Author/s:
Mundy, LK;Canterford, L;Moreno-Betancur, M;Hoq, M;Sawyer, SM;Allen, NB;Patton, GC

Title:
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Date:
2021-05-01

Citation:
Mundy, L. K., Canterford, L., Moreno-Betancur, M., Hoq, M., Sawyer, S. M., Allen, N. B. & Patton, G. C. (2021). Social networking and symptoms of depression and anxiety in early adolescence. Depression and Anxiety, 38 (5), pp.563-570. https://doi.org/10.1002/da.23117.

Persistent Link:
https://hdl.handle.net/11343/276635

Lisa Mundy ORCID iD: 0000-0002-7983-5232

Social Networking and Symptoms of Depression and Anxiety in Early Adolescence

Running title: Social networking and adolescent mental health symptoms

Lisa K. Mundy [1,2], Louise Canterford [1], Margarita Moreno-Betancur [2,3], Monsurul Hoq [1,3], Susan M Sawyer [1,2], Nicholas B. Allen [4], and George C. Patton [1,2]

[1]Centre for Adolescent Health, Murdoch Children's Research Institute, 50 Flemington Road, Parkville, Victoria, 3052, Australia

[2]Department of Paediatrics, University of Melbourne, Parkville, Victoria, 3052, Australia

[3]Clinical Epidemiology and Biostatistics Unit, Murdoch Children's Research Institute, 50 Flemington Road, Parkville, Victoria, 3052, Australia

[4]Department of Psychology, University of Oregon, Eugene OR 97403-1227, USA

Corresponding author: Dr. Lisa Kate Mundy

Murdoch Children's Research Institute, 50 Flemington Road, Parkville, Victoria, 3052, Australia Telephone: +61(0)3 9345 7978, Fax: +61(0)3 9345 6343

Email: lisa.mundy@mcri.edu.au

Acknowledgements

This research was supported by Australia's National Health and Medical Research Council (NHMRC; project grants #1010018 and #1122189), the Australian Rotary

Health, the Victorian and Commonwealth Departments of Education and Training and the Royal Children's Hospital Foundation. Murdoch Children's Research Institute (MCRI) research is supported by the Victorian Government's Operational Infrastructure Program. Professor Patton is supported by a Senior Principal Research Fellowship from NHMRC. Study data were collected and managed using REDCap electronic data capture tools hosted at MCRI. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing: 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources (Harris et al., 2019; Harris et al., 2009). We thank the families and schools who participated in this study and staff and volunteers involved in data collection.

Conflict of interests

The authors declare that there are no conflict of interests.

ABSTRACT

Background: Use of social networking in later childhood and adolescence has risen quickly. The consequences of these changes for mental health are debated but require further empirical evaluation.

Methods: Using data from the Childhood to Adolescence Transition Study (n = 1156), duration of social networking use was measured annually at four time points from 11.9 to 14.8 years of age (≥ 1 hour/day indicating high use). Cross-sectional and prospective relationships between social networking use and depressive and anxiety symptoms were examined.

Results: In adjusted (age, socioeconomic status, prior mental health history) cross-sectional analyses, females with high social networking use had greater

odds of depressive (OR 2.15, 95% CI 1.58-2.91) and anxiety symptoms (OR 1.99, 95% 1.32-3.00) than those that used a few minutes at most, while males with high social networking use had 1.60 greater odds of reporting depressive symptoms (95% CI 1.09-2.35). For females an increased odds of depressive symptoms at age 14.8 was observed for high social networking use at one previous wave and at two or three previous waves, even after adjustment (OR 1.76, 95% CI: 1.11-2.78; OR 2.06, 95% CI 1.27-3.37, respectively) compared to no wave of high use.

Conclusions: Our results suggest weak to moderate increased odds of depression and anxiety in girls and boys with high social networking use versus low/normal use. These findings indicate that prevention programs for early mental health problems might benefit from targeting social networking use in early adolescence.

Key words: Anxiety/Anxiety Disorders, Depression, Child/Adolescent, Computer/Internet Technology, Epidemiology

INTRODUCTION

Fifty percent of mental health problems begin by 14 years of age with symptoms commonly emerging in late childhood (Kessler et al., 2005). In recent years, rates of mental health problems in youth appear to be increasing (Twenge, Cooper, Joiner, Duffy, & Binau, 2019). Digital social networking has been implicated as a possible contributor but strong evidence for this assertion has been scant (Twenge et al., 2019).

Social networking sites are defined as internet-based applications that allow individuals to connect through the creation and exchange of user-based content (Seabrook, Kern, & Rickard, 2016). Since the introduction of social networking, rates of use have risen sharply and it is now a major part of young people's lives. Current estimates suggest 97% of adolescents in the US are active

on social networking sites (Anderson & Jiang, 2018). There is much debate about the effects of increasing social networking by children (Bell, Bishop, & Przybylski, 2015), with many studies showing significant associations but often with small effect sizes that suggest weak effects and the likelihood of significant moderating factors (Orben, Dienlin, & Przybylski, 2019; Orben & Przybylski, 2019).

Social networking shifts interactions with the external world in late childhood and adolescence, particularly with the peer group (O'Keeffe, Clarke-Pearson, & Council on Comminications and Media, 2011). Its benefits include greater social connection and learning, as well as access to information and the development of skills in technology (O'Keeffe et al., 2011). However, there are also potential negative effects on mental health. Engagement with peers, central in identity development and establishment of self-regulation, may be altered with extensive social networking (O'Keeffe et al., 2011). Risks also arise through online hazards including cyberbullying, sexting, invasion of privacy and a heightened sensitivity to body image (O'Keeffe et al., 2011). Social networking may also affect mental health through disruption of sleep, physical activity and face-to-face peer interactions (O'Keeffe et al., 2011; Viner et al., 2019). In the latter scenarios, any link between social networking and mental health problems is likely to be more immediate and proximal, whereas the other mechanisms may explain a more distal relationship.

One limitation of earlier research examining the association between social networking and mental health has been a failure to control for the possibility that children and adolescents with mental health problems are more likely to use social networking sites (Ybarra, Alexander, & Mitchell, 2005). Specifically, most previous studies fail to control for a prior history of mental health problems (McCrae, Gettings, & Purssell, 2017). Although there have been

some prospective studies that have extended beyond 12 months (e.g., Boers, Afzali, Newton, & Conrod, 2019; Booker, Kelly, & Sacker, 2018; Coyne, Rogers, Zurcher, Stockdale, & Booth, 2020; McCrae et al., 2017), most have been cross-sectional or with short-term follow up. Also, most studies have focused on older adolescents or young adults (Orben et al., 2019), which is often after the onset of mental health problems. Furthermore, many studies have focused on only one social networking platform but the majority of adolescents use multiple platforms (Hill et al., 2016).

This study addresses these limitations by examining the longitudinal relationships between levels of social networking use and symptoms of depression and anxiety in a large population-based sample of young adolescents including adjustment for prior history of mental health problems. These relationships will be examined separately for males and females given previous studies that have observed gender differences in associations between social networking and mental health (Booker et al., 2018). The first analyses examine cross-sectional (proximal) associations between longer duration of social networking use and high depressive and anxiety symptoms across four yearly assessments. The second examines whether high levels of social networking in early adolescence predict subsequent emergence of mental health problems.

METHOD

Study Population and Design

Data were from the Childhood to Adolescence Transition Study (CATS). The full design is reported elsewhere (Mundy et al., 2013). Briefly, students were invited from a stratified random sample of 43 primary schools (Government, Catholic, Independent) in Melbourne, Australia, in 2012. All grade three children

(aged 8-9 years; fourth year of formal schooling) in the selected schools were invited to participate. Of the 2289 invited children, 1239 (54%) were recruited.

Procedure

Participants were followed up annually from wave 1 (aged 8-9 years; 2012) to wave 7 (aged 14-15 years; 2018). Data collection occurred through student self-report questionnaires in schools until wave 4 and alternative arrangements were made for those unable to attend. In waves 5 and 6, students at schools with 10 or more participants completed questionnaires at school. Other students completed questionnaires online, via post or by Computer Assisted Telephone Interview (CATI). In wave 7, all data collection was completed either online, via post or by CATI.

Ethical Considerations

Ethics approval was granted by the Royal Children's Hospital Human Research Ethics Committee (#31089). Permission was granted from the Victorian Department of Education and Training and the Catholic Education Office Melbourne to recruit through their schools. Children were recruited through active, written, informed parent consent.

Measures

Depressive and anxiety symptoms. Depressive symptoms were measured using self-report on the Short Mood and Feelings Questionnaire (SMFQ) (Angold, Costello, Pickles, Winder, & Silver, 1995). Items were scored on a 5-point Likert scale, ranging from 0 (never) to 4 (almost always). They were recoded to a 3-point scale (0 (not true); 1 (sometimes true); 2 (true)) to match the original SMFQ scoring. Two items ('I felt miserable and unhappy', 'I didn't enjoy anything at all') were included in waves 1 and 2 (to reduce participant burden) and the full 13 items were included in waves 3-7. The time frame was 'in the past two weeks'. The

total score was dichotomised to define presence of depressive symptoms using a cut-point of 2 or more for the two item scale (Rhew et al., 2010) and 6 or more for the full scale (Katon, Russo, Richardson, McCauley, & Lozano, 2008).

Anxiety symptoms were assessed using the short Spence Children's Anxiety Scale (SCAS) (Reardon, Spence, Hesse, Shakir, & Creswell, 2018; Spence, Barrett, & Turner, 2003). Items were scored on a 5-point Likert scale, ranging from 0 (never) to 4 (almost always). They were recoded to a 4-point scale (0 (never) to 3 (always)) to match the original SCAS scoring. Two items ('I worry about things', 'I feel afraid') were included in waves 1 and 2 and the full 8 items were included in waves 3-7. The time frame was 'in the past two weeks'. The total score was dichotomised using a cut-point of 3 or more for the two-item scale (a child scoring ≥3 answered at least 'often' on at least one of the two items) and 11 or more for the full short version (captures those who reported at least 'some' anxiety on all items) to define presence of anxiety symptoms.

Social networking use. Students reported their social networking use and duration of use in waves 4-7 (ages 11-12 through 14-15). They were asked: "Do you use any of the following social networking sites?" A list was provided with the option to specify others. Students who indicated that they used a social networking site were asked to report duration of use across all sites for a normal school day. The duration item was scored on a six-point scale from "none" to "4 or more hours" and then collapsed into three categories ("none or a few minutes", "30 minutes to 1 hours","1 hour +") based on the distribution of the data and in line with other studies (Selfhout, Branje, Delsing, ter Bogt, & Meeus, 2009). Those that did not use any social networking sites were assigned to the "none or a few minutes" category. A high duration of social networking use was defined as using social networking sites for 1 hour + on school days (with results for 2 hours or more presented in the supplementary material). A measure of incident and

persistent high duration use was derived indicating high duration of use at a single wave or at two or three waves based on data from waves 4-6.

Covariates. To address potential confounding, age (in months; mean-centred) and family socioeconomic status (SES) (both measured at wave 1) were adjusted for in analyses. SES was calculated from home postcode using the Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) from the Australian Bureau of Statistics Socio-Economic Index for Areas (SEIFA IRSAD quintile).

A variable was generated to indicate if depressive symptoms were present in waves 1-3: (i) no waves ('not present'), (ii) at one wave only ('single episode'), or (iii) at two or three waves ('persistent'). Similarly, a three-level variable was generated to indicate the presence of anxiety symptoms during waves 1-3.

Statistical Analysis

Two analyses were conducted for each outcome to examine the cross-sectional (short-term/proximal) and longitudinal (longer-term/distal) effects of social networking on mental health. All analyses were conducted separately for females and males.

The cross-sectional association between duration of social networking use and mental health symptoms at each wave was estimated using logistic generalised estimating equations (exchangeable correlation structure, robust standard errors) to account for repeated measures within individuals. Unadjusted models were initially fitted and then adjusted for age and SES. We further adjusted for mental health symptoms at the previous wave.

The effect of incident and persistent high duration of social networking use (waves 4-6) on mental health symptoms at wave 7 was estimated using logistic regression analysis. Unadjusted models were fitted and then adjusted for

age and SES. Further adjustment was made for prior history of mental health symptoms (waves 1-3), in addition to all previously mentioned covariates.

Several analysis variables were subject to missing data. In the first analysis, an available case approach was used and in the second analysis, missing data were handled using multiple imputation with full details provided in the supplementary material.

RESULTS

Description of sample

Of the 1239 students recruited, 83 (6.7%) were excluded because they had no social networking data, resulting in 1156 participants (623 females, 533 males). Average age at recruitment was 9.0 years (Figure 1). Table 1 summarises the duration of social networking use. Just over ten percent of females used social networking sites for more than one hour a day at wave 4, which increased to more than half at waves 6 and 7. Under ten percent of males used social networking sites for more than one hour a day at wave 5, which increased to over 40% at wave 7. A summary of the duration of social networking use when high use is defined as 2 hours or more is presented in the supplementary material. Prevalence of mental health symptoms increased over the 4 waves and mental health symptoms were more prevalent amongst females (Table 1).

Cross-sectional relationships between duration of social networking and mental health

In cross-sectional analyses, females who used social networking for more than one hour had just over two-fold greater odds of reporting mental health symptoms when compared with those who used social networking for a few minutes at most (Table 2). Results were similar when adjusting for age, SES and

prior mental health history (depressive symptoms: OR 2.15, 95% CI 1.58-2.91; anxiety symptoms: OR 1.99, 95% CI 1.32-3.00). However, associations were smaller when comparing those who used social networking for 30 minutes to 1 hour on a school day with those who used a few minutes.

Males who used social networking for more than one hour had 1.54 greater odds of reporting depressive symptoms (95% CI 1.09-2.18) compared with those who used a few minutes (Table 2). Results were similar when adjusting for age, SES and prior mental health history (OR 1.60, 95% CI 1.09-2.35). As with females, these associations were smaller when comparing males who used social networking for 30 minutes to 1 hour on a school day with males who used a few minutes. There was little evidence of an association between duration of social networking use and anxiety symptoms in males (Table 2). Results were consistent when categorising heavy social networking as 2 hours or more (refer to the supplementary material).

Longitudinal relationships between duration of social networking and mental health

In longitudinal analyses, for females, there was some evidence that reporting a high duration of social networking use (1+ hour) at only one previous wave (incident), was related to higher odds of reporting depressive symptoms in wave 7 (OR 1.79, 95% CI 1.14-2.80; Table 3) compared with those that did not use social networking for 1 + hour at any previous wave. The estimate was similar when adjusted for age, SES and prior history of mental health problems (OR 1.76, 95% CI 1.11-2.78). There was little evidence of an effect of high duration of social networking use at only one previous wave on depression symptoms for males (OR 1.03, 95% CI 0.55-1.91, after adjustment). For females, persistent high duration of social networking use (operationalised as high usage at two or three waves over

waves 4-6), was related to an approximately 2-fold increase in the likelihood of reporting depressive symptoms in wave 7 (OR 2.23, 95% CI 1.40-3.54; Table 3) compared with those who did not use social networking for 1 + hour at previous waves. This estimate was similar after adjustment for age, SES and prior history of mental health symptoms (OR 2.06, 95% CI 1.27-3.37). There was little evidence for an effect of high duration of social networking use at two or three previous waves on depression symptoms for males (OR 1.60, 95% CI 0.77-3.35), after adjustment). When high social networking use was operationalised as 2 hours or more the direction of associations were comparable but with wider confidence intervals, especially for males (refer to Supplementary material).

Associations of a similar magnitude were observed between prior social networking use and subsequent anxiety symptoms, although evidence of an effect in females was weak (one wave only: OR 1.64, 95% CI 0.91-2.93; two or three waves: OR: 1.58, 95% CI: 0.87-2.88; after adjustment) and there was little evidence in males (one wave only: OR 1.97, 95% CI 0.62-6.30; two or three waves: OR: 2.63, 95% CI: 0.81-8.55; after adjustment; Table 4). Results of operationalising high social networking use as 2 hours or more are presented in the supplementary material. For females, the results were consistent and for males, there was some evidence that heavy social networking use was associated with greater odds of anxiety symptoms at wave 7 but with very wide confidence intervals.

DISCUSSION

This is one of the first large longitudinal population-based studies to examine social networking use and depressive and anxiety symptoms in early adolescence; an age when social networking use is escalating and mental health problems are emerging. Participants who reported using social networking sites

for more than one hour a day on a school day were more likely to report symptoms of mental health problems, with effects being strongest for females and for depressive symptoms. Females engaging in high levels of social networking had an over two-fold greater odds for current depressive symptoms and anxiety symptoms, even when adjusting for prior mental health history. For males, over one hour of social networking per day was associated with 1.5-fold greater odds for current depressive symptoms. When examining whether high levels of social networking use prospectively predicted future mental health symptoms, females with high levels of use at two or three prior waves had a two-fold greater odds of reporting depressive symptoms, even when adjusting for a prior history of depressive symptoms. There was a similar pattern for males but this effect was reduced when adjusting for prior mental health symptoms.

Existing research is mixed. Our results are consistent with other studies showing a link between social networking and mental health problems (Lin et al., 2016; Riehm et al., 2019), although other studies have reported no relationship (Coyne et al., 2020; Jensen, George, Russell, & Odgers, 2019) and some have found users experience decreased depression (Bessière, Pressman, Kiesler, & Kraut, 2010). Importantly, our study adjusted for prior mental health history, with findings in females similar to that by Riehm and colleagues (Riehm et al., 2019). However, for males using high levels of social networking at two or three waves, the effect was reduced, suggesting the possibility that males with high levels of depression are more likely to use social networking sites. Our study focuses on subclinical levels of symptoms and not clinically significant levels of depression and anxiety, which may explain divergence in results from some prior studies. We found little evidence of an association between social networking use and anxiety symptoms in males. Although there was some evidence of a short-term association for females, there was only weak evidence of a long-term association.

Few previous studies have examined anxiety as an outcome with most focusing on global wellbeing or mental health measures or only depression (Ivie, Pettitt, Moses, & Allen, 2020). Of the few studies that have looked at both depression and anxiety, typically no association was found between social networking and either depression or anxiety (Coyne et al., 2020; Erevik et al., 2020).

Although we found associations between social network usage and mental health symptoms, the effect size of these associations were small to moderate (especially when adjusting for prior symptoms) and smaller than more well-established risk factors such as prior symptoms (Orben et al., 2019; Orben & Przybylski, 2019). It is therefore unlikely that these effects can fully explain the recently observed cohort wide increases in youth mental health problems (Twenge et al., 2019).

Despite increases in social networking use and depressive symptoms that occur during early adolescence, earlier studies have focused on older adolescents and young adults (Lin et al., 2016). Young adolescents may be particularly susceptible to the risks associated with social networking given that their capacity for self-regulation and identity development are still forming, and their particular susceptibility to peers (O'Keeffe et al., 2011). Heavy users of social networking sites are more likely to experience envy when viewing others on these sites, an experience linked with depressive symptoms (Tandoc Jr, Ferrucci, & Duffy, 2015). It is also possible that using social networking sites may expose young people to known risk factors for mental health problems, such as cyberbullying (O'Keeffe et al., 2011; Viner et al., 2019). Social networking may also displace other activities such as face-to-face interactions with peers, sleep or physical activity (Viner et al., 2019). Although not able to test specific mechanisms as part of this study, our

results suggest that the effects of social networking on mental health may be both proximal and distal.

The large longitudinal population-based sample, with a narrow age range of young adolescents followed over time, and the ability to control for past mental health symptoms are study strengths. Separate measures of depressive and anxiety symptoms, rather than a global construct of psychological distress, is a further strength. The main limitation was the measure of social networking, which captured only duration and not content or the way it was used (Pea et al., 2012). There is evidence that active versus passive use of social networking sites may have different effects and that the number of friends on these sites may also affect symptoms (Hill et al., 2016). It is possible that females and males may use social networking sites differently, contributing to the gender differences observed (McCrae et al., 2017). Thus, further longitudinal research including measures of type as well as duration is required. Participants were also asked to recall their social networking activities for a normal school day, rather than using a time-use diary, direct tracking or other objective measures (Orben & Przybylski, 2019). This may lead to potential recall bias given evidence that participants may not be accurate at estimating their media use (Scharkow, 2016). However, as heavy internet users have been shown to underestimate their time and infrequent users overreport, it may be less likely that misreporting would affect the results of this study (Scharkow, 2016).

Early adolescence is a time when young people are increasingly using social networking. In our study, just over 10% of females at 11.9 years of age were using social networking sites for more than an hour a day, a figure that had dramatically risen to over 1 in 2 females three years later. A similar pattern was observed for males, although overall rates were lower. Of particular interest,

when this study started collecting information about social networking, the mean age of participants was 12 years, a year younger than the minimum age required by many social networking sites. Thus, this study has important implications for parents, teachers, clinicians and researchers and the results should be considered in the development of regulatory frameworks. Current guidelines from the American Academy of Paediatrics advise that for children over six years of age, consistent limits should be in place for the time and types of media used (Chassiakos, Radesky, Christakis, Moreno, & Cross, 2016). This study suggests that using social networking for over an hour a day can impact subclinical levels of adolescent mental health problems and thus should be considered as a part of multifaceted programs aimed at the prevention of mental health problems that are escalating in early adolescence. In the years since 2012, social networking use has increased rapidly with most adolescents now utilising these programs (Anderson & Jiang, 2018). This has brought profound changes across peer and family relationships (Nesi, Choukas-Bradley, & Prinstein, 2018), meaning even low-level users or those who choose to opt out may be impacted (Haidt & Allen, 2020; Rosenquist, Fowler, & Christakis, 2011).

Conclusion

High levels of social networking are linked with depressive symptoms in early adolescence, both proximally and distally. For females these effects persist when adjusting for previous depressive symptoms. Current use of social networking is also associated with anxiety symptoms in females. However, these associations are small to moderate and smaller than known risk factors. Notwithstanding this, high rates of social networking use suggest it is an important component to consider in prevention programs for mental health

problems. This study provides important new insights into the associations between these phenomena during this critical phase of development.

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Data availability statement: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Table 1: Proportion of students using social networking sites by duration and proportion of students with mental health problems (by wave and sex) (available case analysis)

	Wave 4		Wave 5		Wave 6		Wave 7	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Female								
Duration of social networking	559	-	522	-	521	-	472	-
None or a few minutes	344	61.5	199	38.1	104	20.0	72	15.3
30 minutes to 2 hours	140	25.0	151	28.9	152	29.2	136	28.8
2 hours +	75	13.4	172	33.0	265	50.9	264	55.9
Depressive symptoms	554	-	496	-	516	-	468	-
Present	90	16.3	125	25.2	184	35.7	191	40.8
Anxiety symptoms	554	-	522	-	522	-	471	-
Present	67	12.1	54	10.3	82	15.7	95	20.2
Male								
Duration of social networking	499	-	456	-	470	-	408	-
None or a few minutes	331	66.3	253	55.5	127	27.0	90	22.1
30 minutes to 2 hours	126	25.3	115	25.2	163	34.7	139	34.1
2 hours +	42	8.4	88	19.3	180	38.3	179	43.9

Depressive symptoms	494	-	436	-	460	-	407	-
Present	48	9.7	64	14.7	80	17.4	87	21.4
Anxiety symptoms	486	-	459	-	466	-	410	-
Present	15	3.1	16	3.5	20	4.3	21	5.1

Table 2: Relationship between duration of social networking use (on a normal school day) and depressive and anxiety symptoms (average cross-sectional association across waves 4 to 7; available case analysis)

	Depressive symptoms			Anxiety symptoms		
	Unadjusted OR (95% CI)	Partially adjusted[†] OR (95% CI)	Fully adjusted[‡] OR (95% CI)	Unadjusted OR (95% CI)	Partially adjusted[†] OR (95% CI)	Fully adjusted[§] OR (95% CI)
Female						
None or a few minutes	ref	ref	ref	ref	ref	ref
30 minutes - 1 hour	1.22 (0.94-1.59)	1.23 (0.94-1.60)	1.20 (0.86-1.66)	1.30 (0.90-1.87)	1.30 (0.90-1.89)	1.36 (0.87-2.14)
1 hour +	2.20 (1.69-2.85)	2.18 (1.68-2.85)	2.15 (1.58-2.91)	2.19 (1.55-3.10)	2.22 (1.57-3.13)	1.99 (1.32-3.00)
Male						
None or a few minutes	ref	ref	ref	ref	ref	ref

30 minutes - 1 hour	1.09 (0.80-1.48)	1.09 (0.80-1.48)	1.22 (0.86-1.72)	1.20 (0.69-2.08)	1.20 (0.69-2.10)	1.37 (0.75-2.50)
1 hour +	1.54 (1.09-2.18)	1.51 (1.07-2.13)	1.60 (1.09-2.35)	1.44 (0.76-2.74)	1.39 (0.73-2.64)	1.62 (0.78-3.37)

[†] Adjusted for SES (wave 1), age (wave 1)), and wave of data collection. [‡] Adjusted for SES (wave 1), age (wave 1)), wave of data collection, depressive symptoms at the prior wave, and anxiety symptoms at the prior wave. [§] Adjusted for SES (wave 1), age (wave 1)), wave of data collection, anxiety symptoms at the prior wave, and depressive symptoms at the prior wave.

Table 3: Effect of high use of social networking across waves 4-6 on depressive symptoms in wave 7 (multiple imputation analysis)

	n[†]	Depressive symptoms % (95% CI)[‡]	Unadjusted OR (95% CI)	Partially adjusted[§] OR (95% CI)	Fully adjusted[¶] OR (95% CI)
Female					
Not present	248	31.8 (25.6-38.7)	ref	ref	ref
One wave	178	45.5 (37.4-53.8)	1.79 (1.14-2.80)	1.76 (1.12-2.77)	1.76 (1.11-2.78)
Two or three waves	197	51.0 (42.6-59.3)	2.23 (1.40-3.54)	2.17 (1.35-3.49)	2.06 (1.27-3.37)
Male					
Not present	286	19.5 (14.9-25.0)	ref	ref	ref
One wave	143	21.3 (14.3-30.4)	1.12 (0.62-1.99)	1.09 (0.60-1.96)	1.03 (0.55-1.91)
Two or three	103	31.0 (20.4-	1.85 (0.97-	1.81 (0.93-	1.60 (0.77-

waves	44.0)	3.53)	3.54)	3.35)

[†] Calculated using imputed percentage estimates and total number of students in the analysis sample (N = 533 males, N = 623 females). [‡] Estimated marginal (population-average) unadjusted prevalence rate. [§] Adjusted for SES (wave 1) and age (wave 1))

[¶] Adjusted for SES (wave 1), age (wave 1)), depressive symptoms (waves 1-3), and anxiety symptoms (waves 1-3).

Table 4: Effect of high use of social networking across waves 4-6 on anxiety symptoms in wave 7 (multiple imputation analysis)

	n†	Anxiety symptoms % (95% CI)[b]	Unadjusted OR (95% CI)	Partially adjusted§ OR (95% CI)	Fully adjusted¶ OR (95% CI)
Female					
Not present	248	16.1 (11.3-22.3)	ref	ref	ref
One wave	178	23.9 (17.3-32.1)	1.65 (0.93-2.90)	1.65 (0.93-2.91)	1.64 (0.91-2.93)
Two or three waves	197	23.7 (17.3-31.5)	1.62 (0.91-2.89)	1.70 (0.95-3.06)	1.58 (0.87-2.88)
Male					
Not present	286	3.9 (2.0-7.5)	ref	ref	ref
One wave	143	6.4 (3.0-13.3)	1.69 (0.57-5.01)	1.73 (0.56-5.30)	1.72 (0.54-5.46)
Two or three waves	103	8.0 (3.6-16.9)	2.13 (0.70-6.46)	2.28 (0.72-7.20)	1.84 (0.54-6.30)

† Calculated using imputed percentage estimates and total number of students in the analysis sample (N = 533 males, N = 623 females). ‡b Estimated marginal

(population-average) unadjusted prevalence rate. [§] Adjusted for SES (wave 1) and age (wave 1)) [¶] Adjusted for SES (wave 1), age (wave 1)), anxiety symptoms (waves 1-3), and depressive symptoms (waves 1-3).

Figure 1: Mean age (standard deviation) of participants at each wave of CATS (n = 623 females, n = 533 males)

	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7
Survey year	2012	2013	2014	2015	2016	2017	2018
Age (Female)	9.0 (0.4)	9.9 (0.4)	10.9 (0.4)	11.9 (0.4)	13.0 (0.4)	13.8 (0.4)	14.7 (0.4)
Age (Male)	9.0 (0.4)	10.0 (0.4)	10.9 (0.4)	11.9 (0.4)	13.0 (0.4)	13.8 (0.4)	14.8 (0.4)
Response rates[a]	1194 (96)	1156 (93)	1118 (90)	1067 (86)	993 (80)	997 (80)	899 (73)

[a] Number of participants with valid survey responses and percentage out of the total recruited cohort *N* = 1239