Physical activity of German children and adolescents measured by accelerometer 2014–2017: The Motorik-Modul (MoMo) longitudinal study

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Introduction:
The protective effect of an active lifestyle during childhood and adolescence with a high level of physical activity (PA) is well documented. The MoMo study is the first nationwide epidemiological study that has measured and reported PA of children and adolescents objectively in Germany. Beginning with Wave 2 in 2014 PA in free-living conditions was monitored with accelerometers in order to provide a better insight into the behaviour of children and adolescents.

Methods:
2809 children and adolescents between the age of 6 and 17 (N(male) = 1341, N(female)= 1468) wore either ActiGraph GT3x+ or ActiGraph wGT3X-BT as part Wave 2 of the nationwide MoMo survey (2014-2017). The participants wore the device during all waking hours on at least 7 consecutive days. The device was placed laterally at the hip and data was sampled with a frequency of 30Hz. Afterwards data was downloaded and converted into 1-second-epochs using ActiLife. Further data processing was done in MATLAB. Data was reintegrated 15-second-epochs and Choi (Choi et al., 2011) wear time algorithm was applied. A dataset was deemed valid if wear time was greater than 8 hours on at least 4 weekdays and 1 weekend day. A total of 2331 valid datasets were provided (distribution of age and gender in Table).

<table>
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<tr>
<th>Age (years)</th>
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</table>

PA outcome was determined using 2 cut-off point systems commonly used for the specific age groups (Evenson et al., 2008 for 6-9 year-old subjects and Romanzini et al., 2014 for 10-17 year-old subjects). PA outcome was calculated and descriptive statistical analysis and hypothesis tests were performed using SPSS.

Results:
There is a trend of almost continuous diminishing moderate to vigorous PA (MVPA) with increasing age. Significant differences between male and female subjects were found in all age groups except for the 14-year-olds (p < .01). MVPA ranged from 76.7±24.8 min/day for 8-year-old to 41.6±18.5 min/day for 14-year-old male subjects and from 62.0±20.2 min/day for 8-year-old to 33.9±14.4 min/day for 17-year-old old female subjects. There is a significant difference between time spent in MVPA during weekdays and weekend days in all age groups (p < .01). The average time spent in MVPA is 52.3±24.2 min/day during weekdays and 39.1±27.7 min/day during weekend days. Children and adolescents in Germany fulfill the WHO recommendation of 60 minutes of MVPA per day on 2.17±1.98 days per week leading to a prevalence of adherence to the guideline of 15% (22% of males and 9% of females) when declaring 5 of the measured 7 days as sufficient.

Conclusions:
Although the results differ in total magnitude from the results from PA questionnaires reported by the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) (Finger et al., 2018) the trends in the data are similar. Further investigation of the data is needed looking at specific time frames during the day and specific parts the population (i.e. percentiles). The addition of accelerometer data will further complement the subjective PA results reported by the MoMo study.

References:

Funding:
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Impact of different evaluation methods on the dropout rate of objectively detected physical activity on age specific subgroups: results from the Motorik-Modul-Study (MoMo)

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Introduction:
In order to determine physical activity in free-living conditions the most common used objective method is accelerometry. This study analyzed the different technical methods and their outcomes evaluating accelerometer data in the large-scale epidemiological MoMo study. MoMo marks the first nationwide objective collection of data on physical activity and sedentary behavior of German children, adolescents and young adults. Different technical decisions lead to different activity outcomes, which in turn lead to different recommendations for a more active lifestyle.

Methods:
The accelerometer sample size in MoMo from the latest survey from 2014-2017 is n=1,971 (4-18 years). Wearing ActiGraph accelerometers GT3X+/wGT3X-BT movement behavior was objectively registered for one week.

Results:
Recording is in EL of 1s with the possibility to convert into 5s, 10s, 15s, 30s and 60s for future analysis. For the NWT Calculation the Choi-Algorith was chosen because of the constancy in detecting NWT whereas Troiano shows variance up to 3% in NWT with different EL. Valid day criteria is 8h of recordings (+13% valid data compared to 10h) on four weekdays and one further weekend day when wearing the device for 7d. Five different intensity classification algorithms (Everson, Hänggi, Romanzini VA & VM, Freedson) were validated. In a subsample (N=57, age=10-15, MW: 12.35 y., SD = 1.64 y.) the results of Everson and Romanzini and Hänggi were relatively close together. The Freedson results of MVPA Intensity were in contrast to Everson and Romanzini by 15.87% (SD = 4.9%) and 16.32% (SD = 5.04%) higher.

Conclusions:
We decided to use different intensitiy-algorithms for different age groups (5-8, 7-11, 12-18, adults) because of their different age samples in the validation studies. Because there is no general consensus, these results will help researchers to make more suitable decisions for data processing criteria before and after data collection using the GT3X/+ accelerometer in large-scale epidemiological studies.

References:
Hänggi JM, Phillips LRS, Rowlands AV. Validation of the GT3X ActiGraph in children and comparison with the GT1M ActiGraph. Journal of Science and Medicine in Sport 2013;16(1):40-44.

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