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Intervention Effects of a Kindergarten-Based Health Promotion Programme on Health-Related Quality of Life and Child Sick Days

Interventionseffekte eines Kindergarten-basierten Gesundheitsförderungsprogramms auf die gesundheitsbezogene Lebensqualität und die Krankheitstage von Kindern

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Summary

› **Introduction:** Good health is a prerequisite for numerous developmental tasks. However, change in children's behaviour has obesity as a possible consequence. "Join the Healthy Boat" promotes a healthy lifestyle to improve children's health holistically. This work aimed to find out whether the programme affects children's health and health-related quality of life (HRQoL).

› **Methods:** 401 children (3.65±0.56 years; 54.1% boys) from 57 kindergartens were included. The intervention group (IG) carried out a yearlong programme on healthy eating and physical activity. The control group (CG) followed the normal kindergarten routine. Anthropometric data were collected objectively. Information on HRQoL, sick days and doctors' visits were collected subjectively. Intervention effects were analysed using difference measures, Chi^2 tests and logistic regressions.

› **Results:** Over the study year, IG showed no significant intervention effects but a greater increase in HRQoL than CG (1.09±5.65 vs. 0.43±5.67, p=0.40) and a greater reduction in sick days (-1.25±5.30 vs -0.50±5.52, p=0.38) and doctors' visits (-0.79±3.16 vs -0.39±2.95, p=0.75), neither are significant.

› **Conclusions:** "Join the Healthy Boat" did not achieve significant intervention effects on HRQoL, sick days and doctor visits. However, the programme showed promise in improving HRQoL, which could potentially be significant with a longer duration of study.

KEY WORDS:
Preschool, Physical Activity, Child Health, Prevention, Obesity, Healthy Diet

Introduction

Good general health in childhood is important and is considered a prerequisite for the successful completion of numerous development tasks (33). In recent years, however, there has been a change in children's everyday behaviour, which is associated with health risks and negative consequences (31). Latest results of the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) confirmed low levels of physical activity (13); with less than 50% of girls and boys aged three-six years achieving the WHO's (World Health Organization) physical activity of at least 60 minutes of moderate to vigorous physical activity per day (13). Compared to previous KiGGS results from five years prior, the new survey shows a steep decline in the prevalence of girls aged between three and ten years meeting the WHO's physical activity recommendations (40.7% to 32.6%) (13).

An unhealthy lifestyle through inactive leisure time, sedentary behaviour and high screen media use, as well as an unhealthy diet, can have unfavourable consequences on childhood and adolescence health (31). Research indicates that these everyday behaviours can affect the health-related quality of life (HRQoL) of children (43, 55, 56). Moreover, obesity is now one of the greatest public health challenges of the 21st century (52). This places an enormous health burden on those affected, as well as considerable costs on society and healthcare systems (18). Hence, there is a need to promote a healthy lifestyle at a young age, given obesity developed in childhood often persists into adolescence (39) and adulthood (41). The negative health consequences of obesity during early childhood can also extend well into adulthood (32), with individuals at increased risk of developing cardiovascular and metabolic disease, including hypertension, dyslipidaemia and type 2 diabetes (32). Orthopaedic diseases and psychosocial stress are also known consequences (35), as is a reduction in health-related quality of life (46).

Health-related quality of life (HRQoL) is a multidimensional construct that is considered a subjective measurement of one's health, which includes the "perceived physical, emotional, mental, social and behavioural components of well-being and functioning over time" (38, p. 810). In contrast, the recording of frequency of illness and thus the number of sick days is an objective measure of health compared to HRQoL (20).To date, there are no studies associating aspects of everyday child behaviour and the number of sick days of kindergarten children. The results of various studies that include primary school children, however, suggest a possible relationship of physical activity with the number of sick days (22). Similarly, results from studies including schoolchildren indicate an association between children's weight status and sick days. A systematic review examined ›

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the relationship between body weight and school absenteeism among children and adolescents aged six and 18 years (1). Eleven of the thirteen included studies reported a significant positive association (1). Similarly, in a Dutch study that included 3,960 eight-year-olds and assessed their number of sick days (53), compared to children of normal weight, obese children had an approximately 80% higher chance to be absent from school due to illness (53). Obesity was thus significantly associated with greater school absenteeism (53).

It seems conclusive that more sick days are in turn associated with a lower HRQoL score (22). Frequent absences from kindergarten can have numerous negative effects, including impaired motor development (14); children who attended kindergarten irregularly had a 2.63 times greater risk for fine motor and 2.56 times greater risk for gross motor developmental hazards (14). In addition, children who are regularly absent from kindergarten also missed more school and had a lower performance at school (11); chronic absence in kindergarten is associated with lower academic performance in mathematics, reading and general education among first graders (2, 11).

While sick days and absenteeism can be used as an objective measure of health, visits to the doctor can also be used as an additional objective health parameter. However, there are very few studies, which examine children's use of health services (29). The German KiGGS study showed that three to six-year-old girls had an average of 3.8 and boys 3.7 contacts to specialist paediatrics in the last twelve months (40) and the use of health care services has increased significantly in the last ten years (40).

It has been suggested, that there is an association between childhood overweight and visits to the doctor or with the use of health services. It is assumed that the comorbidities present as a result of increased body weight also lead to increased utilisation of health care services (45). In an Australian study with kindergarten children aged four and five, obese children were 72% more likely to have an additional need for health care compared to normal weight counterparts (48). Similar results were shown for hospital visits, with obese children significantly more likely to visit hospital, require longer inpatient stays, and require higher drug use compared to normal weight children (19).

An improvement in HRQoL and a reduction in sick days are essential aspects, since on one hand, children's quality of life and well-being are important. On the other hand, an increased absence from kindergarten can lead to developmental delay (14) and increased school absenteeism (11). Moreover, due to the limited financial resources of healthcare systems, a reduction in direct and indirect costs, namely the expenses for visits to the doctor and childcare-related absenteeism, would be desirable.

The health promotion programme "Join the Healthy Boat" aims to promote changes in children's everyday behaviour and hence improve children's health. The kindergarten-based programme focuses on an increased physical activity and healthy diet as well as reduced screen media use (25). In order to investigate the programme's effectiveness on children's health and health-related quality of life, a large-scale evaluation was carried out. Changes of objective health outcomes such as children's sick days and visits to the doctor as well as differences in children's HRQoL after a one-year intervention are reported here.

Methods

Intervention

"Join the Healthy Boat" is a health promotion programme, which aims at a healthy lifestyle of kindergarten children and supports among others the prevention of overweight and obese children. The development of the programme (49) was guided by the intervention mapping approach (5). It resulted in a kindergarten-based, teacher-centred intervention based on the health-psychological background of Bandura's socio-cognitive theory (4) and the socio-ecological approach of Bronfenbrenner (9). It is implemented state-wide by nearly 5,500 kindergarten teachers in over 1,750 kindergartens throughout south-west Germany.

The three key topics of the programme are the promotion of physical activity, the reduction of screen media consumption, and a more healthy diet including the reduction of sweetened drinks and an increased fruit and vegetable intake. All intervention materials are integrated into the everyday life of kindergartens so no external staff or extra time is required. Further detail on materials and teacher training can be found elsewhere (24).

Study Design

For the evaluation of this multilevel multicomponent programme, a prospective, stratified, cluster randomised and longitudinal study was carried out, including intervention and control group. After baseline measurements were completed, the programme "Join the Healthy Boat" was carried out in the intervention group, while the control group followed the regular kindergarten routine with no contact during that year. Follow-up measurements took place after one year. Details on kindergarten and child recruitment, materials, organisation of randomisation and data collection have been published previously (25).

The study was approved by University's Ethics Committee and the Ministry of Education and was carried out according to the Declaration of Helsinki. In addition, the study is registered in the German Register of Clinical Trials (DRKS-ID: DRKS00010089). Primary outcomes have been reported elsewhere (24), this study shows results of objective health parameters and HRQoL only, since these parameters were not analysed initially and would have gone beyond scope of the previous publication.

Participants

973 kindergarten children (3.6±0.6 years; 47.1% male) in 57 kindergartens (30 kindergartens in the intervention group; 27 kindergartens in the control group), who participated in the evaluation study of the programme were assessed at baseline and 558 (57%) of them at follow-up. Since only participants, whose parents completed the parental questionnaire for baseline as well as follow-up, 157 children had to be excluded from the data set. Therefore, a sample of 401 children could be included in the analyses, 223 children in the intervention group and 178 children in the control group. Prior to data collection, parents provided written and informed consent and children their assent to taking part in the study.

Data Collection

Anthropometric measurements such as children's height (cm) and body mass (kg) were taken by trained technicians to ISAK-standards (23, 42) using a stadiometer and calibrated electronic scales (Seca 213 and Seca 862, respectively, Seca Weighing and Measuring Systems, Hamburg, Germany). Children's BMI was calculated as weight divided by height squared, and converted to BMI percentiles (BMIPCT) using German reference data (26). Cut-off points for overweight children were determined above the 90th percentile; for obese children above the 97th percentile.

Health behaviours such as physical activity and screen time as well as socio-demographic information were assessed

Table 1

Participant's characteristics at baseline split into control and intervention group. m=mean; sd=standard deviation; BMI percentiles=body mass index percentiles according to German reference data (26); overweight/obese=overweight children >90th percentile, obese children >97th percentile; migration background=having least one parent who was born abroad or if the child was spoken to in another language than German in the first three years of their life; SES=Socio-economic status;, HRQoL=Health-related quality of life.

	MISSINGS	INTERVENTION (n=223)	CONTROL (n=178)	TOTAL (n=401)
Age (years), m (sd)		3.65 (0.58)	3.65 (0.54)	3.65 (0.56)
Gender (male), n (%)		134 (60.1)	83 (46.6)	217 (54.1)
BMI percentiles, m (sd)	54	51.4 (25.8)	44.4 (25.6)	48.4 (25.9)
Overweight/obese, n (%)	54	12 (6.0)	4 (2.7)	16 (4.6)
Migration background, n (%)	47	56 (28.9)	59 (36.9)	115 (32.5)
High SES, n (%)	50	113 (57.9)	97 (62.2)	210 (59.8)
Sick days child, m (sd)	50	7.5 (5.8)	7.8 (6.0)	7.6 (5.9)
Visits to the doctor, m (sd)	44	2.9 (3.4)	3.0 (3.5)	2.9 (3.4)
HRQoL (total score), m (sd)	50	62.3 (5.1)	62.3 (5.3)	62.3 (5.2)

using a parental questionnaire. The included questions were based on the German Health Interview and Examination Survey for Children and Adolescents (KiGGS), which previously assessed health behaviour in 18,000 German children and adolescents (28). Subjective health was assessed using the KINDL-R (38), which is a validated German standardised questionnaire used "in clinical populations, but also in healthy children and adolescents" (38, p. 811) and takes into account child development by having different versions for different age groups (38). Self-assessment and peer-assessment versions exist, with the peer-assessed proxy version being used in this study.

The questionnaire covers six dimensions of quality of life: physical well-being, emotional well-being, self-esteem, well-being in the family, well-being in relation to friends/peers, well-being in kindergarten (38). The subscales can be considered separately or converted into an overarching value from 0-100 (36).

In order to record objective health, questions were selected from the questionnaire concerning frequency of children's illness and doctor's visits. Parents indicated the number of sick days and visits to the doctor during the last twelve months.

In addition, levels of academic and professional education as well as monthly net income from both parents were assessed. Family level of education was categorised according to the adjusted "Comparative Analyses of Social Mobility in Industrial Nations" (CASMIN) classification (8). Levels were dichotomised into tertiary and elementary/intermediate level of education. Household monthly net income was assessed on a seven-point-scale and dichotomised into<1750€ and≥1750€, according to Winkler & Stolzenberg (54). Additionally, migration background was defined as at having least one parent who was born abroad or if the child was spoken to in another language than German in the first three years of their life.

Data Analysis

Data analysis was performed using IMB SPSS Statistics 25 (SPSS Inc., Chicago, IL, US) and SAS, version 9.4 (SAS Institute, Cary, NC, US). Significance level was set to $\alpha<0.05$. Socio-demographic characteristics of the sample were described. Depending on scale level and requirements, different methods are used to test for differences (Pearson's Chi², Mann-Whitney U, t-test for independent samples or Welch test).

In order to identify longitudinal changes, descriptive procedures are carried out list wise for each individual parameter. The missing values for baseline and follow-up were adjusted. In addition, the difference dimensions (follow-up – baseline) of the dependent variables were calculated.

For binary logistic regressions, variables were dichotomised using median split: total KINDL-R score was dichotomised into higher (>62.5) and lower HRQoL (≤62.5). Number of sick days were dichotomised into a group with a few sick days (≤6) and a group with more sick days (>6). Doctors' visits were divided into few (≤2) and more doctors' visits (>2). Results were presented as odds ratios (OR) with 95% confidence intervals (CI). In order to take possible centre effects into account (nesting of children within kindergartens), GEE models for a binary outcomes were used.

Results

Participant's baseline characteristics are summarised in table 1. There was a significant gender difference ($\chi^2(1)=7.22$, p=0.007), with significantly more boys (60.1%) in the intervention group. Another significant difference is evident at mean BMI percentiles (t(345)=-2.52, p=0.012) with significantly higher mean BMI percentiles in the intervention group (51.43 kg/m² vs. 44.40 kg/m² for intervention and control, respectively). Table 1 also includes children's baseline objective and subjective health parameters with no group differences.

At follow-up, children's average HRQoL overall score was 62.82 (±5.73) points, they were sick on average on 6.96 (±5.80) days during the last year and went to see a doctor on average 2.48 (±4.28) times due to illness.

HRQoL

Over one year, mean HRQoL score shows an overall increase of 0.80 (±5.66) points for all children. This increase is evident in intervention group (1.09±5.65) as well as control group (0.43±5.67). In the intervention group, there is a tendency towards a stronger increase, however, this is not statistically significant (U=11201.00; z=0.841; p=0.400; r=0.05).

The binary logistic regression analysis for total HRQoL score at follow-up shows that children in the intervention group have a 55% higher chance of having a higher HRQoL (>62.5 points) at follow-up compared to children in the control group, although this is not statistically significant (p=0.172). The intervention therefore has no significant impact on ›

Table 2

Results from binary logistic regression analyses for children's health-related quality of life at follow up. OR=Odds Ratio; 95% CI=95% Confidence interval; SES=Socio-economic status; MVPA=moderate to vigorous physical activity; HRQoL=Health-related quality of life. *significant (p≤0.05).

	P	OR	95% CI
Intervention	0.172	1.55	0.83; 2.93
Age	0.903	1.03	0.61; 1.76
Gender (female)*	0.025	2.09	1.10; 3.98
High SES	0.769	1.11	0.57; 2.15
No migration background	0.838	1.08	0.53; 2.19
Normal weight	0.570	0.99	0.98; 1.01
Screen time <1h/day	0.508	0.80	0.42; 1.53
MVPA ≥4 days/week*	0.004	2.98	1.42; 6.27
HRQoL baseline >62.5*	0.002	2.56	1.41; 4.67
Constant	0.307	0.31	

Table 3

Results from binary logistic regression analyses for children's sick days at follow up. OR=Odds Ratio; 95% CI=95% Confidence interval; SES=Socio-economic status. *significant (p≤0.05).

	P	OR	95% CI
Intervention	0.995	0.99	0.54; 1.83
Age	0.705	1.11	0.66; 1.86
Gender (male)	0.370	1.32	0.72; 2.41
High SES*	0.003	2.72	1.42; 5.22
No migration background	0.235	0.66	0.34; 1.31
Normal weight	0.771	1.00	0.99; 1.01
Screen time <1h/day	0.672	0.87	0.47; 1.64
Sick days baseline ≤6*	0.001	7.42	4.02; 13.70
Constant	0.242	0.28	

the probability of a higher HRQoL total score at follow-up (see table 2).

The coefficients gender (Wald(1)=5.039, p=0.025), physical activity (Wald(1)=8.326, p=0.004) and baseline HRQoL total score (Wald(1)=9.467, p=0.002) showed significant connections. Compared to boys, girls have a 2.1-fold greater chance of having a higher HRQoL at follow-up; children who are physically active≥four times a week for≥60 min per day have a 3-fold greater chance of having a higher HRQoL at follow-up; and children with a higher baseline HRQoL score have a 2.6-fold higher chance of also having a higher HRQoL at follow-up (see table 2).

Controlling for a potential centre effect, the GEE model for binary outcomes revealed significant results for baseline HRQoL total score (p<0.0001) only.

Looking at the recorded sub-scales of HRQoL (namely physical well-being, mental well-being, self-worth, family, friends, kindergarten), self-worth and kindergarten showed the highest scores (12.49±1.98 and 11.13±1.61, respectively), whereas low scores were assessed for physical and mental well-being (4.94±1.81 and 4.70±1.43, respectively). There was no significant difference between intervention and control group (at either baseline or follow-up) for any of those six sub-scales.

Sick Days

The average number of sick days at follow-up was reduced by -0.93 (±5.40) days. A decrease was present in the intervention group (-1.25±5.30) as well as in the control group (-0.50±5.52). This decrease was more pronounced in the intervention group, however, the difference was not statistically significant (U=13636.50; z=-0.883; p=0.377; r=0.05).

Table 3 shows that the chance of having≤6 sick days at follow-up is 0.2% lower in the intervention group than in the control group, but this was not statistically significant (p=0.995). The intervention therefore has no significant impact on the probability of≤6 sick days at follow-up.

The coefficients socio-economic status (SES) (Wald(1)=9.034, p=0.003) and baseline sick days (Wald(1)=41.093, p<0.001) show significant results. Children with high SES had a 2.7 times higher chance of having≤6 sick days at follow-up and also children who already had few sick days at baseline had a 7.4-fold higher chance of also having less sick days at follow-up (table 3).

The GEE model for binary outcomes, which was calculated to control for a potential centre effect, showed significant results for baseline sick days (p<0.0001) and moderate to vigorous physical activity on four or more days per week (p=0.01).

Doctors' Visits

The number of visits to the doctor in the last year decreased by -0.62 (±3.07) visits, both in the intervention (-0.79±3.16) and in the control group (-0.39±2.95). In the intervention group, this difference was more pronounced, but was not statistically significant (U=14.681, 50, z=-0.318, p=0.751, r=0.02).

The chance of≤2 visits to the doctor at follow-up was 7% higher for children in the intervention group than in children in the control group, though this was not statistically significant (p=0.812). Thus, the intervention has no significant impact on the probability of≤2 visits to the doctor at follow-up (table 4). Compared to children who had more doctor visits at baseline, children with fewer doctor visits at baseline were almost 12 times more likely to also have fewer doctor visits at follow-up.

The GEE model for binary outcomes showed significant results for doctor visits at baseline (p<0.0001), household income (p=0.02), and children's screen media use of more than one hour per day (p=0.04).

Discussion

The aim of this study was to find out whether the health promotion programme "Join the Healthy Boat" had the potential to affect kindergarten children's subjective and objective health, assessed by health-related quality of life (HRQoL), sick days and doctors' visits. The intervention effects were examined as part of a cluster-randomised longitudinal controlled study including control and intervention group.

HRQoL

Overall HRQoL increased over the year in both the intervention and control group. This increase can presumably be explained by a general decrease in sickness incidence. Due to a natural maturation of the immune system (10), children with increasing age are less frequently affected by acute infectious illnesses (6). In view of fewer sick days, it can be assumed that children's subjective well-being also increased, as well as their HRQoL.

HRQoL scores increased more in children belonging to the intervention group (1.09±5.65 vs. 0.43±5.67 points, respectively). This greater, though not statistically significant, increase in the intervention group can potentially be explained by the content

of the health promotion programme and an interaction with the associated changes in behaviour. As previously reported, the programme increased children's physical activity significantly in the intervention group within one year of intervention (24). Different cross-sectional studies showed connections between physical activity and HRQoL (16, 20, 44) as well as a systematic review, which found positive associations between physical activity and psychosocial health in eleven studies for kindergarten aged children (44). Ebenegger et al. (12) also reported a positive relationship between objectively assessed physical activity and psychosocial well-being in four- to six-year-olds. These findings suggest that the intervention noted previously (24), that increased physical activity in the intervention might also have increased the HRQoL of those in the intervention group.

Together with an increase in physical activity, a significant decrease in BMI percentiles was reported for the kindergarten children taking part in the "Join the Healthy Boat" intervention (24). This could also lead to a positive effect on HRQoL in the intervention group as previous findings report that increased BMI at kindergarten age is already associated with a reduced HRQoL (27, 48). Bocca et al. (7) also reported in their multidisciplinary intervention study that a reduction in various obesity parameters was associated with an increase in HRQoL. Their programme included units on healthy diet and physical activity as well as psychological counselling sessions for parents and showed positive changes in HRQoL after twelve months (7).

When looking at the unstratified analysis, the intervention group had a 21% higher probability of an increased HRQoL total score (data not shown). The aspects already mentioned serve as a possible explanation for this result. However, it is conceivable that a longer intervention duration or a more intensive intervention is required to be consistent in the bivariate and multivariate analyses achieve statistically significant results. So it seems that the increase in HRQoL caused by the intervention alone is too small and others factors have a greater impact. Because the regression analysis shows, that gender has a significant impact on the probability of a higher HRQoL at follow-up. Girls generally tend to have a higher HRQoL (38) and possibly also experienced a stronger increase within a year.

Physical activity on four days or more per week for at least 60 minutes per day also had a significant impact on HRQoL at follow-up. A positive longitudinal effect of sports participation was shown in an Australian study with eight-year-olds (47). After two years, children who exercised regularly had a significantly higher HRQoL (47). Physical activity appears to play an important role in children's well-being and HRQoL. Further, HRQoL baseline values were also a significant determinant for HRQoL at follow-up. Children who already showed a high HRQoL at baseline had a higher HRQoL at follow-up, too. It seems that it is much more difficult for children with a low HRQoL to achieve a change towards higher HRQoL than for children who have already demonstrated increased well-being.

Since a lack of significance does not automatically mean irrelevance, the effect sizes should be considered (50). Compared to the children in the control group, children in the intervention group showed a 56% higher chance of achieving more than 62.5 points in the HRQoL total score at follow-up. This is not insignificant and suggests that the intervention does have a positive impact on HRQoL, however not statistically significant. Yet, based on the descriptive results and the adjusted odds ratios it can be assumed that the health promotion programme tends to have a positive impact on the overall HRQoL value of kindergarten children.

Table 4

Results from binary logistic regression analyses for children's visits to the doctors at follow up. OR=Odds Ratio; 95% CI=95% Confidence interval; SES=Socio-economic status. *significant (p≤0.05).

	P	OR	95% CI
Intervention	0.812	1.07	0.58; 1.99
Age	0.636	1.15	0.65; 2.00
Gender (male)	0.976	1.01	0.55; 1.84
High SES	0.567	1.20	0.65; 2.21
No migration background	0.911	0.96	0.50; 1.85
Normal weight	0.056	1.00	0.99; 1.01
Doctors' visits baseline ≤2*	0.001	11.89	6.33; 22.34
Constant	0.388	0.375	

Sick Days

As an objective measure for children's health, the number of sick days was assessed. These reduced over the study year in the entire sample, which can probably be explained by the natural maturation of the immune system (10), since it takes children approximately until they are five years of age before they have reached the immunological capacity of an adult (10). The results of KiGGS study also show that the prevalence of acute infectious diseases in early childhood is consistently higher than at school age (6).

In the intervention group, however, there was a tendency towards a greater decrease in sick days (-1.25±5.30 vs. -0.50±5.52 days, respectively), which may be due to the changes in everyday behaviour the programme promotes. As previously reported, physical activity in the intervention group of this sample improved significantly within the study year (24) and for adults as well as primary school children there are findings indicating a connection between physical activity and sick days (20, 34). First and second graders for example, who are regularly sufficiently physically active, were significantly less likely to have more than five sick days per year (20). It is probable that the connection described already exists in kindergarten children and the significant increase in physical activity in the intervention group may have led to a greater reduction in sick days.

Likewise, the decrease in the BMI percentile in the intervention group (24) could possibly explain the increased reduction in sick days. A systematic review for instance, showed a connection between body weight and sick days or absence from school (1), which could also be possible for kindergarten children. Obese primary school children had about an 80% higher chance of being absent from school due to illness in the last two months compared to non-obese students (53) and centrally obese first and second graders had significantly more sick days compared to their normal weight counterparts (22).

It is therefore possible, that the decrease in BMI percentiles in the intervention group in the present study may have led to a greater decrease in sick days. However, the reduction in sick days caused solely by the health promotion programme is apparently too small to achieve a statistically significant intervention effect. Still, since it is assumed that children who are often absent in kindergarten also have more days absent from school later (11), it is conceivable that the increased reduction in sick days in the intervention group now may have a beneficial effect on later absences from school.

Doctors' Visits

As another measure for children's health, the number of doctors' visits were investigated. The average number of visits ›

to the doctor within a year decreased for all kindergarten children in the programme, which is probably related to the previously described maturation of the immune system (10) and the resulting reduction in sick days. The KiGGS study also reports that health service utilisation rates decrease with age (6). 95.7% of 0- to 2-year-olds consult a paediatrician every year because of sickness, while only 87.3% of 3- to 6-year-olds do so (6).

The decrease in doctors' visits tends to be more pronounced in the intervention group than in the control group (-0.79±3.16 vs. -0.39±2.95 visits, respectively). This again, can be explained by the health promotion programme and its associated change in everyday behaviour. As described previously, it is possible that the increased physical activity in the intervention group (24) may have led to a greater decrease in sick days, which may in turn be the reason for the decrease in doctors' visits.

The reduction of BMI percentiles in the intervention group within the study year (24) can also provide an explanation for the present result. Cross-sectional studies report that an increased weight status can be associated with higher use of medical services and doctors' visits (21, 48, 53). For example, a Dutch study of eight-year-olds showed that obesity was associated with a 2.3-fold higher likelihood of visiting a doctor (53). In addition, obese pre-schoolers in Australia had a 72% higher chance of having additional health care needs compared to their normal-weight peers (48). A greater reduction in the BMI percentile in the intervention group could therefore also have led to a greater decrease in doctor visits in the present study. Yet, it is very likely that the decrease in doctor visits due to the intervention alone is too small to reach statistical significance and factors have a greater impact on doctors' visits at follow-up.

Nonetheless, this study is not without limitations, which need to be considered when interpreting these results. Although, a strength of this study lies in its design and implementation as a cluster-randomised, controlled longitudinal study and its acceptable sample size, it should be borne in mind that participation was voluntary, which is why a selection bias cannot be ruled out. In addition, it is possible that even if all kindergarten teachers received the same training on the programme, the implementation and quality may have been inconsistent. Further, children in the control group were not isolated and may have also received health-promoting content during the year. Further should be noted that the intervention duration of one year is relatively short for health effects to be identified (30, 51). "Join the Healthy Boat" was designed as a low-threshold measure so as not to interfere too much with everyday kindergarten life. The desired results and long-term changes may therefore probably only become apparent after the programme has been implemented for several years or through an increased intensity of the intervention content. In addition, the health parameters used for this work were collected subjectively, which makes a bias due to socially desirability or recall possible. Finally, only children from institutions in Baden-Württemberg were examined. Therefore, the representativeness of the sample and the transferability of the results to other regions is limited. Yet, a strength is the attempt to examine the complex construct of health holistically. Both objective (sick days and doctors' visits) and a subjective (HRQoL) health parameter were considered. Still, possible cluster effects were not taken into account. Further, HRQoL as a subjective parameter with the KINDL-R was recorded indirectly via the parents. The use of the proxy version is controversial in some cases, but used often by very young children in particular (37). Moreover, only the total value of HRQoL was considered. Future research should maybe analyse the subscales separately in order to provide further interesting results.

Conclusion

This study was able to provide initial information on the influence of the health promotion programme "Join the Healthy Boat" on subjective and objective aspects of kindergarten children's health; more precisely on children's HRQoL, sick days and doctors' visits. Since to date, there are hardly any studies investigating these associations, this study provides new insights into the identified research gap. The health promotion programme did not reveal any significant intervention effects on HRQoL, sick days and doctors' visits of kindergarten children in south-west Germany. With the selected parameters, the general goal of the intervention, to improve children's health, could not be significantly achieved. However, this does not mean that the intervention has no effect on children's health, but that significant changes within a year are not easy to achieve. The intervention definitely showed a positive trend towards increasing HRQoL and reducing sick days and doctors' visits. The programme is thus aimed at the right direction and tending effects have the potential to become factual if the programme runs for longer, which should be examined in further studies. The present results of the evaluation of the health promotion programme "Join the Healthy Boat" allow the conclusion that low-threshold and attitude-specific measures for sufficient physical activity, a balanced diet and sensible leisure activities can already have a positive effect on health in childhood.

Conflict of Interest
The authors have no conflict of interest.

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Summary Box

„Join the Healthy Boat" is a program that promotes a healthy lifestyle to improve the overall health of children. The aim of this study was to find out whether the program has an impact on children's health and health-related quality of life (HRQoL). 401 children (3.65 ± 0.56 years; 54.1% boys) from 57 kindergartens were included.

Information on HRQoL, sick days and doctor visits was collected subjectively, and the effects of the intervention were analyzed using difference measures, chi-square tests and logistic regressions. „Join the Healthy Boat" did not achieve significant intervention effects on HRQoL, sick days and doctor visits. However, the program showed promising potential for improving HRQoL, which could possibly become significant if the study were to be continued for longer.

References

(1) **An R, Yan H, Shi X, Yang Y.** Childhood obesity and school absenteeism: a systematic review and meta-analysis. Obes Rev. 2017; 18: 1412-1424. doi:10.1111/obr.12599

(2) **Ansari A, Purtell KM.** Absenteeism in Head Start and Children's Academic Learning. Child Dev. 2018; 89: 1088-1098. doi:10.1111/cdev.12800

(3) **Badura B, Ducki A, Schröder H, Klose J, Meyer M.** Fehlzeiten Report. Springer, Berlin, Heidelberg, 2018.

(4) **Bandura A.** Social Cognitive Theory: An Agentic Perspective. Asian Journal of Social Psychology. 1999; 2: 21-41. doi:10.1111/1467-839X.00024

(5) **Bartholomew LK, Parcel GS, Kok G, Ruiter A.** Planning health promotion programs: An intervention mapping approach, Jossey-Bass, San Francisco, Calif, USA, 2006.

(6) **Bergmann E, Eis D, Ellert U, Gaber E, Hagen C, Helm D, Hintzpeter B, Horch K, Kahl H, Knopf H, Lampert T, Langen U.** Laußmann D, Mensink G, Poethko-Müller C, Rattay P, Ryl L, Schaffrath Rosario A, Saß A-C, Schlaud M, Starker A. Lebensphasenspezifische Gesundheit von Kindern und Jugendlichen in Deutschland: Ergebnisse des Nationalen Kinder- und Jugendgesundheitssurveys (KiGGS). Robert Koch-Institut (RKI) (Hrsg.), Berlin. 2008.

(7) **Bocca G, Kuitert MW, Sauer PJ, Stolk RP, Flapper BC, Corpeleijn E.** A multidisciplinary intervention programme has positive effects on quality of life in overweight and obese preschool children. Acta Paediatr. 2014; 103: 962-967. doi:10.1111/apa.12701

(8) **Brauns H, Scherer S, Steinmann S.** The CASMIN Educational Classification in International Comparative Research. In: Advances in Cross-National Comparison (pp. 221–244). Boston, MA: Springer US, 2003. doi:10.1007/978-1-4419-9186-7_11

(9) **Bronfenbrenner U.** The Ecology of Human Development: Experiments by Nature and Design, Harvard University Press, Cambridge, UK, 1979.

(10) **Bufe A, Peters M.** Unterschiede zwischen kindlichem und erwachsenem Immunsystem. Konsequenzen für die Praxis. HAUT. 2013; 2: 68-74.

(11) **Connolly F, Olson LS.** Early Elementary Performance and Attendance in Baltimore City Schools' Pre-Kindergarten and Kindergarten, Baltimore Education Research Consortium, Baltimore, 2012.

(12) **Ebenegger V, Marques-Vidal PM, Munsch S, Quartier V, Nydegger A, Barral J, Hartmann T, Dubnov-Raz G, Kriemler S, Puder JJ.** Relationship of hyperactivity/inattention with adiposity and lifestyle characteristics in preschool children. J Child Neurol. 2012; 27: 852-858. doi:10.1177/0883073811428009

(13) **Finger JD, Varnaccia G, Borrmann A, Lange C, Mensink GBM.** Körperliche Aktivität von Kindern und Jugendlichen in Deutschland – Querschnittergebnisse aus KiGGS Welle 2 und Trends. Journal of Health Monitoring. 2018; 3: 24-31.

(14) **Gottschling-Lang A, Franze M, Hoffmann W.** Prävalenzen und Risikofaktoren motorischer Entwicklungsgefährdungen bei 3- bis 6-jährigen Kindergartenkindern in Mecklenburg-Vorpommern (M-V) [Prevalence and Risk Factors for Motor Developmental Delays in 3- to 6-Year-Old Preschool Children in Mecklenburg-Western Pomerania]. Gesundheitswesen. 2016; 78: 28-33. doi:10.1055/s-0034-1387708

(15) **Greiner W, Batram M, Damm O, Scholz S, Witte J.** Kinder- und Jugendreport 2018: Gesundheitsversorgung von Kindern und Jugendlichen in Deutschland Schwerpunkt: Familiengesundheit, Beiträge zur Gesundheitsökonomie und Versorgungsforschung, Band 23, Medhochzwei Verlag GmbH, Heidelberg, 2018.

(16) **Griffin LJ, Dowda M, Dezateux C, Pate R.** Associations between sport and screen-entertainment with mental health problems in 5-year-old children. Int J Behav Nutr Phys Act. 2010; 7: 30. doi:10.1186/1479-5868-7-3

(17) **Hall C, Lindahl E.** Illness-related absence among preschool children: Insights from a health intervention in Swedish preschools. J Health Econ. 2017; 56: 191-200. doi:10.1016/j.jhealeco.2017.10.004

(18) **Hauner H.** S3-Leitlinie. Prävention und Therapie der Adipositas, Bayrisches Ärzteblatt. 2016; 7-8: 344-350.

(19) **Hering E, Pritsker I, Gonchar L, Pillar G.** Obesity in children is associated with increased health care use. Clin Pediatr (Phila). 2009 Oct; 48: 812-8. doi:10.1177/0009922809336072

(20) **Kesztyüs D, Kettner S, Kobel S, Fischbach N, Schreiber A, Kilian R, Steinacker JM.** Lebensqualität und Erkrankungshäufigkeit bei Grundschulkindern in Korrelation mit Bewegung und Medienkonsum. Dtsch Z Sportmed. 2013; 64: 293-300. doi:10.5960/dzsm.2012.074

(21) **Kesztyüs D, Schreiber A, Kobel S, Wartha O, Kesztyüs T, Kilian R, Steinacker JM; Study group "Join the Healthy Boat – Primary School".** Illness and determinants of health-related quality of life in a cross-sectional sample of schoolchildren in different weight categories. Ger Med Sci. 2014; 12: Doc04. doi:10.3205/000189

(22) **Kesztyüs D, Wirt T, Kobel S, Schreiber A, Kettner S, Dreyhaupt J, Kilian R, Steinacker JM; "Komm mit in das gesunde Boot - Grundschule" - Research Group.** Is central obesity associated with poorer health and health-related quality of life in primary school children? Cross-sectional results from the Baden-Württemberg Study. BMC Public Health. 2013; 13: 260. doi:10.1186/1471-2458-13-260

(23) **Kobel S, Kirsten J, Kelso A.** Anthropometry – assessment of body composition. Dtsch Z Sportmed. 2022; 73: 106-111. doi:10.5960/dzsm.2022.527

(24) **Kobel S, Wartha O, Lämmle C, Dreyhaupt J, Steinacker JM.** Intervention effects of a kindergarten-based health promotion programme on obesity related behavioural outcomes and BMI percentiles, Preventive medicine reports. 2019; 15: 100931. doi:10.3389/fpubh.2020.00219

(25) **Kobel S, Wartha O, Wirt T, Dreyhaupt J, Lämmle C, Friedemann E-M, Kelso A, Kutzner C, Hermeling L, Steinacker JM.** Design, Implementation, and Study Protocol of a Kindergarten-Based Health Promotion Intervention. BioMed research international. 2017; 4347675. doi:10.1155/2017/4347675

(26) **Kromeyer-Hauschild K, Wabitsch M, Kunze D, Geller F, Geiß HC, Hesse V, von Hippel A, Jaeger U, Johnsen D, Korte W, Menner K, Müller G, Müller JM, Niemann-Pilatus A, Remer T, Schaefer F, Wittchen HU, Zabransky S, Zellner K, Ziegler A, Hebebrand J.** Perzentile für den Body-mass-Index für das Kindes- und Jugendalter unter Heranziehung verschiedener deutscher Stichproben. Monatsschr Kinderheilkd. 2001; 149: 807-818. doi=10.1007/s001120170107

(27) **Kuhl ES, Rausch JR, Varni JW, Stark LJ.** Impaired health-related quality of life in preschoolers with obesity. J Pediatr Psychol. 2012; 37: 1148-56. doi: 10.1093/jpepsy/jss090

(28) **Kurth, B.**M., Schaffrath, Rosario A. Übergewicht und Adipositas bei Kindern und Jugendlichen in Deutschland [Overweight and obesity in children and adolescents in Germany]. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz. 2010; 53: 643-652. doi:10.1007/s00103-010-1083-2

(29) **Lampert T, Prütz F, Rommel A, Kuntz B.** Soziale Unterschiede in der Inanspruchnahme medizinischer Leistungen von Kindern und Jugendlichen in Deutschland – Querschnittergebnisse aus KiGGS Welle 2. Journal of Health Monitoring. 2018; 3: 38-53.

(30) **Langford R, Bonell CP, Jones HE, Pouliou T, Murphy SM, Waters E, Komro KA, Gibbs LF, Magnus D, Campbell R.** The WHO Health Promoting School framework for improving the health and well-being of students and their academic achievement. Cochrane Database Syst Rev. 2014; 4: CD008958. doi:10.1002/14651858.CD008958.pub2

(31) **Leech RM, McNaughton SA, Timperio A.** The clustering of diet, physical activity and sedentary behavior in children and adolescents: a review. International of Behavioral Nutrition and Physical Activity. 2014; 11: 4. doi:10.1186/1479-5868-11-4

(32) **Park MH, Falconer C, Viner RM, Kinra S.** The impact of childhood obesity on morbidity and mortality in adulthood: a systematic review. Obes Rev. 2012; 13: 985-1000. doi:10.1111/j.1467-789X.2012.01015.x

(33) **Poethko-Müller C, Kuntz B, Lampert T, Neuhauser H.** Die allgemeine Gesundheit von Kindern und Jugendlichen in Deutschland – Querschnittergebnisse aus KiGGS Welle 2 und Trends. Journal of Health Monitoring. 2018; 3: 8-15. doi:10.17886/RKI GBE 2018 075

(34) Proper KI, van den Heuvel SG, De Vroome EM, Hildebrandt VH, Van der Beek AJ. Dose-response relation between physical activity and sick leave. Br J Sports Med. 2006; 40: 173-8. doi:10.1136/bjsm.2005.022327

(35) Pulgarón ER. Childhood obesity: a review of increased risk for physical and psychological comorbidities. Clin Ther. 2013; 35: A18-32. doi:10.1016/j.clinthera.2012.12.014

(36) Ravens-Sieberer U, Bullinger M. Assessing health related quality of life in chronically ill children with the German KINDL: first psychometric and content analytical results. Quality of Life Research. 1998; 7: 399-407. doi:10.1023/A: 1008853819715

(37) Ravens-Sieberer, U. Verfahren zur Erfassung der gesundheitsbezogenen Lebensqualität bei Kindern und Jugendlichen, Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz. 2000; 43: 198-209.

(38) Ravens-Sieberer U, Ellert U, Erhart M. Gesundheitsbezogene Lebensqualität von Kindern und Jugendlichen in Deutschland. Eine Normstichprobe für Deutschland aus dem Kinder- und Jugendgesundheitssurvey (KIGGS), Bundesgesundheitsblatt - Gesundheitsforschung – Gesundheitsschutz. 2007; 50: 810-818.

(39) Schienkiewitz A, Damerow S, Mauz E, Vogelgesang F, Kuhnert R, Schaffrath Rosario A. Entwicklung von Übergewicht und Adipositas bei Kindern – Ergebnisse der KiGGS-Kohorte. Journal of Health Monitoring. 2018; 3: 76-81.

(40) Seeling S, Prütz F, Gutsche J. Inanspruchnahme pädiatrischer und allgemeinmedizinischer Leistungen durch Kinder und Jugendliche in Deutschland – Querschnittergebnisse aus KiGGS Welle 2 und Trends. Journal of Health Monitoring. 2018; 3: 57-67.

(41) Simmonds M, Llewellyn A, Owen CG, Woolacott N. Predicting adult obesity from childhood obesity: a systematic review and meta-analysis. Obesity. 2016; 17: 95-107. doi:10.1111/obr.12334

(42) Stewart A, Marfell-Jones M, Olds T, de Ridder H. International Standards for Anthropometric Assessment. ISAK, Lower Hutt, New Zealand, 2011.

(43) Stiglic N, Viner RM. Effects of screen time on the health and well-being of children and adolescents: a systematic review of reviews, BMJ open. 2019; 9: e023191. doi:10.1136/bmjopen-2018-023191

(44) Timmons BW, Leblanc AG, Carson V, Connor Gorber S, Dillman C, Janssen I, Kho ME, Spence JC, Stearns JA, Tremblay MS. Systematic review of physical activity and health in the early years (aged 0-4 years). Appl Physiol Nutr Metab. 2012; 37: 773-92. doi:10.1139/h2012-070

(45) Trasande L, Chatterjee S. The impact of obesity on health service utilization and costs in childhood. Obesity (Silver Spring). 2009; 17: 1749-1754. doi:10.1038/oby.2009.67

(46) Ul-Haq Z, Mackay DF, Fenwick E, Pell JP. Meta-analysis of the association between body mass index and health-related quality of life among children and adolescents, assessed using the pediatric quality of life inventory index. J Pediatr. 2013; 162: 280-286.e1. doi:10.1016/j.jpeds.2012.07.049

(47) Vella SA, Cliff DP, Magee CA, Okely AD. Sports participation and parent-reported health-related quality of life in children: longitudinal associations. J Pediatr. 2014; 164: 1469-1474. doi:10.1016/j.jpeds.2014.01.071

(48) Wake M, Hardy P, Sawyer MG, Carlin JB. Comorbidities of overweight/obesity in Australian preschoolers: a cross-sectional population study. Arch Dis Child. 2008; 93: 502-507. doi:10.1136/adc.2007.128116

(49) Wartha O, Kobel S, Lämmle O, Mosler S, Steinacker JM. Entwicklung eines settingspezifischen Gesundheitsförderprogramms durch die Verwendung des Intervention-Mapping-Ansatzes: „Komm mit in das gesunde Boot – Kindergarten. Prävention und Gesundheitsförderung. 2016; 11: 65-72. doi:10.1007/s11553-016-0531-8

(50) Wasserstein RL, Schirm AL, Lazar NA. Moving to a World Beyond "p < 0.05". The American Statistician. 2019; 73: 1-19. doi:10.1080/00031305.2019.1583913

(51) Brown T, Moore TH, Hooper L, Gao Y, Zayegh A, Ijaz S, Elwenspoek M, Foxen SC, Magee L, O'Malley C, Waters E, Summerbell CD. Interventions for preventing obesity in children. Cochrane Database Syst Rev. 2019; 7: CD001871. doi:10.1002/14651858.CD001871.pub4

(52) WHO. Health topics - Non-communicable diseases - Obesity, https://www.who.int/health-topics/noncommunicable-diseases#tab=tab_1 (1 June 2023).

(53) Wijga AH, Scholtens S, Bemelmans WJ, de Jongste JC, Kerkhof M, Schipper M, Sanders EA, Gerritsen J, Brunekreef B, Smit HA. Comorbidities of obesity in school children: a cross-sectional study in the PIAMA birth cohort. BMC Public Health. 2010; 10: 184. doi:10.1186/1471-2458-10-184

(54) Winkler J, Stolzenberg H. Der Sozialschichtindex im Bundes-Gesundheitssurvey Gesundheitswesen. 1999; 61: 178-183.

(55) Wu XY, Han LH, Zhang JH, Luo S, Hu JW, Sun K. The influence of physical activity, sedentary behavior on health-related quality of life among the general population of children and adolescents: A systematic review. PLoS One. 2017; 12: e0187668. doi:10.1371/journal.pone.0187668

(56) Wu XY, Zhuang LH, Li W, Guo HW, Zhang JH, Zhao YK, Hu JW, Gao QQ, Luo S, Ohinmaa A, Veugelers PJ. The influence of diet quality and dietary behavior on health-related quality of life in the general population of children and adolescents: a systematic review and meta-analysis. Qual Life Res. 2019; 28: 1989-2015. doi:10.1007/s11136-019-02162-4