

Physical fitness of school children: Association with the Covid-19 pandemic and school social status

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Physical fitness as a health marker



Cardiopulmonary health, obesity



Executive function, academic performance

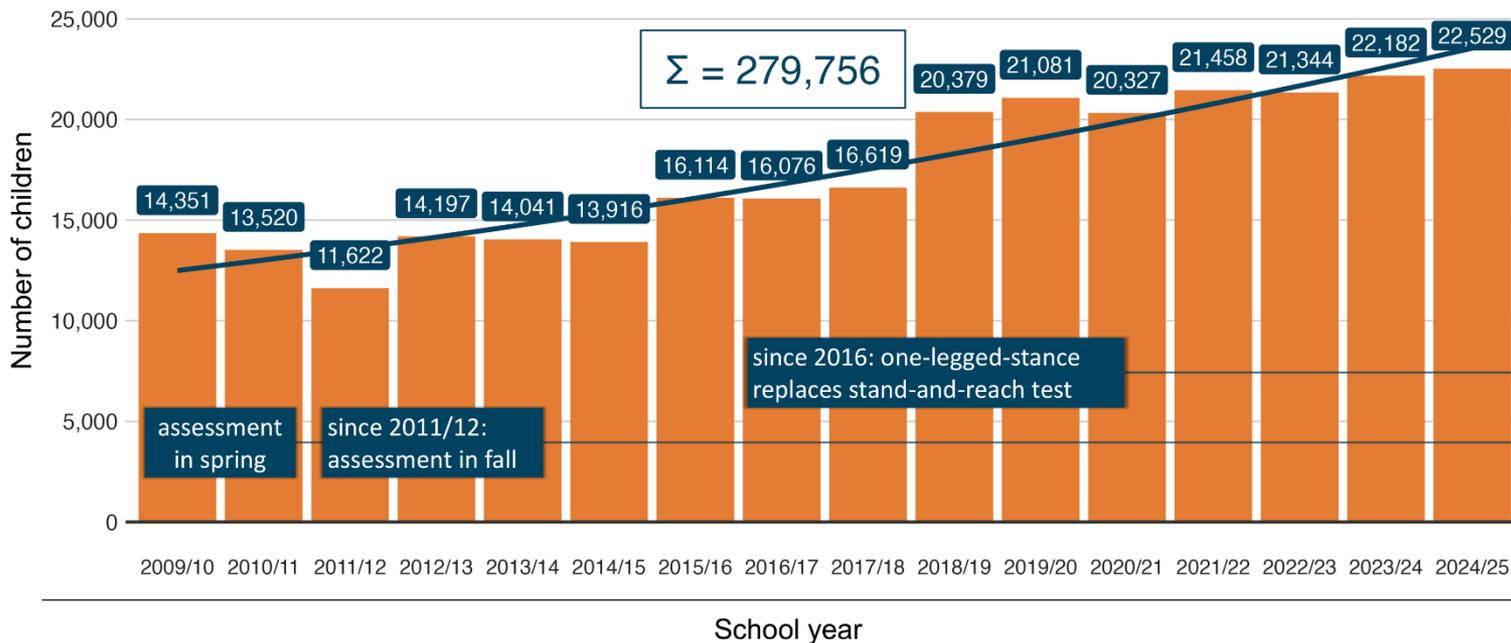


Health-related quality of life



EMOTIKON: Annual assessment of all third-graders' physical fitness

Participating children in EMOTIKON



EMOTIKON tests:

- 6-minute-run
- star-run
- 20-meter-sprint
- standing long jump
- ball-push test
- one-legged-stance/stand-and-reach

EMOTIKON: Physical fitness tests



Cardiorespiratory
endurance: 6-min run
(distance in meters)



Coordination under
time pressure: star-run
(speed in m/s)



Speed: 20m sprint
(speed in m/s)



Lower limbs muscle
power (powerLOW):
standing long jump
(distance in cm)

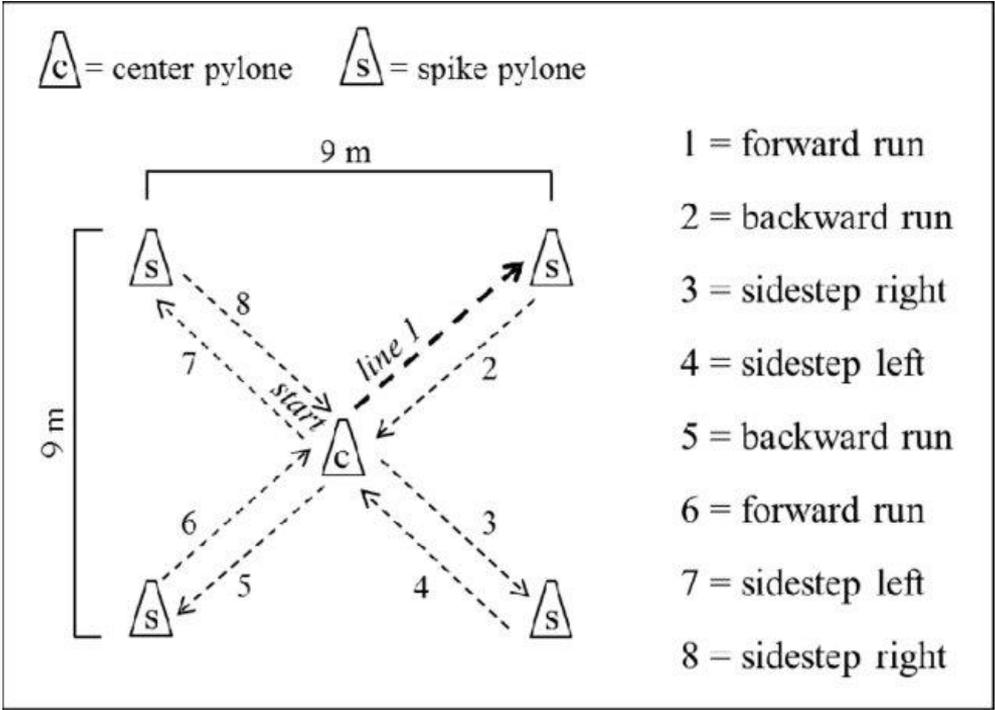


Upper limbs muscle
power (powerUP): ball
push test
(distance in meters)



Static balance: one-
legged-stance with
eyes closed (time in
seconds \rightarrow log(s))

Coordination (star-run)



Covid-19 pandemic effects on physical fitness

-  Physical activity/exercise (Ludwig-Walz et al., 2023; Neville et al., 2022; Pang et al., 2023; but see Schmidt et al., 2021)
- Mixed results for physical fitness (e.g., Bähr et al.; 2024; Drenowatz et al., 2022; Eberhardt et al.; 2024; Teich et al.; 2023)
- Federal State of Brandenburg, Germany:
Decreased performance primarily in running tasks (Teich et al., 2023)



6-min run
(cardiorespiratory
endurance)



star-run
(coordination)



20m sprint
(speed)

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6-min run
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star-run
(coordination)



20m sprint
(speed)

→ How has children's physical fitness developed after the pandemic?

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Star-run
(coordination)



20m sprint
(speed)

→ **Between-school differences in pandemic effects**



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- **Social status** related to health and living environment, including access to sports clubs, and nutrition (e.g., Rittsteiger et al., 2021; Vazquez & Cubbin, 2020)
 - **Is school social status associated with children's fitness?**
 - **Did pandemic effects and post-pandemic rebounds differ by school social status?**

School-specific social index

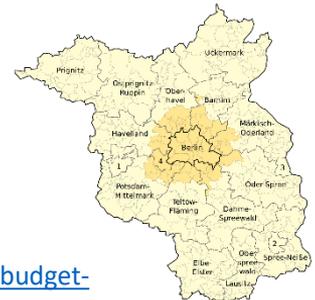
School social index based on:

- **SGB-II rate** (social welfare, weighted by students' place of residence)
- Proportion of students with **non-German native language** (indicator of migration background)
- Proportion of students with **special educational needs** (sonderpädagogischer Förderbedarf)

Four categories based on quartiles of weighted composite score:

Index category 1 = highest social status (lowest social burden);

index category 4 = lowest social status (highest social burden)

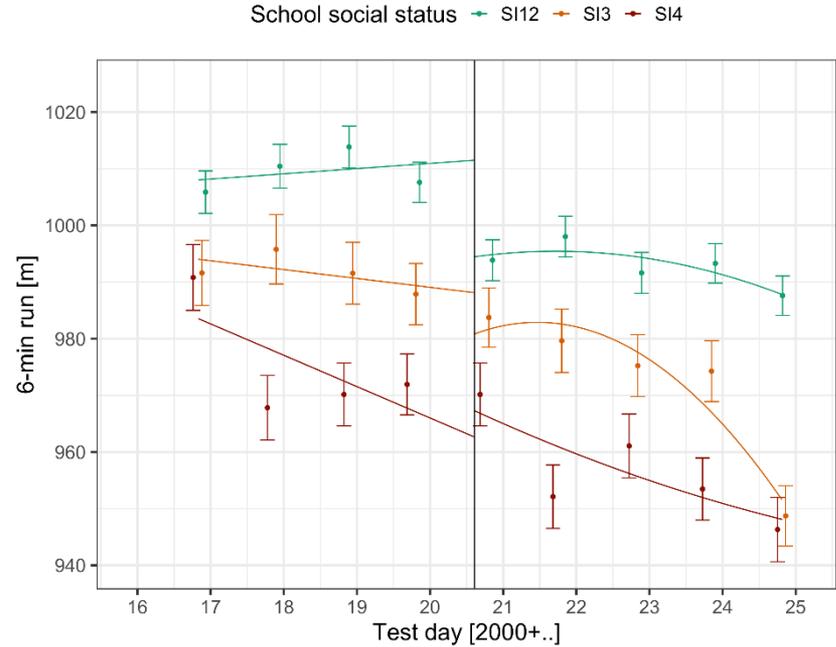
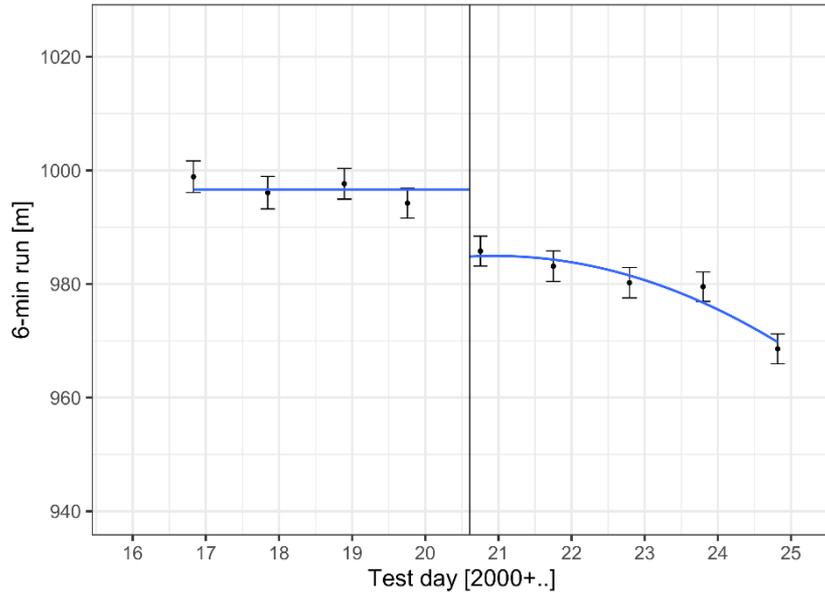


Covid-19 pandemic effects x school social status

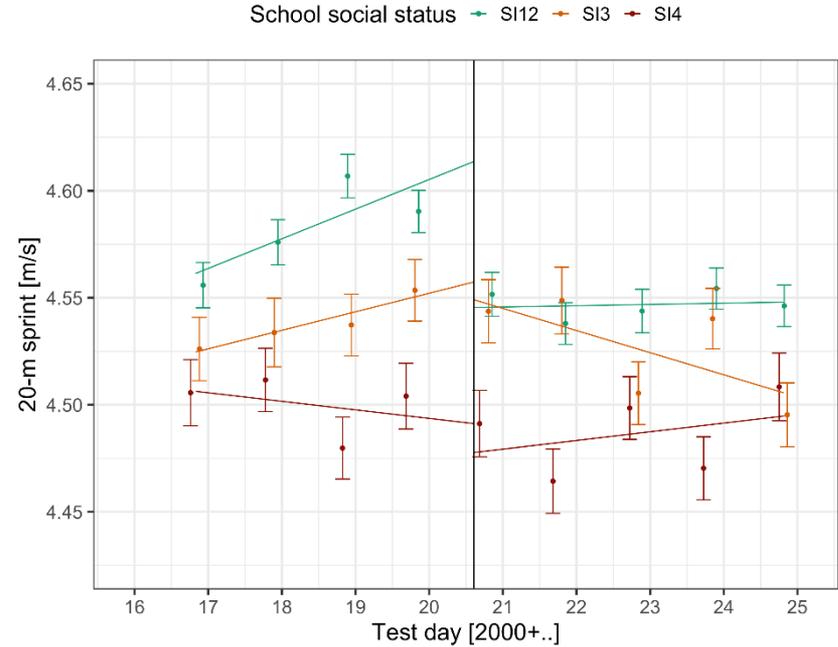
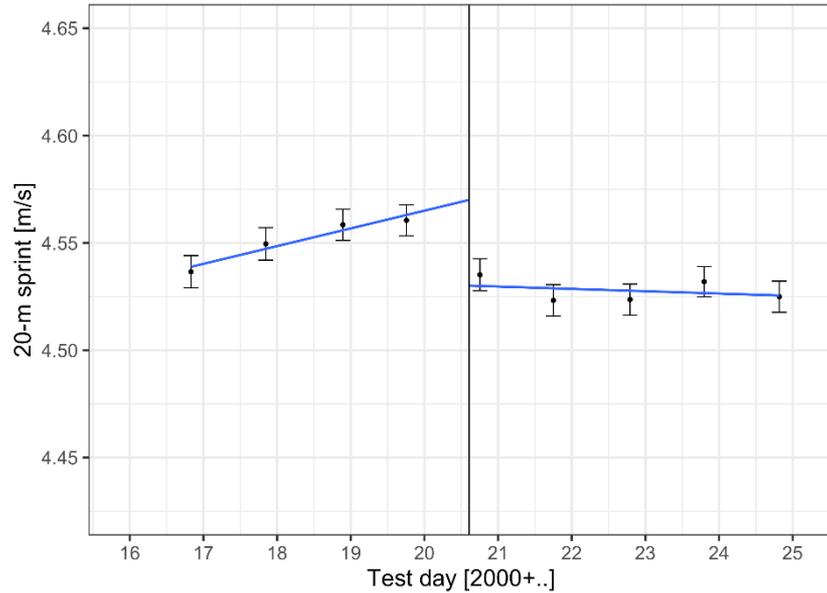
- Data from **123,287 third-graders** in ninth year of life from 446 schools tested between 2016 and 2024
- Pandemic effects confounded with **secular fitness trends** (Fühner et al., 2021; Tomkinson et al. 2019)
 - **Regression discontinuity design** (Thistlethwaite & Campbell, 1960) testing pandemic effects at first day of school year 2020/21 (i.e., critical date) allowing for linear & quadratic secular trends, **linear mixed model** with random effects child and school



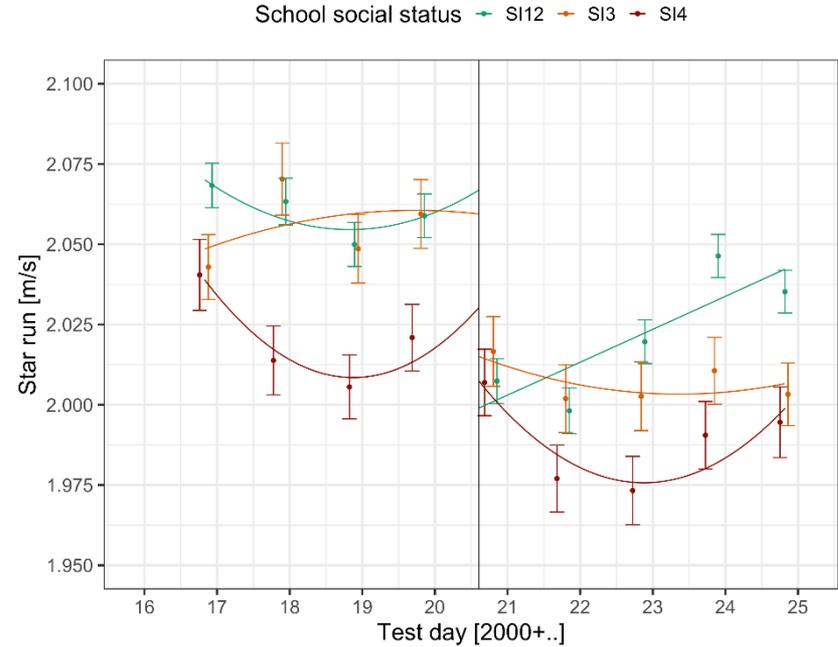
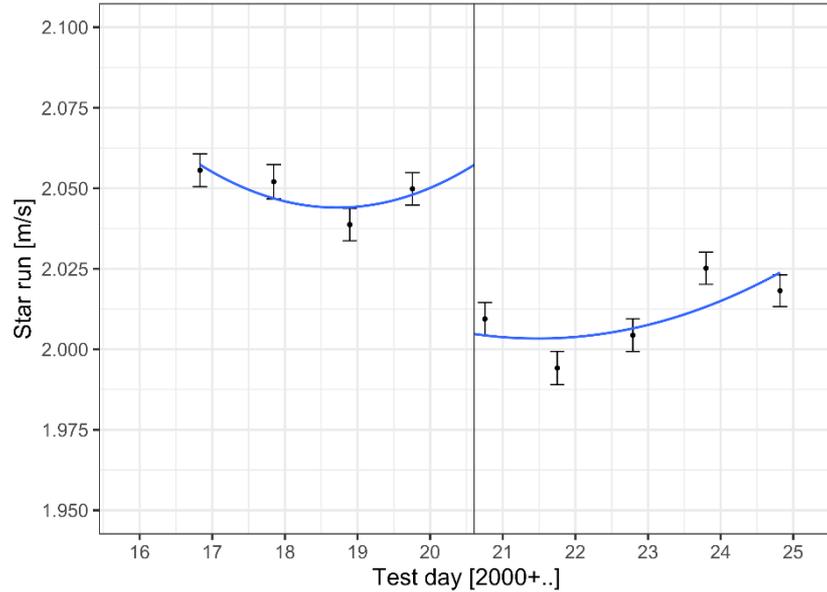
Endurance (6-min run): Covid x school social status



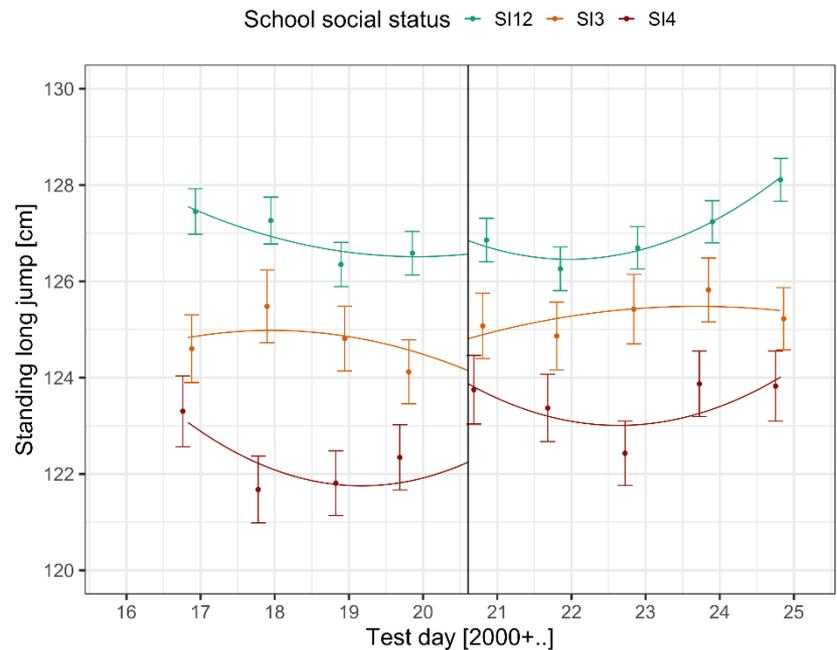
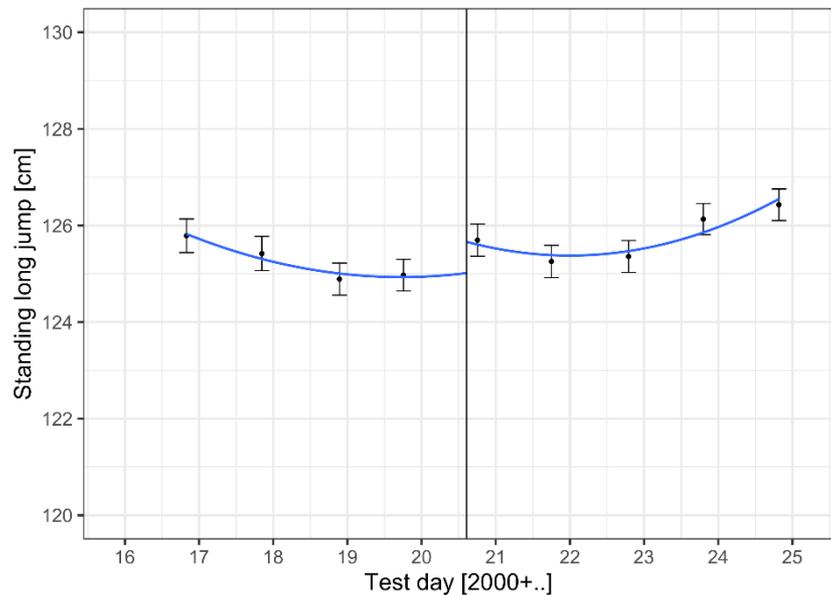
Speed (20m sprint): Covid x school social status



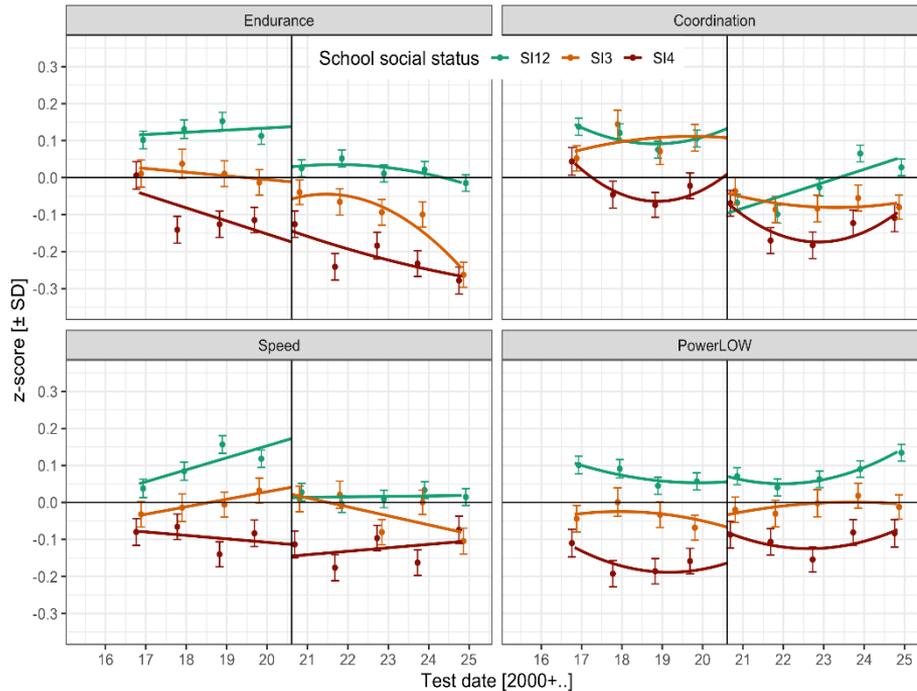
Coordination (star-run): Covid x school social status



PowerLOW (standing long jump): Covid x school social status

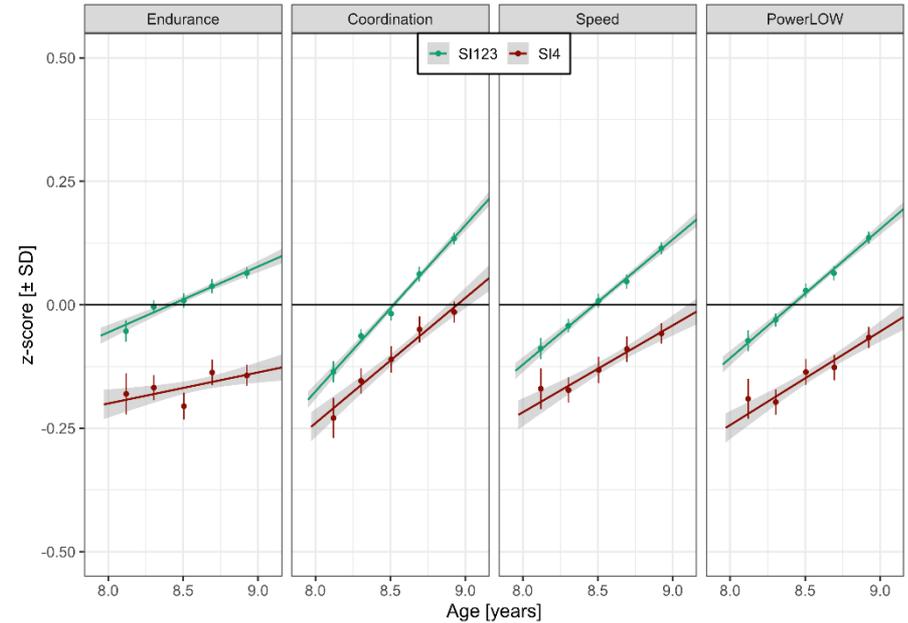
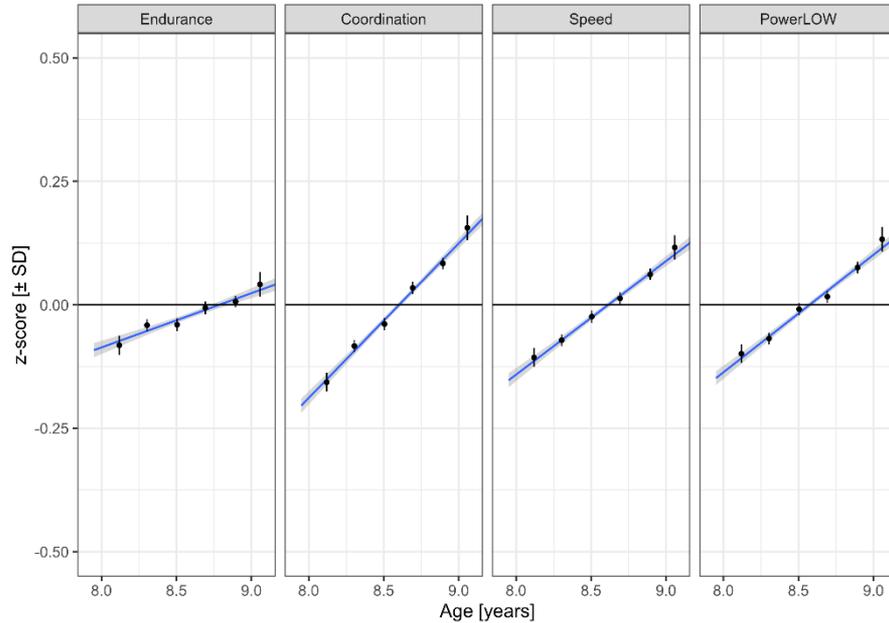


School social status x physical fitness



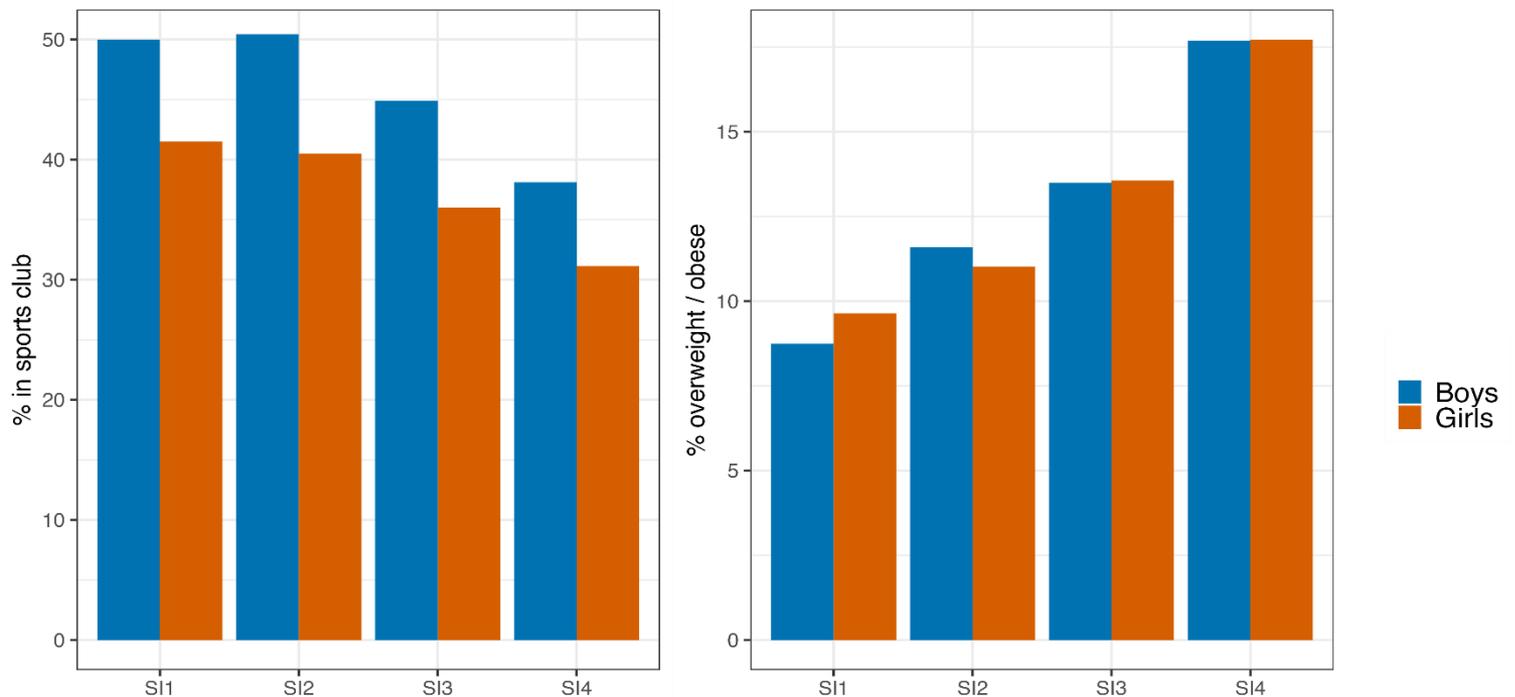
- **Higher school social status** \rightarrow better cardioresp. endurance, coordination, speed, and powerLOW
- **Negative pandemic effects** endurance, coordination, speed
- **Larger pandemic effects** for schools with **higher social status** on coordination & speed
- **Post-pandemic rebound** of coordination larger for schools with higher social status \rightarrow resources
- No evidence for rebounds of endurance and speed (yet) \rightarrow long-term consequences of pandemic?

School social status: Development in 9th year of life



in line with Fühner et al., 2021

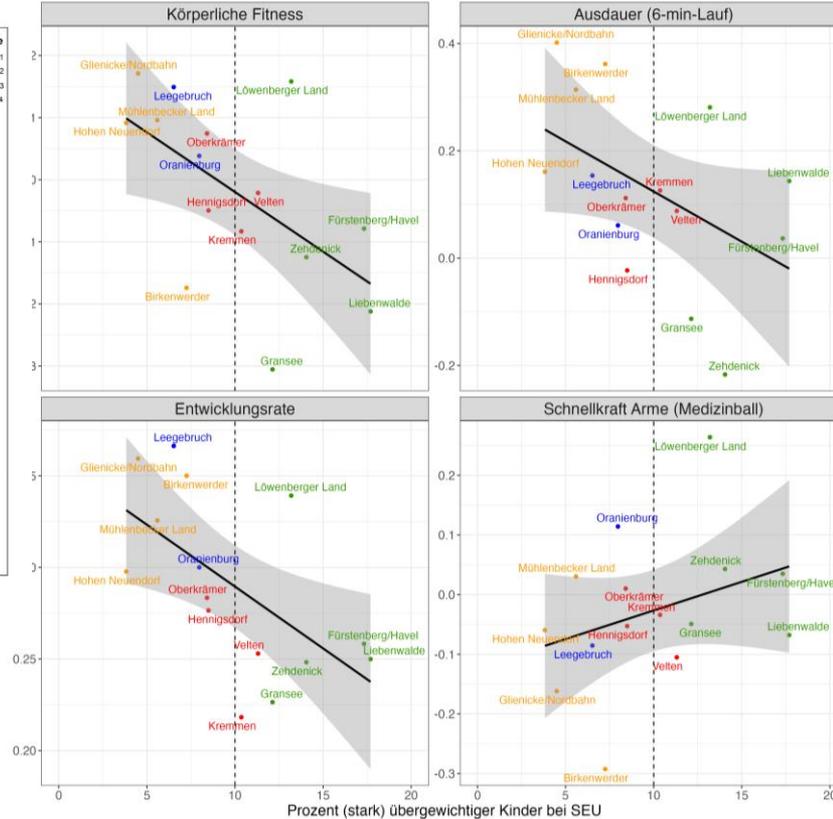
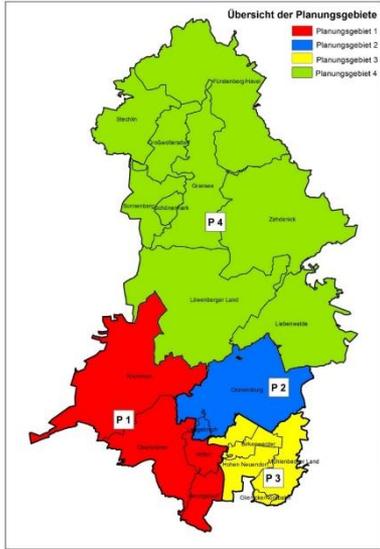
School social status: Sports clubs and Overweight/obesity



School social status

% in sports clubs: voluntary information from 44,019 third-graders from cohorts 2022–24
% overweight/obese: voluntary information from 3,368 third-graders from cohorts 2021–24

School entry examination (SEU) → EMOTIKON



Children in communes with larger percentage of **overweight & obese children** in SEU exhibit...

- Lower average physical fitness,
 - Lower cardiorespiratory endurance,
 - Lower developmental rate in 9th year of life,
 - Better upper limbs muscle power
- ... in EMOTIKON in third grade.

Conclusion

- Results indicate the importance of **living environment and structural resources** for children's development
- Differences related to school social status should be compensated as early as possible
 - Improve access to **sports clubs and other physical activity opportunities**, healthy food options,...?
 - **Cooperation** between schools (teachers), parents, politics, civil society (sports clubs etc.), science (interventions with RCT)

Thank you!

<https://www.uni-potsdam.de/de/emotikon/>

Startseite

Podcast and Newsletter

About the project

Materialien - Aktuelles Schuljahr

Motorische Leistungsbewertung

Bewegungsförderung

Publications and Presentations

Kontakt

Galerie

SMaRTER-Studie

Publications & presentations

International publications

You can find our research on [ResearchGate](#).

Teich, P., Golle, K., & Kliegl, R. (2024). Association between time of assessment within a school year and physical fitness of primary school children. *Scientific Reports* 14, 11500. doi.org/10.1038/s41598-024-61038-x

Bähr, F., Wöhrl, T., Teich, P., Puta, C., & Kliegl, R. (2024). Impact of Height-to-Mass Ratio on Physical Fitness of German Third-Grade Children. *Submitted for publication*. doi.org/10.21203/rs.3.rs-3885133/v1

Arntz, F. (2023). Intervention and moderation of physical fitness in children with physical fitness deficits - Results of the SMaRTER study. <https://faaa6.github.io/SMaRTER/>

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