a framework in European health reporting for population-based health surveys and analyses, and health care provision at the European and national level. The European Health Interview Survey (EHIS) is a key element in this regard. The first EHIS wave (EHIS 1), which was not mandatory, was conducted between 2006 and 2009. 17 Member States and two non-EU countries participated in EHIS 1. Participation in the second wave of EHIS (EHIS 2), which was conducted between 2013 and 2015 in all EU Member States (as well as in Iceland, Norway and Turkey) was legally binding and is based on Commission Regulation (EU) No 141/2013 of 19 February 2013. It provides essential information about the ECHI indicators. In Germany, EHIS is carried out as part of health monitoring at the Robert Koch Institute. During the EHIS 2 survey period, the EU had 28 Member States.

Further information is available at:
https://ec.europa.eu/eurostat/web/microdata/european-health-interview-survey

For participating countries (EU Member States plus Norway, Iceland and Turkey), the Eurostat website provides aggregated data (macrodata) for a diverse set of EHIS 2 health indicators [4]. Furthermore, for research purposes such as the analyses presented in this issue of the Journal of Health Monitoring, applications can be made to Eurostat in order to access anonymised data from EU Member States at participant level (microdata) [16].

2. Methodology

2.1 Development of EHIS 2

Design of the compulsory second wave of EHIS began with an intensive evaluation of EHIS 1. The experience of EHIS 1 had shown the problematic nature of individual modules from the questionnaire. Among other things, this involved sensitive questions on health-related well-being and alcohol consumption which were not consistently understood or interpreted in the different countries and cultures [17-19].

The scope of the survey instrument was also viewed critically. It was therefore decided to carefully revise the questionnaire, with the aim of using the established survey instruments to gather data with the greatest possible comparability. With this in mind, Eurostat commissioned an 18-month research project collaboration between three institutes (the Robert Koch Institute, the former Scientific Institute of Public Health - now Sciensano - in Belgium and the Estonian Institute for Health Development), starting in February 2010. The project aimed to identify the problems that had surfaced in EHIS 1, as well as develop and test question modules for mental health, alcohol consumption and physical activity [17]. The overall aim was to develop survey instruments that enable so-called 'input harmonisation'. This means that questions should be comparable at the point of data collection (in contrast to 'output harmonisation' where different questions or wordings of questions are subsumed into a uniform indicator). However, full input harmonisation has its limits in a study of this size, implemented in over 28 countries, since the different survey methods used in each country can lead to varying operationalisations of questions. In addition, ensuring that people's understanding of a question is comparable depends not only on a standardised translation but also on a shared understanding of the question's underlying concept, which can lead to different formulations of questions.

During a three-year process that built upon the results of the research project mentioned previously, a model questionnaire for EHIS 2 was developed and finalised (chapter 2.4) with the participation of representatives from all Member States [20]. EHIS implementation is regulated by the Commission Regulation (EU) No 141/2013 of 19 February 2013 [21], which contains seven articles covering the scope, required data, reference year, reference population, reference metadata and submission of data to Eurostat. Following the accession of Croatia to the European Union, this regulation was amended by Commission Regulation (EU) No 68/2014 [22]. The implementing regulation contains the target variables of the survey questions. Use of the model questionnaire is recommended to ensure the greatest possible input harmonisation [21].

To support both the data collection in the Member States and the comparability of results, Eurostat and external experts from EU Member States developed a comprehensive manual [20]. This contains guidelines, for example on

the translation process and on the sequence of questions. It also suggests a question along with response categories for each individual target variable and provides precise indications in regard to interviewers and implementation for each individual question. The Statistical Guidelines specify aspects of study design, sampling, sample size, weighting, as well as other technical details of the survey [20].

2.2 Study design and participants

For the EHIS, EU Member States collect data every six years on the health, provision of healthcare, health determinants and socioeconomic situation of the population aged 15 and over.

The study population consists of the EU population living in private households [15]. People living in the overseas territories of the Netherlands, France, Ireland and the UK are exempt, as they are not part of the frame population. The EHIS 2 sample is composed of the national representative samples from the participating EU Member States. Member States used different sampling frames for drawing their national samples: population register, dwelling register and censuses, as well as other statistical sources [15].

The mandatory minimum effective national sample size under the EHIS implementation regulation was defined according to a standardised calculation method [20]. Practical, cost-related and statistical considerations are thereby taken into account. The specified sample size aims to ensure that for each EU country, a prevalence of 8% can be estimated with less than 1% point error (i.e. with the 95% confidence interval of maximum 7.4%-8.6%). This refers to the prevalence of health-related limitations in everyday activities (Global Activity Limitation Indicator, GALI), the most critical variable in the survey [20].

Table 1 provides information on the sample size achieved in the countries participating in EHIS 2. It also depicts both the reached effective sample size and the minimum effective sample size. The effective sample size is the size required if the survey was based on simple random sampling. The reached effective sample size was derived by dividing the reached sample size to the design effect provided for the GALI variable in national quality reports. The design effect describes the degree to which clustering and weighting can account for the increase of variance in complex survey designs. The ratio of the reached effective sample size to the minimum effective sample size indicates whether individual countries reached their target sample size. A value of at least 1 means the target sample size was achieved. However, as not all countries reported the design effect for the GALI variable, the corresponding data is not available for every country.

Nearly all the countries reached or even surpassed their specified effective sample size. Only a few countries failed to achieve the specified sample size despite high levels of participation. On the one hand, the design effect played a role as it affects the calculation. On the other hand, non-response rates during sampling may have been underestimated [15]. Failure to reach the specified effective sample size can lead to less precise prevalence estimators and thus to the non-detection of existing disparities in prevalences. Overall, 304,000 surveys were conducted in EU Member States, making EHIS 2 the largest health interview survey in the EU to date.

The target population in Germany is the German-speaking population aged 15 and above living in private households and registered with their primary residence in population registers [14]. A two-stage cluster sample was drawn. In the initial selection stage of the sampling procedure, the

Table 1
Sample sizes in EHIS 2 participant countries
Source: EHIS 2 quality report [15]

Participating country*	Reached sample size	Reached effective sample size	Minimum effective sample size	Ratio[1]
Austria	15,771	10,729	6,050	1.77
Belgium	9,113	4,297	6,500	0.66
Bulgaria	6,410	5,008	5,920	0.85
Croatia	5,446	–	–	–
Cyprus	4,958	4,948	4,095	1.21
Czech Republic	6,737	6,478	6,510	1.00
Denmark	5,811	–	5,350	–
Estonia	5,452	–	4,270	–
Finland	6,183	6,183	5,330	1.16
France	15,729	11,826	13,110	0.90
Germany	24,824	15,146	15,260	0.99
Greece	8,223	5,367	6,667	0.81
Hungary	5,826	6,905	6,410	1.08
Ireland	10,323	6,928	5,057	1.37
Italy	25,325	21,776	13,180	1.65
Latvia	7,077	9,870	4,555	2.17
Lithuania	5,205	6,426	4,850	1.32
Luxemburg	4,004	3,931	4,000	0.98
Malta	4,086	–	3,975	–
Netherlands	7,653	7,289	7,515	0.97
Poland	24,156	20,824	10,690	1.95
Portugal	18,204	–	6,515	–
Romania	16,605	–	8,420	–
Slovakia	5,490	5,719	5,370	1.06
Slovenia	6,262	4,673	4,486	1.04
Spain	22,842	14,929	11,620	1.28
Sweden	6,292	–	6,200	–
United Kingdom	20,161	14,130	13,085	1.08
Iceland[2]	4,001	–	3,940	–
Norway[2]	8,164	–	5,170	–

– missing data
* No Data available for Turkey
[1] Ratio of the reached effective sample size to minimum effective sample size
[2] No Member State of the European Union

Indicators and instruments for the EHIS 2 were selected during an extensive evaluation and consensus process conducted by the European countries.

GESIS - Leibniz Institute for the Social Sciences selected 301 sample points at random from the total number of German municipalities (n=11,339) [14]. These represent the various sizes of municipalities and regions in Germany. The classification was based on the BIK classification, a regional classification system for Germany [23]. All federal states were taken into account. Less populous federal states were oversampled with a minimum of twelve sample points. In the second sampling stage, individuals with permanent residence in the sampled communities were drawn from the local population registers for each sample point. This drawing was stratified by age group (15 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64, 65 to 74, 75 to 84, and older than 85), using a random statistical procedure (unrestricted random sampling) [14].

2.3 Study implementation

EU Member States were free to decide on the survey modes or combination of survey modes they used to implement the EHIS survey [20, 24]. In 16 out of 30 participating countries, the EHIS 2 survey was conducted using a single-mode design, i.e. using only one survey instrument; in the majority of cases, this took the form of face-to-face interviews, although telephone interviews and paper questionnaires were also used [15]. Fourteen countries used a mixed-mode design, i.e. a combination of several survey modes, for example combinations of self-administered paper-based and online questionnaires, face-to-face interviews plus supplementary self-administered questionnaires or telephone interviews followed up with paper questionnaires [15].

Article 4.3 of the implementation regulation specifies that data collection for EHIS 2 should take at least three months, with at least one month being in Autumn (September to November) [21]. The survey period was greater than three months in most countries [15], with the exception of Denmark, Italy, Lithuania, Hungary and Romania, where the EHIS 2 was completed within three months. The average survey period was eight months. Austria reported the longest survey period of 21 months, followed by Ireland with 19 months [15].

All Member States employing interviewers to implement EHIS provided courses and training sessions in the run-up to the survey. Generally, these involved detailed information about the survey, the questionnaire content, how to handle questions from participants, as well as the technical aspects of completing a questionnaire, for example during computer-assisted telephone interviews (CATI) or computer-assisted personal interviews (CAPI). The number of interviews per interviewer varied greatly between countries (15:1 in Austria and 248:1 in Cyprus). Denmark, Germany, Luxemburg and Finland relied exclusively on self-administered questionnaires and did not employ any interviewers [15].

In all EU Member States, initial contact with the selected participants was made via written invitation, with the exception of Ireland, where first contact was made via home visits. Further contact (e.g. reminders) was either made in writing, by telephone or in person. The number of such attempts to make contact and the method used also varied greatly between countries. Seven participating countries provided incentives to boost people's willingness to participate in the study. These included shopping vouchers,

payments in cash, shopping trolley tokens, reflective bands, keyrings and pens [15].

The duration of the interviews varied widely across Member States, depending on the survey mode and the form of implementation, for example as a stand-alone version of EHIS (leading to a shorter interview duration) or as part of a larger national health survey. On average, face-to-face interviews took between 20 and 47 minutes, while telephone interviews took between 20 and 65 minutes. In some participating EU countries, the duration of interviews was shortened by using surveys such as the European Labour Force Survey (EU-LFS) to supplement certain variables, e.g. for sociodemographics [15].

EHIS is a population-based, cross-sectional survey based on the self-reporting of participants.

The use of proxy interviews, i.e. interviews in which third persons are asked about the actual target person was practiced differently in the participating countries. In twelve of the 30 EHIS 2 survey countries, proxy interviews were generally not permitted. These countries included Germany. In the remaining 18 countries, the proportion of proxy interviews varied between 13.4% in Belgium and 0.5% in Austria [15].

In Germany, EHIS was implemented using a sequential mixed-mode design, which means that the people invited to take part in the study could do so either online or in writing, options which were offered in chronological succession [14]. An initial letter sent by post invited potential participants to take part in the study online. People who did not participate online within four weeks of receiving the initial letter, or who did not explicitly state they did not wish to participate, were then sent the paper questionnaire via post. People who had still not responded after another three weeks were sent a reminder letter in the post.

The EHIS survey was conducted in Germany between November 2014 and July 2015, i.e. over a nine-month period. Incentives were provided to increase people's willingness to participate. Participants aged 15 to 34 received a 10-Euro shopping voucher after completing the interview, and for participants 35 years and older, 400 shopping vouchers were raffled off to the value of 50 Euros each [14].

2.4 Survey instruments

The EHIS 2 questionnaire is comprised of four modules on health status, provision of healthcare, health determinants and sociodemographics [20]. Nearly all the EU Member States followed the suggested sequence of these question modules, with the exception of Belgium, Greece, Estonia, France, Italy, the Netherlands and Norway, where the sequence was modified [15]. Translation of the English language model questionnaire into the target languages of the respective EU Member States was based in nearly all the countries on the standardised translation protocol recommended by Eurostat [20]. Belgium, Spain, France, Lithuania, the Netherlands, Iceland and Norway were exceptions in this regard. In Spain, for example, a private translation company translated the questionnaire into the official regional languages (Catalan, Galician and Basque). EHIS was surveyed in a total of 27 languages. In 14 countries, the survey instrument was used in more than one language (e.g. in Luxemburg, where the survey was conducted in German, French, Portuguese and English) [15]. The EHIS manual contains the English language model questionnaire [20].

Germany and Austria jointly developed a German translation of the model questionnaire, which was then slightly

modified by each country to reflect their use of different terms. The German GEDA 2014/2015-EHIS questionnaire has already been published and contains all of the EHIS 2 questions translated into German, as well as additional questions only surveyed in Germany [25].

2.5 Quality assurance, data management and data use

Article 6 of Commission Regulation (EU) No 141/2013 determines that EU Member States shall submit the finalised, validated and weighted microdata (as well as quality-related reference metadata) in accordance with an exchange standard specified by Eurostat using the Single Entry Point services [21]. Data preparation and quality assurance follow Eurostat's validation rules, which contain regulations on filter and value range checks, as well as plausibility checks [26]. A specially developed software programme was used to test whether the national data sets had been correctly adjusted. After receiving and testing all the data sets from the EU Member States, Eurostat compiled the complete EHIS 2 data set according to prescribed regulations on data protection and anonymization [27]. This data set can be applied for on the Eurostat website and may be used for scientific purposes only. Circulation and use of confidential EHIS data is regulated by Commission Regulation (EU) No 557/2013 [24]. According to this regulation, EHIS microdata may be used, not only for the statistical purposes of the European Statistical System (ESS) but also by research institutes for clearly defined scientific research purposes. This regulation, therefore, permitted the use of EHIS data in the analyses presented in this issue. Applying to access this data is a two-step process. Firstly, the research organisation must apply for the status of a recognised research institution. Secondly, the microdata file can be requested upon submission of a description of the research project [16]. The EU Member States own their data, and may veto attempts to access their country's data set for a specific research project.

EHIS 2 data were collected in the 28 EU Member States between 2013 and 2015.

3. Response

All Member States went to considerable effort to achieve high response rates. As described above, up to five contact attempts were made in an effort to reach as many people as possible and get them to take part. Despite this, response rates in different Member States varied considerably. Denmark, Germany, Luxemburg, Austria and Finland, for example, reported response rates of less than 50%, whereas Cyprus and Portugal achieved over 90% [15]. There are a number of reasons for these differences. Even during the sampling process there were differences between the countries that could potentially affect the response. In the Czech Republic, for example, EHIS 2 was conducted as a follow-up survey to the EU-LFS. These participants had already agreed to further participation, and this had a positive effect on EHIS 2 response rates [15]. Disparities in response rates can also be traced to different ways in which proxy interviews were handled. As described above, some countries permitted the inclusion of proxy interviews, which had a positive effect on response rates (but a negative effect on quality), while other countries did not. Countries that relied exclusively on self-administered forms of data collection (such as Denmark, Germany, Luxemburg or Finland) generally registered the lowest response rates. In some countries,

low response rates were primarily recorded for particular groups of participants, for example, elderly people in Austria, adolescents and men in Finland and Sweden, and younger people in the Czech Republic [15].

At 27.5%, the response rate in Germany was low. Over the past few years, a decline in response rates for health surveys has been observed in many European countries [28, 29]. However, a low response rate does not necessarily mean that a specific sample has a low level of representativeness. A comparison between the sampling distribution in GEDA 2014/2015-EHIS and the German population structure from 2014 shows that the GEDA 2014/2015-EHIS sample is highly representative and that the weighting adjustments were small. This indicates the sample's high level of representativeness [14].

Significant disparities between Member States were also observed in relation to the non-response to certain questionnaire items (item non-response). Data on household income, in particular, was viewed as problematic and particularly sensitive. This was also the case with variables related to physical activity, alcohol consumption, mental health, inpatient and outpatient care, chronic diseases and preventive measures. In some instances, these questions were only answered by a small proportion of interviewees [15].

EHIS data are highly comparable and form an important information base for European health policy and health reporting.

4. Weighting

Weighting factors were calculated individually by each Member State. Weighting was guided by the following objectives: to reduce non-response bias (i.e. a systematic distortion of the sample by non-participation), to reflect the sample design, and to adjust the sample to reflect specified population figures. Weighting ensures adequate consideration of the specific makeup of a country's population. Eurostat's guidelines had a minimum requirement that sex distribution and age distribution (in ten-year age groups) be adjusted to the target population [20]. Sample weights indicate the number of people represented by a participant in the target population. Weighting, therefore, ensures that each EU Member State is considered in proportion to its target population.

Due to the two-stage sample design, EHIS 2 weighting for international analyses in Germany consists of design and adjustment weighting [14]. Design weights correspond to the inverse of the selection probability of a participant in the sample point, multiplied by sample point selection probability (as of 31 December 2011, the date sample points were selected). The adjustment weight, adjusts the sample to the distribution of certain population characteristics. The population distribution is based on Federal Statistical Office data (federal state, age and sex as of 31 December 2014) [30]. The characteristics adjusted were age, sex, federal state and the settlement structure of district types as defined by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR). The German sample shows an effectivity of 83.6% [31], which means that weighting increases the variance estimates by a factor of 1.196 (1/0,836) compared to the unweighted sample.

5. Discussion

Following the mandatory participation in European health surveys for all EU Member States, data on health, on the provision of healthcare, health determinants and the

socioeconomic situation of the population aged 15 and above will be surveyed regularly every six years from the date of EHIS 2. Indicators and instruments for EHIS 2 were selected in an extensive evaluation and consensus process between the European countries. Eurostat provided a manual containing recommendations and guidelines on survey planning and implementation, as well as a model questionnaire, thereby ensuring a broadly comparable implementation of the survey across the EU Member States [20]. This makes the collected data suitable for both national analyses and European comparisons. For the first time, the standardisation of survey instruments in EHIS 2 allows for a direct comparison of prevalences across European countries for many indicators, in particular those relating to state of health and health determinants [10]. This provides opportunities for European comparisons that go beyond national health reporting. Overall, EHIS has thus established a basis for health monitoring with standardised core indicators at the European level. Continued use of the developed survey instruments should provide in particular highly significant comparative analysis of trends over time. These analyses are also a valuable addition to national health reporting.

A comparative interpretation of the results from European countries needs to take into account that this data from EU Member States – within the framework set out in the Eurostat guidelines – has been collected using varying survey methods and sample designs. Depending on the indicator, the selected survey methods can influence results to a greater or lesser extent. Thus, questions on the utilisation of health services are less likely to be affected by trends, while distortions are more likely in areas such as health behaviour or chronic morbidity [32].

As well as taking indicator-related limitations into account, classification of results should observe country-specific differences including socioeconomic or cultural factors. Particularly in regard to the provision of healthcare, an evaluation of results is only possible if the strongly differing structures and care services within the healthcare systems of Europe are taken into consideration [33].

The European comparisons presented in this issue of the Journal of Health Monitoring are based on the population 15 years and older as specified for all EU Member States in EHIS 2. A comparison of prevalences with articles for Germany published to date, using GEDA 2014/2015-EHIS data needs to consider that national analyses only include the population 18 years and above and use a different weighting factor. The national weighting factor also adjusts for levels of education [14]. This means that GEDA 2014/2015-EHIS results in national analyses may differ from European analyses.

Conclusion and outlook

EHIS data are collected and harmonised in EU Member States and are highly comparable, thus constituting an important information basis for European health policy and reporting.

In the articles in this issue of the Journal of Health Monitoring, EHIS 2 data applied for at Eurostat is evaluated in regard to educational differences in the prevalence of behavioural risk factors, partnership, parenthood, employment and self-rated health, depressive symptoms and limitations in activities of daily living.

Pursuant to Commission Implementation Regulation (EU) No 2018/255, the third European EHIS wave is scheduled for 2019 [34]. In Germany, the Robert Koch Institute implements EHIS 3 as part of the GEDA study. Data collection for GEDA 2019-EHIS began in April 2019. The first results, initially at a national level, can be expected in 2021.

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Data protection and ethics

Data for the European Health Interview Survey (EHIS) is collected by national surveys. GEDA 2014/2015-EHIS is subject to strict compliance with the data protection provisions set out in the Federal Data Protection Act (BDSG). The study was reviewed and approved by the German Federal Commissioner for Data Protection and Freedom of Information (BfDI). Participation in the study was voluntary. The participants and/or their parents/legal guardians were also informed about the aims and contents of the study, and about data protection. Depending on the survey mode, informed consent was obtained in writing or electronically.

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Conflict of interest

The authors declared no conflicts of interest.

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