

**The relationships between screen use and health indicators  
among infants, toddlers and preschoolers: A meta-analysis and**

systematic review

Appendix

**Supplemental Files 1:**

**Table S1.** The characteristics of the studies included in this review

**Table S2.** GRADE assessment of quality of evidence reported the associations  
between media use and health indicators.

**Table S1.** The characteristics of the studies included in this review

<i>Author, date</i>	Study design	N	Age group (months)	Country	Measurements	The way described screen time use	Media devices examined	Screen time group	Health domain	Health indicators	Quality
<i>Ariza et al. 2004<sup>1</sup></i>	Cross-sectional study	80	60-72	America (Mexican American)	Maternal report: survey	Viewing categories (hours/day)	TV	≤3 >3	Physical	Adiposity (Overweight (BMI:25-29.9))	6
<i>Barr et al. 2008<sup>2</sup></i>	Quasi-experimental design	120	12(40) 15(40) 18(40)	America	Parent report: survey	Mean (SD) (hours/day)	TV	3.67(2.46)	Psycho-social Physical	Parent interaction (Responsiveness) Cognitive development (Learning)	Low bias (Selective bias)
<i>Bedford et al. 2016<sup>3</sup></i>	Cross-sectional study	612	6-36	England	Parent report: survey	Mean (SD) (hours/day)	Touchscreen	0.41(0.65)	Physical	Cognitive development (Language development) Motor development (Fine motor, Gross motor)	7
<i>Beyens et al. 2019<sup>4</sup></i>	Cross-sectional study	402	36-60	America	Maternal report	Mean (SD) (hours/day)	TV Mobile devices Tablet devices Handheld game player Laptop computer Smartphone	3.8(2.64) 3.08(4.08) 1.4(2.11) 0.59(1.39) 0.51(1.33) 0.41(1.11)	Behavioral	Sleep problems	6
<i>Brambilla et al 2017<sup>5</sup></i>	Cross-sectional study	523	0-36	Italy	Parent report:	Prevalence	TV	39.6%	Behavioral	Sleep problems	7

					survey(inte rview)						
<i>Brockman et al. 2016</i> <sup>6</sup>	Cross-sectional study	100	12-72	Chile	Parent report: survey	Median (min-max) (hours/day)	TV	0.042(0.008,0.018)	Behavioral	Sleep problems	7
<i>Byeon et al. 2015</i> <sup>7</sup>	Cross-sectional study	1778	24-30	Korea	Parent report: survey	Mean (SD) (hours/day)	TV	1.21(0.99)	Physical	Cognitive development (Language development)	7
<i>Cespedes et al. 2014</i> <sup>8</sup>	Cohort study	1864	12-84	America	Parent report: survey	Mean (SD) (hours/day)	TV	6months:0.9 (1.2)	Behavioral	Sleep problems(duration)	7
<i>Chen et al. 2019</i> <sup>9</sup>	Cross-sectional study	714	0-6(321) 6-24(393)	Singapore	Parent report: survey	Median (IQR) (hours/day)	ALL	1.00 (0.50–2.00)	Behavioral	Sleep problems(duration)	7
							TV	0.98 (0.43–2.00)			
							Mobile devices	0.50 (0.25–1.00)			
							Computer	0.50 (0.36–1.00)			
<i>Cheng et al. 2010</i> <sup>10</sup>	Cohort study	302	18-30	Japan	Maternal report: survey	Viewing categories (hours/day)	TV	<1	Psycho-social (Behavioral and emotional outcomes)	Emotional symptoms Conduct problems Hyperactivity-Inattention Peer-problems Prosocial behaviors	7
								≥1 to <3			
								≥3 to <4			
								≥4			
<i>Cheung et al. 2017</i> <sup>11</sup>	Cross-sectional study	612	6-36	England	Parent report	Mean (SD) (hours/day)	Touchscreen	0.41(0.65)	Behavioral	Sleep duration Sleep latency	5
<i>Christakis et al. 2007</i> <sup>12</sup>	Cohort study	330	24-60	America	Parent report: survey	Mean (SD) (hours/day)	TV (content)	Educational:0.42 (0.60) Nonviolent entertainment:0.91 (1.00)	Psycho-social	Aggressive behavior (Antisocial behaviors)	6

								Violent entertainment:0.54 (0.80)			
<i>Collings et al. 2018</i> <sup>13</sup>	Cohort study	1338	12; 18; 24(798); 36(909)	England	Parent report: survey	Mean (SD) (hours/day)	TV	All time points:1.3(1.2) 36 months:2.1(1.5) 24 months:1.3(2)	Physical	Adiposity (BMI, Sum of skinfolds, Waist circumference)	7
<i>Cox et al. 2012</i> <sup>14</sup>	Cross-sectional study	135	24-72	Australia	Maternal report: survey	Mean (SD) (hours/day)	TV	Weekday:1.43(0.92) Weekend:1.72(1.11)	Physical Behavioral	Adiposity (BMI z-score) Healthy dietary behavior (Energy intake, fast foods, vegetables)	7
<i>De Coen et al. 2014</i> <sup>15</sup>	cohort study	568	36-72	Belgium	Parent report: survey	Viewing categories (hours/day)	ALL	Weekday:>1; ≤1 Weekend:>2; ≤2	Physical	Adiposity (Overweight)	7
<i>Ebenegger et al. 2012</i> <sup>16</sup>	Cross-sectional study	450	48-72	Swiss	Parent report: survey	Mean (SD) (hours/day)	TV	0.93(0.82)	Psycho-social	Behavioral and emotional outcomes (Hyperactivity/Inattention)	7
<i>Foster et al. 2010</i> <sup>17</sup>	Cohort study	1159	12, 36	America	Parent report	Viewing categories (hours/day)	TV	0 0-1 1-2 2-3 3-4 4-5 5-6 6-7 ≥7	Psycho-social	Behavioral and emotional outcomes (Attentional problems)	7
<i>Garrison et al. 2011</i> <sup>18</sup>	RCT	617	36-60	America	Parent report:	Mean (SD) (hours/day)	TV	Daytime: 0.98(0.71) Evening:0.24(0.29)	Behavioral	Sleep problems	Low bias (Measur

					survey(inte rview)						ement bias) Low bias (Measur ement bias)
<i>Garrison et al. 2012</i> <sup>19</sup>	RCT	565	36-60	America	Parent report: survey(inte rview)	Content	TV	Unhealthy media: violent or age- inappropriate content	Behavioral	Sleep problems	
							TV	0 0.01-0.24 0.25-0.99 1-1.99		Healthy dietary behavior quality (Snacks, Brown bread, Fresh fruit, Sugar- sweetened drinks, Light soft drinks, Vegetables, White bread)	7
<i>Gubbels et al. 2009</i> <sup>20</sup>	Cross- sectiona l study	2471	24	Netherlan ds	Parent report: survey	Viewing categories (hours/day)	Computer	<2 ≥2	Behavioral		
								0 <1 1-3 4-6 ≥7			
<i>Helm et al. 2019</i> <sup>21</sup>	Cross- sectiona l study	470	33-71	America	Parent report: survey	Viewing categories (hours/day)	TV		Behavioral	Sleep problems	8
							TV Sedentary electronic games	0.12(0.29)		Emotional and social skills (Intrapersonal, Stress management, Interpersonal, Adaptability)	
<i>Hinkley et al. 2017</i> <sup>22</sup>	Cohort study	108	36-60	Australia	Parent report: survey	Mean (SD) (hours/day)	Active electronic games Computer/ internet (excluding games)	0.04(0.09) 0.10(0.23)	Psycho- social		7
<i>Hinkley et al. 2014</i> <sup>23</sup>	Cohort study	3604	24-72	Belgium; Cyprus;		Mean (SD) (hours/day)	Weekday television	Boy:1.04 (0.75); Girl:0.98(0.70)	Psycho- social	Behavioral and emotional outcomes	8

				Estonia; Germany; Hungary; Italy; Spain; Sweden	Parent report: survey		Weekend television	Boy:1.62 (0.93); Girl: 1.53 (0.91)		(Emotional problems, Peer problems, Self- esteem, Emotional well- being)	
							Weekday PC	Boy:0.19 (0.39); Girl:0.11 (0.26)			
							Weekend PC	Boy:0.33 (0.56); Girl:0.21 (0.40)			
<i>Howie et al. 2017</i> <sup>24</sup>	Subject laboratory trial	6	36-60	Australia	Parent report	Range (hours/day)	mobile touchscreen	(0.33,2.7)	Behavioral	Sedentary behaviors	Low bias (Selecti ve bias)
									Physical	Musculoskeletal risk	
									Physical	Adiposity (Overweight)	
<i>Hu et al. 2019</i> <sup>25</sup>	Case- control study	933	12-24(264)  48-60(669)	China	Parent report: survey(inte rview)	Viewing categories (hours/day)	TV	<1  ≥1	Behavioral	Sleep problems) Sleep duration	7
										Physical activity	
								0 <1 1-2 2-3 3-4 4-5 >5	Psycho- social	Emotional and social skills (Self-Regulation)	7
<i>Inoue et L. 2016</i> <sup>26</sup>	Cohort study	3243 9	36-60	Japan	Parent report: survey	Viewing categories (hours/day)	TV				
<i>Jago et al. 2005</i> <sup>27</sup>	Cohort study	149 147 133	36-48 48-60 60-72	America	Maternal report	not mentioned	TV	not mentioned	Physical	Adiposity (BMI)	7
<i>Ji et al. 2018</i> <sup>28</sup>	Cross- sectiona l study	112	36-72	China	Parent report: survey	Mean (SD) (hours/day)	ALL	Weekday:0.75(0.7); Weekend:2.07(1.64)	Behavioral	Sleep problems	7
<i>Jouret et al. 2007</i> <sup>29</sup>		298( boy)	48	France	Parent report	not mentioned	TV	not mentioned	Physical	Adiposity (Overweight (BMI≥90% percent))	7

	Cross-sectional study	295(girl)										
<i>Kirkorian et al. 2016</i> <sup>30</sup>	Cross-sectional study	58(boy) 58(girl)	23.5-36	America	Parent report: survey	Range (hours/day)	ALL TV Interactive media	(0,3.58) (0,3.33) (0,1)	Physical	Cognitive development (Language learning)	6	
<i>Lillard et al. 2011</i> <sup>31</sup>	Cross-sectional study	60	48	America	Parent report: survey	Range (hours/day)	Fast-Paced Television Educational Television Drawing	0.8(0.16) 0.66(0.16) 0.91(0.16)	Physical	Executive function	6	
<i>Lin et al. 2015</i> <sup>32</sup>	Cross-sectional study	150	15-36	China	Parent report: survey(interview)	Mean (hours/day)	TV	2.28	Physical	Cognitive development (Language development) Motor development	7	
<i>Lumeng et al. 2006</i> <sup>33</sup>	Cross-sectional study	1016	36	America	Maternal report	Viewing categories(hours/day)	TV	<2 ≥2	Physical	Adiposity (Overweight (BMI≥95%))	7	
<i>Manganello et al. 2009</i> <sup>34</sup>	Cohort study	3128	36	America	Maternal report	Mean (SD) (hours/day)	TV	3.2(2.3)	Psychosocial	Aggressive behavior	7	
<i>Manios et al. 2009</i> <sup>35</sup>	Cohort study	2241	12-69	Greece	Parental report	Mean (SD) (hours/day)	TV	1.32(1.12)	Physical	Adiposity (Overweight(95%>BMI≥85%), Obese (BMI≥95%))	7	
<i>Marinell et al. 2014</i> <sup>36</sup>	Cohort study	1444	24(657) 48(787)	Spain	Maternal report	Viewing categories(hours/day)	TV	<0.5 ≥0.5	Behavioral	Sleep duration	7	
		185	43.2-57.6	Australia			ALL	2.42(1.33)	Physical	Executive Function	6	

<i>McNeill et al. 2019</i> <sup>37</sup>	Cohort study				Parent report: survey	Mean (SD) (hours/day)	TV	2.04(1.14)	Psycho-social	Behavioral and emotional outcomes (Internalizing problems, Externalizing problems)	
								>2			
								≤2			
							TV	>2			
								≤2			
<i>Mendoza et al. 2007</i> <sup>38</sup>	Cross-sectional study	1809	24-60	America	Parent report: survey	Viewing categories(hours/day)		0	Physical	Adiposity (Overweight, Sum of skinfolds)	7
								<1			
							Computer	1			
								2			
								3			
								4			
								≥5			
<i>Mezie-Okoye et al. 2015</i> <sup>39</sup>	Cross-sectional study	198	24-60	Nigeria	Maternal report	Viewing categories(hours/day)	ALL	≤1	Physical	Adiposity (Overweight (BMI≥85%))	8
								>1			
<i>Miller et al. 2007</i> <sup>40</sup>	Cohort study	107	34.8-70.4	America	Parent report: survey(interview)	not mentioned	TV	not mentioned	Physical	Behavioral and emotional outcomes (Attentional problems)	6
<i>Nathanson et al. 2014</i> <sup>41</sup>	Cross-sectional study	107	38-74	America	Parent report: survey	Mean (SD) (hours/day)	TV (background)	2.87(1.99)	Physical	Executive function	6
<i>Nathanson et al. 2018</i> <sup>42</sup>	cross-sectional study	402	36-60	America	Maternal report	Mean (SD) (hours/day)	TV	3.8(2.64)			
							Tablet devices	1.4(2.11)	Behavioral	Sleep problems (Sleep duration, Sleep latency)	7
							Smartphone	0.41(1.11)			
							Game player	0.59(1.39)			

							Laptop computer	0.51(1.33)			
							iPod	0.17(0.78)			
		1676	6					6months:0.89 (1.21)			
<i>Nevarez et al. 2010</i> <sup>43</sup>	Cohort study	1228	12	America	Maternal report	Mean (SD) (hours/day)	TV	12months:1.20 (1.46)	Behavioral	Sleep problems(duration)	7
		1365	24					24months:1.44 (1.22)			
<i>Paavonen et al. 2006</i> <sup>44</sup>	Cross-sectional study	321	60-72	Finland	Parent report: survey	Viewing categories(hours/day)	TV (content)	<1.66	Behavioral	Sleep problems	7
								≥1.66			
		1997	29						Psycho-social	Bullying	
<i>Pagani et al. 2013</i> <sup>45</sup>	Cohort study	1997	65	Canada	Parent report: survey	Mean (SD) (hours/day)	TV	29months: 1.62(1.21)	Physical	Cognitive development (mathematics, learning)	7
										Motor development (Gross motor)	
								0-2			
								2.1-4		Behavioral problems	
								4.1-6			
<i>Parent et al. 2016</i> <sup>46</sup>	Cohort study	209	36-84	America	Parent report: survey	Viewing categories(hours/day)	ALL	6.1-8	Behavioral	Sleep problems	6
								8.1-10			
								>10			
		1101	60					0			
<i>Parkes et al. 2013</i> <sup>47</sup>	Cohort study	4		England	Parent report	Viewing categories(hours/day)	Television/video/DVD	<1	Psycho-social	Behavioral and emotional outcomes (Conduct problems, Hyperactivity/inattention, Emotional symptoms,	7
		1101	84				Computer/electronic games	≥1,<3			
								≥3,<5			
								≥5,<7			

								≥7		Peer problems, Prosocial behavior)	
<i>Peck et al. 2015</i> <sup>48</sup>	Cross-sectional study	12385	48-72	America	Parent report: survey	Viewing categories(hours/day)	TV	≥1;<1 ≥2;<2	Physical	Adiposity (Obesity, Overweight)	7
<i>Pinhas-Hamiel et al. 2009</i> <sup>49</sup>	Cross-sectional study	204	48-72	Israeli	Parent report: survey	Mean (SD) (hours/day)	ALL	Normal weight (122):4(1.8) Normal weight (51):4(2.2) Normal weight (31):4.6(2.5)	Physical	Adiposity (Overweight)	7
<i>Plancoulaine et al. 2018</i> <sup>50</sup>	Cohort study	1205	60-72	France	Maternal report	Mean (SD) (hours/day)	TV	0.76(0.7)	Behavioral	Sleep duration	7
<i>Raman et al. 2017</i> <sup>51</sup>	Cross-sectional study	210	12-36	America	Parent report: survey	not mentioned	ALL	not mentioned	Psychosocial	Social-emotional delay	7
<i>Reilly et al. 2005</i> <sup>52</sup>	Cohort study	8234	0-36	England	Parent report: survey	not mentioned	TV	not mentioned	Physical	Adiposity (Obesity)	7
<i>Ribner et al. 2017</i> <sup>53</sup>	RCT	807	60.88-76.84	America	Parent report	Mean (SD) (hours/day)	TV	2.19(0.79)	Psychosocial	Cognitive development (language development, mathematics)	no bias
<i>Ruangdaranon et al. 2009</i> <sup>54</sup>	Cohort study	220	0-24	Thailand	Parent report: survey(interview)	Mean (SD) (hours/day)	TV	12months:1.23(1.42) 24months:1.69(1.56)	Physical	Executive function Cognitive development (language development)	8
		759	36-48				ALL	1.02(0.67)	Physical	Adiposity (BMI)	7

<i>Sijtsma et al. 2015</i> <sup>55</sup>	Cohort study			Netherlands	Parent report: survey	Mean (SD) (hours/day)	TV Computer	0.97(0.63) 0.05(0.15)	Behavioral	Sleep problems (Sleep duration)	
<i>Sisson et al. 2012(a)</i> <sup>56</sup>	Cross-sectional study	1368	24-60	America	Parent report: survey	Viewing categories(hours/day)	TV	≤1 2-3 ≥4	Behavioral	Healthy dietary behavior (Energy intake)	6
<i>Sisson et al. 2012(b)</i> <sup>57</sup>	Cross-sectional study	1423	24-60	America	Parent report: survey	Viewing categories(hours/day)	TV	≤1 2-3 ≥4	Behavioral	Healthy dietary behavior (Dietary quality)	6
<i>Skaug et al. 2018</i> <sup>58</sup>	Cohort study	995 795	48 72	Norway	Parent report: survey(interview)	Mean (SD) (hours/day)	TV	0.92(0.57) 1.1(0.87)	Psychosocial	Parent interaction (Responsiveness)	7
<i>Sorrie et al. 2016</i> <sup>59</sup>	cross-sectional study	504	36-60	Ethiopia	Caregiver report: survey(interview)	Viewing categories(hours/day)	TV	≤2 >2	Physical	Adiposity (Overweight)	6
<i>Straker et al. 2006</i> <sup>60</sup>	Cohort study	1600	60	Australia	Parent report: survey	Viewing categories(hours/day)	TV Hand-held games Console games	0 <1 1-2 >2	Physical	Musculoskeletal risk	8
<i>Sugimori et al. 2004</i> <sup>61</sup>	Cohort study	8170 8170	36 72	Japan	Parent report: survey	not mentioned	TV	not mentioned	Physical	Adiposity (Overweight)	7
<i>Suglia et al. 2013</i> <sup>62</sup>	Cohort study	1589 1589	36 60	America	Maternal report	Viewing categories(hours/day)	TV	≤2 >2	Physical	Adiposity (Obesity)	6
<i>Tahir et al. 2019</i> <sup>63</sup>	Cohort study	3092 1	36-60	America	Maternal report: survey	Viewing categories(hours/day)	TV	0 0.5 1 2	Physical	Adiposity (Overweight)	7

								3			
								≥4			
<i>Tamana et al. 2019</i> <sup>64</sup>	Cohort study	2427	36	Canada	Parent report	Mean (95%CI) (hours/day)	ALL	1.8(1.5,2.1)	Psycho-social (Behavioral and emotional outcomes)	Externalizing behaviors problems	7
		2427	60							Internalizing behaviors problems	
<i>Taveras et al. 2006</i> <sup>65</sup>	Cross-sectional study	240	24-70.8	America	Parent report	Mean (SD) (hours/day)	TV	1.4(1.1)	Behavioral	Healthy dietary behavior quality (Fast Food Intake)	7
<i>Tester et al. 2018</i> <sup>66</sup>	Cohort study	7028	24-60	America	Parent report: survey	Viewing categories(hours/day)	TV	>2	Physical	Adiposity (Overweight (BMI:85%-94.5%), Obesity (BMI:95%-1.2*95%), Severe obesity (BMI≥1.2*95%))	5
							ALL	>3 >2 >3 >4			
<i>Thompson et al. 2005</i> <sup>67</sup>	cross-sectional study	1783	4-35	America	Parent report: survey (telephone interview)	Mean (95%CI) (hours/day)	TV	4-11months:0.9 (0.8-1.0) 12-23months:1.6 (1.4-1.8) 24-35months:2.3 (2.1-2.5)	Behavioral	Sleep problems (Naptime/Bedtime Schedules)	7
<i>Tomopoulos et al. 2010</i> <sup>68</sup>	Cohort study	259	6	America	Maternal report: survey(interview)	Mean (SD) (hours/day)	ALL	2.55(2.09)	Physical	Cognitive development	7
		75	21	America			ALL	21months: 1.97(1.8)		Aggressive behavior	

<i>Tomopoulou et al. 2007</i> <sup>69</sup>	Cohort study	96	33		Caregiver report: survey(interview)	Mean (SD) (hours/day)		33months: 2.13(1.59)	Psychosocial	Behavioral and emotional outcomes (Oppositional Defiant problems, Externalizing problems, Hyperactivity problems)	
<i>Tso et al. 2016</i> <sup>70</sup>	Cross-sectional study	533	65.5	China	Parent report: survey	Viewing categories(hours/day)	ALL	≤1 >1-3 ≥3	Behavioral	Sleep problems (Sleep duration)	7
<i>Twenge et al. 2019</i> <sup>71</sup>	Cross-sectional study	13109	0-12(3818) 24-60(9291)	America	Parent report: survey	Viewing categories(hours/day)	TV and Video game Portable electronic devices	<2 ≥2	Behavioral	Sleep problems (Sleep duration)	7
<i>Vallejo et al. 2015</i> <sup>72</sup>	Cross-sectional study	140	24-72	Brazil	Maternal report	not mentioned	TV	not mentioned	Physical	Adiposity (Overweight)	6
<i>Verlinden et al. 2014</i> <sup>73</sup>	Cohort study	1176	24-60	Netherlands	Parent report: survey	Viewing categories	TV	Low Mid-low Mid-high High	Psychosocial	Bullying (Being a bully, Being a bully-victim, Being a victim)	6
<i>Vijakhana et al. 2015</i> <sup>74</sup>	Cohort study	208 208	6 12	Thailand	Caregiver report	Mean (SD) (hours/day)	ALL	6 months:4.46(2.98) 12months:4.81(3.03)	Behavioral	Sleep problems (Sleep duration)	7
<i>Watt et al. 2015</i> <sup>75</sup>	Cohort study	1997	29	Canada	Maternal report	Mean (SD) (hours/day)	TV	1.26(0.88)	Psychosocial	Bullying (Victimization at 12 years old)	7
<i>Wu et al. 2017</i> <sup>76</sup>		8900	36-72	China	Caregiver report		ALL	<2	Psychosocial	Behavioral and emotional outcomes	6

	Cross-sectional study				Viewing categories(hours/day)			≥2		(Emotional symptoms, Conduct problems, Hyperactivity, Peer problems, Prosocial)	
<i>Xu et al..2016</i> <sup>77</sup>	RCT	497	24	Australia	Maternal report	Mean (SD) (hours/day)	ALL	1.37 (1.02)	Behavioral	Sleep problems (Sleep duration)	no bias
		415	42					2.48 (1.49)		Sleep problems (Sleep latency)	
		369	60					2.25 (1.27)			
<i>Zhao et al. 2018</i> <sup>78</sup>	Cross-sectional study	1856	36-48	China	Parent report: survey	Viewing categories(hours/day)	ALL	0-1 1-2 2-3 3-4 >4	Psycho-social	psychosocial problems	8
<i>Zimmerman et al. 2005</i> <sup>79</sup>	Cohort study	1797	0-35	America	Maternal report	Mean (SD) (hours/day)	TV	0-35months: 2.2(2.22)	Physical	Cognitive development (mathematics, reading comprehension. reading recognition)	7
		1797	36-60					36-60months: 3.29(2.18)			
			8-16(384)					8-16 months: 0.15(0.35)			
<i>Zimmerman et al. 2007</i> <sup>80</sup>	Cross-sectional study	729		America	Parent report: survey (telephone interview)	Mean (SD) (hours/day)	Children's educational shows	17-24 months: 0.16(0.43)	Physical	Cognitive development (language development)	5
			17-24(345)					8-16 months: 0.31(0.7)			
								17-24 months: 0.7(0.96)			
								8-16 months: 0.16(0.49)			
								17-24 months: 0.39(0.75)			

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	8-16 months:
Grownup TV	0.1(0.31)
	17-24 months:
	0.15(0.41)

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Note:

RCT: randomized control trail

**Table S2.** GRADE assessment of quality of evidence reported the associations between media use and health indicators.

No. of participants (No. of studies)	Design	Risk of bias		Quality assessment			Summary of findings		Quality of evidence (GRADE)
		Inconsistency	Indirectness	Imprecision	Publication bias	Absolute effect			
Adiposity									
Observational studies									
933 (1) <sup>25</sup>	Case-control study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 1/1 studies reported positive associations	Low	
60997(10) <sup>13, 15, 27, 35, 52, 55, 61-63, 66</sup>	Cohort study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 8/8 studies reported positive associations Screen time (duration) 2/2 studies reported positive associations	High	
17064 (10) <sup>1, 14, 29, 33, 38, 39, 48, 49, 59, 72</sup>	Cross-sectional study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 7/7 studies reported positive associations Screen time (duration) 2/3 studies reported positive associations 1/3 studies reported negative associations	Moderate	
Cognitive development									
Intervention studies									
807 (1) <sup>53</sup>	RCT	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 1/1 study reported null associations	Moderate	
Observational studies									

4273 (4) <sup>45, 54, 68, 79</sup>	Cohort study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 2/3 studies reported negative associations 1/3 studies reported null associations Screen time (duration) 1/1 studies reported negative associations	Low
3385 (5) <sup>3, 7, 30, 32, 80</sup>	Cross-sectional study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 2/2 studies reported negative associations Touchscreen (duration) 1/1 studies reported null associations DVD/videos (duration) 1/1 studies reported null associations Screen time (duration) 1/1 studies reported positive associations	Low
805 (1) <sup>53</sup>	RCT	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	Executive function Intervention studies TV (duration) 1/1 studies reported negative associations	Moderate
185 (1) <sup>37</sup>	Cohort study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	Observational studies Screen time (duration) 1/1 studies reported negative associations	Low
167 (2) <sup>31, 41</sup>	Cross-sectional study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	Observational studies TV (duration) 2/2 studies reported negative associations	Low
1997 (1) <sup>45</sup>	Cohort study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	Motor development Observational studies TV (duration) 1/1 studies reported negative associations	Low
762 (2) <sup>3, 32</sup>	Cross-sectional study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 1/1 studies reported negative associations	Low

							Touchscreen (duration) 1/1 studies reported mixed negative and null associations	
				Musculoskeletal risk				
				Intervention studies				
6 (1) <sup>24</sup>	Subject laboratory trial	Serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	Touchscreen (duration) 1/1 studies reported positive associations	Moderate
				Observational studies				
1600 (1) <sup>60</sup>	Cohort study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 1/1 studies reported positive associations	Low
				Healthy dietary behavior quality				
				Observational studies				
5637 (5) <sup>14, 20, 56, 57, 65</sup>	Cross-sectional study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 5/5 studies reported negative associations	Low
				Physical activity				
				Observational studies				
933 (1) <sup>25</sup>	Case-control study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 1/1 studies reported negative associations	Low
				Sedentary activity				
				Intervention studies				
6 (1) <sup>24</sup>	Subject laboratory trial	Serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	Touchscreen (duration) 1/1 studies reported positive associations	Moderate
				Sleep problems				
				Intervention studies				
1679 (3) <sup>18, 19, 77</sup>	RCT	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 2/2 studies reported positive associations Screen time (duration) 1/1 studies reported positive associations	Moderate
				Observational studies				

933 (1) <sup>25</sup>	Case-control study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 1/1 studies reported positive associations	Low
7365 (7) <sup>8, 36, 43, 46, 50, 55, 74</sup>	Cohort study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 5/5 studies reported positive associations Screen time (duration) 2/2 studies reported positive associations	Moderate
19081 (12) <sup>4, 6, 9, 11, 21, 28, 42, 44, 67, 70, 71</sup>	Cross-sectional study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 5/6 studies reported positive associations 1/6 studies reported negative associations TV (prevalence) 1/1 studies reported positive associations Touchscreen (duration) 1/1 studies reported positive associations Video games (duration) 1/1 studies reported positive associations Screen time (duration) 3/3 studies reported positive associations	Moderate
Aggressive behavior Observational studies								
3533 (3) <sup>11, 34, 69</sup>	Cohort study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 2/2 studies reported positive associations Screen time (duration) 1/1 studies reported positive associations	Low
Behavioral and emotional outcomes Observational studies								
19103 (9) <sup>10, 17, 23, 37, 40, 46, 47, 64, 69</sup>	Cohort study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 5/5 studies reported negative associations Computer games 1/1 studies reported negative associations Screen time (duration)	Moderate

							4/4 studies reported negative associations	
28122 (4) <sup>16, 76</sup>	Cross-sectional study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 1/1 studies reported negative associations Screen time (duration) 2/2 studies reported negative associations Touchscreen(duration) 1/1 studies reported mixed negative, positive and null associations	Moderate
Bullying								
Observational studies								
5170 (3) <sup>73, 75</sup>	Cohort study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 3/3 studies reported positive associations	Low
Social and emotional skills								
Observational studies								
32547 (2) <sup>22, 26</sup>	Cohort study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 1/2 studies reported positive associations 1/2 studies reported negative associations	Low
Parental interaction (Responsiveness)								
Intervention studies								
120 (1) <sup>2</sup>	Quasi-experimental design	Serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 1/1 studies reported positive associations	Moderate
Observational studies								
995 (1) <sup>58</sup>	Cohort study	No serious limitation	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	TV (duration) 1/1 studies reported positive associations	Low

Note: GRADE Working Group grades of evidence.

High quality: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: Further research is likely to have an impact on our confidence in the estimate of effect and may change the estimate.

Low quality: Further research is very likely to influence our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: Uncertain about the estimate.

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