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Correlates of Active Transport to School in German Primary School Children

Faktoren, die mit einen aktiven Schulweg von deutschen Grundschulkindern zusammenhängen

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Summary

- **Background:** Active travel to school is a central source of physical activity for children. However, more and more children use passive modes of transport to commute to school. In order to reverse this trend, it is important to understand correlates of active school transport. Therefore, this study investigated a number of child- and family-related correlates affecting children's active travel to school.
- **Methods:** Parents of 1,690 primary school children (7.1±0.6 years; 50.4% male) provided data on children's physical activity, modes of transport, parental physical activity and health consciousness as well as socio-demographic information. Children's weight status was assessed objectively. Individual logistic regressions were used to determine odds ratios (OR) for all correlates adjusting for age and gender.
- **Results:** Significantly related to active commute to school were children's weight status (OR 0.67, CI [0.48, 0.95], p≤.03), migration background (OR 1.59, CI [1.28, 1.97], p≤.01), distance to school (OR 4.50, CI [3.59, 5.66], p≤.01), maternal physical activity and health consciousness (OR 1.60, CI [1.30, 1.97], p≤.01; OR 1.44, CI [1.17, 1.77], p≤.01; respectively), family education level (OR 1.29, CI [1.03, 1.61], p≤.03) and household income (OR 0.54, CI [0.40, 0.73], p≤.01).
- **Discussion:** A multiplicity of independent correlates of active travel to school has been considered. Understanding these factors might support the development of effective health-promoting interventions.

KEY WORDS:
School Travel, Physical Activity, Overweight, Health

Zusammenfassung

- **Problemstellung:** Ein aktiver Schulweg bietet eine zentrale Quelle körperlicher Aktivität für Kinder. Dennoch nutzen immer mehr Kinder motorisierte Verkehrsmittel, um zur Schule zu fahren. Um diesem Trend entgegenzuwirken, ist es wichtig, Faktoren, die einen aktiven Schulweg bedingen, zu verstehen. In dieser Studie wurde daher eine Reihe von kinder- und familienbezogenen Faktoren untersucht, die mit einem aktiven Schulweg von Kindern zusammenhängen.
- **Methoden:** Eltern von 1690 Grundschulkindern (7,1±0,6 Jahre; 50,4% Jungen) lieferten Daten über körperliche Aktivität, Transportmittel, elterliche körperliche Aktivität und Gesundheitsbewusstsein sowie soziodemografische Informationen. Der Gewichtsstatus der Kinder wurde objektiv erfasst. Individuelle logistische Regressionen wurden verwendet, um Odds Ratios (OR) für alle Faktoren zu bestimmen, adjustiert nach Alter und Geschlecht.
- **Ergebnisse:** Mit einem aktiven Schulweg korrelierten signifikant der kindliche Gewichtsstatus (OR 0,67, KI [0,48; 0,95], p≤,03), Migrationshintergrund (OR 1,59, KI [1,28; 1,97], p≤,01), Entfernung zur Schule (OR 4,50, KI [3,59; 5,66], p≤,01), die körperliche Aktivität und das Gesundheitsbewusstsein der Mutter (OR 1,60, KI [1,30; 1,97], p≤,01 bzw. OR 1,44, KI [1,17; 1,77], p≤,01), sowie das Familienbildungsniveau (OR 1,29, KI [1,03; 1,61], p≤,03) und das Haushaltseinkommen (OR 0,54, KI [0,40; 0,73], p≤,01)
- **Diskussion:** Eine Vielzahl von unabhängigen Faktoren des aktiven Schulwegs wurde in Betracht gezogen. Das Verständnis dieser Faktoren könnte die Entwicklung wirksamer gesundheitsfördernder Interventionen unterstützen.

SCHLÜSSELWÖRTER:
Aktiver Transport, körperliche Aktivität, Übergewicht, Gesundheit

Introduction

Regular physical activity has repeatedly been identified to be an important factor of a healthy lifestyle (71), which should be promoted from an early age in order to support children's healthy growth and development (28). Ample physical activity is not only vital for children's physical and mental health (22, 27) but also for the prevention of overweight and obesity (61). Since adults often lead the lifestyle they have acquired when they were young (4), it is important to regularly engage children in sufficient physical activity. Current guidelines recommend 60 minutes daily of moderate to vigorous physical activity (MVPA) for children in order for it to be health enhancing (70).

One central source of physical activity for children is their active travel to school (15, 24, 44), ›

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Table 1

Participants' Characteristics for Active Commuters, Non-active Commuters, and the Total Sample. Values are displayed as mean and sd=standard deviation; BMI=body mass index, BMIPERC=BMI percentiles, MVPA=moderate to vigorous physical activity. a) active school travel on ≥3 days/week; b) active school travel on <3 days/week; *) significant difference between active and non-active commuters, p≤.05.

	MISSING VALUES	ACTIVE COMMUTERS A	NON-ACTIVE COMMUTERS B	TOTAL
Participants [% (n)]		64.8 (1095)	35.2 (595)	100 (1690)
Age [years (sd)]		7.07 (0.63)	7.05 (0.63)	7.06 (0.63)
Gender [male; % (n)]		50.2 (550)	50.6 (301)	50.4 (851)
Migration background [% (n)] *	62	28.4 (301)	38.4 (218)	31.9 (519)
ANTHROPOMETRY				
Height [m (sd)]	49	1.24 (0.61)	1.24 (0.66)	1.23 (0.63)
Weight [kg (sd)]	50	24.55 (4.62)	24.69 (5.04)	24.6 (4.77)
BMI [kg/m2 (sd)]	50	15.88 (2.00)	16.06 (2.12)	15.94 (2.05)
BMIPERC, [m (sd)]	50	47.61 (26.85)	50.05 (27.93)	48.46 (27.25)
Overweight and obesity [% (n)] *	50	7.6 (81)	10.8 (62)	8.7 (143)
PHYSICAL ACTIVITY AND ACTIVE TRANSPORT				
MVPA on ≥4 days/week ≥ 60 min/day [% (n)]	85	26.3 (274)	28.1 (158)	26.9 (432)
Distance to school [km (sd)] *	125	0.94 (1.36)	2.85 (3.34)	1.61 (2.44)
FAMILY CHARACTERISTICS				
Tertiary family education level [% (n)] *	90	34.2 (356)	28.9 (161)	32.3 (517)
Household income ≤€1,750/month [% (n)] *	217	11.1 (105)	18.3 (97)	13.7 (202)
Physically active mothers [% (n)] *	122	62.2 (634)	50.8 (279)	58.2 (913)
Physically active fathers [% (n)]	204	58.5 (569)	55.0 (282)	57.3 (851)
Health conscious mothers [% (n)] *	53	61.6 (659)	52.9 (300)	58.6 (959)
Health conscious fathers [% (n)]	162	45.7 (455)	43.6 (232)	45.0 (687)

which has also been recognized by the World Health Organization defining the promotion of active transport a key component of their policy to reduce the prevalence of physical inactivity (69). Additionally, has been shown, that countries with higher levels of active transportation also have lower obesity rates (3). On the regular commute to school physical activity can easily be incorporated into everyday life (67). Regular active commute has shown to have numerous health benefits, such as a reduced energy intake (52), decreased BMI (17), and a greater overall physical activity (10, 12, 52) but also better school grades (21) and a reduced use of motorized transport and fuel as well as less congestion (47) which all can benefit the environment in the long run.

Despite these benefits, between 70 and 97% of primary school children are not sufficiently physically active (9) and use passive modes of transport to commute to school (7, 56, 65). It has even been suggested that active travel to school has declined over the past decades by 17% and 70% for walking and cycling, respectively (56). In order to reverse this trend, it is important to understand correlates of active school transport. Often stated barriers and reasons for the use of passive commute are the convenience of motorized transportation, change of social and demographic norms (51), but also parents who are more concerned about their child's safety (2) and long distances to school (14, 20). A review in the US has found that distance to school is the greatest factor explaining inactive travel to school (59). However, this can also be a national issue, as in some places children walk to school irrespective of distance and walking time (67). Consequently, distance seems to be a major explanatory factor although other correlating influences have also to be considered.

Different interventions using approaches such as environmental changes made by communities and local authorities (1), establishment of drop-off spots (66) or introduction of educational lessons and goal-setting tasks (43), have already attempted to increase children's active travel to school and to reverse the before mentioned decline. In order to develop and design effective measures to tackle the trend of passive transportation to school, it is important to understand correlates of active school travel. Thus, several studies have investigated socio-demographic, neighborhood or build environment features as well as perceptions of children and parents in order to identify potential barriers for active travel (46, 53, 68). Also, age and gender differences in walking to school have been analyzed (26), very rarely though examined were child- and family-related correlates affecting children's active travel to school, especially not in mainland Europe or Germany. Therefore, this study investigated a number of different child- and family-related factors potentially affecting active commute to school in German primary school children in order to identify potential risk groups as well as characteristics worth strengthening for interventions to promote active travel in children.

Materials and Methods

Participants

Data of 1,690 first and second grade children (7.1±0.6 years; 50.4% male) who participated in a school-based health promotion program (18, 34) were collected at baseline, prior to any intervention. Parents provided written, informed consent and children their assent to taking part in the study. Also, the University's Ethics Committee and the Ministry of Culture and

Table 2

Odds Ratios from Individual Models for Correlates According to Active Travel to School on Three Days or More Per Week, Adjusted for Age and Gender. OR=odds ratio, CI=confidence interval, MVPA=moderate to vigorous physical activity; *)significant, p≤.05.

	OR	95 % CI	P
Child is oberweight/obese *	0.67	[0.48, 0.95]	0.03
MVPA on ≥4 days/week ≥60 minutes	0.92	[0.73, 1.16]	0.47
Child has a migration background *	0.63	[0.51, 0.78]	0.01
Distance to school ≤1 km *	4.5	[3.59, 5.66]	0.01
Roads around school are (very) safe	0.85	[0.65, 1.10]	0.21
Child has a physically active mother *	1.6	[1.30, 1.97]	0.01
Child has a physically active father	1.16	[0.93, 1.44]	0.18
Child has a health conscious mother *	1.44	[1.17, 1.77]	0.01
Child has a health conscious father	1.09	[0.88, 1.34]	0.44
Child comes from a household with tertiary family education level *	1.29	[1.03, 1.61]	0.03
Child comes from a household with household income ≤€1,750 *	0.54	[0.40, 0.73]	0.01

Education gave their approval for the study and all investigations were in accordance with the declaration of Helsinki (1964). In addition, the study is registered at the German Clinical Trials Register (DRKS-ID: DRKS00000949).

Instrumentation

At a school visit, children's anthropometric measurements such as height (cm) and body mass (kg) were taken by trained technicians to ISAK-standards (60) using a stadiometer and calibrated electronic scales (Seca 213 and Seca 862, respectively, Seca Weighing and Measuring Systems, Hamburg, Germany). Subsequently, children's body mass index (BMI) was calculated (kg/m^2), and converted to BMI percentiles using German reference data (35) to identify their weight status. Children were classified as being overweight if their BMI percentiles were above the 90th percentile; as being obese if they were above the 97th percentile.

Parameters such as migration background, physical activity, means of transport and distance to school as well as parental characteristics like family education level, household income, parental physical activity and health consciousness were assessed using a parental questionnaire. The included questions were taken from the validated and established German Health Interview and Examination Survey for Children and Adolescents, which previously assessed health behavior in 18,000 German children and adolescents (36). School characteristics, such as surroundings and road safety were assessed for each school by a questionnaire completed by the head of school.

Data Analysis

Descriptive statistics were calculated as mean values and standard deviations. For gender differences t-tests were used. For inference statistical analysis, physical activity and active travel to school were dichotomized by engagement on most days per week (i.e. four days or more of at least 60 minutes of MVPA) and three or more days of walking or cycling to school, respectively). Distance to school was dichotomized at 1 km (median), children's daily walking was dichotomized at 1-2 km (median), and parental education was divided into having a tertiary family education level or not. Household income was split into up to €1,750 per month and more than €1,750 per month. Health consciousness was determined by the question whether or not mother and father look after their health and dichotomized by their answers: not at all/a little versus much/very much. Parental physical activity was determined and dichotomized by parental answer to the question "are you [mother/father] physically active?". Children's migration background was determined by either having one parent who was born abroad or another language than German was spoken to the child within the first three years of their lives (yes/no). Road safety was dichotomized by the head of school's rating of surroundings and road safety on a scale from 1 to 5 (not very safe to very safe) and dichotomized into (very) safe (4 and 5) and not (very) safe (1-3). Subsequently, logistic regressions were used to determine odds ratios (OR) for all correlates, individually and adjusted for age and gender. All statistics were performed using SPSS Statistics 21 (SPSS Inc., Chicago, IL, US) with a significance level set to $\alpha<0.05$.

Results

A summary of the participant's anthropometric, socio-demographic, and parental characteristics are shown in Table 1, split into active and non-active commuters. The prevalence of overweight including obesity in the whole sample is 8.7% and of obesity alone 3.4%. Comparing boys and girls, significant gender differences were found for height, weight and MVPA.

Factors with significant ORs were weight status (OR 0.67, CI [0.48, 0.95], p≤.03), migration background (OR 1.59, CI [1.28, 1.97], p≤.001), distance to school (OR 4.50, CI [3.59, 5.66], p≤.001), a physically active and health conscious mother (OR 1.60, CI [1.30, 1.97], p≤.001 and OR 1.44, CI [1.17, 1.77], p≤.001; respectively), as well as the family education level (OR 1.29, CI [1.03, 1.61], p≤.03) and household income (OR 0.54, CI [0.40, 0.73], p≤.001) (see table 2).

The variables age, gender and road safety showed no significance in any analyses, nor did paternal physical activity and health consciousness and the child's engagement in at least 60 minutes of MVPA per day on four or more days a week.

Discussion

This study investigated the relationship between active school travel and various child- and family-related attributes in a large sample of German primary school children. The daily active commute to school is a key aspect of children's physical activity (15, 24, 44), which should be promoted early in order to get children into the habit of leading a healthy and active lifestyle (63). In this sample, nearly two thirds of children commu- ›

ted actively to school, 35% of children were driven to school by their parents. It has been shown that the proportion of active commuters differs on a country level. In Europe for incidence, active school travel is far more common than in the US (59) but this prevalence varies substantially between European countries (3). In Spain and Portugal, only 10% and 20% children walk to school (48, 49), whereas in the UK and Denmark 67% and even 83% of children commute actively (11, 45). In a large German study, more than half of 6 to 10 year old children walked or cycled to school; still, 46% used public transport or were driven to school by their parents (5).

Here, the mode of transport was largely explained by the distance children lived away from school (0.9 km vs. 2.9 km for active and non-active commuters, respectively), which was confirmed by many former studies (16, 20, 72). Most children, who travelled actively to school, had a distance of 0.7 km (median) to cover, whereas the majority of children who were driven to school, lived 2 km (median) away from school. A recent study by Duncan et al. (20) investigated distances between home and school in order to increase daily physical activity. They found that for primary school children 1.7 km was the optimum distance to maximize children's physical activity (20), which is significantly more than children in this study covered. This might also be one of the reasons why active school travel was not associated to children's daily MVPA; children who commuted actively to school did not reach the recommended 60 minutes of daily MVPA any more often than those who travelled passively.

While previous research has shown inconclusive results about increased MVPA for actively commuting children (8, 54, 58), it has been suggested that short walking trip durations are of low intensity (10), which do not add to MVPA. Further could be proposed that an active commute to school – even if intense enough to count towards MVPA – could potentially suppress further physical activity in the afternoon, therefore leading to similar MVPA levels of passive compared to active commuters. On the other hand, even if walking to school does not add any MVPA itself, it could potentially encourage children to play outside during those walks, which therefore could add MVPA.

Although maybe not new, the findings regarding distance to school have potential implications and should be considered for designing interventions attempting to get more children to walk to school. Walking-Busses and so-called drop-off spots have been shown to be feasible measures to encourage children to walk (for at least a part of their journey) to school, who are usually driven by their parents (13, 23, 33). Also, programs providing support to assist communities in creating safer and more supportive environments for children to walk to school have shown an increase in active transport (41). Yet, in this sample, factors such as (perceived) road safety, age, and gender, which have previously been reported to affect active travel to school (63, 64) were not significant.

Furthermore, children's weight status was significantly negatively related to an active commute to school. Besides, the prevalence of overweight including obesity in the group of the non-active commuters is with 10.8% significantly higher than in the group of the children walking to school (7.6%). This is mainly supported by studies examining adolescents (39, 40) but often contradicted for children, especially those at primary school (19, 44, 58). This is therefore one of the few studies showing a negative association of overweight and active travel in primary school children. More, especially longitudinal studies are needed in order to find out whether overweight children do not travel to school actively or whether passive commute to school leads to overweight.

There is also some evidence from previous research to suggest that migration background affects walking to school in children (19, 32, 42, 57) and adolescents (50). In this sample, children whose parents were born abroad or were spoken to in another language than German were significantly more likely to be driven to school than those who had no migration background. This was also true for the assessed family education level and household income. Children from a low income household were significantly more likely to commute to school passively, whereas children with well-educated parents walked significantly more often to school than those with parents without high school degree. Mixed findings have been reported regarding active school travel and socio-economic factors, such as income, education level and migration background (19, 59). For instance, Rothman et al. (53) have found a positive relationship between migration background and active school transport. While that investigation took place in Canada most children with a migration background were European, which has been associated with more walking before (59). In this sample, most children with migration background were from Eastern Europe and Turkey, who have shown to generally have lower physical activity levels (29, 38), especially when considering Turkish children (37). Another reason for the negative association between migration background and active school travel could be found in cultural aspects. Active commute is viewed differently by other cultures and for many parents with migration background it is important that their children do not walk but are driven to school in order to protect them since migration background has been associated with living in unsafe areas (6).

Nevertheless, further correlates on the other hand have shown to be positively related to active school travel. The chances of children with physically active mothers were enhanced by the factor 1.74 to walk to school and the chances of children whose mother classified herself as health conscious were enhanced by the factor 1.39 to commute actively. Since this is one of the few studies considering these aspects, this highlights the importance of parental involvement in any health and physical activity promoting intervention. Still, maternal activity and health consciousness shows to affect active school travel significantly more than paternal physical activity, which has shown no association. Although, no previous research has been found, that investigated the relationship of parental health consciousness and physical activity on active school commute, the fact that maternal physical activity is associated with children's physical activity has been demonstrated before (31), as well as that father's activity behaviors have no influence on those of their children (31). Whether this remains consistently associated has to be investigated further.

Limitations

However, there are limitations to be considered when interpreting these findings. Relying on self-reported school travel and physical activity along with the assessed correlates such as parental physical activity and their health-consciousness is a primary limitation of this study. Even if questions used to determine active school travel, distance to school, physical activity and their correlates have been taken out of a well-established and validated instrument (30) the results should be interpreted with caution since they are based on self-report, which is known to be subject to recall and recording bias (55). Moreover, the parental estimation and general definition of MVPA is not always clear (the WHO counts active commute towards MVPA (71), other studies have shown it cannot be counted towards MVPA

(10)) which may lead to a misinterpretation of MVPA. Further, since the data are cross-sectional, the findings do not allow for causal interpretation. Additionally, since children were recruited from schools about to take part in a health-promotion program, a selection bias cannot be ruled out. Moreover, it is not possible to clearly define children's mode of transport since it was not distinguished between walking, cycling or taking the scooter to school. Despite these limitations, the objective assessment of children's weight status in a large cohort as well as the consideration of a multiplicity of independent factors should be considered a strength of this study. Further research, however, should thrive to use objective measures in order to fully investigate the factors associated with children's active travel to school.

Conclusions

After the consideration of a multiplicity of independent correlates of active travel to school, it was shown that migration background, distance to school and low household income were negatively associated with active school commute, whereas it was significantly more likely to walk to school for children with a physically active and health conscious mother.

These findings give a sound understanding of which factors should be considered in the development of effective health-promoting interventions. Minority groups have to be considered especially in order to avoid potential health inequalities; parents should be targeted so they are more aware of them being role models for their children; and communities and policy makers should be sensitized of their responsibility to provide safe and sufficient means for children to commute to school actively.

In summary, active travel to school can be a central source of physical activity for children, which could be critical to the prevention of chronic disease later in life and makes its promotion a key component of strategies to reduce the prevalence of physical inactivity.

Conflict of Interest

The authors have no conflict of interest.

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