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The Physical Activity and Screen Time of Children and Adolescents living in Germany: The MoMo 2.0-Study 2023-2025

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Abstract

Background

Following the COVID-19 pandemic and amid the ongoing digitalization of everyday life, concerns about physical activity levels among children and adolescents have increased. To identify vulnerable groups and inform targeted interventions, continuous, population-based surveillance of physical activity is essential.

Methods

This study presents recent representative physical activity and leisure screen time questionnaire data from the MoMo 2.0-Study, collected in 2023 and 2024 among children and adolescents across Germany. Weighted data from 4,258 (2,035 girls, 2,223 boys) randomly selected 4-to-17-year-olds drawn from 171 municipalities across Germany were analyzed.

Results

Girls accumulated an average of 105 ± 138 and boys 130 ± 138 min/week in sports activities in sports clubs. Sports club membership was 66.5% among 4-to-17-year-olds living in Germany. Outside of sports clubs, girls spent 31 ± 76 and boys 41 ± 120 min/week in sports activities. 18.2% of boys and 17.7% of girls met the 2010 World Health Organization's physical activity guidelines. Boys engaged in 56 ± 56 min/week of physical activity by playing outside, girls averaged 48 ± 57 min/week. Physical activity in sports clubs increased, whereas physical activity outside sports clubs decreased compared to previous study waves. Leisure screen time averaged 172 ± 164 min/day for girls and 200 ± 174 for boys. In total, only 41.8% of boys and 49.8% of girls accumulated less than two hours of leisure screen time per day.

Conclusions

Although the long-term implications of declining non-organized physical activity are not yet fully understood, the persistent shift away from sports activites outside sports clubs and outdoor play is concerning and warrants continued monitoring.

1 Introduction

Regular physical activity (PA) during childhood and adolescence is a key determinant of both physical and mental health (1), with benefits extending into adulthood (2). Insufficient PA in youth is associated with increased risk of obesity, cardiometabolic disorders, poor mental health outcomes, and reduced overall well-being (3). Accordingly, the World Health Organization (WHO) recommends that children and adolescents accumulate an average of 60 minutes of moderate-to-vigorous PA per day, including aerobic

and muscle- and bone-strengthening activities (3), which was recently updated from at least 60 minutes of moderate-to-vigorous PA per day (4). These guidelines also recommend to limit the amount of time spent being sedentary, particularly the amount of recreational screen time (3).

Despite these well-established recommendations, international surveillance data consistently show that a large proportion of young people do not meet PA guidelines (3). In parallel, there has been a marked increase in sedentary behaviors, particularly leisure screen time, which has been linked to adverse health outcomes independent of PA levels (5). The rapid digitalization of daily life, accompanied by increasing access to smartphones, social media, and digital entertainment, has changed how children spend their leisure time and has raised concerns about declining physical activity and increasing sedentary behavior.

In Germany, the Motorik-Monitoring study (MoMo) has provided one of the most comprehensive longitudinal surveillance systems on PA, motor performance, and health in youth over the last two decades (6, 7). Previous MoMo data have documented important behavioral shifts over time, including a decline in non-organized PA such as outdoor play alongside changes in sports participation in and outside sports clubs (8). In contrast to organized sports in sports clubs, which are typically structured and institutionally embedded, PA outside sport clubs represents more spontaneous, self-directed movement behaviors that may be particularly sensitive to environmental and societal changes.

Evidence from previous MoMo survey waves suggests that while sports activity (SA) in sports clubs has slightly increased over time, SA outside sports clubs and outdoor play have declined (8). At the same time, screen-based behaviors increased substantially during the COVID-19 pandemic, reflecting both lockdown-related restrictions and accelerated digitalization of education and leisure contexts (9, 10). It remains unclear whether pre-pandemic levels have been restored or whether longer-term shifts in movement behavior have emerged.

Up-to-date, representative data on current patterns of PA across different domains, as well as on leisure screen time, are scarce. In particular, little is known about whether previously observed trends, such as the shift from SA outside sports clubs to SA in sports clubs, have continued in the post-pandemic period, and how these changes relate to current adherence to PA and screen time recommendations across age groups and sexes.

Therefore, the aim of the present study was to examine current levels, as well as age- and sex-specific patterns, of SA in and outside sports clubs, outdoor play, leisure screen time, and adherence to movement behavior recommendations in a nationally representative sample of children and adolescents.

2 Methods

The MoMo 2.0-Study (11) contains the most recent cohort as a predecessor of the MoMo Study 2003–2021 (6, 7) investigating PA, motor performance, health, and their determinants among children and

adolescents living in Germany. The present analyses are based on a nationally representative cross-sectional sample of 4,405 children and adolescents aged 4 to 17 years.

2.1 Participants

Participants were recruited using a two-stage random sampling procedure. First, 185 municipalities across Germany were randomly selected with a probability proportional to the number of residents aged 4 to 17 years. Second, 140 individuals per municipality were randomly selected from local population registers and invited by mail. Up to two reminder letters were sent to non-responders. As participation rates were lower than anticipated, 10 additional sampling points were selected to ensure a nationally representative sample.

2.2 Procedure

Data collection was conducted in study centers within the selected municipalities between September 2023 and December 2024. The assessment consisted of five components. Participants first completed a PA questionnaire, followed by anthropometric measurements, motor performance testing, and a structured health interview. In addition, they were asked to wear an accelerometer during the subsequent eight days.

Written informed consent was obtained from all participants or, for participants younger than 16 years, from their parents or legal guardians prior to participation. The complete assessment required approximately 90 to 120 minutes. Participants received a €20 gift voucher and an individualized report summarizing their test results. Further details are provided elsewhere (11).

The PA questionnaire was completed electronically on a tablet and included questions on PA across different settings as well as PA-related determinants, such as enjoyment of PA and media use. The face-to-face health interview was conducted by trained study staff and covered physical and mental health, socioeconomic status, and migration background. Parents or legal guardians were allowed to assist younger children with completing the questionnaire and answering interview questions.

Participants who were unable to attend the on-site assessment were invited to complete an online questionnaire containing the most relevant items from the PA questionnaire and health interview.

2.3 Measures

Self-reports were assessed using the MoMo PA Questionnaire (12). The questionnaire demonstrated acceptable reliability, with a 1-week test–retest reliability of $\kappa = 0.66$ and an intraclass correlation coefficient (ICC) of 0.67 for the questions concerning PA inside and outside of sports clubs (12). Criterion validity against accelerometer-measured moderate-to-vigorous physical activity (MVPA) was moderate ($r = 0.29$) (12). Date of birth and sex were self-reported as part of the questionnaire.

2.3.1 Physical and sports activities

Weekly duration of SA in sports clubs was calculated by summing the duration of up to four reported sports club activities, weighted according to the proportion of months each activity was performed during the previous year. Only sports associated with a substantial amount of PA were included. Activities such as chess and esports were excluded. Weekly values exceeding 2,100 minutes were considered implausible and excluded from the analyses.

Participants were also asked whether they participated in sports outside sports clubs. Weekly duration of sports participation outside sports clubs was calculated using the same procedure as described for SA in sports clubs.

Furthermore, time spent playing outside, as a form of non-organized PA, was assessed by asking participants to report the number of days they played outside and the average duration on those days. The average daily duration was calculated by multiplying the reported frequency by the average duration and dividing by seven.

To ensure comparability with previous MoMo survey waves and existing surveillance data, compliance was assessed according to the 2010 WHO recommendations, which recommend at least 60 minutes of daily MVPA (4). Participants reported the number of days during a typical week on which they accumulated at least 60 minutes of MVPA, following the approach proposed by Prochaska, Sallis, and Long (13). Participants reporting 7 days of at least 60 minutes of MVPA were classified as meeting the PA recommendations.

2.3.2 Leisure screen time

Leisure screen time (ST) was assessed using an adapted version of the media use questionnaire developed by Manz et al. (14). Average daily leisure ST was calculated by summing the reported time spent watching television, gaming, and using the internet for leisure purposes. Screen time was assessed separately for weekdays and weekends using a six-point Likert scale ranging from 0 to 6 hours per day. The calculation procedure the procedure described by Schmidt et al. (8).

As the WHO does not specify a quantitative leisure screen time recommendation for this age group, adherence was defined according to the Canadian 24-Hour Movement Guidelines (15), as referenced in the current WHO recommendations (3). Participants were classified as meeting the recommendation if their average daily leisure screen time did not exceed 120 minutes (15). Other frameworks recommend even lower rates such as not more than 60 minutes per day for children in primary school age (16).

2.4 Statistical analysis

All descriptive analyses were conducted using IBM SPSS Statistics version 27 (IBM Corp., Armonk, NY, USA). Of the initial sample of 4,405 participants aged 4 to 17 years, 146 were excluded because they did not provide any information on PA or ST and one was excluded because sex was not reported. Consequently, analyses were based on data from 4,258 participants (2,035 girls, 2,223 boys) and were stratified by age group and sex.

All analyses were weighted to represent the population of children and adolescents aged 4–17 years in Germany with respect to age, sex, federal state, region, and parental educational level, based on data from the 2023 German Microcensus. Sampling weights were developed in cooperation with the GESIS Leibniz Institute for the Social Sciences.

Missing values were not imputed. Analyses were conducted using all available data for each outcome variable. Consequently, the unweighted sample size (N) differs across outcome variables and is reported for each variable in Tables 1 to 5.

3 Results

Analyses were stratified either by age group, sex, or both. The mean age within each age group was 5.1 years for participants aged 4 to 5 years, 8.4 years for those aged 6 to 10 years, 12.5 years for those aged 11 to 13 years, and 15.8 years for those aged 14 to 17 years.

Table 1 summarizes the results for SA, playing outside and PA guideline adherence for both sexes.

Table 1
Sports activity, playing outsinde and PA guideline adherence (all participants)

Age group	**Sports club activity** **M ± s** **[minutes per week]**	**Sports activity outside sports clubs** **M ± s** **[minutes per week]**	**Playing outside** **M ± s** **[minutes per day]**	**Physical activity guideline adherence** **[%]**
4 to 5 years	54 ± 62 (N = 602)	14 ± 57 (N = 603)	80 ± 64 (N = 610)	33.1 (N = 617)
6 to 10 years	113 ± 113 (N = 1715)	20 ± 59 (N = 1718)	67 ± 54 (N = 1753)	21.1 (N = 1765)
11 to 13 years	145 ± 143 (N = 951)	44 ± 130 (N = 955)	43 ± 50 (N = 972)	10.8 (N = 976)
14 to 17 years	150 ± 183 (N = 887)	70 ± 134 (N = 866)	18 ± 37 (N = 841)	8.4 (N = 900)
All	118 ± 139 (N = 4,155)	37 ± 102 (N = 4,142)	52 ± 57 (N = 4,176)	18.0 (N = 4,258)

M: mean; s: standard deviation; N: number of participants

SA in sports club and outside sports clubs increases with age, whereas playing outside and adherence to the WHO guideline on PA decreased with age. On average, children and adolescents aged 4 to 17 in

Germany engage in 118 ± 139 minutes of SA in sports clubs, 37 ± 102 minutes of SA outside clubs, 52 ± 57 minutes of outside play and 18 percent adhere to the WHO Guideline on PA.

Table 2 summarizes SA and PA indicators among boys.

Table 2
Sports activity, playing outsinde and PA guideline adherence among boys

Age group	Sports club activity M ± s [minutes per week]	Sports activity outside sports clubs M ± s [minutes per week]	Playing outside M ± s [minutes per day]	Physical activity guideline adherence [%]
4 to 5 years	55 ± 58 (N = 315)	14 ± 74 (N = 318)	79 ± 58 (N = 318)	33.4 (N = 324)
6 to 10 years	128 ± 117 (N = 905)	21 ± 71 (N = 899)	69 ± 55 (N = 921)	21.9 (N = 926)
11 to 13 years	157 ± 146 (N = 496)	54 ± 164 (N = 496)	49 ± 52 (N = 511)	10.3 (N = 511)
14 to 17 years	166 ± 176 (N = 454)	80 ± 148 (N = 442)	24 ± 42 (N = 428)	7.8 (N = 462)
All boys	130 ± 138 (N = 2,170)	41 ± 120 (N = 2,155)	56 ± 56 (N = 2,178)	18.2 (N = 2,223)

M: mean; s: standard deviation; N: number of participants

Participation in SA in sports clubs increased from a mean of 55 ± 58 minutes per week among boys aged 4 to 5 years to 166 ± 176 minutes per week among those aged 14 to 17 years. A similar age-related increase was observed for participation in SA outside sports clubs, rising from 14 ± 74 to 80 ± 148 minutes per week. In contrast, time spent playing outdoors decreased markedly across age groups, from 79 ± 58 minutes per day among the youngest boys to 24 ± 42 minutes per day among the oldest. Adherence to the WHO PA recommendations also declined substantially with age, decreasing from 33.4% among boys aged 4 to 5 years to 7.8% among those aged 14 to 17 years.

Table 3 presents the corresponding results for girls.

Table 3
Sports activity, playing outsinde and PA guideline adherence among girls

Age group	Sports club activity M ± s [minutes per week]	Sports activity outside sports clubs M ± s [minutes per week]	Playing outside M ± s [minutes per day]	Physical activity guideline adherence [%]
4 to 5 years	53 ± 66 (N = 287)	14 ± 30 (N = 287)	80 ± 68 (N = 292)	32.9 (N = 293)
6 to 10 years	97 ± 107 (N = 810)	19 ± 43 (N = 819)	65 ± 54 (N = 832)	20.2 (N = 839)
11 to 13 years	123 ± 139 (N = 455)	33 ± 72 (N = 459)	37 ± 46 (N = 461)	10.3 (N = 465)
14 to 17 years	133 ± 191 (N = 433)	59 ± 117 (N = 424)	10 ± 30 (N = 413)	9.0 (N = 438)
All girls	105 ± 138 (N = 1,985)	31 ± 76 (N = 1,987)	48 ± 57 (N = 1,998)	17.7 (N = 2,035)

M: mean; s: standard deviation; N: number of participants

As observed among boys, participation in sports increased with age, from 53 ± 66 minutes per week among girls aged 4 to 5 years to 133 ± 191 minutes per week among those aged 14 to 17 years. Weekly duration of sports outside sports clubs also increased, whereas time spent playing outdoors decreased from 80 ± 68 to 10 ± 30 minutes per day across the age groups. Compliance with the WHO PA recommendations declined from 32.9% among the youngest girls to 9.0% among the oldest.

Sports club membership by age group and sex is presented in Table 4.

Table 4
Sports club membership

	Boys		Girls		All	
	Sports club member [%]	**N**	**Sports club member [%]**	**N**	**Sports club member [%]**	**N**
4 to 5 years	61.1	324	58.3	293	59.8	617
6 to 10 years	75.0	926	69.2	839	72.2	1,765
11 to 13 years	73.3	511	68.0	465	70.9	976
14 to 17 years	66.1	462	53.2	438	59.8	898
All	69.9	2,223	62.7	2,035	66.4	4,258

N: number of participants

Overall, 66.5% of participants reported an active sports club membership, with a higher proportion among boys (69.9%) than girls (62.7%). Across both sexes, sports club membership increased from early childhood to the age of 6 to 10 years (72.2%) and subsequently declined during adolescence to 59.9% among participants aged 14 to 17 years.

Table 5 shows the reported daily minutes spent as ST during leisure time.

Table 5
Screen time (leisure time)

Age group	Boys			Girls			All	
	N	Screen time M ± s [daily mins]	< 2 h per day [%]	N	Screen time M ± s [daily mins]	< 2 h per day [%]	Screen time M ± s [daily mins]	< 2 h per day [%]
4 to 5 years	304	87 ± 96	82.1	280	78 ± 90	82.6	82 ± 93	82.3
6 to 10 years	886	136 ± 123	62.8	808	110 ± 107	71.2	124 ± 117	66.8
11 to 13 years	496	260 ± 181	21.1	451	229 ± 168	30.4	245 ± 176	25.5
14 to 17 years	448	318 ± 181	8.0	423	275 ± 188	19.9	297 ± 186	13.8
All	2,134	200 ± 174	41.8	1,962	172 ± 164	49.8	186 ± 170	47.4

M: mean; s: standard deviation; N: number of participants

Mean daily leisure ST increased consistently with age in both sexes. Among boys, average ST increased from 87 minutes per day in the youngest age group to 318 minutes per day among 14-17-year-olds, while corresponding values for girls increased from 78 to 275 minutes per day. Consequently, the proportion of participants meeting the recommendation of no more than two hours of leisure ST per day declined markedly with age, from more than 80% among 4-5-year-olds to 8.0% of boys and 19.9% of girls aged 14 to 17 years.

In sum, 42.6 percent of participants reached at least one recommendation of PA or screen time (40.7% boys, 44.7% girls), 11.3 percent reached both recommendations (10.5% boys, 12.2% girls), and 46.0 percent (48.8. % boys, 43.0% girls) reached no recommendation.

4 Discussion

The present study provides nationally representative data on PA and leisure screen time among children and adolescents. Using data from the MoMo 2.0 Study, which allows comparisons with previous survey waves, our findings contribute important insights for monitoring long-term behavioral trends and informing public health strategies at the population level.

Compared with previous MoMo survey waves, time spent in SA in sports clubs increased steadily from 89 minutes per week in the baseline assessment (2003–2006) to 99 minutes in Wave 2 (2015–2017)

and 105 minutes in the present sample (8). In contrast, SA outside sports clubs decreased substantially over the same period, from 83 minutes per week at baseline to 53 minutes in Wave 2 (9) and 31 minutes in the present sample. Similarly, time spent playing outdoors declined from 57 minutes per day in 2018–2020 (8) to 48 minutes per day in the present study. These findings confirm a continuing shift from non-organized to organized sports participation, consistent with previous reports from the MoMo framework (9, 10).

Only approximately 18% of participants met the WHO recommendation from 2010 of at least 60 minutes of MVPA per day. Although this guideline is widely used and supported by evidence-based recommendations (4), it should be noted that alternative activity patterns (e.g., uneven distribution of activity across the week with resting days) may also confer health benefits, especially with increasing age. Therefore, the WHO has modified its recommendation in 2020 to recommend an average, not a minimum, of 60 minutes of moderate-to-vigorous physical activity per day (3). Nevertheless, we preferred to use the 2010 definition to ensure comparability with previous MoMo studies and to provide an easily interpretable population-level indicator for surveillance purposes. Applying the updated WHO definition would likely result in higher prevalence estimates. For example, a German study from 2022 showed that 57.0% of children and adolescents were physically active for 7 hours or more per week (boys: 60.0%, girls: 53.8%). These higher prevalence estimates can be explained by the different definition, but do not necessarily indicate an actual change in physical activity levels (17).

The German Olympic Sports Confederation (DOSB) regularly reports membership statistics for sports clubs in Germany. For 2024, reported participation rates were 29.2% among boys and 27.4% among girls younger than 6 years, 80.3% and 60.9% among boys and girls aged 7 to 14 years, and 62.9% and 43.5% among those aged 15 to 18 years, respectively (18). Although the age categories are not directly comparable, these rates are broadly consistent with the results of the present study, supporting the representativeness of the MoMo 2.0-Study sample. As expected, the estimates for sports club membership in this study are slightly lower than those in the DOSB statistics, as the latter also include multiple club memberships.

Across all age groups, girls were less likely than boys to participate in sports clubs, with the difference becoming more pronounced during adolescence. Compared with earlier MoMo survey waves, overall sports club membership has increased over time. Membership rates increased from 53.5% in the baseline assessment (2003–2006) to 60.0% in Wave 2 (2014–2017) and 66.5% in the current sample (2023–2024). These findings indicate a gradual increase in sports club participation among children and adolescents in Germany over the past two decades.

Leisure screen time increased with age in the present study, with a corresponding decrease in the proportion of children and adolescents meeting the recommendation of less than 2 hours per day. While such thresholds provide a useful benchmark for population surveillance, recent WHO guidelines emphasize a broader perspective on sedentary behavior, focusing on reducing overall sedentary time and encouraging a balanced 24-hour movement profile rather than adherence to a single cut-off value

(3). This perspective emphasizes that the context and purpose of screen use ("why") may be more informative than screen duration ("how long") alone. (3). The question “why” instead of “how long” takes this into account. Nevertheless, maintaining sufficient levels of PA should be recommended under all circumstances.

Compared with previous MoMo data collected between 2018 and 2020, leisure screen time has increased in children and adolescents living in Germany (9). However, levels observed in the present study remain lower than those reported during the peak of the COVID-19 pandemic (unweighted data), when mean daily leisure screen time reached 155 minutes among children aged 6 to 10 years and 273 minutes among adolescents aged 11 to 17 years.

A major strength of the present study is the use of a large, nationally representative sample of children and adolescents in Germany, allowing for robust estimation of PA and screen time behaviors. The use of the same questionnaires and general procedures in prior MoMo waves enables a comparison across multiple survey waves. However, it must be noted that MoMo 2.0 followed slightly different procedures (including recruitment, sampling and handling of extreme values in SA) than older MoMo waves that were organized as a sub-module of the German Health Interview and Examination Survey for Children and Adolescents (19).

Despite the use of established and vaild questionnaires self-reports are subject to recall bias and social desirability bias. Future studies incorporating objective measures, such as accelerometry, are needed to validate and extend these findings; a separate publication regarding device-based PA in children and adolescents in the MoMo 2.0-Study is provided by Fiedler et al. (20).

Especially SA outside sports clubs showed high variability and substantial deviations from normal distribution (skewness: 2.00; kurtosis: 5.94) with a large proportion of zero values (70.8%) and a small number of very high values. This distribution likely reflects the heterogeneous nature of non-organized PA in children and adolescents.

Because weighted data were used, comparisons with previous studies or earlier MoMo waves should be interpreted cautiously, as observed differences may reflect both behavioral changes and changes in the underlying population structure.

Finally, despite efforts to ensure representativeness through a two-step randomized sampling strategy and weighted analysis as described in the methods part, residual selection bias due to non-response cannot be fully excluded.

5 Conclusions

In summary, the present study demonstrates a continuing shift from SA outside sports clubs and outdoor play to sports activities in sports clubs among children and adolescents in Germany, alongside persistently low levels of adherence to PA recommendations and increasing leisure screen time with

age. These findings underscore the importance of continued surveillance and targeted public health strategies to promote balanced movement behaviors across childhood and adolescence. Further studies may also investigate whether this shift away is triggered socially, behavioral or environmental. Organized sport may not fully replace free play benefits such as diversity of used motor skills and muscle groups, autonomy, spontaneaous social engagement, and creativity.

Abbreviations

physical activity (PA)

World Health Organization (WHO)

Motorik-Monitoring study (MoMo)

sports activity (SA)

intraclass correlation coefficient (ICC)

moderate-to-vigorous physical activity (MVPA)

screen time (ST)

German Olympic Sports Confederation (DOSB)

Declarations

Ethics approval and consent to participate:

All procedures were in accordance with the ethical standards of the Institutional Research Committee and with the Declaration of Helsinki of 1975 and its subsequent amendments or comparable ethical standards. Participation was voluntary and parents gave their written consent for minors and the presence of a legal guardian was mandatory under the age of 15. Ethical approval for the MoMo 2.0-Study was obtained from the Ethics Committee of the Karlsruhe Institute of Technology on 6 November 2023 (application number A2023-077).

Consent for publication:

not applicable

Competing Interests:

The authors declare no conflict of interests.

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Author Contribution

AW secured funding of the study. LK, CN, and AW collected data. LK created and supervised the data set. SCES analyzed the data and drafted the manuscript. LK, JF, CN, JK, and AW added to the manuscript. LK, JF, CN, JK, and AW reviewed and approved the final version.

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not applicable

Data Availability

The datasets generated and analyzed during the present study are not publicly available due to the strict ethical standards required by the Federal Office for the Protection of Data with which study investigators are obliged to comply but are available from the corresponding author on reasonable request.

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