

Daily Internet time: Towards an evidence-based recommendation?

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Abstract

Background: Since 2001, a recommendation of no more than two hours per day of screen time for children two years of age or older was adopted in many countries. However, this recommendation was rarely examined empirically. The goal of the present study was to question this recommendation in today's connected world.

Methods: We used data from the ado@internet.ch survey (spring 2012), a representative sample of 8th graders in the Canton of Vaud, Switzerland (n=2942, 50.6% female). Internet use, health outcomes, substance use, well-being and socio-demographic characteristics were considered. Bivariate statistical analyses were performed.

Results: All outcomes were significantly associated with the time spent on Internet, more time being associated with a higher prevalence of adverse consequences. Youth spending on average one more hour on Internet per day than the reference category (1.5 – 2.5 hours) did not differ in terms of adverse health outcomes. Differences began to appear on sleeping problems, tobacco use, alcohol misuse, cannabis use, and sport inactivity with youth spending between 3.5 and 4.5 hours per day on Internet.

Conclusions: This study demonstrates the absence of justification for setting a limit to only two hours of screen time per day. Significant effects on health seem to appear only beyond four hours per day and there may be benefits for those who spend less than an hour and a half on Internet.

Keywords: Screen time, Internet use, Somatic problems, Evidence-based recommendations

Introduction

In 2001, the American Academy of Pediatrics (AAP) issued a statement about the potential harmful effects of watching television programs and proposed a recommendation of no more than two hours per day of screen time for children aged two years or older ¹. This recommendation was thereafter adopted throughout the years in many countries ^{2 3} without in-depth discussion nor scientific evidence. In a revised version of the statement released in 2013 ⁴, the AAP acknowledged the emergence of new media such as Internet and their potentially positive effects, but the recommendation of no more than two hours of daily screen time remained unchanged. Recently, new directions were offered ⁵. The focus was not on screen time per se anymore, but on monitoring and accompanying children in their use of media.

The reason for having focused for years on the specific two-hour limit is still unclear, since it is not evidence-based and since many children and teenagers use screens ~~anyway~~ well beyond this limit ⁶. Notwithstanding, this limit was often used in the scientific literature, either to define a threshold in new studies ^{7 8} or as a discussion argument ^{9 10}, but to the best of our knowledge, no study to date has neither specifically investigated the reason for choosing this particular limit over another, nor has questioned its utility.

Studies have been showing for years that excessive screen use by children and adolescents is associated with adverse health consequences such as increased body mass index, overweight, and obesity ^{11 12 13 14 15}, decreased prosocial behaviors and decreased physical activity ¹⁶, elevated blood pressure ¹⁷, poorer mental health and increased somatic and sleep problems ^{18,19}, anxiety and reduced immune function ²⁰. A meta-analysis also found positive and significant associations between Internet addiction and psychiatric comorbidities such as hyperactivity, anxiety, and depression ²¹. However, even if many associations between duration of Internet use and negative

health consequences were found, we still do not know beyond which threshold of daily Internet time these adverse effects become significant, or even if such a limit exists. Moreover, another recent longitudinal study did not find a significant link between the use of Internet and the risk of being overweight ²².

The notion of screen time itself has completely changed since the 1980s. At the beginning, it was mainly equivalent to television. The generalization of personal computers was a first revolution, since this device was not confined to the workspace anymore, and it became a recreational device. After that came the Internet revolution implying different changes: With the multiplication of devices allowing access to the Internet (smartphones, tablets, computers, TV sets, etc.), it is now possible to be connected on a 24/7 basis. All the activities once related to screen use can now be performed through the Internet ²³: watching TV, viewing movies or shows, playing and working, but even more so, it is possible to perform activities which were previously not associated with screen time, such as making phone calls, reading newspapers, shopping, or making new friends ²⁴.

The goal of this study was to question the recommendation of *no more than 2 hours of daily screen use* among young adolescents in today's Internet world. We had two hypotheses: 1) the time spent on Internet is negatively associated with health-related outcomes; 2) the *two-hour per day recommendation* may be outdated and significant adverse effects may be observed only after a significantly longer period of time spent on Internet daily.

Methods

Data were drawn from the first-wave of the *ado@internet* study conducted in the canton of Vaud,

the largest French-speaking canton in Switzerland, between April and July 2012 (n=3367). Sampling weights were computed to adjust the sample with regard to gender and school track. We considered here only students aged between 13 and 15, the age range commonly observed among 8th graders in Switzerland (n=2942). Further details on the sample have been previously reported ²⁵.

The present study addresses time spent on Internet and not screen time per se, but since using Internet almost always implies a screen, and since a heavy use of Internet does not leave much time for other activities, we used Internet time as a proxy for screen use. To evaluate the time spent on Internet each day, we had one question about Internet use frequency: “In the last 30 days, how often did you use Internet?” (several times a day, at least once a day, several days a week, at least once a week, less than once a week, I did not use Internet in the last month), and two questions related to the number of hours spent on Internet on school days and on week-ends/holidays: “On [school days or week-ends] when you use Internet, how much time do you spend on average on Internet?” (I do not connect, less than one hour, 1-<2 hour, 2-<3 hours, 3-<4 hours, 4 hours or more). Answers were then recoded as 0, 0.5, 1.5, 2.5, 3.5, and 6 hours. Recent literature has demonstrated that a measure of Internet use constructed by combining a frequency and a quantity measures is more efficient than using only the frequency or the quantity of use ²⁶. Therefore, we followed this approach. Considering that students had 171 schooldays and 194 week-end/vacation days in 2012, we estimated the yearly number of hours spent on Internet, and we divided it by 365 to obtain a daily average. The result was further separated into six categories (≤ 0.5 hour, $0.5 \leq 1.5$, $1.5 \leq 2.5$, $2.5 \leq 3.5$, $3.5 \leq 4.5$, > 4.5 hours). The third category ($1.5 \leq 2.5$ hours) was then used as a reference for the analyses, since it represented roughly the limit of screen time which was previously advocated for.

We also had information about the distribution between time spent on Internet for leisure and for schoolwork, but since most of the total time was dedicated to leisure, results were not different from the results taking into account the total Internet time (data not shown). Thus we chose to use only the total daily Internet time.

Six somatic health problems were considered: back pain, weight problems, headaches, musculoskeletal pain, sleep problems, and sight problems. The possible answers were dichotomized into often (at least once a week, most days) and rarely (never, less than monthly, about once a month). Emotional well-being was evaluated using the World Health Organization Five Well-Being Index (WHO-5), a score below or equal to 52/100 indicating poor emotional well-being²⁷. Self-reported academic level was dichotomized into “less than average student” and “other”. Extracurricular sport activity was dichotomized into none and at least once a week. We also considered substance use with tobacco consumption dichotomized into yes (current regular or irregular smoker) and no (no smoker or former smoker), alcohol misuse dichotomized into yes (at least one episode of drunkenness during the last month) and no, and cannabis consumption dichotomized into yes (at least one consumption during the last month) and no.

In addition to participants’ age and gender, we also considered family structure (both parents living together vs. other situations) and family socio-economic status (well above average, above average, average, under average). Finally, we considered Internet-specific parenting practices using items developed by van den Eijnden and colleagues²⁸. Parents’ degree of restriction of Internet use was computed from the answers to three items: “My parents allow me to do what I want on Internet”, “My parents allow me to visit all the sites I want”, “My parents allow me to have online contact with anyone” with possible answers “Completely false”, “Fairly false”, “Neither true nor false”, “Fairly true”, and “Completely true”. We scored zero the first three

answers and one the last two, and the parental restriction score was computed as the sum of the three items (range: 0-3). The frequency of communication concerning Internet use was evaluated using the question “How often do you talk with your parents about the time you spend on the Internet?” with answers dichotomized into frequently (very often, often) and non-frequently (never, rarely, from time to time).

We analyzed the bivariate relationship between each variable and daily Internet time. For each variable, results include the prevalence of each modality by category of daily Internet time, the p-value of the chi-square test, and the effect size. Regarding the different outcomes, we also compared each category of daily Internet time with the reference category (1.5- 2.5 hours). Even if all of our variables were either ordinal or dichotomous, we preferred to use the chi-square test rather than the Spearman’s rank-order correlation, because we did not postulate a linear relationship between the daily Internet time and the other variables. Stata 13 (StataCorp, College Station, Texas, USA) was used for data management and statistical analyses. The type I error was set to 5%.

Results

The average daily time spent on Internet was 2.24 hours (sd=1.75, 95% CI: 2.17 – 2.30), and the median was 2.03 hours, but with a high variability between adolescents as indicated by the distribution given at the top of Table 1. Gender, age, and family structure were significantly associated with the time spent on Internet daily. Females were predominant in the more than 4.5-hour category, whereas males were predominant in the 3.5-4.5 category. The time spent on Internet globally increased with age. A family structure other than nuclear was also associated

with more time on Internet, but not the socio-economic status. Both the degree of parental restriction ($w=0.257$) and the frequency of discussion ($w=0.087$) regarding Internet use were statistically significantly associated with daily Internet time, indicating that the more time spent on Internet, the greater the parental restrictions and the more frequent discussions about Internet use.

Table 2 shows the relationship between daily time spent on Internet and different health outcomes. All evaluated outcomes were statistically significantly associated with the time spent on Internet. A higher Internet time was generally associated with more adverse outcomes (e.g, higher Internet time was linked to less sleep). Effect sizes were moderate, the larger ones being achieved for sleeping problems ($w=0.186$) and tobacco consumption ($w=0.172$). Compared to the reference category, youth spending on average one more hour on Internet per day did not differ in terms of adverse health outcomes. Differences began to appear on five outcomes (sleeping problems, tobacco use, alcohol misuse, cannabis consumption, sport activity) among youth spending between 3.5 and 4.5 hours per day on Internet. Finally, the more than 4.5 hours per day category differed significantly from the reference category for all but one outcome (weight problems). Youth spending less time than the reference category on Internet were doing significantly better regarding several outcomes, such as sleeping problems and well-being. The only outcomes implying no difference were musculoskeletal problems, sight problems, alcohol misuse, and cannabis consumption.

Discussion

In this paper, we tried to determine whether the *no more than two hours screen time per day* limit could be justified today by an effect of Internet use on different health outcomes, and we concluded that it is not supported by our data. However, it must be considered that when the AAP published its first recommendations regarding screen time, the main screen activity was watching television. Nowadays, screen use is much more widespread by an increase in both activities (games, social-networks, video streaming, etc.) and devices (TV sets, computers, smartphones, tablets, etc.). Moreover, wifi connections and widespread public networks mean that Internet can be accessed anywhere anytime.

While our first hypothesis (the time spent on Internet is negatively associated with health-related outcomes) is confirmed, the second one (the *two-hour per day recommendation* may be outdated and significant adverse effects may be observed only after a longer daily screen time use) shows mixed results. On the one hand, the guideline of no more than two hours of screen use per day is clearly not evidenced in our results. In terms of health related outcomes, this amount of time has to be doubled before observing a significant population difference. On the other hand, modifying or removing such a guideline does not imply that Internet or screen time is harmless, and limiting screen time to less than 1.5 hour is even associated with a reduction in several negative health outcomes. This finding differs somewhat from the conclusion of Bélanger and colleagues¹¹ who found a U-shaped association between Internet use and depressive symptoms. However, they measured Internet use differently, and their data were from 2002, a time when Internet use was much less developed.

We hypothesized that whatever the time spent on Internet, it is associated with a reduction in sleep time implying an increased probability for sleeping disorders. The blue light emitted by screens can even reinforce this effect by reducing sleepiness, hence sleep time²⁹. On the other

hand, social-networks expose their users to the constant pressure and judgement of their peers³⁰
³¹. The need to respond to instant messages or comment on others' news and behaviors never stops.

Internet time beyond the two hour limit was not associated with an increase in below average self-reported academic level. This finding suggests that excessive Internet use is not specific to students who have bad grades. We hypothesize that students reporting good grades could be using Internet more often for their schoolwork rather than for leisure, contrarily to students reporting lower grades, but further research is required to verify this point.

A higher degree of parental restriction and more frequent discussion with parents regarding Internet use are associated with more time spent on Internet. It could be hypothesized, in line with previous results²⁸, that important Internet use among adolescents may encourage parental discussion and more restrictions, but given the cross sectional nature of our data, this cannot be demonstrated. This is consistent with the findings of Goldstein³² showing that parents do not exert a tight control over Internet use by their children. Additionally, recent parenting literature underlines that the way to communicate and the quality of parental communication (e.g., respectful, autonomy supportive) are essential processes to take into account to understand the relations between parenting and adolescent adjustment or behavior^{28 33}. Our results suggest nonetheless that parental involvement is not associated with less reported Internet use.

Furthermore, enforcing discussion or restrictions about Internet use may be perceived as intrusive and may further elicit adolescents' opposite behaviors, such that a vicious negative spiral may develop^{34 35}. Future research should examine the intervening role of the quality of parental communication processes in the relations between parenting practices and adolescents' Internet use.

This study, to the best of our knowledge, is the first to question the well-known two-hour daily screen time recommendation using evidence-based data. Moreover, it is grounded on a large representative sample of 8th graders. Nonetheless, there are some limitations. First, we had data to quantify only the time spent on Internet, which does not include all screen activities. In particular, we were not able to consider the time spent watching television. Moreover, our measure of daily time spent on Internet stems from a multiple-choice question, the highest possible answer being “4 hours or more”. We transformed this answer into 6 hours, but this value is likely to underestimate the real number of hours spent on Internet by some adolescents, implying an overall underestimation. Nevertheless, a sensitivity analysis replacing 6 hours by 5 and 7 hours alternatively lead to almost identical results and showed no impact on our conclusions.

Furthermore, the data are based on adolescents’ self-report and do not include parents’ report. We only included 8th graders and further studies should be conducted among a wider age range to obtain a complete picture of the evolution of Internet screen time throughout adolescence. Finally, we did not have precise information about the activities performed on Internet, so we were unable to parse out how adolescents are using Internet today beyond the amount of time spent. Moreover, since our data are from 2012, the various activities carried out on Internet have undoubtedly evolved. Future research should also address that point.

This study adds to the literature by demonstrating the absence of justification for setting a limit to only two hours of screen time per day. Significant effects on health seem to appear only beyond four hours per day and there may be benefits for those who spend less than an hour and a half on Internet.

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Conflicts of interest

None declared.

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Keypoints

- Excessive Internet use by adolescents is associated with adverse health consequences.
- The 2001 recommendation of no more than two hours per day of screen time is not supported by data.
- Significant effects on health seem to appear only beyond four hours per day of Internet use.

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Table 1: Socio-demographic and Internet related variables: association with daily time on Internet. We provide the prevalence of each characteristics by category of time. The penultimate column gives the p-value of the chi-square test between daily time on Internet and the characteristics, and the last column gives the effect size.

Main characteristics	Categories	Daily time on Internet							p-value	Effect size (w)
		Overall n=2942	<=0.5 hour n=456	>0.5 – 1.5 hours n=784	>1.5 – 2.5 hours n=646	>2.5 – 3.5 hours n=413	>3.5 – 4.5 hours n=258	> 4.5 hours n=385		
Gender	Female	50.6%	48.7%	53.6%	51.2%	47.0%	41.4%	55.3%	0.004	0.078
	Male	49.4%	51.3%	46.4%	48.8%	53.0%	58.6%	44.7%		
Age	13	7.2%	7.5%	7.2%	8.3%	8.3%	7.0%	4.2%	0.003	0.097
	14	67.6%	67.0%	69.9%	67.9%	70.4%	64.6%	61.8%		
	15	25.2%	25.5%	22.9%	23.8%	21.3%	28.4%	34.0%		
Family structure	Nuclear	68.5%	70.4%	72.3%	68.8%	68.8%	63.8%	61.0%	0.003	0.080
	Other	31.5%	29.6%	27.7%	31.2%	31.2%	36.2%	39.0%		
Socio-economic status	Well above average	11.1%	9.7%	11.3%	10.5%	11.5%	11.3%	12.9%	0.071	0.091
	Above average	26.5%	27.1%	26.9%	27.7%	28.2%	27.8%	20.3%		

	Average	56.2%	56.5%	57.7%	55.5%	51.2%	55.1%	59.8%		
	Under average	6.2%	6.7%	4.1%	6.3%	9.2%	5.8%	7.0%		
Degree of parental restrictions regarding Internet	0	57.4%	68.7%	56.9%	60.6%	47.4%	44.5%	40.9%	<0.001	0.257
	1	17.2%	15.5%	17.4%	17.3%	18.4%	19.9%	15.4%		
	2	15.9%	13.5%	11.1%	13.8%	21.0%	18.8%	24.6%		
	3	9.5%	2.4%	5.6%	8.3%	13.3%	16.8%	19.2%		
Discussions with parents regarding Internet	Non-frequent	90.3%	92.8%	92.9%	90.8%	86.4%	88.0%	87.4%	<0.001	0.087
	Frequent	9.7%	7.2%	7.1%	9.2%	13.6%	12.0%	12.6%		

Table 2: Association between daily time on Internet and outcomes. For each category of time, we provide the prevalence of each outcome. The penultimate column gives the p-value of the chi-square test between daily time on Internet and the outcome, and the last column gives the effect size. We also compare the prevalence of each outcome among the different categories of time using the >1.5 – 2.5 hour category as reference. Significant differences with the reference category are indicated with stars: *** p<0.001, ** p<0.01, * p<0.05.

Outcomes	Categories	Overall	Daily time on Internet						p-value	Effect size (w)
			<=0.5 hour	>0.5 – 1.5 hours	>1.5 – 2.5 hours (reference)	>2.5 – 3.5 hours	>3.5 – 4.5 hours	> 4.5 hours		
		n=2942	n=456 15.5%	n=784 26.7%	n=646 21.9%	n=413 14.0%	n=258 8.8%	n=385 13.1%		
Back problems	Often	13.9%	9.7% *	11.7%	14.4%	13.4%	16.0%	21.4%	<0.001	0.100
								**		
Weight problems	Often	5.5%	3.2% *	4.1%	5.8%	7.2%	5.7%	8.7%	0.005	0.078
Headaches	Often	16.4%	13.3%	12.3% *	17.2%	18.6%	18.3%	23.6%	<0.001	0.101
								*		
Musculoskeletal problems	Often	21.4%	20.5%	16.9%	19.8%	23.3%	24.9%	29.9%	<0.001	0.102

Sleeping problems	Often	29.1%	19.6% ***	21.3% ***	30.2%	32.8%	37.2% *	45.0% ***	<0.001	0.186
Sight problems	Often	13.3%	10.3%	12.2%	11.7%	13.0%	13.2%	22.4% ***	<0.001	0.107
Tobacco consumption	Yes	15.8%	10.4% *	10.7% *	14.7%	17.2%	20.5% *	29.7% ***	<0.001	0.172
Alcohol misuse	Yes	10.5%	6.7%	8.1%	9.1%	9.9%	14.2% *	20.3% ***	<0.001	0.139
Cannabis consumption	Yes	9.2%	4.9%	8.1%	7.9%	9.9%	13.7% *	14.6% **	<0.001	0.106
Well being	Poor	15.9%	9.9% ***	11.5% ***	18.2%	16.5%	18.1%	25.6% **	<0.001	0.136
Academic level	Less than average	8.2%	6.8%	5.3% *	8.7%	8.5%	11.2%	12.2%	0.001	0.086
Sport activity	None	20.3%	15.6%	14.7% *	19.7%	23.4%	27.0% *	30.5% ***	<0.001	0.138