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Children's enjoyment of physical activity and QOL

Is there a relationship between primary school children's enjoyment of recess physical activities and health-related quality of life? A cross-sectional exploratory study

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Issue addressed: An important strategy for increasing children's physical activity is to enhance children's opportunities for school recess physical activities, yet little is known about the influence of school recess physical activities on children's health-related quality of life (HRQOL). The purpose of the present study was to explore the relationship between Australian primary school children's enjoyment of recess physical activities and HRQOL.

Methods: The study consisted of children at two Australian primary schools ($n = 105$) aged 8–12 years. The Lunchtime Enjoyment Activity and Play questionnaire was used to measure school children's enjoyment of school recess physical activities. The Paediatric Quality of Life Inventory 4.0 was used to measure children's HRQOL. Researchers applied linear regression modelling in STATA (ver. 13.0) to investigate the relationship between children's enjoyment of school recess physical activities and HRQOL.

Results: It was discovered that primary school children's enjoyment of more vigorous-type school recess physical activities and playing in a range of weather conditions was associated with children's improved HRQOL.

Conclusion: The findings from this study suggest that health providers and researchers should consider providing primary school children with opportunities and facilities for more vigorous-intensity school recess physical activities as a key strategy to enhance children's HRQOL.

So what?

Key words: school environments.

[Brief summary]

Introduction

There is ample evidence demonstrating the detrimental health effects on children of insufficient physical activity.¹ Evidence suggests recess breaks (both morning recess and lunchtime recess) may provide the greatest opportunities for children's physical activity participation at school.² The length of recess breaks varies widely across countries, from 20 min per day to 60 min per day.³ Children may engage in up to 600 school recess breaks per year, offering significant opportunities for children to be physically active.⁴ The few studies that have examined the contribution of recess physical activity to children's overall physical activity levels have revealed recess contributed to 17.9% for boys and 15.5% for girls of daily moderate to vigorous physical activity (MVPA),⁵ up to 44% of school day step counts⁶ and children spend between 63% (girls) and 78% (boys) of recess time engaged in physical activity.⁷ Knowledge and awareness of the outcomes of physical activity during school recess breaks are vital.⁸ Physical activities during recess breaks can also develop children's communication skills, including negotiation, sharing, co-operation and problem solving.³ Within a school day, unstructured physical activity during school recess is one of the most valuable opportunities to address children's key growth and developmental requirements.^{3,9}

Recent research has examined the influence of enjoyment of physical activities on children's physical activity participation.¹⁰ The connection between enjoyment and physical activities can be explained by the self-determination theory (SDT) which outlines that if behaviour is motivated by internal influences (e.g. the enjoyment of learning physical skills), participation is more likely to be sustained than when motivated via extrinsic factors (e.g. receiving recognition, praise and comparative achievements).¹¹ Enjoyment of physical activities has been demonstrated to be positively associated with children's motivation for involvement and continued participation in sport¹² and physical activity.^{10,13,14} However, there is a paucity of health promotion practice literature investigating whether children's enjoyment of school recess physical activities can predict health-related quality of life (HRQOL). With so many recess physical activity experiences encountered by children from day to day,¹⁵ investigating psychosocial influences such as enjoyment is important to enable the assessment of how to improve HRQOL among children.

The World Health Organization defines quality of life (QOL) as an 'individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns.'¹⁶ Although there are other domains of QOL that include jobs, housing, culture and neighbourhood, HRQOL has become a vitally important domain in public health promotion practice.¹⁶ The measurement of HRQOL can help identify challenges in the preventing disability, injury and disease, by ensuring information around health risk factors (e.g. physical inactivity) that can influence

HRQOL is widely available.¹⁷ Understanding and analysing HRQOL data can also ensure that policies, plans and intervention strategies can be developed to help those most at risk of poor health.¹⁷ Self-reporting health has been established as a powerful predictor of both mortality and morbidity compared with many objective health measures.¹⁷

The promotion of children's HRQOL is a significant challenge for school health providers.¹⁸ Evaluating school-age children's HRQOL can provide understanding of children's self-reported physical, psychosocial and overall well being.¹⁸ Physically active children's HRQOL has been shown to be significantly higher than less active children in the areas of satisfaction, comfort, resilience and achievement.¹⁹ There has been little research examining the relationship between children's physical activity influences and HRQOL.²⁰ The link between physical activity and HRQOL has been identified among Japanese children²⁰ revealing that children were more likely to possess higher HRQOL if they were participating in greater amounts of physical activity.²¹ Additionally, meeting recommended levels of physical activity has also been established to be positively associated with children's perceptions of their physical, psychosocial and overall HRQOL compared with those that did not meet physical activity guidelines.²⁰ Investigation of the relationship between children's enjoyment of school recess physical activities and HRQOL in children is warranted.

HRQOL and overall well being in childhood may be greatly influenced by recess physical activities.³ Researchers have highlighted the importance of school recess physical activities for children's HRQOL, calling for schools to use alternatives to withdrawing children from recess as a discipline strategy and integrate the HRQOL benefits of recess into the curriculum,²² as well as maintaining recess length and quality of school equipment.^{23,24} Reducing opportunities for children's recess physical activities could have a negative impact on children's HRQOL,^{24,25} providing a significant challenge for school health providers.¹⁶ Understanding the link between children's enjoyment of school recess physical activities and HRQOL has the potential to inform health promotion practitioners of the types of school activities and settings that could improve children's contentment with their emotional, social, school and physical functioning.

We are not aware of any previous health promotion research that has explored whether children's enjoyment of school recess physical activities can predict children's HRQOL. The aim of this cross-sectional study was to explore whether there is a relationship between children's enjoyment of school recess physical activities and HRQOL in children aged 8–12 years old.

Method

Design and procedures

The principals of two Catholic coeducational primary schools in western Victoria, Australia, were approached by researchers during term 1, 2010 (autumn). Primary school children (grade levels 3–6) were invited to participate in the enjoyment and HRQOL study via a letter and consent form distributed in March, 2010. Grade levels 3–6 were invited to participate, as children over 8 years are more capable of accurately and reliably self-reporting their own health behaviour.²⁶

All children interested in participating were instructed to provide consent (both parental and personal) and return their consent forms to the general office of their school and attend the scheduled questionnaire session. During this study, a total of 105 children from the two schools aged 8–12 years (60% female, 40% male) returned consent forms by the due date (Grade 3 $n = 28$; Grade 4 $n = 32$; Grade 5 $n = 19$; Grade 6 $n = 26$).

Ethical approval for the study was obtained from the University of XXXX Human Research Ethics Committee, the regional Catholic diocese and permission was gained from the two school principals.

Enjoyment of school recess physical activities

The Lunchtime Enjoyment of Activity and Play (LEAP) questionnaire was used to measure children's enjoyment of school recess physical activities.²⁷ The LEAP questionnaire is a reliable, context-specific questionnaire consisting of 39 items, categorised by social-ecological model levels (intrapersonal, interpersonal, physical environment, policy) to identify the broader influences on children's enjoyment of school physical activities.²⁷ The social-ecological model emphasises a 'person–environment' fit, implying that there is an association between each level of influence within an environment.²⁸ The multilevel model used within the LEAP questionnaire is important for health promotion practitioners to gain insight into the influences on children's health behaviour.²⁸

The intrapersonal component includes six categories (20 items) examining children's enjoyment of activity during school breaks (including items separately examining children's enjoyment of both morning recess and lunchtime recess activities), basic locomotion, imaginative play, play-based movements, play variations, and sedentary behaviour. The interpersonal component consists of one category (two items) examining children's enjoyment of social play. The physical environment and policy and organisation component includes five categories (17 items) examining children's enjoyment of climatic conditions (warm and cool), man-made items, natural items, play area size, and play within sheltered areas.²⁷ All enjoyment items are rated on a five-point Likert scale (1 = very unhappy; 2 =

unhappy; 3 = not sure; 4 = happy; 5 = very happy).²⁷ A score was computed by calculating the average of each social-ecological model enjoyment category and items.

Enjoyment of physical activity

The Physical Activity Children's Enjoyment Scale (PACES) was used to determine children's general enjoyment of physical activity at the intrapersonal level. The revised PACES is reliable¹³ and comprehensive²⁹ for school-aged children aged ≥ 8 years. It consists of a 16-statement scale starting with the question stem 'When I am physically active...' with a five-point Likert scale (1 = disagree a lot; 2 = disagree; 3 = no opinion; 4 = agree; 5 = agree a lot). Statement scale items include 'I enjoy it' and 'It gives me energy.' A score was computed by calculating the mean of the 16 items.¹³

HRQOL

The Paediatric QOL Inventory 4.0, a 23-item, validated questionnaire was used to measure the HRQOL.¹⁸ The Paediatric QOL Inventory 4.0 has been established as reliable for use with school children as young as 8 years old.¹⁸ The questionnaire uses a five-point Likert scale (0 = never; 1 = almost never; 2 = sometimes; 3 = almost always; 4 = always), with items then converted to a score out of 100 (0 = 100; 1 = 75; 2 = 50; 3 = 25; 4 = 0) with a higher score indicating a higher HRQOL. A mean score is calculated for the four HRQOL health functioning scales (physical functioning, emotional functioning, social functioning and school health functioning).¹⁸

Statistical analyses

The Statistical Package for Social Sciences (SPSS ver. 22) and STATA (ver. 13) were used to analyse the data. Linear regression modelling was used to determine the significant LEAP questionnaire and PACES categories and items as predictors of physical, social, emotional and school HRQOL (taking into account age, sex and school). Due to the number of models being tested, a stringent level of statistical significance was set at $P < 0.01$ for the findings of the study. Linear regression values at the $P < 0.05$ level are also displayed to demonstrate which enjoyment variables are approaching statistical significance as predictors of HRQOL (Table 1 and 2).

Results

On average, children recorded a higher physical HRQOL score (mean = 82.0, s.d. = 16.4) than social HRQOL (mean = 76.9, s.d. = 20.3), emotional HRQOL (mean = 74.8, s.d. = 23.1) and school HRQOL (mean = 71.8, s.d. = 18.9) functioning scores. Sex and age were not significant confounders of HRQOL, whereas school attended was a significant confounder of physical and emotional HRQOL scores.

Intrapersonal variables

The enjoyment category 'school break activities' was a significant predictor of physical ($P = 0.005$), social ($P = 0.006$) and school ($P = 0.003$) HRQOL (Table 1). Children's enjoyment of 'general physical activity' (measured via PACES) was also a significant predictor of physical ($P = 0.001$), emotional ($P = 0.003$), social ($P = 0.004$) and school ($P = 0.003$) HRQOL (Table 1). For example, for each average increase in one unit or category of children's enjoyment of general physical activity, a child had a physical HRQOL score which was 12.02 units higher (Table 1).

Examining the individual LEAP questionnaire items within the 'school break activities' enjoyment category showed that 'being active' was a significant predictor of physical ($P = 0.007$), emotional ($P = 0.006$) and social ($P = 0.005$) HRQOL, whereas 'playing at morning recess' was a significant predictor of social ($P < 0.001$) and school ($P = 0.010$) HRQOL. Enjoyment of 'playing at lunchtime recess' was a significant predictor of school HRQOL ($P = 0.009$; Table 2). Children's enjoyment of 'playground activities' was not a significant predictor of children's HRQOL (all health scales $P > 0.01$).

The enjoyment category 'basic locomotion' was a significant predictor of physical ($P = 0.002$) HRQOL (Table 1). When examining the individual LEAP questionnaire items within the 'basic locomotion' enjoyment category, children's enjoyment of 'walking' was not a significant predictor of HRQOL (all $P > 0.01$), whereas children's enjoyment of 'jogging' ($P = 0.002$) and 'running/sprinting' ($P < 0.001$) were significant predictors of physical HRQOL (Table 2). The enjoyment category 'play-based movements' was a significant predictor of physical ($P = 0.009$) HRQOL (Table 1). When examining the individual LEAP questionnaire items within the 'play-based movements' enjoyment category, children's enjoyment of 'jumping' and 'lifting/pushing' were significant predictors of physical ($P = 0.003$ $P < 0.001$) and emotional ($P = 0.005$, $P = 0.004$) HRQOL (Table 2).

The enjoyment categories 'imaginative play' and 'sedentary behaviour' were not significant predictors of physical, emotional, social or school HRQOL (all $P > 0.01$; Table 1).

Interpersonal variables

The enjoyment category of 'social play' was not a significant predictor of physical, emotional, social or school HRQOL (all $P > 0.01$; Table 1).

Physical environment and policy variables

The enjoyment category 'cool conditions' was a significant predictor of physical ($P = 0.009$) and school ($P < 0.001$) HRQOL (Table 1). The enjoyment category of 'man-made items' was a significant predictor of physical ($P = 0.001$) HRQOL (Table 1). When examining the individual LEAP questionnaire items within the 'man-made items' enjoyment

category, enjoyment of 'playing with sporting equipment' was a significant predictor of physical ($P = 0.007$) and school ($P = <0.001$) HRQOL, 'using sports equipment' was a significant predictor of physical ($P = 0.005$), emotional ($P = 0.004$) and social ($P < 0.001$) HRQOL, and 'playing on hard surfaces' was a significant predictor of physical ($P < 0.001$), emotional ($P = 0.002$), social ($P = 0.003$) and school ($P = 0.009$) HRQOL respectively (Table 2).

Within the 'natural items' enjoyment category, children's enjoyment of playing on 'grassy areas' was a significant predictor for social HRQOL ($P = 0.004$), whereas children's enjoyment of other natural materials such as 'trees, rocks and gardens' during recess physical activities was not a significant predictor for physical, emotional, social or school HRQOL (all $P > 0.01$).

The enjoyment category 'warm conditions' was a significant predictor of physical, emotional, social and school HRQOL ($P < 0.001$; Table 1). The individual items within the 'warm conditions' category of 'playing when it's hot' ($P = 0.004$, $P < 0.001$) were significant predictors of physical and school HRQOL respectively, and 'playing in the sun at lunchtime' ($P < 0.001$, $P < 0.001$, $P < 0.001$, $P = 0.003$) were significant predictors of physical, emotional, social and school HRQOL respectively (Table 2). The enjoyment categories 'play within sheltered areas' and 'play variation' were not significant predictors of physical, emotional, social or school HRQOL (all $P > 0.01$).

The enjoyment category 'play area size' was not a significant predictor of HRQOL (all $P > 0.0$; Table 1).

Discussion

The present study provides greater understanding of the relationship between Australian primary school children's enjoyment of school recess physical activities and HRQOL, which can be used by health providers to inform school-based interventions and planning. The social-ecological model was used to understand the multiple levels of influence of different aspects of children's enjoyment of school recess physical activities,²⁸ categorised by the LEAP questionnaire.²⁷ There have been few investigations using questionnaires applying a social-ecological model framework in youth related to school recess physical activities.^{27,30} moreover, the types of school recess physical activities that children enjoy that can predict HRQOL can influence health promotion practices and philosophies regarding supervision during school recess periods. Supervision can be seen as an opportunity to encourage recess physical activities, rather than perceiving supervision as a passive experience.³¹

Children's enjoyment of intrapersonal (individual) recess physical activity variables predicted all aspects of HRQOL functioning (emotional, social, physical, school) that

included general enjoyment of physical activity (via PACES, all HRQOL), school break activities (physical, social and school HRQOL), basic locomotion (physical HRQOL) and play-based movements (physical HRQOL). The finding suggests that providing school recess breaks for the children to escape from classroom regimes and engage in physical activities could be vital for all aspects of children's HRQOL. In contrast to children's enjoyment of generally being active during morning recess, children's enjoyment of being active at lunchtime recess was a key predictor of school health only. Previous research has identified that children's enjoyment of morning recess physical activities can be different to enjoyment of lunchtime recess physical activities and is an area warranting further investigation.²⁷ Interestingly, children's enjoyment of playground equipment physical activities (within the school break activities category) was not a significant predictor of any HRQOL scales. The lack of significance identified could suggest that children could become bored of equipment and play areas, as children are generally unable to move, manipulate and create activities with the many types of fixed playground equipment within contemporary school settings.³⁰

The LEAP questionnaire categories of imaginative play and sedentary behaviour were not significant predictors of all HRQOL scales. The lack of association between the categories and HRQOL could be due to such recess physical activities being less vigorous in nature (i.e. imaginative play = creating or making things; play-based movements = sliding, hiding; sedentary behaviour = sitting or standing). Supporting this suggestion, children's enjoyment of more vigorous-intensity recess physical activities such as jogging, running, sprinting, lifting and jumping were predictors for both physical and emotional HRQOL scale functioning. Children's participation in MVPA (e.g. jogging, running) has been associated with improved HRQOL outcomes in children²⁰ and is vital for the prevention of chronic diseases.³² Australian national physical activity guidelines recommend children engage in 1 hour of daily MPVA.³² Therefore, intervening within school settings with strategies to encourage MVPA could lead to improved physical HRQOL in children.

When examining the interpersonal (social) play variables, there was no significant prediction of HRQOL. However, due to the unpredictable and unstable nature of children's social relationships,³³ there are only two social enjoyment items within the LEAP questionnaire. Lower reliability of interpersonal items within the LEAP questionnaire have previously been reported²⁷ and could be a key factor in children's enjoyment of social play not being a significant predictor of social HRQOL. Children's social well being can be influenced by several variables including level of peer acceptance, victimisation, and popularity.³³ More reliable interpersonal variables may need to be researched and identified to ensure more social items are added to the LEAP Questionnaire.¹⁰

Within the physical environment and policy variables of the social-ecological model, a combination of children's enjoyment of man-made items during school recess physical activities such as sporting equipment (physical and school HRQOL), hard surfaces (all HRQOL) and using sports equipment (physical, emotional and social HRQOL) were predictors across all scales of primary school children's HRQOL. Competitive-type activities that involve sporting equipment on hard surfaces are often associated with more vigorous-intensity physical activities³⁴ and as stated earlier, more vigorous-intensity physical activity is important for children's well being.²⁰ In contrast to sports equipment, children's enjoyment of using playground equipment and quantity of play items was not a significant predictor of HRQOL. Despite fixed playground equipment not being entirely conducive for vigorous jogging and running-based physical activities,³⁰ it is possible that equipment such as monkey bars and climbing structures could facilitate muscular, power strength, endurance, balance and skill development to enhance children's physical functioning.

Within the enjoyment category 'natural items', children's enjoyment of grassy areas was a significant predictor of social health, yet children's enjoyment of trees, rocks and gardens was not a significant predictor of any HRQOL scales. The significant association identified for children's enjoyment of grassy areas indicates that children could be perceiving the function of a grass oval (e.g. vigorous sporting activities) differently to other natural features such as trees, rocks, and gardens (e.g. imaginative play). As children can perceive the functions of natural environmental features differently, the internal reliability of the LEAP category 'natural items' needs to be interpreted with caution.²⁷ Additionally, a significant association was identified for children's enjoyment of the size of the play areas (social HRQOL). The significant link between children's enjoyment of play area size and social HRQOL is supported by previous research revealing that smaller sized school areas can ensure greater interactions between peers and larger sized school areas can ensure reduced collisions and room for group and team activities.³⁵

Children's enjoyment of both 'warm conditions' (all HRQOL) and 'cool conditions' (physical and social HRQOL) were key predictors across the HRQOL scales. This finding is similar to a that of a previous study that suggested children can possess high enjoyment of active lunchtime play across multiple days, despite cold and wintry conditions.¹⁵ Studies suggest that higher temperatures are associated with increased enjoyment of recess physical activities³⁷ and that rainfall can be a negative influence on children's recess physical activities.³⁸ However, very high temperatures can also have negative effects on children's recess physical activities via heat stress.³⁹ In the present study, children's enjoyment of warm conditions was a significant predictor of emotional and social functioning, yet there was no such significant emotional and social association for children's enjoyment of cool conditions.

Interestingly, children's enjoyment of recess physical activity within sheltered areas was not a significant predictor of any HRQOL scale and supports the findings that children's exposure to and enjoyment of a range of weather conditions (e.g. heat, cold) can positively contribute to a variety of HRQOL functioning dimensions.

Valid and reliable measurement tools are essential to measure the health of children within different populations¹⁰ and the assessment of children's enjoyment of recess physical activities and HRQOL using established self-reporting instruments for children are strengths of the present study. Additionally, the present study is the first to examine the relationship between school recess physical activities and HRQOL outcomes. Many studies have measured children's enjoyment of physical activity participation using single-item measures or scales not validated in the childhood age group,¹³ yet there is little research describing the use of multi-item scales to measure children's enjoyment of physical activities.¹³

Limitations of the present study include the small sample size and little demographic information collected about participants other than age and sex. Additionally, as the study was of cross-sectional design undertaken at two Australian primary schools, any generalising of the findings should be done with caution. It should be noted that although face validity and reliability for the majority of the categories and items have been established for the LEAP questionnaire, additional use of the questionnaire will provide further psychometric evidence of its usefulness as a research tool. Measuring or auditing children's actual physical activity during school recess could also have captured more information about whether participation in recess physical activities was also a predictor of HRQOL. Nonetheless, this study uniquely fills a gap in the international literature by exploring whether children's enjoyment of school recess physical activities can predict children's HRQOL. Findings from the present study may influence health promotion practitioners to perceive recess break activities as an opportunity to facilitate children's enjoyment, rather than viewing such periods as having little impact on children's HRQOL.

Conclusion

Children's enjoyment of school recess physical activities can be a significant predictor of HRQOL among school children. We discovered that a variety of children's HRQOL functioning was associated with children's enjoyment of more vigorous-type school recess physical activities including higher intensity locomotor activities such as jogging and running (physical HRQOL), specific play-based movement (e.g. jumping, lifting and pushing; physical and emotional HRQOL), use of sporting equipment (physical HRQOL) and playing on hard surfaced areas (all HRQOL functioning). In contrast, children's enjoyment of school recess physical activities that were less vigorous, such as imaginative play, play-based

movements (e.g. hiding, sliding), lower intensity locomotor activities (e.g. walking) and sedentary behaviour (e.g. sitting, standing) were not significant predictors of children's HRQOL. The findings also revealed that children's enjoyment of playing outside in a range of warm (all HRQOL) and cold weather conditions (physical and school HRQOL) can predict HRQOL, whereas children's enjoyment of play in sheltered areas had no significant association. Considering a social-ecological model framework of the key predictors of children's enjoyment of school recess physical activities may provide valuable insight for school health providers into the multiple levels of influence on children's HRQOL when developing school settings and activities for school recess.

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Table 1. Linear regression of Lunchtime Enjoyment of Activity and Play (LEAP) questionnaire and Physical Activity Children's Enjoyment Scale (PACES) categories as predictors of health-related quality of life (HRQOL)

All models control for age, gender and school. * $P < 0.05$; ** $P < 0.01$; ns = not statistically significant ($P > 0.05$); CI = confidence interval

LEAP and PACES enjoyment categories	Physical health ^A	Emotional health ^A	Social health ^A	School health ^A
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Intrapersonal variables				
Physical activity enjoyment (PACES)	12.02 (6.42, 17.67)**	13.12 (4.69, 21.57)**	11.41 (3.67,19.15)**	11.12 (3.98, 18.27)**
School break activity	9.20 (2.87,15.54)**	10.57 (1.23,19.91)*	12.00 (3.59,20.41)**	11.89 (4.15,19.65)**
Basic locomotion	6.32 (2.39,10.25)**	7.17 (1.35,12.98)*	6.69 (1.39,11.99)*	5.50 (0.55,10.44)*
Imaginative play	ns	ns	ns	ns
Play-based movements	6.23 (1.60,10.85)**	8.21 (1.45,14.97)*	ns	6.50 (0.76,12.23)*
Sedentary behaviour	ns	ns	ns	ns
Interpersonal variables				
Social play	ns	ns	ns	ns
Physical environment/policy variables				
Cool conditions	2.99 (0.76,5.24)**	3.62 (0.32,6.91)*	ns	5.87 (3.27,8.47)**
Man-made items	9.22 (4.02,14.42)**	9.93 (2.18,17.69)*	7.78 (0.64,14.91)*	8.61 (2.06,15.16)*
Natural items	3.64 (0.21,7.10)*	5.37 (0.39,10.35)*	4.77 (0.22,9.33)*	3.64 (0.21,7.08)*
Play area size	ns	4.74 (0.19,9.30)*	4.92 (0.78,9.05)*	4.39 (0.55,8.23)*
Play within sheltered areas	ns	ns	ns	ns
Warm conditions	5.50 (2.51,8.49)**	8.08 (3.75,12.41)**	9.91 (6.18,13.64)**	7.14 (3.49,10.78)**

^AHRQOL categories within the Paediatric Quality of Life Inventory 4.0.¹⁸

Table 2. Linear regression of children's enjoyment of school recess physical activities as predictors of health-related quality of life (HRQOL)

All models control for age, gender and school. * $P < 0.05$; ** $P < 0.01$; ns = $P > 0.05$; LEAP = Lunchtime Enjoyment of Activity and Play; CI, confidence interval

LEAP questionnaire items	Physical health ^A β (95% CI)	Emotional health ^A β (95% CI)	Social health ^A β (95% CI)	School health ^A β (95% CI)
School break activity				
Being active	7.39 (2.61,12.67)**	10.93 (3.28,18.57)**	10.18 (3.21,17.15)**	6.76 (0.17,13.35)*
Playing at lunchtime recess	ns	ns	8.56 (1.15,15.97)*	9.18 (2.38,15.99)**
Playing at morning recess	6.19 (10.42,11.96)*	10.16 (1.83,18.48)**	15.09 (7.87,22.31)**	9.30 (2.30,16.31)*
Basic locomotion				
Walking	ns	ns	ns	ns
Jogging	5.21 (2.03,8.39)**	5.67 (0.95,10.40)*	4.99 (0.67,9.31)*	4.21 (0.18,8.23)*
Running/sprinting	6.54 (3.23,9.85)**	ns	5.51 (0.93,10.10)*	ns
Play based movements				
Jumping	4.32 (1.55,7.10)**	5.82 (1.76,9.87)**	4.32 (0.58,8.07)*	ns
Lifting/pushing	4.80 (2.35,7.25)**	5.49 (1.83,9.15)**	4.16 (0.77,7.54)*	7.52 (4.66,10.38)**
Man-made items				
Playing with sporting equipment	4.17 (1.17,7.16)**	4.64 (0.22,9.05)*	4.24 (0.21,8.27)*	7.73 (4.23,11.22)**
Playing on hard surfaces	5.47 (2.60,8.33)**	6.84 (2.61,11.07)**	6.01 (2.13,9.88)**	4.85 (1.22,8.49)**
More man-made play items	3.99 (0.76,7.23)*	ns	5.00 (0.70,9.33)*	ns
Using sports equipment	5.54 (1.70,9.37)**	8.33 (2.78,13.87)**	13.65 (9.11,18.18)**	5.19 (0.40,9.97)*
Natural items				
Playing on grassy areas	ns	4.94 (0.26,9.61)*	6.18 (2.00,10.36)**	4.33 (0.39,8.26)*
Play area size				
The amount of things within your school play area	ns	4.92 (0.71,9.13)*	ns	4.55 (1.01,8.10)*
The size of your school play area	ns	ns	7.84 (1.25,14.44)**	ns
Warm conditions				
Playing when it's hot	3.44 (1.13,5.75)**	3.76 (0.34,7.18)*	6.76 (3.90,9.62)**	4.91 (2.12,7.71)**
Playing in the sun	5.00 (2.11,7.89)**	9.37 (5.37,13.37)**	8.00 (4.28,11.372)**	5.52 (1.93,9.12)**

^AHRQOL categories within the Paediatric Quality of Life Inventory 4.0¹⁸