Physical fitness in childhood: Associations with timing of school enrollment and the Covid-19 pandemic

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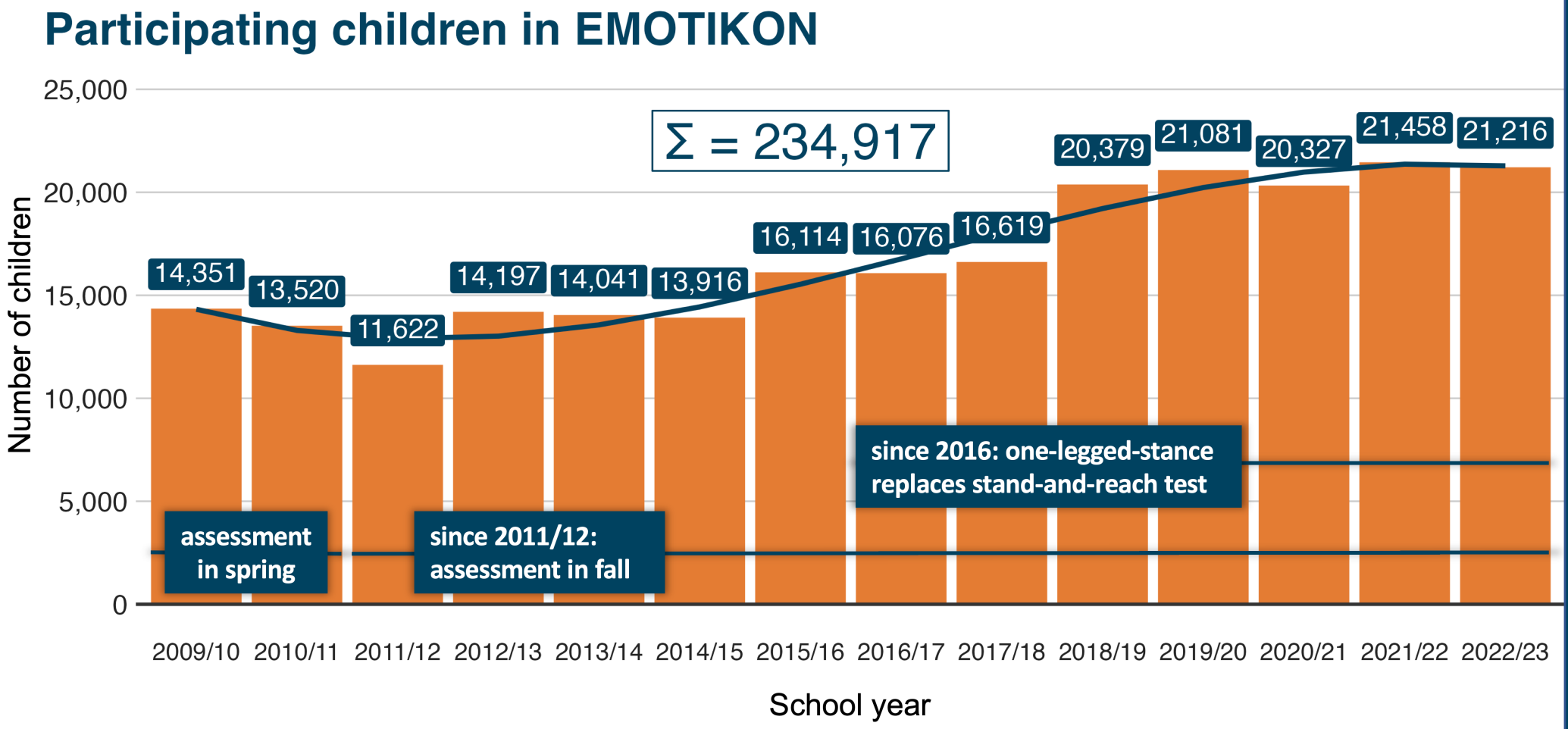
in 2022: + **3.155 children in longitidunal study (grades 4 & 5)**



EMOTIKON tests:

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

Stand 28.12.2022

EMOTIKON test battery

Endurance: 6-min run

Coordination: star-run

Speed: 20m sprint

Lower limbs muscle power:
Standing long jump

Upper limbs muscle power:
ball-push test

Static balance:
one-legged stance test with eyes closed

Timing of school enrollment and physical fitness

- **Keyage children** (Stichtagskinder, “Stichlinge”)
  - School enrollment according to legal key date (they have turned 6 before September 30)
  - between 8 and 9 years in 3rd grade
- **Older-than-keyage children** (OTK, Spätlinge)
  - Delayed school enrollment or repetition of a grade
  - between 9 and 10 years in 3rd grade
- Younger-than-keyage children (YTK, Frühlinge)
  - Early school enrollment or skipping of a grade
  - between 7 and 8 years in 3rd grade

Timing of school enrollment and physical fitness

- **Academic performance**: OTK children exhibit lower reading and math skills compared to keyage children (e.g., Lüdtke et al., 2010; Puhani & Weber, 2007)

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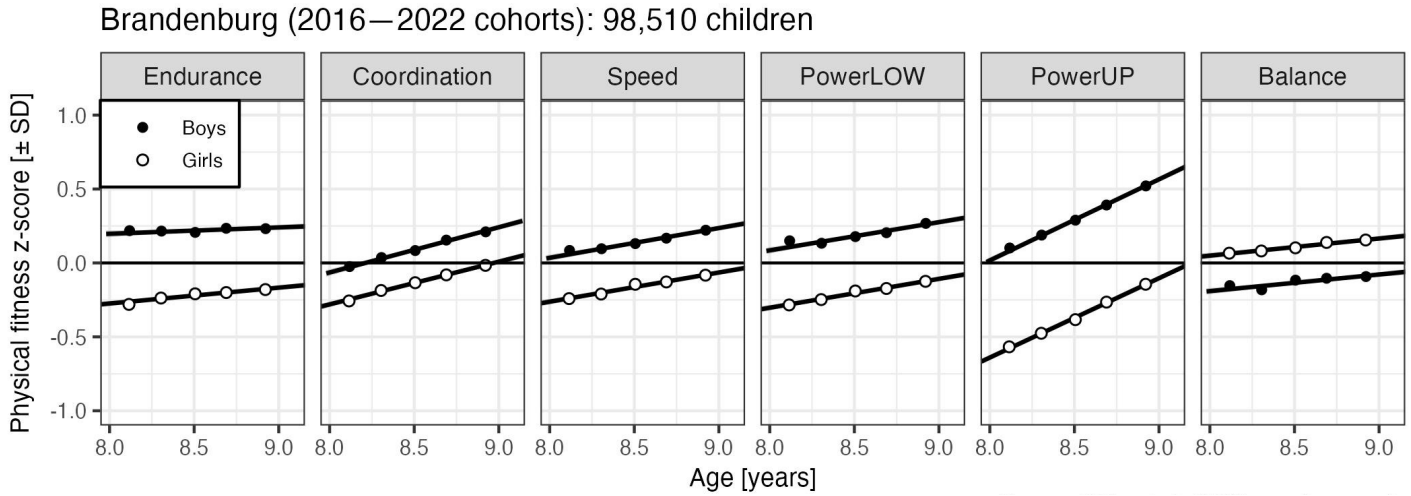
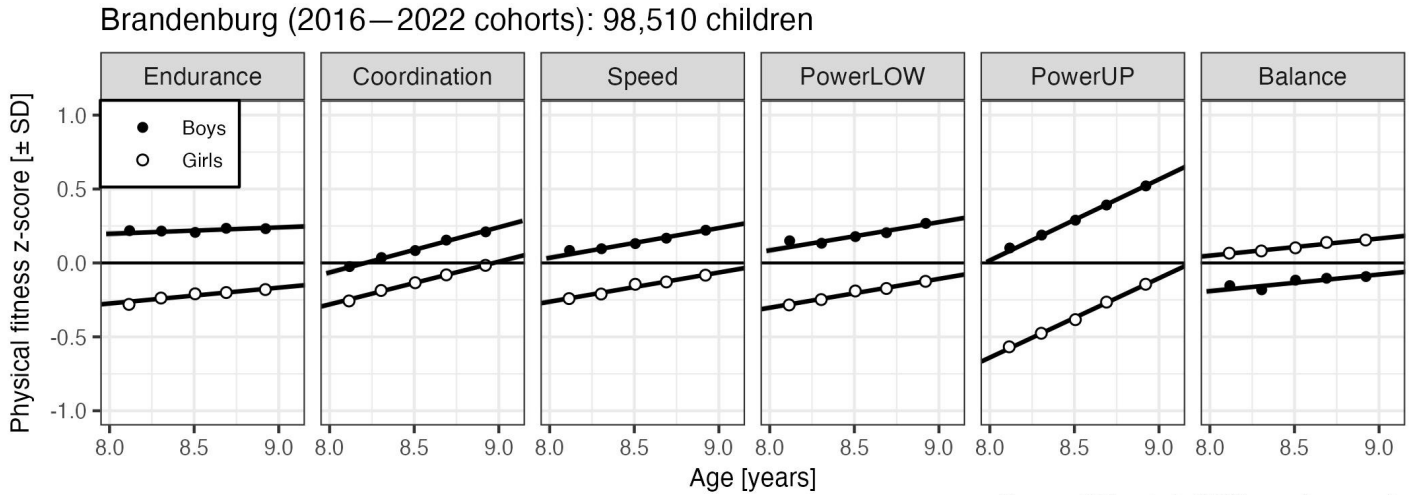


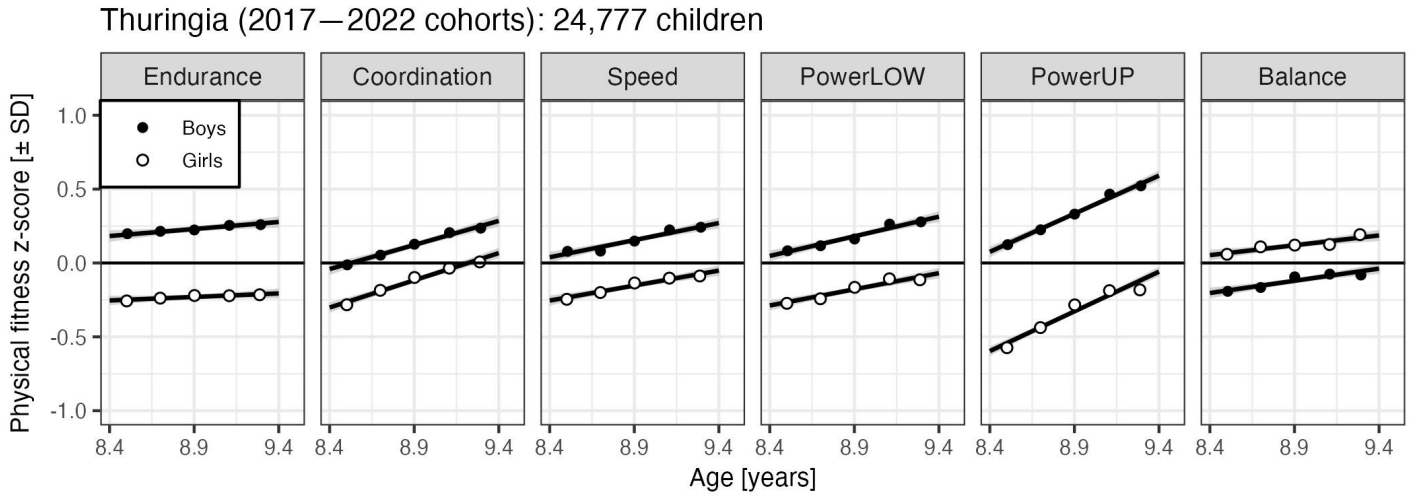
Keyage third-graders: Cross-sectional **linear** development in third grade (for boys and girls) in **all fitness tests**

Boys outperform girls in five tests, girls are better in balance and flexibility

Source: Fühner et al. (2021), Bähr et al. (2023)

Timing of school enrollment and physical fitness





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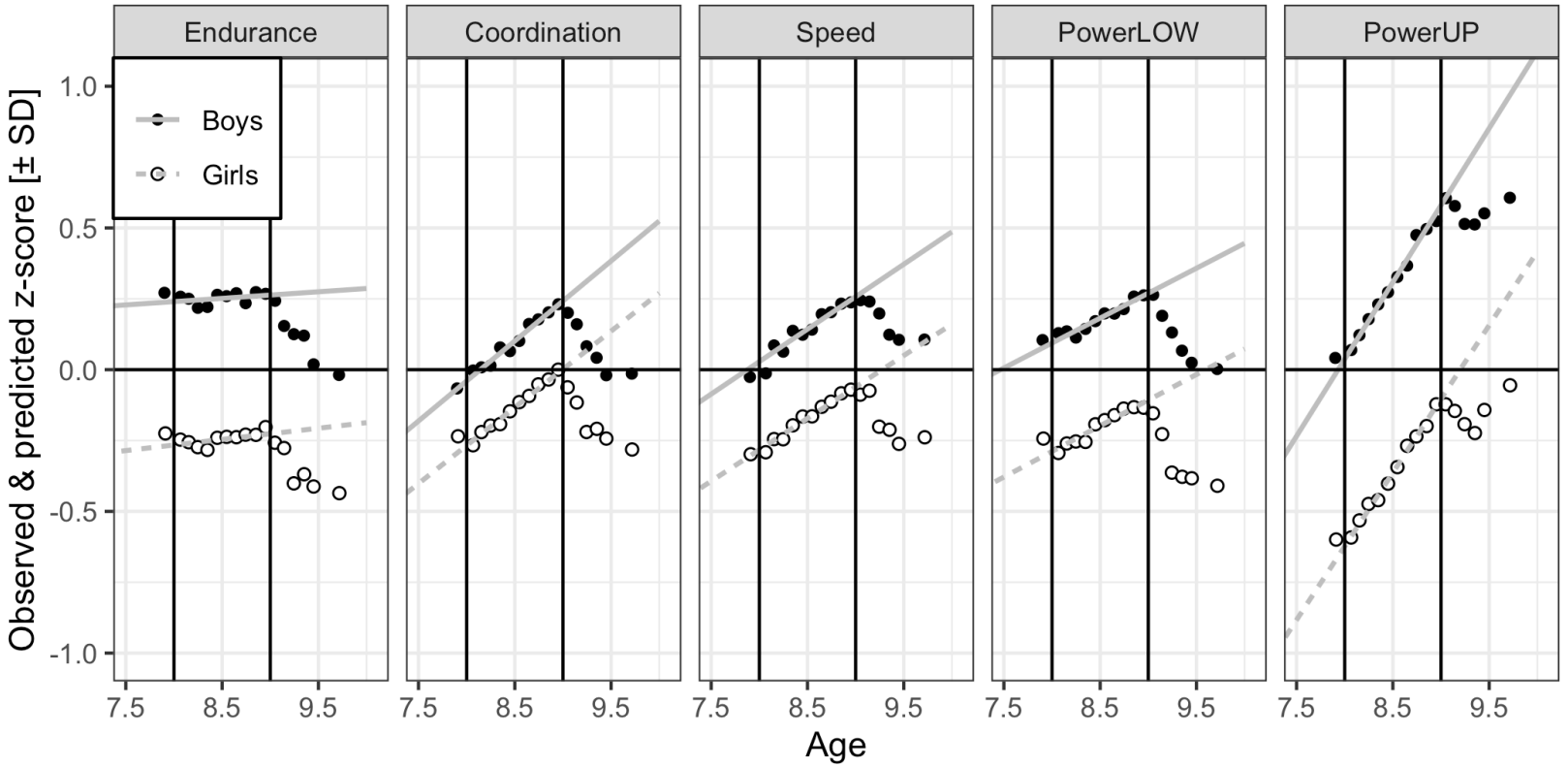


Keyage third-graders: Cross-sectional **linear** development in third grade (for boys and girls) in **all fitness tests**

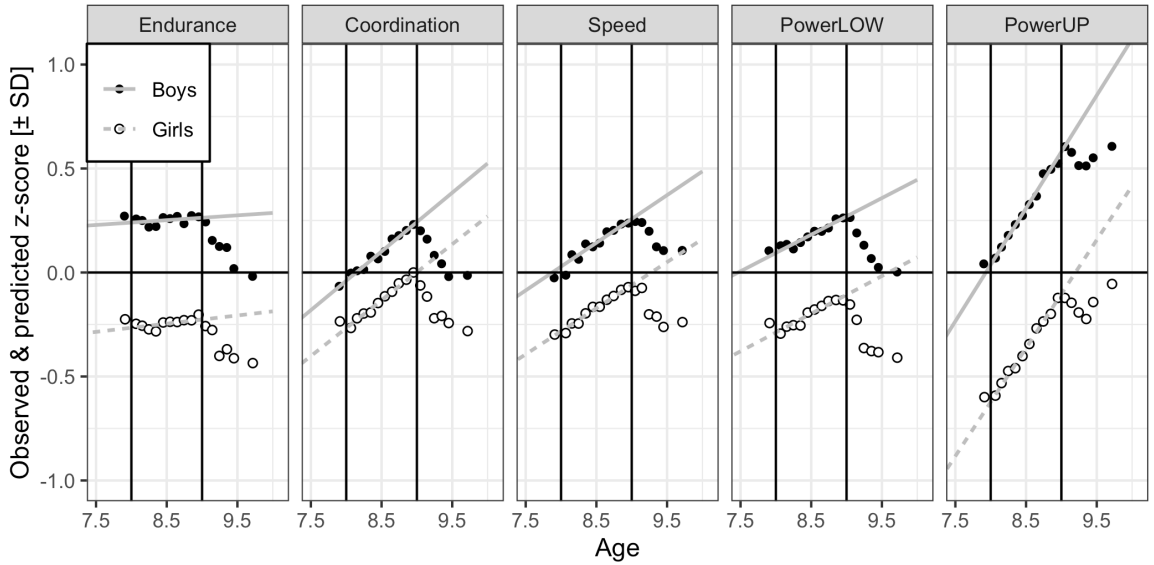
OTK third-graders: Physical fitness lower than predicted (predictions based on LMM with data from 108,295 keyage children)
- physical fitness **declines** with **increasing age**

Fühner et al. (2021, 2022)

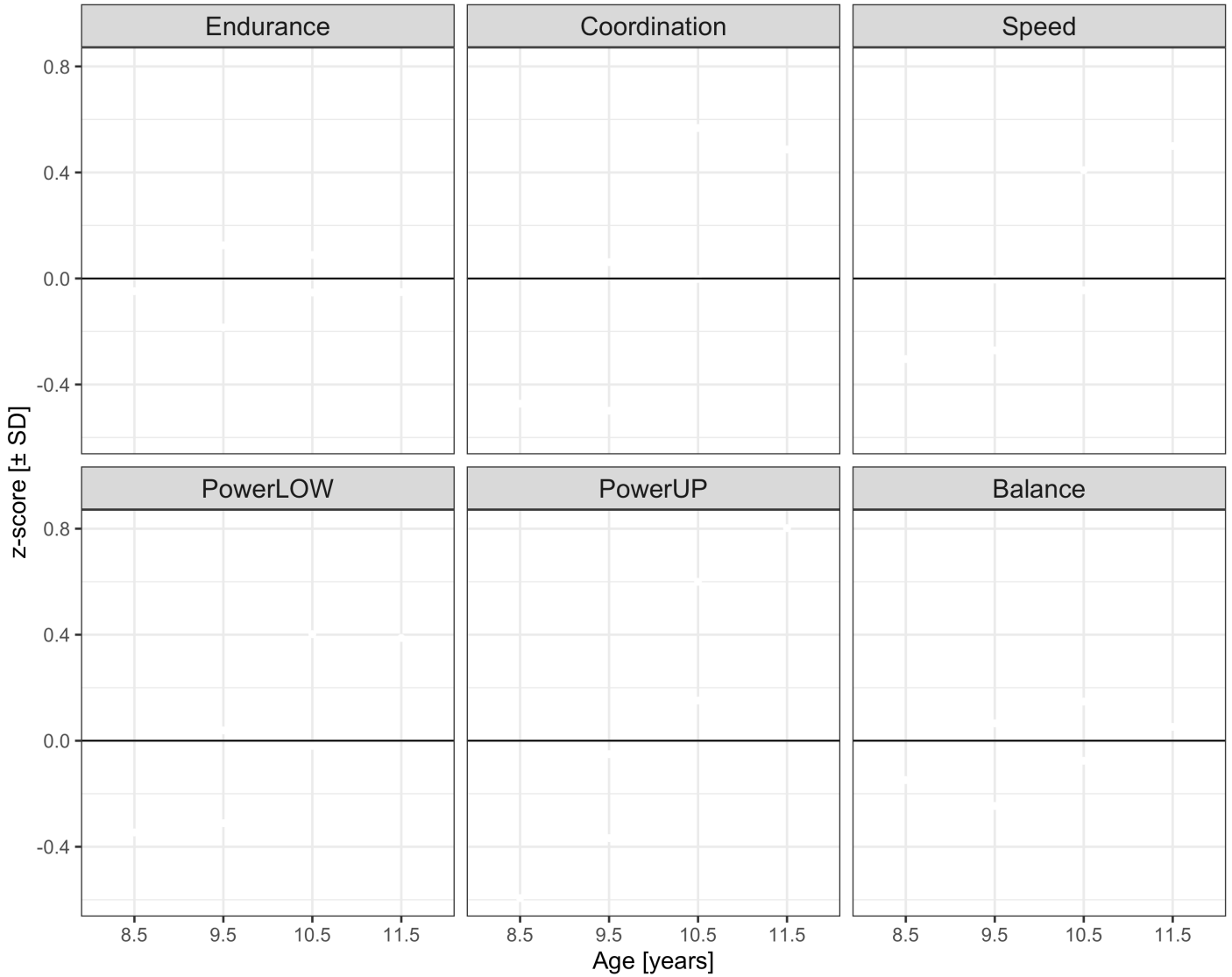
Timing of school enrollment and physical fitness

- ‘age’ and ‘timing of school enrollment’ are confounded

  → Dissociating these effects by comparing keyage and OTK children **at the same age** (but in different school grades)

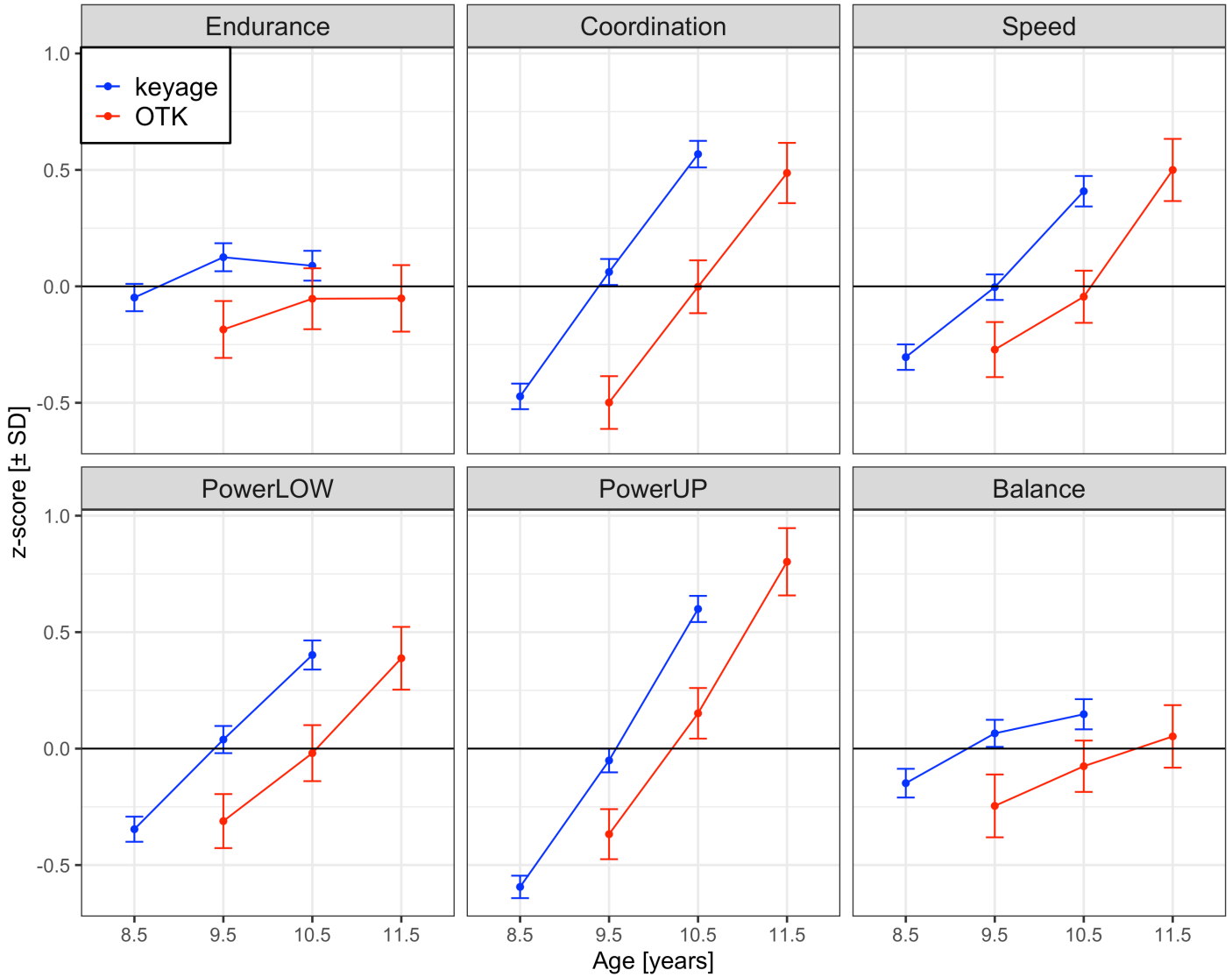


Timing of school enrollment and physical fitness



N = 1206 keyage, 296 OTK children tested in grades 3,4, and 5

Timing of school enrollment and physical fitness



N = 1206 keyage, 296 OTK children tested in grades 3,4, and 5

- Both groups show **positive development** and similar dev. rate
- Keyage children outperform **age-matched** OTK children
- Exception: Endurance
- Largest age gains in powerUP & coordination

Timing of school enrollment and physical fitness

- **Academic performance + physical fitness**: OTK children exhibit lower performance than expected for their age

Timing of school enrollment and physical fitness

- What are the reasons for the poorer fitness of OTK?
  - **Lower SES & regional deprivation** increase risk for **global developmental delays** at school entry examination (Hoffmann et al., 2022)
  - **Biological age of OTK children**: selection bias (“selection-by-judged-maturity-effect”)

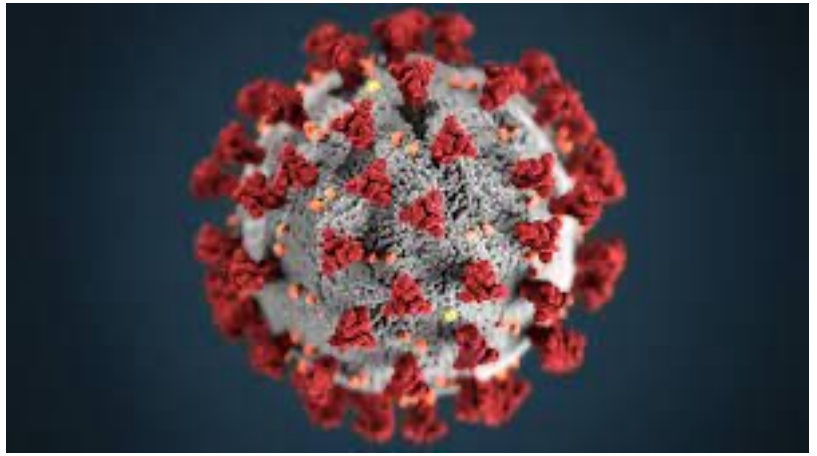
Spieler A (spät entwickelt)	
Alter:	14,2 Jahre
Körperhöhe:	153 cm
Körpermasse:	38,5 kg
PHV:	15,9 Jahre
YPHV:	-1,7 Jahre
Aufschlag:	135 km/h
CMJ:	33,4 cm
20 m Linearsprint:	3,34 s
Crunches:	50

Spieler B (früh entwickelt)	
Alter:	13,8 Jahre
Körperhöhe:	182 cm
Körpermasse:	80,3 kg
PHV:	12,0 Jahre
YPHV:	+1,8 Jahre
Aufschlag:	180 km/h
CMJ:	36,6 cm
20 m Linearsprint:	3,27 s
Crunches:	23

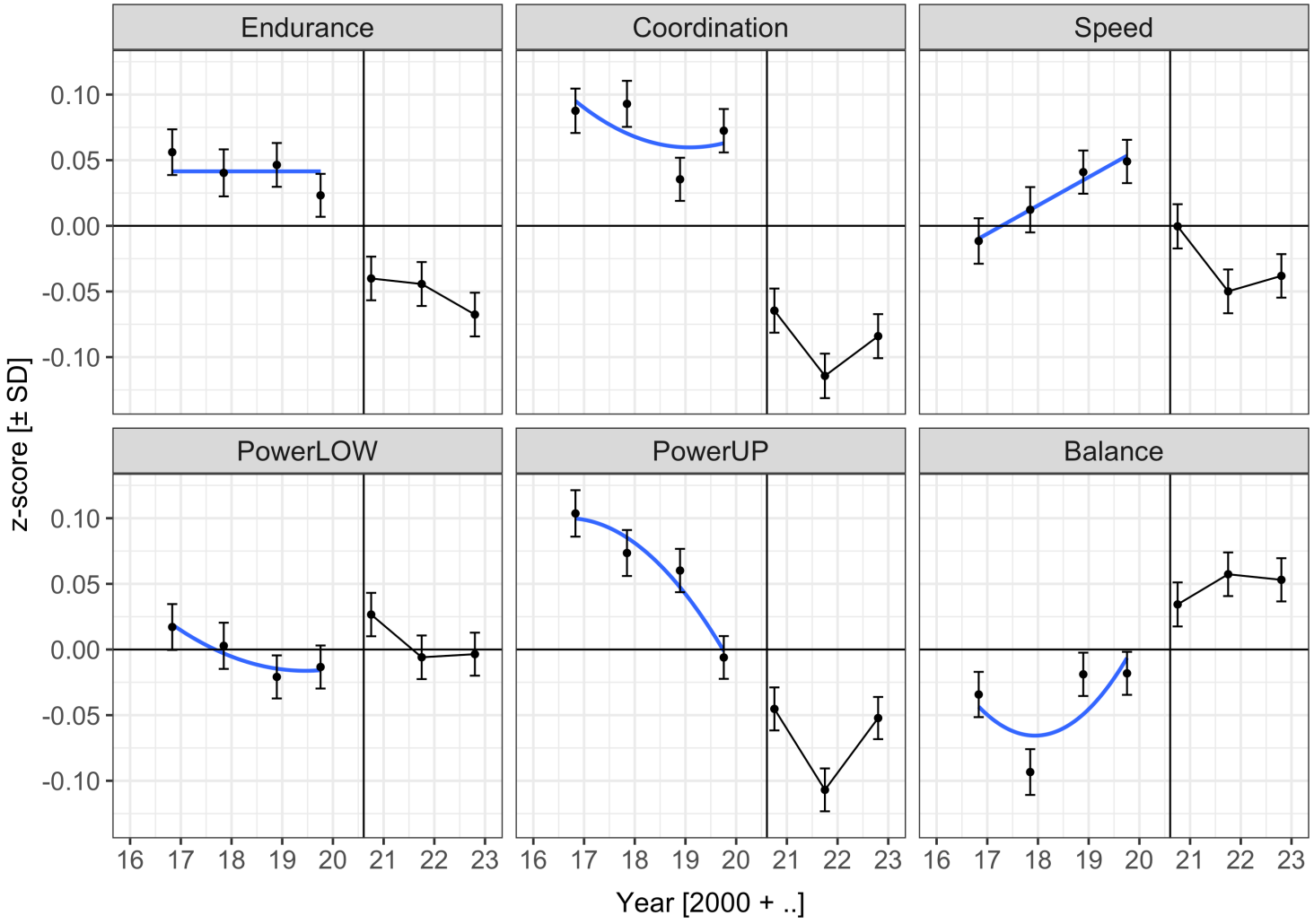
Timing of school enrollment and physical fitness

- **Academic performance + physical fitness**: OTK children exhibit lower performance than expected for their age

Covid-19 pandemic and physical fitness

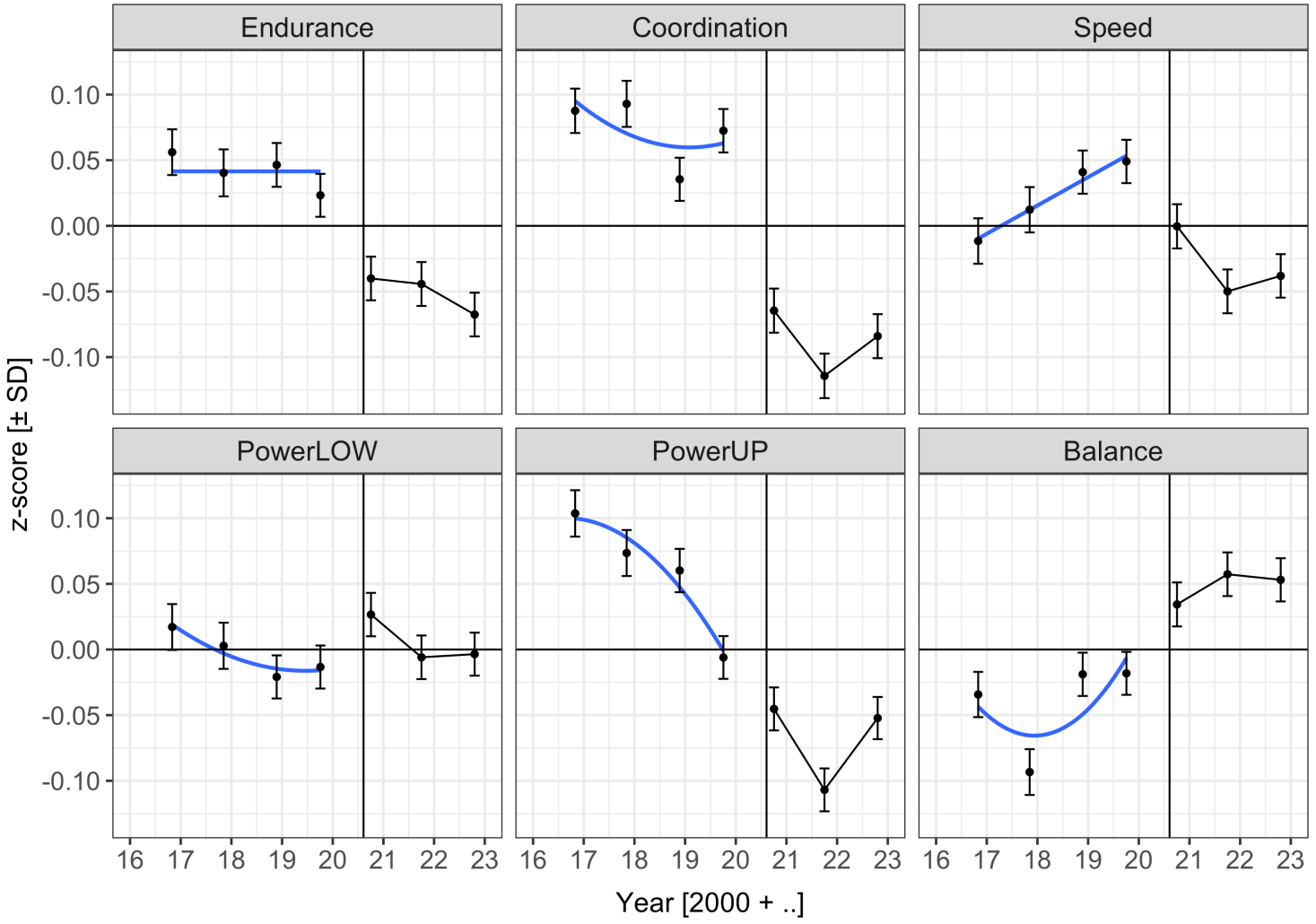


Covid-19 pandemic and physical fitness



N = 98,510 keyage children from 515 schools

Covid-19 pandemic and physical fitness



Regression discontinuity design (LMM)

- Extrapolation of cohort trends, testing pandemic effects on first day of school year 2020/21
- **Significant negative pandemic effects** for endurance, coordination, speed

N = 98,510 keyage children from 515 schools

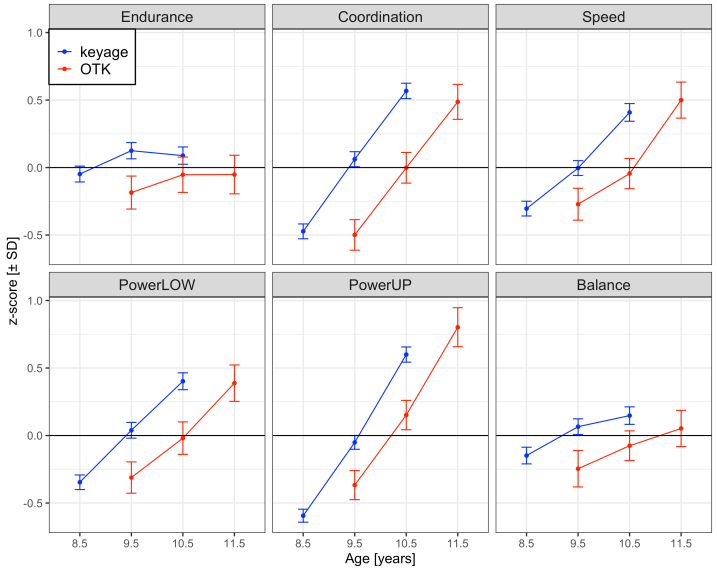
How meaningful are the pandemic effects?

	Endurance	Coordination	Speed
Cohen's *d*	**-0.08**	**-0.15**	**-0.03**
Covid effect in test metric	**-11.7 m**	**-0.038 m/s**	**-0.009 m/s**
Developmental losses = Pandemic effect relative to age gains	**-5 mth**	**-3 mth**	**-1 mth**

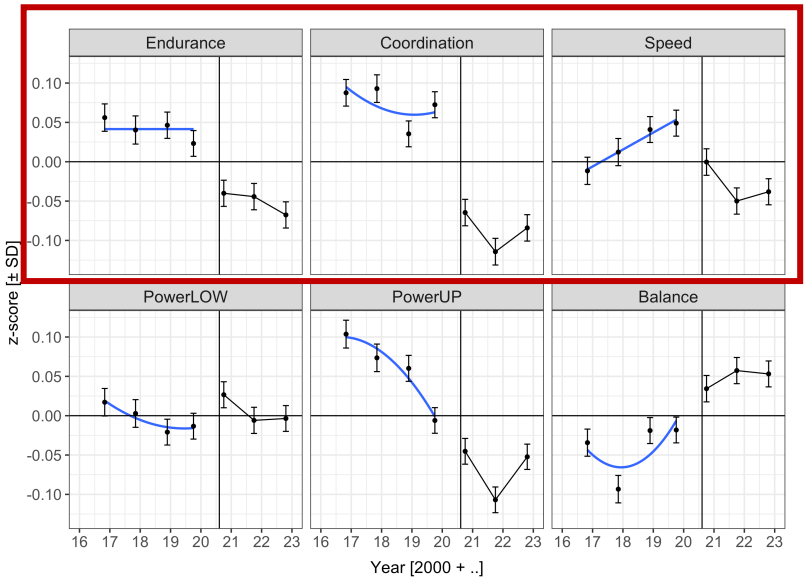
Developmental losses = Pandemic effect relative to age gains from longitudinal study

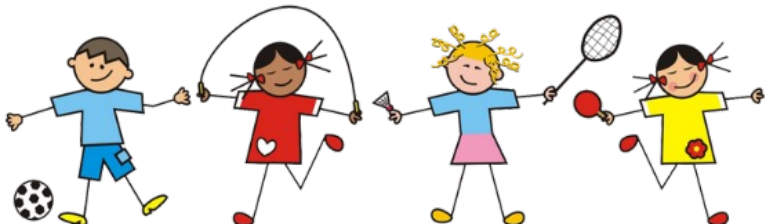
Summary

- **Lower physical fitness for OTK children**
- Reasons: **Biological age**? **Social structure**?



- Small negative pandemic effects on **endurance, coordination, speed**





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EMOTIKON podcast & newsletter

EMOTIKON-Podcast

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