Subjectively and Objectively Assessed Behavioral, Social, and Physical Environmental Correlates of Sedentary Behavior in Preschoolers

Michael Eichinger, Dr.med.univ.[1,2], Sven Schneider, Dr.phil.[1], and Freia De Bock, Dr.med., MPH[1,2]

Objective To investigate associations between preschoolers' objective leisure-time sedentary behavior and a comprehensive set of subjective and objective potential correlates of sedentary behavior across the behavioral, social, and physical environmental domains on both the family and community level.

Study design In 3- to 6-year-old preschoolers (n = 738) from 52 preschools in Southern Germany, leisure time spent in sedentary behavior was assessed by accelerometry in 2008-2009. Family- and community-level potential correlates of sedentary behavior from different domains (behavioral, social, and physical environmental) were subjectively (ie, by parent-proxy report) and objectively (ie, by routine administrative data) assessed.

Results None of the objective social and physical environmental correlates showed associations with sedentary behavior. Leisure-time sedentary behavior decreased with greater levels of moderate-to-vigorous physical activity (both weekends and weekday afternoons), participation in organized sports, parental leisure-time physical activity, as well as greater parental traffic safety perceptions (weekends only).

Conclusions Targeting multiple health behaviors at the same time (ie, physical activity and sedentary behavior) and focusing on the entire family (ie, preschoolers, parents, and potentially older siblings) might be useful opportunities to reduce sedentary behaviors in preschoolers. *(J Pediatr 2018;199:71-8).*

C hildren of preschool age spend a substantial part of their waking time in sedentary behaviors,[1-4] approximately 77%, or 10 hours per day.[1] An increasing number of studies suggest that excess sedentary behavior—predominantly operationalized by screen/TV time—might have detrimental health effects. High levels of sedentary behavior and of screen time in particular are associated with poor health and psychosocial outcomes (eg, overweight and obesity,[5-7] adverse cognitive outcomes[8]). Sedentary behavior often clusters with other unhealthy behaviors (eg, snacking during television viewing),[9,10] aggravating the direct negative effect of excess sedentary behavior. Moreover, there is increasing evidence of tracking of excess sedentary behavior across childhood[11] and adolescence.[12] Reducing sedentary behavior in children as early as in preschool age therefore promises high effects for health gains over the entire life course.

Because correlates of sedentary behavior differ from those of physical activity,[13-15] findings from the extensive literature on physical activity correlates cannot be readily transferred to the prevention of excess sedentary behavior. Thus, research specifically focusing on sedentary behavior in children of preschool age and its unique potential correlates is needed. To date, only a small number of correlates have been consistently associated with screen time as a proxy measure for total sedentary behavior (eg, family TV viewing, maternal depressive symptoms, and TV rules).[13,16] Future studies on the correlates of total sedentary behavior are therefore needed.

The aim of our study was to simultaneously assess associations between accelerometry-based, ie, total, leisure-time sedentary behavior and a comprehensive set of subjective and objective potential correlates of sedentary behavior across the behavioral, social, and physical environmental domains on both family- and community-level in a large sample of German preschoolers.

Methods

In this cross-sectional study, individual- and family-level, preschool-level, village/city-level, as well as county-level data were used, ie, the data were clustered at 3 levels and all preschoolers attending the same preschool that lived in the same village/city or the same county had the same data on all preschool-, village/city-, and county-level potential correlates, respectively (mean numbers of preschoolers with the same data for community-level potential correlates were between 14 and 30, lower bound of ranges: 3, upper bound: 128). As sensitivity analyses showed qualitatively comparable results using 4-level models (ie, taking into account the clustering of the

SES   Socioeconomic status

data at 3 levels; results not shown), we used 2-level models for our analyses, collapsing the preschool, village/city, and county levels into 1 level, henceforth called community level.

Individual-level (eg, accelerometry), family-level (data on potential correlates of sedentary behavior assessed by parent proxy-report), and preschool-level data (eg, preschool geographic location) were based on the baseline measurements of 2 concurrently implemented cluster-randomized controlled trials in 52 preschools in Southern Germany.[17-19] All children aged 3-6 years and enrolled in 1 of the preschools were eligible. In total, 1134 (80%) were recruited and participated in the baseline measurements. Informed written consent was obtained from the parents of all participating children. Both studies were approved by the Ethics Committee of the Medical Faculty Mannheim, Heidelberg University (2008-275N-MA). Data collection was conducted between September 2008 and March 2009.

Individual- and family-level as well as preschool-level data were merged with objective village/city- and county-level socioeconomic and physical environmental factors based on official federal statistics provided by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (INKAR 2013; http://www.bbsr.bund.de). Of all available data, the wave closest in time to the collection of the individual- and family-level data was used for each variable (community-level socioeconomic status [SES]: 2008, community-level proportion of forest, recreational, and settlement area: 2013). When merging individual- and family-level data with community-level potential correlates, preschoolers' private addresses were approximated by preschool addresses due to the unavailability of addresses for a majority of children, ie, we used community-level data for preschools to approximate community-level characteristics for individual preschoolers. In a subsample of 370 preschoolers for whom individual addresses were available, the postcodes of the preschoolers' addresses and those of the preschools agreed in 95% of cases. This suggests that the community-level characteristics for preschool addresses approximate community-level characteristics at home addresses to a reasonable degree, given that community characteristics were available mainly at county-level, ie, at a spatial unit larger than postcode areas.

The outcome in this study was the total time preschoolers spent sedentary during leisure time. Sedentary behavior was assessed by accelerometry via Actiheart devices (Actiheart software version 13.1.4.; CamNtech, Cambridge, United Kingdom). To decrease the burden for study participants and their parents as well as handling errors, preschoolers wore the accelerometers continuously for up to 6 consecutive days, including 2 weekend days (epoch length 15 seconds). Previously validated cutoffs were applied to assess sedentary behavior.[20] Recordings had to include at least 4 hours per day to be considered valid and children had to have recordings for Saturday and Sunday and at least 3 weekday afternoons to be included in the final analysis.

As preschoolers spend more time in sedentary behavior during weekdays compared with weekend days,[21] with potentially different patterns of sedentary behavior correlates, we analyzed separate models for weekends and weekday afternoons. Preschool characteristics were associated with sedentary behavior in the literature,[13] suggesting that correlates of leisure-time sedentary behavior and sedentary behavior during preschool time might differ. As we specifically wanted to investigate leisure-time sedentary behavior, ie, sedentary behavior outside of the preschool context, we used sedentary behavior on weekends and weekday afternoons as outcomes. Accordingly, only children who had exclusively attended preschools during mornings (9 a.m.-1 p.m.) were included in the weekday afternoon sample comprising the time between 1 p.m. and 9 p.m. The weekend sample included Saturdays and Sundays from 7 a.m. to 9 p.m. for all children, as in Germany children only attend preschool during the week.

Potential correlates of sedentary behavior (Figure 1) were identified from comprehensive literature reviews[13,14,16] and subsequently grouped into the 4 domains of the ecological framework presented by Sallis et al[22]: (1) demographic and biological, (2) behavioral, (3) social, and (4) physical environmental potential correlates. Psychological, cognitive, and emotional potential correlates were not available in the dataset. We further distinguished between individual- and family-level and community-level (ie, preschool-, village/city-, and county-level) potential correlates and deliberately included both subjectively (ie, parent-proxy report, eg, parental perceptions) and objectively assessed correlates (eg, items from administrative routine datasets, Figure 1). Potential correlates were included in the final models if they had been associated with sedentary behavior and/or physical activity in past studies. We included correlates that had been associated with either sedentary behavior (both screen time and total sedentary behavior) or physical activity in previous studies, as only a limited number of associations between sedentary behavior and potential correlates had been investigated in preschool children.

Details on all potential correlates included in the final models including references for previous studies, measurement properties, operationalization, and scale levels are presented in Table I (available at www.jpeds.com). To reduce the number of potential correlates in the final models, underlying latent variables were identified by correspondence analyses (ordinal variables) and factor analyses using principal component analysis and an orthogonal rotation (continuous correlates). Cronbach alpha was calculated to assess the internal consistency of the extracted continuous latent variable. The operationalization of the latent variables was based on previous research (references provided in Table I).

Statistical Analyses

After descriptive and bivariate analyses, associations between potential correlates and objectively measured sedentary behavior on weekends and weekday afternoons were investigated by a single covariate-adjusted mixed model each. Both models included all potential correlates and a random intercept. Combining potential correlates from different levels, ie, family- and community-level, in 1 multivariate model allowed us to estimate the effect of individual potential correlates from