Post-print version of the paper by Ringdal et al. in Scandinavian Journal of Public Health, 2018; 46(Suppl 21): 68–73. http://dx.doi.org/10.1016/j.ijimpeng.2015.11.017

Quality of Life in Elementary School Children: The Health Oriented Pedagogical Project (HOPP)

Kristen Ringdal[1], Gerd Inger Ringdal[2], Helene Kristin Olsen[3], Asgeir Mamen[3], Per Morten Fredriksen[3]

[1] Department of Sociology and Political Science, Norwegian University of Science and Technology (NTNU), Trondheim, Norway

[2] Department of Psychology, Norwegian University of Science and Technology (NTNU), Trondheim, Norway

[3] Kristiania University College - Department of Health Sciences, Oslo, Norway.

Correspondence: Kristen Ringdal, Department of Sociology and Political Science, Norwegian University of Science and Technology (NTNU), Trondheim, Norway (NTNU), NO 7491, Trondheim, Norway, Tel: (+47) 92214242, e-mail: kristen.ringdal@ntnu.no

Abstract

Aims The primary aim of the present study was to evaluate the associations between parents' level of education and measurements of physical attributes, and quality of life in a general sample of elementary school children.

Methods: The children's and the parents' versions of the Inventory of Life Quality in Children and Adolescents (ILC) were used to measure health-related quality of life (QOL) in 2140 school children (response rate 93%) and 1639 parents (response rate 71%) recruited from nine elementary schools in Norway. A set of physical characteristics of the children were also measured: Body mass index (BMI), waist circumference, average daily minutes of physical activity, aerobic fitness, and handgrip strength.

Results: The regression analysis showed stronger relationships between the covariates and QOL for the parents' than for the children's assessments. Parents' level of education were significantly related to the QOL of the children with the strongest association for QOL assessed by the parents. Among the physical variables, aerobic fitness ($B=0.01$, $p > 0.001$ in both samples), and handgrip strength in the parents' sample ($B=0.21$, $p<0.05$) were significantly related to the QOL of the children.

Conclusions: **The present study replicated the well-known finding that sociodemographic status of parents is important for the QOL among children. Our new contribution is that the physiological variables aerobic fitness and muscular strength also contributed significantly to explain variance in QOL. This opens for interest perspectives for improving quality of life among children through more emphasis on physical activity and physical fitness in schools.**

Running head: Quality of Life in Elementary School Children

Keywords: Children; Parents; ILC; Quality of life, Physical fitness; parental education

Introduction

In recent years, the interest of developing similar multidimensional health-related quality of life (QOL) instruments for children and adolescents has been growing. A recent review [1] located 30 generic and 64 disease-specific instruments, most of which had been developed in the five years period since 2001. The review showed heterogeneity among the instruments in the numbers and content of dimensions.

Mattejat and Remschmidt [2] developed the original German version of the "Inventory of Life Quality (ILC) for children and adolescents". The 7-item instrument, with versions for both children and parents, covers the subjective experience of important aspects of life domains including health, level of physical and social functioning and participation in activities normal for the child's age. The ILC was chosen for the present study because of its compact size and because a validated Norwegian version has been developed [3].

The social gradient in health in adult populations is well-documented [4–6] and Scandinavian countries including Norway are not exceptions. A similar social gradient has also been uncovered for children [7, 8]. There are also studies that document a similar gradient in the relationship between health-related QOL in children and parents' socio-economic status (SES) [9].

The commonly used SES-indicators, education, occupation, and family income are interlinked; high educational attainment opens for prestigious occupations with high salary. However, in Norway the differences in income are less pronounced as the main part of the population have high income and make use of a well-developed welfare system. National studies indicate the level of education is the single important dominator for disclosing all types of health inequalities in Norway [10,11]. The main explanatory variables in the present study is parental education and a set of physical variables, not commonly used in studies of health-related quality of life in children and adolescents.

Using physical attributes to explore their association with health-related QOL in presumably healthy elementary school children in large-scale study is important to disclose factors that could be

used to increase quality of life of children. The Body mass index (BMI) and waist circumference were included based on an assumption that body composition may play a role in a child's quality of life, as implied in other studies [12]. In the belief that physical strength and physical fitness may affect children's QOL, handgrip strength and aerobic fitness was also included in the analysis. Being physical active has earlier been shown to have an impact on children's quality of life, and measurements of time spent in moderate to vigorous physical activity (MVPA) was therefore included in our analysis [13, 14].

Quality of life studies with measurement of physical attributes are scarce according to a recent systematic review [13], and a large-scale study in presumably healthy elementary school children is warranted. The primary aim of the present study was to evaluate the associations between parents' level of education and measurements of physical attributes, and health-related quality of life in a general sample of elementary school children.

Methods

Parents of children from nine elementary schools received an invitation to participate in a longitudinal intervention study, the Health Oriented Pedagogical Project (HOPP). Seven schools were located in Horten municipality, 100 km south of Oslo, Norway, and two schools in the area around Oslo [15]. Both locations are predominantly upper middle class areas. Of a total population of 2816 children, informed consent was received from 2297 (82 %). The ILC was completed for 2140 children and by 1639 parents, with response rates 93 % and 71 % respectively, of children with informed consent.

Measures

The Inventory of Life Quality in Children and Adolescents (ILC) was chosen as the quality of life (QOL) measurement instrument [2]. The original German version has been translated into Norwegian [3] and validated for elementary school children and their parents [16–18]. The ILC comprised seven items, in both child and a parent version, concerning school performance, family

relations, peer relations, autonomy in play, physical and mental health, and a global assessment of well-being. The five response categories ranged from 1, “very good” to 5 “very poor”. The children’s version has pictograms with smileys to illustrate the response categories. The children’s version was completed under supervision on a hard copy form. The test supervisors were trained in giving instructions for each question according to the ILC-manual. Fourth to sixth grade pupils managed mostly to complete the form without assistance. The children lost to follow-up were mainly due to illness at test day, dentist visits, physician visits, travels or exams. A digitalised parental version of the ILC was distributed using e-mail in Horten municipality. The questionnaires for the parents at the two remaining schools were distributed through the children due to the lack of complete a complete e-mail list. To keep the anonymity, an ID-code was included in the mail, one code for each child for families with multiple children. Non-responding parents received an e-mail reminder after one week. The LQ100 scale used in the present study, for both children and parents, is the sum of reversed scores on the seven items, rescaled to vary between 0 and 100. High LQ100 scores indicate high quality of life.

In addition to age, gender and the informant’s relation (mother/father/other) to the child, parents’ educational level (primary, secondary, tertiary (bachelor) and tertiary (master or PhD), a set of physical variables were collected. They are more thoroughly described in the study protocol paper [15]. Body height was measured to the nearest half cm, without shoes and body weight was measured barefooted, in light clothing, using an electronic scale, with a deduction of 0.4 kg to account for the clothes. Based on the weight and height the isoBMI was calculated. Waist circumference was measured at full expiration at the level of the navel. Accelerometers were used to measure average minutes per day spent in moderate to vigorous intensity physical activity (MVPA). The children wore the accelerometer 7 days to estimate the average daily minutes in physical activity [14]. Handgrip strength was measured using Jamar handgrip. The children were instructed to stand firmly with a straight elbow keeping the right arm close to the body and squeeze as hard as possible for 2–3 seconds. The test was repeated at least once for each child. Aerobic

fitness was measured using the Andersen intermittent running test. The children were instructed to run as fast as they could do across the 20 meters floor of the gymnasium with padded walls. Music signalled 15 seconds of running and 15 seconds of rest during a 10 minutes period. The total length in meters was registered for each child.

Statistical analysis

Stata 15 (stata.com) was used to estimate the multiple regression analysis of the QOL scales and IBM SPSS STATISTICS 21 was used to construct the composite measurements.

Ethics

All parents gave their informed consent prior to inclusion in the study. The Regional Ethical Committee for Medical and Health Research approved the study (reference number 2014/2064/REK sør-øst).

Results

Table I describes the gross samples for children (*n* = 2140) and parents (*n* = 1528). As is evident from the table, the distributions are very similar. The age of the children ranged from six to 12 with quite even distribution except for the first and the last age group. The distribution by sex is also quite even with 50.5 % girls. The educational level of the parents showed that around 70 % of both fathers and mothers have tertiary level of education, which indicate a general high level of socioeconomic status.

Regression analysis

Descriptive statistics for the variables used in the multiple regression analysis is reported in Table II. The distribution of both LQ100 scales were left skewed with means of 84.4 for the children's responses and 88.4 for the parents' report. The BMI ranged from 9.8 to 35.4 with an average of 16.9. Waist circumference ranged from 45.5 to 107 with an average of 62.9. Moderate to vigorous physical activity (MVPA) varied from 15.9 to 185.6 minutes a day with an average of 92.4 minutes.

Handgrip strength ranged from one to 34 kg with an average of 12.9 kg. Aerobic fitness measured by the Andersen intermittent running test ranged from 380 to 1415 meters running in ten minutes with an average of 948.1 meters.

Two multiple regression models were estimated for both children's and parents' responses: model 1 & 3 with only sex, age, and parents' education as covariates, and model 2 & 4, extended with the physical variables (Table III). In model 1 age and fathers' education showed statistical significant coefficients. The age coefficient (B=1.05, p < 0.001) indicate that the marginal effects of each year of age was about one point on the children's scale, which amounts to an increase in LQ100 scale of about six points from the first to the sixth grade. The coefficient for father's education (B=1.0, p < 0.001), indicated a maximum difference between children with parents with secondary and master-level education of about three points on the LQ100 scale. In model 3 (parents' assessment), the children's age was unrelated to the QOL of the children. In addition, girls were given higher LQ100 scores than boys (B= 2.45, $p < 0.001$). The coefficients of mothers' and fathers' education were stronger in model 3 than in model 1 based on the children's assessment ($B_{med} = 1.21$, $p < 0.05$ & $B_{fed} = 2.17$, $p < 0.001$). The latter imply an expected difference in children between parents with secondary and master-level education of about six points on the QOL scale.

In model 2 and 4, the physical variables were added. The regression coefficients in model 2 were weaker than in model 1 for sex, age and parents' education. Only the coefficient of fathers' education remained statistical significant in the QOL scale based on the children's responses. In model 4, based on the parents' responses, the regression coefficients of age, sex, and parents' education were only marginally different from those in model 2. Among the physical variables, aerobic fitness showed a positive and statistical significant regression coefficient (B=0.01, p < 0.000) both in models 2 and 4. This indicates that a difference of 300 meters in the running test is expected to yield a difference of 3 points on the LQ100 scales, equally so for the children's and the parents' responses. The children's handgrip strength was positively related to the children's quality of life as assessed by the parents (B=0.21, p<0.05). This indicates that a difference in handgrip strength of 20

kg, amounts to an expected difference of 4 points on the quality of life scale. The remaining variables, BMI, waist circumference, moderate to vigorous physical activity (MVPA), were not statistical significantly associated with the QOL of the children.

Discussion

The elementary school children in our sample scored in the upper range of the QOL scales, especially for the scale based on the parents' responses. Consistent with an earlier Norwegian study[16] with similar samples, the parents (mainly mothers) rated the QOL of their children higher than did children themselves, with scale scores of 88.4 and 84.4 respectively. The low correlation between the QOL scales from the children's and the parents' responses (r=0.25) is consistent with earlier studies [16, 19].

There was no sex difference in the health-related quality of life scale based on the children's responses. The parents did, however, rate the QOL of the girls about 2.9 points higher than boys, consistent with the study of Michel et al. [20] Earlier studies have revealed that children have higher quality of life than adolescents [21]. The present study, however, did show an increase of quality of life with age for the children's response of about one point per year. Michel et al. [20] suggests that a drop in quality of life occurs during puberty, and most children in the present study have not reached that state yet. There were, however no statistical significant association between age and quality of life in the scale based on the parents' responses.

Parents' education was chosen to represent socioeconomic status. The results from the multiple regression results showed stronger positive associations for the quality of life scale based on the parents' response than for the children's own assessment, and stronger associations for fathers' than for mothers' education. The gap in quality of life based on the parents' response, between children of parents with only elementary education and those of parents with master level education, was about 6 points on the scale ranging from 0 to 100. The comparable difference for mothers' education was about 3 points. The scale based on the children's response, showed only

significant association with fathers' education, for which the marginal difference between the extreme educational levels were about 3 points. Thus, the results reflect a social gradient in health-related quality of life by parental education, and strongest for fathers' level of education.

This is consistent with results reported in the research report[9] from the European KIDSCREEN group based on samples of elementary school-children and their parents from seven European countries. There are, however, studies reporting contrasting findings [22, 23]. Rajmil et al. [22] found differences in children's mental health based on parental education level, but not in the quality of life the children. Berman et al. [23], in a Swedish study based in the KIDSCREEN instrument found an inverted social gradient in that high QOL was associated with a low level of education. Except for the low response rate (35%) in the Swedish study, we have no explanation of this deviant finding.

The Body mass index (BMI) and waist circumference were included on an assumption that body composition may play a role in a child's health-related quality of life, as implied in other studies [12]. However, in the present study these two variables were unrelated to quality of life, as rated by the children. The two variables were, however, consistent negatively but not statistically significant associated with QOL, although the association with waist circumference came close to being statistical significant (B= –0,02, p<0,06).

In the belief that physical fitness may be important for children's quality of life, handgrip strength and aerobic fitness (Andersen intermittent running test) was also included in the analysis. This expectation was confirmed for aerobic fitness for both the QOL scales based on the children's and the parents' responses (B=0.01, $p < 0.001$ for both samples). This yields an expected increase in the QOL scale score of 0.11 percentage points per hundred meters covered in the Andersen test. In other words, a difference of 300 meters in ten minutes running test is expected to yield a difference of 3 points in the QOL scale, equally so for the children's and the parents' responses. This indicates that endurance may play a role in the quality of life of children, consistent with a recent finding by

Andersen et al. [24], who concluded that cardiorespiratory fitness may be beneficial for improving quality of life.

Handgrip strength was positively associated with the parents' rating of their children's quality of life (B=0.21, $p<0.05$) but not with the children's own assessments (B=0.06, $p< 0.6$). The former result indicates that each kg difference in handgrip gave an increase in the QOL scale score of 0.21 points. In other words, a maximal difference in handgrip strength in the sample (about 30 kg), amounts to an expected difference of about 6 points on the QOL scale.

Being physical active has been shown to have an impact on children's quality of life and accordingly, measurement of average moderate to vigorous physical activity (MVPA) was added as a covariate in the regression analysis. A similar positive, but not statistical significant, association between quality of life and MVPA was found for both the parental and the children's response (B=0.02, $p<0.15$).

The main strength of the present study is the examination of the relationship between physical variables and quality of life in a general population sample of elementary school children. The study has some limitations, Firstly, the sample is socially skewed in terms of the educational attainment of the parents, which is a reflection of the location of the schools in mostly upper-middle class areas. Secondly, the response rate for the parents (70%) was lower than might be desired. Thirdly, the study was based on cross-sectional baseline data from the HOPP program without the possibility of studying changes in quality of life. When the longitudinal data from the project become available, this will make studies of individual change and of causal inferences possible.

In conclusion, our findings on the relationship between the health-related quality of life of the children and parental education reflect a social gradient, especially by fathers' education in quality of life assessed by the parents. The social gradient was, however, weaker based on the children's response. Among the physical variables, aerobic fitness showed a statistical significant association with the quality of life of the children as assessed by both the parents and the children. The child's handgrip strength was moderately associated to quality of life as assessed by the parents.

The Body mass index (BMI), waist circumference, and the average moderate to vigorous physical activity level (MVPA) showed no statistical significant associations with the quality of life of the children. The finding that the physiological variables aerobic fitness and muscular strength contributed significantly to explain variance in QO opens for interest perspectives for improving quality of life among children through more emphasis on physical activity and physical fitness in schools.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The HOPP study is funded by Horten municipality, Kristiania University College, Norwegian Order of Odd Fellow Research Fund, Oslofjord Regional Research Fund, Norwegian Fund for Post-graduate Training in Physiotherapy.

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Table I. Description of the sample

	Children sample		Parent sample	
	n	%	*n*	%
Sex: Girl	1080	50.5	771	50.5
Boy	1060	49.5	757	49.5
Age: 6	227	10.6	154	10.1
7	325	15.2	243	15.9
8	324	15.1	224	14.7
9	373	17.4	283	18.5
10	352	16.5	234	15.3
11	400	18.7	278	18.2
12	139	6.5	112	7.3
Mother's education				
1. Primary			35	2.3
2. Secondary			381	24.9
3. Tertiary, bachelor			672	44.0
4. Tertiary, master			440	28.8
Father's education				
1. Primary			45	3.0
2. Secondary			454	29.7
3. Tertiary, bachelor			592	38.7
4. Tertiary, master			437	28.6
N	2140		1528	

Table II. Descriptive statistics[a] for the variables in the regression analysis[b]

Variables [c]	Mean	Std	Min	Max
LQ100 scale, children's response	84.4	10.6	39.6	100
LQ100 scale parents' report	88.4	10.6	42.9	100
Sex (1 = girl, 0 = boy)	0.5	0.5	0	1
Age	9.0	1.8	6	12
Mothers' education	3.0	0.8	1	4
Fathers' education	3.0	0.8	1	4
Body Mass Index (BMI)	16.9	2.7	9.8	35.4
Waist circumference (WC)	62.9	7.7	45.5	107
Moderate to Vigorous Physical Activity (MVPA) in mnutes per day	92.4	28.5	15.9	185.6
Handgrip strength in kg	12.9	5.4	1	34
Aerobic fitness (meters)	948.1	145.6	380	1415

[a] Std: standard deviation, Min: minimum; Max: maximum

[b] *n* = 1135, for ILC parents' scale *n* = 1064

[c] LQ100: Summated scale based on the Inventory of Life Quality in Children and Adolescents (ILC); Mother's & Father's educational level: 1. Elementary, 2 Secondary, 3. Bachelor, 4 Master; Aerobic fitness: Andersen test.

Table III. Regression analysis[a] of LQ100[b] for elementary school children

	LQ100 children's response, *n* = 1135				LQ100 assessed by parents, *n* = 1084			
Variables[c]	Model 1		Model 2		Model 3		Model 4	
	B	*SE B*	*B*	*SE B*	*B*	*SE B*	*B*	*SE B*
Sex (girl =1, boy =0)	–0.50	0.61	0.08	0.63	2.45***	0.63	2.98***	0.64
Age	1.05***	0.18	0.45	0.29	–0.17	0.18	–0.58	0.30
Mother's education	0.60	0.46	0.45	0.46	1.21*	0.48	0.98*	0.47
Father's education	1.02***	0.45	0.92*	0.45	2.17***	0.47	1.92***	0.46
BMI			0.10	0.23			–0.31	0.24
WC (cm)			–0.02	0.08			–0.16	0.08
MVPA (minutes/day)			0.02	0.01			0.02	0.01
Handgrip strength (kg)			0.06	0.09			0.21*	0.09
Aerobic fitness (meters)			0.01***	0.00			0.01***	0.00
Constant	69.55		62.23		77.23		83.61	
R^2	0.07		0.09		0.07		0.11	

[a] *B*: unstandardized regression coefficient, *SE B*: Standard error of *B*, R^2: the multiple correlation coefficient, * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$. Unreported school fixed effects in all models.

[b] LQ100: Summated scale based on the Inventory of Life Quality in Children and Adolescents (ILC), children's response and parents assessment

[c] Mother's & Father's educational level: 1. Elementary, 2 Secondary, 3. Bachelor, 4 Master; BMI = Body Mass Index; WC: Waist Circumference; MVPA = Average Moderate to Vigorous Physical Activity measured in minutes per day; Aerobic fitness: Andersen intermittent running test, measurement in meters.