

Epidemiology

The association between screen time and reported depressive symptoms among adolescents in Sweden

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Abstract

Background: How screen use is associated with adolescents' mental health has been widely debated in public media during the last decade, but there is still lack of information about if and how the associations vary between types of electronic media.

Objective: This study aimed to examine how time spent on types of screen use (social media, gaming alone, gaming in groups and watching TV) was associated with depressive symptoms among adolescents in Sweden, and whether gender moderated these associations.

Methods: We analysed data from the Swedish section of the Children of Immigrants: Longitudinal Survey in Four European Countries. The final sample consisted of 3556 eighth grade adolescents in 2011 (51% girls). We used logistic regression analysis to estimate the odds ratio of feeling depressed often versus less often/not at all using time spent on different types of screen use as predictor variables. Additionally, we tested interaction effects between gender and the predictor variables.

Results: Our results showed that spending more than 2 hours on social media was associated with higher odds of feeling depressed often compared with spending 2 hours or less. Not watching TV was associated with higher odds of feeling depressed often compared with watching TV. These patterns did not differ across genders. Gaming alone and gaming in groups were not associated with depressive symptoms.

Conclusions: Our findings suggest that more frequent social media use and not watching TV were associated with a higher level of depressive symptoms.

Lay Summary

This study examined how time spent on four types of screen use including social media, gaming alone, gaming in groups and watching TV was associated with depressive symptoms among adolescents in Sweden, and whether these associations differed for girls and boys. We analysed data from the Swedish section of the Children of Immigrants: Longitudinal Survey in Four European Countries. The final sample consisted of 3556 eighth grade adolescents in 2011 (51% girls). We used logistic regression analysis to estimate the odds ratio of feeling depressed often versus less often/not at all using time spent on different types of screen use as predictor variables. In addition, we tested interaction effects between gender and the predictor variables. Our results showed

Key messages

- Social media use was associated with depressive symptoms.
- Not watching TV was associated with depressive symptoms.
- These associations did not differ by gender.

that social media use and not watching TV was associated with higher odds of feeling depressed often. Gaming alone and gaming in groups were not associated with higher level of depressive symptoms. These patterns did not differ across genders.

Key words: Adolescents, depressive symptoms, gender difference, screen time, screen use, Sweden

Introduction

Information and communication technologies have increasingly become an integral part of adolescents' daily life. Adolescents regularly engage in screen-based activities such as social media use, computer use, gaming, watching videos or TV (1). Given that sedentary behaviour habits may carry through adulthood (2), it is important to understand the health consequences of regular screen use among youth.

Studies showed that screen use during leisure time was associated with experiencing depressive symptoms and psychological distress among adolescents (3–5). A review of reviews concluded that there was moderate to strong evidence of an association between screen time and symptoms of depression in children and adolescents (6) and that this was evident at a threshold of more than 2 or 3 hours a day of screen use (7). Adolescents who experience more symptoms of mental health problems are more likely to develop a mental health disorder during adulthood, and this is in particular the case for girls (8). Therefore, it is critical to understand how screen use and depressive symptoms might be associated.

Some work has indicated that this association may depend on the type of screen use. Although not many studies have examined specific types of screen use, some have suggested there may be differences regarding effects on adolescent mental health (9). For example, social media use has been linked to depressive symptoms (10,11), although findings for playing video games and watching TV are more mixed. Some studies reported a positive association between playing video games and depressive symptoms (3,10), and others a negative association (12) or no association (13). Similarly, some studies observed a positive association between watching TV and depressive symptoms (10,14) whereas another found no association (3). One study did not find any association when examined cross-sectionally, although watching TV was positively associated with depressive symptoms 1 year later in girls, and negatively associated with depressive symptoms 1 year later in boys (13). This suggests there may be gender differences in the screen use and depressive symptoms association, in addition to differences between types of screen use.

It has been suggested that the association between screen use and depressive symptoms is driven by girls (15,16). Girls have consistently higher rates of internalizing problems such as depression (17), although observations of gender differences in screen use are mixed. Some studies found that adolescent boys reported more overall screen use (18,19), whereas others found that adolescent girls reported more overall screen use (20). Differences in the types of screen use measured may account for these discrepancies. For example, boys reported playing more video games than girls (13,19,21), whereas girls reported more passive screen use (including watching TV) and more social networking than boys (19,21). One study found that more frequent social media use was associated with

more depressive symptoms in girls only (14). Thus, the association between screen use and depressive symptoms may differ between girls and boys depending on the type of screen use.

In Sweden, whether screen use is associated with mental health among adolescents has been intensely debated in the public media in recent years. The aim of this study was to examine the association between different types of screen use and depressive symptoms among adolescents in Sweden, and whether these associations were moderated by gender. We hypothesized that adolescents who spent more time on screen use would report symptoms of depression more often, and that this association would be stronger for girls than for boys.

Methods

Study population

Data used for the analysis came from the Swedish section of the Children of Immigrants: Longitudinal Survey in Four European Countries (CILS4EU) wave of 2011. Children of immigrants and their native-born peers at age 14 were the target population. In Sweden, to ensure representation of the full target population, a stratified three-stage sample design was used. First, Statistics Sweden selected 168 schools (first-stage sampling units) from a comprehensive national list of all eligible schools (22). For each participating school, a random sample of two classes within grade eight (second-stage sampling units) was drawn. Within the sampled classes, all students (third-stage sampling units) were selected. The survey was conducted in schools during regular school hours (2010–11 school year). In total, 5025 eighth grade students (aged around 14–15 years) from 251 classes of 129 schools participated. The participation rates at the school-, class- and student levels were 77%, 99% and 86%, respectively (22). Ethical approval was obtained from the relevant ethical review board prior to the data collection. Informed consent was obtained from all students and their parents or guardians prior to the survey (22,23).

Among the 5025 students who responded to the questionnaire, 1469 students failed to report their depressive symptoms, screen use behaviour or other variables of interest and were thus excluded from the study. The final sample used for analysis consisted of 3556 adolescents. Among them, around 30% had parents who were both foreign born. Given the corresponding figure for Sweden was approximately 20% in 2011 (24), our sample was over-represented by children with a migration background. Approximately half (51%) of the sample were girls.

Measures

Screen use was indicated by four types of activities: social media use (i.e. chatting online or visiting social network sites such as

Facebook), gaming alone (i.e. playing video or computer games alone), gaming in groups (i.e. playing video or computer games together with others) and watching TV. Adolescents indicated how much time they usually spent on these activities on a typical school day. The answer categories were: 'more than 2 hours a day', 'about 2 hours a day', 'about 1 hour a day', 'less than 1 hour a day' and 'no time at all'. In this study, the answers were collapsed into three categories: more than 2 hours, 2 hours or less and no time at all.

The outcome variable of the study is adolescents' self-reported depressive symptoms. Adolescents answered one question on how often they felt depressed. The answer categories were: 'never', 'rarely', 'sometimes' and 'often'. Using a single question as the outcome measure warrants caution. However, when validated scales based on multiple items are not available, a single-question measure may be a useful alternative. It may have relatively high levels of specificity in ruling out non-cases, thus providing a quick and pragmatic way to rule out depression (25,26).

Analytical strategy

This study was cross-sectional in nature. Variables of interest were available from the first wave of the survey. We applied logistic regression to examine how screen-based activities were associated with the odds of feeling depressed often versus the lower levels of depressive symptoms.

We controlled for parent education level, parent employment status, family structure and body mass index. Considering that our sample is over-represented by adolescents with foreign-born parents, we controlled for migration background.

We first estimated main effects of types of screen use, respectively, in four separate models. These effects were considered significant at $P < 0.01$ (Bonferroni correction). We then included interaction terms in each model to explore whether gender moderated the association between screen use and depressive symptoms, while other variables were controlled for. If the model including the interaction term was significantly improved ($P < 0.05$), we examined the nature of the interaction.

Results

Table 1 presents descriptive statistics of the independent variables used in the analysis. Five percent of adolescents (173 out of 3556) in our total sample felt depressed often, 16% felt depressed sometimes, 35% felt depressed rarely and 44% never felt depressed.

Screen use and depressive symptoms: main effects

Table 2 shows the adjusted odds ratios of feeling depressed often versus other levels of depressive symptoms by screen time from the main effects logistic regression model. Among the four types of screen use we examined, only social media and watching TV were associated with depressive symptoms.

Compared with adolescents who spent 2 hours or less on social media, those who spent more than 2 hours on this activity had significantly higher odds of feeling depressed often ($P = 0.002$). Those who did not spend time on social media did not differ from the reference group regarding the odds of feeling depressed often.

Adolescents who did not watch TV had significantly higher odds of feeling depressed often ($P < 0.001$) than those who watched TV for 2 hours or less a day. Those who watched TV for more than 2

hours did not differ significantly from the reference group regarding the odds of feeling depressed often.

Table 3 demonstrates estimations for our confounding variables from a separate multivariate analysis model where types of screen use were left out. Estimations from models 1 to 4 resemble the results presented in Table 3. We can see that girls had significantly higher odds of feeling depressed often than boys ($P < 0.001$). A few subgroups had higher odds of often feeling depressed than their counterparts, including adolescents with only one parent employed ($P < 0.01$) compared with those with both parents employed, adolescents under unequally shared custody ($P < 0.001$) compared with those living with both parents and adolescents with a higher body mass index ($P \leq 0.001$). Adolescents with both parents foreign-born ($P < 0.01$) had lower odds of often feeling depressed than those with both parents Swedish born.

Screen use and depressive symptoms: moderation by gender

We ran interaction models to examine whether the association between screen time and depressive symptoms was moderated by gender, while other variables were controlled for. Our likelihood ratio tests did not show a significant improvement of model fit for any of the four models when the interaction terms of gender and each of the screen use variables were included into the respective models.

Post hoc sensitivity analyses

We conducted a few supplementary analyses to test the robustness of our results. First, we constructed a new variable—overall screen use, based on the four types of screen use. Adolescents who reported having spent more than 2 hours on a typical school day on any of the four types of screen use activities were categorized as 'more than 2 hours' of overall screen use (55% of our sample). The remaining were categorized into '2 hours or less'. Our estimation did not show any significant association between overall screen use and depressive symptoms.

Furthermore, for experimental purposes we re-ran the analysis including smoking. The association between social media use and depressive symptoms then became weaker. Given that our data were cross-sectional and that the habit of smoking may occur either before or after the appearance of depressive symptoms, we decided not to adjust for this variable in our final models to avoid the risk of anticipatory analysis.

In addition, we tested different cut-off thresholds for screen time. When screen time was categorized into '≥2 hours', '<2 hours' and 'no time', the estimated results for the four types of screen use were consistent with the results presented in the study. When screen time was categorized into '≥1 hour', '<1 hour' and 'no time', the estimated results for social media, gaming alone or in groups were statistically non-significant whereas the association between not watching TV and feeling depressed often remained.

Finally, we collapsed feeling depressed often and sometimes into one group and estimated adolescents' odds of feeling depressed often and sometimes versus never and rarely. The estimations for gaming in groups deserve attention: adolescents who did not spend time gaming in groups had higher odds of feeling depressed sometimes or often ($P < 0.01$) than those who spent 2 hours or less on this activity. Additionally, the estimation of the interaction term of gender and social media demonstrated that girls who spent more than 2 hours

Table 1. Descriptive statistics of variables used for logistic regression analysis on the association between screen time and reported depressive symptoms among adolescents in Sweden, 2011

	Often	%	Non-often	%	Total	%
Social media (Type 1)						
>2 hours	82	47	1169	35	1251	35
≤2 hours	84	49	2012	59	2096	59
No time	7	4	202	6	209	6
Gaming alone (Type 2)						
>2 hours	31	18	669	20	700	20
≤2 hours	68	39	1599	47	1667	47
No time	74	43	1115	33	1189	33
Gaming in groups (Type 3)						
>2 hours	21	12	563	17	584	16
≤2 hours	62	36	1521	45	1583	45
No time	90	52	1299	38	1389	39
Watching TV (Type 4)						
>2 hours	41	24	815	24	856	24
≤2 hours	110	64	2398	71	2508	71
No time	22	13	170	5	192	5
Genders						
Boys	45	26	1696	50	1741	49
Girls	128	74	1687	50	1815	51
Parents' education						
Both high	52	30	1119	33	1171	33
One high	50	29	909	27	959	27
Neither high	71	41	1355	40	1426	40
Parents' employment						
Both employed	109	63	2498	74	2607	73
One employed	55	32	677	20	732	21
Neither employed	9	5	208	6	217	6
Migration background						
Both native	112	65	1995	59	2107	59
One native	24	14	391	12	415	12
Both foreign	37	21	997	29	1034	29
Family structure						
Two-parent household	97	56	2325	69	2422	68
One-parent household	40	23	492	15	532	15
Equally shared custody	9	5	307	9	316	9
Unequally shared custody	27	16	259	8	286	8
Body mass index						
Mean (SD)	21.3 (5.6)		20.5 (3.7)		20.6 (3.8)	
Total	173		3383		3556	100

Source: Authors' calculations based on CILS4EU Sweden (2011).

on social media had higher odds of feeling depressed sometimes or often than those who spent 2 hours or less on this activity. This pattern did not apply to boys.

Discussion

In this study, we examined the association between screen use and depressive symptoms among adolescents. Our results showed that social media use and watching TV were associated with depressive symptoms. Spending more than 2 hours on social media was associated with higher odds of feeling depressed often compared with spending 2 hours or less on this activity. Not watching TV was associated with higher odds of feeling depressed often compared with watching TV. Time spent gaming alone and gaming in groups were not associated with higher odds of feeling depressed often.

Similar to our findings in this study, most previous studies reported that more frequent screen use was associated with experiencing more symptoms of depression (6). Nonetheless, most previous

studies measured time spent on screen use in hours. In our study, we utilized the categorical coding in the questionnaire, and we were therefore unable to determine the exact time in hours spent on screen use. Instead, we examined the threshold of more than 2 hours a day compared with less than that. Although threshold effects of 2–3 hours a day of screen use have been put forth regarding adolescents' mental health (7), existing studies showed that youth nowadays may spend between 7 and 8 hours a day on recreational screen use (20). Therefore, our categorical coding of more than 2 hours a day or less may not have been sufficiently sensitive in differentiating between different groups of screen users.

In our study, adolescents who spent more than 2 hours on social media were more likely to feel depressed often compared with those who spent 2 hours or less. A number of different explanations have been suggested for the association between screen use and depressive symptoms. Recent work suggests that the association is independent of body mass index and physical activity levels (7). Shorter sleep duration and quality of sleep may be possible mechanisms (10), given

Table 2. Adjusted odds ratio (95% CI) for depressive symptoms by screen time among adolescents in Sweden, 2011

	Model 1			Model 2			Model 3			Model 4		
	(Type 1: social media)			(Type 2: gaming alone)			(Type 3: gaming in groups)			(Type 4: watching TV)		
	Odds ratio	P > z	[95% CI]	Odds ratio	P > z	[95% CI]	Odds ratio	P > z	[95% CI]	Odds ratio	P > z	[95% CI]
Screen time												
>2 hours	1.66	0.002	[1.21–2.29]	1.47	0.105	[0.92–2.35]	1.36	0.268	[0.79–2.36]	1.13	0.524	[0.77–1.65]
≤2 hours	1			1			1			1		
No time	1.01	0.988	[0.45–2.23]	1.05	0.786	[0.73–1.51]	1.20	0.302	[0.85–1.72]	2.57	0.000	[1.56–4.22]
_cons	0.01	0.000	[0.00–0.01]	0.01	0.000	[0.00–0.02]	0.01	0.000	[0.00–0.02]	0.01	0.000	[0.00–0.02]
Logistic regression												
Prob > chi ²	0.00			0.00			0.00			0.00		
Log likelihood	-643.48			-647.14			-647.49			-642.57		
Pseudo R ²	0.07			0.06			0.06			0.07		

Notes: Estimated results from four separate models, each adjusted for sociodemographic and family characteristics including genders, parents' education, parents' employment, migration background, family structure and body mass index. See Table 3 for estimations for the confounding variables.

Source: Authors' calculations based on CILS4EU Sweden (2011).

the associations between screen use and sleep (27) and between sleep and depression (28) in adolescents. Alternatively, adolescents who frequently engage in screen-based activities may be socially isolating themselves, which may increase their risk of feeling depressed. For example, a meta-analysis showed a positive association between Facebook use and loneliness (29). Another study reported that the association between social media use and depressive symptoms was only evident in adolescents who engaged in in-person social interaction less often (14).

Adolescents who did not watch TV at all were more likely to feel depressed often compared with those who watched TV for less than 2 hours a day. Studies that have examined this association have reported mixed findings. Some observed that adolescents who spent more time watching TV reported more depressive symptoms (10), whereas others observed no association (3). Possibly, as a whole watching TV may be more socially interactive than other forms of screen use, and therefore may act as a protective factor for depressive symptoms (30).

We did not find evidence to support the hypothesis that the association between screen use and depressive symptoms would be stronger in girls, as the interaction models were not significantly improved compared with the main effects models. While previous studies controlled for gender, few tested interaction effects. Among those that did, some reported the association was only evident in girls (16), and some reported it was stronger in boys (31). Other studies reported non-significant interaction effects (30,32).

Interestingly, our sensitivity analysis showed that spending no time in gaming in groups was associated with higher odds of feeling depressed sometimes or often than those who spent 2 hours or less a day. These results suggest that the social interaction in group activities including group gaming may act as a protective factor for depressive symptoms.

Our study was cross-sectional, therefore we could not determine the direction of effects. Some possible confounders such as smoking were not controlled for in this study as they may occur either before or after the appearance of depressive symptoms (33). A few studies that examined longitudinal associations showed that more frequent screen use during adolescence was associated with poorer wellbeing 6 months (34) and 26 years (32) later. However, watching TV/movies was associated with psychological distress 6 months later (34) and with depression 7 years later, particularly in boys (31). Two studies which examined bidirectional effects found that internalizing problems were associated with more frequent screen use 2 years later (35) and that depressive symptoms were associated with more frequent TV watching 2 years later (36). Interestingly, both of these associations were found in girls only (35,36). These studies suggest that, at least among girls, internalizing problems may precede more frequent screen use.

This study should be considered in light of some other limitations. First, all variables were self-reported by a single informant. Second, in the questions on gaming alone and gaming in groups, it was not specified whether this referred to *physically* being alone/in groups or *digitally* (e.g. online gaming with others). Third, adolescents are often engaged in more than one kind of screen activity at the same time. In this study, we could not capture how such combined screen use was associated with depressive symptoms among adolescents. Fourth, a single question was used to measure depressive symptoms. Lastly, data were collected in 2011/2012. Since then, there has been a rapid development of screen-based technologies and the use of electronic media has become much more frequent.

Table 3. Estimations for confounding variables from a separate multivariate analysis: odds ratio (95% CI) for depressive symptoms by sociodemographic and family characteristics among adolescents in Sweden, 2011

Estimations for sociodemographic and family characteristics			
	Odds ratio	<i>P</i> > <i>z</i>	[95% CI]
Genders			
Boys	1		
Girls	2.88	0.000	[2.02–4.09]
Parents' education			
Both high	1		
One high	1.01	0.972	[0.67–1.51]
Both low	0.96	0.850	[0.66–1.41]
Parents' employment			
Both employed	1		
One employed	1.84	0.002	[1.26–2.68]
Neither employed	1.13	0.744	[0.54–2.38]
Migration background			
Both native	1		
One native	0.89	0.638	[0.56–1.43]
Both foreign	0.53	0.003	[0.35–0.80]
Family structure			
Two-parent household	1		
One-parent household	1.53	0.047	[1.01–2.34]
Equally shared custody	0.67	0.255	[0.33–1.34]
Unequally shared custody	2.26	0.000	[1.43–3.58]
Body mass index			
_cons	1.06	0.001	[1.02–1.09]
	0.01	0.000	[0.00–0.02]
Logistic regression			
Prob > chi ²	0.00		
Log likelihood	–648.42		
Pseudo R ²	0.06		

Source: Authors' calculations based on CILS4EU Sweden (2011).

Conclusions

Our results indicated that gaming alone and gaming in groups were not associated with adolescents' odds of feeling depressed often. Compared with spending 2 hours or less on social media, spending more than 2 hours on social media was associated with higher odds of feeling depressed often. Watching TV was associated with depressive symptoms such that adolescents who did not watch TV at all were more likely to report feeling depressed often compared with adolescents who watched TV. Interpretation of these findings warrant caution due to the limitations of this study. Nonetheless, our findings provide a nuanced view of the association between screen use and depressive symptoms. We expect that our findings can provide empirical evidence to inform appropriate policy and practice guidelines to adolescents and parents regarding time spent on different types of screen use. However, some questions such as gender differences and causal effect require further exploring. Longitudinal studies with more recent data and validated scales are needed for a better understanding of the association between screen use and depressive symptoms.

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Ethical approval: ethical approval was not required because we used anonymized data, which are available for use to international research community.

Conflict of interest: the authors declare that there is no conflict of interest.

Data availability

The data underlying the research results of this study were provided by GESIS Data Archive for the Social Sciences, Cologne, Germany (<http://www.cils4.eu/>). The data are available to the international research community for public use.

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