Journal of Health Monitoring

The World Health Organization's Health Behaviour in School-aged Children (HBSC) Study – Survey Results from Germany 2022 and Trends
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The World Health Organization’s Health Behaviour in School-aged Children (HBSC) Study – Survey Results from Germany 2022 and Trends

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Child and adolescent health – Resources and potential of the international ‘Health Behaviour in School-aged Children (HBSC)’ study

The initiation of the Health Behaviour in School-aged Children (HBSC) study in 1982 by researchers from Finland, Norway, and England in cooperation with the World Health Organization (WHO) Europe laid the foundation for one of the largest studies on child and adolescent health worldwide. When the first survey was undertaken in 1983/84 in only five countries [1, 2], the researchers at that time would certainly not have thought that this study would be so successful for over 40 years, or that, nowadays 51 countries in Europe and North America and over 450 scientists would participate. The idea at the time was as simple as ingenious: they asked themselves how the health of children and adolescents in their respective country is, in comparison to other countries. How are adolescents doing in comparison to those in other countries? Do other countries have similar problems? The need for a cross-national study emerged from these questions, for which the study would provide reliable data. A study that uses the same methodological approach as well as the same instruments across all countries. In addition, the HBSC Study Group wanted to understand different core areas of child and adolescent health. Therefore, it had to be a broad study that would examine how health and health behaviour of children and adolescents develop over time by regular surveys and at the same time take into account contextual factors that are important for young people’s health, such as family or school.

Since the foundation of the study, the international HBSC network has published over 1,300 publications and cooperated at international level with key stakeholders in child and adolescent health, such as the WHO and UNICEF, resulting in additional reports on current topics such as obesity, substance use, and children’s health during the COVID-19 pandemic (see www.hbsc.org under Publications and Reports).

The HBSC study is one of the main sources of data for WHO/Europe. The problems identified are transformed into ‘action points’ in the European strategy for child and adolescent health and wellbeing, which provides the WHO member states (53 in Europe and Central Asia) with recommendations for action [3, 4]. The cross-national results are of high value: why are young people in other countries doing better, where have health outcomes improved or deteriorated? This is the particular benefit of HBSC compared to purely national studies.

Thanks to Professor Dr. Klaus Hurrelmann, Germany has been participating in this study since the 1990s. Until then, health reporting on child and adolescent health was fragmented. At that time, representative information on a national level was largely lacking, and it was often limited to specific regions or topics. One notable exception were the Drug Affinity Studies conducted by the Federal Centre for Health Education (BZgA), which were able to provide...
Child and adolescent health – Resources and potential of the international HBSC study

representative information on substance use [5]. Although the HBSC study Germany was initially limited to North Rhine-Westphalia, several federal states were added to the study over time, resulting in a nationwide study since 2009/10.

In addition, the Robert Koch Institute launched the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) in the early 2000s, in which more than 10,000 children and adolescents aged 0 to 17 repeatedly took part throughout Germany. In contrast to HBSC, the KiGGS study does not take place in a school setting and also collects objective test and examination data, in addition to questionnaire data, e.g. motor skills tests, measuring and weighing, blood samples. These two study approaches complement each other with regard to child and adolescent health.

Over the course of 30 years, the HBSC study Germany has not only grown into a nationwide study, but also into a veritable treasure trove of data. With each survey cycle, survey data from around 5,000 students aged around 11, 13, and 15 years can be analysed. Information from over 20,000 students is thus available for the present trend analysis (2009/10–2022), as described in the methodology article by Winter & Moor et al. in this issue of the Journal of Health Monitoring.

The HBSC study is therefore an extremely important source of data on the health of students in Germany and internationally. In this issue, we have focussed on the results from the current 2022 survey as well as trends over time in Germany, in order to outline health developments from 2009/10 to 2022 and thus contribute to health monitoring. The HBSC Study Group Germany currently consists of seven locations that have jointly conducted the nationwide HBSC study without external financial support. With their respective expertise, this issue was able to cover a broad spectrum of topics relating to child and adolescent health: from subjective health and psychosomatic complaints (Reiß & Behn et al.) to health literacy (Sendatzki & Helmchen et al.), bullying (Fischer et al.), and physical activity (Bucksch et al.), to trends in health inequalities (Moor et al.). The findings show whether efforts in health promotion and prevention have been successful in recent years and what current challenges lie ahead.

The foundations for health in adulthood lie in childhood and adolescence. In addition, the COVID-19 pandemic has shown the impact that crises can have on the young generation. The lessons learned in recent years show that we should regularly examine what adolescents need to grow up healthy and which challenges require special consideration. While substance use was one of the main causes for concern in the 1990s and 2000s, today’s challenges in child and adolescent health include impaired mental health, dealing with crises, the influence of social media, climate change, and increasing social and health inequalities. Regular monitoring of child and adolescent health using complementary studies is therefore essential. The HBSC study sees it as their responsibility to contribute the necessary information in order to give children and adolescents a voice.
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Subjective health and psychosomatic complaints of children and adolescents in Germany: Results of the HBSC study 2009/10–2022

Abstract

Background: Subjective health and well-being are important health indicators in childhood and adolescence. This article shows current results and trends over time between 2009/10 and 2022.

Methods: The Health Behaviour in School-aged Children (HBSC) study examined subjective health, life satisfaction and psychosomatic complaints of N=21,788 students aged 11 to 15 years in the school years 2009/10, 2013/14, 2017/18 and in the calendar year 2022. Multivariate regression analyses show the associations between sociodemographic characteristics and well-being in 2022, as well as trends since 2009/10.

Results: The majority of children and adolescents indicate a good subjective health and high life satisfaction. About half of the girls and one third of the boys report multiple psychosomatic health complaints, with a clear increase over time. Older adolescents, girls and gender diverse adolescents are at an increased risk of poor well-being. Subjective health and life satisfaction varied between 2009/10 and 2022, with a significant deterioration between 2017/18 and 2022.

Conclusions: The high proportion of children and adolescents with psychosomatic complaints, as well as the observed gender and age differences, underline the need for target group-specific prevention, health promotion and continuous health monitoring.

1. Introduction

It is not only physical health that is important for children and adolescents to grow up healthy, but also their mental well-being. A look at the last decade and the present shows that several societal crises, such as the COVID-19 pandemic, the financial and energy crisis and the war in Ukraine, have (temporarily) changed societal coexistence. This has had an impact on the everyday lives of children and adolescents, affecting their health and well-being [1].

In line with the World Health Organization’s (WHO) definition of health, great importance is attributed to social and psychological well-being in addition to complete physical health. Subjective well-being has become an indispensable construct in public health research. Thereby, self-rated health, life satisfaction and psychosomatic complaints are
commonly used as indicators of well-being [2, 3]. Good well-being is important throughout the entire life course, whereby impairments in health and well-being at an early age have negative effects into adulthood [4]. Good mental health and well-being are also closely related to health behaviour and healthcare utilisation, which in turn is related to the burden of disease (morbidity) and mortality [5–7].

An earlier trend study by Ottova et al. [8] showed that students in Germany rated their health positively overall between 2002 and 2010. During this period, an improvement in self-rated health and a decrease in multiple recurrent health complaints were observed [8]. These findings have been confirmed in other international studies [9], for example the increase in life satisfaction between 2002 and 2010, particularly in Western European countries such as Austria, Denmark, Switzerland and Finland [10].

The outbreak of the COVID-19 pandemic in 2020 had a negative impact on the positive developments in health-related quality of life, life satisfaction, and mental health in Germany that had been observed over the previous two decades [11, 12]. As children and adolescents are in a vulnerable developmental period, they were particularly affected by the COVID-19 pandemic and the associated containment measures. Thereby, the loss of social contacts and increased family conflicts were particularly stressful for them [13]. As a result of the COVID-19 pandemic, international literature reviews and meta-analyses have reported increases in worries, anxiety, sleep problems and depressive symptoms in children and adolescents [14–18].

Research findings often indicate gender and age differences in self-rated health and well-being, as well as differences by migration background. Even before the COVID-19 pandemic, girls reported lower subjective well-being, lower life satisfaction and more psychosomatic complaints than boys [8]. In the context of the COVID-19 pandemic, girls also showed more symptoms of anxiety, depression and stress than boys [16]. In terms of age differences, adolescents were more likely to report mental health problems than children [11, 16]. Previous studies have reported mixed findings on the association between migration background and health [19].

Newest studies suggest that current societal crises contribute to further stress [20, 21]. Against this background, the question arises how subjective health, life satisfaction and psychosomatic health complaints have changed in adolescents in the period from before and towards the end of the coronavirus pandemic. The analysis and presentation of prevalences and trends is based on representative data and provides valuable information for the identification of needs, target group-specific interventions and the development of political and practical measures.

The aim of this study is to present the current prevalences of self-rated health, life satisfaction and psychosomatic health complaints in 11-, 13- and 15-year-old children and adolescents in Germany. In addition, health trends for the period from 2009/10 to 2022 are presented, taking into account age and gender differences. The research questions are as follows:

- What are the current prevalences of subjective health, life satisfaction and psychosomatic health complaints among students?
- What are the trends in subjective health, life satisfaction and psychosomatic health complaints for 11-, 13- and 15-year-olds between 2009/10 and 2022?
• What are the differences in subjective health, life satisfaction and psychosomatic complaints by age and gender during the period mentioned?
• What implications do these findings have for prevention and health promotion?

2. Methods
2.1 Sample design and study implementation

The Health Behaviour in School-aged Children (HBSC) study is designed as a cross-sectional study that takes place every four years in a school setting and surveys students aged around 11, 13 and 15 (mean deviation of 0.5 years). In Germany, these age groups mainly comprise grades 5, 7, and 9. Students at general education schools in all 16 federal states in Germany have been surveyed in the school years 2009/10, 2013/14, 2017/18 and in the calendar year 2022 as part of the HBSC study. The schools contacted for participation were drawn as a cluster sample from the population of all state general education schools in Germany. In order to obtain a representative estimate (close to the distribution of the population), school size and the percentage distribution of students were included in the sampling, stratified by school type (Probability Proportional to Size (PPS) design).

The HBSC study is conducted by means of a questionnaire, which students complete themselves. The study has been approved by the responsible ministries or state education authorities in all federal states (except North Rhine-Westphalia, as the decision of participation lies within the schools in this federal state).

Four survey cycles of the HBSC study Germany were analysed for the present study. In addition to the current survey in 2022 (n = 6,475), three further surveys were included in the following school years: 2009/10 (n = 5,005), 2013/14 (n = 5,961) and 2017/18 (n = 4,347). All data sets were standardised and adjusted by the international HBSC consortium so that the age groups are comparable. Further information on the HBSC study and the methodology can be found in the article by Winter & Moor et al. [23] in this issue of the Journal of Health Monitoring.

2.2 Instruments

Subjective health and well-being were assessed by using the indicators self-rated health, life satisfaction and psychosomatic health complaints.

Self-rated health comprises an individual’s perception and judgement of their own health [24]. Students were asked how they rate their health, with the response options ‘excellent’, ‘good’, ‘fair’ and ‘poor’. The upper categories ‘excellent’ and ‘good’ and the lower categories ‘fair’ and ‘poor’ were summarised as ‘rather good’ and ‘rather poor’ health, respectively.

Life satisfaction captures the evaluation of one’s life as an expression of subjective well-being and was assessed using the Cantril Ladder [25]. The participants were asked to use an 11-point visual analogue scale in the form of a ladder to indicate their current life satisfaction. The top of the ladder represented the ‘best possible life’ (10 points) and the bottom represented the ‘worst possible life’ (0 points). In accordance with the HBSC standard, responses were dichotomised for analysis into ‘low life satisfaction’ (0 to 5 points) and ‘high life satisfaction’ (6 to 10 points).
Psychosomatic health complaints were assessed with the HBSC Symptom Checklist (HBSC-SCL) [26]. Using a five-point answer scale ranging from ‘about every day’ to ‘rarely or never’, students were asked to indicate how often they had experienced headache, stomachache, backache, feeling low, irritability/bad mood, nervousness, difficulties falling asleep and drowsiness/dizziness during the past six months. Responses ranged from ‘almost every day’, ‘several times a week’, ‘almost every week’, ‘about once a month’ to ‘rarely or never’. If two or more of these complaints occurred at least once a week, they were referred to as ‘multiple recurrent complaints’.

Sociodemographic characteristics include age, gender and migration background. Gender was recorded in the 2022 survey year using the three options ‘girl’, ‘boy’ or ‘diverse’. In the previous survey cycles, gender was recorded in binary form (girl, boy). For the trend analyses, participants who did not specify their gender or classified themselves as diverse were excluded from the gender-specific analyses. The age was determined at the time of the survey using the information provided by the students on their month and year of birth and summarised with a deviation of +/-0.5 years into the age categories ‘11 years’, ‘13 years’ and ‘15 years’. The migration background was assessed by asking about the students’ own country of birth and the country of birth of their parents. Adolescents were classified as having a one-sided migration background if one of their parents was not born in Germany. A two-sided migration background was classified if the adolescents were not born in Germany and at least one parent was not born in Germany, or if both parents immigrated or were not born in Germany. Further information can be found in Moor et al. [27].

2.3 Statistical methods

Statistical analyses were performed using the data from the German HBSC survey cycles 2009/10 until the calendar year 2022.

Descriptive results for subjective health, life satisfaction and psychosomatic health complaints are presented as prevalences or proportions stratified by gender (girls, boys, diverse) and age (11-, 13- and 15-year-olds). Differences in the number of respondents between health indicators are due to differences in the number of missing values. The correlation between sociodemographic characteristics (gender, age and migration background) and the indicators of subjective health, life satisfaction and psychosomatic health complaints was calculated using multivariate logistic regression models, adjusting for all other included variables. Results are presented as odds ratios (OR) and 95% confidence intervals (CI).

The time trends of the health indicators were described for the four survey cycles 2009/10 to 2022 using proportions (95% CI). In addition, binary logistic regressions with OR and 95% CI were calculated, using the four survey cycles (with 2009/10 as the reference for the first measurement point), gender (girls and boys), age (11-, 13- and 15-year-olds) and migration background as independent variables. The prevalences and effect estimates of the regression models are reported weighted.

A weighting factor was created for all survey cycles to ensure nationwide sample representativeness. This equalises different participation rates in the federal states and school types so that the distribution corresponds to the population. Due to the weighting, all three age categories
3. Results

A total of N = 21,788 students aged 11, 13 and 15 years participated in the HBSC study in the survey period 2009/10 to 2022 (2009/10: N = 5,005, 2013/14: N = 5,961, 2017/18: N = 4,347 and 2022: N = 6,475). Of these, 51% were girls (n = 11,066). The current results for 2022 and trends from 2009/10 to 2022 are shown below.

3.1 Current results for the 2022 survey cycle

The 2022 HBSC survey included N = 6,475 participants, of whom n = 3,074 were boys (47.5%), n = 3,258 girls (50.3%), n = 112 gender diverse (1.7%), and n = 31 (0.5%) had missing gender information. 38.0% of the respondents had a migration background. The distribution across the age groups of 11-, 13- and 15-year-olds was balanced (33.7%, 34.0% and 32.1%, respectively).

Figure 1 and Figure 2 show the results for self-rated health, life satisfaction and psychosomatic complaints by age and gender in 2022. Overall, the majority of students reported ‘rather good’ health, while 16.1% reported ‘rather poor’ health. Older adolescents, girls and diverse adolescents were less likely to report ‘rather good’ health than younger adolescents and boys, with diverse adolescents reporting the worst health perception. In contrast, there was little difference in self-rated health by migration background.

The majority of adolescents reported a high level of life satisfaction (86.3%), with boys showing the highest overall life satisfaction compared to girls and gender diverse respondents (91.1% vs. 82.7% vs. 51.9%). Boys' life satisfaction remained largely stable across the age groups, while girls' life satisfaction decreased with increasing age. The life satisfaction of young people who describe themselves as gender diverse increased between the ages of 11 and 13, but fell again at age 15. Students with a two-sided migration background were more likely to report lower life satisfaction than those without a migration background (20.0% vs. 11.1%).

In 2022, a total of 41.7% of all respondents reported multiple psychosomatic health complaints. These were reported significantly more often by girls and gender diverse respondents than by boys (52.2% and 80.4%, respectively, compared with 29.8%). This gender difference increased with age, with about half of 15-year-olds suffering from multiple psychosomatic complaints on a weekly basis. Children and adolescents with a one-sided or two-sided migration background were slightly more likely to report psychosomatic complaints than those without a migration background (44.1% and 43.5% vs. 40.5%).
Table 1 shows the results of the multivariate logistic regression analysis. The odds of a ‘rather poor’ health perception were up to 2 times higher for 13- and 15-year-olds than for 11-year-olds. Compared with boys, girls had a 1.7-fold higher risk of a ‘rather poor’ health perception, while gender diverse participants had a 4.4-fold higher risk. There were no significant differences with regard to migration background. Overall, the model was able to explain 5.3% of the variance in subjective health.

The odds of low life satisfaction were 1.9 and 2.5 times higher for 13- and 15-year-olds, respectively, than for 11-year-olds. Again, the odds of low life satisfaction were 2.2 times and 8.5 times higher for girls and gender diverse participants than for boys. Both one-sided and two-sided migration background were associated with a 1.4-fold and 1.9-fold increased risk of low life satisfaction, respectively. The variables explained 11.3% of the variance in life satisfaction.

A slightly increased risk of multiple psychosomatic health complaints was found for students with a one-sided and a two-sided migration background compared to their peers without a migration background. 13- and 15-year-old students had a 1.6-fold and 2.2-fold higher risk of multiple psychosomatic complaints compared with 11-year-olds, respectively. Girls and gender diverse students had a 2.6-fold and 8.5-fold higher risk of psychosomatic health complaints, respectively, compared with boys. Overall, the model explained 11.5% of the variance in multiple psychosomatic complaints.
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3.2 Health trends from 2009/10 to 2022

Figure 3 shows the descriptive trends over time for self-rated health, life satisfaction and multiple psychosomatic complaints. Compared to previous years, there was a significant deterioration in subjective health in the 2022, especially among 15-year-olds. There was also a more pronounced deterioration in self-rated health among girls (+6.5%) compared to boys of the same age (+2.7%) between 2017/18 and 2022.

Both in the overall analysis and between the gender and age groups, there was a deterioration in life satisfaction from 2009/10 to 2013/14, an improvement until 2017/18 and then a deterioration again to 2022. The exception was 11-year-olds, whose life satisfaction increased steadily over all survey cycles. Compared to boys, girls showed significantly lower levels of life satisfaction, with varying trends over the past ten years.

The occurrence of multiple psychosomatic health complaints increased overall in all survey cycles, with a significant rise between 2017/18 and 2022 (+14.8%). In all four surveys, girls and older students were significantly more likely to have multiple psychosomatic complaints than boys and younger students. In addition, a higher increase in multiple psychosomatic complaints was observed with increasing age between 2017/18 and 2022 (11-year-olds: +10.3%, 13-year-olds: +16.1%, 15-year-olds: +18.0%).

Table 2 shows the results of the multivariate logistic regression for self-rated health, life satisfaction and psychosomatic health complaints over time from 2009/10 to 2022. It shows that the risk of having a rather poor self-rated health and multiple psychosomatic health complaints was signifi-
The reported subjective health and life satisfaction deteriorated in 2022 compared to the survey periods 2009/10 to 2017/18.

Significantly higher in 2022 than in the 2009/10 reference period. The trend analyses showed a significant improvement in life satisfaction in 2017/18 and 2022 compared to 2009/10. While subjective health was rated significantly better overall in 2017/18 compared to 2009/10, a significant deterioration was observed in 2022 compared to 2009/10.

There were significant health trends by gender over the whole time course, with girls having a 1.5 times higher risk of a rather poor self-rated health, a 1.8 times higher risk of low life satisfaction and a 2.3 times higher risk of multiple psychosomatic complaints compared to boys. It was also observed that 13- and 15-year-olds had a higher risk of low life satisfaction and multiple psychosomatic health complaints than 11-year-olds.

The trend analyses also showed that both a one-sided and a two-sided migration background were associated with an increased risk of rather poor subjective health, low life satisfaction and multiple psychosomatic health complaints.

Overall, 3.0% of the variance in subjective health, 4.5% of the variance in life satisfaction and 10.8% of the variance in multiple psychosomatic complaints could be explained by the respective models.

Figure 3
Proportion of students with rather poor subjective health, low life satisfaction and multiple psychosomatic complaints by age, gender1 and survey year
Source: HBSC Germany 2009/10, 2013/14, 2017/18, 2022

1 The gender category ‘gender diverse’ was not included as it was not asked in all survey cycles.
However, the current HBSC data also show that about half of the girls and one third of the boys reported multiple psychosomatic complaints such as headache, stomachache and difficulty falling asleep. For the first time, the 2022 HBSC survey also analysed gender diverse children and adolescents, who reported poorer subjective health, lower life satisfaction and more frequent psychosomatic complaints in all age groups. These findings are supported by international studies showing that non-binary youth are particularly affected by verbal and physical violence and general rejection [32–34]. With regard to age, older adolescents showed a deterioration in all indicators of subjective health and psychosomatic complaints over the HBSC survey cycles 2009/10 to 2022.

### Table 2

<table>
<thead>
<tr>
<th>Survey cycle</th>
<th>Rather poor subjective health (n=20,465)</th>
<th>Low life satisfaction (n=20,332)</th>
<th>Multiple psychosomatic complaints (n=20,274)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td>2009/10 (ref.)</td>
<td>1.02 (0.91–1.15)</td>
<td>1.09 (0.98–1.21)</td>
<td>1.19 (1.40–1.83)**</td>
</tr>
<tr>
<td>2013/14</td>
<td>0.81 (0.71–0.92)*</td>
<td>0.63 (0.56–0.72)**</td>
<td>1.37 (1.24–1.51)**</td>
</tr>
<tr>
<td>2017/18</td>
<td>1.26 (1.13–1.40)**</td>
<td>0.75 (0.67–0.83)**</td>
<td>2.69 (2.46–2.94)**</td>
</tr>
<tr>
<td>2022</td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>11 years (ref.)</td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>13 years</td>
<td>1.44 (1.29–1.60)**</td>
<td>1.54 (1.39–1.71)**</td>
<td>1.39 (1.29–1.51)</td>
</tr>
<tr>
<td>15 years</td>
<td>1.89 (1.71–2.10)**</td>
<td>1.66 (1.50–1.84)**</td>
<td>1.82 (1.68–1.97)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>Boys (ref.)</td>
<td>1.53 (1.41–1.66)**</td>
<td>1.80 (1.66–1.95)**</td>
<td>2.27 (2.13–2.43)**</td>
</tr>
<tr>
<td>Girls</td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td><strong>Migration background</strong></td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>None (ref.)</td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>One-sided</td>
<td>1.34 (1.18–1.52)**</td>
<td>1.41 (1.24–1.59)**</td>
<td>1.33 (1.20–1.47)**</td>
</tr>
<tr>
<td>Two-sided</td>
<td>1.16 (1.05–1.29)*</td>
<td>1.70 (1.54–1.87)**</td>
<td>1.33 (1.23–1.44)**</td>
</tr>
</tbody>
</table>

*OR = odds ratio, CI = confidence interval, ref. = reference category, *p < 0.05, **p < 0.001

1 The gender category ‘gender diverse’ was not included as it was not asked in all survey cycles.

The occurrence of multiple psychosomatic complaints increased between 2009/10 and 2022, and reached a new high level in 2022.

### 4. Discussion

The fundamental goals of public health research include not only the monitoring of health, but also the improvement of population health and reduction of health inequalities [28]. The current results of the HBSC 2022 study show that the majority of children and adolescents have good subjective health and a high level of overall life satisfaction. This finding is consistent with the results of previous cycles of the HBSC study [29] and other population-based studies (KiGGS, BELLA) [30, 31], which also reported good to very good general health among children and adolescents. However, the current HBSC data also show that about half of the girls and one third of the boys reported multiple psychosomatic complaints such as headache, stomachache and difficulty falling asleep. For the first time, the 2022 HBSC survey also analysed gender diverse children and adolescents, who reported poorer subjective health, lower life satisfaction and more frequent psychosomatic complaints in all age groups. These findings are supported by international studies showing that non-binary youth are particularly affected by verbal and physical violence and general rejection [32–34].
Subjective health and psychosomatic complaints of children and adolescents in Germany: Results of the HBSC study 2009/10 – 2022

Health and well-being. These findings are in line with previous national and international studies, which have also shown that girls and older adolescents are more likely to report poor health, multiple psychosomatic complaints and lower life satisfaction [16, 20, 29, 35]. One possible explanation for the gender differences could be an increased sensitivity to stress due to hormonal changes in girls during puberty [36]. Another explanation could be that girls are more strongly encouraged to express and communicate emotional feelings than boys as a result of socialisation [37].

Looking at the overall time trends from 2009/10 to 2022, both subjective health and life satisfaction show a fluctuating course, with the proportion of children and adolescents with rather poor subjective health and low life satisfaction increasing significantly in 2022 – compared to 2017/18. The trend in life satisfaction is consistent with the longitudinal results of Reiß et al. [11], who also analysed data from the COPSY and BELLA studies in addition to data from the HBSC study. The trend analyses also show that multiple psychosomatic complaints increased continuously between 2009/10 and 2022. Between 2017/18 and 2022, the proportion of students with such complaints increased the most clearly. This could be, among other factors, due to the effects of the COVID-19 pandemic. Even two years after the outbreak of the COVID-19 pandemic, these results illustrate the possible consequences of pandemic-related stress due to the drastic restrictions in children’s and adolescents’ daily lives and social relationships. The results are consistent with numerous international reviews and meta-analyses describing the negative effects of the pandemic on the well-being of adolescents not only at the beginning of the pandemic [38–43], but also as the pandemic progressed [1, 16]. An increase in symptoms of anxiety and depression among children and adolescents has also been reported at the national level during the pandemic [12, 44]. Thus, the changes and stress caused by the pandemic may explain the significant deterioration in psychosomatic complaints, which also highlights the need for action and for targeted prevention and intervention programmes in times of crisis. In addition, other studies show that almost a half of young people in Germany feel burdened by other crises, such as the climate crisis, the energy crisis or the war in Ukraine, and feel that their mental health is impaired [20, 21, 45]. One third of young people also report anxiety about the impact of these crises on their future [13], which in turn could have long-term consequences for their own health and is therefore relevant to public health. Although later studies, such as the nationwide COPSY study (‘COVID-19 and PSYchological Health’), show an improvement in health-related quality of life and life satisfaction over time, as well as a downward trend in mental health problems, they have not yet returned to pre-pandemic levels [13, 44].

Strengths and limitations

The strength of the HBSC study lies in the high methodological quality achieved through the use of internationally validated measurement instruments, a large sample and a standardised procedure. Another strength of the study is that it captures the analysed indicators from the perspective of the children and adolescents themselves. The repeated cross-sectional surveys make it possible to depict age- and gender-related trends in the subjective health and well-being of children and adolescents for a comprehensive

Target group-specific prevention and health promotion programmes are necessary to promote the subjective health and well-being of children and adolescents.
health monitoring. Due to the large number of European and non-European countries now participating in the HBSC study (www.hbsc.org), direct international comparisons will be possible in the future. One limitation is the cross-sectional design of the HBSC study, which means that it is not possible to draw conclusions about causal relationships and developmental trajectories. Due to the several months of data collection for the current HBSC study from March onwards, possible effects of the dynamic course of the COVID-19 pandemic are conceivable, e.g. that the Omicron wave of the winter and the associated restrictions at the beginning of spring had an even greater impact on subjective health and well-being than at a later survey date in the calendar year 2022.

Outlook

Girls and gender diverse students as well as older adolescents are a large, heterogeneous and vulnerable population that should be particularly addressed in mental health prevention and interventions. Existing policies should therefore be reviewed and adapted to address persistent age and gender differences. The marked declines in self-rated health and well-being of children and adolescents reported in this article reinforce the existing demands of the German Ethics Council [46] and the National Action Plan ‘New Opportunities for Children in Germany’ [47]. Both statements emphasise specific health promotion and the rapid expansion of resources for comprehensive psychological and therapeutic support and care for children and adolescents. In addition, continuous health monitoring of children and adolescents is recommended. Thereby, the present HBSC study can contribute as a valuable data source, which provides continuous up-to-date data and facilitates the investigation of further development processes and trend analyses.

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Data protection and ethics

Like the previous cycles, the current survey of the HBSC study 2022 was reviewed by the ethics committee of the Medical Association of Hamburg (processing no.: 2021-100700-WF). The survey is voluntary and anonymous at school and individual level at all times. The school principals and students were informed in advance about all the content and objectives of the study and about the data protection concept. Written consent (informed and active consent) was required from the parents/guardians and the students.
themselves (from grade 7) in order to participate in the study. The study was conducted in accordance with the German Federal Data Protection Act (BDSG) and the European General Data Protection Regulation (GDPR). A corresponding data protection concept was developed in advance with the data protection officer of Martin Luther University Halle-Wittenberg (print survey) and the data protection officer of Brandenburg University of Technology Cottbus-Senftenberg (online survey). Additional information and conditions on data protection that the HBSC team received from various ministries as part of the approval process were also taken into account and added to the concept.

Data availability
The current HBSC data is not available as open access as their use is reserved exclusively for the HBSC Study Group Germany for the first three years after collection. Use of the data by third parties is possible on request. Enquiries about the data or ideas for analysis can be addressed to the HBSC Study Group Germany (Principal Investigator and Coordinator: Prof. Dr. Matthias Richter, Technical University of Munich; Co-Principal Investigator and Coordinator: Dr. Irene Moor, Martin Luther University Halle-Wittenberg). After an embargo period of three years, the national and international HBSC data can be requested from the ‘HBSC Data Management Centre’ (Head: Prof. Dr. Oddrun Samdal) at the University of Bergen (Norway) (https://www.uib.no/en/hbscdata).

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Conflicts of interest
The authors declared no conflicts of interest.

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Subjective health and psychosomatic complaints of children and adolescents in Germany: Results of the HBSC study 2009/10–2022
Health literacy of students in Germany – Results of the HBSC study 2022

Abstract

Background: Health literacy (HL) encompasses knowledge and skills for dealing critically and confidently with health information in individual and social contexts. Current studies show that a high proportion of children and adolescents have limited health literacy, depending on aspects of their social background. Health literacy is considered an important factor influencing health. Little is known about the development of health literacy over time and its connection with psychosomatic complaints in young people.

Methods: Based on the results of the Health Behaviour in School-aged Children (HBSC) study, this article focusses on the level of HL in 11-, 13-, and 15-year-old students (N = 6,475) over time and taking social differences into account. Finally, the relationship between HL and psychosomatic complaints is analysed. Univariate, bivariate, and multivariate analyses were carried out for this purpose.

Results: At 24.4%, slightly more students have low HL in 2022 than in 2017/18 (21.4%). There are differences in HL according to gender, age, type of school, and family affluence. Low HL is associated with a high psychosomatic burden.

Conclusions: The results highlight the need for target group-specific measures to promote young people’s HL, which address individual and organisational aspects of HL.

1. Introduction

In recent years, an increasing amount of research has focussed on the concept of health literacy (HL). Paakkari and Paakkari [1] define health literacy as a set of five core competences in relation to dealing with health information. These include theoretical and practical knowledge, critical thinking, self-awareness, and citizenship. Citizenship describes, among other things, the ability to look at health issues beyond one’s own perspective in terms of social responsibility [1]. With regard to the COVID-19 pandemic, observing hygiene measures, wearing masks, and maintaining social distancing are some examples of citizenship.

For the target group of children and adolescents in Germany, initial studies show that between 15 and 50 per cent of adolescents have difficulties in dealing with health information [2–6]. Major challenges arise in the search for health information, especially digitally [7, 8]. Even more pro-
Health literacy of students in Germany – Results of the HBSC study 2022

HBSC 2022

Data holder: HBSC Study Group Germany

Objective: The aim of the study is to analyse the health and health behaviour of students. Continuous health monitoring through the HBSC study contributes to informing decision-makers in policy and practice about the current fields in prevention and health promotion in childhood and adolescence. A particular focus is on the influencing factors and the social contexts of health in the young generation.

Study design: Cross-sectional survey by written questionnaire every four years

Population: Students with average ages 11, 13, and 15

Sampling: Observation units are schools and the class groups clustered within them. From the population of all state general education schools in Germany, a cluster sample was drawn. In order to obtain a representative estimate (close to the distribution of the population), school size and the percentage distribution of students were included in the sampling, stratified by school type and federal state (Probability Proportional to Size (PPS) design).

Data collection period: March – November 2022

Sample size:
2022: 6,475 students
All four survey cycles (2009/10 – 2022): 21,788 students

HBSC survey cycles:
Included in the articles in this issue of the Journal of Health Monitoring:
> 2009/10
> 2013/14
> 2017/18
> 2022

More information can be found at https://hbsc-germany.de/ (German)

HBSC 2022: Health literature of students in Germany – Results of the HBSC study 2022

Data holder: HBSC Study Group Germany

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Health literacy of students in Germany – Results of the HBSC study 2022

nounced are difficulties in the critical evaluation and application of the health information found [3, 5, 8]. With an increasing amount and heterogeneity of information available (infodemic [9]), it is necessary to analyse regularly how HL is developing in the general population. Especially for children and adolescents, research on time trends in HL is still in its infancy. The results of the Health Literacy Survey Germany 2 (HLS-GER 2) show that the general population’s HL has had a downward tendency between 2014 and 2021. The increasing complexity of the healthcare system, digitalisation, and the rapid spread of information of varying quality are possible reasons that could have contributed to this development. Most recently in 2020, there was a slight decline in the proportion of people with a low level of HL, which could be related to the COVID-19 pandemic. People have been sensitised to the topic of health and specifically to infection protection and are increasingly engaging with health information as a result [10].

Based on the available studies, there are clear indications of an unequal distribution of HL in children and adolescents. In terms of age- and gender-specific differences, the evidence is heterogeneous, with the findings of the Health Behaviour in School-aged Children (HBSC) study 2017/18 indicating lower HL in boys and younger students [6, 11]. Furthermore, a history of migration is associated with limitations in HL [12]. Studies also point to socioeconomic inequalities in HL following a social gradient. For example, grammar school students and those with a high level of family affluence also have higher HL [2, 6, 11, 12].

Furthermore, previous studies have established correlations between HL and various health indicators [3, 4, 11]. It should be noted that, in addition to HL, aspects of the social and educational background are also associated with both health and HL indicators [13]. Even after adjustment for subjective social status and gender, adolescents with limited HL are more likely to exhibit poor dietary and physical activity behaviour, although the corresponding correlations prove to be differential, i.e. in some cases only appear for individual dimensions of HL [3, 11]. Little research has been conducted to date on the relationships between HL and the mental and psychosomatic health of children and adolescents. Zhang et al. [14] show that, in a Chinese study, adolescents with low HL exhibit more physical and psychological symptoms compared to respondents with high HL. As far as the authors are aware, no evidence is currently available for Germany on the relationship between HL and the occurrence of psychosomatic complaints in childhood and adolescence. For Germany, data from the HBSC study 2017/18 showed moderate correlations between HL and mental health problems [11].

Psychosomatic complaints are characterised by physical symptoms (both with and without organic or functional findings), which are often caused by psychological factors [15]. The latest HBSC survey 2017/18 showed that 26.9% of children and adolescents report multiple psychosomatic complaints, i.e. symptoms occurring at least twice a week (headaches, stomach ache, backache, feeling low, irritability, nervousness, sleeping difficulties, and dizziness) [16]. With regard to gender- and age-specific differences, it is clear that girls and older children and adolescents more frequently report psychosomatic complaints as well as limitations to their mental health [17, 18]. More details on this can be found in the article by Reiß & Behn et al. [19] in this issue of the Journal of Health Monitoring.
Against this background, this article examines three research questions:

1) How does the HL of children and young people in 2022 compare to the 2017/18 school year?
2) What sociodemographic and socioeconomic differences are evident in the HL of children and young people?
3) What associations exist between HL and the psychosomatic complaints in children and adolescents?

2. Methods

2.1 Sample design and study implementation

The Health Behaviour in School-aged Children (HBSC) study is designed as a cross-sectional study that takes place every four years in a school setting and surveys students aged around 11, 13, and 15 (mean deviation of 0.5 years). In Germany, these age groups mainly comprise grades 5, 7, and 9. Students at general education schools in all 16 federal states in Germany have been surveyed in the school years 2009/10, 2013/14, 2017/18, and in the calendar year 2022 as part of the HBSC study. The schools approached for participation were drawn as a cluster sample from the population of all state general education schools in Germany. In order to obtain a representative estimate (close to the distribution of the population), school size and the percentage distribution of students were included in the sampling, stratified by school type (Probability Proportional to Size (PPS) design).

The HBSC study is conducted by means of a questionnaire, which the students complete themselves. The study has been approved by the responsible ministries or state education authorities in all federal states (except North Rhine-Westphalia, as the decision of participation lies within the schools in this federal state).

Two survey cycles of the HBSC study Germany were analysed for this evaluation: the surveys in the 2017/18 school year (n = 4,347) and in 2022 (n = 6,475). In contrast to the other publications in this issue, only data from the last two survey cycles could be included in this article, as the HL has only been included in the questionnaire since the 2017/18 school year.

All data sets were standardised and adjusted by the international HBSC consortium so that the age groups are comparable. Further information on the HBSC study and the methodology can be found in the article by Winter & Moor et al. [20] in this issue of the Journal of Health Monitoring.

2.2 Survey and evaluation procedures

This article focuses on HL. It is considered in connection with sociodemographic and socioeconomic characteristics (gender, age, history of migration, type of school, family affluence) and psychosomatic complaints.

The Health Literacy for School-Aged Children (HLSAC) scale, which has been validated as a survey instrument for the age groups in question and is based on the understanding of HL described above [1, 11, 21, 22], was used for the students’ self-assessment of HL. The HLSAC scale comprises ten items, which were answered on a four-point Likert scale from ‘not at all true’ to ‘absolutely true’. Five components of HL (theoretical knowledge, practical knowledge
or skills, critical thinking, self-awareness, and citizenship) were mapped with two items each, for which a statistical test using factor analysis confirmed that the pairs of items each belonged to one dimension of HL. All items were introduced with 'I am sure that...', followed by various assessments (e.g. ‘...I can compare health information obtained from different sources’). To form the scale, a sum score of all items was formed, which can assume a value range between 10 and 40. This was only done for cases with complete answers to all items. The reliability of the scale was at a high level for the present sample (Cronbach’s $\alpha = 0.887$). In the course of the analyses, the sum score was divided into three categories, which represent low (10–25), moderate (26–35), and high (36–40) HL of the respondents. This procedure was chosen based on the analysis in other publications and to ensure the international comparability of the results [6]. When using HL as the dependent variable in the binary-logistic regression analysis (see 2.3 Statistical methods), a dichotomisation into the characteristics 'low' and 'moderate/high' was carried out, based on the original categorisation according to Paakkari et al. [6].

The HBSC Symptom Checklist (HBSC-SCL) [23] was employed to record psychosomatic complaints. It uses a five-point response scale (‘about every day’ to ‘rarely or never’) to determine how often students had experienced headaches, stomach ache, backache, feeling low, irritability or bad temper, nervousness, sleeping difficulties, and dizziness in the last six months. The answers were summarised into an index, which was then divided into two categories: according to this, a high level of psychosomatic complaints was present if students reported at least two weekly complaints in the last six months. A low level was assumed for respondents with less than two weekly complaints in the last six months. This categorisation was chosen in line with previous research and to ensure the consistency of the results. Further information on the HBSC-SCL can be found in the article by Reiß & Behn et al. [19].

Gender was recorded in the 2022 survey year using the three options ‘girl’, ‘boy’, or ‘diverse’. In the previous survey cycles, gender was recorded in binary form (girl, boy). The age was determined at the time of the survey using the information provided by the students on their month and year of birth and summarised with a deviation of +/- 0.5 years into the age categories ‘11 years’, ‘13 years’, and ‘15 years’. The students’ history of migration was operationalised via their own country of birth and the country of birth of their mother and father. Children and adolescents who had one parent not born in Germany were categorised as having a one-sided history of migration. A two-sided history of migration was recorded if either the students themselves and at least one parent or both parents were not born in Germany [20, 24].

The school types were recorded by the schools when they confirmed their participation in the study. This resulted in the following categorisation: 1. grammar school, 2. 5th and 6th grade middle school, 3. secondary general school, 4. intermediate school, 5. comprehensive school, 6. combined secondary general and intermediate school.

Family affluence was measured using the Family Affluence Scale (FAS) [25, 26]. The students were asked about material wealth indicators of their parents’ home (presence of computer, car, own room, bathroom, dishwasher, as well as vacations taken). An index was formed from these six items, which was transformed using a RIDIT (Relative to
an Identified Distribution Integral Transformation) calculation and then categorised into three groups along quintiles. These categories are divided into low (<20%), medium (20–80%), and high (>80%) family affluence.

2.3 Statistical methods

The evaluation included univariate, bivariate, and multivariate analyses using IBM SPSS Statistics software (version 28). In the univariate analyses, absolute and relative frequencies were used to describe the sample and the level of HL and psychosomatic complaints. A weighting factor was created for all survey cycles to ensure nationwide sample representativeness. This equalises different participation rates in the federal states and school types so that the distribution corresponds to the population. Due to the weighting, all three age categories and the binary gender categories of girls and boys are included in the analyses in equal parts from the 2017/18 survey cycle onwards. In the 2022 HBSC survey cycle, gender was not recorded exclusively in binary form for the first time, with 1.7% of respondents indicating the gender category gender diverse. This was taken into account in the weighting of the 2022 data, while girls and boys were weighted equally (49.2% each; participants who did not specify their gender were excluded). Further details on the weighting of the data can be found in the article by Winter & Moor et al. [20].

A Mann-Whitney U test was used to compare the HL between the 2017/18 and 2022 survey cycles. The effect size was assessed using the Pearson correlation coefficient r, which can be interpreted as low (r < 0.3), medium (0.3 < r < 0.5), or strong (r ≥ 0.5) according to common conventions [27]. It should be noted that due to the limited number of available time points, it is not yet possible to depict a trend, only initial tendencies. The bivariate and multivariate analyses are based on the current data set for the year 2022, focusing on a) the relationship between HL and sociodemographic and socioeconomic characteristics and b) the relationship between HL and psychosomatic complaints among students. Cross-tabular analyses with chi-square tests were used to analyse bivariate correlations. In cases with cell populations below n = 5, Fisher’s exact test (FET) was used. The multivariate evaluation was performed using binary-logistic regression analyses. Statistical adjustments were made to the calculated correlations for the characteristics of age, gender, history of migration, school type, and family affluence. The results are reported as odds ratios (OR) and 95% confidence intervals (95% CI). All analyses were based on a significance level of p < 0.05.

3. Results

3.1 Health literacy: a comparison between 2017/18 and 2022

In the 2022 survey, 24.4% of students were found to have low HL, 61.4% moderate HL and 14.2% high HL. For the 2017/18 school year, a comparison shows that low HL is indicated for fewer students (21.4%), whereas for a larger proportion the HL can be described as moderate (65.2%) (Figure 1). The difference between the survey cycles is statistically significant (p < 0.05), although the effect size is small (r < 0.1).
intermediate schools (33.9%) are the most likely to have limited HL. In contrast, grammar school students are the least likely to have low HL in a comparison of school types (14.9%). Differentiation according to family affluence clearly shows that students with a low level of affluence (29.1%) have more difficulties in dealing with health information than students in the medium (24.8%) and high affluence categories (17.5%). Figure 2 illustrates the results of the bivariate analyses.

The results of the binary-logistic regression analysis largely support the findings of the cross tabulation (Table 1). The gender-specific analysis shows that adolescents in the 'gender diverse' category are at a 4.12 times higher risk of low HL than female respondents. Girls and boys do not differ from each other. Furthermore, 11-year-olds show lower HL than 15-year-olds, whereas no differences are evident for 13-year-olds compared to 15-year-olds. The binary-logistic regression shows no differences for presence or absence of migration history. In the comparison of school types, a higher risk of lower HL can be derived for students from school types other than grammar school (secondary general school, 5th and 6th grade middle school, combined secondary general and intermediate school) (OR = 2.80 to OR = 2.92). With regard to family affluence, students from low and medium affluence backgrounds are at a higher risk of having a low HL than respondents with a high level of affluence.

3.2 Sociodemographic and socioeconomic differences in health literacy

With regard to gender-specific differences in HL, the results show that students who have indicated that they belong to the ‘gender diverse’ category are the most likely to be assigned low HL (51.2%). Female (22.6%) and male (25.2%) respondents, on the other hand, hardly differ from each other. There are also age-specific differences in HL at the expense of younger respondents. 11-year-olds are the most likely to have low HL at 27.0% (13-year-olds: 24.9%, 15-year-olds: 21.8%). However, at 19.1%, the proportion of those with high HL is also highest in the youngest age group. With regard to migration status, the results show that students with a one-sided (27.3%) and two-sided migration history (27.1%) are more likely to have limited HL than students without a history of migration (22.8%).

In terms of socioeconomic differences, the analysis shows a clear educational gradient. Students at 5th and 6th grade middle schools (37.1%), secondary general schools (35.2%) and combined secondary general and
Younger students have greater difficulties in dealing with health information, while girls and boys do not differ from each other.

Figure 2
Health literacy of students, differentiated by gender (n = 4,839), age (n = 4,839), type of school (n = 4,840), migration background (n = 4,698), and family affluence (n = 4,763), 2022
Source: HBSC Germany 2022

Table 1
Multivariate logistic regression on the probability of occurrence of low health literacy among students (N = 4,593, n = 2,371 female, n = 2,145 male, and n = 77 gender diverse) 2022
Source: HBSC Germany 2022

Low health literacy

<table>
<thead>
<tr>
<th>Gender</th>
<th>OR</th>
<th>(95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls (Ref.)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Boys</td>
<td>1.10</td>
<td>(0.95 – 1.27)</td>
<td>0.169</td>
</tr>
<tr>
<td>Gender diverse</td>
<td>4.12</td>
<td>(2.58 – 6.59)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Age group

<table>
<thead>
<tr>
<th>Age group</th>
<th>OR</th>
<th>(95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-year-olds (Ref.)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>13-year-olds</td>
<td>1.16</td>
<td>(0.98 – 1.37)</td>
<td>0.084</td>
</tr>
<tr>
<td>11-year-olds</td>
<td>1.34</td>
<td>(1.12 – 1.60)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

OR = Odds ratio, CI = confidence interval, Ref. = reference group
Bold: Significant result (p < 0.05)
There is a social gradient in health literacy at the expense of students from schools other than grammar schools and those from socioeconomically disadvantaged families.

### 3.3 Associations with psychosomatic complaints

In the current survey, 40.8% of students stated that they were affected by at least two of the recorded complaints at least once a week.

A differentiated analysis of psychosomatic complaints shows that students with low HL (51.6%) are more frequently affected by a high psychosomatic burden than students with high HL (29.1%). Furthermore, when stratified by gender, it can be seen that female and gender diverse respondents, especially those with low HL, are more likely to have a high level of psychosomatic complaints. It should be noted that the results of the bivariate analysis for gender diverse respondents are not statistically significant (Figure 3). This result is confirmed by the adjusted analyses of the binary-logistic regression analysis (Table 2). After controlling for the sociodemographic and socioeconomic characteristics, it emerges that students with low HL have an increased risk of a high psychosomatic burden by a factor of 2.64. The gender-differentiated analyses of the psychosomatic complaints show a risk factor increase to 2.68 and 9.80 for girls and gender diverse respondents, respectively.

### Table 1 Continued

<table>
<thead>
<tr>
<th>Multivariate logistic regression on the probability of occurrence of low health literacy among students (N = 4,593, n = 2,371 female, n = 2,145 male, and n = 77 gender diverse) 2022</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Migration history</strong></td>
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</tr>
<tr>
<td>None (Ref.)</td>
<td></td>
</tr>
<tr>
<td>One-sided</td>
<td>1.21 (0.98 – 1.50) 0.077</td>
</tr>
<tr>
<td>Two-sided</td>
<td>1.01 (0.85 – 1.19) 0.945</td>
</tr>
<tr>
<td><strong>Type of school</strong></td>
<td></td>
</tr>
<tr>
<td>Grammar school (Ref.)</td>
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</tr>
<tr>
<td>5th and 6th grade middle school</td>
<td>2.80 (1.77 – 4.45) &lt;0.001</td>
</tr>
<tr>
<td>Secondary general school</td>
<td>2.92 (2.26 – 3.78) &lt;0.001</td>
</tr>
<tr>
<td>Intermediate school</td>
<td>1.88 (1.52 – 2.33) &lt;0.001</td>
</tr>
<tr>
<td>Comprehensive school</td>
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<tr>
<td>Combined secondary general and intermediate school</td>
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<td><strong>Family affluence</strong></td>
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</tr>
<tr>
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<tr>
<td>Medium</td>
<td>1.28 (1.04 – 1.57) &lt;0.05</td>
</tr>
<tr>
<td>Low</td>
<td>1.37 (1.07 – 1.75) &lt;0.05</td>
</tr>
</tbody>
</table>

OR = Odds ratio, CI = confidence interval, Ref. = reference group
Bold: Significant result (p < 0.05)
Low health literacy is associated with a high level of psychosomatic complaints among the students surveyed.

**Figure 3**
Proportion of students with a high level of psychosomatic complaints (at least two complaints at least weekly), differentiated by level of health literacy, 2022 (N = 4,835, n = 2,399 female, n = 2,355 male, and n = 81 gender diverse)
Source: HBSC Germany 2022

**Table 2**
Multivariate logistic regression for the prediction of a high level of psychosomatic complaints among students, differentiated by health literacy and gender, 2022 (N = 4,586, n = 2,371 female, n = 2,138 male, and n = 77 gender diverse)
Source: HBSC Germany 2022

<table>
<thead>
<tr>
<th></th>
<th>High level of psychosomatic complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td><strong>Health literacy</strong></td>
<td></td>
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<tr>
<td>High (Ref.)</td>
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<td>2.64</td>
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<td><strong>Gender</strong></td>
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<tr>
<td>Boys (Ref.)</td>
<td>–</td>
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<tr>
<td>Girls</td>
<td>2.68</td>
</tr>
<tr>
<td>Gender diverse</td>
<td>9.80</td>
</tr>
</tbody>
</table>

Bold print: Significant result (p < 0.05)
OR = Odds ratio, CI = confidence Interval, Ref. = reference Group
Results adjusted for the variables gender (only for health literacy), age group, migration history, type of school, family affluence
4. Discussion

Summary
In comparison to the survey from the 2017/18 school year, an increase of around three percent in the proportion of students with low HL was shown for the survey year 2022. For the current HBSC survey, differences in HL can be identified according to gender (at the expense of gender diverse children and adolescents), age (at the expense of younger students), school type (at the expense of students who do not attend grammar school), and family affluence (at the expense of students with a low level of affluence). Even after correcting for the above-mentioned social background characteristics, low HL is associated with a higher burden of psychosomatic complaints.

Strengths and limitations
The HBSC study comprises a large representative sample of children and adolescents aged 11, 13, and 15. It is the only national study that focusses on health in the school context and is internationally comparable. HBSC uses validated instruments to assess the health and HL of children and adolescents. In addition, for the first time in a national context, the relationship between health and psychosomatic complaints among students was analysed.

One limitation is that it is not yet possible to analyse trends in the data on HL, as only two survey dates are currently available. If HL is recorded in future survey cycles, initial trend analyses can be carried out. It should be noted that no causal statements can be made due to the cross-sectional study design.

Overall, a cautious interpretation of the HL results is required, as the HLSAC scale is a self-assessment tool for children and adolescents and is therefore subject to certain limitations (e.g. tendency to over/underestimate own abilities) [6]. When presenting results, it should always be borne in mind that the levels are based on subjective assessments of students’ confidence in their ability to deal with health information. The applicability of the scale with regard to younger students is also critically discussed in the literature. Due to the complexity of the HL construct and the items used here, it can be assumed that 11-year-old students have greater difficulties in answering the questions, which is associated with a higher proportion of missing values [11, 20].

The FAS was used to describe socioeconomic differences in HL. The FAS is a regularly updated and validated instrument that is generally suitable for mapping the socioeconomic situation of children and adolescents. However, as described by Moor et al. [28] in this issue of the Journal of Health Monitoring, when interpreting the results, it must be considered that the indicators used do not necessarily provide a picture of economic prosperity in view of changing living conditions and norms (e.g. a family may deliberately choose not to own a car in the context of the climate crisis). The use of family affluence as an indicator of social status has been criticised in other studies. It is known that family affluence becomes a less significant indicator when youth-specific indicators (such as school type as indicator of the adolescent’s educational level) are added. There is also debate about the extent to which the material wealth measured by the FAS adequately reflects the actual socioeconomic situation of the family or the adolescent, particularly in western industrialised nations [29].
Interpretation
The difference in the frequency of low HL between the survey cycles was comparatively small at three percentage points. The tendency towards an increase in the proportion of low HL among students in 2022 should be discussed in the context of the COVID-19 pandemic. The increase in difficulties in dealing with health information appears plausible against the background of the infodemic caused by the COVID-19 pandemic. This refers to the sharp rise in information of different qualities. This increasing amount of heterogeneous information has made it more and more difficult for children and young people to navigate and orientate themselves in a highly dynamic information space [30]. The findings of the HBSC study are in contrast to the results of a population-representative study, which indicates an increase in sufficient HL during the course of the pandemic [10]. However, the study points to strong differences between individual population groups, although only the adult population was represented in the study [31]. In the course of the pandemic, the importance of health from a social perspective increased significantly. It is possible that children and adolescents reached the limits of their HL in the context of the pandemic, perhaps in part because parents played a major role in protecting against infection and adolescents had less impact on decision-making [32]. This is also shown by the results of the HLS-COVID-19 study, which indicates uncertainty due to too much information about the COVID-19 pandemic, especially for young adults [33]. However, as described above, the results should be interpreted with caution in light of the small changes in HL.

In contrast to the previous results of the HBSC study, the present analyses did not reveal any differences in HL between female and male respondents [6, 11]. Other studies for the target group of children and adolescents likewise did not find any gender-specific differences in HL (e.g. [2]). It should be noted that the majority of previous studies refer to the binary understanding of gender (girls/boys). This article shows that gender diverse respondents belong to a vulnerable group with lower HL than for girls and boys. The number of studies on HL in gender diverse people in Germany is still very limited [34]. Initial studies indicate that transgender and non-binary people often report difficulties in dealing with health information [35]. One possible explanation is that people with greater or more specific demands on the healthcare system have a high need for information. They are therefore more challenged with regard to their HL, which is why difficulties in dealing with health information are more readily apparent [36]. In principle, the available results for the group of gender diverse children and adolescents should be interpreted with caution in view of the small number of cases (1.7%; n = 80).

The results on the age-specific consideration of HL are consistent with previous results of the HBSC study. Younger students tend to have greater limitations in HL [6, 11]. This seems plausible considering developmental differences between the age groups. Interestingly, the results also show that 11-year-olds are the age group that most frequently rates their HL as ‘high’. It is possible that younger children and adolescents tend to overestimate their own abilities, as many decisions were taken by caregivers (e.g. parents) or organisations (e.g. schools) during the pandemic while children and adolescents had to support these without being able to make their own decisions. It can also be assumed that 13- and 15-year-old students assess their own
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Seifert et al. [42], who found no significant correlation between cognitive abilities and reading comprehension or subjectively measured HL. On the other hand, objective measures of HL showed medium positive correlations with these abilities [42]. It should be noted that, in addition to cognitive abilities, other characteristics should also be considered as determinants of HL, which potentially differ between students of different school types (e.g. self-efficacy) [43].

The consideration of stratification according to family affluence is consistent with the results of other studies, according to which the economic situation is a significant explanatory characteristic for the manifestation of health inequality, in line with current theories on health inequality [6, 12, 44, 45]. The results emphasise the need for target group-specific measures to strengthen HL, which relate to the needs of children and adolescents from different socioeconomic groups.

The relationship between HL and psychosomatic complaints was analysed for the first time in a national context in this article. It was found that students for whom the analyses revealed low HL were more frequently affected by psychosomatic complaints than those for whom high HL was found. This is consistent with the results of Zhang et al. [14]. When stratified by gender, it was also found that female and gender diverse respondents, especially those with low HL, were more likely to have a high level of psychosomatic complaints. However, due to the number of cases, the effect for gender diverse respondents was not statistically significant. Further details on the classification of gender-specific differences in psychosomatic health can be found in the article by Reiß & Behn et al. [19]. The find-
ings of this study are thus in line with the results of many other studies that illustrate the relationship between HL and indicators of health in children and adolescents (e.g. [6, 46, 47]). As Okan et al. [13] illustrate, the relationship between HL and (psychosomatic) health is mediated indirectly via health-related attitudes and behaviours. These are considered important determinants of mental and psychosomatic health. It should always be borne in mind that both HL and health-related indicators are subject to a social gradient. Students with a low socioeconomic status are therefore exposed to multiple disadvantages and are at a higher risk of having their HL and psychosomatic health impaired [13, 47].

Conclusions
The results of the HBSC study emphasise the need for measures to strengthen children’s and adolescents’ HL. To this end, measures to promote HL should be offered in all settings relevant to young people (including day-care centres, children’s and youth centres, sports clubs, schools, etc.). Corresponding strategies should not only focus on the individual abilities and resources of adolescents, but also on the (organisational) conditions under which HL can develop [48, 49]. A suitable setting for this is the school, where extensive health promotion and prevention activities have already been carried out in recent years [50]. In this context, HL should by no means be introduced as a new or independent intervention strategy, but should be integrated into existing holistic approaches to health promotion and good healthy schools [51]. Some German federal states have comprehensive structures and programmes in place. Holistic approaches to school health promotion in particular focus on the level of individual competences and on the level of school structures and processes, thus providing a meaningful basis for the integration of new approaches. Initial considerations for combining HL with the overarching approach of health promotion [13] and for linking it with existing curricula [52] have already been made. In addition, offers and tools are available that can be used to promote HL of students and the organisation [53, 54].

As found in the present study, students show differences in HL depending on their social status and the type of school they attend. Accordingly, intervention activities in a school setting should be differentiated according to need. In order to counteract the so-called ‘prevention dilemma’, schools with a particularly high need for measures to strengthen health and HL should be prioritised (especially secondary general schools, intermediate schools, comprehensive schools and 5th and 6th grade middle school). The provision of health information for children and adolescents in simple language is one way of creating target-group-appropriate programmes [55]. Due to pandemic-related challenges, school health promotion programmes could not be implemented or maintained as planned in recent years [56]. With this in mind, efforts should be made to consolidate existing services, even in exceptional situations such as the COVID-19 pandemic, so that health-competent schools can be created at an organisational level [49]. Schools should be supported in this task by a network of other actors in prevention and health promotion [57].
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Data protection and ethics
Like the previous cycles, the current survey of the HBSC study 2022 was reviewed by the ethics committee of the Medical Association of Hamburg (processing no.: 2021-100700-WF). The survey is voluntary and anonymous at school and individual level at all times. The school principals and students were informed in advance about all the content and objectives of the study and about the data protection concept. Written consent (informed and active consent) was required from the parents/guardians and the students themselves (from grade 7) in order to participate in the survey. The study was conducted in accordance with the German Federal Data Protection Act (BDSG) and the European General Data Protection Regulation (GDPR). A corresponding data protection concept was developed in advance with the data protection officer of Martin Luther University Halle-Wittenberg (print survey) and the data protection officer of Brandenburg University of Technology Cottbus-Senftenberg (online survey). Additional information and conditions on data protection that the HBSC team received from various ministries as part of the approval process were also taken into account and added to the concept.

Data availability
The current HBSC data is not available as open access as their use is reserved exclusively for the HBSC Study Group Germany for the first three years after collection. Use of the data by third parties is possible on request. Enquiries about the data or ideas for analysis can be addressed to the HBSC Study Group Germany (Principal Investigator and Coordinator: Prof. Dr. Matthias Richter, Technical University of Munich; Co-Principal Investigator and Coordinator: Dr. Irene Moor, Martin Luther University Halle-Wittenberg). After an embargo period of three years, the national and international HBSC data can be requested from the ‘HBSC Data Management Centre’ (Head: Prof. Dr. Oddrun Samdal) at the University of Bergen (Norway) https://www.uib.no/en/hbscdata).

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Conflicts of interest
The authors declared no conflicts of interest.

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HBSC Study Group Germany
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References


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Traditional bullying and cyberbullying at schools in Germany: Results of the HBSC study 2022 and trends from 2009/10 to 2022

Abstract

**Background:** Bullying is a form of violence that is carried out repeatedly, with the intention of causing harm and with an imbalance of power between those involved. Bullying has serious negative effects on the mental health of adolescents and thus represents a significant health risk in childhood and adolescence.

**Methods:** Based on data from the Health Behaviour in School-aged Children (HBSC) study from the survey year 2022 in Germany \((N=6,475)\), the prevalence of school bullying and cyberbullying among 11-, 13- and 15-year-olds in Germany was analysed. In addition, the prevalence of school bullying and cyberbullying was analysed as a trend from 2009/10 to 2022 (bullying) and from 2017/18 to 2022 (cyberbullying).

**Results:** Around 14% of the learners surveyed reported direct experience of bullying at school, and around 7% reported cyberbullying experiences as bullied and/or bullying victims. Adolescents who identified as gender diverse were particularly likely to report bullying experiences. School bullying decreased over time, but remained stable between 2017/18 and 2022. Cyberbullying, on the other hand, increased in 2022 compared to 2017/18.

**Conclusions:** Experiencing bullying at school and online is an everyday experience for many children and young people, so there is still a need for the broad implementation of effective anti-bullying measures in schools.

1. **Introduction**

Bullying is a specific form of violence that is characterised by the fact that it is carried out repeatedly and with the intention of causing harm. There is an imbalance of power between the students involved, which makes it difficult for the bullied to defend themselves against the bullying alone and without the help of others [1]. The power imbalance between students can be caused by differences in physical size and strength, for example, but also by aspects such as social integration. Acts of bullying can include insults, punches, kicks, spreading rumours or social exclusion. If the bullying is mediated by the media (e.g. via social networks or chat groups), it is called cyberbullying.

Cyberbullying is often defined analogue to school bullying as bullying in the digital space. However, the definitional aspect of repetition in particular is also repeatedly discussed (e.g. [2]). Schultze-Krumbholz and colleagues [3]...
Traditional bullying and cyberbullying at schools in Germany: Results of the HBSC study 2022 and trends from 2009/10 to 2022

HBSC 2022
Data holder: HBSC Study Group Germany

Objective: The aim of the study is to analyse the health and health behaviour of students. Continuous health monitoring through the HBSC study contributes to informing decision-makers in policy and practice about the current fields in prevention and health promotion in childhood and adolescence. A particular focus is on the influencing factors and the social contexts of health in the young generation.

Study design: Cross-sectional survey by written questionnaire every four years

Population: Students with average ages 11, 13, and 15

Sampling: Observation units are schools and the class groups clustered within them. From the population of all state general education schools in Germany, a cluster sample was drawn. In order to obtain a representative estimate (close to the percentage distribution of the population), school size and the percentage distribution of students were included in the sampling, stratified by school type and federal state (Probability Proportional to Size (PPS) design).

Data collection period: March – November 2022

Sample size:
2022: 6,475 students
All four survey cycles (2009/10 – 2022): 21,788 students

HBSC survey cycles:
Included in the articles in this issue of the Journal of Health Monitoring:
▶ 2009/10 ▶ 2017/18
▶ 2013/14 ▶ 2022

More information can be found at https://hbsc-germany.de/ (German)

also considering findings on students’ understanding of cyberbullying, suggest that cyberbullying should be understood as ‘aggressive behaviour by a person with an intention to harm or cause harm’ ([3, P. 375] translation by the author). The key characteristics of cyberbullying compared to school bullying outside the digital space are that the bullied students often do not know who is doing the bullying. This anonymity can further increase the power imbalance that exists between the bully and the bullied [4]. In addition, cyberbullying has a larger audience than school bullying and it is almost impossible for those affected to escape the bullying [4].

Despite greater social awareness of bullying and the implementation of various anti-bullying measures in many schools, bullying remains an everyday experience for many students in all types of schools [5]. This is particularly problematic because bullying can have serious negative consequences. These include, for example, academic underachievement and a higher level of school avoidance, but also higher risks of depression, anxiety, psychosomatic complaints, self-harming behaviour and suicidal tendencies [6, 7, 8]. Some of these risks are more than threefold higher as a result of bullying experiences [7, 8]. Learners who are bullied are particularly at risk. However, bullying can also have negative consequences for those who practise bullying or those who observe bullying [7, 9]. Bullying therefore represents a potential health risk for all learners.

Various studies show that cyberbullying is reported less frequently overall than school bullying outside the digital space [5, 10]. However, there is a high degree of overlap between school bullying and cyberbullying in terms of the learners involved [10, 11, 12, 13]. Just like bullying at school, cyberbullying can have serious negative consequences for those affected [10]. Some findings suggest that the risk of externalising and internalising problems after cyberbullying experiences is even higher than in the case of school bullying outside the digital space [13]. This means that both school bullying and cyberbullying are associated with high social costs, such as school avoidance and academic performance losses, as well as health restrictions and necessary therapeutic measures [6, 14].

Analyses based on data from the HBSC cycles between 2001/02 and 2017/18 suggest that bullying in schools tends to decrease over time [5]. However, the COVID-19 pandemic and the associated measures to contain the pandemic may have changed this trend, although the corresponding empirical findings are contradictory. For example, school lockdowns have prevented bullying that does not take place online [15, 16]. Some empirical findings indicate that the incidence of bullying (both school bullying and cyberbullying) initially decreased with the school lockdowns [15, 16, 17], but increased again with the resumption of face-to-face teaching in schools [15]. However, the incidence of bullying remained below the pre-pandemic level [15]. It is possible that organisational changes, such as learning in smaller classes and increased individual support for learners by teachers, but also social effects (e.g. more cohesion due to the pandemic-related crisis experience), contributed to a reduction in the incidence of bullying during the pandemic [18]. At the same time, the finding that bullying decreased after the school lockdowns could also be a short-term effect. Changes in organisational measures were not permanent and the feeling of social connectedness may have decreased rather than increased as the pandemic progressed.
Studies from regions where there were only brief or partial school lockdowns suggest that bullying increased after the acute phase of the pandemic [19].

In contrast to school bullying, there are no findings on the development of cyberbullying in Germany compared to previous survey cycles from the HBSC study, as cyberbullying experiences were surveyed for the first time in 2017/18 [5]. Possible developments between the 2017/18 and 2022 survey cycles could also be related to the pandemic-related experiences of learners. With regard to the influence of the COVID-19 pandemic on cyberbullying experiences, international research shows very heterogeneous results. Some studies show a significant decline in cyberbullying in connection with school lockdowns [15], while others show a decline that is significantly weaker than the decline in traditional bullying [18]. Still others report an increase in cyberbullying during the pandemic [20]. Online teaching during the COVID-19 pandemic may have led to school bullying occurring exclusively in the form of cyberbullying. During the COVID-19 pandemic, the daily use of online media among adolescents has increased further [21, 22]. Daily use of digital media, and in particular frequent social interaction in the digital space, can increase the risk of bullying (both traditional and online) [23]. As social contact with peers was almost exclusively possible digitally for adolescents due to pandemic-related contact restrictions, there may therefore have been an increase in cyberbullying in the 2022 survey cycle.

This article will first analyse the prevalence of bullying and cyberbullying in Germany in 2022. For this purpose, both the overall group of learners surveyed and various subgroups differentiated by gender, age and type of school will be analysed. In addition, the question of how the prevalence of bullying and cyberbullying has changed from 2009/10 and 2017/18 to 2022 will be analysed.

2. Methods
2.1 Sample design and study implementation

The Health Behaviour in School-aged Children (HBSC) study is designed as a cross-sectional study that takes place every four years in a school setting and surveys students aged around 11, 13 and 15 (mean deviation of 0.5 years). In Germany, these age groups are mainly represented in grades 5, 7 and 9. Students at general education schools in all 16 federal states in Germany have been surveyed in the school years 2009/10, 2013/14, 2017/18 and in the calendar year 2022 as part of the HBSC study. The schools approached for participation were drawn as a cluster sample from the population of all state general education schools in Germany. In order to obtain a representative estimate (close to the distribution of the population), school size and the percentage distribution of students were included in the sampling, stratified by school type (Probability Proportional to Size (PPS) design).

The HBSC study is conducted by means of a questionnaire which students complete themselves. The study has been approved by the responsible ministries or state education authorities in all federal states (except North Rhine-Westphalia, as the decision of participation lies within the schools in this federal state).

Four survey cycles of the HBSC study Germany were analysed for the present study. In addition to the current survey in 2022 (n = 6,475), three further surveys were included in the following school years: 2009/10 (n = 5,005),
Traditional bullying and cyberbullying at schools in Germany: Results of the HBSC study 2022 and trends from 2009/10 to 2022

2013/14 (n = 5,961) and 2017/18 (n = 4,347). All data sets were standardised and adjusted by the international HBSC consortium so that the age groups are comparable. The data collection in 2022 took place after the pandemic-related school lockdowns, when teaching in schools largely took place without pandemic-related protective measures. Further information on the HBSC study and the methodology can be found in the article by Winter & Moor et al. [24] in this issue of the Journal of Health Monitoring.

2.2 Sample

Sample 2022: Data from N = 6,475 students at 174 schools are available from the 2022 survey cycle (50.3% girls, 47.5% boys, 1.7% adolescents who identify as gender diverse; see Winter & Moor et al. [24] for further information on the sample).

Sample 2017/18: N = 4,347 adolescents participated in the HBSC study 2017/18 (see Winter & Moor et al. [24]). Further information on the methodology of the 2017/18 HBSC survey cycle can be found in Moor et al [25]; further information on the distribution of bullying in Germany in 2017/18 can be found in Fischer et al [5].

Sample 2013/14: Data from N = 5,818 students from the 2013/14 survey year are used for the trend analyses. The total sample from the 2013/14 survey year is larger than the sample used for the trend analyses (total sample 2013/14: N = 5,961, cf. Winter & Moor et al. [24]) because, in contrast to the other survey cycles, special schools were also surveyed in the 2013/14 HBSC survey cycle. Various studies suggest that the incidence of bullying is particularly high at special schools [26, 27]. In order to ensure comparability with the other survey cycles with regard to the prevalence of bullying, the data from students at special schools were removed from the trend analyses (n = 143 students at ten special schools). Further information on the 2013/14 survey cycle and the incidence of bullying in 2013/14 can be found in Bucksch et al. [28] and Oertel et al. [29].

Sample 2009/10: Data from N = 5,005 students are available from the 2009/10 survey year (see Winter & Moor et al. [24]). Further information on the methodology of the 2009/10 HBSC survey cycle and the incidence of bullying in 2009/10 can be found in Kolip et al. [30] and Oertel et al. [31].

A weighting factor was created for all survey cycles to ensure nationwide sample representativeness. This equalises different participation rates in the federal states and school types so that the distribution corresponds to the population. Due to the weighting, all three age categories and the binary gender categories of girls and boys are included in the analyses in equal parts from the 2017/18 survey cycle onwards. In the 2022 HBSC survey cycle, gender was not recorded exclusively in binary form for the first time, with 1.7% of respondents indicating the category gender diverse. This was taken into account in the weighting of the 2022 data, while girls and boys were weighted equally (49.2% each; participants who did not specify their gender were excluded). Further details on the weighting of the data can be found in the article by Winter & Moor et al. [24].

2.3 Survey instruments

Bullying at school and cyberbullying

Bullying at school: Experiences of bullying at school as the bullied and the bully were assessed using two items from
Traditional bullying and cyberbullying at schools in Germany: Results of the HBSC study 2022 and trends from 2009/10 to 2022

The students surveyed were presented with an age-appropriate definition of bullying, which included the core elements of repetition, power imbalance and intent to harm. Specifically, the bullying definition was:

We say that a person is bullied when another person or group of people repeatedly says or does mean or unkind things to him or her. It is also bullying when a person is teased with things they don’t like or deliberately excluded. The person who bullies has more power than the person being bullied and wants to harm them. Bullying does not occur when two people of equal power argue or fight with each other.

the Revised Olweus Bully/Victim Questionnaire (OBVQ) [32]. Students were asked how often they had ‘participated in bullying at school in the last few months’ and how often they had been ‘bullied at school in the last few months’. The response options were (1) ‘I have not bullied anyone at school in the last few months’ or ‘I have not been bullied at school in the last few months’, (2) ‘1 or 2 times’, (3) ‘2 to 3 times a month’, (4) ‘about once a week’ and (5) ‘several times a week’. The two items were dichotomised for the analysis. In order to take the repetitive aspect of bullying into account, all answers from ‘2 to 3 times a month’ (answer options 3 to 5) were classified as experiences of being bullied or bullied. Students who reported regular bullying experiences for both items were assigned to the double role of both bullying others and being bullied. The survey and categorisation were identical in all survey cycles considered (2009/10, 2013/14, 2017/18, 2022). Complete information on their bullying experiences is available from n = 5,793 students from the survey year 2022.

Cyberbullying: Experiences with cyberbullying were recorded in a similar way to experiences with bullying at school. The students were asked how often they had ‘bullied someone online’ or been ‘bullied online’ in the last few months. They were given the following examples: ‘e.g. you have written mean messages, emails, text messages or noticeboard postings, created websites to make fun of someone or posted or sent unflattering photos of someone without permission’ (wording in the item on the experience of being bullied analogue). The response options were collected and the responses categorised as described for school bullying. Cyberbullying was surveyed identically in the 2017/18 and 2022 survey cycles. Cyberbullying was not surveyed in the previous survey cycles. Complete information on cyberbullying experiences is available from n = 5,706 students from the 2022 survey year.

Typology of (cyber)bullying experiences: In order to be able to analyse the bullying experiences, a typology of bullying experiences was formed from the dichotomised items separately for school bullying and cyberbullying. This distinguishes between four categories: Uninvolved, bullied, bullies and double role bully and bullied (i.e. students who are both bullied and bully others).

Control variables
Gender, age and type of school are considered as control variables in the analyses. Gender was recorded in the 2022 survey year using the three options ‘girl’, ‘boy’ or ‘diverse’. In the previous survey cycles, gender was recorded in binary form (girl, boy). For the trend analyses, participants who did not specify their gender or classified themselves as diverse were excluded from the gender-specific analyses. The age was determined at the time of the survey using the information provided by the students on their month and year of birth and summarised with a deviation of +/- 0.5 years into the age categories ‘11 years’, ‘13 years’ and ‘15 years’.

The school type was recorded by the survey team using the school data. The respective school types within the federal states were divided into six categories in the 2022 survey year: Primary schools, secondary general schools, intermediate schools, grammar schools as well as the groups of comprehensive schools etc. (different types of comprehensive schools in the different federal states in Germany, i.e. schools in which different graduations can be obtained) and secondary schools etc. (secondary schools/combined
Traditional bullying and cyberbullying at schools in Germany: Results of the HBSC study 2022 and trends from 2009/10 to 2022

2.4 Statistical methods

The prevalence of bullying and cyberbullying in the survey year 2022 was calculated using the typology described for school bullying and cyberbullying. Group differences by gender, age and type of school were determined for both typologies using chi-square tests with post-hoc analyses.

To provide an overview of the development of bullying prevalence over the four survey years between 2009/10 and 2022, the percentages of the four bullying roles (typology) considered are first reported for all survey years, with group differences between survey years examined using a chi-squared test and post-hoc analyses. The trend was then analysed using logistic regression analyses with robust standard errors (maximum likelihood estimation with robust standard errors, MLR), including the control variables of gender and age. The robust standard errors were used to consider the non-normal distribution and dependence of the data within survey periods, classes and schools. In the regression analyses, one category of the typology was compared with all other categories. Predictors in the regression analyses were year of survey (dummy coded), age (dummy coded) and gender (binary; adolescents who identified as gender diverse in 2022 were excluded from the trend analyses) as well as the interaction effects of year of survey and age or year of survey and gender. These interaction effects were used to analyse whether the trend might be different for each gender or age group.

The analyses were carried out with SPSS 29 and Mplus 8.10. The significance level in the analyses of data from the 2022 survey year is \( p < 0.05 \). An alpha error correction was applied to individual comparisons. A more conservative significance level of \( p < 0.001 \) was chosen for the logistic regression analyses looking at trends in bullying at school, in order to avoid interpreting random results in many individual comparisons. As data for cyberbullying is only available from two survey years and hence the number of individual comparisons is lower than for school bullying, the conservative significance level was only chosen for the regression analyses on school bullying. For the regression analyses on cyberbullying, the significance level was set at \( p < 0.05 \).

3. Results

3.1 Prevalence of bullying and cyberbullying at school in 2022

The prevalence of school bullying and cyberbullying in the total sample and by subgroup is shown in Table 1. In 2022, most students reported that they had not been directly involved in school bullying or cyberbullying, with school bullying being reported even less frequently than school bullying (uninvolved school bullying: 86.1%; uninvolved cyberbullying: 92.9%). Among those directly involved in school bullying, most reported being bullied by others (8.6%). Fewer reported having bullied others at school (3.4%). With regard to cyberbullying, however, of those directly involved in bullying, roughly the same number of students reported having been bullied online (3.0%) and having bullied others online (2.7%). The
Table 1
Traditional bullying and cyberbullying at schools in Germany: Results of the HBSC study 2022 and trends from 2009/10 to 2022

<table>
<thead>
<tr>
<th>School bullying</th>
<th>Uninvolved (in %)</th>
<th>Suffered bullying (in %)</th>
<th>Bully (in %)</th>
<th>Double role bully and bullied (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (N=5,793)</td>
<td>86.1</td>
<td>8.6</td>
<td>3.4</td>
<td>1.9</td>
</tr>
<tr>
<td>Gender (χ² (6) = 97.4, p &lt; 0.001, V = 0.09, n = 5,767)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girls (n = 2,942)</td>
<td>88.0</td>
<td>8.9</td>
<td>2.0</td>
<td>1.1</td>
</tr>
<tr>
<td>Boys (n = 2,727)</td>
<td>84.8</td>
<td>7.8</td>
<td>4.9</td>
<td>2.5</td>
</tr>
<tr>
<td>Gender diverse (n=98)</td>
<td>65.7</td>
<td>23.5</td>
<td>3.9</td>
<td>6.9</td>
</tr>
<tr>
<td>Age (χ² (6) = 18.7, p = 0.005, V = 0.04, n = 5,736)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 years (n = 1,862)</td>
<td>86.2</td>
<td>9.3</td>
<td>2.6</td>
<td>1.9</td>
</tr>
<tr>
<td>13 years (n = 1,937)</td>
<td>84.2</td>
<td>9.3</td>
<td>4.3</td>
<td>2.3</td>
</tr>
<tr>
<td>15 years (n = 1,937)</td>
<td>87.8</td>
<td>7.4</td>
<td>3.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Type of school (χ² (15) = 52.8, p &lt; 0.001, V = 0.06, n = 5,680)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school (n=249)</td>
<td>79.4</td>
<td>13.2</td>
<td>5.1</td>
<td>2.2</td>
</tr>
<tr>
<td>Secondary general school (n = 154)</td>
<td>88.4</td>
<td>7.4</td>
<td>4.3</td>
<td>1.8</td>
</tr>
<tr>
<td>Intermediate school (n = 544)</td>
<td>85.1</td>
<td>9.4</td>
<td>3.6</td>
<td>1.8</td>
</tr>
<tr>
<td>Grammar school (n = 3,075)</td>
<td>88.8</td>
<td>7.4</td>
<td>2.7</td>
<td>1.1</td>
</tr>
<tr>
<td>Comprehensive school etc. (n = 672)</td>
<td>84.0</td>
<td>10.0</td>
<td>3.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Secondary school etc. (n = 1,099)</td>
<td>83.1</td>
<td>9.0</td>
<td>5.6</td>
<td>2.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cyberbullying</th>
<th>Total (N=5,706)</th>
<th>92.9</th>
<th>3.0</th>
<th>2.7</th>
<th>1.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (χ² (6) = 99.9, p &lt; 0.001, V = 0.09, n = 5,679)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girls (n = 2,913)</td>
<td>94.9</td>
<td>3.1</td>
<td>1.3</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>Boys (n = 2,669)</td>
<td>91.4</td>
<td>2.6</td>
<td>4.1</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Gender diverse (n = 98)</td>
<td>77.7</td>
<td>11.7</td>
<td>4.9</td>
<td>5.8</td>
<td></td>
</tr>
<tr>
<td>Age (χ² (6) = 14.5, p = 0.025, V = 0.04, n = 5,652)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 years (n = 1,817)</td>
<td>94.0</td>
<td>3.0</td>
<td>2.0</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>13 years (n = 1,914)</td>
<td>92.6</td>
<td>3.4</td>
<td>2.9</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>15 years (n = 1,921)</td>
<td>92.3</td>
<td>2.6</td>
<td>3.2</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Type of school (χ² (15) = 73.1, p &lt; 0.001, V = 0.07, n = 5,706)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school (n = 239)</td>
<td>89.3</td>
<td>4.6</td>
<td>2.3</td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td>Secondary general school (n = 149)</td>
<td>91.5</td>
<td>6.5</td>
<td>1.6</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Intermediate school (n = 536)</td>
<td>93.6</td>
<td>2.5</td>
<td>2.8</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Grammar school (n = 3,054)</td>
<td>95.1</td>
<td>2.5</td>
<td>1.6</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>Comprehensive school etc. (n = 658)</td>
<td>91.0</td>
<td>2.8</td>
<td>4.0</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>Secondary school etc. (n = 1,070)</td>
<td>90.9</td>
<td>2.9</td>
<td>3.9</td>
<td>2.4</td>
<td></td>
</tr>
</tbody>
</table>

Subscripts indicate subgroups that are not significantly different in the post-hoc analyses. Subgroups that do not have the same letter within a bullying role are therefore significantly different from each other. In the post-hoc analyses, the alpha errors were adjusted according to Bonferroni (p_gender and age < 0.017; p_school type < 0.003). Values slightly above or below 100% are due to rounding of decimals. The number of cases (n) refers to the number of cases before weighting. All percentages are based on the weighted data.
group of those who have both been bullied and bullied others is the least represented in both school bullying (1.9%) and cyberbullying (1.4%).

Involvement in bullying and cyberbullying varies according to the gender of the respondent. Young people who identify as gender diverse were significantly more likely than girls and boys to report having been bullied at school or online. Girls were less likely than boys to report having been bullied at school or online. With regard to cyberbullying, girls were also less likely than young people who identify as gender diverse to have bullied others. For both school bullying and cyberbullying, girls were the least likely and youth who identified as gender diverse were the most likely to report both being bullied and bullying others (double role bully and bullied) (Table 1).

The bullying experiences of the children and adolescents surveyed differed only slightly by age. For bullying at school, 13-year-olds were more likely than 15-year-olds to report direct experiences of bullying and more likely than 11-year-olds to report having bullied others at school. With regard to cyberbullying, there were no differences between 11-, 13- and 15-year-olds’ involvement in bullying.

In terms of school type, there are many differences between the six school types and the four bullying roles analysed. Students in grammar schools were less likely than students in most other school types to have been directly involved in bullying or cyberbullying at school. The experience of being bullied by others in a school context was about equally common among students in all types of schools, while students in secondary general schools were significantly more likely to report being bullied online. In terms of bullying, students in intermediate schools were more likely than students in grammar schools and secondary general schools to report having bullied others at school. Students in grammar schools were less likely than those in comprehensive schools and secondary schools to report having bullied others online. Students who have both been bullied and bullied others at school or online are less likely to be found in grammar schools than in other types of school, although there are no differences between all types of school. All significant group differences are shown in Table 1.

3.2 Trend in prevalence of bullying: general trend

Table 2 shows the prevalence of bullying in the school context in the survey years 2009/10, 2013/14, 2017/18 and 2022. The comparison without the control variables of age and gender shows that overall more direct experiences of bullying were reported in 2009/10 and 2013/14 than in 2017/18 and 2022. Regarding the experience of being bullied, the information does not differ between the four survey cycles considered. However, more students reported having bullied others in 2009/10 and 2013/14 than in 2017/18 and 2022. There are no significant differences between 2009/10 and 2013/14. The survey years 2017/18 and 2022 differ only in the proportion of students who reported both being bullied and bullying others: the proportion of the double role bully and bullied is higher in 2022 than in 2017/18. However, there are no differences for this bullying role compared to the previous survey years 2009/10 and 2013/14. Due to the different weighting of the data in 2009/10 and 2013/14 compared to 2017/18 and 2022 (see section 2.2), a direct comparison of the percentages must be made with caution. Even if there are usually

In 2022, just under 14% of adolescents stated that they had experienced bullying at school.
Traditional bullying and cyberbullying at schools in Germany: Results of the HBSC study 2022 and trends from 2009/10 to 2022

Bullying experiences in relation to school bullying over time between 2009/10 and 2022 (n = 10,556 girls, n = 9,939 boys, n = 124 without gender information) and cyberbullying between 2017/18 and 2022 (n = 5,150 girls, n = 4,597 boys, n = 124 without gender information)

Source: HBSC Germany 2009/10, 2013/14, 2017/18 and 2022

Table 2

<table>
<thead>
<tr>
<th>Survey year</th>
<th>Uninvolved (in %)</th>
<th>Suffered bullying (in %)</th>
<th>Bully (in %)</th>
<th>Double role bully and bullied (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School bullying ((X^2 \ (9) = 189.7, p &lt; 0.001, V = 0.06, n = 20,619))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009/10 (n = 4,910)</td>
<td>81.4(\text{a})</td>
<td>8.6(\text{c})</td>
<td>8.4(\text{d})</td>
<td>1.6(\text{f, g})</td>
</tr>
<tr>
<td>2013/14 (n = 5,711)</td>
<td>83.2(\text{a})</td>
<td>7.8(\text{c})</td>
<td>7.5(\text{d})</td>
<td>1.4(\text{f, g})</td>
</tr>
<tr>
<td>2017/18 (n = 4,205)</td>
<td>86.7(\text{a})</td>
<td>8.3(\text{e})</td>
<td>3.9(\text{g})</td>
<td>1.1(\text{f})</td>
</tr>
<tr>
<td>2022 (n = 5,793)</td>
<td>86.1(\text{a})</td>
<td>8.6(\text{c})</td>
<td>3.4(\text{e})</td>
<td>1.9(\text{f})</td>
</tr>
<tr>
<td>Cyberbullying ((X^2 \ (3) = 45.7, p &lt; 0.001, V = 0.07, n = 9,871))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017/18 (n = 4,165)</td>
<td>96.0(\text{a})</td>
<td>2.0(\text{e})</td>
<td>1.3(\text{g})</td>
<td>0.6(\text{g})</td>
</tr>
<tr>
<td>2022 (n = 5,706)</td>
<td>92.9(\text{b})</td>
<td>3.0(\text{d})</td>
<td>2.7(\text{f})</td>
<td>1.4(\text{h})</td>
</tr>
</tbody>
</table>

Subscripts indicate subgroups that are not significantly different in the post-hoc analyses. Subgroups that do not have the same letter within a bullying role are therefore significantly different from each other. Post-hoc analyses with alpha error correction according to Bonferroni (school bullying: p < 0.008). Values slightly above or below 100 % are due to rounding of decimals. The n in each year refers to the number of cases before weighting. All percentages are based on the weighted data.

Just under 7 % of students reported experiences with cyberbullying in 2022.

Only small shifts due to the weighting, it is more reliable to compare the survey periods considering age and gender (see section 3.3).

Table 2 compares experiences of cyberbullying in the two survey years 2017/18 and 2022. It can be seen that students are more often represented in all cyberbullying roles in 2022 than in 2017/18.

3.3 Trends in the prevalence of bullying taking into account age and gender

In addition to the univariate trends considered in section 3.2, the analysis of bullying trends from 2009/10 to 2022 also takes into account the control variables of age and gender in more complex statistical analyses. This makes it possible to determine whether there are different trends for boys and girls or for younger and older adolescents. This is done by including interaction terms between age and survey year or between gender and survey year.

The results for the prevalence of bullying at school from 2009/10 to 2022 are shown in Table 3. Similar to the results of the univariate trend analysis (see Table 2), it can be seen that there is no difference in the prevalence of bullying between 2017/18 and 2022. The difference between 2017/18 and 2022 regarding the double role of bully and bullied (Table 2) disappears when the control variables are considered. However, in the earlier survey years 2009/10 and 2013/14, significantly more students reported that they had been involved in bullying, and in particular that they had bullied others, compared to 2022.

The trend is comparable for girls and boys (not shown in the table; all confidence intervals include 1 for all bullying roles, \(p > 0.05\)). Looking at the trend as a function of age, it can be seen that especially the youngest respondents (compared to the oldest respondents) were not involved in bullying in 2009/10 (compared to 2022) (interaction term 11 years x year 2009/10 for the bullying role of those not involved, reference: 15-year-olds in the survey year 2022;
FOCUS

Adolescents who identified as gender diverse were significantly more likely to report having been bullied at school or online.

Table 3

<table>
<thead>
<tr>
<th>Survey year (Reference: 2022)</th>
<th>Uninvoled</th>
<th>Suffered bullying</th>
<th>Bully</th>
<th>Double role bully and bullied</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009/10</td>
<td>OR (95 % CI)</td>
<td>OR (95 % CI)</td>
<td>OR (95 % CI)</td>
<td>OR (95 % CI)</td>
</tr>
<tr>
<td></td>
<td>0.4***</td>
<td>1.2</td>
<td>3.3***</td>
<td>2.0 (1.0–4.3)</td>
</tr>
<tr>
<td>2013/14</td>
<td>0.6***</td>
<td>0.8</td>
<td>3.1***</td>
<td>1.0 (0.5–2.2)</td>
</tr>
<tr>
<td>2017/18</td>
<td>0.8</td>
<td>1.0</td>
<td>1.9</td>
<td>0.7 (0.3–1.7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender (Reference: male)</th>
<th>Uninvoled</th>
<th>Suffered bullying</th>
<th>Bully</th>
<th>Double role bully and bullied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>1.3 (1.1–1.6)</td>
<td>1.2 (0.9–1.5)</td>
<td>0.4***</td>
<td>0.4 (0.2–0.9)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age (Reference: 15 years)</th>
<th>Uninvoled</th>
<th>Suffered bullying</th>
<th>Bully</th>
<th>Double role bully and bullied</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 years</td>
<td>0.8 (0.6–1.0)</td>
<td>1.4 (1.0–2.0)</td>
<td>0.8 (0.5–1.2)</td>
<td>1.6 (0.8–3.5)</td>
</tr>
<tr>
<td>13 years</td>
<td>0.7 (0.5–0.9)</td>
<td>1.4 (1.0–1.9)</td>
<td>1.3 (0.9–1.9)</td>
<td>2.0 (0.8–4.6)</td>
</tr>
</tbody>
</table>

OR = odds ratio, CI = confidence interval. *** p < 0.001
The significance level was set at p < 0.001 due to the large number of individual comparisons. Results of four logistic regression analyses, one per bullying role. N refers to the number of cases before weighting. Calculations with weighted data.

The increase in those not involved in school bullying in 2022 was greater among 15-year-olds than among 11-year-olds compared to 2009/10. There were therefore more uninvolved 15-year-olds in 2022 than in 2009/10. However, this is due to the fact that 11-year-olds already reported less active involvement in bullying at school in the 2009/10 survey year (uninvolved 11-year-olds 2009/10: 84.3 %, 2022: 86.1 %; uninvolved 15-year-olds 2009/10: 79.3 %, 2022: 87.8 %). A further decrease in bullying experiences since 2009/10 was therefore less possible for the group of 11-year-olds, as the youngest students surveyed have been involved in very little bullying at school since the beginning of the nationwide HBSC surveys. There are no further developments in the trend according to age group (other significant interaction terms between age group and survey year).

Table 4 shows the results of the logistic regression analyses for participation in cyberbullying in the survey years 2017/18 and 2022. Considering the control variables, it can be seen that the surveyed students reported more cyberbullying experiences in 2022 than in 2017/18. Looking at the three groups of those directly involved, a significant increase can only be observed in the double role of bully and bullied. Here, the inclusion of the control variables leads to different results than in the univariate analysis in Table 2.

There are no age differences in participation in cyberbullying in 2022. Changes between 2017/18 and 2022 are also largely uniform across age groups (interaction terms between age group and survey year). Only 13-year-olds report less involvement as bullies in cyberbullying in 2017/18 than in 2022 compared to 15-year-olds (interaction term 13 years x survey year 2017/18 for the role of bullies, reference: 15-year-olds in survey year 2022; OR = 0.4, p < 0.005, 95 % CI: 0.2–1.0). This means that 13-year-olds had a greater increase in experience of bullying others online between 2017/18 and 2022 than 15-year-olds. However, it should be noted that 15-year-olds were already more likely to report having bullied others online in 2017/18 (13-year-olds bullied online in
4. Discussion

4.1 Prevalence of bullying at school and cyberbullying in 2022

Just under 14% of the young people surveyed said that they had been bullied and/or had bullied others at school in 2022. This means that around one in seven learners have experienced direct bullying in 2022. Given that bullying can have a negative impact not only on these directly affected learners, but also on all those who observe and experience bullying in their classrooms (see section 1), this finding underlines that bullying continues to be an everyday problem for many children and young people.

In line with current research [5, 10], the results of the HBSC 2022 survey show that cyberbullying is less commonly reported than bullying at school. In this study, only just over 7% of students reported being bullied online and/or having bullied others online. This means that bullying experiences at school are twice as common as bullying experiences explicitly attributed to the digital space.

In the 2022 HBSC study in Germany, boys were more likely than girls to report having bullied others at school or online. A closer look at the differences between 2017/18 and 2022 by gender shows that in 2022, girls were less likely than boys to be involved in cyberbullying (and especially less likely to bully others online). In addition, the increase in cyberbullying experiences from 2017/18 to 2022 was also lower for girls than for boys (interaction term girls x survey year 2017/18 for the role of uninvolved, reference: boys in survey year 2022; OR = 0.6, p < 0.01, 95% CI: 0.4 – 0.9; interaction term girls x survey year 2017/18 for the role of bullied; OR = 2.1, p < 0.01, 95% CI: 1.0 – 4.3). The proportion of girls not involved in cyberbullying decreased only slightly (2017/18: 95.9%, 2022: 94.9%; see Table 1 and [5]), while the proportion of boys not involved in cyberbullying decreased significantly in 2022 compared to 2017/18 (2017/18: 96.1%, 2022: 91.5%; see Table 2 and [5]). In particular, the risk of boys bullying others online has increased (bullying boys 2017/18: 1.6%, 2022: 4.1%; bullying girls 2017/18: 1.0%, 2022: 1.3%; see Table 2 and [5]).

There are no significant differences between the survey years 2017/18 and 2022 in terms of the prevalence of bullying at school, but cyberbullying has increased.

Table 4
Odds ratios of experiences with cyberbullying by survey year, gender and age in 2017/18 and 2022 (n=5,110 girls, n=4,556 boys)
Source: HBSC Germany 2017/18, 2022
online. More frequent bullying by boys than girls is often reported in studies [10], so the findings are consistent with the current state of research. In contrast, there is little evidence about young people who identify as gender diverse. It is known that sexual minority (LGBTQ) learners are at higher risk of being bullied [33]. In contrast, the group of adolescents who do not identify with a binary gender group has rarely been analysed separately. Studies from the USA and Finland suggest that non-binary and transgender youth are at higher risk of being bullied at school and are also more likely to be bullied themselves [34, 35]. A study from Finland suggests that students may pass on their own experiences of victimisation through bullying, or that bullying may result from inappropriate strategies for coping with internal stress and strain [35]. In general, however, it should be noted that there is a paucity of research on gender diverse youth in relation to bullying and, in particular, perpetration of bullying is rarely included. Findings from Germany appear to be particularly scarce: a systematic review of 2023 identified 111 empirical publications on bullying and LGBTQ+, none of which were from Germany [33]. There is therefore a need for further research in this area, as well as to review and categorise the available evidence.

There were few age differences in the reported incidence of bullying in 2022. 13-year-olds were more likely than the younger and older age groups to report directly experiencing bullying and bullying others. However, these differences are small and do not affect the experience of being bullied themselves. There were no age differences in cyberbullying. This contradicts the findings of the 2017/18 HBSC study [5], in which 15-year-olds were more likely than younger students to report bullying others in a school context and online. At that time, 13-year-olds were also more likely than 15-year-olds to report being bullied at school [5]. It is possible that younger adolescents are now becoming more involved in bullying themselves in an apparent attempt to protect themselves from being bullied. The results of the HBSC 2022 study suggest that bullying is more likely to be directed at younger students, although these findings are not significant. Age differences in the three age groups described have not been widely investigated and should be further explored in future studies.

4.2 Trends in the prevalence of bullying at school and cyberbullying

The analysis of the prevalence of bullying in the school context from 2009/10 to 2022 shows that less bullying was reported in 2022 than in 2009/10 and 2013/14. However, there are no differences compared to the survey year 2017/18. An increase in the double role of bullies and bullied, which seemed relevant when looking at the percentages in the survey years, is no longer evident when the control variables of age and gender are taken into account.
This means that overall it can be assumed that the prevalence of bullying has remained stable since 2017/18. Compared to previous years (up to 2013/14), bullying at school has decreased, but there does not seem to have been a further decrease. This has already been mentioned in the analyses of the 2017/18 HBSC study in Germany [5]. Overall, the trend is comparable for the age groups analysed and for boys and girls. Only 11-year-olds show a smaller decrease in bullying at school between 2009/10 and 2022, but this is mainly due to the fact that the 11-year-olds surveyed in 2009/10 already reported fewer active bullying experiences than other students. A decrease in bullying experiences is only evident where there was already more bullying, so overall it could be a floor effect. This means that there is a low level of bullying at which further reductions in bullying are statistically difficult to prove. However, it should also be taken into account that the lower bullying figures in 2009/10 and 2013/14 are mainly due to the role of the bullies. This could also be a reporting effect: Learners in 2017/18 and 2022 may be more likely to refrain from reporting their own bullying behaviour as a result of increased awareness-raising activities. The reduction in bullying behaviour would then be reflected in studies, but not in everyday school life. It is also possible that students who bully others despite increased anti-bullying measures will bully different other students. In this case, the number of bullies would decrease compared to previous survey years, but not the number of bullying incidents.

Due to the COVID-19 pandemic, the question of the development of the prevalence of bullying from 2017/18 to 2022 is particularly relevant. However, the available evidence suggests that the pandemic has not led to significant changes in the prevalence of bullying in schools. It should be noted, however, that most of the pandemic-related safeguards had expired by the time of the 2022 survey. Extensive school closures due to the pandemic occurred mainly in 2020. Possible shifts in the incidence of bullying from the school context to the cyber context [15, 16], contextual amplification of bullying processes due to a general sense of insecurity [36], or contextual protective factors such as an increased sense of community or learning in smaller classes [18], as suggested by some researchers, may have taken place but would no longer be measurable in 2022. A study conducted in the US suggests that there may have been a comparatively rapid increase in school bullying after schools reopened, although this initially remained below pre-pandemic levels [15]. However, as time elapsed between the interventions and the reopening of schools, the dynamics of bullying may have adjusted so that there are no differences in the incidence of bullying compared to pre-pandemic levels. This means that the lack of change in the prevalence of bullying in schools between 2017/18 and 2022 does not rule out an influence of the pandemic on the incidence of bullying.

However, the prevalence of cyberbullying has increased. The increase mainly affects 13-year-old students and boys. The time that children and young people spend with online media continued to increase in 2022 [21, 22], which may also have been facilitated by the pandemic-related experiences in the online space (online lessons, online social contacts). Cyberbullying experiences may have increased as a result, independent of school bullying.

As bullying at school has not decreased, but cyberbullying has increased, the overall problem of bullying is
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When interpreting the data on the prevalence of bullying at school and cyberbullying, it is important to bear in mind the way in which bullying experiences were collected. For example, for the school bullying survey, children and young people were asked about their experiences of bullying ‘at school’. For the cyberbullying survey, they were explicitly asked about their experiences online. It is possible that students thought of bullying experiences that included both contexts (e.g. cyberbullying in a class chat during the school day), which could have led to double counting. In addition, children and adolescents may make less of a distinction between offline and online spaces, meaning that bullying that was not explicitly categorised as cyberbullying by the adolescents did not necessarily take place outside of the online space. This means that cyberbullying may have been underreported.

The survey on bullying and cyberbullying at school was self-reported by the adolescents, so social desirability may have led to underreporting of bullying (and especially bullying practice, see section 4.2). Completing the questionnaire in class may also have influenced students’ reporting behaviour (e.g. reinforcement of social desirability; fear that classmates will see their own statements). In addition, experiences of bullying (school bullying and cyberbullying) were measured with only a few items (one item each for experiences of being bullied and bullying in school and cyberbullying). This could also lead to an underestimation of bullying, as learners may not directly recall their own experiences of bullying as such in a global item. Including specific types of bullying with examples could lead to more accurate information.

Overlaps between experiences of school bullying and cyberbullying were not considered in the present analyses. In addition, the chosen typology may be an over-simplified representation of reality, as studies indicate that experiences of cyberbullying in particular are rarely made in one of the differentiated roles [37, 38].

The trend was analysed considering the control variables of age and gender. The trend might be different for other aspects such as type of school or migration background. In addition, future trend analyses should also include adolescents who identify as gender diverse, as the findings for 2022 show that the bullying experiences of these students differ from those of adolescents with binary gender identification (as girls and boys).

Possible effects of the COVID-19 pandemic on the incidence of bullying among students can only be analysed indirectly through comparisons over time. These time comparisons, as here between the 2017/18 and 2022 survey cycles, are distorted by other influences. Changes cannot be attributed solely to the pandemic, but are inextricably linked to other temporal and contextual influences.
4.4 Conclusions

This study shows that bullying is still an everyday experience for many children and young people. Compared to previous years, less bullying was reported at school in 2022. Compared to 2017/18, there was no increase, but also no further decrease in school bullying. However, more experiences of cyberbullying were reported in 2022 than in 2017/18, so there may have been an overall increase in bullying. However, it is unclear whether the number of students affected by school bullying and cyberbullying has increased, or whether more students affected by school bullying are also directly experiencing cyberbullying. This will require further statistical analysis. In addition, the development of the prevalence of bullying needs to be further monitored and analysed in the coming years.

Overall, the continuation and further implementation of anti-bullying policies in schools is necessary to successfully counteract bullying. In addition to the students themselves, appropriate interventions should also target teachers and the school system as a whole. Teachers should be provided with a range of successful anti-bullying strategies to choose from depending on the situation, and they should be encouraged to be confident in their own pedagogical behaviour even in the face of bullying incidents. Collaborative strategies appear to be particularly promising [39, 40], so collaborations within and outside the school should be established and utilised. This includes collaboration with local health services (e.g. counselling services, doctors, psychotherapists, clinics), as bullying poses a significant risk to young people’s physical and mental health. Students in the classroom should be encouraged to stand by the bullied students, thus depriving the bullied students of motivating positive feedback (bystander behaviour; see participant role approach) [41, 42]. Appropriately trained and available school social workers can help to implement school-wide anti-bullying policies, thereby reducing the burden on teachers and acting as a resource for students.

In particular, the prevalence of cyberbullying needs to be monitored and taken into account and analysed in later cycles of the survey in order to identify and counteract possible negative effects on students. In this context, efforts by society as a whole to help young people become competent in the use of digital media and appropriate social digital communication are also relevant. This includes both in-school and out-of-school promotion of media literacy as well as promotion of social skills and conflict resolution skills. In addition, young people need to have someone they can talk to in confidence if they have negative experiences online, are bullied at school or online, or witness bullying. Appropriate youth work services and parental counselling are just as important as legal measures to protect children and young people in the digital space.

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Data protection and ethics
Like the previous cycles, the current survey of the HBSC study 2022 was reviewed by the ethics committee of the Medical Association of Hamburg (processing no.: 2021-100700-WF). The survey is voluntary and anonymous at school and individual level at all times. The school principals and students were informed in advance about all the content and objectives of the study and about the data protection concept. Written consent (informed and active consent) was required from the parents/guardians and the students themselves (from grade 7) in order to participate in the survey. The study was conducted in accordance with the German Federal Data Protection Act (BDSG) and the European General Data Protection Regulation (GDPR). A corresponding data protection concept was developed in advance with the data protection officer of Martin Luther University Halle-Wittenberg (print survey) and the data protection officer of Brandenburg University of Technology Cottbus-Senftenberg (online survey). Additional information and conditions on data protection that the HBSC team received from various ministries as part of the approval process were also taken into account and added to the concept.

Data availability
The current HBSC data is not available as open access as their use is reserved exclusively for the HBSC Study Group Germany for the first three years after collection. Use of the data by third parties is possible on request. Enquiries about the data or ideas for analysis can be addressed to the HBSC Study Group Germany (Principal Investigator and Coordinator: Prof. Dr. Matthias Richter, Technical University of Munich; Co-Principal Investigator and Coordinator: Dr. Irene Moor, Martin Luther University Halle-Wittenberg). After an embargo period of three years, the national and international HBSC data can be requested from the ‘HBSC Data Management Centre’ (Head: Prof. Dr. Oddrun Samdal) at the University of Bergen (Norway) (https://www.uib.no/en/hbscdata).

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Conflicts of interest
The authors declared no conflicts of interest.
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Physical activity of older children and adolescents in Germany – Results of the HBSC study 2022 and trends since 2009/10

Abstract

Background: Physical activity is central to health, beginning in childhood and adolescence, and regular monitoring provides important information for strategic decisions on promoting physical activity in Germany.

Methods: The current survey cycle of the Health Behaviour in School-aged Children (HBSC) study gives an insight into the prevalence of the indicators daily recommended physical activity, high and low physical activity, and sporting activity among students aged between 11 and 15 for 2022. In addition, the data is compared to the survey cycles of the 2009/10, 2013/14, and 2017/18 school years and analysed over time.

Results: The results of the current survey cycle show that 10.8% of girls, 20.9% of boys, and 12.4% of gender diverse adolescents fulfil the daily physical activity recommendation. There are also major gender-specific differences for the other indicators. The group of gender diverse adolescents needs to be analysed further. The changes over time between 2009/10 and 2022 are relatively small. While girls' physical activity habits decreased slightly for the various indicators between 2009/10 and 2022, boys' prevalence remained relatively stable over the same period.

Conclusions: Overall, in part due to the effects of the various COVID-19 lockdowns, the need for effective and population-based measures to promote physical activity in childhood and adolescence remains high.

1. Introduction

Physical activity is a key influencing factor for health across all phases of life. Even children’s and adolescents’ physical and mental health benefits from physical and sporting activities [1, 2]. In addition, the preventive effect of physical activity on various chronic, non-communicable diseases (e.g. type II diabetes, heart attack, bowel cancer) in adulthood has been strongly proven [3]. If health-promoting physical activities are socially and ritually established in children and adolescents at an early age, active children are more likely to become active adults [4, 5].

According to the updated international recommendations of the World Health Organization (WHO), adolescents should be physically active for at least 60 minutes a day with at least moderate intensity (e.g. cycling at 15 km/h). This activity can be reached in everyday life or during leisure time. In the recently updated version of the WHO
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HBSC 2022
Data holder: HBSC Study Group Germany
Objective: The aim of the study is to analyse the health and health behaviour of students. Continuous health monitoring through the HBSC study contributes to informing decision-makers in policy and practice about the current fields in prevention and health promotion in childhood and adolescence. A particular focus is on the influencing factors and the social contexts of health in the young generation.

Study design: Cross-sectional survey by written questionnaire every four years
Population: Students with average ages 11, 13, and 15
Sampling: Observation units are schools and the class groups clustered within them. From the population of all state general education schools in Germany, a cluster sample was drawn. In order to obtain a representative estimate (close to the distribution of the population), school size and the percentage distribution of students were included in the sampling, stratified by school type and federal state (Probability Proportional to Size (PPS) design).

Data collection period: March – November 2022
Sample size:
2022: 6,475 students
All four survey cycles (2009/10–2022): 21,788 students
HBSC survey cycles:
Included in the articles in this issue of the Journal of Health Monitoring:
▶ 2009/10 ▶ 2013/14 ▶ 2017/18 ▶ 2022
More information can be found at https://hbsc-germany.de/ (German)

Physical activity recommendation at international level, the focus for children and adolescents has shifted from daily physical activity time to the total weekly amount of at least moderate-intensity physical activity. There is sufficient evidence in favour of a weekly average of 60 minutes per day causing positive health effects rather than a daily target of 60 minutes. In addition, it is pointed out that children and adolescents should perform aerobic-orientated and muscle-strengthening activities with higher-intensity use of large muscle groups at least three days a week in order to achieve further effects for healthy development. High-intensity activities generally involve activities that significantly increase the heart rate. In addition, the time spent sitting should be limited [6].

Although the health potential is undisputed, many children and adolescents globally and nationally fall short of the physical activity recommendation. According to a comparative international analysis of available data, 22.4% of 11 to 17-year-old boys and 15.3% of girls of the same age worldwide fulfil the WHO recommendation for daily physical activity of at least 60 minutes. At 20.3% and 12.1%, respectively, the figures for Germany are below the global average in this comparison. The data stem from a compilation of 298 population-based surveys in this age group and were collected by means of adolescents’ self-reporting [7]. In addition, the Active Healthy Kids Global Alliance issues physical activity report cards in the form of the Global Matrix for 57 countries based on various indicators of physical activities, which summarise existing studies such as the Health Behaviour in School-aged Children (HBSC) study in a secondary analysis. In the latest Global Matrix 4.0, ‘weak’ grades or a low level of physical activity are found across the board, with Germany scoring ‘D+’ in this regard [8]. If, in comparison, physical activity is measured using objective, device-based measurement methods (e.g. accelerometry), even fewer children and adolescents fulfil the health-oriented physical activity recommendation [9].

Another clear finding at both international and national level is that, on average, girls are less (physically) active than boys [9]. On average, girls also lose more time spent with physical activity than boys from childhood to adolescence [10]. If sporting activity is considered, there are recurring clear differences between the genders, both internationally and nationally, at the expense of girls and at the expense of girls and boys from socioeconomically disadvantaged families [11].

The extent to which the physical activity of children and adolescents have changed in recent decades is the subject of frequent scientific debate. A systematic review based on international and national data shows roughly the same number of studies reporting an increase or decrease in physical activity between 1970 and 2018 [12]. In addition, the Global Matrices 1.0 to 4.0 evaluate the current situation regarding physical activity and sporting activities at a low grade in various countries over time. Across the participating countries, positive developments can only be seen in free play and active transport (e.g. walking or cycling to school). It is again striking that these positive developments are less evident in girls than in boys [13]. For the German national context, the assessment of physical activity using the Global Matrices remains at a low level between 2018 and 2022 [8, 14].

For Germany, the latest cycles of the HBSC study between 2009/10 and 2017/18 showed that both the fulfilment of the
physical activity recommendation for total physical activity per day and specifically sporting activity are slightly declining – for both girls and boys. At the same time, the proportion of girls and boys with low levels of physical activity increased over time [11]. Further analyses between the 2001/02 and 2013/14 survey dates of the HBSC study report relatively stable values for overall physical activity and sporting activity in particular [15]. For longer-term trends of physical activity, it should be emphasised that the prevalence data refer to the period before the COVID-19 pandemic and related lockdowns, which were associated with significant effects on health and health behaviour for children and adolescents [16]. Studies on physical activity conducted during the COVID-19 pandemic and related lockdowns observed a decline in the prevalence of physical activity [17, 18]. The magnitude of the decline is estimated at -10.8 min/day to -91 min/day, with the greatest losses being observed in the area of structured activities and organised sport. Boys were less affected by the reduction [19].

Against this background, the aim of this article is to use the current data from the HBSC study 2022 to present the prevalence of various indicators of physical activity in late childhood and adolescence. With reference to the COVID-19 pandemic and the associated restrictions, it should also be noted that the current HBSC data were collected at a time when physical and sporting activities in informal and organised forms were largely permitted again. In addition, temporal trends since the 2009/10 HBSC survey cycle are reported, allowing the development of physical activity to be tracked at four-year intervals on the basis of the nationwide surveys.

2. Methods
2.1 Sample design and study implementation

The Health Behaviour in School-aged Children (HBSC) study is designed as a cross-sectional study that takes place every four years in a school setting and surveys students aged around 11, 13 and 15 (mean deviation of 0.5 years). In Germany, these age groups mainly comprise grades 5, 7, and 9. Students at general education schools in all 16 federal states in Germany have been surveyed in the school years 2009/10, 2013/14, 2017/18 and in the calendar year 2022 as part of the HBSC study. The schools approached for participation were drawn as a cluster sample from the population of all state general education schools in Germany. In order to obtain a representative estimate (close to the distribution of the population), school size and the percentage distribution of students were included in the sampling, stratified by school type (Probability Proportional to Size (PPS) design).

The HBSC study is conducted by means of a questionnaire, which the students complete themselves. The study has been approved by the responsible ministries or state education authorities in all federal states (except North Rhine-Westphalia, as the decision of participation lies within the schools in this federal state).

Four survey cycles of the HBSC study Germany were analysed for the present study. In addition to the current survey in 2022 (n = 6,475), three further surveys were included in the following school years: 2009/10 (n = 5,005), 2013/14 (n = 5,961), and 2017/18 (n = 4,347). All data sets were standardised and adjusted by the international HBSC consortium so that the age groups are comparable. Further
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2.2 Survey procedure

This article focuses on indicators for physical activity as well as gender and age as sociodemographic stratification variables. Gender was recorded in the 2022 survey year using the three options ‘girl’, ‘boy’, or ‘diverse’. In the previous survey cycles, gender was recorded in binary form (girl, boy). For the trend analyses, people who did not specify their gender or classified themselves as diverse were excluded from the gender-specific analyses. The age was determined at the time of the survey using the information provided by the students on their month and year of birth and summarised with a deviation of +/-0.5 years into the age categories ‘11 years’, ‘13 years’ and ‘15 years’. For regression analyses, socioeconomic status is also included as a control variable for the 2022 survey cycle. This is determined in the HBSC study using the Family Affluence Scale (FAS) to measure the social status of adolescents. Six items (car, own room, vacations taken with the family, computer, number of bathrooms, dishwasher) are added and categorised as low, medium, or high family affluence based on the percentage distributions within the sample [21].

Indicators of physical and sporting activities

Physical activity of at least moderate intensity was determined by asking on how many of the last seven days the older children and adolescents had been physically active for at least 60 minutes. The introduction to this item uses examples to illustrate that it refers to all physical activities throughout the day that elevate the pulse rate and cause you to get out of breath for a while. The respondents ticked one of the eight response categories from zero to seven days. Three indicators were formed on the basis of these response categories. Firstly, it was determined whether the respondents were engaged in 60 minutes of moderate-intensity physical activity per day and thus fulfil the health-effective level of physical activity according to the minimum duration per day (‘physical activity recommendation fulfilled’). The survey instrument thus still refers to the WHO recommendation of at least 60 minutes per day, although the update of the recommendations introduced an average daily target of 60 minutes, as described above [6]. The criterion was chosen as an approximation of the updated physical activity recommendation to allow comparisons of HBSC cycles over time. We also use other indicators to further characterise physical activity. On the one hand, adolescents with ‘low physical activity’ who engage in 60 minutes of moderate-intensity physical activity on between zero and two days are identified, as well as those adolescents with ‘high physical activity’ who were physically active for at least 60 minutes of moderate-intensity physical activity on five or more days. This approach can also be found in other publications of the HBSC network [22].

In addition to information on general physical activity, sporting activities are also surveyed in the HBSC studies. In principle, sporting activities are already included in the first indicator, as the information relates to all activities in leisure time and everyday life. The exact intensity can therefore not be determined from this item and various studies emphasise that the proportion of sporting activities con-
Only 10.8% of girls, 20.9% of boys and 12.4% of gender diverse adolescents fulfil the WHO recommendation for daily physical activity.

2.3 Statistical methods

The main results are described separately for girls, boys, and gender diverse adolescents as prevalences or percentage frequencies with a 95% confidence interval (CI), with additional stratification by age. Deviations in the number of respondents between the indicators of physical activity are due to the different number of missing values. Binary logistic regressions were calculated to statistically substantiate the descriptive information in the comparison of different subgroups of the sample. The relationship between the sociodemographic characteristics of gender, age, and family affluence and the various indicators is estimated using regression models with adjustment for all other included variables. The results are presented as odds ratios (OR) and 95% CI. The temporal trends of the characteristics of physical activity habits are described for the last four survey cycles using the gender-specific percentage frequencies. In addition, binary logistic regressions were calculated separately for girls and boys, by using various survey cycles in dummy format as independent variables (reference category: survey cycle 2009/10) and age as a control variable. In this way, changes in the indicators of physical activity habits over time are statistically substantiated using OR and 95% CI. In addition, the trend was tested for linearity by treating the survey cycles as a categorical variable in the regression analyses controlled for age. All analyses were performed with SPSS 28. The significance level is set at p < 0.05 for all inferential statistical methods.

A weighting factor was created for all survey cycles to ensure nationwide sample representativeness. This equalises different participation rates in the federal states and school types so that the distribution corresponds to the population. Due to the weighting, all three age categories and the binary gender categories of girls and boys are included in the analyses in equal parts from the 2017/18 survey cycle onwards. In the 2022 HBSC survey cycle, gender was not recorded exclusively in binary form for the first time, with 1.7% of respondents indicating the category gender diverse. This was taken into account in the weighting of the 2022 data, while girls and boys were weighted equally (49.2% each; participants who did not specify their gender were excluded). Further details on the weighting of the data can be found in the article by Winter & Moor et al. [20].

3. Results

Physical and sporting activity indicators for the 2022 survey cycle

The physical activity recommendation is fulfilled by 10.8% of girls, 20.9% of boys, and 12.4% of gender diverse adolescents. In all gender categories, the proportion fulfilling this requirement decreases in the older age groups (Table 1). The
logistic regression analyses underline a statistically significant difference between the gender categories and the age groups (Table 2). The lowest values were found among 15-year-old gender diverse adolescents, only 4.5% of whom reported being physically active for at least 60 minutes a day. The highest values were found among 11-year-old boys (26.5%). The results of the logistic regression are controlled for family affluence and confirm the correlations with the age and gender categories shown in the descriptive data.

For the indicator of a high level of physical activity, which is defined as 60 minutes of moderate-intensity physical activity on five to seven days per week, the situation is similar across the gender and age categories with significantly higher prevalences, which correspond to around two to three times the 'physical activity recommendations fulfilled' indicator (Table 1); however, there are only slight differences between 13- and 15-year-old girls and boys for the indicator of a high level of physical activity. The highest value is again found among 11-year-old boys (49.6%), while the 15-year-old gender diverse adolescents have the lowest value (23.6%).

Looking at the category with low physical activity, it can be seen that a fifth of boys and a third of girls are physically active for 60 minutes on less than three days a week (Table 1). Here, too, the gender difference is statistically significant (Table 2). It is particularly noticeable that gender diverse adolescents have by far the highest prevalence of low physical activity (every second adolescent in this group). Taking into account the age categories, there is also an increasing proportion of low physical activity among girls from the 11-year-olds to 13-year-olds to 15-year-olds.

Boys are more active than girls; this difference is much more pronounced for sporting activity compared to physical activity.

### Table 1

<table>
<thead>
<tr>
<th>Age</th>
<th>Physical activity recommendation fulfilled¹</th>
<th>High physical activity²</th>
<th>Low physical activity³</th>
<th>Sporting activity (≥ 4 days per week)²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=6,214)</td>
<td>(n=6,214)</td>
<td>(n=6,214)</td>
<td>(n=6,192)</td>
</tr>
<tr>
<td>Girls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 years</td>
<td>10.8 (9.4–12.3)</td>
<td>30.7 (28.6–32.8)</td>
<td>33.6 (31.3–35.9)</td>
<td>28.2 (26.3–30.2)</td>
</tr>
<tr>
<td>13 years</td>
<td>14.7 (12.3–17.6)</td>
<td>36.4 (32.9–40.2)</td>
<td>28.6 (25.3–32.1)</td>
<td>40.3 (36.6–44.1)</td>
</tr>
<tr>
<td>15 years</td>
<td>10.5 (7.9–13.8)</td>
<td>28.7 (25.1–32.6)</td>
<td>32.9 (28.7–37.3)</td>
<td>24.3 (21.3–27.6)</td>
</tr>
<tr>
<td>Boys</td>
<td>20.9 (19.0–23.0)</td>
<td>45.7 (43.3–48.1)</td>
<td>21.0 (19.2–23.0)</td>
<td>49.8 (46.5–51.3)</td>
</tr>
<tr>
<td>11 years</td>
<td>26.5 (23.0–30.4)</td>
<td>49.6 (45.7–53.5)</td>
<td>21.8 (18.8–25.2)</td>
<td>54.1 (50.2–58.1)</td>
</tr>
<tr>
<td>13 years</td>
<td>17.8 (15.1–20.8)</td>
<td>43.8 (39.7–48.0)</td>
<td>19.7 (16.8–23.0)</td>
<td>46.9 (42.7–51.1)</td>
</tr>
<tr>
<td>15 years</td>
<td>18.1 (14.8–22.1)</td>
<td>43.5 (39.3–47.8)</td>
<td>21.6 (18.1–25.5)</td>
<td>45.5 (41.2–49.8)</td>
</tr>
<tr>
<td>Gender diverse⁴</td>
<td>12.4 (7.2–20.6)</td>
<td>23.6 (16.3–33.0)</td>
<td>48.2 (37.0–59.7)</td>
<td>19.1 (12.4–28.4)</td>
</tr>
</tbody>
</table>

¹ Physical activity recommendation fulfilled = 60 minutes of physical activity seven days a week
² High physical activity = 60 minutes of physical activity on five to seven days a week
³ Low physical activity = 60 minutes of physical activity on less than three days per week
⁴ The data on the 11-year-old gender diverse adolescents was not presented, as this group comprises only seven people.

*Source: HBSC Germany 2022*
Physical activity of older children and adolescents in Germany – Results of the HBSC study 2022 and trends since 2009/10

Table 2
Fulfilling the physical activity recommendation, physical and sporting activity by gender and age, multivariate logistic regression model with inclusion of all predictors and family affluence
Source: HBSC Germany 2022

<table>
<thead>
<tr>
<th></th>
<th>Physical activity recommendation fulfilled^1</th>
<th>High physical activity^2</th>
<th>Low physical activity^3</th>
<th>Sporting activity (≥ 4 days per week) (n=5,776)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 years (Ref.)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>13 years</td>
<td>0.61 (0.49–0.77)^***</td>
<td>0.72 (0.61–0.86)^***</td>
<td>1.10 (0.90–1.33)</td>
<td>0.59 (0.49–0.70)^***</td>
</tr>
<tr>
<td>15 years</td>
<td>0.53 (0.41–0.67)^***</td>
<td>0.68 (0.57–0.81)^***</td>
<td>1.34 (1.11–1.61)^***</td>
<td>0.51 (0.43–0.61)^***</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys (Ref.)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Girls</td>
<td>0.44 (0.36–0.54)^***</td>
<td>0.50 (0.44–0.58)^***</td>
<td>1.97 (1.68–2.31)^***</td>
<td>0.39 (0.34–0.45)^***</td>
</tr>
<tr>
<td>Gender diverse</td>
<td>0.64 (0.34–1.17)</td>
<td>0.38 (0.24–0.62)^*</td>
<td>3.46 (2.10–5.69)^***</td>
<td>0.32 (0.19–0.55)^***</td>
</tr>
<tr>
<td>Nagelkerke’s R²</td>
<td>0.062</td>
<td>0.066</td>
<td>0.062</td>
<td>0.112</td>
</tr>
</tbody>
</table>

OR = Odds ratio, CI = confidence interval
^1 Physical activity recommendation fulfilled = 60 minutes of physical activity seven days a week
^2 High physical activity = 60 minutes of physical activity on five to seven days a week
^3 Low physical activity = 60 minutes of physical activity on less than three days per week
* significant p < 0.05, ** very significant p < 0.01, *** highly significant p < 0.001

Indicators of physical and sporting activity over time
Figure 1 shows the prevalence of the four physical activity indicators over the last four HBSC survey cycles. If the data is compared chronologically in ascending order from 2009/10 onwards, the daily physical activity recommendation is fulfilled less frequently by girls over time, with a slight increase from 2017/18 to 2022. The difference between 2009/10 and 2022 is three percentage points. For boys, the proportion remains relatively stable over time with the highest prevalence in 2022.

The other indicators of physical activity complete the picture. While the proportion of boys with low physical activity, i.e. at least 60 minutes of moderate-intensity activity on zero to two days per week, increased by around three percentage points after 2009/10 and remained at this level in the subsequent survey cycles, girls saw an increase of 8.7 percentage points from 2009/10 to 2022.

Physical and sporting activities decrease with age; the differences between girls and boys increase between the ages of 11 and 15.

while no age differences can be observed among boys (Table 1). In the regression model, the correlations visible in the descriptive data are confirmed when controlling for family affluence (Table 2).

There are also strong differences between the gender categories when it comes to sporting activity on at least four days a week. Almost half of boys (49.8%) are active in sport at least four days a week, whereas the proportions of girls and gender diverse adolescents are 28.2% and 19.1%, respectively. In the latter two gender categories, there are also strong correlations with age. For girls, the proportion of sporting activities at more than four days per week decreases by half from 11-year-olds to 15-year-olds. For boys, on the other hand, changes can be observed from 11-year-olds to 13-year-olds, although these are smaller overall. The regression model reflects the descriptive data regardless of family affluence (Table 2).

Indicators of physical and sporting activity over time
Figure 1 shows the prevalence of the four physical activity indicators over the last four HBSC survey cycles. If the data is compared chronologically in ascending order from 2009/10 onwards, the daily physical activity recommendation is fulfilled less frequently by girls over time, with a slight increase from 2017/18 to 2022. The difference between 2009/10 and 2022 is three percentage points. For boys, the proportion remains relatively stable over time with the highest prevalence in 2022.

The other indicators of physical activity complete the picture. While the proportion of boys with low physical activity, i.e. at least 60 minutes of moderate-intensity activity on zero to two days per week, increased by around three percentage points after 2009/10 and remained at this level in the subsequent survey cycles, girls saw an increase of 8.7 percentage points from 2009/10 to 2022.
The reduction is particularly noticeable among girls from 2013/14 to 2017/18. Regression analyses on these changes over time were carried out, statistically confirmed for the age effect and are presented in Table 3 and Table 4 with the reference category 2009/10.

For girls, it is statistically significant that there was a decrease in physical and sporting activities and an increase in low physical activity between 2009/10 and 2022. The trend effects over time are comparably high for the various indicators. A closer look reveals the following statistically significant differences with the 2009/10 reference category:

- For the indicator of a high level of physical activity, i.e. at least 60 minutes of moderate-intensity activity on five to seven days per week, a decrease of 6.1 percentage points can be seen among girls for the period mentioned. For boys, this difference is 0.6 percentage points, with the percentages for the 2013/14 and 2017/18 survey cycles being slightly lower.

- Finally, a decline in sporting activity over time can be seen for both girls and boys. The differences are somewhat more pronounced for girls. The lowest proportion of 11- to 15-year-olds who are active in sport at least four times a week is 38.6% of girls in the 2022 survey cycle.
In this article, the HBSC data from the 2022 survey cycle were analysed with regard to physical activity based on self-reports by 11-, 13-, and 15-year-old children and adolescents on general physical activity and sporting activities. Gender-specific differences and differences between the three age categories are striking: On average, girls show less physical and sporting activities than boys; with

- For comparison with 2017/18 for achieving the physical activity recommendation,
- For the comparison with the 2022 survey cycle for low physical activity and a decrease in sporting activities (Table 3).

For boys, it is clear that a significant decrease can be observed for sporting activities over the period from 2009/10 to 2022. No significant trend can be identified for the other indicators of physical activity. There is a statistically significant reduction in the proportion of boys fulfilling the physical activity recommendation and high levels of physical activity compared to 2017/18 and 2009/10 (Table 4).

4. Discussion

In this article, the HBSC data from the 2022 survey cycle were analysed with regard to physical activity based on self-reports by 11-, 13-, and 15-year-old children and adolescents on general physical activity and sporting activities. Gender-specific differences and differences between the three age categories are striking: On average, girls show less physical and sporting activities than boys; with
increasing age, girls and boys exhibit less physical and sporting activities. There are also indications that gender diverse adolescents have very low levels of physical and sporting activities. In summary, the data on the time trends for fulfilling the physical activity recommendation and a high level of physical activity show that the changes between 2009/10 and 2022 are relatively small.

In view of the observation that only one tenth of girls and one fifth of boys achieve the recommended 60 minutes of physical activity per day, a frequent lack of physical activity must be stated in the age groups between 11 and 15 years. This has been exacerbated over time for girls. It should therefore be noted that the need for effective and population-based measures to promote physical activity in children and adolescents remains high and that previous efforts have not yet been able to reverse the trend. The authors come to a similar conclusion based on the Global Matrices for both the national and international context [8, 13, 14]. Our findings are confirmed by further studies [7, 25].

In our data, it is also striking that the proportion of children and adolescents with significantly too little physical activity has increased substantially among girls. The trend for boys is not as clear as for girls and shows stable prevalences, which nevertheless continue to signal a high need for intervention. Other studies confirm that the extent of low physical activity affects a non-negligible proportion of the adolescent population and see an overall increase in this proportion among adolescents [25, 26].

With regard to the frequency of sporting activities, the current data from the HBSC study confirms the findings of quite high prevalences and an imbalance in favour of boys [15, 27, 28]. Based on the Global Matrix, the general conditions for organised sport and for playing sport in clubs are assessed as comparatively positive in Germany [8, 14]. In the MoMo studies (motor skills module of the German Health Interview and Examination Survey for Children and Adolescents, KiGGS), sporting activities were surveyed in a more differentiated way, with the data showing clear differences in adolescence between girls and boys, particularly for extracurricular sport, which takes place in sports clubs or in informal contexts [29]. With regard to the temporal trends of sporting activities, a significant decrease can be observed for both genders, which is more pronounced for girls. This development is a cause for concern, as it further widens the gap between girls and boys in terms of participation in sports. However, the data from the MoMo study found comparable prevalences between the two survey cycles 2003 to 2006 and 2014 to 2017 and found no significant differences over time [29]. The measurement methodology in the MoMo study is more differentiated and the age range is not comparable with the sample of our study.

The comparative studies presented so far relate to the situation before the COVID-19 pandemic. There are indications that the amount of time children and adolescents spent with physical activity has decreased due to the pandemic [17, 18], particularly in structured activities and organised sport [19]. This conclusion is also consistent with our own findings, as we see a temporal trend towards less sporting activities over time in both girls and boys, with the lowest values being achieved in the current cycle. Other studies also show that the lockdown in the winter months of January/February 2021 led to significantly greater losses in physical activity habits compared to the lockdown in spring 2020. Organised sport activities play a greater role

From 2009/10 to 2022, physical and sporting activities among girls decreased for the various indicators; relatively stable prevalence rates can be observed among boys.
in the winter months in particular [30, 31]. However, boys appear to be less affected by the reduction [19]. This could be an indication that the prevalence of sporting activities in our data for girls is even less favourable over time compared to boys. It should also be pointed out again that our data collection took place in 2022 and reflects a situation in which many sporting activities could already be resumed in an informal and formal context. Overall, various studies indicate that the amount of physical activity has not yet fully recovered after the COVID-19 lockdown and corresponds roughly to an additional loss that is expected to occur during adolescence anyway [32].

In addition to the clear difference in prevalence between girls and boys, there are remarkable results for gender diverse adolescents. In the current survey cycle, it was possible to categorise oneself as ‘girl’, ‘boy’, or ‘diverse’. It was found that the physical and sporting activities of gender diverse adolescents was significantly lower than that of girls and boys. In the group of 15-year-old gender diverse adolescents in particular, only 4.5% fulfilled the physical activity recommendation, around 50% were physically active for at least 60 minutes on less than three days a week and only 11% were physically active at least four times a week. Overall, this issue has rarely been investigated. The Minnesota Student Survey confirmed large differences in organised sports and general physical activity between those who classified themselves as boys or girls vs. those who classified themselves as transgender, genderqueer, genderfluid, or unsure about their gender identity [33]. However, the findings on the differences between girls and boys on the one hand and gender diverse adolescents on the other should be put into perspective, as the variance explanation within the logistic regression models is low, meaning that other influencing factors in addition to sociodemographic factors (e.g., living environment, motivational mindset) are significant.

Our results should also be categorised against the background of some limitations. Firstly, all the data from the HBSC study are self-reported questionnaire responses from children and adolescents, which are subject to memory bias compared to device-based, objective measurement methods. The prevalences should therefore be used more as a benchmark, but are suitable as a measure over time. Even if our measurement instrument probably overestimates the overall level of physical activity, studies in adolescence that measured physical activity using devices (such as accelerometry, pedometers) also confirm a decline over time [34, 35]. In addition, we must emphasise that the screening question on fulfilling the physical activity recommendation does not match the updated physical activity recommendation, as the accumulated physical activity time over the course of the week has become more relevant than the ‘strict’ daily physical activity time of 60 minutes [6, 36]. The development of new reliable and valid survey instruments is of high priority in order to collect adequate and comparable data in the future [37]. With regard to the time trends, it should be added that we only report on cross-sectional trends and do not present longitudinal data on changes in physical activity over time.

In addition to the implications for the gender-sensitive development of physical activity promotion measures [38], the results of the current HBSC survey cycle and the development over time from 2009/10 to 2022 show that there is a great need for interventions. Previous measures have not yet contributed to a sufficient spread of physical and
sporting activity in the young population, which significantly reduces the probability of positive transfer effects into adulthood [5]. It is clear from the data that comprehensive promotion of physical activity for older children and adolescents can only be achieved through a combined strategy if, in addition to promoting structured sports programmes in sports clubs and strengthening physical education, it also addresses the general promotion of physical activity in leisure and everyday life. Both play a central role. There is no simple answer to the question of the specific type of intervention required. There is much to be said for an optimised combination of structural and behavioural prevention approaches [39]. For example, various studies show that everyday journeys, e.g. to school, are travelled more actively if there are safe cycle/walking routes and options for stowing heavy and bulky objects, and if motivational aspects are also strengthened at the same time [40, 41]. Successful implementations include the ‘walking school bus’ or the so-called bicycle train [42]. In addition, the community setting appears to be a promising basal approach for the promotion of physical activity, as it subsumes various settings and unites them under one roof and at the same time creates the conditions and framework for physical activity for all people – for example by prioritising walking and cycling [43, 44].

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Data protection and ethics
Like the previous cycles, the current survey of the HBSC study 2022 was reviewed by the ethics committee of the Medical Association of Hamburg (processing no.: 2021-100700-WF). The survey is voluntary and anonymous at school and individual level at all times. The school principals and students were informed in advance about all the content and objectives of the study and about the data protection concept. Written consent (informed and active consent) was required from the parents/guardians and the students themselves (from grade 7) in order to participate in the survey. The study was conducted in accordance with the German Federal Data Protection Act (BDSG) and the European General Data Protection Regulation (GDPR). A corresponding data protection concept was developed in advance with the data protection officer of Martin Luther University Halle-Wittenberg (print survey) and the data protection officer of Brandenburg University of Technology Cottbus-Senftenberg (online survey). Additional information and conditions on data protection that the HBSC team received from various ministries as part of the approval process were also taken into account and added to the concept.
Data availability
The current HBSC data is not available as open access as their use is reserved exclusively for the HBSC Study Group Germany for the first three years after collection. Use of the data by third parties is possible on request. Enquiries about the data or ideas for analysis can be addressed to the HBSC Study Group Germany (Principal Investigator and Coordinator: Prof. Dr. Matthias Richter, Technical University of Munich; Co-Principal Investigator and Coordinator: Dr. Irene Moor, Martin Luther University Halle-Wittenberg). After an embargo period of three years, the national and international HBSC data can be requested from the ‘HBSC Data Management Centre’ (Head: Prof. Dr. Oddrun Samdal) at the University of Bergen (Norway) (https://www.uib.no/en/hbscdata).

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Conflicts of interest
The authors declared no conflicts of interest.

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HBSC Study Group Germany
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Physical activity of older children and adolescents in Germany – Results of the HBSC study 2022 and trends since 2009/10

(Prof. Dr. Matthias Richter), University Medical Center Hamburg-Eppendorf (Prof. Dr. Ulrike Ravens-Sieberer), University of Tübingen (Prof. Dr. Gorden Sudeck).

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Physical activity of older children and adolescents in Germany – Results of the HBSC study 2022 and trends since 2009/10


Physical activity of older children and adolescents in Germany – Results of the HBSC study 2022 and trends since 2009/10
Trends in health inequalities in childhood and adolescence in Germany: Results of the HBSC study 2009/10 – 2022

Abstract

Background: Many studies have identified health inequalities in childhood and adolescence. However, it is unclear how these have developed in recent years, particularly since the COVID-19 pandemic.

Methods: Analyses are based on the German data from the international Health Behaviour in School-aged Children (HBSC) study from 2009/10 (n = 5,005), 2013/14 (n = 5,961), 2017/18 (n = 4,347), and 2022 (n = 6,475). A total of 21,788 students aged approximately between 11 and 15 years were included. Socioeconomic status (SES) was assessed using the Family Affluence Scale (FAS). Several health indicators were analysed stratified by gender using bivariate and multivariate analysis methods.

Results: In 2022, there are clear socioeconomic inequalities in life satisfaction, self-rated health, fruit and vegetable consumption, and physical activity. These inequalities remained largely constant or increased between 2009/10 and 2022. Between 2017/18 and 2022, no significant changes in inequalities were found.

Conclusions: Health inequalities are persistent and reduce the chances of growing up healthy. There is no evidence that inequalities in the analysed outcomes have changed during the pandemic period (between 2017/18 and 2022). Rather, the changes in the health indicators seem to affect all adolescents in a similar way.

Socioeconomic Status · Self-Rated Health · Nutrition · Physical Activity · Life Satisfaction · Health Equity · Children · Adolescents · Schools · HBSC · Survey · Prevalences · COVID-19 · Trend · Germany

1. Introduction

More than one in five children in Germany live in poverty, i.e. they are at risk of income poverty, or their families receive benefits according to the German Social Code (SGB II). This amounts to 2.9 million children and adolescents under the age of 18 [1]. Those affected by poverty often grow up in conditions of considerable deprivation and are restricted in their developmental and educational opportunities as well as in their social participation, for example due to a lack of financial resources for activities or access to experiences. Because of their precarious living conditions, they are more likely to experience shame, marginalisation, and violence than socioeconomically privileged adolescents [1–3]. Particularly in childhood and adolescence, the impact of poverty on educational opportunities or on cognitive [4] as well as social and behavioural development [5] is massive.
In addition, socioeconomic disadvantage in childhood and adolescence is clearly linked to health status, well-being, and health behaviour. These differences in health begin to manifest themselves at an early age [6–9]. Longitudinal studies show that socioeconomic disadvantage in childhood and adolescence also has long-term effects on health in later life [10] and that health inequalities are often perpetuated over the life course.

Adolescents from less privileged socioeconomic backgrounds report significantly more health problems and restrictions, such as poorer mental health or poorer self-rated health, than those from more socially privileged families [11–13]. There are also socioeconomic differences in health and risk behaviours, e.g. students from disadvantaged families often show an unhealthier diet and are less likely to exercise [14, 15]. The extent of socioeconomic differences varies by age, gender, health outcome, and the socioeconomic status (SES) indicator used. Nevertheless, the same pattern often emerges: the lower the SES, the worse the health situation and the less favourable the health behaviour [9, 16, 17]. There are controversial discussions about how to assess socioeconomic status in childhood and adolescence. On the one hand, parental information on their income, education, and occupational status is often used [18]. On the other hand, measures of the adolescents themselves are used, such as on their subjective social status [17, 18], their own education, or the assessment of their family affluence [17, 19, 20].

Regarding the development of health inequalities in childhood and adolescence over time, much research is based on the Health Behaviour in School-aged Children (HBSC) study. International research primarily revealed constant or increasing health inequalities over the last two to three decades [14, 20–22]. For students from Canada, for example, inequalities in life satisfaction and self-rated health increased between 2002 and 2022. Deteriorations in these outcomes were particularly observed among socioeconomically disadvantaged children and adolescents [23]. In the Netherlands, constant socioeconomic differences in mental health were identified from 2001 to 2017 [13]. A study involving up to 37 countries analysed inequalities in psychosomatic health complaints: Between 1994 and 2010, five countries showed increasing, 29 countries showed constant, one country showed decreasing and two countries showed no inequalities [22].

Trends in health inequalities in diet and physical activity between 2002 and 2014 were also examined in a study of 32 countries. In the majority of countries, differences in physical activity and healthy nutrition (daily fruit and vegetable consumption) were observed according to family affluence, to the disadvantage of adolescents with low family wealth. These inequalities mainly remained constant, but in some countries increasing inequalities were observed [14].

For Germany, there are only a few studies analysing health inequalities in children and adolescents over time. Two also refer to HBSC data. These two studies showed that socioeconomic inequalities in both self-rated health and in psychosomatic health complaints remained largely constant between 2002 and 2010 [22, 24]. Further evidence comes from the German Health Interview and Examination Survey for Children and Adolescents (KiGGS). Compared to the baseline survey (2003–2006), KiGGS Wave 2 (2014–2017) revealed an increase in relative inequalities
in self-rated health and soft drink consumption. Although there was an overall positive trend in these health outcomes, this was more pronounced among adolescents with a medium or high social status. In contrast, a reduction in relative inequalities in physical activity was found among boys, as the proportion of less physically active adolescents increased more among medium and high SES boys [8].

It remains unclear how health inequalities among children and adolescents have developed during the COVID-19 pandemic. Some studies suggest that the already deprived and sometimes precarious living conditions of socioeconomically disadvantaged families have worsened significantly and that they have been more affected by the negative effects of the pandemic. Difficult family situations, cramped living conditions during lockdowns, fewer resources for compensation, limited leisure and contact opportunities, fewer resources for home schooling, etc., suggest an increase in health inequalities [25–27]. However, the findings are heterogeneous. For example, an analysis of the Düsseldorf school entry examination between 2018 and 2022 found no increase in inequalities. Instead, negative trends in general health and development were found for all school entrants [28]. Other studies from Lower Saxony found differences in obesity, language development, and recommended deferrals, to the disadvantage of children with a poor educational background. The current prevalences are higher than it would be expected from pre-pandemic data [29]. However, these studies are based on younger children.

Overall, the evidence on the development of health inequalities over time in childhood and adolescence in Germany is heterogeneous and incomplete. The following paper will address this research gap and pursue the following research questions:

1) Are there socioeconomic inequalities in health or health behaviour among adolescents in 2022?
2) Have these health inequalities changed over time from 2009/10 to 2022 (and especially during the pandemic period between 2017/18 and 2022)?
3) Do health inequalities vary by health indicator, age or gender?

2. Methods
2.1 Sample design and study implementation

The Health Behaviour in School-aged Children (HBSC) study is designed as a cross-sectional survey conducted in schools every four years that covers students aged around 11, 13, and 15 years (mean deviation of 0.5 years). In Germany, these age groups mainly comprise grades 5, 7, and 9. In the school years 2009/10, 2013/14, 2017/18 and in year 2022 the HBSC study surveyed students in general education schools in all 16 federal states of Germany. The schools approached for participation were drawn as a cluster sample from the population of all state general education schools in Germany. In order to obtain a representative estimate (close to the distribution of the population), the school size and the distribution of students were included in the sampling, stratified by school type (Probability Proportional to Size (PPS) design).

The HBSC study is conducted using a questionnaire that the students complete themselves. The study has been approved by the responsible ministries or state education
Infobox
Slope Index of Inequality (SII) and Relative Index of Inequality (RII)

Analysis strategy: The Slope Index of Inequality (SII) represents absolute inequality, while the Relative Index of Inequality (RII) represents relative inequality. Both measures are based on regression analysis and consider the overall distribution of the socioeconomic measure (in this case the Family Affluence Scale, FAS) as well as the size of the respective socioeconomic groups. The FAS scale was transformed into a metric scale of 0 (highest family affluence) and 1 (lowest family affluence) using Ridit analysis, which was then included as an independent variable in the regression models. The development of absolute and relative health inequalities over time was tested by analysing all survey years together, taking into account an interaction term between SES and the year of data collection [8]. For a more detailed analysis of the changes in inequalities between the respective HBSC surveys, a pairwise comparison (e.g. changes between 2017/18 and 2022) was calculated and repeated using a corresponding interaction term.

2.2 Survey instruments

Socioeconomic status
There is no standardised instrument for capturing the socioeconomic status of children and adolescents, as their status is still being developed. The international HBSC network has therefore developed an instrument that is easy for students to answer and reflects their family affluence: the Family Affluence Scale (FAS) [31]. This scale has undergone continuous development. The second version (FAS II) for the 2009/10 survey was based on four items (car ownership, own bedroom, vacations taken with the family, computer ownership); for the surveys from 2013/14 onwards, two further items were added to the FAS (FAS III) (number of bathrooms, dishwasher ownership). To ensure comparability, all FAS scales were set to an identical range of values. For the descriptive analyses, they were divided into quintiles, which were grouped into three categories of

Life satisfaction
Life satisfaction (LS) is assessed using the ‘Cantril Ladder’ [33]. Based on an eleven-point visual analogue scale (0–10) in the form of a ladder, students were asked to rate their life. The bottom of the ladder represents the ‘worst possible life’ (0), the top of the ladder the ‘best possible life’ (10). A low LS was set at 0–5 points, a high LS at 6–10 points.

Self-rated health
The subjective health perception (‘self-rated health’ (SRH)) is assessed using a standardised instrument for recording general well-being and provides information about the future (objective) health of adolescents [34]. Students were asked how they would describe their state of health. The available response categories were ‘excellent’, ‘good’, ‘fair’ and ‘poor’. The first two categories were summarised as rather good SRH and the last two as rather poor SRH.
Dietary habits
This article looked at fruit and vegetable consumption as an indicator of healthy dietary habits, as fruit and vegetables consumption has a positive effect on health [35]. The students were asked how often they eat both fruit and vegetables. The response categories ranged from ‘never’, ‘less than once a week’, ‘once a week’, ‘2–4 days a week’, ‘5–6 days a week’, ‘once a day, every day’ to ‘every day, more than once’. The two indicators were combined into ‘at least daily fruit and vegetable consumption’ (daily consumption must be reported for both fruit and vegetables) and ‘less than daily fruit and vegetable consumption’. The categorisation follows the recommendations of the German Nutrition Society (DGE), which recommends the daily consumption of both fruit and vegetables for a balanced diet [36].

Physical activity
Physical activity was operationalised based on the World Health Organization (WHO) recommendation. At the time the study was designed, the recommendation was 60 minutes of daily physical activity for children and adolescents. Although the recommendation has been changed to a weekly average of seven hours since the 2020 update of the WHO recommendations, this operationalisation was chosen as an approximation (see Bucksch et al. [37] in this issue). Children and adolescents were asked how many days of the last seven they had been physically active for at least one hour. It was explained that all physical activities that increase the pulse rate or cause them to be out of breath for some time should be considered and counted together. The response categories ranged from ‘zero’ to ‘7 days’. If at least one hour of physical activity took place on all seven days, this was operationalised as ‘meeting daily physical activity recommendations’. In addition, adolescents who were physically active for less than 60 minutes per day were categorised as ‘not meeting daily physical activity recommendations’.

Sociodemographic determinants
Gender and age were considered as sociodemographic determinants. In the 2022 survey, gender was recorded using three response options ‘girl’, ‘boy’ or ‘diverse’. In the previous survey cycles, gender was recorded in binary form (girl, boy). For the trend analyses, students who did not specify their gender or who identified as diverse were excluded from the gender-specific analyses. Age was determined at the time of the survey using the student’s reported month and year of birth and grouped into the age categories ‘11 years’, ‘13 years’ and ‘15 years’ with a deviation of +/- 0.5 years.

2.3 Statistical methods
For univariate and bivariate analyses as well as for time trends, prevalences were calculated for the respective health indicators, stratified by survey year, gender, age, and family affluence. Chi-square test was used for bivariate analyses.

The extent of health inequalities based on family affluence was analysed using the SII and the RII (see infobox). As the analysis of trends in health inequalities can differ significantly depending on whether relative or absolute inequalities are analysed, both aspects were considered in the corresponding analyses (analogous to Lampert et al. [8]). The analyses...
were controlled for age and migration background (information on the measurement instrument can be found in Moor et al. [38]) and the regressions were calculated separately for girls and boys (see infobox for further explanations). Finally, it was tested whether absolute and relative health inequalities had changed significantly over time. First, SII and RII were calculated for this purpose, albeit by pooling the data from all survey years and testing with the help of an interaction term between SES and the year of data collection (p-value is reported). Secondly, a detailed analysis of the change in inequalities between two HBSC surveys (e.g. between 2017/18 and 2022) was carried out, including a corresponding interaction term. In addition, this analysis was repeated with a pairwise pooling of the survey years in order to test for differences in SII and RII between the respective survey years.

A weighting factor was created for all survey cycles to ensure that the sample is nationally representative. This compensates for differences in participation rates across federal states and school types, so that the distribution corresponds to the population. Due to the weighting, all three age categories and the binary gender categories of girls and boys are equally included in the analyses from the 2017/18 survey cycle onwards. For the first time in the 2022 HBSC survey cycle, gender was not recorded exclusively in binary form, with 1.7% of respondents indicating the category ‘diverse’. In the 2022 data, this distribution was considered in the weighting, while girls and boys were weighted equally (49.2% each; participants who did not specify their gender were excluded). Further details on the weighting of the data can be found in the article by Winter & Moor et al. [30]. Univariate and bivariate analyses were performed using IBM SPSS version 28, multivariate analyses were carried out using the statistical program R [39]. Results with a p-value of less than 0.05 are regarded as statistically significant differences.

3. Results

The respective sample distributions by age and gender can be found in the article by Winter & Moor et al. [30], the prevalences for life satisfaction and self-rated health assessment can be found in the article by Reiß & Behn et al. [40] and the frequencies for physical activity in Bucksch et al. [37]. This article focuses on socioeconomic inequalities in these health indicators.

3.1 Results on health inequalities in the 2022 survey cycle

All in all, there is a social gradient in life satisfaction and self-rated health (Figure 1). Girls and boys with low family affluence are significantly more likely to report lower life satisfaction and poorer self-rated health than those with a medium or high family affluence. The difference is considerable: girls with low family affluence are twice as likely, and boys with low family affluence are three times as likely, to report low life satisfaction than their better-off peers. Very high prevalence of low life satisfaction is particularly evident among those belonging to the gender diverse category, regardless of their family affluence (48.5%–53.3%).

With regard to self-rated health, socioeconomic differences are somewhat smaller, but still very clear. Boys with low family affluence were about twice as likely to report rather poor self-rated health, while the difference for girls...
In 2022, significant inequalities in life satisfaction, self-rated health, fruit and vegetable consumption, and physical activity were identified.

was six percentage points. Again, the prevalence is significantly higher among gender diverse adolescents, with those with high family affluence showing a lower prevalence comparable to girls and boys.

In terms of dietary habits, the results show that over a third of girls with high levels of family affluence meet the recommendations for daily fruit and vegetable consumption. As family affluence decreases, so does the proportion of girls eating fruit and vegetables daily. Compared to girls, the prevalence of daily fruit and vegetable consumption among boys is lower and the differences by family affluence are small. Only few students meet the WHO’s recommendations for physical activity – especially among girls. There is also a clear social gradient among girls: only half as many girls with a low level of family affluence get enough exercise compared to those with a high level of family affluence. Overall, boys exercise more than girls, but significantly more boys with high family affluence meet the recommendations than those with low or medium family affluence.

A clear social gradient can also be seen in relation to the age (Figure 2). In each age group, those with low family affluence report lower life satisfaction, poorer self-rated health, less daily fruit and vegetable consumption (except for 11-year-olds), and less daily physical activity. The older
Between 2009/10 and 2022, health inequalities remained largely constant or have increased, particularly between 2013/14 and 2017/18.

3.2 Trends in health inequalities (2009/10 – 2022)

Health inequalities vary by gender and by health outcome (Figure 3). They are particularly evident for life satisfaction in all survey years from 2009/10 to 2022. Even though life satisfaction itself has evolved in various ways in recent years, the extent of inequalities has remained more or less the same. An exception can be seen from 2009/10 to 2013/14 in the form of an improvement in life satisfaction among boys with low family affluence and a simultaneous deterioration in life satisfaction among boys with medium family affluence. This means that health inequalities have decreased over this period. Girl’s life satisfaction follows a similar pattern to that of boys, while the prevalence of low life satisfaction is higher in all survey cycles.

The proportion of adolescents with low self-rated health remained largely stable between 2009/10 and 2017/18. However, a deterioration can be observed in 2022, particularly among girls, but also to a lesser extent among boys. There is also an increase in inequalities for girls between 2009/10 and 2013/14 and again between 2017/18 and 2022. For boys, inequalities increase primarily between 2017/18 and 2022.

There are clear and consistent inequalities in girls’ daily fruit and vegetable consumption. In all survey cycles, girls with a high family affluence are more likely to report daily fruit and vegetable consumption than girls with medium affluence, the less favourable the outcomes according to family affluence.
A comparison of the 2017/18 survey cycle before the COVID-19 pandemic and the 2022 survey cycle shows no increase in inequalities, but they remain at high levels.

and low family affluence. The gap widened in particular between 2013/14 and 2017/18. For boys, the differences are less pronounced and not noticeable in all survey cycles. However, between 2017/18 and 2022, there was a significant increase in daily fruit and vegetable consumption among boys with the highest family affluence, which occurred to a lesser extent in the other family affluence groups. Accordingly, inequalities in this respect have increased somewhat.
Overall, there was a deterioration in mental health and an improvement in healthy diet and physical activity between 2017/18 and 2022 – these changes affected all adolescents to a similar extent.

There was also no reduction in inequalities in meeting the physical activity recommendations between 2009/10 and 2022, as these remained largely constant over that period. While overall the prevalence of sufficient physical activity declined similarly for girls in all family affluence groups between 2009/10 and 2017/18, girls became more physically active again in 2022. Except for 2009/10, boys with higher family affluence are more likely to meet the physical activity recommendations than boys with a lower family affluence. The inequalities are most pronounced in 2022. Even more than for girls, boys also show a positive increase in physical activity in 2022.

### 3.3 Extent of relative and absolute health inequalities (2009/10–2022)

Absolute (SII) and relative (RII) inequalities were calculated for all health indicators, adjusted for age and migration background, to determine the extent of health inequalities more precisely. They are summarised in Table 1. The results broadly confirm the bivariate results and provide more specific information on the extent. In 2022, there are clear relative inequalities for all the health indicators analysed. Adolescents with low family affluence are more than twice as likely to report rather poor self-rated

<table>
<thead>
<tr>
<th></th>
<th>2009/10 (95 % CI)</th>
<th>2013/14 (95 % CI)</th>
<th>2017/18 (95 % CI)</th>
<th>2022 (95 % CI)</th>
<th>p trend*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Girls</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Low</strong> life satisfaction</td>
<td>0.12*** (0.08–0.17)</td>
<td>0.10*** (0.05–0.15)</td>
<td>0.20*** (0.14–0.27)</td>
<td>0.14*** (0.07–0.20)</td>
<td>0.138</td>
</tr>
<tr>
<td>RII</td>
<td>2.33*** (1.66–3.28)</td>
<td>1.89*** (1.34–2.67)</td>
<td>5.81*** (3.37–10.00)</td>
<td>2.69*** (1.66–4.36)</td>
<td>0.050</td>
</tr>
<tr>
<td>Rather poor</td>
<td>0.06** (0.02–0.11)</td>
<td>0.07** (0.02–0.12)</td>
<td>0.05 (0.00–0.11)</td>
<td>0.11*** (0.04–0.19)</td>
<td>0.579</td>
</tr>
<tr>
<td>self-rated health</td>
<td>1.67** (1.14–2.45)</td>
<td>1.73** (1.18–2.53)</td>
<td>1.65 (0.97–2.81)</td>
<td>2.15*** (1.31–3.52)</td>
<td>0.985</td>
</tr>
<tr>
<td>Daily fruit and vegetable consumption</td>
<td>0.17** (0.04–0.17)</td>
<td>0.10** (0.03–0.16)</td>
<td>0.22*** (0.13–0.30)</td>
<td>0.22*** (0.13–0.31)</td>
<td>0.002</td>
</tr>
<tr>
<td><strong>Daily physical activity recommendation fulfilled</strong></td>
<td>1.37 (0.94–2.01)</td>
<td>2.05*** (1.36–3.09)</td>
<td>1.78* (0.96–3.30)</td>
<td>2.39*** (1.33–4.27)</td>
<td>0.074</td>
</tr>
<tr>
<td><strong>Boys</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Low</strong> life satisfaction</td>
<td>0.07** (0.03–0.12)</td>
<td>0.05* (0.00–0.09)</td>
<td>0.14*** (0.09–0.20)</td>
<td>0.14*** (0.07–0.20)</td>
<td>0.008</td>
</tr>
<tr>
<td>RII</td>
<td>1.91** (1.24–2.92)</td>
<td>1.51** (1.02–2.22)</td>
<td>7.42*** (3.59–15.34)</td>
<td>6.44*** (2.71–15.35)</td>
<td>0.000</td>
</tr>
<tr>
<td>Rather poor</td>
<td>0.05* (0.01–0.09)</td>
<td>0.03* (0.00–0.07)</td>
<td>0.10*** (0.05–0.16)</td>
<td>0.09*** (0.02–0.17)</td>
<td>0.049</td>
</tr>
<tr>
<td>self-rated health</td>
<td>1.61*** (1.06–2.45)</td>
<td>1.45 (0.95–2.21)</td>
<td>3.39*** (1.73–6.66)</td>
<td>2.42*** (1.24–4.71)</td>
<td>0.071</td>
</tr>
<tr>
<td>Daily fruit and vegetable consumption</td>
<td>0.07** (0.01–0.13)</td>
<td>0.07* (0.01–0.13)</td>
<td>0.18*** (0.09–0.27)</td>
<td>0.21*** (0.12–0.29)</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Daily physical activity recommendation fulfilled</strong></td>
<td>1.35* (1.02–1.78)</td>
<td>1.35* (1.04–1.76)</td>
<td>2.19*** (1.47–3.25)</td>
<td>2.39*** (1.64–3.48)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Table 1: Trends of absolute (SII) and relative inequalities (RII) of various health outcomes among girls (n = 10,296–10,501) and boys (n = 9,729–9,964) Source: HBSC Germany 2009/10, 2013/14, 2017/18, 2022

*CI = confidence interval, SII = Slope Index of Inequality, RII = Relative Index of Inequality, bold print = significant values, * p < 0.05, ** p < 0.01, *** p < 0.001

* = significant changes in SII or RII over time
Analyses adjusted for age and migration background
The greatest socioeconomic inequalities are found in the areas of life satisfaction and nutrition.

Health (RII_girls 2.15; RII_boys 2.42), less healthy dietary habits (RII_girls 2.46; RII_boys 2.39) and less physical activity (RII_girls 2.39; RII_boys 1.93) than socioeconomically privileged adolescents. In terms of life satisfaction, in 2022 socioeconomically disadvantaged boys have a 6.44 times higher risk of low life satisfaction than socioeconomically more privileged boys (RII 6.44). In 2017/18, the difference was 7.42 times higher. The risk of low life satisfaction was also highest for girls in 2017/18 at 5.81; in 2022, the risk was still 2.69 times higher compared to girls with high family affluence.

The largest absolute inequalities (SII) are found for girls and boys for fruit and vegetable consumption and life satisfaction in 2017/18 and 2022. The difference in prevalence of fruit and vegetable consumption between girls with the lowest family affluence score and those with the highest family affluence score is 22 percentage points (2017/18 and 2022, for boys 18% and 21%, respectively). For satisfaction, the difference for girls is 20 (2017/18) and 14 percentage points (2017/18 and 2022) between those with the highest and lowest family affluence.

The greatest socioeconomic inequalities are found in the areas of life satisfaction and nutrition.

### Table 2

<table>
<thead>
<tr>
<th>Health outcome</th>
<th>p-value (pairwise comparison HBSC surveys) absolute inequalities</th>
<th>p-value (pairwise comparison HBSC surveys) relative inequalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rather poor self-rated health</td>
<td>0.679</td>
<td>0.025</td>
</tr>
<tr>
<td>Low life satisfaction</td>
<td>0.312</td>
<td>0.002</td>
</tr>
<tr>
<td>Daily fruit and vegetable consumption</td>
<td>0.981</td>
<td>0.032</td>
</tr>
<tr>
<td>Daily physical activity recommendation fulfilled</td>
<td>0.082</td>
<td>0.085</td>
</tr>
</tbody>
</table>

SII = Slope Index of Inequality, RII = Relative Index of Inequality, bold print = significant values (p < 0.05), girls highlighted in grey, boys highlighted in white

Analyses adjusted for age and migration background
Trends in health inequalities in childhood and adolescence in Germany: Results of the HBSC study 2009/10 – 2022

4. Discussion

4.1 Summary of the results

Health inequalities among children and adolescents were analysed using various health indicators for the German 2022 survey cycle. In addition, it was examined how these have changed between 2009/10 and 2022. This included an analysis whether there were gender or age differences in the health indicators considered. Based on the available results of the nationwide HBSC study, it was shown that 1) there are clear inequalities in life satisfaction, self-rated health, fruit and vegetable consumption, and physical activity in 2022; 2) socioeconomic inequalities are evident in all survey cycles with few exceptions and these have largely remained constant or have increased (especially between 2013/14 and 2017/18). Contrary to the assumption, inequalities did not increase between 2017/18 and 2022 (pre- and post-pandemic), but remained at a high level. Rather, the changes seem to apply equally to all status groups; 3) there are differences in the extent of health inequalities by health outcome, gender, and age. The largest relative inequalities were found for life satisfaction (especially for boys) and in absolute terms for fruit and vegetable consumption. No clear social gradient was identified for gender diverse adolescents. However, it became clear that gender diverse adolescents are significantly more likely to have low life satisfaction and poor self-rated health, regardless of their family affluence (except for self-rated health in the case of high family affluence).

4.2 Comparison to other research

The findings show that socioeconomic inequalities in health and health behaviour are persistent among children and adolescents. Health inequalities have also been found in a number of other studies [8, 22, 24, 41]. Contrary to our findings, some studies suggest that during the COVID-19 pandemic, socioeconomically disadvantaged adolescents were particularly negatively affected, especially in terms of mental health, including family and school stress [42–45]. However, the results of our study suggest that all children and adolescents were similarly affected by the pandemic, and accordingly both socioeconomically privileged and socioeconomically disadvantaged students reported deterioration in health. This result is consistent with the analysis of the Düsseldorf school entry study by Weyers and Rigó [28], who also found no increase in existing health inequalities in language development and obesity. Rather, unfavourable changes were observed in all children regardless of family affluence.

Table 2 shows whether the changes between the HBSC survey cycles are significant. It is striking that the greatest significant changes in absolute and relative inequalities occurred primarily between 2013/14 and 2017/18, but not between 2017/18 and 2022 (see Table 2). This means that inequalities in particular increased significantly between 2013/14 and 2017/18 and then remained constant between 2017/18 and 2022. Therefore, it can be seen that for (almost) all adolescents, the prevalences changed for the better between 2017/18 and 2022 in terms of dietary and physical activity, and for the worse in terms of life satisfaction and self-rated health (Figure 3).
We also found stable health inequalities in health behaviour, i.e. dietary and physical activity. The existence of health inequalities in dietary and physical activity is not new [8, 14, 15, 46], as dietary and other health-related habits are learned within the family. Studies have shown that families with a low SES are more likely to have unhealthy dietary habits and pass this on to their children [47]. Other studies have also found a correlation between socioeconomic status and physical activity. For example, adolescents with high SES are more likely to be involved in organised sports activities than those with low family affluence [48]. This may be due to the cost of physical activity programmes or other barriers to participation [15]. Interestingly, our results show an improvement in dietary and physical activity between 2017/18 and 2022. There are similar findings available from the MoMo study (motor skills module of the German Health Interview and Examination Survey for Children and Adolescents, KiGGS), which found an increase in physical activity during the pandemic despite the lack of organised sports activities in, e.g., clubs. This may be due to the increase in leisure time during the first lockdown or possibly also due to increased health awareness [49].

Overall, our results show no significant increase in inequalities between 2017/18 and 2022. However, it is clear that differences in health opportunities are strongly linked to socioeconomic background and that socioeconomically disadvantaged children and adolescents have different and, above all, worse starting conditions. This also shows that previous measures to increase health equity are not yet sufficient. Strategies such as the introduction of basic child protection or the establishment of mental health coaches in schools in Germany are important building blocks whose success remains to be evaluated. However, it is clear that these measures need to be both strengthened and sustained in order to achieve the goal of health equity.

Apart from health inequalities, the findings show a significant increase in the prevalence of rather low life satisfaction and rather poor self-rated health compared to 2017/18 (pre-pandemic) and 2022 (post-pandemic). Other studies suggest that the COVID-19 pandemic may have played a central role in this. For example, there is evidence of a link between the events of the pandemic and increased psychological distress, increased depressive symptoms, internalising symptoms, feelings of loneliness, and poorer overall mental health among schoolchildren [50–53]. Overall, the present findings show clear gender differences, with girls in particular reporting higher prevalences of lower life satisfaction and poorer self-rated health than boys. Gender differences in mental health have been observed in many studies [54]. They can be explained in part by the different ways in which girls and boys deal with problems. While boys often tend to use externalising behaviours to deal with problems, girls are more likely to use internalising behaviour, which have implications for mental health [55]. This was also observed in the context of the COVID-19 pandemic, where girls were more likely to respond with a deterioration in their mental health to the negative effects [52, 54]. The evidence on gender diverse adolescents in Germany is rather rudimentary. It is generally assumed that a gender identity outside the binary norm is more likely to lead to fewer opportunities for participation and to discrimination, with negative effects on health [56]. Our findings support this assumption. Even if no conclusions can be drawn regarding the mechanisms of action, it is clear that there is a need for both action and research in this area.
4.3 Strengths and limitations of the study

The strengths of the HBSC study are many and are discussed in more detail in the article by Winter & Moor et al. [30]. With regard to the present analysis, the HBSC study made it possible to analyse and compare various health outcomes over a period of twelve years. There are only few studies that allow these analyses over time. To date, there has been little data available to allow analysis of health outcomes for gender diverse children and adolescents.

However, the small number of gender diverse adolescents \( (n=112) \) is a limitation, and the results must be interpreted with caution. Another limitation is that the measurement of socioeconomic status in childhood and adolescence is fraught with uncertainties, as there is no standard indicator. Numerous instruments have been developed to measure both the parental or family situation of adolescents and youth-specific indicators, which play an important role [16, 17]. As part of the HBSC study, the Family Affluence Scale is regularly validated and updated, so it can be assumed to reflect the socioeconomic situation of the family [57, 58]. However, the living conditions and norms of families and adolescents are constantly changing and especially in affluent countries such as Germany, for example, holiday trips or even car ownership may be avoided for environmental reasons rather than economic reasons.

4.4 Conclusions

The results of the HBSC study show that not all children and adolescents have the same health opportunities. Their health status still depends on their family background and also varies by gender and age. Overall, it is clear that socioeconomically disadvantaged adolescents, girls and gender-diverse as well as older students need to be particularly the focus of prevention and health promotion strategies. Over the past twelve years, there has been no reduction of health inequalities among adolescents. It appears that the effects of the COVID-19 pandemic are reflected in poorer health outcomes even after restrictions have been lifted. However, crises affect all children and adolescents, and even socioeconomically advantaged families and their children have not been able to fully mitigate the effects. It can be assumed that the effects of the coronavirus crisis will manifest themselves in a variety of ways over the coming years. It is therefore important to monitor health, as the HBSC study does, in order to identify future socio-economic and health challenges.

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Data protection and ethics
Like the previous cycles, the current survey of the HBSC study 2022 was reviewed by the ethics committee of the Medical Association of Hamburg (processing no.: 2021-100700-WF). The survey is voluntary and anonymous at school and individual level at all times. The school principals and students were informed in advance about all the content and objectives of the study and about the data protection concept. Written consent (informed and active consent) was required from the parents/guardians and the students themselves (from grade 7) in order to participate in the survey. The study was conducted in accordance with the German Federal Data Protection Act (BDSG) and the European General Data Protection Regulation (GDPR). A corresponding data protection concept was developed in advance with the data protection officer of Martin Luther University Halle-Wittenberg (paper survey) and the data protection officer of Brandenburg University of Technology Cottbus-Senftenberg (online survey). Additional information and conditions on data protection that the HBSC team received from various ministries as part of the approval process were also taken into account and added to the concept.

Data availability
The current HBSC data is not available as open access as their use is reserved exclusively for the HBSC Study Group Germany for the first three years after collection. Use of the data by third parties is possible on request. Enquiries about the data or ideas for analysis can be addressed to the HBSC Study Group Germany (Principal Investigator and Coordinator: Prof. Dr. Matthias Richter, Technical University of Munich; Co-Principal Investigator and Coordinator: Dr. Irene Moor, Martin Luther University Halle-Wittenberg). After an embargo period of three years, the national and international HBSC data can be requested from the ‘HBSC Data Management Centre’ (Head: Prof. Dr. Oddrun Samdal) at the University of Bergen (Norway) (https://www.uib.no/en/hbscdata).

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Conflicts of interest
The authors declared no conflicts of interest.
Acknowledgement

Our special thanks go to all schools, teachers, parents/guardians and, of course, the students who provided us with valuable information on their health situation by participating in this survey. We would also like to thank the ministries for authorising the HBSC study in the respective federal states, so that representative data could be collected nationwide. Thanks are also due to the scientific and student staff at all HBSC locations who supported us in collecting the data (cf. Winter & Moor et al. [30]). The HBSC study could not have been realised without the great commitment of these numerous colleagues at all HBSC sites in Germany. At the Halle site, we were supported by the following student employees: Katharina Bargholz, Marie Böhm, Verena Haupt, John-Patrick Petisch and Mareike Wiegmann. At the international level, we would like to thank the International Coordinating Centre (ICC) at the University of Glasgow (headed by Dr. Jo Inchley) and the HBSC Data Management Centre (DMC) at the University of Bergen under the direction of Prof. Dr. Oddrun Samdal.

HBSC Study Group Germany

The HBSC Study Group Germany consists of the following institutions: Brandenburg University of Technology Cottbus-Senftenberg (Prof. Dr. Ludwig Bilz), Fulda University of Applied Sciences (Prof. Dr. Katharina Rathmann, Prof. Dr. Kevin Dadaczynski), Heidelberg University of Education (Prof. Dr. Jens Bucksch), Martin Luther University Halle-Wittenberg (Dr. Irene Moor), Technical University of Munich (Prof. Dr. Matthias Richter), University Medical Center Hamburg-Eppendorf (Prof. Dr. Ulrike Ravens-Sieberer), University of Tübingen (Prof. Dr. Gorden Sudeck).

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Trends in health inequalities in childhood and adolescence in Germany: Results of the HBSC study 2009/10 – 2022


Abstract

Background: Health Behaviour in School-aged Children (HBSC) is one of the largest international studies on child and adolescent health and cooperates with the World Health Organization (WHO). In Germany, adolescents aged 11, 13 and 15 are surveyed every four years about their health, health behaviour and social conditions. This article describes the HBSC study and in particular the methodology of the current 2022 survey and prior surveys conducted between 2009/10 and 2017/18.

Method: 174 schools with a total of 6,475 students participated in the 2022 survey. The survey was conducted using questionnaires and covered a wide range of topics (including mental health, physical activity, bullying experiences, social determinants of health and experiences related to COVID-19). The 2022 survey was complemented by a school principal survey (N = 160). In addition to the current sample, the samples of the three previous surveys with representative data for Germany are presented: 2009/10 (N = 5,005), 2013/14 (N = 5,961) and 2017/18 (N = 4,347).

Discussion: The health of children and adolescents is of great public health importance. The HBSC study makes a substantial contribution by providing internationally comparable results, analysing trends, and providing stakeholders with comprehensive and representative health monitoring data.
of evidence on mental health during these critical developmental years, not least in times of crisis such as the COVID-19 pandemic. For example, a recent study shows that more than half of mental disorders in adulthood occur before or during adolescence \[10, 11\]. Thus, the foundations for future health are laid in childhood and adolescence, underscoring the particular importance of these life stages for prevention and health promotion \[12–14\].

Recent comprehensive data on the health of children and adolescents are of great public health relevance for science, policy, and practice, which has taken on a new dimension, especially in times of crisis such as the COVID-19 pandemic \[15, 16\]. The Health Behaviour in School-aged Children (HBSC) study makes a fundamental contribution to this by providing internationally comparable data, making it possible to map trends and providing decision-makers in the field of child and adolescent health with representative health monitoring data \[17\]. This article gives a general overview of the HBSC study design. Thus, it presents the methodology of the current survey 2022 for Germany, also taking into account the previous surveys from 2009/10 to 2017/18. Therewith the paper provides the methodological foundation for all other HBSC articles in this issue of the Journal of Health Monitoring.

1.2 HBSC – one of the world’s largest studies of child and adolescent health

With 51 participating countries (Figure 1), the HBSC study is one of the largest collaborative research projects on child and adolescent health in the world, providing an important national and international resource for monitoring the health of the younger generation. For example, HBSC results are used by the World Health Organization (WHO) for international comparative health reporting on childhood and adolescence \[17, 18\]. The issues identified by the HBSC study have led to a European strategy on child and adolescent health, with different action, which is available to all WHO Member States as a guide for current and future activities \[19\]. Recent joint publications by WHO and HBSC present adolescents’ perspectives on the impact of the COVID-19 pandemic on their lives \[16\].

HBSC aims to collect current data on students’ health and health-related behaviours and to understand how different social determinants affect health and well-being. In addition, there is a specific topical focus for each cycle of the survey. In 2022, for example, the focus was on the impact of the COVID-19 pandemic and adolescent mental health. The results of the HBSC study can be used to inform policies and support developments of health promotion strategies for school-aged children. Therefore, HBSC focuses on understanding the health situation of young people, taking into account social contextual factors and living conditions, and on identifying the need for health-promoting measures \[17\].
CONCEPTS & METHODS

1.3 The history of the HBSC study and German participation

The HBSC study was initiated in 1982 by researchers in England, Finland and Norway. The first survey was carried out in these countries as well as in Austria and Denmark, in 1983/84. Since then, the study has been conducted every four years with a rising number of countries joining the international HBSC network. In the current survey (2022), 51 countries participated with more than 279,000 adolescents [17]. The exchange regarding the topics and methods between the approximately 400–500 scientists takes place at regular international meetings and in thematic focus groups, where, among other things, the respective surveys are prepared, the measurement instruments are validated and expanded, and publications are centrally planned. Germany joined the HBSC network with the 1993/94 survey, initially with its most populous state, North Rhine-Westphalia (NRW). Other federal states (Saxony, Hesse, Berlin, Thuringia and Hamburg) were included in the subsequent cycles in 1997/98, 2001/02 and 2005/06. With the exception of Baden-Wuerttemberg, all federal states participated.

Figure 1
World map of the countries participating in HBSC
Source: Own chart
in the 2009/10 cycle. Data from 2009/10 onwards are therefore included in the trend analyses in this issue. Since the follow-up survey in 2013/14, the HBSC study has been conducted every four years in all 16 federal states. In the current survey in 2022, as in the previous cycle in 2017/18, the nationwide survey was conducted with two supplementary state samples in Brandenburg [20] and Saxony-Anhalt [21] as well as a survey for the city of Stuttgart (Figure 2).

All surveys conducted in Germany were carried out under the joint responsibility of the HBSC Study Group Germany. The HBSC Study Group Germany currently consists of seven sites (Figure 3; listed in alphabetical order): Brandenburg University of Technology Cottbus-Senftenberg (Prof. Dr. Ludwig Bilz), Fulda University of Applied Sciences (Prof. Dr. Katharina Rathmann, Prof. Dr. Kevin Dadaczynski), Heidelberg University of Education (Prof. Dr. Jens Bucksch), Martin Luther University Halle-Wittenberg (Dr. Irene Moor; Co-Principal Investigator), Technical University of Munich (Prof. Dr. Matthias Richter; Principal Investigator), University Medical Centre Hamburg-Eppendorf (Prof. Dr. Ulrike Ravens-Sieberer), University of Tübingen (Prof. Dr. Gorden Sudeck). In addition, a total of 11 research associates and 14 student assistants supported the preparation and conduction of the current HBSC survey.

**Figure 2**
HBSC study: Participating countries and participation of federal states in Germany by survey cycle

Source: Own chart

International

1983/84
1993/94
1997/98
2001/02
2005/06
2009/10
2013/14
2017/18
2021/22

Germany

NRW

Four federal states (NRW, Berlin, Hesse, Saxony)

Five federal states (NRW, Berlin, Hesse, Saxony, and Hamburg)

Nationwide (15/16 federal states) with additional state samples in NRW, Hamburg, Hesse and Thuringia

Nationwide with additional state samples in Hamburg and Hesse

Nationwide with additional state samples in Saxony-Anhalt, Brandenburg and complete survey in Stuttgart

NRW = North Rhine-Westphalia
Figure 3
HBSC Study Group Germany (2023)
Source: Own chart

2. Methods
2.1 Study design and sample design

The Health Behaviour in School-aged Children (HBSC) study is designed as a cross-sectional study that takes place every four years in the school setting and surveys students aged around 11, 13 and 15 (mean deviation of 0.5 years). In Germany, these age groups mainly comprise grades 5, 7, and 9. International HBSC guidelines call for a total national sample of 4,500 students, with a sample size of approximately $n=1,500$ per age group [17].

The units of the HBSC study are schools and school classes clustered within them. In preparation, the sample calculation was initially based on the current state-specific
Concept and methodology of the Health Behaviour in School-aged Children (HBSC) study

2.2 Study content and survey instruments

Student survey
The focus of the HBSC study is the collection of health indicators and related social determinants of health in students. The survey is conducted in all participating countries according to standardised and internationally agreed methods, using a questionnaire that adolescents complete themselves using a paper-and-pencil method or fill out online or offline with a tablet. The questionnaire consists of a mandatory section and an optional section, which ensures international comparability while allowing each country to set its own research priorities. The questions used are continuously developed and validated [17]. Most of the instruments (from the mandatory section) used are items in English, of which most of them have been used in previous cycles in Germany and therefore have already been translated. New items included in the 2022 survey were translated into German in a multi-stage process (forward-backward translation). Under the slogan ‘Don’t talk about us without us’, the international HBSC study network (focus group ‘Youth Engagement Advisory Group’) regularly involves young people in identifying current and important issues for them. These results are considered in the respective HBSC cycles [17]. Further information can be found on the international HBSC website [22].

Detailed information regarding the items and scales used (Figure 4) as well as the methodological procedure and validation can be found in the international research protocol [17].
Survey of school principals
There is growing evidence that, in addition to individual factors, institutional and contextual factors at the meso level also play a role in adolescent health. Examples include the type of school, but also organisational, structural, cultural and physical factors of schools and classes, such as school norms and values, class or school size, sociodemographic/economic composition of the students population, equipment, premises or school hours [4, 23]. Alongside the family as a secondary socialisation setting, school is an important context for the psychosocial and health-related development of young people. Not only do children and adolescents spend a large proportion of their time at school [1, 24, 25], but they also interact with their peers and teachers and have a variety of positive (e.g. perceptions of support) and negative (e.g. pressure to perform, fear of failure) experiences. The school context can therefore shape adolescents in many ways and influence their health, making it an important setting for health promotion and prevention [25–28]. For this reason, in addition to the survey of
students, a survey of school principals was conducted in the 2022 cycle. The aim was to collect contextual information from schools and to assess the commitment of schools to implementing health-promoting activities. In addition, the restrictions imposed on schools by the COVID-19 containment measures (including restrictions on school operations), but also the opportunities to expand the range of services (support services) were also considered [29]. School principals (or their deputies) were asked to complete an online questionnaire. Figure 4 provides an insight into the different topics covered by the two questionnaires in the current survey.

### 2.3 Pretest

The German questionnaire was pre-tested with regard to processing time, content ambiguities and comprehension questions, with a special focus on the comprehension among younger students. For this purpose, students from grade 5 (n=21) and 7 (n=23) from different school types were interviewed between July and August 2021. Due to the COVID-19 pandemic, the pretests were conducted online. Students received the link to the online questionnaire and completed it using the ‘think aloud’ method. All comments made by the participants were transferred to the pretest protocols. The majority of the questions and answer options were easy to answer for the students. However, some students had problems with longer introductions or respondents lacked further answer options. In addition, there were some comprehension difficulties, e.g., on the health literacy scale for younger students. As a result, minor changes were made to the questionnaire (where possible).

### 2.4 Recruitment, implementation and data collection

Permission to conduct the HBSC study in schools was obtained from the relevant ministries or state education authorities in each federal state (with the exception of North Rhine-Westphalia, where schools decide autonomously whether to participate). Approvals were granted in close cooperation with the relevant data protection officers – appropriate data protection policy was part of the approval process and an integral part of the approval to conduct the study. The approval process took up to nine months, depending on the federal state. As recruitment was depending on approval, there were delays in the recruitment and survey process in some federal states. Recruitment of schools was carried out in a decentralised but standardised way by all sites in the study group, with each site taking responsibility for certain federal states. In the first step, the randomly selected schools were invited by post and e-mail to participate in the survey. In addition to the letter of invitation, the schools received information material about the study. If schools did not respond within two weeks, they were contacted by telephone and invited to participate. The telephone contact proved to be particularly beneficial, although it was also very resource-intense [30, 31]. Schools that agreed to participate were closely accompanied and supported by the HBSC recruitment team and kept informed of all the steps to be taken.

After accepting to participate in the survey, each school received a comprehensive information pack, including survey materials and flyers, so that school staff, parents and students had all relevant information regarding the HBSC study at an early stage. In addition, key information was...
Concept and methodology of the Health Behaviour in School-aged Children (HBSC) study

made available on the study’s password-protected website for each target group.

In each school, students in class groups of one class each in grade 5, 7 and 9 were surveyed. In some cases (e.g. at the request of the schools or in case of lower participation rates in the respective federal states or school types) more than one class per grade was included in the survey. The participating classes were selected randomly by the school principal. The survey could be completed online, offline via tablets, or by printed questionnaires, depending on the technical infrastructure and preferences of the school. The questionnaire could only be completed if a parent/guardian and the students themselves (from grade 7) had given their consent to participate in the survey. In order to ensure a standardised survey procedure, detailed information and instructions were provided to school staff well in advance of the survey. For example, to gain access to the online questionnaires, a list of access codes was prepared in advance and provided to each class individually. These were only used to access the survey and to monitor the respective grade, school type and federal state. Upon completion of the survey, the data were re-encrypted. If schools opted for an offline survey using tablets (this option was only available in Brandenburg), the survey was administered by members of the research team on site at the schools. All data were collected anonymously.

Irrespective of the mode of data collection, it is nearly impossible to identify individual students from the data. Due to the recording of the data, it is also no longer possible to identify individual schools. The representative federal state samples are an exception, as each participating school agreed on receiving a school-specific feedback (school health profiles) as an incentive. However, identification was also stored separately and is subject to strict data protection guidelines.

All participating schools received an individual certificate as an incentive for taking part in the HBSC survey. Schools also receive a summary of the latest results from the HBSC study Germany.

The survey period ranged from March to November 2022. After the survey was completed, all data collected in the form of anonymous printed questionnaires was sent to an external data provider for data entry. The Brandenburg University of Technology Cottbus-Senftenberg used the tool LimeSurvey to collect data from questionnaires completed offline on tablets or online. The data collected was stored directly in the tool and created as a dataset. Finally, all data was merged into one overall dataset followed by an internal review and quality adjustment. Following this, the international HBSC study network undertook a central cleansing for all participating countries to ensure international comparability [17].

3. Results on representativeness and response rates
3.1 Sample and response rates over time

A total of 174 schools with a total of 7,935 students (unadjusted net sample) participated in the 2022 national HBSC cycle. More than half of all participating schools chose to fill out the questionnaire online instead of paper-and-pencil. As part of the internationally standardised data cleaning by the Data Management Centre in Bergen/Norway, quality-neutral omissions in the data set were corrected. These mainly include deviations in the age groups, where

51 countries with more than 279,000 adolescents participated in the current 2022 survey.
In Germany, a total of 174 schools (response rate: 8.4%) with 6,475 students (response rate: 56.8%) and 160 school principals was taken into account in the 2022 survey year.

For these reasons, a total of 1,478 cases (18.6%) were excluded. The realised sample (net), which was used as the data basis for the analyses, therefore consists of \( N = 6,475 \) students. In addition, 160 school principals were surveyed (Figure 5).

Table 1 provides information on the sample distribution of schools and students participating in the 2022 national survey in each federal state and in total. The sample realised in most of the federal states corresponds approximately (partly with slight deviations) to the proportional targets. Any deviations are compensated by weighting the data for subsequent analyses (see 3.2 Weighting).

<table>
<thead>
<tr>
<th>Federal state</th>
<th>Number of participating schools</th>
<th>Realised number of students (ACTUAL) (after adjustment)</th>
<th>ACTUAL Proportion of students</th>
<th>TARGET Proportion of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baden-Wuerttemberg</td>
<td>15</td>
<td>556</td>
<td>8.6%</td>
<td>13.7%</td>
</tr>
<tr>
<td>Bavaria</td>
<td>26</td>
<td>929</td>
<td>14.3%</td>
<td>15.5%</td>
</tr>
<tr>
<td>Berlin</td>
<td>13</td>
<td>210</td>
<td>3.2%</td>
<td>4.1%</td>
</tr>
<tr>
<td>Brandenburg</td>
<td>10</td>
<td>434</td>
<td>6.7%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Bremen</td>
<td>1</td>
<td>40</td>
<td>0.6%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Hamburg</td>
<td>3</td>
<td>100</td>
<td>1.5%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Hesse</td>
<td>23</td>
<td>936</td>
<td>14.5%</td>
<td>7.7%</td>
</tr>
<tr>
<td>Mecklenburg-Western Pomerania</td>
<td>5</td>
<td>156</td>
<td>2.4%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Lower Saxony</td>
<td>23</td>
<td>798</td>
<td>12.3%</td>
<td>10.3%</td>
</tr>
<tr>
<td>North Rhine-Westphalia</td>
<td>16</td>
<td>642</td>
<td>9.9%</td>
<td>22.1%</td>
</tr>
<tr>
<td>Rhineland-Palatinate</td>
<td>7</td>
<td>260</td>
<td>4.0%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Saarland</td>
<td>2</td>
<td>63</td>
<td>1.0%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Saxony</td>
<td>10</td>
<td>408</td>
<td>6.3%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Saxony-Anhalt</td>
<td>5</td>
<td>370</td>
<td>5.7%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Schleswig-Holstein</td>
<td>6</td>
<td>250</td>
<td>3.9%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Thuringia</td>
<td>9</td>
<td>323</td>
<td>5.0%</td>
<td>2.5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>174</strong></td>
<td><strong>6,475</strong></td>
<td><strong>100 %</strong></td>
<td><strong>100 %</strong></td>
</tr>
</tbody>
</table>

Table 1 Distribution of the adjusted unweighted total sample of HBSC 2022 by federal state
Source: HBSC Germany 2022
### 3.2 Weighting

In order to achieve a representative sample based on the distribution of students in Germany, data from the actual and target samples were compared and checked for their distribution at the level of federal states and school types. Deviations in the realised sample are due, among other things, to a lower willingness to participate and to data adjustments. Deviations from the official statistics (school year 2020/21) were taken into account by means of a weighting variable. This is a standardised methodological procedure to counteract discrepancies in the response rate and thus distortions in the comparative values (e.g. disproportionality of one type of school) [35]. For age and (binary) gender, proportionally equal proportions were preferred. As the gender category ‘diverse’ was included for the first time in 2022, but representative distributions for this age group are not yet available in Germany, the corresponding sample

---

**Table 2**

Case numbers, percentage and response rates of the HBSC study over the last twelve years by gender and age group.*

Source: HBSC Germany 2022

<table>
<thead>
<tr>
<th>Age group</th>
<th>Gender</th>
<th>2009/10</th>
<th>2013/14</th>
<th>2017/18</th>
<th>2022</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>2,576</td>
<td>51.5</td>
<td>2,926</td>
<td>49.1</td>
<td>2,306</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>2,429</td>
<td>48.5</td>
<td>3,035</td>
<td>50.9</td>
<td>2,041</td>
</tr>
<tr>
<td>Gender diverse</td>
<td></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-year-olds (5th grade)</td>
<td></td>
<td>1,687</td>
<td>34.0</td>
<td>1,736</td>
<td>29.4</td>
<td>1,387</td>
</tr>
<tr>
<td>13-year-olds (7th grade)</td>
<td></td>
<td>1,628</td>
<td>32.9</td>
<td>2,070</td>
<td>35.0</td>
<td>1,403</td>
</tr>
<tr>
<td>15-year-olds (9th grade)</td>
<td></td>
<td>1,640</td>
<td>33.1</td>
<td>2,104</td>
<td>35.6</td>
<td>1,515</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td></td>
<td>5,005</td>
<td>86.0</td>
<td>5,961</td>
<td>72.5</td>
<td>4,347</td>
</tr>
<tr>
<td>Schools</td>
<td></td>
<td>187</td>
<td>48.0</td>
<td>188</td>
<td>24.4</td>
<td>146</td>
</tr>
</tbody>
</table>

*Absolute figures unweighted, percentage figures weighted

Some of the data still contain missing values in individual variables and survey years, which is why there may be deviations in the total number of cases. RR = response rate.

Table 2 shows the realised samples for the survey years 2009/10 to 2022 by age and gender. Overall, the participation rate is broadly similar for girls and boys and by age group. One exception is the case of gender diverse adolescents, for whom it is not possible to make any statements about trends, as this third category was added as a response option for the first time in the current cycle. In total, more than 100 young people identified themselves as gender diverse.

The response rate decreased over the last twelve years at both student and school level. While about half of the schools and 86% of the students participated in the 2009/10 survey cycle, only 8.6% of the schools and just over half of the students participated in the current survey. Detailed information on the survey cycles 2009/10 to 2017/18 can be found in the previous methodological articles [32–34].
The HBSC provides continuous and comprehensive internationally comparable data on the health of children and adolescents and enables trend analysis.

The HBSC study provides valid and representative data on the health of children and adolescents in Germany, which are internationally comparable and can be monitored over time. From a public health perspective, HBSC is therefore an important source of data for health monitoring and health reporting. One of the most important goals of HBSC is to provide a broad database for health policy decisions. In addition to contributing to international and national health reporting and to the development of health goals, the regional HBSC data of the federal states of Saxony-Anhalt and Brandenburg have been used to identify specific fields of action. These analyses at the regional level [20, 21] have led to the initiation of health-promoting measures, for example a school-based intervention in Saxony-Anhalt to promote the mental health of adolescents. In some countries, the HBSC study is the only source of data on the health of children and adolescents, and in Germany, too, the HBSC was one of the first studies to report comprehensively on the health of this age group, alongside the KiGGS study [36].

This paper provides an insight into the origins and development of the HBSC study in Germany and presents the methods and study design of the current 2022 survey. In addition to the complete survey process, the current case numbers and response rates are presented. With a focus on trend analysis, case numbers and response rates from the previous twelve years of the survey were also used for comparison. This publication serves as a basis for the thematic contributions in this issue, which deal with subjective health and psychosomatic complaints (Reiß & Behn et al. [37]), physical activity (Bucksch et al. [38]), health literacy (Sendatzki & Helmchen et al. [39]), bullying (Fischer et al. [40]) and health inequalities (Moor et al. [41]). These papers will map the health situation of children and adolescents in Germany and track trends over the last twelve years (2009/10 – 2022). They provide information on current challenges as well as positive developments and are therefore an important source of information for stakeholders in the field of child and adolescent health.

4.1 Strengths and weaknesses of the HBSC study

The strengths of the HBSC study are manifold: in particular, the international comparability of 51 countries, the possibility of analysing trends over time and the consideration of social determinants and contextual factors. The measurement instruments are valid and the data are representative of children and adolescents in the age groups covered in Germany. The current 2022 survey also provides a special opportunity to examine the health situation of adolescents considering the possible effects of the COVID-19 pandemic and to compare it with the situation before the pandemic (2017/18 survey). In addition to the survey of students, it was also possible to conduct a survey of school
Concept and methodology of the Health Behaviour in School-aged Children (HBSC) study

principals, which made it possible to include additional assessments of the structural conditions of the school context. In the current survey, it was also possible to achieve a more differentiated survey of gender identity by adding the category ‘diverse’. This means that the HBSC study can provide data on a minoritised group in this age group for the first time at the national level; data on gender diverse (young) adults can be found, for example, in the study ‘German Health Update’ (GEDA) [42]. Insights into the health situation of gender diverse adolescents can be found in the different publications in this issue. These findings are of great importance, especially in view of the research gaps. However, the number of cases is sometimes too small for all statistical analyses. In addition, the response category ‘diverse’ does not cover gender diversity in its entirety, but serves as a collective term that does not allow for further differentiation [42].

The broad range of health topics are a strength and a limitation at the same time. Although this has the advantage that a wide range of different health-related topics can be continuously surveyed, they are only touched on in passing. The HBSC study can therefore provide indications that can be analysed in more detail in further research projects (e.g., in focus group interviews or topic-specific studies). In addition, HBSC is designed as a cross-sectional study. Although this makes it possible to analyse current prevalence and trends, it is not possible to deduce causalities, only to illustrate correlations. Another limitation and challenge for most scientific studies is the declining willingness to participate in the surveys [30], which is a very alarming development for science. It is expected that the willingness of both schools and students to participate will continue to decline in the coming years. Without the willingness of study participants, reliable results cannot be obtained. Although the response rate for the HBSC study was similar to other surveys of this age group [43], incentive structures are essential to increase the response rate. These need to be implemented at every stage of the project, from planning (e.g., adequate staffing, good coordination), through contact initiation (e.g., personal contact, relevance of topic, special attention to privacy), implementation (e.g., all costs covered, close contact), to completion of the study (feedback of results) [31, 44]. Although the HBSC study is self-funded, these aspects have been implemented as far as possible by the HBSC Study Group Germany. In addition, willingness to participate is inextricably linked to staff shortages in schools. The assumption that online surveys would achieve a higher willingness to participate with a lower use of resources [34] could not be confirmed with HBSC. Rather, it was found that schools were still lagging behind in terms of digitisation and preferred a printed survey. Further, the online questionnaire was more likely to be abandoned than the paper questionnaire.

An additional challenge is the approval process for the study, which any health study in a school context is faced with. The sometimes state-specific adaptations and the fulfilment of specific requirements, which are seen as a prerequisite for approval, require many feedback loops in the preparation of the study (both within the study network and between the study coordinator and the responsible ministries/state education authorities). If access would be easier – especially for regularly recurring studies such as HBSC – this could reduce the workload on both sides and also counteract delays in the study process (e.g., due to
long waiting times in the approval procedure). This would also make it possible to significantly reduce the duration of the study recruitment.

4.2 Conclusion

The next generation is the foundation of our future society. Investing in healthy development is therefore an important public health objective. There is evidence that social crises such as the COVID-19 pandemic have a massive impact (beyond the infectious disease) on the living environment and health situation of children and adolescents, thus emphasising the relevance of child and adolescent health research [4, 45, 46]. Regular health monitoring is needed to assess the health impact on the young generation and to identify options for action. This requires close cooperation between all stakeholders in policy, practice and research, and of course with children and adolescents themselves, in order to give them the best possible opportunities to grow up healthy.

Data protection and ethics

Like the previous cycles, the current survey of the HBSC study 2022 was reviewed by the ethics committee of the Medical Association of Hamburg (processing no.: 2021-100700-WF). The survey is voluntary and anonymous at school and individual level at all times. The school principals and students were informed in advance about all the content and objectives of the study and about the data protection concept. Written consent (informed and active consent) was required from the parents/guardians and the students themselves (from grade 7) in order to participate in the survey. The study was conducted in accordance with the German Federal Data Protection Act (BDSG) and the European General Data Protection Regulation (GDPR). A corresponding data protection concept was developed in advance with the data protection officer of Martin Luther University Halle-Wittenberg (print survey) and the data protection officer of Brandenburg University of Technology Cottbus-Senftenberg (online survey). Additional information and conditions on data protection that the HBSC team received from various ministries as part of the approval process were also taken into account and added to the concept.
Data availability
The current HBSC data is not available as open access as their use is reserved exclusively for the HBSC Study Group Germany for the first three years after collection. Use of the data by third parties is possible on request. Enquiries about the data or ideas for analysis can be addressed to the HBSC Study Group Germany (Principal Investigator and Coordinator: Prof. Dr. Matthias Richter, Technical University of Munich; Co-Principal Investigator and Coordinator: Dr. Irene Moor, Martin Luther University Halle-Wittenberg). After an embargo period of three years, the national and international HBSC data can be requested from the ‘HBSC Data Management Centre’ (Head: Prof. Dr. Oddrun Samdal at the University of Bergen (Norway) https://www.uib.no/en/hbscdata).

Conflicts of interest
The authors declared no conflicts of interest.

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HBSC Study Group Germany
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