



MARCH 2022  
ISSUE

1

FEDERAL HEALTH REPORTING  
JOINT SERVICE BY RKI AND DESTATIS

# Journal of Health Monitoring

Health of people with impairments  
and disabilities in Germany

### Health of people with impairments and disabilities in Germany

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Journal of Health Monitoring · 2022 7(1)  
DOI 10.25646/9568  
Robert Koch Institute, Berlin

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Submitted: 16.02.2022  
Accepted: 07.03.2022  
Published: 30.03.2022

## Monitoring health diversity across the life span

Our health is not a static condition, but rather a dynamic equilibrium that people maintain and constantly re-establish in all phases of life, in constant interaction with their environment. This basic understanding of health has its roots in the founding preamble of the World Health Organization (WHO). This understanding of health has been known at least since the Ottawa Charter of the WHO (1986), but is not necessarily aware for many of us when 'health' is mentioned. We often continue to separate the two poles of health and illness. Chronic diseases and disabilities in particular are quickly associated with a static and thus permanent, unchangeable state.

However, research shows that chronic diseases can also be changed. Studies indicate, for example, that lifestyle changes can significantly lower high blood pressure and sustainably reduce type 2 diabetes [1, 2]; these are just two of many examples that are of great importance for our quality of life and life expectancy.

Our view of limitations and disabilities has also changed over the past decades. The international classification system ICIDH established by the WHO in 1980 described diseases, health impairments, disabilities and their social consequences (handicaps) in the form of a causal chain, as if this were an almost inevitable sequence. It was not until the turn of the millennium that the WHO initiated an important rethinking through the International Classification of Functioning, Disability and Health (ICF) by focusing more strongly on the dynamic equilibrium. The changed title of this classification already sends a signal, because disability

and health are not mutually exclusive. Above all, the ICF makes it clear that health impairments do not necessarily limit activities and result in social impairments, but that this depends decisively on the interaction of environmental and personal factors. We can therefore do something – both as those affected by health impairments and in the role of the 'environment'. The extent to which we support people in their need for independence, for example through private and professional assistance, through medical and technological progress, or through housing and urban development, is not only an important lever in preventing health impairments from becoming disabilities and social handicaps. It is also an expression of how humanly we shape our society.

The three Focus articles in the current issue of the Journal of Health Monitoring by Laura Krause, Franziska Prütz, Judith Fuchs and their co-authors raise awareness of health diversity across the life span by examining disabilities and health impairments in children and adolescents as well as in younger and older adults. All three contributions highlight the high need for prevention to avoid secondary diseases and problems. Regardless of their age, people with health challenges have a higher risk of developing further health problems, as exemplified by the findings on children's oral health, depressive symptoms in adults, and lack of support for basic activities of daily living in old age. They all face particular risks because they have to draw on their psychological, social, financial or knowledge resources every day to a much greater extent than people without

comparable health challenges. This puts them at greater risk of exhausting their resources. This is especially true for those who already have fewer resources.

In recent years, the studies of the RKI health monitoring and health reporting have become more diverse. Migration-sensitive methods of data collection have been established ([Issue 3/2019](#) of the Journal of Health Monitoring, JoHM). The health of refugees ([Issue 1/2021](#) of JoHM) and of lesbian, gay, bisexual and trans and intersex people was reported on ([Special Issue S1/2020](#) of JoHM). The current issue provides an important complementary perspective on health diversity across the life span. Continuing these perspectives that have been started is a particular challenge. How can the most representative picture possible be obtained for those population groups that are difficult to recruit for studies? This is especially true for older people who need care and live in their own homes or in nursing homes. The COVID-19 pandemic has turned a magnifying glass on how difficult their living situation often is.

The WHO has declared the current decade as the Decade of Healthy Ageing, giving governments and societies four tasks: Older people must have access to good long-term care; older people should have access to all forms of health care, including prevention and health promotion; the physical and social environment, as well as the economic environment should become more age-friendly; and finally, negative age stereotypes, prejudices and discrimination against older people should be combated. These four goals require a special focus on the rapidly growing group of older people. If we replace 'older' with 'all' in all four goals, it becomes clear at the same time that achieving these goals will benefit diversity across the entire life span.

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Wurm S (2022)

Monitoring health diversity across the life span.

J Health Monit 7(1):3–5.

DOI 10.25646/9568

The German version of the article is available at:  
[www.rki.de/journalhealthmonitoring](http://www.rki.de/journalhealthmonitoring)

**Conflicts of interest**

The author declared no conflicts of interest.

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## Imprint

### Journal of Health Monitoring

#### Publisher

Robert Koch Institute  
Nordufer 20  
13353 Berlin, Germany

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#### Typesetting

Kerstin Möllerke, Alexander Krönke

#### Translation

intellitext SprachenService

ISSN 2511-2708

#### Note

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



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

Journal of Health Monitoring · 2022 7(1)  
DOI 10.25646/9570  
Robert Koch Institute, Berlin

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Submitted: 05.01.2022

Accepted: 04.03.2022

Published: 30.03.2022

# Limitations in activities of daily living and support needs – Analysis of GEDA 2019/2020-EHIS

## Abstract

Being able to perform activities of daily living is an important component of a person's ability to function. If these activities are impaired, support is needed. Using data from GEDA 2019/2020-EHIS, we present how many people aged 55 and older living in private households in Germany experience limitations in activities of daily living. Severe limitations in basic (fundamental) activities (e.g. food intake) are reported by 5.8% of women and 3.7% of men. The proportion increases with age as 13.4% of women and 9.0% of men aged 80 and older experience limitations. Severe limitations of instrumental activities of daily living (e.g. grocery shopping) are rather rare in participants less than 80 years of age. But at age 80 and older the proportion rises to 35.9% of women and 21.0% of men. A total of 68.1% of afflicted women and 57.5% of men receive help and support related to limitations of basic activities. Women are also more likely to report a lack of support (48.8% vs. 43.2%). The situation is slightly better with regard to instrumental activities.

The results of GEDA 2019/2020-EHIS show in which areas of daily life older and very old people are impaired, give an impression of who is affected particularly strongly and indicate where support services are insufficient. As such, these results provide clues as to where support can be provided to enable older people to keep living in their own homes for a long time.

📌 ACTIVITIES OF DAILY LIVING · OLDER PERSONS · GERMANY · HEALTH MONITORING

## 1. Introduction

As a result of the ongoing demographic change, the proportion of the population accounted for by older people is increasing; according to the Federal Statistical Office, the number of people aged 67 and older in Germany will rise by 22% between 2020 and 2035 [1]. Although people age very differently, the likelihood of illness and declining physical and cognitive performance consistently increases with age [2]. The recording of limitations in basic and

instrumental activities of daily living provides evidence as to where particular deficits exist and thus points to opportunities to improve the overall situation of older people [2–4].

The number of people reporting limitations in activities of daily living increases with age, and this holds true in Germany as well [5]. These limitations restrict people in their participation and autonomy and they are dependent on help. In the course of the ongoing demographic change, the number of people affected will continue to rise in the future.

## GEDA 2019/2020-EHIS

Fifth follow-up survey of the German Health Update

**Data holder:** Robert Koch Institute

**Objectives:** Provision of reliable information on the health status, health behaviour and health care of the population living in Germany, with the possibility of European comparisons

**Study design:** Cross-sectional telephone survey

**Population:** German-speaking population aged 15 and older living in private households that can be reached via landline or mobile phone

**Sampling:** Random sample of landline and mobile telephone numbers (dual-frame method) from the ADM sampling system (Arbeitskreis Deutscher Markt- und Sozialforschungsinstitute e.V.)

**Sample size:** 23,001 respondents

**Study period:** April 2019 to September 2020

### GEDA survey waves:

- ▶ GEDA 2009
- ▶ GEDA 2010
- ▶ GEDA 2012
- ▶ GEDA 2014/2015-EHIS
- ▶ GEDA 2019/2020-EHIS

Further information in German is available at [www.geda-studie.de](http://www.geda-studie.de)

It is unclear how many people in the general population aged 55 and older currently living in Germany experience limitations in activities of daily living, which areas are particularly limited, and which group of people lacks support with activities of daily living. Another matter of interest is a description of associations with other health indicators and sociodemographic variables [6].

The German Health Update (GEDA) surveys activities related to personal care and household activities. The aim of the present paper is to describe the presence of limitations of activities of daily living ([Info box](#)) among people aged 55 and older in Germany by gender and age group. In addition, a characterisation of impaired and unimpaired participants by disease-relevant and sociodemographic characteristics is presented here. It will also be shown whether or not impaired persons receive sufficient help. This serves to identify participants who are clearly afflicted by limitations and to illustrate prevention potentials and health care needs.

Self-assessed health status is an indicator that reflects the perception of one's own health, encompassing not only physical health but also psychological status and quality of life [7]. Analyses related to limitations of activities show that the self-assessed health status is a predictor of ensuing limitations [8].

Health-related limitations in daily living are captured by the Global Activity Limitation Indicator (GALI), which uses the International Classification of Functioning, Disability and Health (ICF) [4] as a conceptual framework and functions as a global, self-reported measure of the limitation of participation [9].

There is a significant correlation of visual and hearing impairments and limitations in activities of daily living, with

no gender differences found. Early detection and effective treatment of visual and hearing impairments are important to prevent limitations in activities of daily living and to improve the independence in older people [10]. Mobility limitations are also often preceded by limitations in basic (fundamental) and instrumental activities of daily living (ADL/IADL limitations) and can thus serve as a clue for preventive measures [11].

Among the possible sociodemographic influencing factors, in addition to age, gender plays a central role for overall health and thus also for the ADL/IADL status [12]. Low education and poverty are risk factors for limitations of ADL and IADL [13, 14]. In addition, family composition also has a significant influence, as shown by results from the Irish longitudinal study [15]. It is known from the USA and from the SHARE study that urban and rural regions differ in the frequency of limitations [16, 17].

## 2. Methodology

### 2.1 Study design and sampling

GEDA is a nationwide cross-sectional survey of the resident population living in Germany ([Info box](#)). The GEDA survey has been conducted by the Robert Koch Institute (RKI) on behalf of the Federal Ministry of Health at multi-year intervals since 2008 and is a component of health monitoring at the RKI [21, 22]. The fifth follow-up survey, GEDA 2019/2020-EHIS, took place between April 2019 and September 2020 using computer-assisted, fully-structured interviews over the phone. The survey was based on a random sample of landline and mobile phone numbers (dual-frame method) [23]. The population comprised the



### Info box

#### Basic and instrumental activities of daily living (ADL/IADL)

According to the International Classification of Functioning, Disability and Health (ICF), an activity impairment is a difficulty or inability a person may have in performing a particular activity.

In research and practice, the recording of limitations in activities of daily living is often done with the help of two instruments that record limitations in the so-called basic activities (activities of daily living, ADL) and the instrumental activities of daily living (instrumental activities of daily living, IADL). ADLs include the basic activities of meeting basic needs, such as eating, personal hygiene, getting up, dressing, or using the toilet. The most commonly used indices were published by Katz et al. [18] in 1963 and by Mahoney and Barthel [19] in 1965. IADLs include more elaborate tasks of daily living that are more complex to accomplish. These include, for example, activities such as making telephone calls, shopping, doing banking, house-keeping, taking medications, and using transportation. IADL are captured using a score based on the work of Lawton and Brody from 1969 [20]. ADLs are assessed in GEDA 2019/2020-EHIS via the variables of feeding, getting in and out of a bed or chair, dressing and undressing, using toilets, and bathing or showering (according to Katz et al. 1963). IADLs are assessed by means of the following activities: Preparing meals, using the telephone, shopping, managing medication (e.g. preparing pillboxes), doing light housework (e.g. washing dishes), doing occasional heavy housework (e.g. mopping floors), and taking care of finances and everyday administrative tasks (e.g. paying bills) (according to Lawton and Brody 1969).

Source: Adapted from Gaertner et al. 2019 [5]

population aged 15 and over living in private households whose usual place of residence at the time of data collection was in Germany. A total of 23,001 individuals with usable interviews participated in GEDA 2019/2020-EHIS (12,101 women, 10,838 men, 62 of other gender identity or no information provided). The response rate according to the standards of the American Association for Public Opinion Research was 21.6% [24]. A detailed description of the methodology as well as of the classification of the response rate of GEDA 2019/2020-EHIS is available elsewhere [25]. Questions concerning limitations in activities of daily living were asked only after age 55, so the present sample includes 12,985 persons (7,086 women, 5,871 men, 28 of other gender identity or no information provided).

## 2.2 Indicators

### Limitations in activities of daily living

Internationally established instruments of the European Health Interview Survey (EHIS) were used to assess the limitations in activities of daily living in everyday life [26]. The questions measure the capability and the help received or needed in relation to five basic activities (ADL) according to Katz et al. [18] and seven instrumental activities of daily living (IADL) according to Lawton and Brody [20] (Info box). Participants were asked whether they would normally have difficulty doing that activity without help. The response categories were 'No difficulty', 'Some difficulty', 'A lot of difficulty', and 'Cannot do at all/Unable to do'. The IADL included 'Not applicable (I have never tried or done)' as an additional response category. For the analyses concerning existing limitations, the variables were

dichotomised: 'A lot of difficulty/Cannot do at all' versus 'No/some difficulty/not applicable'. On this basis, the variables on the respective ADL and IADL limitations were generated. Participants who reported at least one ADL or IADL limitation were defined as ADL- or IADL-limited.

Participants with an ADL and/or IADL limitation were asked the following question to analyse the level of help received: 'Thinking about all personal care/household activities where you have difficulty in doing them without help. Do you usually have help with any of these activities?' with response options of 'Yes, with at least one activity' and 'No'. The help received in each case was coded 'Yes' or 'No'. Another question asked individuals with help if more help was needed and individuals without help were asked if help was needed. By definition, '(More) help needed' was evident when more help or any help was needed according to the self-assessment.

### Covariates

The three questions of the Minimum European Health Module (MEHM) [27] summarise the self-assessment of general health, the presence of chronic diseases, and the health-related limitations on daily living. The MEHM is part of the European Survey on Income and Living Conditions (EU-SILC) and of the EHIS and provides comparable information on the subjective perception of one's own state of health across Europe.

The self-assessed general health status is recorded according to a recommendation of the World Health Organization (WHO) using the following question: 'How is your health in general?' The surveyed participants were asked to select one of five given response options. For the eval-



uation, these were dichotomised, whereby: ‘Very good’, ‘Good’, ‘Fair’ versus ‘Bad’, ‘Very bad’ were combined [27]. The presence of a chronic disease or a long-standing health problem was recorded using the following question: ‘Do you have any long-standing illness or health problem? This refers to illnesses or health problems that lasted, or are expected to last for 6 months or more’. Response options were ‘Yes’, ‘No’, or ‘Don’t know’.

Health-related limitations on daily living were recorded using the Global Activity Limitation Indicator (GALI) via respondent self-report [27]. The question was ‘Are you limited by a health problem in activities people usually do?’ (response categories: severely limited, limited, but not severely, not limited at all). Participants with limitations were additionally asked ‘Have you been limited at least the past 6 months?’ (response categories yes and no). The period of ‘At least 6 months’ was developed at European level to take account of the presence of a long-term limitation [28]. This concept was adopted for the analyses; participants who had been limited for more than six months are defined as having longer-term health limitations. All other participants are considered to have no long-term limitations.

Vision impairment was recorded as follows: ‘Do you have difficulty seeing even when wearing your glasses or contact lenses? Would you say... none, some, a lot of difficulty, or cannot do at all/unable to do’. These were dichotomised for the analyses: no severe difficulties (none and some difficulties) and severe difficulties (a lot of difficulties or cannot do at all).

Impaired hearing was recorded through two questions: ‘Do you have difficulty hearing what is said in a conversation

with one other person in a quiet room, even when using your hearing aid?’ and ‘Do you have difficulty hearing what is said in a conversation with one other person in a noisier room, even when using your hearing aid?’ each with response options of: ‘Would you say... none, some, a lot of difficulty, or cannot do at all/unable to do’. For the analyses, these were summarised into a dichotomous variable as difficulties in hearing: no serious difficulties (no or some difficulties in each case) and serious difficulties (at least once a lot of difficulties or cannot do at all).

Mobility limitations were assessed with the questions: ‘Do you have difficulty walking half a kilometre, or 500 meters, on level ground without the use of any aid?’ and ‘Do you have difficulty walking up or down 12 steps? Would you say... no, some, a lot of difficulty or cannot do at all/unable to do’. For the analyses, these were summarised into a dichotomous variable as mobility limitations: no serious difficulties (no or some difficulties in each case) and serious difficulties (at least once a lot of difficulties or cannot do at all).

Gender identity was used to describe gender differences. Participants could indicate which gender they felt they belonged to (female, male, other gender identity). Due to the small number of cases, participants who indicated a different gender identity or no gender identity are not shown in the analyses by gender. For the analyses, age in years was divided into age groups 55 to 64, 65 to 79, and 80 years and older. For household size a dichotomous variable was created: a) Participants who reported living in a single-person household and b) participants who reported living in a multi-person household, regardless of household type (couple with or without children, single parent, etc.).

**A total of 5.8% of women and 3.7% of men aged 55 and older are limited in at least one basic activity of daily living (ADL), whereby this proportion increases with age.**

Education levels were assigned to low, medium, and high education groups according to the CASMIN (Comparative Analyses of Social Mobility in Industrial Nations) classification using school and vocational educational attainment [29]. For income, the imputed equivalised income (income weighted by household size and composition, missing information is estimated) was used and participants with less than 60% of the median income were considered to be at risk of poverty. For municipality size, the political municipality size class (categorized as of: 31.12.2018) was used as the variable, divided into four categories: rural (population <5,000), small town (population 5,000–20,000), medium town (population 20,000–<100,000), and city (population 100,000 and more).

### 2.3 Statistical analysis

Prevalences are presented overall or stratified by gender identity, age and education level with 95% confidence intervals (95% CI). Prevalences are estimates of the proportion of participants in the target group affected at some point in time. Their precision can be assessed using confidence intervals – wide confidence intervals indicate greater statistical uncertainty in the results.

The analyses were performed applying a weighting factor in order to correct for deviations of the sample from the population structure. As part of the data weighting, a design weighting was first performed for the different selection probabilities (mobile and landline network). Subsequently, an adjustment was made to the official population figures related to age, sex, federal state and type of district (as of 31.12.2019). In addition, the sample was adjusted to

the education distribution in the 2017 Microcensus according to the International Standard Classification of Education (ISCED classification) [30].

All analyses were conducted using Stata 17.0 (Stata Corp., College Station, TX, USA, 2017). In order to take the weighting appropriately into account when calculating confidence intervals and p-values, all analyses were calculated using the survey procedures of Stata 17.0. A difference between groups is assumed to be statistically significant if the corresponding p-value ('Pearson 2 statistic for two-way tables', i.e. Pearson's  $\chi^2$  statistic) is less than 0.05.

## 3. Results

### 3.1 Limitations in basic activities of daily living (ADL)

Individual ADL limitations were seldomly reported by women and men overall (0.3% to 4.5%, [Annex Table 1](#)). Regarding individual limitations, women and men aged 80 and older were significantly more likely to report difficulty bathing or showering (11.1% and 7.1%, respectively) and getting in and out of a bed or chair (4.6% and 4.4%, respectively) compared with those aged younger than 80.

The proportion of participants with severe limitations in at least one ADL was low, at 5.8% in women and 3.7% in men. There was a significant increase with age to 13.4% in women and 9.0% in men aged 80 years and older ([Figure 1](#)).

### 3.2 Limitations in instrumental activities of daily living (IADL)

Overall, the youngest age group experiences IADL limitations relatively rarely. All limitations show an increase in

**Figure 1 (left)**

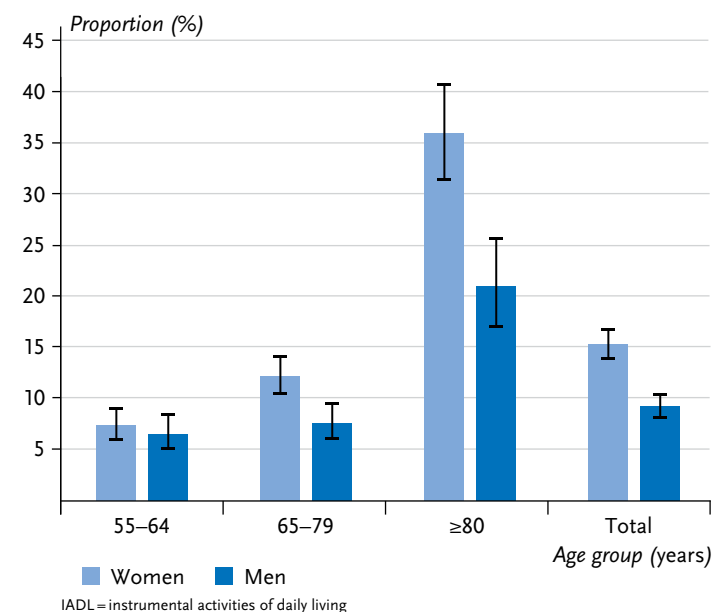
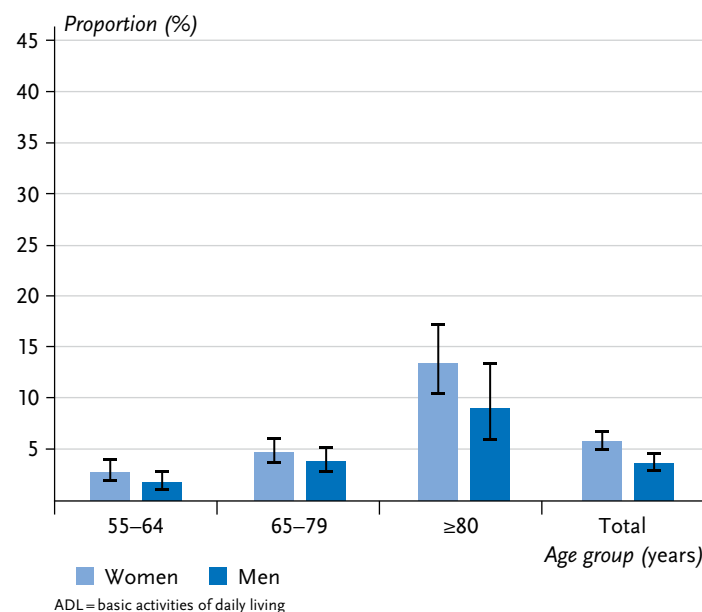
Proportion of participants reporting at least one severe ADL limitation by gender and age (weighted analyses)

Source: GEDA 2019/2020-EHIS

**Figure 2 (right)**

Proportion of participants reporting at least one severe IADL limitation by gender and age (weighted analyses)

Source: GEDA 2019/2020-EHIS



**The most common basic limitation of daily living reported by women and men of age 80 years and older is great difficulty in bathing or showering, at 11.1% and 7.1%, respectively.**

incidence with increasing age. The most frequently mentioned limitation is ‘doing occasional heavy housework’. It is reported overall by 13.9% of women and 7.9% of men, with women (33.5%) and men (19.6%) in the 80 years and older age group reporting it significantly more often ([Annex Table 2](#)). In second place, with a prevalence of 7.6% in women and 3.9% in men, is ‘shopping’, again more commonly among the very old (women 19.6%, men 9.1%). In third place is ‘taking care of finances and everyday administrative tasks’ (3.1% of women, 2.3% of men). Using the telephone causes problems for only a very small number of participants, which may also be explained by the survey mode (telephone interview).

Similar to ADL, the proportion of participants reporting at least one severe IADL limitation is rather low among those under 80 years of age. However, the proportion increases

significantly among those aged 80 and older, at 35.9% of women and 21.0% of men in this age group ([Figure 2](#)).

### 3.3 Characterisation of groups of participants with limitations in basic and instrumental daily activities

In the following, the results of the comparison of participants with and without limitations in basic and instrumental daily activities are presented with regard to the health indicators. It is evident for both genders that ADL- or IADL-limited are significantly more likely to report limitations in health status, health-related limitations (Global Activity Limitation Indicator, GALI), the presence of chronic diseases, vision and hearing, and mobility ([Figure 3](#) and [Annex Table 3](#)). About one in two with ADL limitation (49.0% of women, 55.4% of men) report poor or very poor

**Only a small proportion of those under 80 experience limitations of instrumental activities of daily living (IADL), whereas 35.9% of women and 21.0% of men aged 80 and older experience these limitations.**

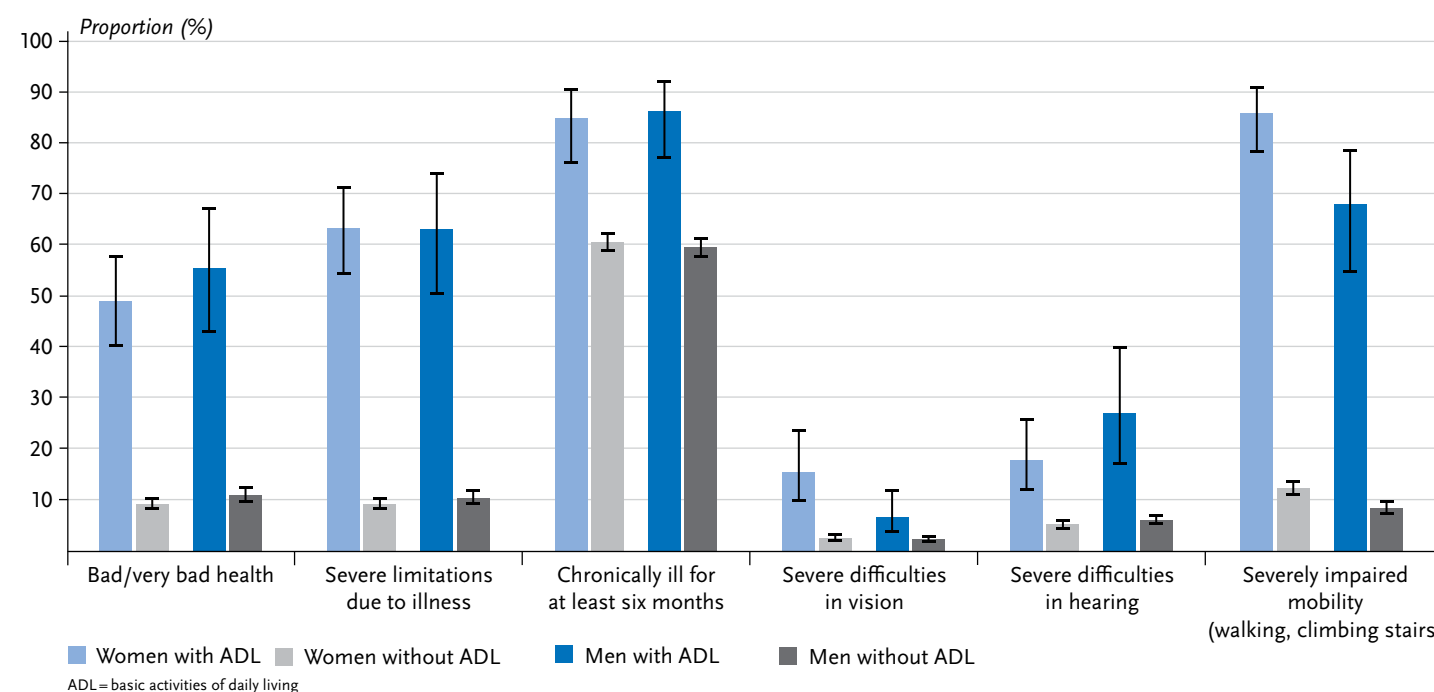
health, compared with about one in ten participants without ADL limitation (9.2% and 11.1%, respectively). The results for IADL limitations are similar (Figure 4 and Annex Table 3). Participants limited in their daily activities differ even more significantly with respect to health-related limitations (GALI): 63.3% of women and 63.0% of men with ADL limitation and 50.6% of women and 58.2% of men with IADL limitation report health-related limitations. By comparison, only about one in ten of those without ADL or IADL limitations report health-related limitations.

The majority of participants with ADL/IADL limitations have been chronically ill for at least six months: 84.8% of women and 86.3% of men with ADL limitation and 84.1% of women and 85.4% of men with IADL limitation (Figure 3,

Figure 4 and Annex Table 3). In contrast, 60% of those without ADL/IADL limitation report being chronically ill.

Vision or hearing impairments are reported by few participants in the population aged 55 and older, but occur significantly more frequently among participants with ADL/IADL limitations (Annex Table 3). The difference is particularly marked for mobility limitations: About two-thirds of ADL-/IADL-limited women and men report them; especially women with ADL limitation (85.8%).

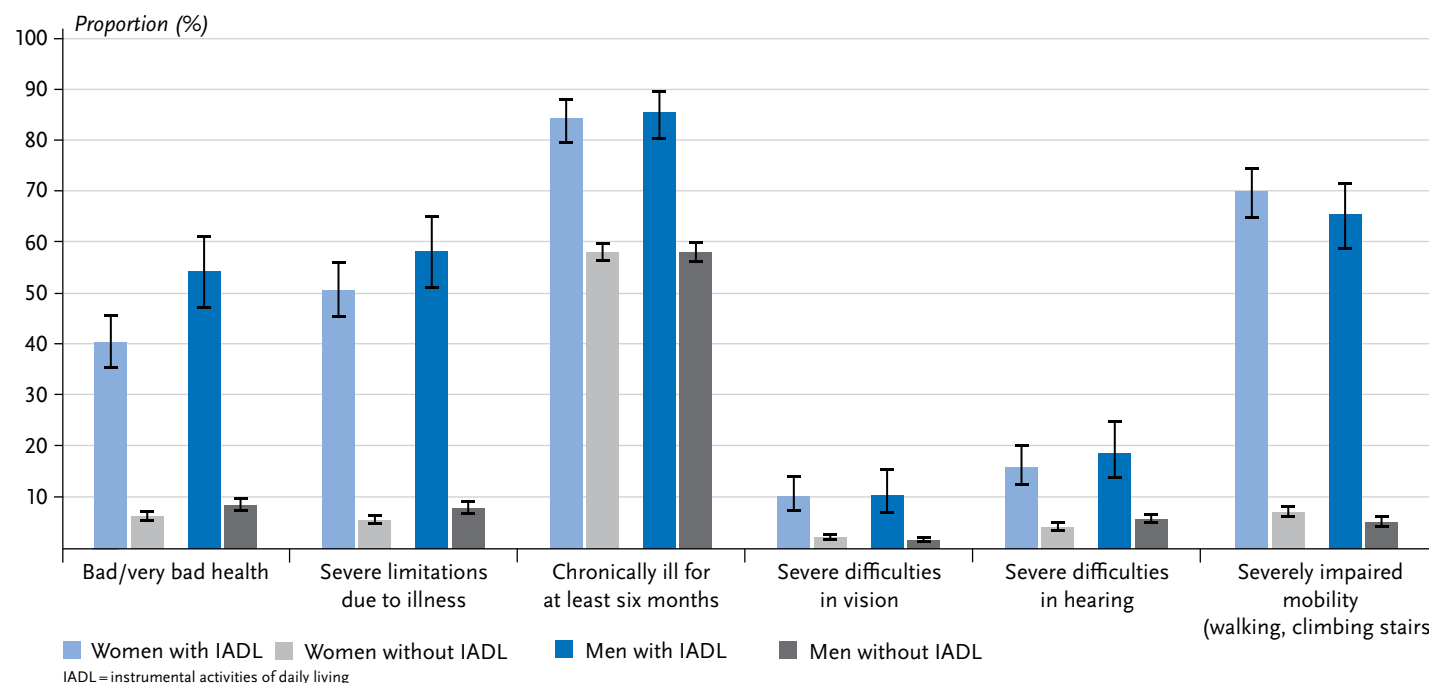
The sociodemographic data show that ADL- and IADL-limited participants are more likely to have a low level of education and a lower income and are more likely to live in single-person households than non-impaired participants (Annex Table 4). Among participants with ADL lim-



**Figure 3**  
Proportion of health indicators by gender and ADL limitation (weighted analyses)  
Source: GEDA 2019/2020-EHIS

**Figure 4**  
Proportion of health indicators by gender and IADL limitation (weighted analyses)  
Source: GEDA 2019/2020-EHIS

A total of 33.5% of women of age 80 and older and 19.6% of men of the same age report great difficulty in doing occasional heavy housework.



itation, 58.8% of women and 61.0% of men have a low education level and 4.3% and 10.6%, respectively, have a high education level; among persons without ADL limitation, 43.4% of women and 42.1% of men have a low education level and 10.9% and 21.1%, respectively, have a high education level. Among participants with IADL limitation, 61.0% of women and 52.0% of men have a low education level and 5.0% and 13.1%, respectively, have a high education level; compared to 41.2% of women and 42.1% of men, respectively, and 11.5% and 21.5%, respectively, among persons without IADL limitation. A total of 30.6% of women and 29.3% of men with ADL limitations, but only 18.7% of women and 15.4% of men without ADL limitations live in poverty. Similar results are seen for IADL limitations. Partic-

ipants with ADL or IADL limitation are more likely to live alone than participants without limitations: for women, the proportion is almost three-quarters; for men, the proportion is around 60% each, while only about half of women and about 40% of men without limitations live alone. There are no differences with regard to community size (urban/rural).

### 3.4 Support received and lack of support in performing ADLs and IADLs

The majority of participants with limitations in a basic activity of daily living (68.1% of women and 57.5% of men) (Table 1) indicate that they usually receive help with these activities. On average, women are more likely to receive

**Table 1**  
Proportion of participants with and without help for existing ADL and IADL limitations by gender and age (weighted analyses)  
Source: GEDA 2019/2020-EHIS

Limitations of activities of daily living may be associated with being female, with older age, low education status, poor health, and impairments due to illness.

	Women			
	Age group (years)			Total
	55–64	65–79	≥80	
ADL limitation				
n	50	104	111	265
Help received (%)	61.6	56.1	79.0	68.1
(95% CI)	(42.4–77.8)	(41.3–69.9)	(64.9–88.4)	(59.0–76.0)
(More) help needed (%)	53.7	50.2	46.0	48.8
(95% CI)	(35.2–71.2)	(36.4–64.2)	(32.6–60.0)	(39.9–57.8)
IADL limitation				
n	160	308	310	778
Help received (%)	79.3	80.9	90.6	85.3
(95% CI)	(68.6–87.1)	(72.0–87.5)	(85.1–94.1)	(81.1–88.8)
(More) help needed (%)	55.7	48.0	36.0	43.6
(95% CI)	(44.5–66.3)	(39.6–56.6)	(28.2–44.5)	(38.3–49.1)

	Total			
	Age group (years)			Total
	55–64	65–79	≥80	
ADL limitation				
n	80	174	163	417
Help received (%)	54.6	57.6	71.7	63.1
(95% CI)	(38.3–70.0)	(46.3–68.1)	(58.8–81.8)	(55.5–70.0)
(More) help needed (%)	50.3	51.0	42.9	47.4
(95% CI)	(34.5–66.0)	(40.4–61.6)	(31.7–54.8)	(40.2–54.7)
IADL limitation				
n	265	468	457	1,190
Help received (%)	74.3	78.7	87.1	81.4
(95% CI)	(65.7–81.3)	(71.8–84.3)	(82.3–90.8)	(77.8–84.5)
(More) help needed (%)	27.9	28.0	29.2	28.3
(95% CI)	(24.0–32.3)	(24.7–31.5)	(25.0–33.8)	(26.1–30.7)

ADL=basic activities of daily living, IADL=instrumental activities of daily living, CI=confidence interval

	Men			
	Age group (years)			Total
	55–64	65–79	≥80	
ADL limitation				
n	30	70	52	152
Help received (%)	54.3	61.7	54.6	57.5
(95% CI)	(28.4–78.1)	(44.3–76.5)	(32.2–75.3)	(44.7–69.3)
(More) help needed (%)	35.0	54.0	35.6	43.2
(95% CI)	(15.4–61.4)	(37.7–69.5)	(18.3–57.8)	(31.8–55.3)
IADL limitation				
n	105	160	147	412
Help received (%)	66.7	74.5	77.5	73.1
(95% CI)	(52.4–78.4)	(62.3–83.8)	(66.3–85.8)	(66.1–79.1)
(More) help needed (%)	48.6	51.9	33.1	44.2
(95% CI)	(35.0–62.5)	(30.9–63.6)	(23.1–44.9)	(37.1–51.6)

help than men. However, the percentage of people who need (more) help varies between 35.0% and 53.7% depending on age group and gender.

With regard to help and support related to IADL limitation, it is evident that the majority of participants are not left to their own; 85.3% of women and 73.1% of men have people in their environment who provide help. However, again depending on gender and age group, every second or third person lacks the support they would need here (Table 1).

#### 4. Discussion

The present results provide valid data on limitations in activities of daily living in a large sample of persons aged 55 years and older living in private households in Germany.

The prevalence of limitations in ADL and IADL is generally low in Germany. About one in ten participants have IADL limitations, and a lower proportion report ADL limitations (5.8% of women, 3.7% of men). ADL and IADL limitations are associated to female gender, older age, lower education level, poorer health status, disease-related limitations, and impaired vision, hearing, and mobility. Results from the previous GEDA survey in 2014 [5] showed similar associations for Germany and for the countries of the European Union.

Women were found to be more likely to experience limitations than men in all three age groups, which is consistent with many European and non-European studies [31–33]. A Swedish study also shows that limitations tend to decrease across birth cohorts. However, it is not clear whether this is a real reduction or whether the limitations only occur later in life.

Limitations in ADL and IADL are usually due to existing chronic diseases, and the number of diseases and/or the presence of multimorbidity is another relevant factor [34]. Limitations in ADL and IADL arise in relation with (multi-)morbidity and IADL precedes ADL. The present results clearly show that ADL-limited participants are often impaired due to diseases.

Visual and hearing impairments are not very common in the population aged 55 years and older and seem to be compensated quite well by pertinent aids. These were included in the interview meaning that these limitations occur, possibly, with aiding devices. Again, it is evident that ADL- and IADL-limited participants are more likely to be afflicted, which may increase the risk of further loss of functional capacity [35].

People living alone are more likely to be limited in performing activities of daily living than people in multi-person households, which is consistent with other studies [36–38]. This has implications for policy and care. In this context, offers to support people living alone could possibly prevent more severe limitations if, for example, outreach assistance is made available.

An urban-rural difference with regard to the incidence of limitations, which was shown in one study [39] was not found in the present study. The GEDA data show no association between town/city size and proportions of ADL- or IADL-limited participants.

In addition, associations with socioeconomic status are evident: Participants with an ADL or IADL limitation are more likely to be at risk of poverty than individuals without an ADL or IADL limitation. Similar results are found, for example, in an English longitudinal study [40], which concluded that initiatives to improve social participation and social support for older people should be promoted. Especially with regard to support, which is lacking more often for impaired and very old people, there seems to be a need for improvement [41, 42]. Overall, it seems necessary to apply measures to reduce or reverse the limitations in activities of daily living of older people, for example by offering exercise programs or preventive home visits at the community level.

The need for help and support is differently well covered; those with limitations in basic activities receive help and support less frequently than those with limitations in instrumental activities. In addition, depending on age group and gender, approximately one-third to one-half of participants with limitations appear to lack support. This is consistent with findings from other studies [41, 43–45]. Informal helpers



may less easily provide body-related support services than assistance with various household activities [46]. This should be considered for future assessments, for example in the context of a care needs assessment by the medical services of the health care insurance in the area of self-care with regard to the delivery of support.

As a limitation of the study, it should be noted that GEDA 2019/2020-EHIS is a general population-based cross-sectional study, based on telephone interviews in private households. Therefore, the available data do not allow a statement on the health status and functional limitations of nursing home residents. It can be assumed that the incidence of limitations among this population is higher than among people living in private households [46]. In addition, the data concerning severe hearing impairment in the general population, in particular, were probably underestimated in GEDA 2019/2020-EHIS, as these was a significant impediment to participation in a telephone survey. In addition, in these cases and also in the case of other factors impeding participation (e.g. speech disorders, cognitive limitations, or absences due to illness), a proxy interview was not conducted, so this may also have contributed to an underestimation of ADL and IADL limitations. Also, if there was only some difficulty in performing ADLs or IADLs, this was defined as no limitation in ADLs or IADLs. Methodological studies in this context should clarify the extent to which this definition is comparable in terms of the underlying competence dimensions relative to the other response categories.

Data collection took place from 2019 to 2020 and includes periods of strict containment measures during the COVID-19 pandemic. Analyses of changes in willingness to

participate as a result are pending. However, analyses, for example, of changes in the need for support or assistance in the population aged 55 and older showed no pandemic-related variations [47]. Finally, the cross-sectional design does not allow any conclusions to be drawn about the causes, course or consequences of limitations of daily living.

Many studies also reported an association with cognitive functioning [15, 34]. Since this could not be adequately captured in GEDA 2019/2020-EHIS due to its procedure (telephone survey), no statements can be made in this regard. Further methodological studies are also needed for a more in-depth analysis of the gender differences described here as a function of gender roles, individual life situations and changes across birth cohorts.

The results of GEDA 2019/2020-EHIS show in which areas of daily life older and very old people are impaired, give an impression of who is affected particularly strongly and indicate where support services are insufficient. As such, these results provide clues as to where support can be provided to enable older people to keep living in their own homes for as long as possible.

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#### Please cite this publication as

Fuchs J, Gaertner B, Prütz F (2022)

Limitations in activities of daily living and support needs –

Analysis of GEDA 2019/2020-EHIS.

J Health Monit 7(1): 6–25.

DOI 10.25646/9570

The German version of the article is available at:  
[www.rki.de/journalhealthmonitoring](http://www.rki.de/journalhealthmonitoring)

### Data protection and ethics

GEDA 2019/2020-EHIS is subject to strict compliance with the data protection provisions set out in the EU General Data Protection Regulation (GDPR) and the Federal Data Protection Act (BDSG). The Ethics Committee of the Charité – Universitätsmedizin Berlin assessed the ethics of the study and approved the implementation of the study (application number EA2/070/19).

Participation in the study was voluntary. The participants were informed about the aims and contents of the study and about data protection. Informed consent was obtained verbally.

### Funding

GEDA 2019/2020-EHIS was funded by the Robert Koch Institute and the German Federal Ministry of Health.

### Conflicts of interest

The authors declared no conflicts of interest.

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Annex Table 1

Limitations in five basic activities of daily living by gender and age (percentage and confidence interval, weighted analyses)

Source: GEDA 2019/2020-EHIS

	Women				Men				Total			
	Age group (years)				Age group (years)				Age group (years)			
	55–64	65–79	≥80	Total	55–64	65–79	≥80	Total	55–64	65–79	≥80	Total
<b>n</b>	2,756	3,303	1,027	7,086	2,365	2,734	772	5,871	5,121	6,037	1,799	12,957
	<b>Proportion (%)</b>											
<b>Feeding yourself</b>	0.5	0.2	0.1	0.3	0.4	0.3	0.2	0.3	0.6	0.3	0.1	0.4
(95% CI)	(0.1–1.6)	(0.1–0.8)	(0.0–0.3)	(0.1–0.7)	(0.1–1.8)	(0.1–0.9)	(0.1–0.6)	(0.1–0.8)	(0.3–1.5)	(0.1–0.6)	(0.1–0.3)	(0.2–0.7)
<b>Getting in and out of a bed or chair</b>	1.3	1.8	4.6	2.2	0.6	1.2	4.4	1.4	1.2	1.6	4.5	1.9
(95% CI)	(0.7–2.4)	(1.2–2.7)	(2.9–7.2)	(1.7–2.9)	(0.3–1.2)	(0.7–2.1)	(2.1–8.8)	(1.0–2.2)	(0.7–1.9)	(1.1–2.1)	(3.0–6.6)	(1.5–2.4)
<b>Dressing and undressing</b>	1.6	1.5	3.1	1.9	0.7	1.8	3.4	1.6	1.4	1.6	3.2	1.8
(95% CI)	(0.9–2.8)	(0.9–2.3)	(1.8–5.2)	(1.4–2.5)	(0.3–1.7)	(1.1–3.0)	(1.6–7.1)	(1.1–2.3)	(0.8–2.2)	(1.2–2.3)	(2.1–4.9)	(1.4–2.3)
<b>Using Toilets</b>	0.8	0.8	1.0	0.8	0.6	0.7	0.6	0.7	0.9	0.8	0.8	0.8
(95% CI)	(0.3–1.8)	(0.5–1.3)	(0.4–2.2)	(0.5–1.2)	(0.2–1.6)	(0.4–1.5)	(0.2–1.6)	(0.4–1.1)	(0.5–1.7)	(0.5–1.2)	(0.4–1.5)	(0.6–1.2)
<b>Bathing or showering</b>	2.1	3.4	11.1	4.5	1.1	2.8	7.1	2.7	1.8	3.2	9.5	3.8
(95% CI)	(1.3–3.2)	(2.4–4.8)	(8.3–14.7)	(3.7–5.5)	(0.5–2.3)	(1.9–3.9)	(4.5–11.0)	(2.0–3.5)	(1.2–2.7)	(2.5–4.0)	(7.5–12.1)	(3.2–4.4)

CI=confidence interval

Annex Table 2

Limitations in seven instrumental activities of daily living by gender and age (percentage and confidence interval, weighted analyses)

Source: GEDA 2019/2020-EHIS

	Women				Men				Total			
	Age group (years)				Age group (years)				Age group (years)			
	55–64	65–79	≥80	Total	55–64	65–79	≥80	Total	55–64	65–79	≥80	Total
<b>n</b>	2,756	3,303	1,027	7,086	2,365	2,734	772	5,871	5,121	6,037	1,799	12,957
	<b>Proportion (%)</b>											
<b>Preparing meals</b>	1.4	1.5	4.9	2.1	1.2	2.0	4.6	2.0	1.5	1.7	4.8	2.2
(95% CI)	(0.8–2.2)	(0.9–2.5)	(3.2–7.4)	(1.6–2.8)	(0.6–2.4)	(1.3–3.0)	(2.9–7.4)	(1.5–2.7)	(1.0–2.3)	(1.2–2.4)	(3.5–6.5)	(1.8–2.7)
<b>Using the telephone</b>	0.5	0.1	0.6	0.3	0.0	0.1	0.2	0.1	0.2	0.1	0.5	0.2
(95% CI)	(0.2–1.2)	(0.0–0.3)	(0.1–2.7)	(0.1–0.7)	–	(0.0–0.2)	(0.1–0.7)	(0.0–0.1)	(0.1–0.6)	(0.0–0.2)	(0.1–1.5)	(0.1–0.4)
<b>Shopping</b>	3.4	5.6	19.6	7.6	2.3	3.6	9.1	3.9	3.1	4.7	15.5	6.0
(95% CI)	(2.4–4.9)	(4.4–7.1)	(15.7–24.1)	(6.5–8.9)	(1.4–3.8)	(2.5–5.2)	(6.3–13.0)	(3.1–4.9)	(2.3–4.1)	(3.8–5.7)	(12.8–18.6)	(5.2–6.8)
<b>Managing medication</b>	0.5	1.1	4.6	1.6	1.4	1.2	3.3	1.6	0.9	1.1	4.1	1.6
(95% CI)	(0.2–1.0)	(0.6–2.2)	(2.8–7.5)	(1.1–2.3)	(0.7–2.9)	(0.6–2.2)	(1.5–6.7)	(1.1–2.4)	(0.5–1.7)	(0.7–1.8)	(2.7–6.1)	(1.2–2.1)
<b>Doing light housework</b>	2.2	2.4	8.4	3.6	1.5	3.2	6.4	2.9	1.9	2.8	7.6	3.3
(95% CI)	(1.4–3.5)	(1.7–3.5)	(6.0–11.8)	(2.9–4.5)	(0.8–2.6)	(2.1–4.8)	(4.4–9.3)	(2.3–3.8)	(1.3–2.6)	(2.1–3.7)	(5.9–9.9)	(2.8–3.9)
<b>Doing occasional heavy housework</b>	6.4	11.4	33.5	13.9	5.1	6.7	19.6	7.9	6.0	9.2	28.2	11.2
(95% CI)	(5.1–8.0)	(9.6–13.4)	(28.9–38.5)	(12.5–15.4)	(3.7–7.0)	(5.2–8.7)	(15.4–24.5)	(6.8–9.2)	(4.9–7.2)	(8.0–10.6)	(24.8–31.8)	(10.3–12.2)
<b>Taking care of finances and everyday administrative tasks</b>	0.9	1.6	10.1	3.1	2.1	1.5	5.2	2.3	1.7	1.6	8.2	2.8
(95% CI)	(0.5–1.7)	(1.0–2.7)	(7.2–13.9)	(2.4–4.0)	(1.2–3.7)	(0.9–2.5)	(3.2–8.2)	(1.7–3.2)	(1.1–2.7)	(1.1–2.3)	(6.2–10.7)	(2.3–3.5)

CI=confidence interval

Annex Table 3

Basic and instrumental limitations of activities of daily living by gender and health-relevant limitations (percentage and confidence interval, weighted analyses)

Source: GEDA 2019/2020-EHIS

	Women			Men			Total		
	With ADL	Without ADL	Total	With ADL	Without ADL	Total	With ADL	Without ADL	Total
<b>n</b>	265	6,821	7,086	152	5,719	5,871	417	12,540	12,957
<b>Proportion (%)</b>									
<b>Bad/very bad health status</b>	49.0	9.2	11.6	55.4	11.1	12.7	50.8	10.1	12.1
(95% CI)	(40.2–58.0)	(8.1–10.5)	(10.3–12.9)	(42.9–67.3)	(9.6–12.7)	(11.2–14.3)	(43.5–58.0)	(9.2–11.1)	(11.1–13.1)
<b>Severe limitations due to illness</b>	63.3	9.2	12.3	63.0	10.5	12.5	61.9	9.9	12.4
(95% CI)	(54.3–71.5)	(8.2–10.5)	(11.1–13.7)	(50.2–74.2)	(9.1–12.1)	(11.0–14.1)	(54.5–68.8)	(9.0–10.8)	(11.5–13.5)
<b>Chronically ill for at least six months</b>	84.8	60.6	62.0	86.3	59.6	60.5	84.1	60.1	61.3
(95% CI)	(76.0–90.7)	(58.8–62.4)	(60.2–63.8)	(76.9–92.2)	(57.5–61.5)	(58.6–62.5)	(77.3–89.1)	(58.7–61.4)	(59.9–62.6)
<b>Severe difficulties in vision</b>	15.6	2.6	3.4	6.7	2.3	2.5	12.2	2.5	3.0
(95% CI)	(9.8–23.9)	(2.0–3.4)	(2.7–4.3)	(3.6–12.2)	(1.7–3.1)	(1.9–3.3)	(8.2–17.8)	(2.1–3.0)	(2.5–3.5)
<b>Severe difficulties in hearing</b>	17.9	5.3	6.0	27.1	6.2	6.9	21.3	5.7	6.5
(95% CI)	(11.9–26.0)	(4.4–6.3)	(5.1–7.1)	(17.1–40.1)	(5.2–7.3)	(5.9–8.1)	(15.8–28.1)	(5.1–6.5)	(5.8–7.3)
<b>Severely impaired mobility (walking, climbing stairs)</b>	85.8	12.4	16.6	67.9	8.5	10.7	79.9	10.5	14.0
(95% CI)	(78.1–91.1)	(11.0–13.9)	(15.1–18.3)	(54.6–78.7)	(7.3–9.9)	(9.4–12.2)	(73.0–85.4)	(9.6–11.6)	(12.9–15.1)
	With IADL	Without IADL	Total	With IADL	Without IADL	Total	With IADL	Without IADL	Total
	With IADL	Without IADL	Total	With IADL	Without IADL	Total	With IADL	Without IADL	Total
<b>n</b>	778	6,308	7,086	412	5,459	5,871	1,190	11,767	12,957
<b>Proportion (%)</b>									
<b>Bad/very bad health status</b>	40.4	6.4	11.6	54.2	8.5	12.7	44.8	7.4	12.1
(95% CI)	(35.2–45.8)	(5.3–7.5)	(10.3–12.9)	(46.9–61.3)	(7.2–10.0)	(11.2–14.3)	(40.5–49.2)	(6.6–8.3)	(11.1–13.1)
<b>Severe limitations due to illness</b>	50.6	5.6	12.3	58.2	7.9	12.5	52.9	6.7	12.4
(95% CI)	(45.1–56.1)	(4.7–6.6)	(11.1–13.7)	(50.9–65.2)	(6.6–9.4)	(11.0–14.1)	(48.4–57.2)	(5.9–7.6)	(11.5–13.5)
<b>Chronically ill for at least six months</b>	84.1	58.0	62.0	85.4	58.0	60.5	84.0	58.0	61.3
(95% CI)	(79.3–88.0)	(56.2–59.9)	(60.2–63.8)	(80.0–89.6)	(55.9–60.1)	(58.6–62.5)	(82.2–87.1)	(56.6–59.4)	(59.9–62.6)
<b>Severe difficulties in vision</b>	10.3	2.2	3.4	10.5	1.7	2.5	10.3	1.9	3.0
(95% CI)	(7.3–14.2)	(1.6–2.9)	(2.7–4.3)	(6.9–15.7)	(1.2–2.4)	(1.9–3.3)	(8.0–13.3)	(1.5–2.4)	(2.5–3.5)
<b>Severe difficulties in hearing</b>	15.9	4.2	6.0	18.7	5.8	6.9	16.7	5.0	6.5
(95% CI)	(12.3–20.3)	(3.4–5.2)	(5.1–7.1)	(13.6–25.0)	(4.8–6.9)	(5.9–8.1)	(13.7–20.2)	(4.4–5.8)	(5.8–7.3)
<b>Severely impaired mobility (walking, climbing stairs)</b>	69.8	7.1	16.6	65.3	5.2	10.7	68.4	6.2	14.0
(95% CI)	(64.6–74.5)	(6.0–8.4)	(15.1–18.3)	(58.4–71.6)	(4.2–6.4)	(9.4–12.2)	(64.3–72.2)	(5.4–7.0)	(12.9–15.1)

ADL=basic activities of daily living, IADL=instrumental activities of daily living, CI=confidence interval



Annex Table 4

Basic and instrumental limitations of activities of daily living by gender and sociodemographic parameters (percentage and confidence interval, weighted analyses)

Source: GEDA 2019/2020-EHIS

	Women			Men			Total		
	With ADL	Without ADL	Total	With ADL	Without ADL	Total	With ADL	Without ADL	Total
<b>n</b>	265	6,821	7,086	152	5,719	5,871	417	12,540	12,957
<b>Proportion (%)</b>									
<b>Education level (CASMIN)</b>									
<b>Low education group</b>	58.8	43.4	44.3	66.2	42.1	43.0	62.3	42.8	43.7
(95% CI)	(49.9–67.2)	(41.5–45.3)	(42.4–46.1)	(55.4–75.5)	(40.0–44.3)	(40.9–45.1)	(55.4–68.7)	(41.4–44.2)	(42.3–45.1)
<b>Medium education group</b>	36.8	45.8	45.3	23.2	36.8	36.3	31.3	41.6	41.1
(95% CI)	(28.7–45.7)	(44.0–47.6)	(43.5–47.0)	(15.4–33.3)	(34.9–38.8)	(34.4–38.2)	(25.2–38.0)	(40.3–42.9)	(39.8–42.4)
<b>High education group</b>	4.3	10.9	10.5	10.6	21.1	20.7	6.4	15.6	15.2
(95% CI)	(3.0–6.2)	(10.2–11.5)	(9.9–11.1)	(6.9–15.9)	(20.0–22.3)	(19.6–21.8)	(4.8–8.5)	(15.0–16.3)	(14.6–15.8)
<b>At risk of poverty</b>									
<b>&lt;60% of median income</b>	30.6	18.7	19.4	29.3	15.4	15.9	31.7	17.3	18.0
(95% CI)	(22.7–39.8)	(17.1–20.4)	(17.8–21.1)	(19.1–42.1)	(13.7–17.3)	(14.2–17.8)	(25.0–39.2)	(16.1–18.5)	(16.8–19.2)
<b>One-person household</b>									
<b>Yes</b>	71.6	53.0	54.0	62.9	42.6	43.3	69.2	48.1	49.2
(95% CI)	(63.6–78.4)	(51.1–54.8)	(52.3–55.8)	(51.5–73.0)	(40.4–44.7)	(41.2–45.4)	(62.8–75.0)	(46.8–49.5)	(47.8–50.5)
<b>Size of municipality</b>									
<b>Rural</b>	7.7	11.2	11.0	6.6	12.2	12.0	7.2	11.7	11.5
(95% CI)	(4.0–14.1)	(10.0–12.5)	(9.8–12.3)	(2.7–15.4)	(10.8–13.7)	(10.6–13.4)	(4.3–12.0)	(10.8–12.7)	(10.6–12.5)
<b>Small town</b>	26.4	27.0	26.9	26.6	29.0	28.9	26.3	27.9	27.8
(95% CI)	(18.5–36.2)	(25.3–28.7)	(25.2–28.7)	(16.2–40.5)	(27.1–31.0)	(27.0–30.9)	(19.8–34.1)	(26.6–29.2)	(26.5–29.1)
<b>Medium town</b>	31.4	31.2	31.2	29.4	30.9	30.8	30.5	31.0	30.9
(95% CI)	(23.3–40.8)	(29.4–32.9)	(29.5–32.9)	(18.8–42.8)	(28.9–32.9)	(28.9–32.8)	(23.8–38.0)	(29.7–32.3)	(29.6–32.3)
<b>City</b>	34.5	30.7	30.9	37.4	28.0	28.3	36.0	29.5	29.8
(95% CI)	(26.9–43.0)	(29.1–32.4)	(29.3–32.6)	(26.7–49.5)	(26.3–29.8)	(26.6–30.1)	(29.7–42.9)	(28.3–30.7)	(28.6–31.0)

ADL=basic activities of daily living, IADL=instrumental activities of daily living, CASMIN=Comparative Analyses of Social Mobility in Industrial Nations, CI=confidence interval

Continued on next page

Annex Table 4 *Continued*

Basic and instrumental limitations of activities of daily living by gender and sociodemographic parameters (percentage and confidence interval, weighted analyses)

Source: GEDA 2019/2020-EHIS

	Women			Men			Total		
	With IADL	Without IADL	Total	With IADL	Without IADL	Total	With IADL	Without IADL	Total
<b>n</b>	778	6,308	7,086	412	5,459	5,871	1,190	11,767	12,957
									<b>Proportion (%)</b>
<b>Education level (CASMIN)</b>									
<b>Low education group</b>	61.0	41.2	44.3	52.0	42.1	43.0	58.3	41.7	43.7
(95% CI)	(55.8–66.0)	(39.3–43.2)	(42.4–46.1)	(44.8–59.1)	(39.9–44.3)	(40.9–45.1)	(54.1–62.4)	(40.2–43.1)	(42.3–45.1)
<b>Medium education group</b>	33.9	47.3	45.3	34.9	36.5	36.3	34.0	42.1	41.1
(95% CI)	(29.2–39.1)	(45.4–49.2)	(43.5–47.0)	(28.5–42.0)	(34.5–38.5)	(34.4–38.2)	(30.2–38.1)	(40.7–43.5)	(39.8–42.4)
<b>High education group</b>	5.0	11.5	10.5	13.1	21.5	20.7	7.7	16.2	15.2
(95% CI)	(4.0–6.2)	(10.8–12.2)	(9.9–11.1)	(10.4–16.4)	(20.3–22.7)	(19.6–21.8)	(6.5–9.0)	(15.6–16.9)	(14.6–15.8)
<b>At risk of poverty</b>									
<b>&lt;60% of median income</b>	28.9	17.7	19.4	30.6	14.5	15.9	30.0	16.2	18.0
(95% CI)	(24.1–34.3)	(16.1–19.5)	(17.8–21.1)	(24.0–38.1)	(12.7–16.4)	(14.2–17.8)	(26.0–34.4)	(15.0–17.5)	(16.8–19.2)
<b>One-person household</b>									
<b>Yes</b>	72.0	50.8	54.0	60.9	41.5	43.3	68.5	46.4	49.2
(95% CI)	(67.4–76.3)	(48.9–52.7)	(52.3–55.8)	(54.1–67.4)	(39.4–43.8)	(41.2–45.4)	(64.6–72.1)	(45.0–47.9)	(47.8–50.5)
<b>Size of municipality</b>									
<b>Rural</b>	8.0	11.5	11.0	7.3	12.4	12.0	7.8	12.0	11.5
(95% CI)	(5.4–11.8)	(10.2–12.9)	(9.8–12.3)	(4.3–12.0)	(11.0–14.0)	(10.6–13.4)	(5.4–10.6)	(11.0–13.1)	(10.6–12.5)
<b>Small town</b>	28.1	26.7	26.9	19.9	29.8	28.9	25.3	28.1	27.8
(95% CI)	(22.9–34.0)	(25.0–28.5)	(25.2–28.7)	(14.2–27.0)	(27.8–31.9)	(27.0–30.9)	(21.2–29.8)	(26.8–29.5)	(26.5–29.1)
<b>Medium town</b>	28.4	31.7	31.2	35.4	30.4	30.8	30.7	31.0	30.9
(95% CI)	(23.6–33.6)	(29.9–33.5)	(29.5–32.9)	(28.6–42.9)	(28.4–32.5)	(28.9–32.8)	(26.7–35.0)	(29.6–32.4)	(29.6–32.3)
<b>City</b>	35.5	30.1	30.9	37.5	27.4	28.3	36.3	28.9	29.8
(95% CI)	(30.5–40.9)	(28.4–31.8)	(29.3–32.6)	(30.6–44.9)	(25.7–29.2)	(26.6–30.1)	(32.1–40.6)	(27.7–30.1)	(28.6–31.0)

ADL=basic activities of daily living, IADL=instrumental activities of daily living, CASMIN=Comparative Analyses of Social Mobility in Industrial Nations, CI=confidence interval

## Imprint

### Journal of Health Monitoring

#### Publisher

Robert Koch Institute  
Nordufer 20  
13353 Berlin, Germany

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#### Typesetting

Kerstin Möllerke, Alexander Krönke

#### Translation

intellitext SprachenService

ISSN 2511-2708

#### Note

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



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

Journal of Health Monitoring · 2022 7(1)  
DOI 10.25646/9752  
Robert Koch Institute, Berlin

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Health Monitoring

Submitted: 25.11.2021

Accepted: 22.02.2022

Published: 30.03.2022

# Health of people with impairments and disabilities in Germany – Selected indicators from GEDA 2014/2015-EHIS

## Abstract

A large part of the population is affected by impairments and disabilities. Around 13% of people in Germany have an officially recognised disability, and an estimated 15.6% have an impairment. This article provides an overview of the health of people with impairments and disabilities on the basis of selected indicators. The analyses are based on data from 23,372 participating persons aged 18 and over (12,747 women, 10,625 men) in the GEDA 2014/2015-EHIS study of the Robert Koch Institute (RKI), a nationwide survey of the adult population in Germany. 21.5% of persons with impairments and disabilities rate their health as good or very good, in contrast to 76.0% of persons without impairments and disabilities. Depressive symptoms exist in 27.1% of persons with impairments and disabilities and 7.5% of persons without impairments and disabilities. In part, there were differences in health behaviour, for example, people with impairments and disabilities do less aerobic physical activities and consume alcohol in risky amounts less often. 97.0% of the persons with and 86.1% of the persons without impairments and disabilities make use of outpatient medical services within one year, the former also have a higher inpatient and home care utilisation. Overall, poorer health is found among women than among men with impairments and disabilities, as well as with increasing age. The analyses show the need for prevention, health promotion and health care. Further data is needed to describe the health situation of people with impairments and disabilities.

DISABILITIES · IMPAIRMENTS · HEALTH BEHAVIOUR · HEALTH CARE · HEALTH MONITORING

## 1. Introduction

A large part of the population is affected by impairments and disabilities – directly or as relatives. In 2019, 10.4 million people with an officially recognised disability lived in private households in Germany, which corresponds to 12.7% of the residents living in private households [1]. 9.5% of people in Germany had an officially recognised severe disability, i.e. the degree of disability (GdB) was 50 or higher [2]. The proportion of people with impairments is much higher.

It is estimated at about 15.6% of the population [3]. Definitions of disability, severe disability and impairment can be found in the [Info box](#).

Article 25 of the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) stipulates ‘that persons with disabilities have the right to the enjoyment of the highest attainable standard of health without discrimination on the basis of disability’ [4]. Reliable data on the health of persons with disabilities is indispensable for identifying the need for political action. The UNCRPD also formulates cor-

## GEDA 2014/2015-EHIS

**Data holder:** Robert Koch Institute

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

**Method:** Questionnaires completed on paper or online

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

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

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

**Response rate:** 26.9%

**Study period:** November 2014–July 2015

More information in German is available at [www.geda-studie.de](http://www.geda-studie.de)

responding requirements in Article 31 [4]. However, there is still only little data on the health of people with impairments and disabilities in Germany. The microcensus and the statistics on severely disabled persons provided by the Federal Statistical Office only include persons with officially recognised disabilities. The microcensus also only includes persons living in private households. The statistics on severely disabled persons provide information on the cause (e.g. accident or illness) and the type of disability (e.g. physical, visual, hearing, mental or learning disability), while the microcensus collects data on the social situation, for example on marital status, household size and educational qualifications, and also includes some questions on health every four years [5]. The Federal Government's Reports on Participation [3, 6, 7] describe the health situation of people with impairments and disabilities, using data from the studies German Health Update (GEDA), German Health Interview and Examination Survey for Children and Adolescents (KiGGS), the Socio-Economic Panel (SOEP) and social security data. The reports Health in Germany [8] and Health Situation of Women in Germany [9] published by Federal Health Reporting, contain chapters on the health of people with impairments and disabilities, which are based on various data sources.

People with impairments and disabilities are a heterogeneous group in which very different health situations and needs exist. Nevertheless, the existing data conveys the picture that they have poorer physical and mental health and thus have a higher need for health care, but at the same time there are gaps, for example with regard to the accessibility of medical practices [3, 9]. There are also differences in health behaviour between people with and without impairments and disabilities, partly in the direction of a

more health-risky, partly in the direction of a more health-conscious behaviour [3, 9].

The aim of this article is to provide an overview of the health of people with impairments and disabilities on the basis of selected indicators. This includes indicators of health status, health behaviour as well as health care with data from the study GEDA 2014/2015-EHIS. The selection is based on the report Health Situation of Women in Germany [9], which was published in December 2020. Thus, the self-assessment of the general state of health contains important information for the description of the health of persons and population groups [8–10]. The presence of depressive symptoms gives an indication of mental health, as depression is one of the most common mental disorders [9, 11]. Aerobic physical activities (such as cycling, jogging or swimming), muscle-strengthening activities (such as strength training or yoga), fruit and vegetable consumption, smoking and risky alcohol consumption represent relevant aspects of health-related behaviour [9, 12]. The use of outpatient medical care, inpatient care and home care are reported as indicators of health care [9, 13, 14].

## 2. Methodology

### 2.1 Sample design and study implementation

The German Health Update (GEDA) is a nationwide survey of the adult population (aged 18 years and older) and part of the health monitoring program at the Robert Koch Institute (RKI). In GEDA 2014/2015, the questionnaire of the European Health Interview Survey (EHIS Wave 2) was fully integrated for the first time [15]. The survey was conducted by means of a self-completion questionnaire, which

## Info box

### Persons with impairments and disabilities

#### 1. Persons with impairments

Persons with impairments are those who are permanently impaired in activities related to damage to body structures and functions. Depending on the data source, there are different statistical definitions for persons with impairments. Common to all of these groups, however, is that the persons belonging to them do not necessarily have to be restricted in their activities of everyday life due to their impairments, but they may nevertheless be so. [...]

#### 2. Persons with disabilities

These are persons who are hindered in activities of daily living and/or equal participation by interactions of their own impairments and environmental barriers. It does not matter whether this is an officially recognised disability or severe disability. [...]

#### 3. Persons with recognised disability and recognised severe disability

Persons with a recognised disability or a recognised severe disability include all persons whose disability has been determined or recognised by a competent office. Recognition is accompanied by the assignment of a degree of severity of disability in the form of a degree of disability (GdB). If a GdB of 50 or more has been assigned, this person has a recognised severe disability. [...]

Source: Federal Ministry of Labour and Social Affairs (2021) [3]

could be processed either as a paper or online version [16]. GEDA 2014/2015-EHIS is based on a two-stage stratified cluster sample. For this purpose, 301 municipalities were initially randomly selected. These account for 231 districts and district-free cities and represent the different municipality sizes and regions in Germany. In a second step, persons with permanent residence in the selected municipalities were randomly drawn from local population registers. Persons living in institutions or homes did not take part in the survey.

## 2.2 Indicators

For the analyses, the target variable on impairments and disabilities was operationalised as in the [Second Report on Participation](#) [7]: Persons with impairments and disabilities are understood to be all participants who have an officially recognised severe disability or a severe illness-related restriction in the performance of everyday activities lasting longer than six months. Participants were asked: ‘Do you have a disability that is officially recognised by the pension office?’ and, if the answer was ‘Yes’, ‘What is your officially recognised degree of disability?’ A GdB of 50 or more constitutes a severe disability. Impairments were recorded with the following question: ‘Are you permanently restricted by a health problem in activities of normal everyday life?’ If the answer to this question was ‘Yes’, the respondents were then asked about the severity (‘How severe are the limitations?’), possible answers: ‘Severely limited’, ‘Moderately limited’) and the duration of the limitations (‘How long have your limitations lasted?’), possible answers: ‘Less than 6 months’, ‘6 months and longer’).

To survey self-rated health, the question ‘How is your health in general?’ was used with the response categories ‘Very good’, ‘Good’, ‘Fair’, ‘Bad’, and ‘Very bad’ [17]. In the analyses, the proportions of participants who rated their health as good and very good were contrasted with participants with self-rated fair to very bad health [10].

To assess the presence of depressive symptoms, the internationally established 8-item Patient Health Questionnaire (PHQ-8) was used [18]. This inquires about the symptoms of major depression in the two weeks before the interview according to DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, 4th edition) [19]. A total of scale values of at least ten out of a maximum of 24 points is considered to indicate the presence of depressive symptoms [20, 21].

The exercise of aerobic physical activities and muscle-strengthening activities was assessed with the German validated version of the European Health Interview Survey – Physical Activity Questionnaires (EHIS-PAQ) [20, 21]. Participants were asked how much time per week they engaged in moderately strenuous aerobic physical activity during leisure time and cycling for locomotion, and how many days per week they engaged in muscle-strengthening activities. On this basis, the proportions of those meeting the World Health Organization (WHO) physical activity recommendations [22] for aerobic physical activities (at least 2.5 hours per week) and muscle-strengthening activities (at least two days per week) were calculated [23].

Fruit consumption was assessed with the question ‘How often do you consume fruit, including freshly squeezed fruit juices?’. Response categories were ‘Daily or several times a day’, ‘4 to 6 times a week’, ‘1 to 3 times a week’,

‘Less than once a week’, and ‘Never’. A similar question was used on vegetable consumption (consumption of vegetables or salad, including freshly squeezed vegetable juices). In each case, the proportion of individuals with daily fruit or vegetable consumption was calculated [24, 25].

Regarding smoking status, the question ‘Do you smoke?’ was asked, with the response categories ‘Yes, daily’, ‘Yes, occasionally’, ‘No, not anymore’, and ‘I have never smoked’. Smokers are those who had answered the question in the affirmative [26].

Alcohol consumption was recorded in GEDA 2014/2015-EHIS using an instrument adapted from the Alcohol Use Disorder Identification Test – Consumption Questions (AUDIT-C) [27]: first the frequency of alcohol consumption in the last twelve months was asked, then, differentiated by weekdays (Monday to Thursday) and weekends (Friday to Sunday), the amount of alcohol consumed based on so-called standard drinks. From this information, the average consumption in grams of pure alcohol per day and the proportion of people exceeding the limits of more than 10g of pure alcohol/day for women and more than 20g of pure alcohol/day for men can be determined. This corresponds to the proportion of those who consume alcohol in risky amounts [28–30].

Outpatient medical utilisation was surveyed with the question ‘When was the last time you consulted a general practitioner or family doctor on your own behalf?’ and a corresponding question for specialist utilisation. The response categories were ‘Less than 12 months ago’, ‘12 months ago or longer’, and ‘Never’. The proportion of those who had used primary care or specialist care at least once in the 12 months prior to the survey was calculated [13]. Use

of inpatient care was determined by the question ‘In the past 12 months have you been in hospital as an inpatient, that is overnight or longer?’ [14]. The use of nursing care services was determined by the question ‘In the past 12 months, have you yourself used or received any home care services?’ Both questions could be answered with ‘Yes’ or ‘No’.

### 2.3 Statistical analyses

The analyses are based on data from 23,372 participating persons aged 18 years and older (12,747 women, 10,625 men) with valid information on illness-related permanent limitations as well as officially recognised disabilities. Whether differences in health status, health behaviour, and health care exist between people with and without impairments and disabilities was analysed using selected parameters. Prevalence with 95% confidence intervals and p-values from multivariate log-Poisson regressions were calculated. Regression analyses by sex are controlled for age and socioeconomic status (SES), and regression analyses by sex and age are controlled for SES only. A statistically significant difference between women and men with and without impairments and disabilities is assumed when the p-value is less than 0.05.

Calculations were performed using a weighting factor that corrects for deviations of the sample from the population structure (as of 31.12.2014) in terms of sex, age, type of municipality and education level. Type of municipality reflects the degree of urbanisation and corresponds to the regional distribution in Germany. The International Standard Classification of Education (ISCED) was used to classify the school and vocational degrees of participants [31].



**A fifth of the persons with impairments and disabilities rate their health as good or very good, in contrast to three quarters of the persons without impairments and disabilities.**

All analyses were conducted using Stata 17.0 survey procedures (Stata Corp., College Station, TX, USA, 2015). A detailed description of the GEDA 2014/2015-EHIS methodology can be found elsewhere [32, 33].

### 3. Results

Of those participating in GEDA 2014/2015-EHIS, 13.5% were affected by impairments and disabilities (women 13.1%, men 13.9%). The proportion of persons with impairments and disabilities increases significantly with age, from 3.4% for women and 3.7% for men aged 18 to 29 years to 27.8% for women and 30.6% for men aged 65 years and older (Figure 1).

#### Self-rated health and depressive symptoms

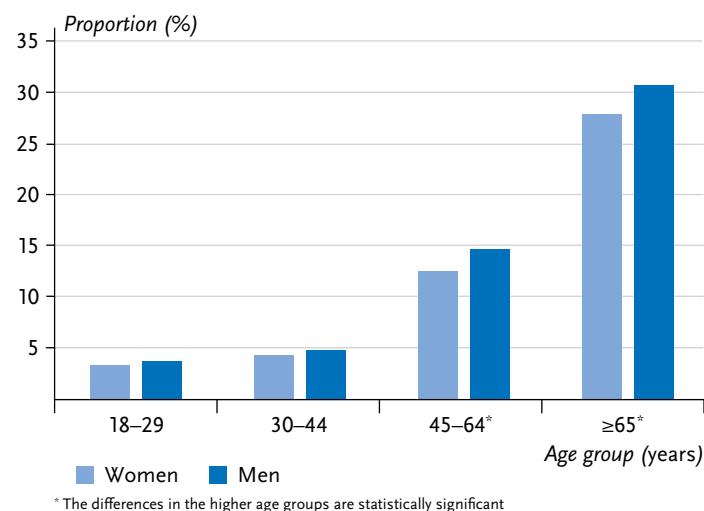
Only about one-fifth (21.5%) of persons with impairments and disabilities rate their health as good or very good, in

contrast to about three-quarters of persons without impairments and disabilities (76.0%, Figure 2 and Table 1). In this context, women rate their health worse than men on average: 18.8% of women and 24.1% of men with impairments and disabilities report good or very good health (Table 1). The proportion of those who rate their health as very good or good decreases with age; this is true for both women and men with and without impairments and disabilities. Women and men with impairments and disabilities rate their health worse in all age groups (Annex Table 1 and Annex Table 2).

Depressive symptoms in the previous two weeks are present in 31.3% of women and 23.0% of men with impairments and disabilities. Of those without impairments and disabilities, significantly fewer women and men are affected, at 8.6% and 6.3%, respectively (Table 1). With increasing age, the proportion of persons with depressive symptoms decreases; this is evident for both women and men with and without impairments and disabilities. In all age groups, women and men with impairments and disabilities are more frequently affected by depressive symptoms (Annex Table 1 and Annex Table 2).

#### Health behaviour

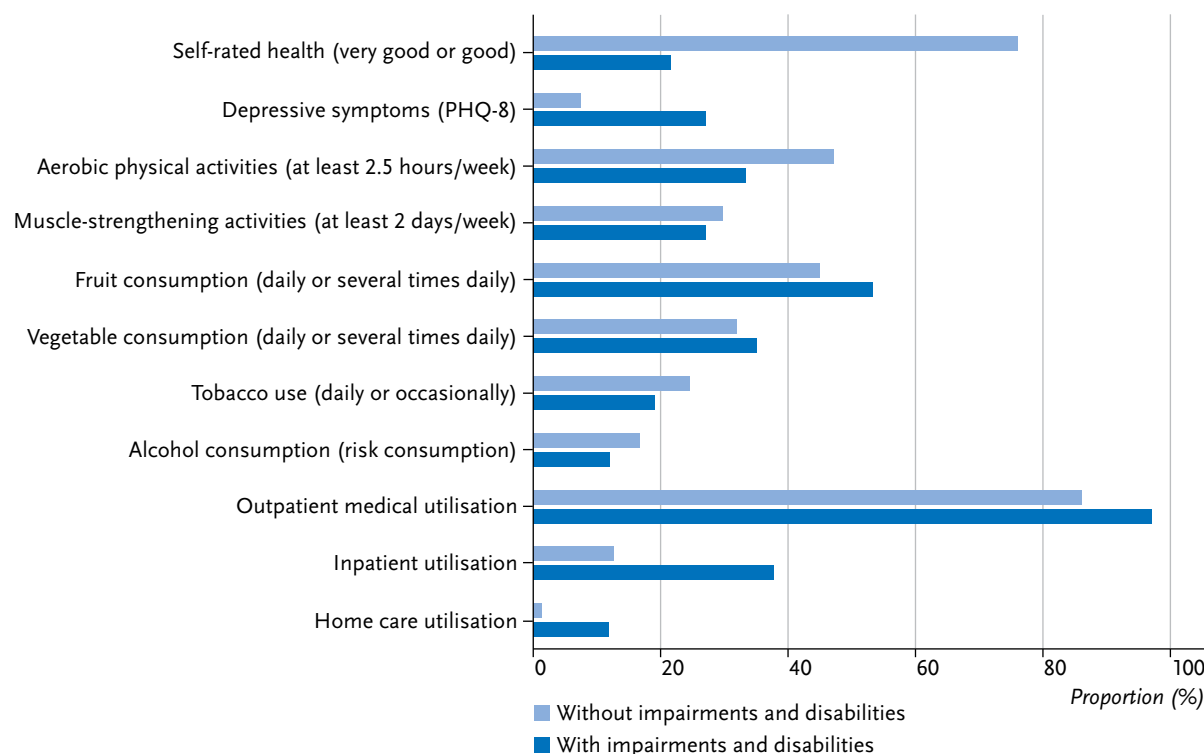
Women and men with impairments and disabilities are less likely to engage in aerobic physical activities (28.9% and 37.6%, respectively) than women and men without impairments and disabilities (44.7% and 49.6%, respectively). However, the results by age show that this is not equally true for all age groups: for example, among those with impairments and disabilities, it is mainly women in young adulthood (18 to 29 years) and older adulthood (65 years



**Figure 1**  
Proportion of women and men with impairments and disabilities by age (n=1,406 women, n=1,505 men)  
Source: GEDA 2014/2015-EHIS

**Figure 2**  
**Health status among persons with and without impairments and disabilities**  
 (n=2,911 persons with and n=20,461 persons without impairments and disabilities)  
 Source: GEDA 2014/2015-EHIS

Depressive symptoms exist in about 30% of women and 23% of men with impairments and disabilities, but in about 9% of women and 6% of men without impairments and disabilities.



	Self-rated health (very good or good)			Depressive symptoms (PHQ-8)		
	%	(95% CI)	p-value*	%	(95% CI)	p-value*
<b>Women</b>						
With impairments and disabilities	18.8	(16.3–21.5)	<0.001	31.3	(28.4–34.4)	<0.001
Without impairments and disabilities	74.5	(73.4–75.6)	Ref.	8.6	(8.0–9.3)	Ref.
<b>Men</b>						
With impairments and disabilities	24.1	(21.6–26.8)	<0.001	23.0	(20.3–25.9)	<0.001
Without impairments and disabilities	77.6	(76.5–78.7)	Ref.	6.3	(5.7–7.1)	Ref.
<b>Total</b>						
With impairments and disabilities	21.5	(19.6–23.4)	<0.001	27.1	(25.1–29.1)	<0.001
Without impairments and disabilities	76.0	(75.2–76.8)	Ref.	7.5	(7.0–8.0)	Ref.

CI=confidence interval, Ref.=reference group, PHQ-8=8-item Patient Health Questionnaire

\* p-value from multivariate log-Poisson regressions

**Table 1**

**Self-rated health and depressive symptoms among women and men with and without impairments and disabilities**  
 (n=1,406 women with/n=11,341 without impairments and disabilities, n=1,505 men with/n=9,120 without impairments and disabilities)

Source: GEDA 2014/2015-EHIS

**Table 2**  
Aerobic physical activities and muscle-strengthening activities among women and men with and without impairments and disabilities (n=1,406 women with/n=11,341 without impairments and disabilities, n=1,505 men with/n=9,120 without impairments and disabilities)

Source: GEDA 2014/2015-EHIS

	Aerobic physical activities (at least 2.5 hours/week)			Muscle-strengthening activities (at least 2 days/week)		
	%	(95% CI)	p-value*	%	(95% CI)	p-value*
<b>Women</b>						
With impairments and disabilities	28.9	(25.9–32.0)	<0.001	24.4	(21.6–27.5)	0.539
Without impairments and disabilities	44.7	(43.3–46.1)	Ref.	28.1	(27.1–29.1)	Ref.
<b>Men</b>						
With impairments and disabilities	37.6	(34.2–41.2)	<0.001	29.6	(26.6–32.8)	0.812
Without impairments and disabilities	49.6	(48.8–51.9)	Ref.	31.5	(30.4–32.7)	Ref.
<b>Total</b>						
With impairments and disabilities	33.3	(31.1–35.7)	<0.001	27.0	(24.9–29.3)	0.687
Without impairments and disabilities	47.1	(46.0–48.3)	Ref.	29.8	(28.9–30.6)	Ref.

CI = confidence interval, Ref. = reference group

\* p-value from multivariate log-Poisson regressions

**In some areas of health behaviour, people with and without impairments and disabilities differ, for example, the former do less aerobic physical activities and consume less alcohol in risky amounts.**

and older) and men in late middle and older adulthood (45 years and older) who engage in aerobic physical activities less often than their peers without impairments and disabilities ([Annex Table 1](#) and [Annex Table 2](#)). The picture is different for physical activities for muscle strengthening: Here, there is little difference between the two groups (women 24.4% and 28.1%, men 44.7% and 49.6%; [Table 2](#)). Only 65-year-old and older women with impairments and

disabilities perform muscle-strengthening exercises less frequently than women of the same age without impairments and disabilities ([Annex Table 1](#)).

More than half of women – 59.6% of women with and 53.1% without impairments and disabilities – consume fruit daily, compared with 47.1% and 36.6% of men, respectively ([Table 3](#)). There are no significant differences between people with and without impairments and disabilities ([Figure 2](#)

**Table 3**  
Fruit and vegetable consumption among women and men with and without impairments and disabilities (n=1,406 women with/n=11,341 without impairments and disabilities, n=1,505 men with/n=9,120 without impairments and disabilities)

Source: GEDA 2014/2015-EHIS

	Fruit consumption (daily or several times daily)			Vegetable consumption (daily or several times daily)		
	%	(95% CI)	p-value*	%	(95% CI)	p-value*
<b>Women</b>						
With impairments and disabilities	59.6	(56.2–63.0)	0.069	41.4	(38.7–44.2)	0.145
Without impairments and disabilities	53.1	(51.9–54.4)	Ref.	40.3	(39.1–41.6)	Ref.
<b>Men</b>						
With impairments and disabilities	47.1	(43.9–50.4)	0.394	28.8	(26.0–31.8)	0.516
Without impairments and disabilities	36.6	(35.3–37.9)	Ref.	23.1	(21.9–24.2)	Ref.
<b>Total</b>						
With impairments and disabilities	53.3	(50.9–55.6)	0.083	35.0	(33.1–37.0)	0.610
Without impairments and disabilities	45.0	(44.0–46.1)	Ref.	31.9	(30.9–32.8)	Ref.

CI = confidence interval, Ref. = reference group

\* p-value from multivariate log-Poisson regressions

Table 4

**Tobacco and alcohol consumption among women and men with and without impairments and disabilities (n=1,406 women with/n=11,341 without impairments and disabilities, n=1,505 men with/n=9,120 without impairments and disabilities)**

Source: GEDA 2014/2015-EHIS

	Tobacco use (daily or occasionally)			Alcohol consumption (risky consumption)		
	%	(95% CI)	p-value*	%	(95% CI)	p-value*
<b>Women</b>						
With impairments and disabilities	16.0	(13.7–18.6)	0.108	8.6	(7.0–10.6)	<0.001
Without impairments and disabilities	21.6	(20.6–22.6)	Ref.	14.8	(13.9–15.8)	Ref.
<b>Men</b>						
With impairments and disabilities	22.1	(19.6–24.7)	0.278	15.3	(13.2–17.6)	0.005
Without impairments and disabilities	27.7	(26.5–28.9)	Ref.	18.6	(17.6–19.6)	Ref.
<b>Total</b>						
With impairments and disabilities	19.1	(17.5–20.8)	0.034	12.0	(10.5–13.6)	<0.001
Without impairments and disabilities	24.6	(23.8–25.4)	Ref.	16.7	(16.0–17.4)	Ref.

CI = confidence interval, Ref. = reference group

\* p-value from multivariate log-Poisson regressions

**Within one year, more than 95% of persons with impairments and disabilities make use of outpatient medical services, a higher utilisation than in persons without impairments and disabilities.**

and Table 1); this is true for all age groups (Annex Table 1 and Annex Table 2). 41.1% of women with and 40.3% of women without impairments and disabilities consume vegetables daily. For men, this is true for 28.8% and 23.1%, respectively. Differences by age are only observed among women: Women aged 65 years and older with impairments and disabilities are less likely to eat vegetables daily than women of the same age who are not affected by impairments and disabilities (Annex Table 1).

16.0% of women and 22.1% of men with impairments and disabilities reported current smoking, compared with 21.6% and 27.7% of women and men without impairments and disabilities, respectively (Table 4). Results by age show that there are differences in tobacco use between persons with and without impairments and disabilities in some age groups: Women in early middle adulthood (30 to 44 years) with impairments and disabilities were more likely to report current smoking than women of the same age without impairments and disabilities. The same is true for men with and without impairments and disabilities in late mid-

dle adulthood (45 to 64 years). In contrast, men in older adulthood (65 years and older) with impairments and disabilities were less likely to report current smoking than men of the same age without impairments and disabilities (Annex Table 1 and Annex Table 2).

In contrast, when it comes to alcohol consumption, people with impairments and disabilities have healthier lifestyles (Figure 2 and Table 1): risky alcohol consumption is present in 8.6% of women and 15.3% of men with impairments and disabilities and in 14.8% of women and 18.6% of men without impairments and disabilities (Table 4). However, the age-stratified results suggest that lower alcohol consumption among people with impairments and disabilities emerges later in adulthood, among women 45 years of age and older and among men 65 years of age and older (Annex Table 1 and Annex Table 2).

#### Utilisation of health care services

At 98.2% and 95.7%, almost all women and men with impairments and disabilities, respectively, use outpatient

Table 5

Utilisation of outpatient medical services, inpatient services, and home care services among women and men with and without impairments and disabilities (n=1,406 women with/n=11,341 without impairments and disabilities, n=1,505 men with/n=9,120 without impairments and disabilities)  
Source: GEDA 2014/2015-EHIS

	Outpatient medical utilisation			Inpatient utilisation			Utilisation of home care services		
	%	(95% CI)	p-value*	%	(95% CI)	p-value*	%	(95% CI)	p-value*
<b>Women</b>									
With impairments and disabilities	98.2	(97.2–98.9)	<0.001	38.5	(35.6–41.4)	<0.001	15.0	(12.8–17.6)	<0.001
Without impairments and disabilities	89.9	(89.1–90.7)	Ref.	13.3	(12.5–14.1)	Ref.	2.0	(1.8–2.4)	Ref.
<b>Men</b>									
With impairments and disabilities	95.7	(94.2–96.9)	<0.001	36.9	(34.1–39.8)	<0.001	8.7	(7.1–10.6)	<0.001
Without impairments and disabilities	82.0	(81.0–83.1)	Ref.	11.8	(11.0–12.7)	Ref.	0.6	(0.4–0.8)	Ref.
<b>Total</b>									
With impairments and disabilities	97.0	(96.1–97.7)	<0.001	37.7	(35.6–39.8)	<0.001	11.8	(10.4–13.4)	<0.001
Without impairments and disabilities	86.1	(85.3–86.7)	Ref.	12.6	(12.0–13.1)	Ref.	1.3	(1.1–1.5)	Ref.

CI = confidence interval, Ref. = reference group

\* p-value from multivariate log-Poisson regressions

**In order to describe the health situation of people with impairments and disabilities and to determine the need for action in health policy, further data is essential.**

medical services in the twelve months prior to the survey. Among people without impairments and disabilities, utilisation is lower with 89.9% for women and 82.0% for men. There are also clear differences in the use of hospital treatment. At 38.5% for women and 36.6% for men, utilisation is more than twice as high among people with impairments and disabilities than among people without impairments and disabilities, at 13.3% and 11.8%, respectively (Table 5). Higher use of outpatient medical and inpatient services by people with impairments and disabilities is seen among women in all age groups, and among men only from early middle adulthood (30 years and older) (Annex Table 1 and Annex Table 2).

Home care services are also used much more by persons with impairments and disabilities (Figure 2 and Table 1). Moreover, there is a clear sex difference: 15.0% of women and 8.7% of men with impairments and disabilities use outpatient care, compared with only 2.0% of women and 0.6% of men without impairments and disabilities (Table 5). While higher use of outpatient caregivers is evident for men

in all age groups, this is true for women only from early middle adulthood (30 years and older) (Annex Table 1 and Annex Table 2).

#### 4. Discussion

People with impairments and disabilities perceive their health as significantly worse than people without impairments and disabilities. They also have poorer mental health, as shown by the higher prevalence of depressive symptoms. This leads to an increased need for medical care and is reflected in a higher utilisation of outpatient, inpatient and home care services. Overall, poorer health is seen in women than in men and with increasing age. The differences in health behaviour are less clear. Persons with impairments and disabilities are less likely to engage in aerobic physical activities than persons without impairments and disabilities; there are almost no differences in muscle-strengthening activities and in fruit and vegetable consumption. Smoking prevalences differ mainly in middle

and older age, with partly lower, partly higher values for people with impairments and disabilities. Risky alcohol consumption, on the other hand, is less frequent among persons with impairments and disabilities. In general, women are more health-conscious than men.

### Self-rated health and depressive symptoms

Significantly poorer health among people with impairments and disabilities can be deduced from many studies [34]. Regarding self-rated health, the GEDA data can be compared with the data of the SOEP, which were analysed for the Third Report on Participation (2021) [3], and of the Representative Survey on the Participation of People with Disabilities (participation survey) [35]. The differences in the concrete figures are mainly related to different survey instruments on subjective health and the different operationalisation of impairments and disabilities (see [3]). According to the SOEP data, 13% of people with impairments and 60% of people without impairments assessed their health as good or very good, i.e. less than in the GEDA study (21.5% and 76.0%). The SOEP analyses also show poorer subjective health among women than among men, but there was no clear increase in poorer health with age [3]. In the participation survey, not officially recognised but self-assessed disabilities were considered. According to the first results, 94% of the non-impaired, 73% of the impaired and 25% of the persons with self-assessed disability in private households rated their health as good or very good [35]. Whether impaired persons are considered self-assessed disabled depends on the severity of the impairment in combination with the severity of the limitation in everyday activities. The participation survey

also shows that subjective health was rated differently depending on the type of the most severe impairment: The proportion of those who rated their health as good or very good was highest for people with visual impairment (69%), addiction (64%) and hearing impairment (63%), and lowest for impairment due to pain (41%), emotional or psychological problems (39%) and moving (35%) [35].

Population-wide data on depressive symptoms among people with impairments and disabilities are only available for Germany from the GEDA study, which also serves as the data basis for the Third Report on Participation. High psychological stress among women with impairments and disabilities is shown in the study on [life situations of and pressures on disabled women in Germany](#) by the Federal Ministry for Family Affairs, Senior Citizens, Women and Youth [36]. Regional and international studies also show that people with disabilities are more frequently affected by mental health problems [37–39]. Overall, the number of people with mental impairments has increased in Germany [3, 8]. The fact that a high proportion of women with disabilities are affected by mental distress may also be related to discrimination and experiences of violence [9, 36].

The relationship between illness and disability is complex [34]. Many impairments and disabilities result from illnesses; conversely, when people with impairments become ill, they are often affected for longer. Impairments can also strongly influence perceptions of health status and also have an impact on mental health. The fact that people with impairments and disabilities show poorer health also results from the definition of impairments, which comprises ‘damage to body structures and functions’



(these also include mental functions) (Info box) [3]. This also applies to people with chronic diseases, which is reflected in the methodology of the present analyses.

### Health behaviour

There is data from the SOEP on the sporting activity of people with impairments and disabilities in Germany, which were analysed for the Third Report on Participation. There, too, it is shown that people with impairments and disabilities do less sport overall: 32% state that they actively do sport every week, compared to 48% of those without impairments. There are hardly any differences between women and men, older people do less sport than younger people [3]. These proportions are similar to those for endurance activities (at least 2.5 hours per week) in our analyses, although the difference in the indicators prevents direct comparisons. According to the data from the participation survey, 34% of impaired persons and 50% of persons with self-assessed disability rarely or never engage in sports, in contrast to 30% of non-impaired persons [35]. Reasons for the inactivity of people with impairments and disabilities can be that there are no inclusive offers or that sports facilities are not accessible. But the feeling of not being able to perform certain sporting activities or – in the case of physical impairments – facing health obstacles can also play a role [3, 40]. On the other hand, sporting activity for people with disabilities can increase mobility in everyday life and contribute to physical and mental well-being [41, 42]. The promotion of inclusive sport – both popular and competitive sport – is one of the goals of the Federal Government's National Action Plan to implement the UN Convention on the Rights of Persons with Disabilities (NAP 2.0) [43].

According to the available analyses, fruit and vegetables are consumed with similar frequency by people with and without impairments and disabilities; so far there is no data comparable to those reported here. In the Report on Participation, the proportion of respondents with an awareness of healthy eating is analysed with SOEP data [44]. Differences become apparent, especially among young men. 35% of 18- to 29-year-old men with impairments and 15% of those of the same age without impairments do not pay attention to health-conscious nutrition; among women and older men, however, the differences were small [3]. As with physical activity, fruit and vegetable consumption has health-promoting effects and may be reduced due to, for example, functional and mobility impairments that may make it difficult to access and prepare these foods [44].

The results reported here on smoking differ from the analyses of the SOEP data from 2018 presented in the Third Report on Participation: at around 23% for women and 30% for men, the prevalence there is seven to eight percentage points higher than in GEDA (16.0% and 22.1%, respectively). Analyses of SOEP data differentiated by age show significantly higher prevalence in people with disabilities up to the age of 65 years, with the prevalences levelling off at older ages. This trend can also be seen in the GEDA data. The differences could be related, for example, to the different operationalisation of impairments and disabilities, but also to differences in the survey methodology. A comparison of smoking prevalences in the general population shows that these are partly higher and partly lower in the RKI data than in the data from the SOEP [45]. Higher prevalence of tobacco consumption among people with impairments and disabilities are also reported in international studies [46, 47].



The fact that people with impairments and disabilities consume alcohol to a lesser extent than people without impairments and disabilities is also described in the Third Report on Participation, which uses the SOEP data from 2018. According to the report, 27% of people with impairments and 33% of people without impairments consumed alcohol on a weekly basis. 32% of people with and 18% of people without impairments and disabilities stated that no alcohol was consumed at all [3]. For the group of people with cognitive disabilities, studies show a lower prevalence of alcohol consumption, but those who do consume alcohol are at higher risk for alcohol abuse [48–51].

#### Health services utilisation

Due to their poorer health status on average, people with impairments and disabilities use health services to a greater extent than people without impairments and disabilities. This is not only evident with regard to the 12-month prevalence of the use of medical services, inpatient care or nursing care, but also when looking at contacts with doctors [3]. The Third Report on Participation states that a large proportion of medical practices are still not accessible [3]. Accessibility does not only mean that ground-level entrances, lifts or wheelchair-accessible practice rooms are available, but also includes, for example, flexible examination furniture, orientation aids for the visually impaired as well as accessible communication and information, for example in sign language or simple language [52–54]. Depending on the type of disability, different barriers play a role. A study on the use of health care by people with cognitive disabilities did not show a general underuse in the outpatient sector, but there was a less frequent use of cancer screening

examinations [55]. An analysis of the Swiss Health Survey of 2002 also found that persons with disabilities made more use of services and often use the services more intensively [56]. However, such utilisation data cannot be used to derive any statements on the quality and needs-based nature of care; this would require further – also qualitative – studies. The satisfaction of women with disabilities with their health care is addressed in the study on life situations of and pressures on disabled women in Germany: accordingly, 20% of women with disabilities living in households were rather dissatisfied to very dissatisfied with their health care [36]. The Participation Survey also showed gaps in care: people with self-assessed disabilities more often reported not having access to necessary counselling and treatment than people with and without impairments. This was most frequently the case for psychological or psychiatric counselling and treatment (8.9%), rehabilitation (7.2%) and psychiatric facilities (6.2%). Overall, 21.4% of people with self-assessed disabilities reported not having access to necessary counselling or treatment from at least one agency, and this was particularly common among women and among people with a migration background [3].

#### Strengths and limitations

GEDA 2014/2015-EHIS is a population-representative survey with a large number of participants. However, the method also has limitations that are particularly relevant for people with impairments and disabilities. Participation in surveys aimed at the general population can be difficult for people with disabilities, for example, if people with visual impairments cannot fill out the paper or online questionnaires used for the survey, or can do so only with difficulty.

This can result in under-representation and bias in the results due to selective non-participation (selection bias) [57]. Also, people who do not live in their own households or with their families, but in residential facilities or nursing homes, were not included in the survey. Furthermore, there are special limitations for individual indicators. For example, self-reported use of health care services can be associated with recall bias [58]; however, this applies more to the number of contacts than to whether doctors in private practice were used at all. Recall bias is also more likely if a longer period than the last twelve months is recorded [59]. Another limitation is the socially desirable response behaviour, which plays a role especially for indicators such as tobacco and alcohol consumption [26, 30]. Another limitation is the age of the data source (2014/2015). However, there is no recent data available in RKI health monitoring in which the presence of impairments and disabilities can be analysed in combination; the analyses showed that 2.6% of people without an officially recognised disability reported a severe and permanent illness-related limitation.

### Conclusion and outlook

Like other reports and studies, our results show the health inequality between people with and without impairments and disabilities. Women with impairments and disabilities are (partly) more affected by health disadvantages than men. The Third Report on Participation points out that health and participation are closely linked and that special attention must be paid to persons with multiple disadvantages in the sense of intersecting forms of discrimination (intersectionality) [3]. Overall, the results presented here are only an initial overview. In order to be able to make more

detailed statements on individual groups of people with impairments, for example according to age, social situation and migration history, further and up-to-date data and analyses are necessary – also in view of the fact that people with impairments and disabilities are a very heterogeneous group, in different life situations and with different needs. This heterogeneity is taken into account, for example, in the participation survey, which was also designed in a participatory manner and provided for the involvement of the respondents [60]. It would be desirable to conduct such a survey also on health topics or to supplement health surveys with corresponding questions in order to obtain reliable data on the health situation of people with impairments and disabilities, also as a basis for (health) policy decisions. For example, important findings were obtained from the study on the living conditions of women with disabilities and impairments, for example on psychological stress, satisfaction with one's own health and health care or the use of medication [36]. There is a particular need for research in the field of prevention and health promotion [3, 61]. For less specific questions, data is also available in many epidemiological studies that could be analysed with regard to impairments and disabilities [5]. The UNCRPD requires partner states to collect data in order to develop and implement policies to implement the Convention (Article 31) [4].

Comparing our findings with the UNCRPD, further needs for action arise from a public health perspective. Article 25 states that persons with disabilities shall be provided with 'the same range, quality and standard of free or affordable health care and programmes as provided to other persons' and 'health services needed by persons with

disabilities specifically because of their disabilities' [4]. Equal participation in sports activities (Art. 30) is also contained in the UNCRPD [4]. It follows from this that – in addition to care aspects such as the accessibility of medical practices, more therapy offers for people with mental disorders and the adaptation of inpatient care to the needs of people with impairments and disabilities – targeted prevention and health promotion continue to be important goals. In the course of demographic change, the number of people with impairments and disabilities has increased in recent decades and this development will continue in the future [3, 8]. Therefore, the aspects mentioned are also important for future health care planning.

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#### Please cite this publication as

Prütz F, Krause L (2022)  
Health of people with impairments and disabilities in Germany –  
Selected indicators from GEDA 2014/2015-EHIS.  
J Health Monit 7(1): 26–47.  
DOI 10.25646/9752

The German version of the article is available at:  
[www.rki.de/journalhealthmonitoring](http://www.rki.de/journalhealthmonitoring)

#### Data protection and ethics

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 were 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.

#### Funding

GEDA 2014/2015-EHIS was funded by the Robert Koch Institute and the German Federal Ministry of Health.

#### Conflicts of interest

The authors declared no conflicts of interest.

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**Annex Table 1**  
**Health situation among women with and without impairments and disabilities by age (n=1,406 women with and n=11,341 without impairments and disabilities)**  
 Source: GEDA 2014/2015-EHIS

	18–29 years		30–44 years	
	With ID	Without ID	With ID	Without ID
<b>Self-rated health (very good or good)</b>				
% (95% CI)	20.5 (11.2–34.6)	82.9 (80.7–84.9)	23.2 (15.5–33.2)	83.2 (81.3–84.9)
p-value*	<0.001	Ref.	<0.001	Ref.
<b>Depressive symptoms (PHQ-8)</b>				
% (95% CI)	55.5 (39.8–70.0)	15.0 (13.2–17.1)	42.9 (32.3–54.1)	9.1 (7.8–10.5)
p-value*	<0.001	Ref.	<0.001	Ref.
<b>Aerobic physical activities (at least 2.5 hours per week)</b>				
% (95% CI)	23.9 (13.4–39.1)	46.1 (43.0–49.1)	32.7 (23.6–43.3)	39.3 (37.1–41.6)
p-value*	0.003	Ref.	0.358	Ref.
<b>Muscle-strengthening activities (at least 2 days per week)</b>				
% (95% CI)	28.3 (17.2–43.0)	34.6 (32.1–37.2)	24.5 (16.1–35.5)	21.2 (19.5–23.0)
p-value*	0.640	Ref.	0.351	Ref.
<b>Fruit consumption (daily or several times daily)</b>				
% (95% CI)	33.6 (21.1–49.0)	38.3 (35.7–41.1)	46.4 (35.9–57.2)	44.5 (42.2–46.9)
p-value*	0.758	Ref.	0.314	Ref.
<b>Vegetable consumption (daily or several times daily)</b>				
% (95% CI)	33.1 (21.1–47.8)	31.9 (29.5–34.3)	35.8 (25.8–47.3)	38.6 (36.2–41.1)
p-value*	0.668	Ref.	0.942	Ref.
<b>Tobacco use (daily or occasionally)</b>				
% (95% CI)	17.8 (8.6–33.3)	28.4 (26.1–30.8)	40.5 (29.4–52.6)	26.2 (24.1–28.4)
p-value*	0.112	Ref.	0.047	Ref.
<b>Alcohol consumption (risky consumption)</b>				
% (95% CI)	4.6 (1.6–12.6)	13.2 (11.5–15.2)	10.9 (5.7–19.8)	11.1 (9.5–12.9)
p-value*	0.063	Ref.	0.764	Ref.
<b>Outpatient medical utilisation</b>				
% (95% CI)	100.0	90.1 (88.3–91.6)	99.6 (97.5–99.9)	87.4 (85.7–88.9)
p-value*	<0.001	Ref.	<0.001	Ref.
<b>Inpatient utilisation</b>				
% (95% CI)	34.0 (21.6–49.1)	14.3 (12.3–16.6)	32.5 (23.2–43.3)	10.3 (9.0–11.9)
p-value*	0.004	Ref.	<0.001	Ref.
<b>Home care utilisation</b>				
% (95% CI)	2.6 (0.4–13.9)	2.3 (1.6–3.4)	7.8 (3.9–14.9)	3.5 (2.8–4.2)
p-value*	0.926	Ref.	0.023	Ref.

With ID=with impairments and disabilities, without ID=without impairments and disabilities, CI=Confidence interval, Ref.=Reference group,

PHQ-8=8-Item Patient Health Questionnaire

\* p-value from multivariate log-Poisson regressions

Continued on next page



**Annex Table 1 Continued**  
**Health situation among women with and without impairments and disabilities by age (n=1,406 women with and n=11,341 without impairments and disabilities)**  
 Source: GEDA 2014/2015-EHIS

	45–64 years		≥65 years	
	With ID	Without ID	With ID	Without ID
<b>Self-rated health (very good or good)</b>				
% (95% CI)	21.9 (17.8–26.6)	74.5 (72.9–76.1)	16.1 (12.9–19.8)	57.5 (54.4–60.5)
p-value*	<0.001	Ref.	<0.001	Ref.
<b>Depressive symptoms (PHQ-8)</b>				
% (95% CI)	36.1 (31.4–41.0)	8.3 (7.3–9.4)	24.7 (21.0–28.8)	3.1 (2.2–4.2)
p-value*	<0.001	Ref.	<0.001	Ref.
<b>Aerobic physical activities (at least 2.5 hours per week)</b>				
% (95% CI)	41.0 (35.9–46.3)	49.0 (47.2–50.9)	20.4 (16.7–24.7)	42.2 (39.1–45.5)
p-value*	0.075	Ref.	<0.001	Ref.
<b>Muscle-strengthening activities (at least 2 days per week)</b>				
% (95% CI)	30.0 (25.4–35.1)	29.2 (27.6–30.8)	20.3 (16.7–24.3)	28.4 (26.1–30.7)
p-value*	0.311	Ref.	0.003	Ref.
<b>Fruit consumption (daily or several times daily)</b>				
% (95% CI)	51.3 (46.5–56.1)	53.8 (51.9–55.7)	68.6 (63.6–73.2)	74.6 (72.1–76.9)
p-value*	0.661	Ref.	0.057	Ref.
<b>Vegetable consumption (daily or several times daily)</b>				
% (95% CI)	40.8 (36.2–45.6)	39.6 (37.8–41.5)	43.2 (39.2–47.3)	50.6 (47.8–53.5)
p-value*	0.139	Ref.	0.009	Ref.
<b>Tobacco use (daily or occasionally)</b>				
% (95% CI)	26.1 (21.6–31.1)	23.7 (22.3–25.2)	6.2 (4.4–8.5)	6.8 (5.7–8.1)
p-value*	0.856	Ref.	0.892	Ref.
<b>Alcohol consumption (risky consumption)</b>				
% (95% CI)	9.2 (6.8–12.4)	18.6 (17.1–20.1)	8.3 (5.9–11.4)	14.2 (12.4–16.3)
p-value*	<0.001	Ref.	0.006	Ref.
<b>Outpatient medical utilisation</b>				
% (95% CI)	97.5 (95.2–98.7)	89.8 (88.6–90.8)	98.4 (96.8–99.2)	92.9 (91.3–94.2)
p-value*	<0.001	Ref.	<0.001	Ref.
<b>Inpatient utilisation</b>				
% (95% CI)	35.9 (31.3–40.8)	11.0 (9.9–12.2)	41.2 (37.1–45.4)	19.7 (17.4–22.2)
p-value*	<0.001	Ref.	<0.001	Ref.
<b>Home care utilisation</b>				
% (95% CI)	6.2 (4.2–8.9)	0.5 (0.3–0.9)	22.6 (19.0–26.5)	2.8 (2.0–3.8)
p-value*	<0.001	Ref.	<0.001	Ref.

With ID=with impairments and disabilities, without ID=without impairments and disabilities, CI=Confidence interval, Ref.=Reference group,

PHQ-8=8-Item Patient Health Questionnaire

\* p-value from multivariate log-Poisson regressions

**Annex Table 2**  
**Health status among men with and without**  
**impairments and disabilities (n=1,505 men**  
**with and n=9,120 persons without**  
**impairments and disabilities)**  
 Source: GEDA 2014/2015-EHIS

	18–29 years		30–44 years	
	With ID	Without ID	With ID	Without ID
<b>Self-rated health (very good or good)</b>				
% (95% CI)	46.0 (30.1–62.7)	91.2 (89.2–92.8)	33.8 (23.5–46.0)	83.6 (81.4–85.5)
p-value*	<0.001	Ref.	<0.001	Ref.
<b>Depressive symptoms (PHQ-8)</b>				
% (95% CI)	34.2 (19.8–52.2)	8.6 (6.8–10.7)	40.1 (28.4–53.1)	7.8 (6.4–9.5)
p-value*	<0.001	Ref.	<0.001	Ref.
<b>Aerobic physical activities (at least 2.5 hours per week)</b>				
% (95% CI)	44.1 (28.0–61.6)	57.0 (53.8–60.1)	32.4 (21.2–46.0)	54.5 (51.7–57.2)
p-value*	0.270	Ref.	0.121	Ref.
<b>Muscle-strengthening activities (at least 2 days per week)</b>				
% (95% CI)	36.1 (21.4–53.8)	43.9 (41.1–46.8)	23.5 (14.5–35.9)	28.9 (26.7–31.3)
p-value*	0.422	Ref.	0.613	Ref.
<b>Fruit consumption (daily or several times daily)</b>				
% (95% CI)	36.0 (21.6–53.5)	25.2 (22.5–28.1)	33.0 (22.3–45.9)	28.2 (25.9–30.6)
p-value*	0.139	Ref.	0.296	Ref.
<b>Vegetable consumption (daily or several times daily)</b>				
% (95% CI)	29.1 (17.0–45.1)	19.7 (17.4–22.2)	19.8 (12.1–30.6)	19.1 (17.1–21.2)
p-value*	0.172	Ref.	0.803	Ref.
<b>Tobacco use (daily or occasionally)</b>				
% (95% CI)	20.7 (10.5–36.6)	35.1 (32.0–38.4)	46.7 (35.8–57.9)	34.9 (32.4–37.6)
p-value*	0.065	Ref.	0.204	Ref.
<b>Alcohol consumption (risky consumption)</b>				
% (95% CI)	9.3 (3.2–24.2)	17.6 (15.5–19.9)	11.4 (5.7–21.3)	13.7 (12.0–15.7)
p-value*	0.232	Ref.	0.485	Ref.
<b>Outpatient medical utilisation</b>				
% (95% CI)	83.8 (66.7–93.0)	77.9 (75.2–80.4)	92.8 (83.6–97.0)	77.0 (74.6–79.3)
p-value*	0.330	Ref.	<0.001	Ref.
<b>Inpatient utilisation</b>				
% (95% CI)	17.5 (8.0–34.2)	8.2 (6.6–10.2)	37.3 (26.1–50.0)	8.2 (6.8–9.8)
p-value*	0.078	Ref.	<0.001	Ref.
<b>Home care utilisation</b>				
% (95% CI)	26.5 (13.6–45.2)	0.1 (0.0–0.4)	11.0 (4.8–23.1)	0.4 (0.2–1.0)
p-value*	<0.001	Ref.	<0.001	Ref.

With ID=with impairments and disabilities, without ID=without impairments and disabilities, CI=Confidence interval, Ref.=Reference group,

PHQ-8=8-Item Patient Health Questionnaire

\* p-value from multivariate log-Poisson regressions

*Continued on next page*

**Annex Table 2 Continued**  
**Health status among men with and without**  
**impairments and disabilities (n=1,505 men**  
**with and n=9,120 persons without**  
**impairments and disabilities)**  
 Source: GEDA 2014/2015-EHIS

	45–64 years		≥65 years	
	With ID	Without ID	With ID	Without ID
<b>Self-rated health (very good or good)</b>				
% (95% CI)	23.1 (19.4–27.1)	73.3 (71.4–75.1)	21.1 (17.9–24.9)	62.3 (59.4–65.1)
p-value*	<0.001	Ref.	<0.001	Ref.
<b>Depressive symptoms (PHQ-8)</b>				
% (95% CI)	28.7 (24.0–34.0)	6.3 (5.4–7.3)	14.3 (11.4–17.6)	1.7 (1.2–2.5)
p-value*	<0.001	Ref.	<0.001	Ref.
<b>Aerobic physical activities (at least 2.5 hours per week)</b>				
% (95% CI)	37.0 (32.0–42.3)	47.2 (45.1–49.3)	38.4 (34.3–42.7)	52.5 (49.5–55.5)
p-value*	0.017	Ref.	<0.001	Ref.
<b>Muscle-strengthening activities (at least 2 days per week)</b>				
% (95% CI)	28.8 (24.2–33.9)	26.0 (24.4–27.7)	30.7 (27.0–34.6)	32.8 (30.4–35.4)
p-value*	0.070	Ref.	0.557	Ref.
<b>Fruit consumption (daily or several times daily)</b>				
% (95% CI)	32.5 (27.9–37.3)	37.0 (34.9–39.3)	62.8 (58.5–66.8)	60.9 (58.3–63.5)
p-value*	0.105	Ref.	0.388	Ref.
<b>Vegetable consumption (daily or several times daily)</b>				
% (95% CI)	19.5 (15.9–23.7)	21.9 (20.4–23.6)	37.9 (33.7–42.2)	35.2 (32.4–38.0)
p-value*	0.730	Ref.	0.301	Ref.
<b>Tobacco use (daily or occasionally)</b>				
% (95% CI)	35.1 (30.5–40.1)	26.9 (25.2–28.7)	7.4 (5.7–9.7)	10.1 (8.6–11.7)
p-value*	0.041	Ref.	0.030	Ref.
<b>Alcohol consumption (risky consumption)</b>				
% (95% CI)	18.4 (14.8–22.6)	22.1 (20.5–23.9)	13.9 (11.3–17.1)	19.3 (17.3–21.5)
p-value*	0.143	Ref.	0.048	Ref.
<b>Outpatient medical utilisation</b>				
% (95% CI)	96.3 (93.5–98.0)	83.1 (81.5–84.6)	96.9 (95.1–98.1)	91.9 (90.2–93.2)
p-value*	<0.001	Ref.	<0.001	Ref.
<b>Inpatient utilisation</b>				
% (95% CI)	37.5 (32.9–42.3)	12.1 (10.9–13.5)	38.3 (34.1–42.7)	20.4 (18.2–22.8)
p-value*	<0.001	Ref.	<0.001	Ref.
<b>Home care utilisation</b>				
% (95% CI)	3.8 (2.3–6.2)	0.4 (0.2–0.8)	10.5 (8.3–13.2)	1.6 (1.0–2.7)
p-value*	<0.001	Ref.	<0.001	Ref.

With ID=with impairments and disabilities, without ID=without impairments and disabilities, CI=Confidence interval, Ref.=Reference group,

PHQ-8=8-Item Patient Health Questionnaire

\* p-value from multivariate log-Poisson regressions

## Imprint

### Journal of Health Monitoring

#### Publisher

Robert Koch Institute  
Nordufer 20  
13353 Berlin, Germany

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[www.rki.de/journalhealthmonitoring-en](http://www.rki.de/journalhealthmonitoring-en)

#### Typesetting

Kerstin Möllerke, Alexander Krönke

#### Translation

intellitext SprachenService

ISSN 2511-2708

#### Note

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



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

Journal of Health Monitoring · 2022 7(1)  
DOI 10.25646/9565  
Robert Koch Institute, Berlin

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Submitted: 08.10.2021

Accepted: 17.02.2022

Published: 30.03.2022

# Toothache, tooth brushing frequency and dental check-ups in children and adolescents with and without disabilities

## Abstract

According to international studies, children and adolescents with disabilities have more tooth decay, brush their teeth less often twice a day and use preventive dental services less often than children and adolescents without disabilities. With data from the second follow-up to the German Health Interview and Examination Survey for Children and Adolescents (KiGGS Wave 2, 2014–2017), toothache, tooth brushing frequency and dental check-ups are examined in children and adolescents with and without disabilities. It was found that children and adolescents with disabilities had more toothache in the three months before the survey (23.5% and 15.9%, respectively) and brushed or got their teeth brushed twice a day less often (33.5% and 22.2%, respectively) than children and adolescents without disabilities. Differences in the utilisation of dental check-ups could not be determined. Overall, the results point to the importance of measures to promote tooth brushing frequency in order to improve the oral health of children and adolescents with disabilities. In addition, further opportunities should be created to collect data on the oral health of people with disabilities at the population level in health or participation studies.

🔍 ORAL HEALTH · DENTAL HEALTH · UTILISATION · DISABILITIES · KIGGS

## 1. Introduction

Oral health is a central component of general health and of great importance for well-being and quality of life [1]. Nationwide and population-representative data on oral health are available from the Fifth German Oral Health Study (DMS V), which was conducted by the Institute of German Dentists (IDZ) between 2013 and 2014 [2]. The data show that in 12-year-old adolescents, caries experience on permanent teeth has declined sharply in recent decades due to dental prophylaxis and good dental care. The data of the epidemiological accompanying studies on group

prophylaxis, which are collected by the German Association for Youth Dental Care (DAJ), support this finding, but also show that caries experience in the primary dentition is still frequent among 3-year-olds in day-care centres and 6-to 7-year-olds in the first grade of school (13.7% and 43.6%, respectively) [3]. The highest caries prevalence is found in all age groups among children and adolescents from families in the low socioeconomic status group [2–4].

The presence of a disability can have a negative impact on oral health. For example, mental and psychological disabilities, but also some physical disabilities (e.g. hands or arms) and sensory impairments (e.g. visual impairments,

## KiGGS Wave 2

Second follow-up to the German Health Interview and Examination Survey for Children and Adolescents

**Data owner:** Robert Koch Institute

**Aim:** Providing reliable information on health status, health-related behaviour, living conditions, protective and risk factors, and health care among children, adolescents and young adults living in Germany, with the possibility of trend and longitudinal analyses

**Study design:** Combined cross-sectional and cohort study

### Cross-sectional study in KiGGS Wave 2

**Age range:** 0–17 years

**Population:** Children and adolescents with permanent residence in Germany

**Sampling:** Samples from official residency registries - randomly selected children and adolescents from the 167 cities and municipalities covered by the KiGGS baseline study

**Sample size:** 15,023 participants

### KiGGS cohort study in KiGGS Wave 2

**Age range:** 10–31 years

**Sampling:** Re-invitation of everyone who took part in the KiGGS baseline study and who was willing to participate in a follow-up

**Sample size:** 10,853 participants

### KiGGS survey waves

- ▶ KiGGS baseline study (2003–2006), examination and interview survey
- ▶ KiGGS Wave 1 (2009–2012), interview survey
- ▶ KiGGS Wave 2 (2014–2017), examination and interview survey

More information is available at [www.kiggs-studie.de/english](http://www.kiggs-studie.de/english)

hearing impairments) can be associated with poorer oral health [5]. Overall, there are very few studies on the oral health of children and adolescents with disabilities in Germany [5]. A few studies have examined the oral health of children and adolescents with disabilities in comparison to children and adolescents without disabilities [6–8]. The results indicate that, on average, children and adolescents with disabilities have a (significantly) higher caries experience than children and adolescents without disabilities [6–8]. Furthermore, isolated studies have examined the oral health of children and adolescents with disabilities without making a comparison to children and adolescents without disabilities [9–11]. According to the results, children and adolescents with intellectual and mental disabilities have significantly higher caries experience than children and adolescents with physical disabilities [9–11]. In this respect, the oral health of children and adolescents with disabilities varies depending on the type and severity of the disability [12].

In order to prevent caries, in addition to a tooth-healthy diet and the use of fluorides (e.g. fluoride toothpaste for brushing teeth, fluoridated salt for meal preparation), appropriate dental care and regular dental check-ups are essential [13, 14]. In addition to frequency (at least twice a day), the duration of tooth brushing also plays a role in dental care; at least two minutes are recommended here, regardless of the type of toothbrush [14]. In the second follow-up to the German Health Interview and Examination Survey for Children and Adolescents (KiGGS Wave 2, 2014–2017), data was collected on the frequency of tooth brushing and the utilisation of dental check-ups [15]. The analyses to date show that 22.3% of children and adolescents aged

0 to 17 years brush or get their teeth brushed less frequently than twice a day, and 19.7% present themselves for check-ups at a dental practice less frequently than twice a year. In families with low socioeconomic status, the figures are 40.3% (twice-daily tooth brushing) and 31.8% (twice-yearly dental check-ups) [15]. Whether children and adolescents with and without disabilities differ in their oral health behaviour has been rarely studied and only internationally [16, 17]. The studies provide evidence that children and adolescents with disabilities have less favourable oral health behaviour than children and adolescents without disabilities.

Against this background, this article describes the occurrence of toothache, the frequency of tooth brushing and the utilisation of dental check-ups in 3- to 17-year-old children and adolescents with and without officially recognised disability (in the following children and adolescents with and without disabilities, [Info box 1](#)) on the basis of data from KiGGS Wave 2 (2014–2017). Statements on the presence of caries cannot be made because no dental examination took place in KiGGS Wave 2. The indicator on toothache [18] is used as an indication of caries.

## 2. Methodology

### 2.1 Sample design and study conduct

KiGGS is part of the health monitoring system of the Robert Koch Institute (RKI) [23]. The KiGGS baseline study (2003–2006) provided population-based, nationally representative results on the health situation of 0- to 17-year-old children and adolescents in Germany for the first time. With KiGGS Wave 2 (2014–2017), a good ten years later, the most

### Info box 1 Children and adolescents with disabilities

'People with disabilities are hindered in activities of daily living and/or equal participation by interactions of their own impairments and accessibility in the environment' [19]. People with a recognised disability are 'all persons whose disability has been determined or recognised by a competent office' [19]. This includes the awarding of a severity grade of disability (GdB). The GdB can be between 20 and 100, whereby a GdB  $\geq 50$  is classified as severe disability.

According to the microcensus, 216,000 children and adolescents under 18 years of age with an officially recognised disability lived in private households in 2019 [20]. This corresponds to a share of 1.6% of all under 18-year-olds in Germany. According to the statistics on severe disabilities, 194,213 children and adolescents under the age of 18 had an officially recognised severe disability [21]. About three quarters of these were caused by illness (77.3%), almost one fifth were congenitally disabled (18.7%) and 4% had other causes (including accidents) [21]. The most common forms of severe disability among under 18-year-olds in 2019 were mental disabilities/learning disabilities (68,041), followed by physical disabilities (54,864). Speech and language disorders, deafness, hearing loss and balance disorders ranked third (8,569), mental disabilities fourth (6,843) and blindness and visual impairments fifth (5,041) [22], own calculations).

up-to-date data is available. Those to be invited were randomly drawn from the population registers in 167 cities and communities that were representative of Germany and had already been selected for the baseline study. A variety of measures were used to achieve a high number of participants as well as a sample that corresponds as closely as possible to the composition of the population [24]. A total of 15,023 children and adolescents participated in KiGGS Wave 2 (response: 40.1%). The concept and design of the study are described in detail elsewhere (see also [Info box on KiGGS Wave 2](#)) [24, 25].

## 2.2 Description of the indicators

Information on the indicators used here was collected in a questionnaire to be completed in writing. The question on the existence of an officially recognised disability was only asked of the parents or guardians. The questions on toothache, tooth brushing frequency and utilisation of dental check-ups were answered by the guardians for up to 10-year-olds, while 11- to 17-year-olds provided information themselves. For 11- to 17-year-olds with an officially recognised disability, the answers were given by the guardians. Since the question on dental pain was not asked of the guardians of children between 0 and 2 years, the data basis in this article refers to the age group of 3 years and older.

The question on the existence of an officially recognised disability was: 'Does your child have a disability officially recognised by the pension office? The possible answers were 'yes' and 'no'. Regarding pain, the question was: 'Has your child/have you had the following pain in the last 3 months?'

'Tooth' could be ticked in a list of given locations [26]. The three-point response scale was divided into 'yes, once/yes, repeatedly' and 'no' for the analyses. The question on tooth brushing frequency was: 'How often are your child's teeth brushed or how often does your child brush his/her teeth?' or 'How often do you brush your teeth?' Response options were 'twice a day or more often', 'once a day', 'several times a week', 'once a week or less often' and 'not at all' (multiple responses were not possible). For the analyses, the answer option 'twice a day or more often' was compared to the other categories [15]. Regarding the use of dental check-ups, the question was: 'At what intervals does your child go to the dentist for a check-up?' or 'At what intervals do you go to the dentist for a check-up?' Response options were 'quarterly', 'every six months', 'once a year', 'less often' and 'I have never been to the dentist'. For the analyses, the response categories were combined into 'quarterly/semi-annually' versus the other options [15].

## 2.3 Statistical analysis

The analyses are based on data from 13,308 children and adolescents aged 3 to 17 years with a valid response to the question about an officially recognised disability (yes/no). [Table 1](#) shows the distribution of the sample based on important sociodemographic characteristics. Since in KiGGS Wave 2 a disability was only indicated for 261 children and adolescents ( $n=47$  participants with a degree of disability (GdB)  $<50$ ;  $n=177$  with a GdB  $\geq 50$ ;  $n=37$  missing information on GdB), no stratifications by degree and form of disability or other characteristics such as sex and age are possible.



**Info box 2****Socioeconomic status of the family**

In KiGGS, the socioeconomic status of the family is determined on the basis of information provided by the parents on their school education and professional qualifications, their professional position and the needs-weighted net household income. Based on an index formed as a sum of point scores, in which the three indicators are included with equal weighting, a distribution-based delimitation of three groups is carried out, according to which 20% of children and adolescents are to be assigned to the low (first quintile), 60% to the middle (second – fourth quintile) and 20% to the high socioeconomic status group (fifth quintile) [29].

**Table 1**

**Sample description (n=261 children and adolescents with disabilities, n=13,047 children and adolescents without disabilities)**

Source: KiGGS Wave 2 (2014–2017)

Prevalence and univariate and multivariate prevalence ratios (PR) with 95% confidence intervals were calculated from log-Poisson regressions, with the presence of a disability as the dependent outcome variable. The multivariate regression analyses for toothache, tooth brushing frequency and utilisation of dental check-ups were adjusted for sex, age and family socioeconomic status (Info box 2). Due to the strong association between oral health and the presence of a disability [5] on the one hand and the social

	Number of cases (n)	Unweighted sample (%)	Weighted sample (%)
<b>Children and adolescents with disabilities</b>			
<b>Sex</b>			
Girls	125	47.9	46.9
Boys	136	52.1	53.1
<b>Age group*</b>			
3–10 years	121	46.4	49.9
11–17 years	140	53.6	50.1
<b>Socioeconomic status</b>			
Low	54	21.3	30.9
Medium	150	59.1	57.5
High	50	19.7	11.6
<b>Children and adolescents without disabilities</b>			
<b>Sex</b>			
Girls	6,555	50.2	48.5
Boys	6,492	49.8	51.5
<b>Age group*</b>			
3–10 years	6,753	51.8	51.5
11–17 years	6,294	48.2	48.5
<b>Socioeconomic status</b>			
Low	1,595	12.3	19.8
Medium	8,030	61.9	60.6
High	3,354	25.8	19.6

\* The mean age for children and adolescents with disabilities is 10.4 years (95% CI 9.7–11.2), for children and adolescents without disabilities 10.2 years (95% CI 10.1–10.3)

situation [27] on the other hand, an interaction between disability and socioeconomic status was taken into account in the multivariate regression analyses in a further step. Furthermore, in the multivariate regression model for toothache, the frequency of tooth brushing and the utilisation of dental check-ups were additionally controlled for. A statistically significant difference between children and adolescents with and without disabilities is assumed if the p-value is smaller than 0.05.

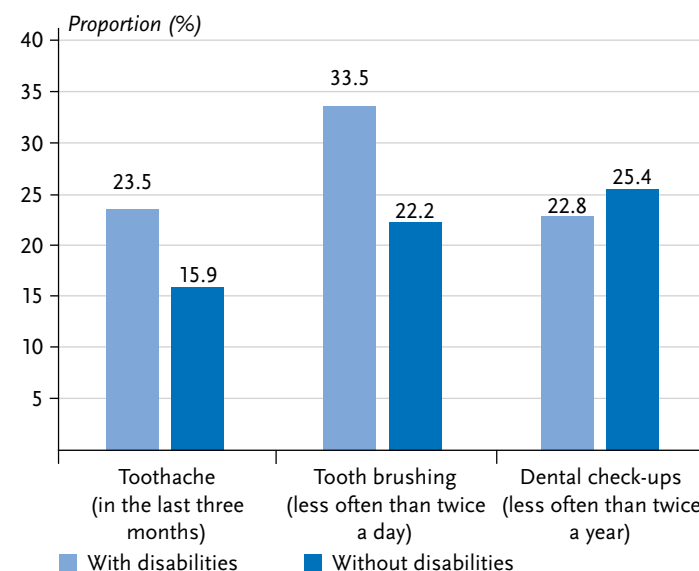
All analyses were conducted using the survey procedures of Stata 17.0 (Stata Corp., College Station, TX, USA, 2015) in order to take the cluster design of KiGGS and the weighting appropriately into account when calculating confidence intervals and p-values. The analyses were calculated with a weighting factor that corrects for deviations of the sample from the population structure with regard to regional structure (city/rural), age (in years), sex, federal state (as of 31.12.2015), German citizenship (as of 31.12.2014) and parental education (Microcensus 2013 [28]).

**3. Results**

Figure 1 shows that 3- to 17-year-old children and adolescents with disabilities were affected by single or recurrent toothache more frequently in the three months prior to the survey than their peers without disabilities (23.5% and 15.9%, respectively). They were also less likely to brush their teeth twice a day (by themselves or a caregiver) (33.5% and 22.2%, respectively). There were no differences between children and adolescents with and without disabilities in the utilisation of dental check-ups (22.8% and 25.4%, respectively). The differences between children and

**Figure 1**

**Toothache (once/repeated), tooth brushing frequency and utilisation of dental check-ups in 3- to 17-year-olds (n=261 children and adolescents with disabilities, n=13,047 children and adolescents without disabilities)**  
Source: KiGGS Wave 2 (2014–2017)



adolescents with and without disabilities in the occurrence of toothache and in tooth brushing frequency are statistically significant, as shown by univariate log-Poisson regression models (toothache: univariate PR 1.5,  $p=0.023$ ; tooth brushing frequency: univariate PR 1.5,  $p=0.005$ ; data not shown).

The association between tooth brushing frequency and the presence of a disability remained after controlling for age, sex and socioeconomic status of the family in the multivariate log-Poisson model (multivariate PR 1.3,  $p=0.020$ ). If an interaction between disability and socioeconomic status was additionally considered in this model, it was shown that it was especially children and adolescents with disabilities from families in the low socioeconomic status group for whom twice-daily toothbrushing occurred less frequently (multivariate PR 4.3;  $p=0.028$ ; data not shown).

The association between toothache and disability was no longer significant after statistically controlling for all characteristics (multivariate PR 1.4;  $p=0.070$ ; data not shown). If, in addition to age, sex and socioeconomic status, tooth brushing frequency and the utilisation of dental check-ups were included in the multivariate model for toothache, it was shown that in particular too little tooth brushing frequency (less than twice a day) and a low socioeconomic status of the family explained the occurrence of toothache in children and adolescents (multivariate PR  $<0.001$  each; Table 2).

**Table 2**

**Toothache in the last three months (once/repeated) according to sociodemographic and dental factors in 3- to 17-year-olds (n=261 children and adolescents with disabilities, n=13,047 children and adolescents without disabilities)**  
Source: KiGGS Wave 2 (2014–2017)

	Prevalence Ratio* (95% CI)	p-value
<b>Disability</b>		
No	Ref.	–
Yes	1.4 (0.9–2.0)	0.102
<b>Age group</b>		
3–10 years	Ref.	–
11–17 years	1.1 (1.0–1.3)	0.036
<b>Sex</b>		
Girls	Ref.	–
Boys	0.9 (0.8–1.0)	0.016
<b>Socioeconomic status</b>		
Low	1.5 (1.3–1.8)	$<0.001$
Medium	1.0 (0.9–1.2)	0.526
High	Ref.	–
<b>Tooth brushing (twice daily)</b>		
Yes	Ref.	–
No	1.3 (1.2–1.6)	$<0.001$
<b>Dental check-ups (twice yearly)</b>		
Yes	Ref.	–
No	0.9 (0.7–1.0)	0.031

CI = Confidence interval, Ref. = Reference group

\* Results from multivariate log-Poisson regressions

**Children and adolescents with disabilities were affected by single or recurrent toothache more frequently than children and adolescents without disabilities.**

**Compared to children and adolescents without disabilities, children and adolescents with disabilities had a lower daily frequency of tooth brushing.**

#### 4. Discussion

The aim of this study was to identify possible differences in the occurrence of toothache, in the frequency of tooth brushing and in the utilisation of dental check-ups between children and adolescents with and without disabilities based on data from a representative sample for Germany.

Children and adolescents with disabilities were affected by single or recurrent toothache more frequently in the last three months than children and adolescents without disabilities. This result is in line with international studies [30, 31]. A very common cause of toothache is caries [18]. Thus, the higher caries experience among children and adolescents with disabilities described in the literature also fits our finding [6, 7]. However, toothache cannot only be equated with a manifest (i.e. untreated) caries, as it can also occur, for example, with teeth that have already been treated, with eruption disorders in the wisdom tooth region and, under certain circumstances, during the change of teeth. In addition, caries that has been present for a long time can also be associated with reduced pain sensitivity. In the multivariate model on toothache, it was shown that there is no direct correlation between toothache and disability in childhood and adolescence, but that this is primarily mediated by an insufficient frequency of tooth brushing (less frequently than twice a day) and a low socioeconomic status of the family. In this context, studies should be considered that provide evidence that persons with a low socioeconomic status compared to persons with a high socioeconomic status may have a higher perception of pain and a lower individual pain threshold [32], which may be related to a lack of coping strategies and a low self-efficacy

experience [33]. This could possibly also play a role in people with certain disabilities.

A direct correlation was shown between tooth brushing frequency and the presence of a disability: twice-daily tooth brushing occurred less frequently among children and adolescents with disabilities; this is particularly true for children and adolescents with disabilities from families in the low socioeconomic status group. To the authors' knowledge, there are only a few studies that have investigated the tooth brushing frequency of children and adolescents with disabilities compared to children and adolescents without disabilities. A Dutch study [16] found that 16- to 18-year-olds with mild mental retardation and learning disabilities in special schools hardly differed from 17-year-olds in the general population in terms of tooth brushing frequency (75% and 76%, respectively). The reason discussed was whether social desirability might have played a greater role in the response behaviour of adolescents with mild mental retardation and learning disabilities than for adolescents from the general population [16] (for social desirability bias in tooth brushing frequency, see e.g. [34]). Despite brushing their teeth with equal frequency, the adolescents with mild intellectual disability and learning disability had poorer oral health status, which may indicate lower motor skills to perform tooth brushing (i.e. although teeth were brushed twice a day, bacterial plaque was not adequately removed) [16]; in particular, deficits in hand dexterity in children and adolescents with mild intellectual disability and learning disability are described in the literature [35]. A Saudi Arabian study [17] points in a similar direction as the KiGGS study – taking into account socio-cultural differences in oral health behaviour [36] – accord-

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**There were no differences between children and adolescents with and without disabilities in the utilisation of dental check-ups.**

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ing to which 6- to 12-year-old girls with visual impairments at special schools were less likely to report brushing their teeth daily than girls without visual impairments at primary schools (78.5% and 90.4%, respectively). Furthermore, isolated studies have examined the oral health of children and adolescents with disabilities without making a comparison to children and adolescents without disabilities [37–41]. These studies consistently show that the majority of children and adolescents with disabilities brush or get their teeth brushed less frequently than twice a day. Reasons for the lower frequency of tooth brushing among children and adolescents with disabilities may include limited communication and cooperation skills in oral hygiene, in addition to the already mentioned lower mental and/or motor skills to perform tooth brushing [42]. Pathological biting reflexes and head movements, which affect some children and adolescents with specific disabilities, can also make brushing teeth difficult. Further barriers on the part of the parents may be low oral health awareness or a high physical and psychological burden of daily care [42].

About a quarter of children and adolescents with and without disabilities have attended less than two dental check-ups within one year. This means that about three quarters (77.2% of children and adolescents with and 74.6% of those without disabilities) have presented themselves to the dental practice for a check-up at least twice a year. In Germany, children and adolescents with an increased caries risk can even make utilisation of dental check-ups and preventive measures four times a year on the basis of the statutory health insurance (SHI). Looking at the proportion of children and adolescents who attended quarterly dental check-ups, there is a weak but statistically

significant difference in favour of children and adolescents with disabilities (18.4% and 12.0%, respectively; univariate PR 1.5,  $p=0.040$ ; multivariate PR 1.5,  $p=0.049$  (adjusted for age, sex and socioeconomic status); data from this sensitivity analysis are not shown). These findings are in contrast to the results of international studies: in the previously cited work from the Netherlands [16], the proportion of adolescents consulting a dentist twice a year among those with mild mental retardation and learning disabilities in special schools was only about half as high at 44% as among adolescents from the general population at 82%. In the study from Saudi Arabia [17], the proportion of 6- to 12-year-old girls who regularly visited a dental practice was more than 15 percentage points lower among those with visual impairments in special schools than among girls without visual impairments in primary schools (54.5% and 71.0%, respectively). Studies that have investigated dental utilisation exclusively among children and adolescents with disabilities at special schools uniformly point to a very low utilisation of preventive dental services by children and adolescents with disabilities [38–40]. However, international comparisons of the utilisation of health services are only of very limited value due to the different health and social systems. Reasons for lower dental utilisation by children and adolescents with disabilities may be, for example, a lack of wheelchair access to the dental practice or difficulties in finding a dental practice where children and adolescents with disabilities can be adequately cared for [42].

When surveying utilisation in population-based studies such as the RKI health surveys, it should be noted that certain groups of people, such as very ill or severely impaired people, are underrepresented in surveys [43]. It can be

assumed that something similar also applies to parents of children with disabilities. Therefore, the present results should be interpreted with caution. There may be differences in the utilisation of dental check-ups between children and adolescents with and without disabilities that could not be identified in this study. This assumption is supported by the results of a study which, based on billing data from the National Association of Statutory Health Insurance Dentists ((Kassenzahnärztliche Bundesvereinigung, KZBV), was able to show that individual prophylactic measures are carried out and billed less frequently for children and adolescents who have a care degree or receive integration assistance than for those without a care degree and without receiving integration assistance [44]. Differences in the occurrence of toothache and in tooth brushing frequency may also be underestimated due to the selectivity of the sample (see also [20]). Further limitations may be recall bias [45] or responses in terms of social desirability [34], which may be different for children and adolescents with and without disabilities. Furthermore, it should be noted that children and adolescents with disabilities are a heterogeneous group with very different health situations and needs, which could not be surveyed in detail in the KiGGS study.

### Conclusion and outlook

According to the results of KiGGS Wave 2, children and adolescents with disabilities had toothache more often than children and adolescents without disabilities. The relation between toothache and disability is mainly explained by a low socioeconomic status and a too low tooth brushing frequency: Children and adolescents with

disabilities brushed or got their teeth brushed less frequently than twice a day; this applies in particular to children and adolescents with disabilities from families in the low socioeconomic status group. To prevent caries, it is important that children and their parents are made aware at an early age to brush their teeth at least twice a day [46]. Special attention should be paid not only to families of the low socioeconomic status group [46], but also to children and adolescents with disabilities. Since children and adolescents with disabilities also generally brush their teeth less efficiently [47], measures to improve tooth brushing behaviour are of great importance. An international study was able to show that children and adolescents do not benefit equally from measures to improve tooth brushing behaviour, depending on the type of disability: Children and adolescents with intellectual disabilities did not show any improvement in tooth brushing behaviour in the context of an intervention, whereas children and adolescents with physical disabilities and sensory impairments did [48]. In this respect, interventions for more effective tooth brushing should be developed according to the type and severity of the disability [49]. Dentists play an important role in teaching tooth brushing, as they offer advice and instructions on oral hygiene as preventive services and the costs for these are also covered by the SHI in Germany. It is important to also address and improve the motor skills of children and adolescents with disabilities [35]. Close cooperation with parents and caregivers is essential, as the oral health of children and adolescents with disabilities is decisively influenced by their knowledge of effective oral hygiene [50].

According to the results from KiGGS Wave 2, children and adolescents with and without disabilities make utilisation of dental check-ups with equal frequency: Only about a quarter of them visited a dental practice for a check-up less frequently than twice a year. In view of the fact that children and adolescents with disabilities have an increased caries risk, it is necessary to consider how the dental care of this very heterogeneous patient group can be further improved. In addition to the accessibility of dental practices, the topic of care for people with disabilities must also be addressed in postgraduate dental training in order to ensure demand-oriented care [5, 42]. If access to dental care is limited for people with disabilities, outreach public dental health services can provide support [50]. Therefore, in addition to dental care, group prophylactic care in schools and inclusive institutions by community dental services is of great importance for the dental health equity of children and adolescents with disabilities.

The present results point to a need for further research on oral health and oral health behaviour of children and adolescents with disabilities in Germany, also against the background of the incomplete data situation. It would be conceivable to survey dental findings within the framework of health or participation studies, to survey disabilities in oral health studies or to design a separate study on the oral health of people with disabilities. In general, the presence of a disability should be taken into account in health studies, in addition to the usually used stratification characteristics such as age, sex and socioeconomic status of the family, if possible due to the number of cases [51].

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Krause L, Seeling S, Prütz F, Wager J (2022)

Toothache, tooth brushing frequency and dental check-ups  
in children and adolescents with and without disabilities.

J Health Monit 7(1):48–60.

DOI 10.25564/9565

The German version of the article is available at:

[www.rki.de/journalhealthmonitoring](http://www.rki.de/journalhealthmonitoring)

**Data protection and ethics**

KiGGS Wave 2 is subject to strict compliance with the data protection provisions set out in the Federal Data Protection Act (BDSG). Hannover Medical School's ethics committee assessed the ethics of the study and provided its approval (No. 2275-2014). 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. Informed consent was obtained in writing.

**Funding**

KiGGS is funded by the Federal Ministry of Health and the Robert Koch Institute.

**Conflicts of interest**

The authors declared no conflicts of interest.



### Acknowledgement

Foremost we would like to express our gratitude to both the participants and their parents. We would also like to thank everyone at the 167 study sites who provided us with space and active support on site. KiGGS Wave 2 could not have been conducted without the dedication of numerous colleagues at the Robert Koch Institute. We would especially like to thank the study teams for their excellent work and their exceptional commitment during the three-year data collection phase.

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## Imprint

### Journal of Health Monitoring

#### Publisher

Robert Koch Institute  
Nordufer 20  
13353 Berlin, Germany

#### Editors

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[www.rki.de/journalhealthmonitoring-en](http://www.rki.de/journalhealthmonitoring-en)

#### Typesetting

Kerstin Möllerke, Alexander Krönke

#### Translation

intellitext SprachenService

ISSN 2511-2708

#### Note

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