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Is there an association between physical activity and lower urinary tract symptoms in adolescent girls?: Results from the Avon Longitudinal Study of Parents and Children

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Abstract

Introduction and hypothesis: Lower urinary tract symptoms (LUTS) are common among adolescent girls. Physical activity (PA) has been implicated as both a risk (high impact PA) and protective factor (low-impact, moderate to vigorous intensity PA) for LUTS in adult women, but its role in adolescent girls is unclear. This study investigated the prospective association between physical activity and LUTS risk in adolescent females.

Methods: The sample comprised 3,484 female participants in the Avon Longitudinal Study of Parents and Children. Multivariable logistic regression models were used to examine daily minutes of moderate to vigorous PA (MVPA) at ages 11 and 15 years in relation to LUTS at ages 14 and 19, respectively. MVPA was assessed by seven-day accelerometer data. LUTS were assessed by questionnaire. MVPA were analyzed as continuous (minutes/day) and categorical variables (<10th percentile, 10-89th percentile, ≥90th percentile).

Results: Prevalence of LUTS ranged from 2.0% for bedwetting to 9.5% for nocturia at age 14 and from 2.0% for straining to urinate to 35.5% for interrupted urine flow at age 19. Physical activity was not associated with LUTS at either time-point.

Conclusions: Given the prevalence of LUTS in female adolescent populations, although this study did not find an association with accelerometer-measured MVPA, other aspects of PA that may serve as risk or protective factors deserve investigation.

Brief Summary:

This study investigated the prospective association between physical activity (duration and intensity), measured by accelerometer, and risk of lower urinary tract symptoms in adolescent females.

Keywords

Adolescent girls; Avon Longitudinal Study of Parents and Children; Lower urinary tract symptoms; Physical activity; Sedentary behavior

Introduction

Lower urinary tract symptoms (LUTS) are common in the pediatric population. Although prevalence rates decrease throughout childhood due to the developmental nature of bladder control, a non-trivial proportion of adolescent's experience LUTS. Estimates as high as 45% have been observed in healthy younger children, and as high as 10-18.5% in healthy adolescents [1-3]. At all ages, the prevalence of LUTS is higher in girls than in boys [4]. Urinary incontinence (UI) is particularly common among female adolescents, with as many as 17% experiencing urgency urinary incontinence (UUI) and 15% experiencing stress urinary incontinence (SUI) [5]. Moreover, UI risk increases as female adolescents transition into adulthood. Studies among the general population have observed UI prevalence estimates ranging from 5.8% in adolescents 14-15 years of age, to more than double this estimate (12.3%) in adolescents 19-20 years of age [6].

Besides obesity [7] and sexual history [8], very few risk and protective factors have been identified for LUTS in adolescents. High impact physical activity (PA) has been implicated as a risk factor for LUTS in adult women [9], and may likewise influence bladder health in younger girls. Incontinence is a notable issue in adolescents involved in sports, with prevalence estimates of any UI ranging from 18-80% [10]. Prevalence of SUI is estimated to be 28-34% in high school female athletes and 28% in collegiate athletes [11,12].

In contrast to high-impact PA, low-impact moderate to vigorous intensity PA (MVPA) is believed to reduce the risk of having or developing UI symptoms in adult females [9,13]. Young female athletes who participate in low-impact sports have also been found to have a lower prevalence of SUI [14]. It is *probable* that MVPA enhances overall core muscle strength, leading to improved pelvic floor muscle strength, endurance and coordination, whereas high impact/high intensity PA may, in fact, reduce pelvic floor muscle strength due to excessive strain without compensatory strengthening, thereby predisposing to incontinence. Unlike MVPA, sedentary behavior likely leads to a failure to attain optimal muscle tone/motor control (coordination) and lacks the benefit to neurocognitive function that PA confers [15,16].

The objective of this study was to investigate the prospective association between PA (duration and intensity) and risk of LUTS in adolescent females. Using data from the Avon Longitudinal Study of Parents and Children (ALSPAC), we examined daily minutes of MVPA, assessed by seven-day accelerometer data, at age 11 in relation to LUTS at age 14 and daily minutes of MVPA at age 15 in relation to LUTS at age 19. We hypothesized that engaging in more MVPA at ages 11 and 15 would be associated with less LUTS at ages 14 and 19, respectively. We further hypothesized that engaging in more blocks of 10-19 minutes of MVPA would be associated with more LUTS. This study focuses specifically on females, as the prevalence of UI at age 14 is three times higher in adolescent females than males [4]. LUTS data were also collected at a greater number of time points in female than male participants in the ALSPAC cohort.

Materials and Methods

Participants

ALSPAC included pregnant women residing in Avon, United Kingdom, with expected dates of delivery between April 1991 and December 1992. Detailed information about the cohort has been collected since early pregnancy, including regular self-administered questionnaires from mothers and children. Information about ALSPAC is available at www.bristol.ac.uk/alspac/, including a searchable data dictionary and variable search tool (www.bristol.ac.uk/alspac/researchers/our-data/). Further details on the cohort profile, representativeness, and phases of recruitment are described in two cohort profile papers [17,18] as well as an update [19].

Because our hypothesis focused on LUTS in adolescent girls and young women, our analysis included data from female offspring only. We included participants that had at least one accelerometer recording.

Ethical approval

Ethical approval for the study was obtained from the ALSPAC ethics and law committee and the local research ethics committees. Informed consent for use of data collected via questionnaires was obtained from participants following the recommendations of the ALSPAC ethics and law committee at the time. As these analyses use pre-existing de-identified data, they do not constitute human subjects research.

Measures

Exposures: The primary exposure was total daily MVPA >3600 counts per minute (cpm) on accelerometer as measured by Actigraph accelerometers worn on the hip for 7 days at ages 11 and 15.5 (Actigraph LLC, Fort Walton Beach, FL, USA). Participants were instructed to wear the Actigraph during waking hours and to take it off during showers, baths and water activities. Following prior studies [20], actigraph measurements of physical activity intensity were classified into three categories with the cut-points defined as: low (<199 counts per minute [cpm]), mid (>200 cpm and <3,600 cpm), and high (≥3,600 cpm). Average daily MVPA was derived by the CPM cut-points and the average daily number of minutes spent in MVPA based on valid days (Actigraph data available for at least 10 hours per day) in the whole week. Further information on the Actigraph is reported elsewhere [21]. MVPA was analyzed as both continuous (minutes/day) and categorical variables (<10th percentile, 10-89th percentile, and ≥90th percentile).

Outcomes:

Lower Urinary Tract Symptoms.: A self-report postal questionnaire was sent to study children when they were 13 years, 10 months (hereafter referred to as 14 years), and 19 years. The questionnaire at age 14 asked about the presence and frequency of a range of LUTS over the past two weeks, including daytime UI, urgency, frequent urination, low voiding volume, nocturia, bedwetting, and voiding postponement. Participants were classified as having LUTS at age 14 if they indicated ‘yes’ to at least one symptom [22] (Supplemental Table 1).

Questions from the International Consultation on Incontinence Questionnaire on Female LUTS (ICIQ-FLUTS long form) [23] were administered at age 19 and assessed LUTS over the past month including subscales (filling, voiding, incontinence). Consistent with prior studies [23], we classified women as having LUTS based on the following 15 categorizations: Urinary frequency, nocturia, SUI, urgency, UUI, hesitancy, interrupted urine flow, urinary retention, urinary tract infection, UI in the past year, leak for no obvious reason, leak frequency, leak while asleep, strain to urinate and bladder pain. LUTS variables were dichotomized (Supplemental Table 1) [4, 23]. We further note that age 14 LUTS items do not perfectly overlap with age 19 ICIQ items; some items were assessed only at age 19.

Confounders: Potential confounders were selected based on knowledge from expert clinicians and review of previous literature. They included total minutes of Actigraph data (summing total daily mean minutes of sedentary behavior, as well as light, moderate, and vigorous PA), body mass index (BMI), Short Mood and Feelings Questionnaire (SMFQ) depression score, and histories of UTIs and constipation. When multiple values were available, the one closest to assessment of the LUTS outcome was used. The analyses also adjusted for the following variables assessed through the maternal questionnaire during the antenatal period: maternal educational attainment (low: none, Certificate of Secondary School Education, or vocational; medium: high school qualifications obtained at age 16 years; high: advanced level qualifications obtained at age 18 years/degree or greater), and parental social class as determined during pregnancy and dichotomized into manual (partly or unskilled occupations) or non-manual (professional, managerial, or skilled professions) using the 1991 British Office of Population and Census Statistics classification.

Statistical Methods

Categorical variables were described by frequency and percentage. Continuous variables were described using means and standard deviations (SDs). The associations between PA at age 11 with LUTS at age 14, and between PA at age 15.5 with LUTS at age 19 were estimated using multivariable logistic regression methods. Logistic regression was also used to investigate whether the lowest and highest levels of MVPA were associated with higher LUTS risk by treating MVPA minutes as a categorical variable (partitioned at the 10^{th} and 90^{th} percentiles). PA at age 15.5 was also modeled with the ICIQ (Bristol Female Lower Urinary Tract Symptoms questionnaire) score at age 19. All models were adjusted for the amount of time the accelerometer was worn (minutes), BMI, SMFQ, history of UTI, history of constipation, maternal education, and parental social class. All analyses were completed in SAS 9.4.

Results

The 15,447 participants in the ALSPAC study gave birth to 14,901 babies who were alive at one year of age, 7,148 (48.0%) of which were female. Of those, 3,484 (48.74%) had accelerometry data, 2,880 (82.66%) had data on LUTS at age 14, and 1,526 (43.80%) had data on LUTS at age 19. Mean BMI was 20.08 (standard deviation [SD] 3.56) at age 12.5 years and 22.91 (4.27) at age 17 years. All participants' time (in minutes) spent in sedentary, light, moderate, and vigorous activity was recorded (Table 1). Maternal education attainment was low in 686 (21.58%), medium in 1,125 (35.39%), and high in 1368 (43.03%), and 453 (14.82) were categorized into manual class. The mean SMFQ score ranged from 2.45 to 2.50 from ages 13 to 16. At age 14, 86 (3.13%) participants reported experiencing a UTI in the past year and 73 (2.57%) reported constipation in the past two weeks. The overall prevalence of LUTS ranged from 2.0% for bedwetting to 9.5% for nocturia at age 14 and from 2.0% for straining to urinate to 35.5% for interrupted urine flow at age 19 (Table 2).

We found no association between LUTS at age 14 and MVPA, whether measured as continuous minutes) or categorized as low (10^{th} percentile) or high (90^{th} percentile or higher) compared to middle (10-90^{th} percentile) (Table 3). Similarly, continuous MVPA at age 15.5 was not associated with any LUTS or ICIQ score at age 19 (Tables 4 and 5). Although a positive association was observed between engaging in low MPVA at age 15.5 (compared to mid) with interrupted urine flow at age 19 (OR 2.09, 95% CI 1.13-3.86), this association was no longer statistically significant after Bonferroni correction. No other associations were observed between categorical PA at age 15.5 and other LUTS or ICIQ score at age 19 (Tables 4 and 5).

Discussion

Our longitudinal analysis of adolescent girls suggests that duration and intensity of MVPA at ages 11 and 15.5 does not influence the development of LUTS later in adolescence. Specifically, non-elite, highly active girls are at no greater risk of LUTS than mid- and low-level activity girls. Despite the lack of association between physical activity and LUTS found here, LUTS outcomes are consistent with other studies showing an increase in LUTS prevalence from early to late adolescence [6,24].

Multiple reasons may account for the lack of association between PA and LUTS observed in this sample. Non-differential misclassification of exposure or outcome variables will lead to null associations even if a true association is present [25]. However, this is unlikely due ALSPAC having used gold-standard accelerometry and validated survey measures. A life course developmental lens may help elucidate factors that contribute to the development of LUTS [26]. Continence mechanisms develop and mature throughout childhood, a potentially sensitive period which may impact later development of LUTS, and where PA may be a protective factor. Viewed from a developmental perspective, PA during early adolescence may have more of a long term versus short term impact on the development of LUTS among healthy adolescent girls. A study of elite female athletes identified that the presence of any UI earlier in life is a strong predictor of any UI later in life [27]. It’s possible that the impact of PA on LUTS may not be realized until other risk factors for LUTS accumulated over the life course [23], such as hormone changes, childbearing, or more intense or prolonged PA.

Strengths of the study include its longitudinal nature and the use of accelerometer data, rather than self-report, to assess sedentary time and physical activity. Accelerometers are widely used and provide highly reliable, objective information about the total amount, frequency, intensity, and duration of PA in daily life [21]. However, our findings must be interpreted in light of several limitations. Like many other longitudinal studies, the ALSPAC cohort has experienced attrition; participants lost to follow-up were more likely to come from socio-economically disadvantaged backgrounds than those with complete data [18]. Accelerometer data were only collected for one week, thus may not be representative of participants’ yearly lifestyles. Data were not collected on high impact or type of PA. It is possible the effects of high-impact PA may cancel out those of low-impact PA. Data were also not collected on PA among older adolescents for whom duration and intensity levels may increase. LUTS were self-reported, and some LUTS were assessed differently at ages 14 and 19 or only at age 19. The sample only included British participants, a majority of whom were white; thus, findings may not be generalizable to other populations. Physical activity and sedentary behavior among children and adolescents have consistently been shown to differ between countries and regions [28-30]. This variation is consistent across age and independent of BMI. Future research on the association between PA and LUTS in diverse contexts is warranted.

LUTS are common in female adolescent populations and associated with increased risk of LUTS in adulthood [1-3,5,6,24]. Physical activity has well-established benefits for other health conditions. Adolescence is a critical period of development during which personal lifestyle choices and behavior patterns, including being physically active, are established. Additional research is needed to determine whether increasing physical activity and reducing sedentariness during adolescence may be effective strategies to promote bladder health and prevent LUTS.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Characteristics of female children who provided accelerometer data in the Avon Longitudinal Study of Parents and Children

	N	All participants	MVPA Age 11					
			Low		Mid		High	
			N		N		N	
Physical activity at age 11 (minutes, mean (SD)):								
Light	3115	319.98 (58.07)	304	287.85 (56.42)	2499	320.34 (56.76)	312	348.47 (54.38)
Moderate	3115	15.44 (9.91)	304	3.19 (1.17)	2499	14.41 (6.56)	312	35.68 (8.42)
Vigorous	3115	2.76 (3.70)	304	0.37 (0.43)	2499	2.39 (2.68)	312	8.09 (6.62)
Moderate-to-vigorous	3115	18.21 (11.86)	304	3.56 (1.25)	2499	16.80 (7.51)	312	43.77 (8.57)
Physical activity at age 14 (minutes, mean (SD)):								
Light	2297	266.70 (54.46)	184	250.45 (50.80)	1618	266.53 (53.94)	182	282.28 (57.79)
Moderate	2297	16.60 (12.51)	184	10.01 (8.54)	1618	16.34 (12.16)	182	24.62 (15.16)
Vigorous	2297	3.06 (4.56)	184	2.07 (4.39)	1618	2.91 (4.32)	182	4.80 (5.38)
Moderate-to-vigorous	2297	19.67 (14.62)	184	12.08 (10.34)	1618	19.24 (14.12)	182	29.42 (17.97)
Physical activity at age 15.5 (minutes, mean (SD)):								
Light	1309	237.54 (58.90)	116	222.23 (52.16)	925	239.14 (60.81)	103	242.40 (52.98)
Moderate	1309	16.34 (13.85)	116	9.80 (9.79)	925	15.94 (13.22)	103	25.64 (17.08)
Vigorous	1309	2.08 (3.66)	116	1.18 (2.09)	925	1.93 (3.31)	103	3.78 (4.80)
Moderate-to-vigorous	1309	18.42 (15.38)	116	10.99 (10.33)	925	17.86 (14.48)	103	29.42 (19.53)
Sedentary behavior at age (minutes, mean (SD)):								
11	3315	434.56 (66.43)	304	462.00 (62.95)	2499	436.81 (64.44)	312	389.85 (64.66)
14	2297	494.77 (69.41)	184	516.71 (65.77)	1618	496.10 (69.13)	182	472.91 (65.43)
15.5	1309	524.31 (67.65)	116	525.67 (68.60)	925	525.98 (66.33)	103	508.71 (73.59)
Body mass index at age: (kg/m^2, mean (SD))								
12.5	3022	20.08 (3.56)	271	21.00 (4.03)	2206	20.03 (3.54)	269	19.64 (3.24)
17	2373	22.91 (4.27)	202	23.39 (4.79)	1736	22.85 (4.25)	199	22.77 (3.89)
Age at menarche (years, mean (SD))	3014	12.69 (1.18)	258	12.61 (1.21)	2179	12.70 (1.15)	256	12.69 (1.28)
Maternal Education	3179		278		2287		277	
Low		686 (21.58)		68 (24.46)		465 (20.33)		68 (24.55)

	N	All participants	MVPA Age 11					
	N		Low		Mid		High	
			N		N		N	
Medium		1125(35.39)		103 (37.05)		824 (36.03)		100 (36.10)
High		1368(43.03)		107 (38.49)		998 (43.64)		109 (39.35)
Manual social class (vs nonmanual)	3056	453 (14.82)	265	37 (13.96)	2201	316 (14.36)	269	49 (18.22)
SMFQ (score mean (SD))								
Age 9	2845	2.44 (3.01)	240	2.48 (3.24)	2092	2.43 (3.02)	253	2.03 (2.44)
Age 11	2787	2.36 (3.19)	232	2.22 (3.08)	2057	2.40 (3.24)	242	2.14 (2.92)
Age 13	2742	2.45 (3.40)	237	2.32 (3.09)	2012	2.53 (3.51)	232	2.10 (2.84)
Age 16	2266	2.50 (3.55)	194	2.45 (3.74)	1656	2.56 (3.60)	189	2.44 (3.33)
Constipation age 13 (%)	2841	73 (2.57)	247	10 (4.05)	2062	45 (2.18)	236	5 (2.12)
History of UTI in past year at age 13	2751	86 (3.13)	241	9 (3.73)	1992	60 (3.01)	237	5 (2.11)
History of LUTS at age 10 (%)	2175	359 (16.15)	192	33 (17.19)	1590	263 (16.54)	194	30 (15.46)

MVPA=Moderate to vigorous physical activity

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Table 2.

LUTS Frequency by Age

		Age 14		Age 19
LUTS (%)				
Urgency	2855	156 (5.46)	1522	204 (13.04)
Frequency	2850	85 (2.98)	1519	373 (24.56)
Low voided volume	2840	133 (4.68)		
Frequency of "holding"	2851	256 (8.98)		
Voiding postponement	2845	392 (13.78)		
Constipation	2841	73 (2.57)		
Nocturia	2841	269 (9.47)	1525	81 (5.310)
Frequency of waking to void but fell back asleep	2832	142 (5.01)		
Daytime wetting	2856	133 (4.66)		
Bedwetting	2858	58 (2.03)		
Stress incontinence			1521	404 (26.56)
Urgency Incontinence			1523	294 (19.30)
Leak urine for no obvious reason			1522	101 (6.64)
Hesitancy			1516	106 (6.99)
Strain to urinate			1520	30 (1.97)
Interrupted urine flow			1522	540 (35.48)
Leak frequency			1509	339 (22.47)
Leak urine while asleep			1512	59 (3.90)
Urinary retention			1519	162 (10.66)
Urinary incontinence in the last year			1512	93 (6.15)
Bladder pain			1499	384 (25.62)
Urinary Tract infection UTI	2751	86 (3.13)	1515	234 (15.45)
ICIQ*(mean (SD))				
ICIQ Filling			1490	1.73 (1.83)

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		Age 14		Age 19
ICIQ Voiding			1514	1.08 (1.31)
ICIQ Incontinence			1505	0.98 (1.78)
ICIQ Total			1468	3.79 (3.64)

*ICIQ=International Consultation on Incontinence Questionnaire

Table 3.

Association of Activity at age 11 and LUTS at age 14 regression results

			MVPA Categorical[b]	
OR (95%CI)	**MVPA[a]**	**MVPA[b]**	**Low vs mid**	**High vs mid**
Urgency	0.95 (0.81 - 1.11)	0.95 (0.78 - 1.15)	0.88 (0.43 - 1.82)	0.78 (0.35 - 1.74)
Frequent urination	0.99 (0.81 - 1.21)	0.89 (0.68 - 1.16)	1.18 (0.48 - 2.88)	0.65 (0.20 - 2.15)
Low voided volume	0.93 (0.79 - 1.10)	0.96 (0.78 - 1.19)	0.54 (0.21 - 1.38)	0.64 (0.25 - 1.66)
Hold until bursting	1.00 (0.89 - 1.12)	1.07 (0.93 - 1.24)	0.40 (0.18 - 0.89)	0.73 (0.39 - 1.39)
Nocturia	0.94 (0.84 - 1.06)	1.01 (0.87 - 1.18)	1.01 (0.57 - 1.79)	1.14 (0.64 - 2.02)
Frequency of woke up needing a wee but didn't go	0.93 (0.79 - 1.09)	0.90 (0.72 - 1.12)	0.60 (0.24 - 1.54)	0.69 (0.27 - 1.76)
Daytime wetting	1.05 (0.90 - 1.23)	1.06 (0.87 - 1.28)	0.54 (0.21 - 1.39)	1.51 (0.77 - 2.99)
Nighttime wetting	1.13 (0.90 - 1.43)	1.16 (0.89 - 1.52)	0.26 (0.03 - 1.96)	1.14 (0.39 - 3.33)

a. adjusted for total minutes accelerometer worn

b. adjusted for total minutes, bmi (age 12), SMFQ score (age 13), UTI (age 13) and constipation (age 13), maternal educational attainment, social class.

Table 4.

Association of Activity at age 15.5 and LUTS at age 19 regression results

			MVPA Categorical[b]	
	MVPA[a]	MVPA[b]	Low vs mid	high vs mid
Daytime Frequency	0.94 (0.83 - 1.05)	0.88 (0.75 - 1.03)	1.24 (0.62 - 2.48)	0.79 (0.35 - 1.78)
Nighttime Frequency	0.93 (0.73 - 1.18)	0.86 (0.60 - 1.23)	2.13 (0.55 - 8.25)	0.00 (0.00 - 33E224)
Leak on exertion	1.07 (0.97 - 1.19)	1.09 (096 - 1.25)	1.04 (0.50 - 2.15)	1.33 (0.65 - 2.71)
Urgency	1.02 (0.88 - 1.17)	0.91 (0.73 - 1.13)	1.57 (0.66 - 3.74)	0.75 (0.22 - 2.55)
Leaks before toilet	1.02 (0.91 - 1.15)	1.05 (0.91 - 1.22)	0.62 (0.25 - 1.55)	1.07 (0.47 - 2.43)
Leaks for no reason	1.14 (0.97 - 1.34)	1.13 (0.91 - 1.40)	1.68 (0.53 - 5.29)	2.59 (0.91 - 7.37)
Delay before start of urination	0.99 (0.82 - 1.18)	1.03 (0.81 - 1.30)	2.46 (0.92 - 6.57)	1.61 (0.52 - 4.97)
Strain to urinate	0.98 (0.69 - 1.38)	0.96 (0.62 - 1.47)	0.93 (0.10 - 8.22)	0.00 (0.00 - 28E199)
Interrupted urine flow	1.03 (0.93 - 1.14)	1.07 (0.94 - 1.21)	2.09 (1.13 - 3.86)	1.32 (0.68 - 2.56)
Frequently leaks	1.09 (0.98 - 1.21)	1.09 (0.95 - 1.26)	1.30 (0.63 - 2.69)	1.95 (0.95 - 4.01)
Leaks while asleep	1.15 (0.94 - 1.41)	0.95 (0.63 - 1.42)	1.30 (0.15 - 11.28)	1.11 (0.13 - 9.42)
Incomplete emptying	0.97 (0.81 - 1.15)	1.02 (0.82 - 1.28)	1.92 (0.72 - 5.10)	1.95 (0.70 - 5.47)
Wetting accident in past year	0.93 (0.76 - 1.15)	0.70 (0.47 - 1.03)	1.13 (0.31 - 4.12)	0.44 (0.06 - 3.43)
Frequency of pain in bladder	0.94 (0.84 - 1.05)	0.97 (0.83 - 1.13)	1.28 (0.63 - 2.61)	1.49 (0.72 - 3.08)
UTI in past month	1.01 (0.88 - 1.15)	0.98 (0.82 - 1.18)	0.74 (0.28 - 1.99)	1.24 (0.52 - 2.96)

[a.] adjusted for total minutes accelerometer worn

[b.] adjusted for total minutes, bmi (age 17), SMFQ score (age 16), UTI (age 13) and constipation (age 13), maternal education, social class.

Table 5.

Association of Activity at age 15.5 and ICIQ at age 19 regression results

			MVPA Categorical[b]	
OR (95%CI)	**MVPA[a]**	**MVPA[b]**	**Low vs mid**	**high vs mid**
ICIQ Filling	−0.058 (−0.149 - 0.032)	−0.076 (−0.173 - 0.022)	0.49 ± 0.25	0.09 ± 0.26
ICIQ Voiding	0.009 (−0.053 - 0.070)	0.027 (−0.048 - 0.102)	0.45 ± 0.19	0.18 ± 0.20
ICIQ Incontinence	0.076 (−0.013 - 0.165)	0.065 (−0.036 - 0.166)	0.12 ± 0.26	0.30 ± 0.27
ICIQ Total	0.026 (−0.157 - 0.210)	0.017 (−0.184 - 0.217)	1.04 ± 0.52	0.62 ± 0.55

a. adjusted for total minutes accelerometer worn

b. adjusted for total minutes, bmi (age 17), SMFQ score (age 16), UTI (age 13) and constipation (age 13.5)