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Better health indicators of FitSpirit participants meeting 24-h movement guidelines for Canadian children and youth

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Summary

This study aims to determine the proportion of girls who meet the recommendations for moderate-to-vigorous physical activity (MVPA), screen time and sleep duration among FitSpirit participants and evaluate the associations of these recommendations with perceived health-related quality of life (QOL), perceived health, physical activity (PA), self-efficacy and body mass index. Cross-sectional analyses of FitSpirit data were performed. All variables were collected through an online questionnaire. The proportion of girls meeting all recommendations was 2.2%, while 72.5% met either one or two and 25.4% met none. A greater percentage of girls with $\geq$3 years in FitSpirit met MVPA and sleep recommendations combined when compared with fewer years (12.9% vs. 1.7% with 1 year; vs. 10.1% with 2 years; $p < 0.05$). Meeting the combinations of MVPA and screen time ($\beta = 0.19$, 95% CI = 0.40, 1.68), MVPA and sleep ($\beta = 0.20$, 95% CI = 0.27, 1.04) and all three combined ($\beta = 0.17$, 95% CI = 0.33, 1.71) was the most significant predictors of better perceived QOL. Respecting MVPA recommendations predicted a better perceived health ($\beta = 0.18$, 95% CI = 0.18, 0.87) while girls who slept as recommended had a better PA-related self-efficacy ($\beta = 0.23$, 95% CI = 0.51, 2.11). Not meeting any recommendation was associated with inferior PA-related self-efficacy ($\beta = -0.32$, 95% CI = −3.03, −1.21). Lastly, meeting MVPA and sleep recommendations was significantly associated with lower body mass index *z*-scores ($\beta = -0.14$, 95% CI = −1.16, −0.11). There was a small percentage of girls following all of the recommendations. Furthermore, meeting individual and combined recommendations was associated with better perceived QOL and health, PA self-efficacy as well as healthier body mass index *z*-score.

Key words: physical activity, lifestyle, health-related quality of life, body mass index, adolescents

INTRODUCTION

The health benefits of regular physical activity (PA) practice in adolescents are well documented (Granger *et al.*, 2017; Rhodes *et al.*, 2017). Specifically, moderate-to-vigorous PA (MVPA) has positive impacts on adolescents' health (e.g. obesity and cardiometabolic risk factors) and health-related quality of life (Jalali-Farahani *et al.*, 2016; Saunders *et al.*, 2016; Wu *et al.*, 2017). Also, limited screen time and adequate sleep are associated with better quality of life and health perception, as well as reduced cardiometabolic risk (Baskin *et al.*, 2001; Chaput *et al.*, 2013; Wu *et al.*, 2017). The Canadian 24-hour movement guidelines for children and youth take into account these relevant behaviours for health (Saunders *et al.*, 2016). Studies show that meeting these guidelines is associated with having lower levels of obesity and cardiometabolic risk factors (Roman-Vinas *et al.*, 2016; Carson *et al.*, 2017; Katzmarzyk and Staiano, 2017), yet many Canadian adolescents fail to meet them. Between 2009 and 2013, less than one in 20 adolescents met at least three of the established recommendations (Roberts *et al.*, 2017). In addition, a lower percentage of girls respected all recommendations compared to boys (11.8% vs. 22.9%), especially in PA, the behaviour with the lowest percentage of achievement in girls (14.4% vs. 32.8% for sedentary time vs. 64.3% for sleep duration) (Roberts *et al.*, 2017).

Although many studies show the impact of individual lifestyle habits on health outcomes (Humphreys *et al.*, 2014; Chaput, 2016; Nguyen *et al.*, 2016; Bell *et al.*, 2017; Biddle *et al.*, 2017), a more integrated approach should be considered to address new findings concerning adolescents (Saunders *et al.*, 2016; Carson *et al.*, 2017). Quality of life and health perceptions are important outcome measurements that can be used to identify individuals at risk of unhealthy behaviours (Patton *et al.*, 2016; Lee *et al.*, 2019), including physical inactivity, unhealthy sleep hygiene and poor diet (Lee *et al.*, 2019). Perceived quality of life focuses on how the overall health status is influenced by individual physical, psychological and social wellbeing and can hence serve as an outcome measure of overall health (Jalali-Farahani *et al.*, 2016). An additional important parameter, still under-studied in the adolescent population (Plotnikoff *et al.*, 2014), is PA self-efficacy, which is associated with both PA and sedentary behaviour in adolescents (Van Der Horst *et al.*, 2007). This is important given that it documents the capability to choose and participate in PA despite existing barriers (Voskuil and Robbins, 2015). PA self-efficacy is also a prerequisite of behaviour adoption or maintenance (Plotnikoff et al., 2014) and is related to lifestyle habits (Busch *et al.*, 2013; Cataldo *et al.*, 2013) and environmental perceptions (Plotnikoff *et al.*, 2014).

The lifelong benefits of adolescent PA on adult health are unequivocal. Therefore, the promotion of PA must start early in life (Hallal *et al.*, 2012; McGregor *et al.*, 2018). Increasing the overall PA of adolescents is an effective strategy to provide overall health benefits, such as improved quality of life and obesity prevention (Chaput *et al.*, 2014; Wafa *et al.*, 2016; Rhodes *et al.*, 2017). These assertions should address more programmes and policies to encourage healthy movement behaviours, such as PA, in school-aged children and youth.

FitSpirit is a school-based initiative to improve PA participation in adolescent girls, and this may develop into improved self-efficacy, self-esteem and lifestyle habits by integrating multiple health-promotion activities. This large-scale programme, implemented yearly in ~250 schools in Canada, achieves ~12 000 adolescent girls' participation in PA. However, if and how combinations of 24-h movement behaviours are associated with favourable quality of life, health, PA self-efficacy and body mass index (BMI) is still unknown among girls participating in a school-based lifestyle intervention.

The purpose of this study is three-fold. First, it aims to describe the compliance with 24-h movement variables in FitSpirit participants. Second, to verify the proportion of girls participating in FitSpirit for different time periods meeting the 24-h movement guidelines (MVPA, screen time and sleep duration recommendations, separately and combined). Third, to evaluate the associations of these recommendations (separately and combined with each other) with perceived health-related quality of life, health, PA self-efficacy and BMI.

The hypotheses are that (i) there is a small percentage of girls meeting all three recommendations; (ii) there is a higher percentage of girls with a longer participation in FitSpirit meeting the 24-h movement guidelines; and (iii) meeting the recommendations, specially MVPA and screen time, is associated with better perceived health-related quality of life, health, PA self-efficacy and BMI.

METHODS

Study design, intervention protocol and participants

The cross-sectional data presented in this paper were drawn from the Spring 2018 evaluation of the FitSpirit intervention (https://www.fitspirit.ca/). FitSpirit is a girls-only intervention that offers four types of activities to the participants and each school decides which

combination of them they put forward every year: (i) speaking engagements and various sports or PA given by inspiring women, (ii) weekly PA sessions, (iii) an 8–10-week turn-key running programme and (iv) a celebration day at the end of the school year to explore new activities in a non-competitive environment. Most schools start their FitSpirit activities around February but can decide to run yearlong activities.

Five participants per school who have enrolled in FitSpirit were selected through a draw. Participants were stratified by school and selected randomly within each school. The study sample included 276 Canadian adolescent girls aged between 12 and 17 years old (average age and standard deviation: 14.7 ± 1.5 years old).

Ethical approval was obtained. Participants (14 years and older) or their parents (13 years and younger) provided consent.

Instruments and procedures

Data were collected at the end of the school year which also corresponds to the end of the FitSpirit intervention (May/June 2018) through an online questionnaire available in both French and English (questions and scales used for the present study are presented as Supplementary material). The experts who worked in collaboration to develop the questionnaire are listed in the Acknowledgements. Based on the results and the experience gained during a pilot study ran in 2017, the questionnaire included questions about socio-demographic information (age), MVPA level, screen time, sleep duration, health-related quality of life, perceived health, PA self-efficacy and anthropometric profile (height and body mass). These questions were adapted from the Canadian Health Measures Survey (Statistique Canada, 2013), from Bartholomew *et al.* (Bartholomew *et al.*, 2006) and were used elsewhere (Paiement *et al.*, 2020). Details are described below.

Outcome measures

The reported number of years of participation in the intervention was divided in three categories: 1 year, 2 years and 3 or more years. Girls reported their MVPA levels stating the hours and minutes of MVPA per week performed. Total minutes per week were used as a proxy estimate of the daily amount of MVPA. Screen time (hours and minutes/week) and sleep duration (hours/night) were stated by girls. These variables were analysed based on the Canadian 24-hour movement guidelines for children and youth (Roberts *et al.*, 2017): ≥60 min of MVPA; ≤2 h of recreational screen time; 9–11 h of uninterrupted sleep at ages 5–13 years and 8–10 h at ages 14–17 years. Participants were classified as meeting the overall guidelines if they met all three recommendations. The fruits and vegetables consumption questions included how many days per week (0–7) and how many servings were consumed (Pica *et al.*, 2012). The adherence to dietary guidelines for consumption of fruits and vegetables was assessed on the basis of the 2007 Canada's Food Guide recommendations for age and sex (Santé Canada, 2007). Participants had five options to describe their perceived health-related quality of life and health: excellent, very good, good, fair and poor (Statistique Canada, 2013). The self-efficacy questions ($n = 8$) were selected from a validated scale (Bartholomew *et al.*, 2006) and they evaluated the capability of being active independent of barriers, such as weather or environment conditions. An example of the questions used is 'I can be physically active no matter if my day is busy or not'. The answers' options were 'No', 'I do not know' and 'Yes', each of them having a weight value of 1, 2 or 3, respectively. The answers to self-efficacy questions were summed and transformed into a score. Self-reported height and body mass were used to calculate BMI *z*-score (zBMI) based on the World Health Organization method (de Onis *et al.*, 2007).

Data analyses

The comparisons between lifestyle variables within years of participation were performed using chi-square tests or Fishers' exact test, depending on the sample size in each category. Pearson's test was performed to analyse the correlation between meeting the recommendations and having higher health-related quality of life, perceived health, PA self-efficacy and healthier zBMI. Linear regression models were performed to examine the associations between meeting individual (i.e. sleep only, screen time only and MVPA only) and cumulative (i.e. none, one out of three, two out of three and all three) movement behaviour recommendations with each health indicator (quality of life, perceived health and zBMI) and PA self-efficacy. Not meeting the recommendation was the reference group for recommendations and its combinations. All the analyses were adjusted by age and fruits and vegetables daily consumption. The significance level was set at 0.05. The Statistical Package for Social Sciences (SPSS) version 24.0 was used to analyse the data (IBM SPSS Statistics, Version 24.0. Armonk, NY, USA).

RESULTS

In the FitSpirit sample, median values for daily MVPA was 17 min, 3 h for daily screen time and 8 h for nightly

Table 1: Proportion of girls meeting the recommendations of the Canadian 24-hour movement guidelines

Compliance with 24-h movement variables, %	$n = 276$
MVPA	12.0
Screen time	34.4
Sleep	60.5
Number of recommendations met, %	
None	25.4
One	44.6
Two	27.9
Three	2.2

MVPA, moderate-to-vigorous physical activity.

sleep. The sleep recommendation was the most prevalent guideline met (60.5%) and MVPA the least met (12.0%) (Table 1). Most girls met only one recommendation, while few of them met all three (Table 1).

The proportion of adolescents meeting individual and combined recommendations, by number of years of participation in FitSpirit, is presented in Table 2. Girls who participated for 2 years in FitSpirit showed a higher proportion of meeting the sleep recommendations when compared to their peers (+17.9% vs. 1 year; +11.2% vs. 3 or more years; all $p < 0.05$). Additionally, a greater percentage of girls who accumulated 3 or more years of participation met MVPA and sleep recommendations combined when compared to those with fewer years in FitSpirit ($\Delta\% = 11.2\%$ vs. 1 year; $\Delta\% = 2.8\%$ vs. 2 years; $p < 0.05$).

Correlations between meeting the recommendations and quality of life ($r = 0.22$, $p < 0.01$), perceived health ($r = 0.21$, $p < 0.01$) and self-efficacy ($r = 0.32$, $p < 0.01$) were significant. Associations of individual and combined recommendations with zBMI, perceived health, quality of life and PA self-efficacy are presented in Table 3.

Meeting two or more recommendations compared to meeting no recommendations (reference group) was associated with better perceived health-related quality of life. In addition, meeting all the combined recommendations was associated with a better perception of this indicator, with exception to screen time only and its combination with sleep. Regarding perceived health, meeting two out of three recommendations was positively associated with this variable. In addition, meeting the MVPA recommendation predicted a favourable perceived health. Likewise, following the combined recommendations of MVPA and sleep predicted better perceived health as well. Meeting at least one recommendation was associated with favourable perceived PA self-efficacy. In line with these findings, meeting sleep guidelines only, screen time only and the combination of both predicted better perceived self-efficacy. Moreover, meeting none of the recommendations was associated with worse perceived self-efficacy. Girls who respected MVPA and sleep recommendations combined had a significantly lower zBMI.

DISCUSSION

The present study examined whether meeting individual and combined recommendations within the Canadian Guidelines was associated with perceived health-related quality of life, perceived health, PA self-efficacy and zBMI in a sample of FitSpirit participants. Overall, there was a small percentage of girls meeting the recommendations and significant trends of better health indicators when meeting more guidelines were observed.

Our results revealed that only 2% of girls met all three recommendations (MVPA, screen time and sleep duration), and 24.5% of them met any. This prevalence is consistent with antecedent research conducted among Canadian girl populations, where 2% met all the recommendations and ~20% met none (Ian *et al.*, 2017; Roberts *et al.*, 2017). It also indicates that the FitSpirit programme reaches a sample of teenage girls representative of the population. Meeting the sleep recommendation was the most prevalent behaviour (60.5%), while MVPA was the least predominant (12%). These results are comparable to previous national data, where 64.3% respected the sleep recommendation (Roberts *et al.*, 2017). However, the percentage of girls meeting MVPA recommendation was slightly higher than those from this Canadian study that also used self-reported PA measures (12.0% vs. 8.4%).

When splitting the sample by years of participation in the FitSpirit programme, those with 2 years were more likely to meet sleep recommendations; whereas a higher percentage of those with 3 or more years met the MVPA and sleep combination, when compared to their peers. Girls who participated for 3 years or more in FitSpirit seemed to be more likely to show better sleeping and PA habits, confirming our hypotheses. These habits are positively associated with each other (Semplonius and Willoughby, 2018). Another study showed that PA is beneficial for sleep quality and duration, among adolescents (Mendelson *et al.*, 2016). Similarly, the study of Foti *et al.* showed that adolescents who engaged in ≥60 min of PA daily during the 7 days before the survey had higher odds of sufficient sleep than their peers. The opposite is also true, better sleep can improve the likelihood of being more active

Table 2: Proportion of girls meeting recommendations of the Canadian 24-hour movement guidelines by number of years of participation in FitSpirit

Number of recommendations met	Total ($n = 276$) (%)	1 year ($n = 176$) (%)	2 years ($n = 69$) (%)	3 or more years ($n = 31$) (%)	χ^2
None	25.4	30.1	17.4	16.1	5.81
MVPA	4.3	5.1	1.4	6.5	4.28
Screen time	9.4	11.4	5.8	6.5	2.25
Sleep	30.8	25.6	43.5[a,b]	32.3	10.76
MVPA and screen time	0.4	0.0	0.0	3.2	1.65
MVPA and sleep	5.1	1.7	10.1	12.9[c]	12.54
Screen time and sleep	22.5	23.3	20.3	22.6	0.60
All three	2.2	2.8	1.4	0.0	1.23

MVPA, moderate-to-vigorous physical activity. Level of significance set at $p < 0.05$.
[a]Significantly different from 1 year of participation.
[b]Significantly different from 3 or more years of participation.
[c]Significantly different from 1 year and 2 years of participation.

Table 3: Associations between meeting recommendations with health indicators and self-efficacy in the FitSpirit sample

Recommendation	Perceived HQL	Perceived health	Perceived self-efficacy	zBMI
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
None	—	—	—	—
One	0.05 (−0.16, 0.34)	0.06 (−0.17, 0.40)	**0.36 (0.97, 2.91)**	0.92 (−0.13, 0.56)
Two	**0.16 (0.04, 0.60)**	**0.20 (0.11, 0.74)**	**0.41 (1.31, 3.40)**	−0.03 (−0.46, 0.32)
Three	**0.20 (0.46, 1.88)**	0.10 (−0.15, 1.43)	**0.16 (0.31, 5.59)**	−0.07 (−1.55, 0.41)
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
None				
Meet at least one	—	—	—	—
Do not meet any	−0.10 (−0.44, 0.04)	−0.11 (−0.51, 0.03)	**−0.32 (−3.03, −1.21)**	−0.04 (−0.42, 0.23)
MVPA only				
Do not meet	—	—	—	—
Meet	**0.15 (0.09, 0.72)**	**0.18 (0.18, 0.87)**	0.09 (−0.42, 2.11)	−0.08 (−0.71, 0.15)
Screen time only				
Do not meet	—	—	—	—
Meet	0.07 (−0.09, 0.35)	0.05 (−0.15, 0.34)	**0.19 (0.23, 1.81)**	0.03 (−0.23, 0.36)
Sleep only				
Do not meet	—	—	—	—
Meet	**0.13 (0.02, 0.44)**	0.11 (−0.02, 0.45)	**0.23 (0.51, 2.11)**	−0.06 (−0.42, 0.16)
MVPA and screen time				
Do not meet	—	—	—	—
Meet	**0.19 (0.40, 1.68)**	0.09 (−0.15, 1.27)	0.06 (−1.50, 3.82)	−0.09 (−1.53, 0.23)
MVPA and sleep				
Do not meet	—	—	—	—
Meet	**0.20 (0.27, 1.04)**	**0.17 (0.17, 1.03)**	0.09 (−0.50, 2.50)	**−0.14 (−1.16, −0.11)**
Screen time and sleep				
Do not meet	—	—	—	—
Meet	0.10 (−0.03, 0.45)	0.09 (−0.06, 0.48)	**0.16 (0.08, 1.77)**	−0.04 (−0.43, 0.23)
MVPA, screen time and sleep				
Do not meet	—	—	—	—
Meet	**0.17 (0.33, 1.71)**	0.07 (−0.33, 1.21)	0.06 (−1.50, 3.82)	−0.08 (−1.59, 0.30)

(—) Reference. β (95% CI), standardized beta coefficients (95% confidence intervals). Analyses controlled by age and fruits and vegetables consumption. HQL, health-related quality of life; MVPA, moderate-to-vigorous physical activity; zBMI, body mass index *z*-score. Statistically significant associations ($p < 0.05$) are highlighted in bold.

(Foti *et al.*, 2011; Barnes, 2018). This evidence supports the potential of PA regular practice encouraged by FitSpirit to improve sleep habits among adolescents, also how these variables are related with each other.

The results of our study showed that there were small but significant correlations between meeting recommendations and quality of life, perceived health as well as PA self-efficacy. These correlations can be explained by the fact that girls with healthier lifestyle habits tend to better perceive their quality of life and health. Though, caution should be raised given the cross-sectional design for this study that prevents inference causality. However, the way adolescents perceive their health could be related to their behavioural choices, which can lead to a healthy lifestyle, health occupying a relevant place in their lives (Michaelson *et al.*, 2016). In addition, PA has been suggested to be related to better quality of life in adolescents (Motamed-Gorji *et al.*, 2019). Interestingly, the adverse effects of prolonged screen time on quality of life perception can be diminished by high PA levels (Motamed-Gorji *et al.*, 2019). Also, epidemiological evidence showed that adolescent girls who are engaged in PA are less likely to report being in fair/poor health (Humphreys *et al.*, 2014). In agreement with these findings, our results suggest that meeting these recommendations may improve perceived quality of life and health . Concerning PA self-efficacy, the positive correlation with meeting recommendations can be described as an indirect outcome of the emotional response or satisfaction towards the PA practice (Chen *et al.*, 2017). Considering the current study design, it is also possible that higher levels of PA self-efficacy can lead to higher PA among adolescents (Voskuil and Robbins, 2015). Furthermore, peer support can be indirectly related to PA through self-efficacy, which is a remarkable characteristic of the FitSpirit programme, which focuses its intervention towards the practice of PA surrounded by peers.

Regarding the number of recommendations met, meeting most individual and combined recommendations was associated with better perceived quality of life. These results can indicate that the engagement in health-related behaviours is related to better perceived quality of life. There is not much research on the relationship of quality of life with combined movement behaviours among adolescents (Saunders *et al.*, 2016). Though, recent studies have shown that lifestyle health behaviours are related to the predictors of adolescents' quality of life (Jalali-Farahani *et al.*, 2016; Lee *et al.*, 2019), which reinforces the importance of our results. Also, the perception of quality of life can be useful in identifying adolescents at risk of engaging in health-compromising behaviours (Lee *et al.*, 2019), for example not meeting the PA, screen time or sleep recommendations.

Similar patterns were seen with perceived health. Meeting two out of all recommendations was associated with better perceived health. In addition, meeting the MVPA recommendation, as well as combinations of MVPA/sleep and screen time/sleep, was associated with better perceived health. Even though it is not well explored within the adolescent population (Humphreys *et al.*, 2014), healthy attitudes, such as avoiding sedentariness and getting adequate sleep, play an important role in the adoption and maintenance of healthy habits (Jembere *et al.*, 2010). Accordingly, regular PA reduces the likelihood of perceiving health as fair/poor. Novak *et al.* showed that participating in MVPA more frequently was associated with good self-rated health in adolescents (Novak *et al.*, 2017).

In regard to PA self-efficacy, meeting at least one recommendation was positively associated with this variable. Additionally, most individual recommendations were strongly associated, including sleep, screen time and the combination of these last two. Lastly, meeting none of the recommendations was associated with a worse perceived self-efficacy. PA self-efficacy is considered to be a mediating variable in tracking unhealthy behaviours (Busch *et al.*, 2013). Previous studies described PA self-efficacy to be a correlate of moderate and vigorous PA among adolescents contributing to their intentions to be physically active (Dishman *et al.*, 2004; Chen *et al.*, 2017). In addition, Cataldo *et al.* showed that PA intervention programmes may improve self-efficacy in youth (Cataldo *et al.*, 2013). This assertion corroborates our findings, since FitSpirit participants who meet recommendations seem to have a favourable PA self-efficacy.

The results regarding combined recommendations across zBMI indicated that meeting the MVPA and sleep recommendations was associated with a healthier zBMI ($\beta = -0.14$, 95% CI $= -1.16, -0.11$). Nonetheless, meeting the other recommendations was not significantly associated with zBMI. Although the β of meeting the MVPA and sleep recommendations associated with zBMI was modest, this finding is encouraging as small changes in zBMI associated with healthy lifestyle could also potentially prevent the occurrence of morbidity later in life (Watts *et al.*, 2016). It is clearly documented that regularly practicing PA is related to the prevention of obesity (Katzmarzyk *et al.*, 2015). Additionally, some studies have shown that insufficient sleep duration is also a known risk for overweight and obesity (Chaput, 2016). Bad sleep hygiene can affect PA levels and eating behaviours (Chaput, 2016). A decrease in PA may

possibly happen due to fatigue and tiredness caused by sleep deprivation (Chaput, 2016). The combined effects of MVPA and sleep may possibly explain the negative association with body weight status found in this study, indicating that girls who respected this combination had significantly lower zBMI values. A systematic review showed that a combination of adequate sleep with high levels of PA is associated with more favourable measures of adiposity (Saunders *et al.*, 2016). Lastly, similar to the findings of this study, Laurson *et al.* observed that children failing to meet the PA and sleep combined recommendations are more likely to be living with obesity than those who follow the recommendations (Laurson *et al.*, 2014).

Findings from the current study may suggest that FitSpirit helps girls to achieve lifestyle recommendations, based on the number of years of their participation. FitSpirit may improve participants' perceived quality of life and health, PA self-efficacy, as well as zBMI, which are related to individual and combined movement behaviours, as hypothesized. Conversely, longitudinal evidence with a larger sample based on the combined associations of all three movement behaviours on health indicators in adolescents is still under-studied.

Limitations and strengths

The strengths of this study include the choice of health indicators examined for the adolescent population, which are still unexplored in this population. Also, the exploration of three Canadian 24-hour movement guideline variables together is important, since the majority of studies implied their effects without comparing them together. In addition, our findings provide a unique interpretation of subjective health-related variables, such as perceived quality of life and health, which are certainly underused among adolescents. Likewise, PA self-efficacy is a consistent mediator of intervention effects on PA among youth, but not well explored among this population. To the authors' knowledge, there were no other studies that evaluated the associations between meeting the recommendations and perceived quality of life and health, PA self-efficacy as well as zBMI among adolescent girls undergoing an intervention programme.

Nevertheless, given the cross-sectional design of these analyses, causal inferences cannot be made in regard to the associations observed. Future longitudinal and experimental work is needed to grow and strengthen the evidence base. Self-reported error associated with these subjective measures and the selection bias concerning the sample selection may have influenced the results. It is possible that the FitSpirit intervention may have attracted and retained the most active girls and those with healthiest lifestyle. However, it is unknown whether the girls who participated for many years in the programme would have remained active without the FitSpirit intervention. This can influence the interpretation of the data. Although the variables are all self-reported by the participants, the questions used in the questionnaire have been validated for the age group of the population studied. This helps ensure that the questions properly assess the variables indicated.

CONCLUSION

In conclusion, there was a small percentage of girls who achieved all of the recommendations. Furthermore, meeting individual and combined recommendations within the Canadian 24-hour movement guidelines was associated with better perceived quality of life and health, PA self-efficacy as well as healthier zBMI in a sample of FitSpirit participants. More strategies and efforts are needed to improve the adherence of these new guidelines by adolescents. Future studies should examine the longitudinal effects of a PA intervention on following the 24-h movement guidelines and its influence on health indicators among adolescents.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *Health Promotion International* online.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no competing interests.

COMPLIANCE WITH ETHICAL STANDARDS

The ethics approval was obtained from the Comité d'éthique de la recherche en santé (CERES, #16160, 21 December 2016) of the Université de Montréal. Participants aged 14 years and above were eligible to the study if they provided research consent. Younger participants had to provide their parent's written informed consent.

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