



Short communication

“Movement-enhancing footpaths” – A natural experiment on street design and physical activity in children in a deprived district of Leipzig, Germany

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ABSTRACT

Despite the beneficial effects of physical activity (PA), only 26% of children in Germany meet the WHO's recommendations. Because active play contributes to PA and is accepted by families, the creation of “playable” environments could promote PA. This study is a natural experiment that was conducted to investigate whether slight changes in the physical environment can increase PA in children. In autumn 2016, 140 students from two primary schools located in a deprived district of Leipzig (Germany) gathered ideas on PA-promoting street designs. After protracted negotiations with the city administration, two footpaths were decorated with colored markings (hopscotch grids, labyrinths, “mirror me”) in September 2019. 48 observations were made before (August 2019) and after (September/October 2019) the implementation using the System for Observing Play and Recreation in Communities (SOPARC). Age, gender, activity level, bike use, and interactions with the colored markings were recorded. A total of 5455 individuals (including 1099 cyclists) were observed. Almost one fifth of the observed children (0 to 12 years) interacted with the markings. There was a slight increase in vigorous activity in all observed individuals after the implementation (2.9% vs. 6.4%, $p < 0.001$). The chance for vigorous activity was higher on decorated footpaths (OR 2.45, CI 1.54–3.89, $p < 0.001$), for children (OR 19.32, CI 13.07–28.56, $p < 0.001$), and on Sundays (OR 3.39, CI 2.33–4.94, $p < 0.001$). The participatory development and design of footpaths that support spontaneous active play “on the way” might be one component that can be used to support changes in children's PA behaviors and social interactions.

1. Introduction

Physical activity (PA) is associated with the status of people's health, physical and cognitive development, and well-being even in childhood (World Health Organization, 2010). PA can take place in different contexts (homes, schools, daycares, neighborhoods) and comprises sports, physical education, transportation, and recreation, including play activities (Sallis et al., 2006). Active play is of particular importance for (younger) children. It fosters children's physical, social, emotional, and cognitive development as well as their well-being (Burdette and Whitaker, 2005), is widely accepted by parents and children (Curtis et al., 2012), and contributes to moderate-to-vigorous PA (Borghese and Janssen, 2019; Burdette et al., 2004). Focusing on the design of “playable” environments that encourage spontaneous unstructured PA and social interactions might be a valuable strategy for

promoting health, particularly for children in low SES communities (Curtis et al., 2012) who are more often inactive (Manz et al., 2014). Although numerous studies on environmental characteristics and PA exist, there is no clear evidence on effects of built environment features on PA in youth (McGrath et al., 2015). However, intervention studies on park and playground renovations were associated with an increase in visits and PA (Smith et al., 2017). Referring to childcare and school settings, some studies showed that the provision of (portable) play equipment and playground markings can increase PA (Gubbels et al., 2018; Stratton and Mullan, 2005), but others found no effect (Cardon et al., 2009). Overall, the impact of community-based environmental interventions on PA is not clear (Baker et al., 2015). Moreover, it has been argued that the development of appropriate and effective interventions requires the participation of stakeholders and children to understand the specific needs and desires of a certain community

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Fig 1. Footpath decorations (Leipzig/Germany, September 2019).

(Wallerstein and Duran, 2006).

In the scope of the community-based health promotion project “GRÜNAU moves” (Igel et al., 2016), footpaths near schools were decorated (see Fig. 1) as part of a participatory planning process that was aimed at increasing the PA of pedestrians and children in particular.

The purpose of this study was to investigate whether slight changes in the physical environment (decorations on footpaths) would be associated with an increase in the intensity of PA in pedestrians. Because we expected that younger children would be more attracted by the decorations, we hypothesized greater use of the footpaths and a higher intensity of PA in children compared with older pedestrians.

2. Methods

2.1. Intervention

This study is a natural experiment that was part of the intervention “Movement enhancing footpaths – active ways to school” as part of the participatory community-based health promotion project “GRÜNAU moves” (GRÜNAU BEWEGT sich - GBs). GBs began in 2015 and is aimed at reducing obesity and increasing healthy behaviors in children living in a large housing estate in Leipzig (Germany) with above-average unemployment rates, a tendency for students to leave school early, low education levels, and below-average income levels. Ethics approval was obtained from the Ethics Committee of the University of Leipzig (Ref. No. 270-15-13072015).

Needs assessment: Referring to data from the school entry examination administered by the Health Department 2015/16, a relatively large proportion of preschool children in the study area, in comparison with the entire city, showed disorders in their gross motor skills (16.9% vs. 13.5%) and was overweight or obese (12.8% vs. 8.6%). Two focus groups were conducted in 2015 with 19 local stakeholders. The focus group attendees perceived that the children were physically inactive, had coordinative and social difficulties, and lacked emotional and social support. During inspections made by the district (“Stadtteilbegehungen”) (Deinet, 2009), project team members observed that open spaces were rarely used for PA or play, although there was not much traffic, and there was a high density of green space and playgrounds. Consequently, creating attractive places for PA and social interactions and changing social norms with respect to PA and active play in the public sphere were the main objectives of this intervention.

Planning and implementation: In August 2016, the project initiated a planning process that involved 140 students from two primary schools

and a landscape architect. Over the course of seven lessons, children explored their daily routes, worked out types and facilitators of active locomotion, and gathered ideas about street games that promote vigorous PA. The games were temporarily implemented in the school yards. The landscape architect refined the ideas and developed designs for interactive or solitary active play (e. g. labyrinths, footsteps, hopscotch grids, colored lines) that the children voted on. After protracted negotiations with various municipal departments, three decorations (labyrinths, “mirror me,” hopscotch grids) were implemented on two footpaths in September 2019. Area A was located near a primary school, gym, and playground, whereas area B was situated next to a community center and a health center that included different registered doctors, therapists, and a pharmacy.

2.2. Evaluation

Measures: Data were collected with an adapted version of the SOPARC (System for Observing Play and Recreation in Communities) Path Coding form (McKenzie et al., 2006), a standardized observation tool for measuring PA levels on walking/jogging tracks. An observation point near the location of interest (footpath) was determined. Each individual passing the observation point was classified by gender (female, male, unknown), age (young child 0 to 5 years, child 6 to 12 years, adolescent 13 to 18 years [in accordance with (Bocarro et al., 2009)], adult 19 to 64 years, or older adult 65 years or older), and activity level (sedentary, walking, vigorous). Moreover, we recorded the use of bicycles and interactions with the decorations. Conditions such as weather, accessibility, usability, equipment, supervision, darkness, and organized activities were also documented. Field notes on social interactions and special occurrences were also taken. Each footpath was observed by trained staff on three days (two weekdays, one Sunday) during the school term before (T0: August 2019) and after (T1: September/October 2019) the implementation of the decorations. One observation day included four observation periods (morning 7 to 10 am, noon 11:30 am to 1:30 pm, afternoon 2 to 5 pm, evening 5:30 to 8 pm). Data were collected for 60 consecutive minutes within the observation periods. There were 48 observation periods in total.

Analyses: Multivariate logistic regression analyses were computed with the activity level as the dependent variable (dichotomized into 1 “vigorously active” and 0 “sedentary or walking”) and the decorating of the footpath (1 “yes” vs. 0 “no”) as the independent variable. Age (categorized into children 0 to 12 years, adolescents, and adults, including older adults as the reference category), gender, weather, time of

Table 1

Descriptive statistics for the sample and for differences in PA at baseline (August 2019) and follow-up (September/October 2019) in Leipzig (Germany).

	Baseline (T0)	Follow-up (T1)	Interactions with the decorations* (% within category)
area A			
<i>gender</i>			
female	656 (50.7%)	546 (48.8%)	28 (6.2%)
male	615 (47.5%)	551 (49.2%)	38 (9.5%)
<i>age group</i>			
young children (0–5)	114 (8.8%)	75 (6.7%)	18 (25.4%)
children (6–12)	276 (21.4%)	252 (22.5%)	38 (17.2%)
adolescents (13–18)	113 (8.8%)	99 (8.8%)	2 (2.6%)
adults (19–64)	614 (47.6%)	501 (44.8%)	7 (1.9%)
older adults (65 +)	173 (13.4%)	192 (17.2%)	1 (0.8%)
<i>activity levels*</i>			
sedentary	66 (7.3%)	53 (6.1%)	0
walking	787 (87.3%)	740 (85.5%)	27 (3.6%)
vigorous	48 (5.3%)	73 (8.4%)	38 (52.1%)
cyclists	393 (30.3%)	249 (22.3%)	–
area B			
<i>gender</i>			
female	833 (52.7%)	750 (51.4%)	45 (6.6%)
male	733 (46.3%)	680 (46.6%)	25 (4.4%)
<i>age group</i>			
young children (0–5)	85 (5.4%)	109 (7.5%)	25 (25.8%)
children (6–12)	109 (6.9%)	146 (10.1%)	25 (21.4%)
adolescents (13–18)	168 (10.6%)	113 (7.8%)	5 (5.1%)
adults (19–64)	902 (57.1%)	766 (52.8%)	15 (2.2%)
older adults (65 +)	315 (19.9%)	317 (21.8%)	0
<i>activity levels*</i>			
sedentary	51 (3.9%)	74 (5.8%)	1 (1.4%)
walking	1237 (94.9%)	1136 (89.2%)	28 (2.5%)
vigorous	16 (1.2%)	64 (5.0%)	40 (62.5%)
cyclists	277 (17.5%)	180 (12.3%)	–

* Cyclists excluded.

day, and weekday (1 “Sunday” vs. 0 “work day”) were included as covariates. Cycling individuals were excluded from the analyses. SPSS version 26 was used for descriptive analyses, t-tests, and logistic regression analyses.

3. Results

Characteristics of the sample at baseline and follow-up are displayed in Table 1. A total of 5455 individuals (including 1099 cyclists) were recorded. The double-counting of individuals could not be avoided. There were no organized or supervised activities, and areas were always accessible, usable, and well lit. Weather conditions differed significantly between baseline and follow-up with higher temperatures ($26.4\text{ }^{\circ}\text{C} \pm 4.1$ vs. $15.0\text{ }^{\circ}\text{C} \pm 3.6$) and more sunny days (95.8% vs. 29.2%) at baseline ($p < 0.001$). The total number of passers-by decreased in the follow-up (T0: 2875, T1: 2569). The proportion of vigorously active pedestrians (cyclists excluded) increased significantly from 2.9% to 6.4% ($p < 0.001$). There were larger proportions of (young) children and vigorously active individuals in area A than in area B.

A total of 136 (6.3%) pedestrians interacted with the decorations. 25.6% of the young children and 18.6% of the children aged 6 to 12 used the colored markings for PA. There were no differences between male and female users ($X^2 = 3.595$, $p = 0.166$, data not shown).

The multivariate logistic regression analysis showed a greater chance for vigorous activity on decorated footpaths (OR 2.45, CI 1.54–3.89, $p < 0.001$), for children (aged 0 to 12) (OR 19.32, CI 13.07–28.56, $p < 0.001$), and on Sundays (OR 3.39, CI 2.33–4.94, $p < 0.001$). Weather, time of day, and gender were not associated with vigorous activity. Single analyses for children, adolescents, and adults revealed a greater chance of vigorous PA on decorated footpaths (OR 2.63, CI 1.64–4.20) and on Sundays (OR 2.54, CI 1.59–4.06) for

children aged 0 to 12 years ($n = 977$). None of the variables was related to PA in adolescents ($n = 380$). Only the female gender was associated with a decreased chance of PA (OR 0.42, CI 0.20–0.88) in the adult group ($n = 2,975$).

4. Discussion

The aim of this study was to investigate whether slight changes in the physical environment would increase the intensity of PA for individuals in a deprived area and for children in particular. Multivariate logistic regression analyses showed that the chance of being vigorously active was higher after the decorations were provided (OR 2.45), for children (OR 19.32), and on Sundays (OR 3.39). In contrast to studies on park or playground renovations (Smith et al., 2017), no increase in users could be observed. As our intervention addressed passers-by on their daily routes, an increase in users was neither intended nor expected. Almost one fifth of the observed children interacted with the colored markings and used them for active play. This rather high use might be explained by the casualness of the intervention and the “low cost” (time, distance) of use. Although the duration of PA was not systematically recorded, it was rather short and might therefore not contribute substantially to total PA and associated health outcomes. However, we observed that the decorations induced spontaneous and creative active play and social interactions between children and their peers or family members and might therefore offer a starting point for changes in PA and social norms.

In this study, we used a validated, objective, and non-invasive method to assess physical activity in a natural setting. As a result, we obtained a large sample, and selection bias or social desirability are likely to be small. This method seems appropriate, especially in socially deprived areas where study participation is often low (Bonevski et al., 2014). Moreover, because it allows a direct observation of the intensity

of PA at our point of interest, it was more suitable than the use of accelerometers or other wearable devices that measure individual PA over longer periods. However, there are some limitations. As SOPARC is a momentary assessment of PA, no information on the duration of PA could be recorded. Moreover, the presence of observers might have influenced the behaviors of individuals, although an observer expectancy effect is rather unlikely as the reason for the observation was not known. Due to limited financial and human resources and a lack of time, we could not investigate intrapersonal or psychosocial factors, which are important correlates of PA (Bauman et al., 2012), nor could we investigate long-term effects. Relatedly, as the follow-up data were collected immediately after the implementation, the novelty of the decorations might have a greater effect than the markings themselves. We plan to conduct a more comprehensive follow-up study that includes psychosocial characteristics (e. g. self-efficacy, social cohesion/capital) and uses a control-group design.

5. Conclusion

The participatory development and design of colored footpaths that stimulate spontaneous active play “on the way” might be one component to support changes in PA behaviors and social interactions.

CRedit authorship contribution statement

Ulrike Igel: Methodology, Formal analysis, Writing - original draft.
Ruth Gausche: Conceptualization, Project administration, Investigation.
Almut Krapf: Investigation, Resources.
Martina Lück: Data curation, Funding acquisition.
Wieland Kiess: Supervision.
Gesine Grande: Supervision, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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