

Is internet use unhealthy? A cross-sectional study of adolescent internet overuse

Joan-Carles Suris^a, Christina Akre^a, Claire Piguet^a, Anne-Emmanuelle Ambresin^a, Grégoire Zimmermann^c, André Berchtold^{a,b}

^a Institute of Social and Preventive Medicine, Lausanne University Hospital, Lausanne, Switzerland

^b Institute of Social Sciences, University of Lausanne, Lausanne, Switzerland

^c Institute of Psychology, University of Lausanne, Lausanne, Switzerland

Summary

OBJECTIVE: To assess whether problematic internet use is associated with somatic complaints and whether this association remains when checking for internet activity among a random sample of adolescents living in the canton of Vaud, Switzerland.

METHODS: Cross-sectional survey of 3,067 8th graders (50.3% females) divided into average ($n = 2,708$) and problematic ($n = 359$) Internet users and compared for somatic complaints (backache, overweight, headaches, musculoskeletal pain, sleep problems and sight problems) controlling for sociodemographic and internet-related variables. Logistic regressions were performed for each complaint and for all of them simultaneously controlling variables significant at the bivariate level.

RESULTS: At the multivariate level, when taken separately, problematic internet users were more likely to have a chronic condition (adjusted odds ratio [aOR] with 95% CI: 1.58 [1.11:2.23]) and to report back pain (aOR: 1.46 [1.04:2.05]), overweight (aOR: 1.74 [1.03:2.93]), musculoskeletal pain (aOR: 1.36 [1.00:1.84]) and sleep problems (aOR: 2.16 [1.62:2.88]). When considered in the full model, only sleep problems remained significant (aOR: 2.03 [1.50:2.74]).

CONCLUSIONS: Our results confirm that problematic internet users report health problems more frequently, with lack of sleep being the most strongly associated and seeming to act as mediator regarding the other ones. Clinicians should remember to screen for excessive internet use their patients complaining of sleep-related problems, back or musculoskeletal pain or overweight. Clinicians should advise parents to limit the amount of time their adolescent children can spend online for leisure activities. Furthermore, limiting the number of devices used to connect to the internet could help warrant enough sleeping time.

Abbreviations

aOR	adjusted odds ratio
IAT	internet addiction test
SES	socioeconomic status

Key words: *adolescence; internet use; health status; adolescent behaviour*

Introduction

Internet use has become part of adolescents' lives, to the point that a young person not using this tool is exceptional. Since the advent of generalised internet use, scholars have been interested in assessing its impact on adolescent health. However, most studies have focused on mental health [1–6] and unhealthy behaviours (such as substance use or sedentary behaviour) [1, 4]. Furthermore, research on the effects of excessive internet use on health mostly relate to overweight/obesity [7–10] and lack of sleep [3, 7, 9, 11].

In fact very few studies on the relationship between youths' internet use and somatic complaints have been carried out, and the literature seems to indicate that excessive internet use has a negative effect on health. Hakala et al. [12] reported an association between increased internet use and neck-shoulder and low back pain, as well as headaches [13]. In previous research based on a Swiss national survey carried out in 2002, Bélanger et al. [14] described a U-shaped association between the amount of internet use and somatic complaints, with occasional and heavy internet users reporting more complaints than regular users. Finally, in a qualitative study, college students [15] indicated eyesight deterioration, sleep deprivation, fatigue and sore shoulders, back, hands and fingers as negative consequences of internet use.

Moreover, little is known about the association between excessive internet use and health taking into account the type of activity performed on the internet. Nowadays, time online cannot be computed as a whole as youths are increasingly required to use the internet for their schoolwork. For this reason, there is a need to differentiate between time spent on the internet for schoolwork and for leisure. It could thus be hypothesised that those using the internet mainly for leisure (compared to those using it mainly for schoolwork) would potentially have more health complaints.

The objective of this research is to assess whether problematic internet use is associated with somatic complaints and

whether this association remains when checking for internet activity among a random sample of adolescents living in the canton of Vaud, Switzerland.

Methods

Data were drawn from the *ado@internet.ch* study, a longitudinal study of a representative sample of 35 schools in the canton of Vaud, in the French-speaking part of Switzerland. In this paper only cross-sectional baseline data are discussed. All 8th graders in each school were invited to participate ($n = 3,367$). Among them, 230 were absent the day the questionnaire was administered, 60 refused to participate and 10 did not complete the questionnaire correctly and were excluded, for a final sample of 3,067 youths (50.3% females). Data were collected between 23 April and 4 July 2012 (spring quarter in Swiss schools). The questionnaire contained 51 questions and was filled in online in the schools' computer science rooms. Participating schools were offered the option to have their students fill in the questionnaire under the supervision of a trained research assistant external to the school system, and 21 of the 35 schools (1,939 students) accepted (while the rest of the schools chose supervision by their teachers). There were no significant differences in participants' age, gender, main socio-demographic variables, problematic internet use or any of the studied health problems when comparing schools requesting a research assistant and those doing it on their own (data not shown).

To assess internet overuse we used the French version of the Internet Addiction Test (IAT) [16], which is widely used, valid and reliable with adolescent populations [17, 18]. The test consists of 20 items (such as "How often do you find that you stay online longer than you intended?" or "How often do you try to hide how long you've been online?") with possible answers ranging from 1 (rarely) to 5 (always). A '0' (does not apply) option is also available. The maximum score is 100, with higher scores indicating a greater level of problematic use. The instrument showed a good internal consistency with a Cronbach alpha coefficient of .89, similar to other studies [17, 19].

As described in the literature [17], we divided our sample into average online users ($IAT < 50$; $n = 2,704$, 88.2%), frequent problem users ($IAT \geq 50-79$; $n = 346$, 11.3%) and significant problem users ($IAT \geq 80$; $n = 17$, 0.6%). Due to the small number of cases in the significant problem users category, we combined it with frequent problem users to create the problematic user category ($n = 363$; 11.8%), as previously done [20].

We analysed six somatic health problems: back pain, weight problems, headaches, musculoskeletal pain, sleep problems, and sight problems. Each health problem had five possible answers dichotomised as at least weekly (at least once a week, most days) and other (never, less than monthly, about once a month).

We checked for several potential confounding factors described in the literature as being related to excessive internet use and/or health problems, such as age [21], gender [22], residence (rural/urban) [1, 23], migrant status (Swiss-born/other) [24], family structure (parents together/other) [1, 22], socioeconomic status (SES) [1, 25], physical activ-

ity [1, 26], being overweight [4, 10, 14, 27], sleep deprivation [3, 4, 14], suffering from a chronic condition [28], emotional wellbeing [29], and amount of time online [22]. For SES, we used the question of the European School Project on Alcohol and Other Drugs (ESPAD) survey (www.espad.org) that reads "Compared to other families in Switzerland, you think that the financial situation of your family is..." with seven possible answers grouped as follows: very well/well above average, above average, average and below average (including below, well below and much below average). Physical activity was determined as the number of days per week performing a physical activity lasting at least 60 minutes. Body mass index (BMI) was calculated from self-reported height and weight and we used the standards published by Cole et al. [30] to define overweight and obesity. The variable was subsequently dichotomised into overweight/obesity and other. Sleep deprivation was measured as self-reported mean hours of sleep on schooldays. Participants were asked if they were suffering from a chronic condition, defined as "A condition lasting more than one year and requiring regular care, such as asthma, diabetes, scoliosis, etc." To measure emotional wellbeing, we used the World Health Organization Five Well-Being Index (WHO-5), with a score below 13 indicating poor well-being [31]. Amount of time online when connected was divided into four categories: less than 2 hours, 2-3 hours, 3-4 hours, and 4 hours or more.

Finally, we also checked for activity performed on the internet. Participants were asked how much of their Internet time was used for schoolwork and for leisure on schooldays with five possible answers to each of the two questions: most of the time, more than half of the time, about the same time, less than half of the time, and almost no time. Based on the responses, the main activity on the internet variable was created with three categories: for schoolwork mainly, similarly for both, for leisure mainly. As adolescents are known to be media multitaskers [32], we also controlled the number of devices used to connect to the Internet, with six possible answers: console, computer, smartphone, tablet, television, and other. Responses were dichotomised into one or two devices and more than two devices, as done by others [33].

We first performed a bivariate analysis comparing the two groups derived from the IAT for each variable. We used student's t-test for continuous variables and chi-square test for categorical variables. Subsequently all statistically significant variables (plus age) at the bivariate level were included in independent logistic regressions (one for each health problem) with average users being the reference category. Additionally, a logistic regression including all health problems was also performed. Finally, we ran a log-linear model to determine the overall structure of association between all of our variables of interest. On the basis of preliminary computations, we chose to start with a model including all bivariate relations. Unnecessary relations were then removed one by one using the Bayesian Information Criterion. The final model therefore represents the minimal set of associations required to accurately describe the complex relationships among the whole set of variables. All calculations were done with STATA 13.0 (StataCorp, College Station, Texas) except for the log-lin-

ear model which was computed using the R environment. The study was approved by the ethics committee of the canton of Vaud.

Results

At the bivariate level there were no age differences between groups, but females were significantly more represented among problematic users. Problematic users were also less likely to live with both parents. The average num-

ber of days per week doing physical activity was lower in the problematic users group than in the average users group. The two groups also differed on the number of devices to connect to the internet, the amount of time spent on the internet and the main activity performed on it, with problematic users using it mostly for leisure. On average, problematic users slept almost one hour less on schooldays than regular users. Finally, prevalence rates of overweight, poor emotional wellbeing and chronic conditions were higher in the problematic use group. In the same line, all health problems also showed higher prevalence rates among problematic users (table 1).

At the multivariate level (table 2), problematic users were more than twice as likely to suffer from sleep problems, 74% more likely to suffer from weight problems and between 30% and 50% more likely to suffer from musculoskeletal and back problems. In the same line, they were 58% more likely to suffer from a chronic condition. After checking for significant variables, headaches and sight problems did not remain statistically associated with problematic internet use. When including all health problems in the same logistic regression, sleep problems were the only health complaint that remained statistically significant (table 3).

The different associations can be seen more clearly in the log-linear model (fig. 1). Problematic internet use was linked both to sleep problems and back problems, and sleep

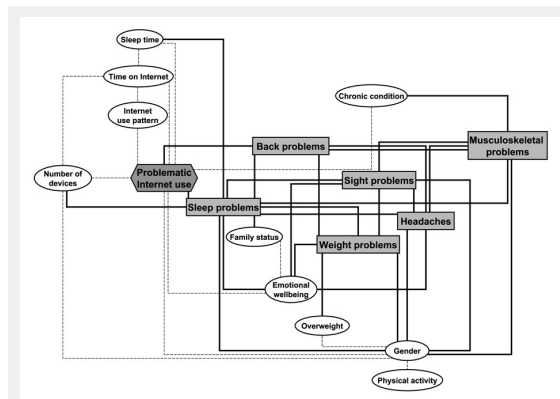


Figure 1

Log-linear model representing the associations between significant variables.

Table 1: Bivariate analysis comparing average and problematic internet users.

	Average users (n = 2708)	Problematic users (n = 359)	p-value
Mean age (\pm SE)	14.23 \pm 0.01	14.29 \pm 0.04	NS
Gender (female)	49.3%	57.6%	<0.01
Nationality (Swiss)	85.8%	82.5%	NS
Residence (urban)	46.9%	50.6%	NS
Family status (parents together)	68.7%	62.2%	<0.05
Socioeconomic status			NS
Well/very above average	11.0%	10.9%	
Above average	26.2%	26.2%	
Average	56.7%	53.8%	
Below average	6.1%	9.1%	
Physical activity (mean days/week)	3.29 \pm 0.04	2.76 \pm 0.10	<0.001
Devices to connect to Internet (>2)	40.3%	58.9%	<0.001
Hours per day on Internet			<0.001
<2 hours	71.9%	33.8%	
2-<3 hours	16.2%	20.9%	
3-<4 hours	6.8%	15.2%	
4 hours or more	5.1%	30.1%	
Main internet use pattern			<0.001
For school/work mainly	18.3%	6.5%	
Similarly for both	16.9%	13.5%	
For leisure mainly	64.8%	80.0%	
Average sleeping hours (schooldays)	8.13 \pm 0.02	7.37 \pm 0.07	<0.001
Overweight (yes)	10.5%	15.9%	<0.01
Emotional wellbeing (poor)	13.6%	30.0%	<0.001
Having a chronic condition (yes)	12.2%	19.2%	<.01
Back problems	12.9%	23.7%	<0.001
Weight problems	4.7%	11.8%	<0.001
Headaches	15.3%	27.2%	<.001
Musculoskeletal problems	20.3%	31.7%	<.001
Sleep problems	25.9%	55.2%	<.001
Sight problems	12.2%	22.0%	<.001

problems were also related to number of devices. Additionally, both gender and emotional wellbeing were connected to most health problems.

Discussion

Overall, 11.2% of our sample was moderately and 0.6% severely addicted to the internet. These prevalence rates are similar to [34] or slightly higher than [35] those reported in the literature using the same instrument. It is however, worth noting that contrary to what has been mainly described by other researchers [22, 34, 36], the prevalence of problematic internet use in our study was higher among females. Park [37] also found a higher prevalence among females and hypothesised that it could be related to Internet activities mostly used by females such as social networks. The fact that we included school-related internet activities could explain this finding, as the literature indicates that heavy internet female users favouring information seeking and chatting report a better academic performance than non-heavy users and males [38]. Another hypothesis could be that, as it has been observed with risk behaviours such as smoking [39], there may be a changing trend with adolescent girls becoming more internet-addicted than males. Further studies are needed to investigate this result more in-depth.

Problematic internet use is also associated with suffering from a chronic condition and this is independent of gender. Previous studies carried out in Switzerland [14, 28] reported similar results but for females only. However, to date

this relationship has been seldom studied and deserves a more in-depth analysis.

In line with previous results, both backache [12, 13, 15] and musculoskeletal pain [12, 13, 15, 40] were associated with problematic internet use in our study, even though other studies [14] found no such associations. Similarly, the association between internet use and headaches is not conclusive, with some authors reporting a relationship [13] and others none [14]. In our case, although the difference was clear in the bivariate analysis, it did not remain significant when allowing for confounding variables. Similarly, eye-sight deterioration has been described as one of the main negative impacts of excessive internet use [13, 15] but our results did not support it. As is the case for headaches, the multivariate analysis does not confirm the bivariate findings. One explanation to these inconsistent findings reported in the literature could be the diverse instruments and cut-off points used in the different studies.

Our results show that problematic internet use is related to some somatic complaints even after controlling for potential confounders. This is in agreement with previous research [1, 9, 40] reporting that increasing time on internet is related to poorer perceived health overall and to health complaints [40]. Our results also confirm our hypothesis that the association between internet use and poor perceived health is more important when adolescents mostly devote their time online to leisure activities.

Problematic internet users are over twice more likely to report sleep problems. Internet overuse has been associated with less hours of sleep [9, 11, 15, 36] and excessive daytime sleepiness [4, 36] or insomnia [3]. A previous Swiss study [14] also found that high internet users did not sleep enough, but only for adolescent girls. The fact that problematic users have access to the internet through numerous devices could be associated with a higher probability of internet access at any time and any place (even when in bed) without parental control and less hours of sleep. Several authors [33, 41] have also found that having devices in the bedroom was associated with sleep-related problems. As sleep problems are directly related to all other health problems in the log-linear model and are the only health problem that remains significant when all others problems are included in the multivariate analysis, it could be assumed, as described by Punamäki et al. [40], that poor perceived health and health complaints could be mediated by poor sleeping habits.

The main strengths of our study are that it is based on a large representative sample, the use of a widely recognised tool to measure problematic internet use and the control for potential confounders in the analyses. However, some limitations need to be mentioned. First, the cross-sectional nature of the study does not allow drawing conclusions about causal relationships. Second, a response bias cannot be precluded as the questionnaire was self-reported. Third, as adolescents are media multitaskers, it may be difficult for them to differentiate between school and leisure internet time. However, the fact that we controlled for the number of devices to connect to the internet (as a proxy for multitasking) and that we did not ask them what they spent *their time* on but rather *most of their time*, should minimise this bias.

Table 2: Multivariate analysis for each health problem individually using average users as the reference group*.

	Problematic users	p-value
Chronic condition**	1.58 [1.11:2.23]	0.011
Back problems	1.46 [1.04:2.05]	0.029
Weight problems	1.74 [1.03:2.93]	0.037
Headaches	1.33 [0.96:1.85]	NS
Musculoskeletal problems	1.36 [1.00:1.84]	0.048
Sleep problems	2.16 [1.62:2.88]	<0.001
Sight problems	1.15 [0.80:1.66]	NS

*Controlling for age, gender, family status, physical activity, main internet use pattern, number of devices to access Internet, daily time on Internet, wellbeing, having a chronic illness, being overweight and average hours of sleep on schooldays.

**Controlling for age, gender, family status, physical activity, main internet use pattern, number of devices to access internet, daily time on internet, wellbeing, being overweight and average hours of sleep on schooldays.

Table 3: Multivariate analysis including all the health problems at the same time using average users as the reference group*.

	Problematic users	p-value
Back problems	1.23 [0.85:1.77]	NS
Weight problems	1.48 [0.86:2.53]	NS
Headaches	1.07 [0.75:1.51]	NS
Musculoskeletal problems	1.09 [0.79:1.51]	NS
Sleep problems	2.03 [1.50:2.74]	<0.001
Sight problems	0.97 [0.66:1.42]	NS

*Controlling for age, gender, family status, physical activity, main internet use pattern, number of devices to access internet, daily time on internet, wellbeing, having a chronic illness, being overweight and average hours of sleep on schooldays.

Our results confirm that problematic internet users more frequently report health problems, even after controlling for confounding factors. Among those, lack of sleep is the most strongly associated and seems to influence the other ones.

Clinicians dealing with adolescents should remember to screen any patient complaining of sleep-related problems, back or musculoskeletal pain or weight problems for excessive internet use. Clinicians can also play an important role in parental guidance regarding the limitation of time their adolescent children can spend online for leisure activities. Furthermore, advising parents to limit the number of devices used to connect to the internet, mainly those that can be kept in their adolescent's room could help warrant enough sleeping time.

Funding / potential competing interests:

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Correspondence: Joan-Carles Surís, MD, PhD, GRSA/IUMSP, Route de la Corniche 10, CH-1010 Lausanne, Switzerland, joan-carles.suris@atjchuv.ch

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Figures (large format)

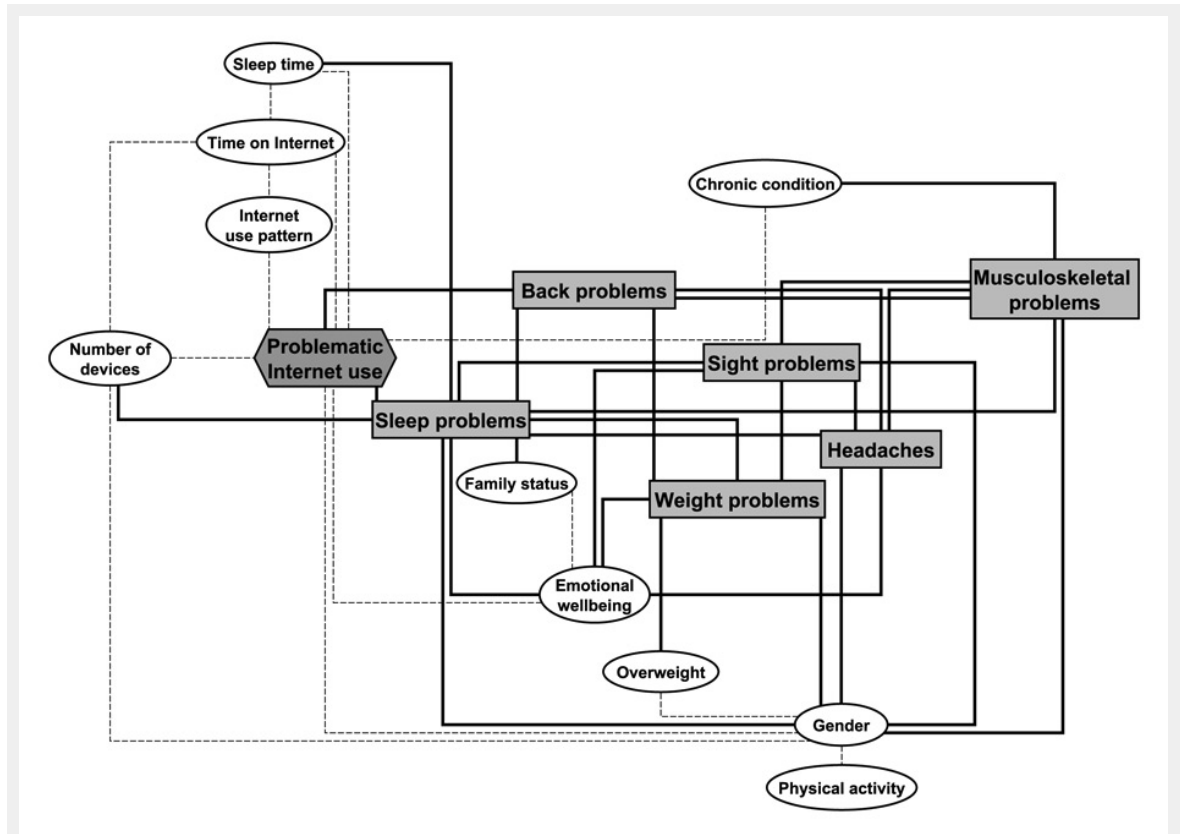


Figure 1
Log-linear model representing the associations between significant variables.