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How are 24-hour movement guidelines linked to health-related quality of life in Spanish children and adolescents?

Raquel Pastor-Cisneros[1], María Mendoza-Muñoz[2], Damián Pereira-Payo[3] and José Francisco López-Gil[4,5*]

Abstract

Background This study investigates the association between adherence to the 24-h movement guidelines, which include physical activity (PA), screen time (ST), and sleep duration (SD), and health-related quality of life (HRQoL) in a representative sample of Spanish children and adolescents aged 8–14 years.

Methods Data were obtained from the Spanish National Health Survey (2017), a representative cross-sectional survey. The survey employed a three-stage sampling process and included 2711 participants aged 8–14 years after exclusions for missing data. HRQoL was assessed using the modified KIDSCREEN-10 (proxy version). PA, ST, and SD were self-reported by parents and categorized based on international guidelines. Covariates such as age, sex, socioeconomic status, body mass index (BMI), and diet quality were also considered. Robust linear regression models were used to examine associations between the number of guidelines met and HRQoL, adjusting for potential confounders.

Results Overall, a positive dose–response association was observed, with greater compliance with the 24-h movement guidelines linked to higher HRQoL. After adjusting for potential covariates, significant differences in HRQoL were identified on the basis of adherence to the guidelines. Compared with those who complied with one, two, or all three guidelines, participants who adhered to none of the guidelines presented a lower HRQoL. However, significant differences were found only between those who adhered to any of the guidelines and those who followed two ($p = 0.003$), or all the three ($p < 0.001$) guidelines.

Conclusions A combination of optimal levels of PA, ST and SD could play a crucial role in enhancing HRQoL among children and adolescents.

Keywords Well-being, Physical activity, Sedentary behavior, Screen time, Sleep duration, Teenagers

*Correspondence:
José Francisco López-Gil
josefranciscolopezgil@gmail.com
[1] Promoting a Healthy Society Research Group (PHeSO), Faculty of Sport Sciences, University of Extremadura, Caceres 10003, Spain
[2] Research Group On Physical and Health Literacy and Health-Related Quality of Life (PHYQOL), Faculty of Sport Sciences, University of Extremadura, Caceres 10003, Spain
[3] Health, Economy, Motricity and Education (HEME), University of Extremadura, Caceres 10003, Spain
[4] School of Medicine, Universidad Espíritu Santo, Samborondón, Ecuador
[5] Vicerrectoría de Investigación y Postgrado, Universidad de Los Lagos, Osorno, Chile

Introduction

Focusing on movement, 24-h is divided into sleep, sedentary behavior and physical activity (PA) on a scale ranging from no movement to high movement [1]. In fact, in recent years, numerous previous studies have shown the positive implications of high PA, low sedentary behavior, and adecuate duration sleep for the health of children and adolescents [2–5]. To evaluate the importance of the optimal use of time throughout the day in terms of healthy habits, Canadian 24-h movement guidelines for children and youth (5–17 years) [6] and preschool children [7] were established and published in 2016 and 2017, respectively.

In the study by Tapia et al. [8], which included results from 23 countries from all continents, only 7% of the young population complied with the three 24-h movement guidelines, and 1 in 5 young people did not comply with any of the recommendations. These alarming data are also found in some Spanish studies, where the lowest rate of compliance with PA recommendations in children in the last decade was observed [9]; at the same time, high rates of sedentary behavior and screen time (ST) [10] and inadequate sleep duration (SD) [11] have been reported. Furthermore, the majority of Spanish adolescents do not comply with the combination of these variables, as reflected in the 24-h movement guidelines [12].

In this context, researchers have focused their interest on compliance with 24-h movement behaviors in children and adolescents and their potential health effects in this population, finding positive associations with higher health-related quality of life (HRQoL) [13], better physical fitness [14], healthy body mass index (BMI) and lower cardiometabolic risk factors [15] compared with no or lower compliance with the proposed guidelines. In support of this notion, many previous studies have indicated the contraindication of having a low score on this variable, among which the increased risk of developing mental health problems is associated with low HRQoL [16] and the alteration of psychological dimensions in a negative way [17]. Obesity is also associated with low HRQoL [18]. On the other hand, high HRQoL scores have positive implications, such as increased resilience in children and youth [19] and improved diet quality [20]. Therefore, taking into account the decline in HRQoL once Spanish children start secondary school [21] and the influence this may have on the aforementioned health-related variables, the importance of improving HRQoL in children and adolescents becomes apparent.

Taking into account the evidence that shows a clear relationship between adherence to the 24-h movement guidelines and health-related aspects, different countries, such as Australia [22, 23], Portugal, China, the United Kingdom, the United States, Colombia, Finland, South Africa, Kenya, Brazil and Canada [13], have studied the associations between adherence to the 24-h movement guidelines and HRQoL in children and adolescents. A recently published review collected data on this association of variables in the same study population from all continents, with 10 studies in Europe [24]. However, evidence of the association between adherence to 24-h movement guidelines and HRQoL in a representative population sample of Spanish children and adolescents is lacking, as no previous study has examined the relationships between these variables. Given the close relationship between 24-h movement guidelines and health-related variables, this study aims to analyze the association between adherence to 24-h movement guidelines and HRQoL in the Spanish youth population aged 8–14 years.

Methods

Participants and study design

Data for this cross-sectional study were sourced from the latest available wave (2017) of the Spanish National Health Survey (SNHS), a representative survey. The SNHS was conducted by the Ministry of Health, Consumer Affairs and Social Welfare [25] and the National Statistics Institute [26]. It targeted noninstitutionalized individuals and employed a three-stage sampling design: 1) census section; 2) households; and 3) individuals. In each household, an adult (≥ 15 years old) was selected to complete the Adult Questionnaire, and if there were minors (aged 0–14 years) in the household, one was also randomly chosen, with parents/guardians completing the Minors Questionnaire.

This research focused on analyzing data from the Minor Questionnaire, which was aimed at children between the ages of 0 and 14 years. The original sample included 6101 participants (100.0%). However, since the HRQoL assessment applied only to those aged 8 years or older, 2875 participants (47.1%) under the age of 8 years were excluded. Furthermore, 317 participants (5.2%) were excluded because of incomplete data on dietary patterns, and 201 participants (3.3%) were removed because of missing information on various covariates, such as socioeconomic status, ST, and BMI. As a result, the final sample consisted of 2708 Spanish children and adolescents aged 8–14 years (44.3%).

Anonymized data from the SHNS (2017) were acquired from the Ministry of Health, Consumer Affairs and Social Welfare [25] (publicly accessible). Since this study utilized secondary data, approval from an ethics committee was not necessary.

Procedures

Twenty-four-hour movement guidelines (independent variable)

The participants were asked about SD: "Can you tell me approximately how many hours your child usually sleeps daily? (Counting nap times)". Adherence to SD guideline was determined via the National Sleep Foundation's recommendations [27]: preschooler (10–13 h/day of sleep), child (9–11 h/day of sleep), and adolescent (8–10 h/day of sleep). Recreational ST was assessed through questions about the duration of ST during weekdays/weekends: "How much time does your child typically spend on weekdays/weekends in front of a screen, including a computer, tablet, TV, video, video game or cell phone screen?". Possible responses were (a) "nothing or almost nothing"; (b) "less than one hour"; and (c) "one hour or more". If the answer was "one hour or more", they were also asked about the actual number of hours they spent. Compliance with recreational ST guideline was based on the World Health Organization (WHO) recommendations on sedentary behavior for children under 5 years of age [28] (under 1 year: no ST; 1–4 years: < 60 min per day) and the Canadian ST guideline for the young population (5–14 years: less than 120 min per day of ST) [6]. PA was measured via an adapted version of the International Physical Activity Questionnaire [29]. The participants could choose from four options: (a) "no exercise" (free time mostly spent in sedentary activities [e.g., watching TV, reading]); (b) "occasional sport or PA participation"; (c) "PA several times per month"; and (d) "physical training or sports several times per week" [25]. The participants who selected "no exercise", "occasional sport", "PA participation" or "PA several times per month" were classified as "not meeting the PA guideline", whereas those who reported "physical training or sports several times per week" were classified as "meeting the PA guideline".

Health-related quality of life (dependent variable)

Health-related quality of life was assessed via the modified Screening for and Promotion of Health-Related Quality of Life in Children and Adolescents–10 (KIDSCREEN–10) index (proxy version) [25], which is composed of nine items instead of 10 (KS9). The response options were (1) "not at all", (2) "a little", (3) "moderately", (4) "a lot" and (5) "very much". It was constructed with the sum of items E14.1-E14.9 (inverting the values of items E14.3 and E14.4) divided by the number of items and can take values between 1 (worst HRQoL) and 5 (best HRQoL). The resulting score was then converted to a scale ranging from 0 to 100, with higher scores indicating greater HRQoL.

Covariates

Sex (boys/girls), age, and immigrant status (i.e., nationality) were reported by the parents/caregivers, and socioeconomic status (SES) was determined according to six different categories on the basis of the respondent's occupation. The categories varied from "status 1" (the highest) to "status 6" (the lowest). For our analyses, we collapsed this variable into three different categories as follows: low SES (statuses 5 and 6), medium SES (statuses 3 and 4), and high SES (statuses 1 and 2). Height and body weight were also measured by parents/caregivers. BMI was calculated by dividing weight (in kg) by height (in m^2). BMI (z score) and, subsequently, excess weight were calculated following the International Obesity Task Force criteria [30]. Diet quality was determined by the Spanish Health Eating Index (S-HEI) [31], which is an adapted version of the original Healthy Eating Index (HEI) [32]. The S-HEI includes 10 food groups (e.g., fruit, vegetables, dairy products) divided into five categories related to food consumption: a) "never or hardly ever"; b) "one time per week"; c) "from one to two times per week"; d) "more than three times per week, but not daily"; and e) "daily", following the Spanish Society of Community Nutrition guidelines [33]. The overall score for the S-HEI was computed by summing the frequency of food group consumption (0–10 points), and it reflects the meeting of the Spanish Society of Community Nutrition guidelines (i.e., a higher S-HEI score means a higher degree of meeting these guidelines). The choice of these covariates was based on previous scientific literature [34–38].

Statistical analysis

Density plots, quantile–quantile plots, and the Shapiro–Wilk test were used to assess the normality of the variables. Categorical variables are reported as counts (n) and percentages (%), whereas continuous variables are summarized as medians and interquartile ranges (IQRs). The overlap in adherence to the 24-h movement behavior guidelines (PA, SD, and ST) was examined using a Venn diagram based on binary adherence indicators. Generalized linear models with robust methods (specifically the "*KS2014*" method) were employed to explore the relationships between the number of 24-h movement guidelines met (none, one, two, or all three) and HRQoL among participants. These methods offer advantages in managing outliers and heteroscedasticity. Likewise, analyses were conducted based on the specific combinations of guideline adherence (i.e., meets none, only PA, only ST, only sleep, PA and ST, PA and sleep, ST and sleep, meets all three). Additionally, estimated marginal means (M) and their 95% confidence intervals (CIs) for HRQoL were calculated on the basis of the number

of 24-h movement guidelines met. Corrections for multiple comparisons were applied utilizing the false discovery rate *p*-value according to the Benjamini and Hochberg procedure [39]. All the models were adjusted for various covariates, including age, sex, SES, immigrant status, excess weight status, and diet quality. Statistical analyses were conducted via R statistical software (version 4.4.0) from the R Core Team in Vienna, Austria, and RStudio (2024.04.1 + 748) from Posit in Boston, MA, USA. A significance level of $p < 0.05$ was established.

Results

Table 1 shows the characteristics of the study participants according to compliance with the 24-h movement guidelines. With respect to the total number of participants ($N = 2711$), 39.5% of them complied with two guideliness, and a similar percentage of participants (37.3%) complied with only one guideline. However, only 13.2% complied with all three guidelines. Finally, 10.1% did not comply with any of the guidelines. The HRQoL scores increased as more recommendations were complied with, from 87.5 points in participants who did not comply with any guidelines to 92.5 points in participants who complied with all three guidelines.

Figure 1 presents the overlap in adherence to the physical activity, sleep, and screen time guidelines among Spanish children and adolescents. A total of 274 participants (10.1%) met all three movement behavior recommendations, while 731 (27.0%) adhered only to the sleep guideline, and 560 (20.7%) only to the screen time recommendation. Adherence exclusively to the physical activity guideline was observed in 111 individuals (4.1%). A smaller proportion met combinations of two guidelines, such as physical activity and screen time (3.1%), or

Table 1 Descriptive data of the study participants ($N = 2711$)

Variable		None of the guidelines	One guideline	Two guidelines	All three guidelines
Participants	*n* (%)	274 (10.1)	1010 (37.3)	1070 (39.5)	357 (13.2)
Age (years)	Median (IQR)	12.0 (2.0)	12.0 (3.0)	11.0 (4.0)	11.0 (3.0)
Sex	Boys (%)	126 (46.0)	489 (48.4)	536 (50.1)	193 (54.1)
	Girls (%)	148 (54.0)	521 (51.6)	534 (49.9)	164 (45.9)
SES status	Low SES (%)	136 (49.6)	506 (50.1)	469 (43.8)	133 (37.3)
	Medium SES (%)	98 (35.8)	321 (31.8)	353 (33.0)	130 (36.4)
	High SES (%)	40 (14.6)	183 (18.1)	248 (23.2)	94 (26.3)
Immigrant status	Native-born (%)	249 (90.9)	963 (95.3)	1031 (96.4)	344 (96.4)
	Foreign-born (%)	25 (9.1)	47 (4.7)	39 (3.6)	13 (3.6)
BMI (kilograms/meters^2)	Median (IQR)	19.3 (5.1)	19.1 (4.4)	18.7 (4.5)	17.9 (4.3)
Excess weight †	No excess weight (%)	167 (60.9)	607 (60.1)	669 (62.5)	237 (66.4)
	Excess weight (%)	107 (39.1)	403 (39.9)	401 (37.5)	120 (33.6)
HEI (score)	Median (IQR)	68.8 (13.5)	68.5 (13.0)	70.5 (11.9)	71.0 (10.5)
PA status	No exercise (%)	67 (24.5)	207 (20.5)	94 (8.8)	-
	Occasional PA or sport (%)	84 (30.7)	276 (27.3)	169 (15.8)	-
	PA several times a month (%)	123 (44.9)	416 (41.2)	297 (27.8)	-
	Sports or physical training several times a week (%)	-	111 (11.0)	510 (47.7)	357 (100.0)
PA guideline	Nonmeeting (%)	274 (100.0)	899 (89.0)	560 (52.3)	0 (0.0)
	Meeting (%)	-	111 (11.0)	510 (47.7)	357 (100.0)
ST duration (min) ‡	Median (IQR)	162.9 (85.7)	145.7 (85.7)	94.3 (77.1)	77.1 (21.4)
ST guideline	Nonmeeting (%)	274 (100.0)	842 (83.4)	425 (39.7)	0 (0.0)
	Meeting (%)	-	168 (16.6)	645 (60.3)	357 (100.0)
SD (hours)	Median (IQR)	8.0 (0.0)	9.0 (2.0)	9.0 (1.0)	9.0 (1.0)
SD guideline	Nonmeeting (%)	274 (100.0)	279 (27.6)	85 (7.9)	0 (0.0)
	Meeting (%)	-	731 (72.4)	985 (92.1)	357 (100.0)
HRQoL (score)	Median (IQR)	87.5 (17.5)	87.5 (15.0)	90.0 (12.5)	92.5 (12.5)

BMI body mass index, *HEI* Healthy Eating Index, *HRQoL* health-related quality of life, *IQR* interquartile range, *PA* physical activity, *SD,* sleep duration, *SES* socioeconomic status, *ST* screen time

† According to the International Obesity Task Force criteria [30]

‡ Including time-weighted weekdays and weekends

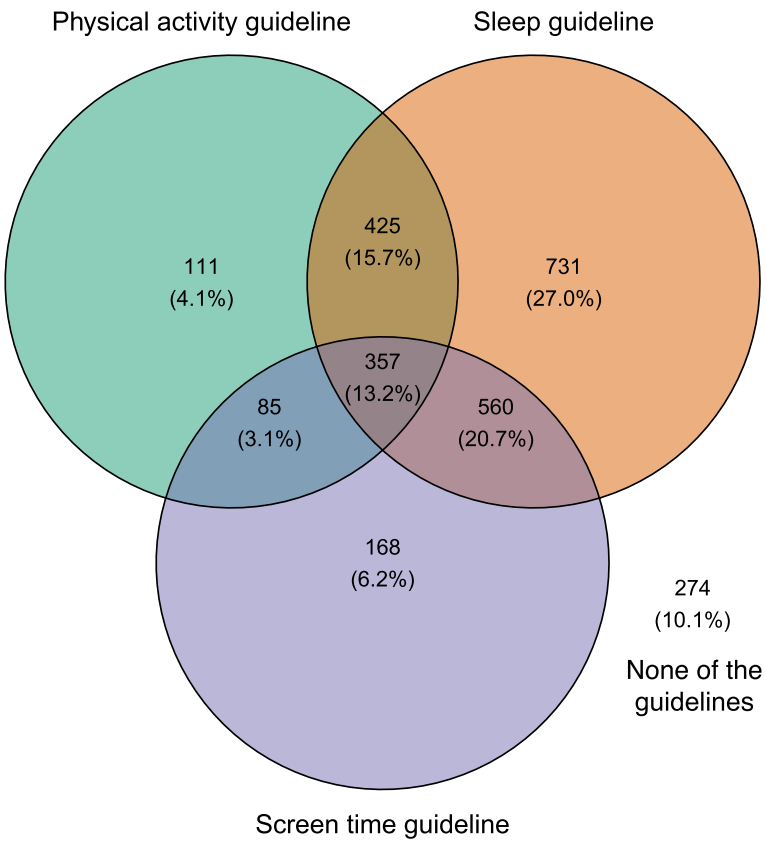

Fig. 1 Overlap in adherence to physical activity, sleep, and screen time guidelines among Spanish children and adolescents. The Venn diagram shows the distribution of participants who met the 24-h movement guidelines individually and in combination. The number of children and adolescents who did not meet any of the three guidelines is shown in the bottom-left corner

physical activity and sleep (6.2%). Notably, 357 participants (13.2%) did not meet any of the three 24-h movement guidelines.

Figure 2 illustrates the estimated marginal means of HRQoL according to 24-h movement guideline compliance among the Spanish young population. Overall, a positive dose–response association was observed, with greater compliance with the 24-h movement guidelines linked to higher HRQoL. The lowest predicted HRQoL was observed among participants who met none of the 24-h movement guidelines (M = 87.1, 95% CI 85.9 to 88.2), while the highest was found among those who met all three guidelines (M = 90.3, 95% CI 89.3 to 91.3). After adjusting for potential covariates, significant differences in HRQoL were identified on the basis of adherence to the guidelines. Compared with those who complied with one, two, or all three guidelines, participants who adhered to none of the guidelines presented a lower HRQoL. However, significant differences were found only between those who adhered to any of the guidelines and those who followed two ($p = 0.003$) or three ($p < 0.001$) of the guidelines. Table S1 shows the full results of the association of the number of 24-h movement guidelines complied and covariates with HRQoL.

Table 2 and Figure S1 present the estimated HRQoL values according to compliance with the 24-h movement recommendations, considering different combinations of PA, ST and SD. The lowest HRQoL values were observed in those who did not comply with any recommendation (87.1) and in those who only complied with ST or SD (86.6 and 87.1, respectively). In contrast, the highest values were recorded for those who complied only with PA (90.1) or combined PA with another healthy behaviour, such as reduced ST (90.0) or adequate SD (89.8). In addition, the group that complied with all three recommendations scored the highest (90.3). Regarding the differences found between the 24-h movement compliance, it was observed that those who complied only with PA obtained significantly better HRQoL values compared to those who did not comply with any recommendation ($p < 0.05$). Those who complied only with ST or SD scored significantly lower on HRQoL compared to those who complied only with PA ($p < 0.05$). In addition, compliance with PA and ST,

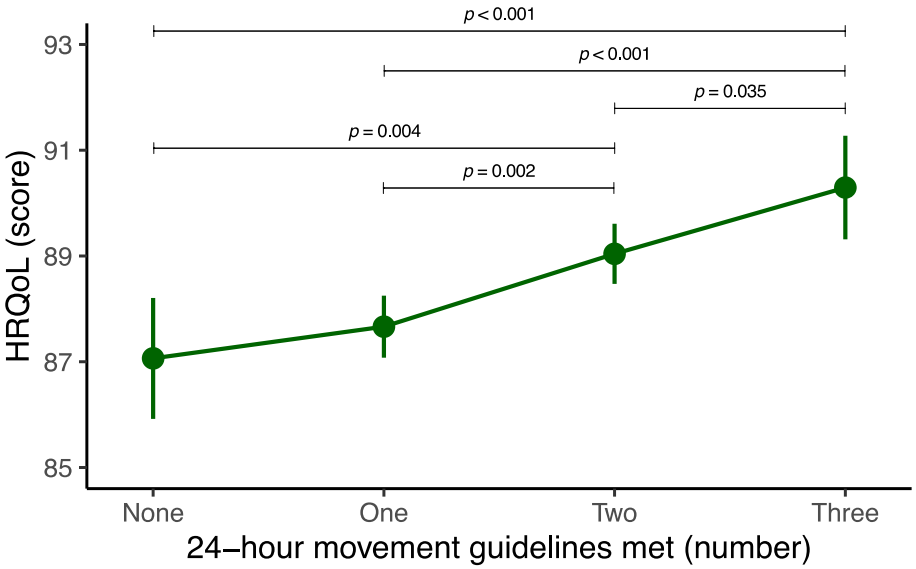

Fig. 2 Estimated marginal means of health-related quality of life according to the number of 24-h movement guidelines met among the Spanish young population. Data are expressed as estimated marginal means (dots) and 95% confidence intervals (vertical lines). HRQoL, health-related quality of life. Age, sex, socioeconomic status, immigration status, excess weight status, and diet quality were adjusted for. Corrections for multiple comparisons were applied utilizing the false discovery rate *p*-value according to the Benjamini and Hochberg procedure [39]

Table 2 Estimated marginal means of health-related quality of life based on the different combinations of 24-h movement guidelines met in the Spanish young population

	None	Only PA	Only ST	Only SD	PA + ST	PA + SD	ST + SD	All three
HRQoL	87.1 (85.9 to 88.2)	90.1 (88.4 to 91.9) [a]	86.6 (85.2 to 88.0) [b]	87.1 (86.8 to 88.2) [b]	90.0 (88.0 to 92.0) [a,c,d]	89.8 (88.9 to 90.7) [a,c,d]	88.3 (87.5 to 89.1) [e]	90.3 (89.3 to 91.3) [a,c,d,f]

Adjusted for age, sex, socioeconomic status, immigrant status, excess weight status, and diet quality. Corrections for multiple comparisons were applied utilizing the false discovery rate *p*-value according to the Benjamini and Hochberg procedure [39]

Data expressed as mean (95% confidence Interval)

PA physical activity, *SD* sleep duration, *ST* screen time

[a] Statistical differences ($p < 0.05$) from "none"

[b] Statistical differences ($p < 0.05$) from "only physical activity"

[c] Statistical differences ($p < 0.05$) from "only screen time"

[d] Statistical differences ($p < 0.05$) from "only sleep duration"

[e] Statistical differences ($p < 0.05$) from "physical activity and screen time"

[f] Statistical differences ($p < 0.05$) from "physical activity and sleep duration"

PA and SD or all three recommendations showed significantly higher HRQoL values compared to those who complied with no recommendation, only ST or only SD ($p < 0.05$). Finally, those who complied with all three recommendations had significantly higher HRQoL than those who did not comply with any recommendation, only complied with ST, SD or only with PA and SD ($p < 0.05$).

Table S2 shows the full results of the association of the different combinations of 24-h movement guidelines met and covariates with health-related quality of life among the Spanish young population.

Discussion

This study examined the cross-sectional association between 24-h movement guidelines, which encompass the measurement of sleep, sedentary behavior and PA, and parent-reported HRQoL in Spanish children and adolescents aged 8–14 years. The main finding of this study is that complying with two or three of the 24-h movement guidelines is significantly associated with greater HRQoL among young Spaniards than meeting none of the guidelines. Furthermore, a linear trend was identified between the number of 24-h movement guidelines met and HRQoL.

These results are consistent with those of previous studies that reported the same associations between 24-h movement guidelines and HRQoL in this population [13, 22, 24, 40]. In the study by Khan et al. [22] An incremental trend in HRQoL scores was observed between not meeting any recommendations and meeting more recommendations, with a significant association, which is consistent with the results of our study. Tapia et al. reported that the rate of compliance with 24-h movement guidelines among young people is very low at the global level (7%), and the same applies to the compliance rate at the European level (9.62%) [8]. Furthermore, this meta-analysis demonstrated the associations between adherence to the 24-h movement guidelines and positive health indicators and [8]. Similarly, our study presented a similar rate of compliance with the three recommendations (13.2%) and revealed relevant associations between HRQoL, which acts as a health indicator, and compliance with the 24-h movement guidelines in children and adolescents.

Our findings differ somewhat from those of Kyan et al. (2022), who found that adherence to sleep recommendations was most strongly associated with better self-rated health among Japanese adolescents [41]. In contrast, our study showed that meeting two or more 24-h movement guidelines—without one behavior standing out—was most associated with higher HRQoL. These differences may be due to variations in outcome measures (self-rated health vs. HRQoL), reporting sources (self-report vs. parent-report), cultural contexts, and study populations. Despite these differences, both studies support the importance of integrated movement behaviors for adolescent health.

In a large sample of children and adolescents from 12 countries, significant positive differences were observed between children who did not adhere to any recommendations and those who met one, two, or all three recommendations in terms of their HRQoL [13]. This contrasts with the findings of our study, where these associations were identified in the context of meeting two or three recommendations. Thus, the higher the compliance with the recommendations is, the higher the HRQoL in this population, and the lower the HRQoL in this population if the recommendations are not complied with. This slight discrepancy between our studies may be attributed to the size of the sample and the cultural variations present in the population.

Our findings suggest that compliance with the PA recommendation is most strongly associated with higher HRQoL among Spanish adolescents. This seems evident since meeting only the PA guideline resulted in a significantly higher HRQoL (M = 90.1; 95% CI 88.4 to 91.9) compared to meeting only the ST (M = 86.6; 85.2 to 88.0) or SD (M = 87.1; 86,8 to 88.2) guidelines ($p < 0.05$ for all). Furthermore, any combination that included PA (PA and ST [M = 90.0; 95% CI 88.0 to 92.0], PA and SD [M = 89.8; 95% CI 88.9 to 90.7], and all three guidelines [M = 90.3; 95% CI 89.3 to 91.3]) was associated with the highest HRQoL scores compared to those that did not include PA ($p < 0.05$ for all). This finding reinforces the idea that PA plays a crucial role in adolescents' well-being. These results align with previous studies indicating that regular engagement in PA is strongly linked to higher physical, mental, and social health [42–44]. One possible explanation is that PA enhances mood, reduces stress, and improves self-perception, which are key components of HRQoL [45–47].

Numerous preceding studies have reported findings regarding meeting two of the recommendations, namely, increased PA and reduced ST [23, 48], to increase HRQoL scores. With regard to PA, it has been shown in numerous studies to have a positive effect on HRQoL scores in this population [46, 49, 50]. Higher levels of PA may be associated with increased HRQoL in children and adolescents because of the physical and mental health benefits it provides [51]. Regular exercise can enhance cardiorespiratory fitness [52] and increase mood through the release of endorphins [53], all of which contribute to a greater overall quality of life [5]. Additionally, PA may promote social interactions [54, 55] and a sense of achievement [56], further enhancing well-being [57]. Conversely, as the frequency of PA decreases, HRQoL scores decrease; i.e., youth with lower levels of PA are associated with lower HRQoL scores [21] because they do not benefit from the positive effect found between PA and physical, emotional and social functioning on HRQoL [58].

Insufficient PA and prolonged sedentary behavior can have physical and psychological consequences for the health of this population [59] and are influential factors in HRQoL [60]. An increase in sedentary behavior time has also been found to be associated with a reduction in HRQoL scores in youths in previous studies [61–63]. The reason why increased sedentary behavior may negatively influence HRQoL, reducing its score, is that the downregulation of the shear rate and blood flow induced by sedentary behavior, together with alterations in glucose metabolism and inflammatory and oxidative stress pathways, are likely to play a key role in the vascular dysfunction associated with sedentary behavior [64]. Additionally, excessive sedentary behavior can be associated with social inactivity and loneliness in this population [65].

With respect to the role of SD, which is the last of the three recommended 24-h movement guidelines, numerous previous studies have reported the relationship of this

variable with HRQoL scores in youths [66–68]. Specifically, a significant association has been observed between insufficient sleep and low HRQoL scores, whereas adequate SD is positively linked to higher HRQoL scores in this population [66, 69]. The National Sleep Foundation recommends a healthy SD of 9–11 h for school-aged children to maximize overall health and well-being [27]. In addition, insufficient SD or sleep deprivation may contribute to fatigue and depression [70], which explains why young people with insufficient sleep tend to have lower HRQoL scores.

Methodological considerations

One of the main limitations we found was that the variables studied (PA, ST and SD) were self-reported measures and may have influenced the associations found. PA was assessed through approximation rather than precise measurement, which may not allow for a reliable determination of participants'adherence to the recommended 60 min of daily activity. This could impact the accuracy of our findings and their generalizability. Future studies should consider using objective measures, such as accelerometers or validated questionnaires, to enhance the precision of PA assessment. Furthermore, owing to the nature of the study design, cause–effect relationships cannot be established. Future research should study these variables via longitudinal design studies. Notably, the PA recommendation was an approximation and not an exact determination of recommended levels. Although these limitations may have influenced the results of our study, one of the strengths is the large sample size and the practical implications of our results. The adjustment for sociodemographic, lifestyle and anthropometric variables should also be taken into account, which makes the findings robust.

In light of this evidence, guidelines should focus on increasing daily PA at the earliest ages so that it is acquired during development and used in the transition from one age-specific pattern of movement to the next. Although this would serve as a preventive measure for the adolescent stage, where the decline in PA and increase in sedentary behavior is clear, resources and efforts should also be targeted at this stage. Improving the quality of life in the younger population through adherence to the 24-h movement guidelines could have an important impact on future health, as a previous study indicated that following these guidelines may be protective against frailty [71] and mortality [72]. The practical applications of this study suggest that public health strategies, school policies, clinical recommendations, and community interventions should be designed to promote adherence to the 24-h movement guidelines by focusing on PA, reducing ST, and ensuring adequate SD for children and adolescents. Furthermore, taking into account our further analysis of the different combinations of 24-h movement guidelines observed in the young Spanish population, public health strategies should prioritize interventions that promote PA while also encouraging balanced ST and adequate SD to maximize overall well-being in this population. These efforts can help to enhance HRQoL, prevent the decline in PA during adolescence, and reduce the risk of noncommunicable diseases in the future. In this sense, exploring 24-h movement guidelines could contribute to the prevention of noncommunicable diseases later in life. At the same time, the results obtained should be used to raise awareness and further action by sports educators, families and public institutions, as they are the direct and indirect influences of the younger population at the age of development.

Conclusions

A combination of optimal levels of PA, ST and SD could play a crucial role in enhancing HRQoL among children and adolescents. An incremental trend was found between greater adherence to 24-h movement guidelines and higher HRQoL scores in youth Spaniards. An objective measurement of these variables is needed for future studies. These results could contribute to the prevention of noncommunicable diseases later in life. Raising awareness and encouraging action by those who influence youth to comply with 24-h movement guidelines is necessary for the health of the population in the future.

Abbreviations

HRQoL	Health-Related Quality of Life
PA	Physical activity
ST	Screen time
SD	Sleep duration
BMI	Body Mass Index
SNHS	Spanish National Health Survey
HEI	Healthy Eating Index
CI	Confidence interval
IQR	Interquartile range
M	Mean
SES	Socioeconomic status
WHO	World Health Organization

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-025-22998-5.

Supplementary Material 1.

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Authors' contributions

Conceptualization, R.P.-C., and J.F.L.-G.; data curation, J.F.L.-G.; formal analysis, J.F.L.-G.; methodology, J.F.L.-G.; writing—original draft, R.P.-C.; writing—review

and editing, JF.L.-G, D.P.-P. and M.M.-M. All authors have read and agreed to the published version of the manuscript.

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Data availability
The availability of the data can be requested from the corresponding author of this article.

Declarations

Ethics approval and consent to participate
Anonymized data from the SHNS (2017) were acquired from the Ministry of Health, Consumer Affairs and Social Welfare [25] (publicly accessible). Since this study utilized secondary data, approval from an ethics committee was not necessary.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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