Table A.2.d. Adiposity/body composition and sedentary behaviour, children and adolescents

Questions: What is the association between **sedentary behaviour** and health-related outcomes? Is there a dose response association (total volume and the frequency, duration and intensity of interruption)? Does the association vary by type and domain of sedentary behaviour?
Population: Children aged 5-under 18 years of age
Exposure: Greater volume, decreased frequency, duration or intensity of interruption of sedentary behaviour
Comparison: Lesser volume, increased frequency, duration or intensity of interruption of sedentary behaviour
Outcome: Adiposity/Body composition
***Importance**: CRITICAL

Black font is from original GRADE Evidence Profiles from Australian 24-Hour Movement Guidelines for Children (5-12 years) and Young People (12-17 years).*(26)* Red font denotes additions based on WHO update using review of existing systematic reviews.

	Quality Assessment							
No. of studies/ Study design **No. of participants**	**Risk of bias**	**Inconsistency**	**Indirect-ness**	**Imprecision**	**Other**	**Summary of findings**	**Certainty**	**US PAGAC evidence** *(27)*
Mean baseline age ranged between 5.0 and 16.7 years; where mean age was not reported, baseline age ranged from 3 to 19 years and grades 5 to 12. Data were collected by longitudinal (n=32), case-control (n=5), and cross-sectional (n=125) design with up to 12 years follow-up. Body composition was assessed as BMI (objectively measured, self-report, parental-report), BMI z-score (objectively measured, self-reported), BMI percentiles (objectively measured, self-reported), overweight and obesity (objectively measured, self-report, parental-report; International Obesity Task Force, Centre for Disease Control and Prevention, World Health Organization, other country-specific percentiles), WHtR (objectively measured), WHR (objectively measured), fat mass (TANITA bioelectric impedance, duel-energy x-ray absorptiometry, Lunar Prodigy DEXA scanner), WC (objectively measured), WC z-score (objectively measured), sum of skinfolds (objectively measured), % body fat (objectively measured), and overfat (slaughter equation).								
45 Longitudinal [a] n = 102,934[d]	Serious risk of bias[b]	No serious inconsistency	No serious indirect-ness	No serious imprecision	Dose-response gradient [c]	Among *prospective findings*, higher sedentary behaviour was associated with unfavourable body composition for: 1) Accelerometer-derived sedentary time – *5/18 studies* (1 study found higher waist circumference at follow-up was associated with higher sedentary time at baseline). 2) Accelerometer-derived breaks - *0/2 study*. 3) Screen time - *15/17 studies* (only for 6 and 10 yr. old's in 1 study, only in males for 1 study, not for waist circumference in 1 study). 4) TV - *15/18 studies* (only for females in 1 study, not for movie viewing in 1 study, not for movie viewing in males in 1 study, only for males and not for body fatness, waist circumference and skinfold thickness for males in 1 study). 5) Computer - *3/5 studies* (only for females in 1 study, not for waist circumference in 2 studies, not for body fatness, hip circumference, and BMI in 1 study). 6) Video game - *0/2 studies*. 7) Total sedentary behaviour - *0/1 study*. 8) Weekend internet use – 1/1 study Higher sedentary behaviour was associated with better body composition 1) Accelerometer-derived sedentary time – *1/9 studies* (Higher total or uninterrupted SB (exposure and change) were associated with better body composition).	MODERATE[e]	8 ESRs Limited evidence suggests that greater time spent in sedentary behaviour is related to higher weight status or adiposity in children and adolescents; the evidence is somewhat stronger for television viewing or screen time than for total sedentary time. **PAGAC Grade: Limited.**

						2) Accelerometer-derived breaks - *1/2 study*. (Fragmentation findings were inconsistent – less fragmentation was beneficial overall (7-15y), but more fragmentation was beneficial between 9-12y		
5 Case-control[f] n = 4,748	No serious risk of bias	No serious inconsistency	No serious indirectn-ess	No serious imprecision	None.	Higher sedentary behaviour was associated with being overweight/obese (case group) for: 1) Screen time - *4/4 studies.* 2) TV - *2/2 studies (*only for weekends in 1 study). 3) Computer - *0/2 studies.*	LOW	
125 Cross-sectional[g] n = 1,386,706[j]	Serious risk of bias[h]	No serious inconsistency	No serious indirect-ness	No serious imprecision	Exposure/outcome gradient[i]	Fang et al. 2019 *(10)* (14 cross-sectional studies, 2 longitudinal studies, 1 case-control study; n = 45,381): Total screen time ≥2 hours/day was positively associated with childhood overweight/obesity compared with total screen time <2 hours/day (OR = 1.67 [95% CI, 1.48 to 1.88]). Marker et al. 2019 *(14)* (20 cross-sectional studies; n = 36,119)[m]: No statistically significant association between sedentary video gaming and body mass among children (correlation = 0.09 [95% CI, -0.07 to 0.25]) or adolescents (correlation = 0.01 [95% CI, -0.21 to 0.23]). Mohammadi et al. 2019 *(18)*: (2 cross-sectional studies; n=NR): **1/2 studies** found no association between screen time and BMI z-score; **1/2 studies** found a negative association between self-reported sedentary activities and risk of obesity among girls. Higher sedentary behaviour was associated with unfavourable body composition for: 1) Accelerometer-derived sedentary time - *3/18* studies (only after 3pm on weekdays for males in 1 study). 2) Long accelerometer-derived sedentary bouts (≥5 min) - *3/4 studies* (Only 5-9 minute bouts on weekdays and weekends only and in low MVPA group for only 5-9 minute and 10-19 minute bout on total days and weekends only in 1 study, Only 10-14 minute bouts for only BMI z-score and in males only in 1 study, and only at least 40 minutes (waist circumference only) in 11-14 yr old males after 3pm on weekdays and only at least 80 minutes for males only in 1 study). 3) Short accelerometer-derived sedentary bouts (1-4 minute) - *1/2 studies* (only for the weekend in 1 study). 4) Screen time - *26/36 studies* (only for males in 3 studies, not for urban participants in 1 study, not for certain ethnic groups in 1 study). 5) TV - *58/71 studies* (only for participates aged 4-8 yr in 1 study, only for males in 4 studies, only for females in 3 studies, only for weekdays in 1 study, only 12-18 yr old males for 1 study, not for BMI z-score in 1 study). 6) Computer - 7*/30 studies* (only for females in 2 studies). 7) Video game - 3*/20 studies* (only for weekends in 1 study and only for females in 1 study). 8) Total sedentary behaviour -*3/4 studies* (not for WC in 1 study, only in 1 sample and only for 6-11 yr olds in 1 study). 9) Homework - *3/7 studies* (only for males in 1 study, only in 6-11 yr old males in 1 study) 10) Quiet time - *1/1 study* (only for males in 1 study) Higher sedentary behaviour was associated with favourable body composition for:	VERY LOW[k]	

						1) Accelerometer-derived sedentary time - *1/18 studies*. 2) Accelerometer-derived sedentary breaks - *2/4 studies (*only 11-14 yr old males after 3pm on weekdays in 1 study). 3) Short accelerometer-derived sedentary bouts (1-4 min) - *1/2 studies* (1-4 minute bouts in 1 study). 4) Long accelerometer-derived sedentary bouts (≥5 min) - *1/4 studies* (only for girls and only for WC in 1 study). 5) Screen time - *1/36 studies* 6) Computer - *2/30* studies (only for 1hr/day in 1 study, not for sum of skinfolds in 1 study). 7) Reading - *1/2 studies* (only for low group in 1 study) 8) Non-screen time - *1/1 study*.		
1 NRT[l]	Serious risk of bias	No serious inconsistency	No serious indirect-ness	Serious imprecision	None	No effect for total sitting (during class school or whole day). Effect for sitting in long bouts (>10 min) and number of sit-to-stand transitions. No effect for BMIz/WCz.	VERY LOW[e]	

Abbreviations: WHtR = waist to height ratio; WHR = waist to hip ratio; WC = waist circumference; BMI = body mass index; min= minutes; OR = odds ratio

[*] As determined by WHO

[a] Includes 45 longitudinal studies *(50, 51, 53, 54, 61, 79-105)*; Allen et al. 2016; Barrense-Dias et al. 2016; Collings et al. 2015; Griffiths et al. 2016; Janz et al. 2017; Mann et al. 2017; Marques et al. 2016; Oellingrath et al. 2016; Sluijs et al. 2016; Tanaka et al. 2018; Wheaton et al. 2015; Skrede et al. 2017; Dong et al. 2017)

[b] Out of the 26 studies that used a subjective measure of sedentary behaviour, only 7 studies mention psychometric properties for the sedentary behaviour items *(85, 88, 94, 96, 99, 100, 102)*.

[c] Dose response gradient was observed for higher TV, sedentary time, screen time, computer with unfavourable body composition in 14 studies *(50, 51, 53, 81, 88-90, 93, 95-97, 99, 100, 102)*.

[d] Two studies used the Longitudinal Study of Australian Children *(84, 89)*.

[e] The quality of evidence for longitudinal studies could not be upgraded from "low" to "moderate" due to serious risk of bias but was upgraded to "moderate" due to a dose-response.

[f] Includes 5 case-control studies *(106-110)*.

[g] Includes 125 cross-sectional studies *(32, 37, 40, 42, 45, 49, 56, 59, 60, 63, 71, 78, 89, 111-222)*.

[h] Out of 108 studies that used a subjective measure of sedentary behaviour only 33 studies mentioned psychometric properties for the sedentary behaviour items *(49, 85, 88, 94, 96, 99, 100, 102, 106-109, 114, 120, 126, 128, 145-148, 152, 154, 168, 179-181, 183, 186, 191, 192, 197, 209, 210)*.

[i] A gradient for higher TV, video games, sedentary bouts, sedentary breaks, screen time, studying with unfavourable body composition was observed in 30 studies *(60, 71, 78, 122, 126, 128, 129, 138, 149, 152, 156, 159, 171, 173-177, 183, 185, 189, 194, 195, 197, 203-205, 208, 212, 221)*.

[j] Two studies used the Gateshead Millenium Study *(80, 81)*. Two studies used the optimal well-being, development and health for Danish children through a health New Nordic Diet school meal study *(54, 86)*. Three studies used the Longitudinal Study of Australian Children *(89, 123, 124)*. Three studies used the China Health and Nutrition Survey *(200, 220, 221)*. Three studies used the Quebec Adiposity and Lifestyle Investigator in Youth study *(71, 132, 157)*. Two studies used the 2007-2009 Canadian Health Measures Survey *(60, 135)*. Three studies used the International Study of Childhood Obesity, Lifestyle and the Environment *(133, 168, 169)*. Two studies used the 2003/04 and 2005/06 National Health and Nutrition Examination Survey *(78, 192)*. Two studies used the Alimentación y Valoración del Estado Nutricional de los Adolescentes study *(45, 182)*]. Two studies used the Arab Teens Lifestyle Study *(111, 112)*.

[k] The quality of evidence for cross-sectional studies was downgraded to "very low" from "low" due to serious risk of bias.

[l] Includes one non-RCT (Allen et al. 2016)

[m] 15/20 studies were among children or adolescents.