



# Isolation despite hyper-connectivity? The association between adolescents' mental health and online behaviours in a large study of school-aged students

Holly Bear<sup>1</sup> · Mina Fazel<sup>1</sup> · the OxWell Study Team<sup>1</sup> · Simona Skripkauskaitė<sup>1,2</sup>

Accepted: 26 February 2025 / Published online: 25 March 2025  
© The Author(s) 2025

## Abstract

Smartphone use has risen rapidly amongst adolescents over the last decade, as has the rates of common mental disorders. This has raised widespread concerns about direct links between adolescents' general screen time, social media use and their mental health. This study aimed to describe adolescents' online behaviours (e.g., time spent on social media) and how that relates to anxiety, depression, and loneliness. In a sample of 14,726 adolescents (aged 12–16 years) using data from the OxWell 2021 student survey, Structural Equation Modelling (SEM) path analysis was conducted, exploring co-occurring associations between self-reported anxiety and depression symptoms (RCADS-25), loneliness (UCLA-SF3), and various screentime related activities. Moderation analyses per gender, age, and self-harm history were also conducted. Greater social media use was related to higher exposure to self-harm content online, seeking help online, regretting posting content online, meeting online strangers, frequency of social media use before sleep, and lower exposure to school night screen rules. Furthermore, exposure to self-harm content, seeking help online, and posting content online that was later regretted, in turn, related to higher anxiety, depression, and loneliness scores. Weak direct links between time spent on social media and anxiety and depression symptoms and loneliness were further moderated by age and self-harm history, respectively. These results suggest that what adolescents do online, rather than how much time they spend on social media, relate to anxiety and depression symptoms and loneliness. Although this study cannot infer the cause or direction of the examined associations, it highlights the importance of better understanding the context and content of social media use.

**Keywords** Adolescents · Social media · Anxiety · Depression · Loneliness

## Background

Adolescents today are more digitally connected than ever, with recent reports indicating that 69% of 12- to 15-year-olds in the United Kingdom (UK) have a social media profile and smartphone ownership among this group is now almost ubiquitous (Ofcom, 2019; Taylor & Silver, 2019). On average, 13- to 18-year-olds use screens for about eight and a half hours per day (Rideout & Robb, 2022). This includes time spent on social media, browsing websites and watching

online videos. These usage patterns highlight the integral role of social media in adolescents' daily lives, profoundly transforming how they socialize and connect with peers and the broader world (Hamilton et al., 2022).

Simultaneously, rates of self-harm and common mental health disorders have risen among adolescents, particularly among females, leading to increased demand for mental health services (NHS Digital, 2023). The relationship between social media use and mental health is complex, with empirical research yielding mixed results that suggest both positive and negative implications for mental well-being (Marciano et al., 2022; Odgers & Jensen, 2020). This ambiguity leaves parents, educators, and mental health care providers uncertain about how best to support adolescents in their social media engagement. Given the significant implications of poor mental health during adolescence—impacting academic performance, future employment, and adult

---

✉ Holly Bear  
holly.bear@psych.ox.ac.uk

<sup>1</sup> Department of Psychiatry, University of Oxford, Oxford, UK

<sup>2</sup> Department of Experimental Psychology, University of Oxford, Oxford, UK

mental health—understanding the relationship between social media use and adolescent mental health is crucial.

Various contributing factors further complicate social media's impact on mental health, necessitating a nuanced understanding (Kelly et al., 2018; Odgers & Jensen, 2020; Sala et al., 2024; Siongers & Spruyt, 2024). Many studies report small or mixed effects between time spent on social media and adolescents' mental health. Evidence suggests that social media can provide perceived social support while exposing users to harmful content and cyberbullying (Cauberghe et al., 2021; Giumetti & Kowalski, 2022). Additionally, social media use has been linked to adverse health indicators such as sleep problems, lower self-esteem, poor body image, and social difficulties (Abi-Jaoude et al., 2020; Barry et al., 2017; Barthorpe et al., 2020). However, social media may also offer adaptive opportunities, including access to peer and professional support and a sense of connectedness, potentially safeguarding well-being (Beyens et al., 2020; Cauberghe et al., 2021; George, 2019).

Despite emerging evidence of bidirectional effects, limited research has focused on potential moderators and the interplay of specific online behaviours (Orben, 2020). The rapid evolution of media use and inconsistent empirical findings have led to the development of various theories regarding social media effects (Subrahmanyam & Michikyan, 2022). Early theories often proposed a unidirectional relationship, while more comprehensive frameworks, such as the transactional model, highlight the interactive effects of media use, individual characteristics, and contextual factors on outcomes (Valkenburg & Peter, 2013).

Notably, much-existing research emphasises screen time as a general measure of social media use, overlooking specific online behaviours (Moreno & Jolliff, 2022). Emerging evidence suggests that the nature of what adolescents post and view online—rather than mere time spent online—may more significantly correlate with risks for depression and self-harm, particularly among vulnerable populations (George, 2019). For instance, adolescents who already have a history of self-harm may be particularly susceptible to exposure to posts about self-harm or suicide, especially if those posts are seen as promoting those behaviours. Beyond the time spent on social media, factors including household rules around bedtime technology use (Fry, 2021), using social media before sleep (Nagata et al., 2020), (regretting posting content online (Dhir et al., 2016), meeting online strangers (Gamez-Guadix et al., 2016), exposure to self-harm content online (Kirtley et al., 2021), and seeking help online (Pretorius et al., 2019) have all been suggested as potential behaviours relevant to mental health outcomes. Yet, there has been limited research examining how and whether, at least, some of these factors act together (Hamilton & Lee, 2021; Kelly et al., 2018; van den Eijnden et al.,

2021). Investigating the interaction between these behaviours is essential because of their likely shared variance, which may inflate or hide observed effects when confounders are not accounted for (Kelly et al., 2018). Overall, the observed associations between social media use and mental health are contingent on analytic methods and several interacting moderating factors, such as gender, highlighting the many unanswered questions in this area.

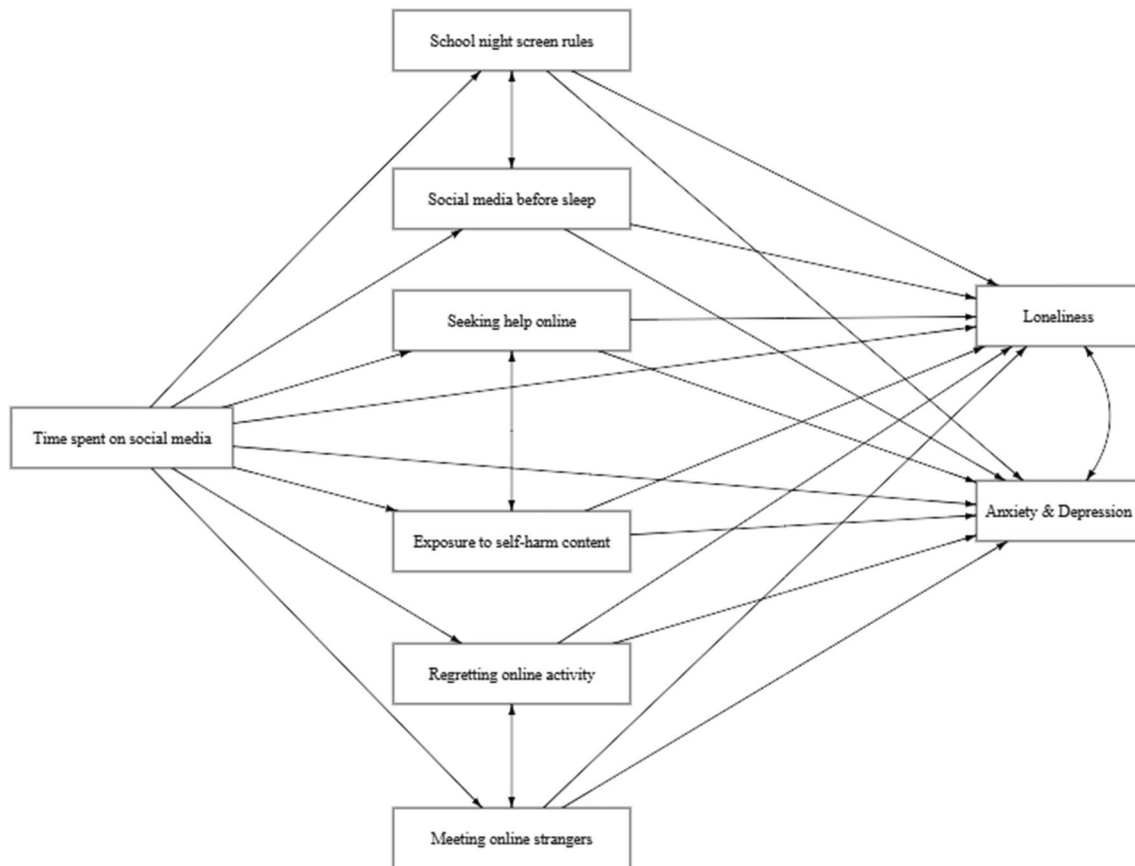
Given the growing public discourse surrounding the role of social media in adolescent mental health challenges, it is vital to address methodological limitations in existing research. This study aims to provide a more comprehensive examination of the nuanced relationships between specific online behaviours (such as exposure to self-harm content, frequency of use before sleep, and seeking online mental health support) and adolescent mental health outcomes (anxiety, depression, and loneliness) in a large-scale, representative sample of English adolescents. By exploring not just the quantity of social media use but also the quality and content of online interactions, this research offers a deeper understanding of how social media may contribute to mental health challenges among adolescents, addressing the gap in previous studies that have focused primarily on overall screen time.

## Research questions

1. What are adolescents' self-reported online behaviours? Including time spent on social media, frequency of using social media before sleep, school night screen rules, exposure to self-harm content online, meeting an older person alone who was first met online, posting content online that was later regretted, and accessing online mental health support.
2. Are there concurrent associations between online behaviours, anxiety and depression symptoms, and loneliness?
  - a. Do these associations differ between males and females/other/prefer not to say?
  - b. Do these associations differ between different school year groups?
  - c. Do these associations differ between those who report self-harm and those who do not?

## Hypotheses

Based on the previous literature, all hypothesised concurrent associations are visually represented in Fig. 1. Note that despite the apparent directionality of regression lines, due to limitations of cross-sectional data and in line with



**Fig. 1** Hypothesised model of associations between time spent on social media, online behaviours, loneliness, and anxiety and depression

transactional media effects theory, the hypothesised model does not propose or test the theoretical directionality of these effects. Instead, we hypothesised that not only time spent on social media but also specific online behaviours, such as frequency of social media use before sleep, exposure to self-harm content online, meeting an older person alone whom they first met online, and posting content online that was later regretted would be associated with higher anxiety, depression, and loneliness. We also included additional hypothesised relationships, such as the presence of school night screen rules, frequency of social media use before sleep, and accessing online mental health support with time spent on social media. We further expected that gender, school year group, and self-harm would moderate the relationship between online behaviours, anxiety and depression symptoms and loneliness. Yet, we had no prior hypotheses on which pathways would be affected. As the inclusion of specific online behaviours in the model could dilute the potential direct effect between time spent on social media and anxiety and depression symptoms and loneliness, we have also estimated their potential indirect associations via online behaviours as a secondary aim.

## Methods

### Study design

We conducted a secondary data analysis of the 2021 OxWell Student Survey. OxWell is a repeated, cross-sectional online survey that asks students (aged 9–18 years) in England over 200 questions on a range of life experiences, behaviours, and wellbeing and mental health measures (Mansfield et al., 2021). It has three age-appropriate versions (divided into English school years 5 to 7, 8 to 11, and 12 and 13). The data analysed here were collected from pupils in school years 8 to 11 in June and July 2021. Participation in the OxWell survey was voluntary, and participants received no monetary incentives. The analyses presented were pre-registered on the OSF in September 2022 (<https://doi.org/10.17605/OSF.IO/4ZMG2>).

### Ethical approval

The study was approved by the University of Oxford Research Ethics Committee (Ref: R62366).

**Table 1** Participants’ responses on the model variables for the total and moderation samples

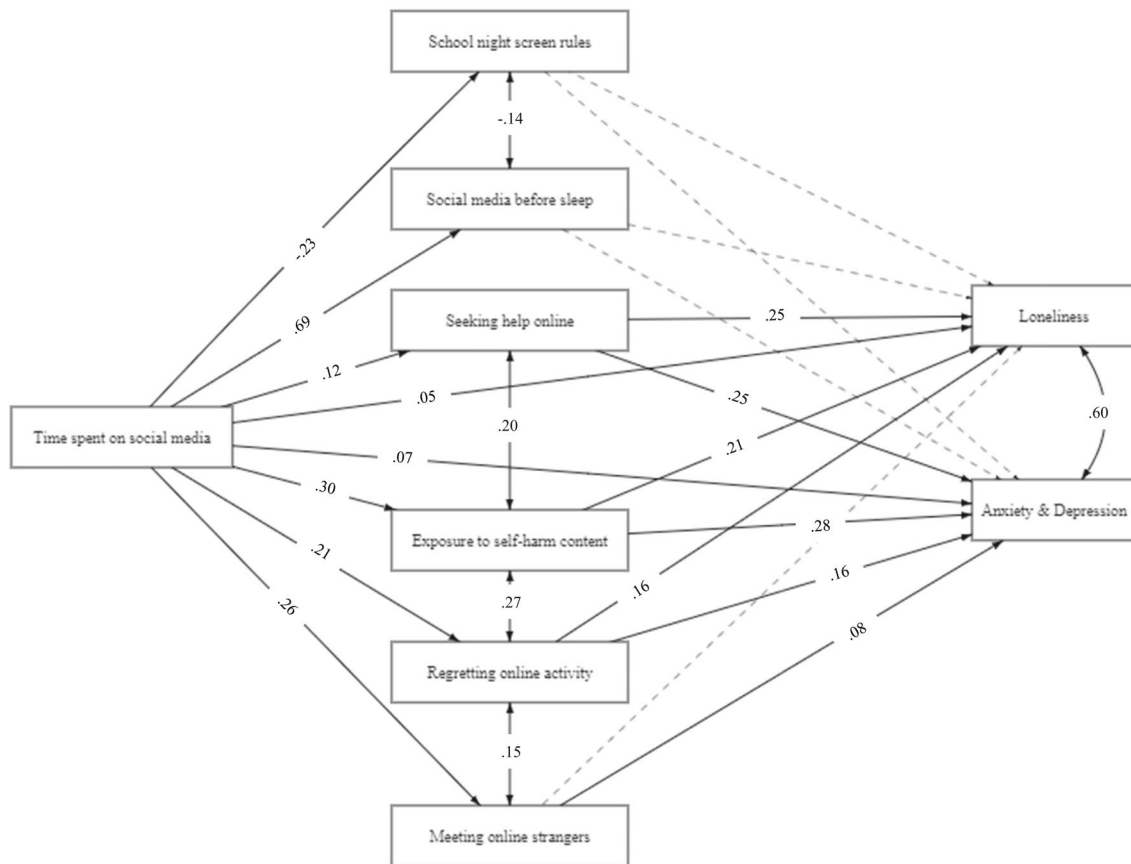
	Total	School Year		Gender		Self-harm	
	(n=14726)	Y8-9 (n=10485)	Y10-11 (n=4241)	Female/Other (n=8549)	Male (n=6177)	No (n=7351)	Yes (n=2001)
<b>Anxiety &amp; Depression</b>							
M (SD)	53.90 (17.10)	53.00 (16.70)	56.30 (17.70) ***	57.90 (17.20)	48.20 (15.20) ***	47.20 (13.00)	71.00 (16.10) ***
Missing	744 (5.1%)	486 (4.6%)	258 (6.1%)	349 (4.1%)	395 (6.4%)	78 (1.1%)	17 (0.8%)
<b>Loneliness</b>							
M (SD)	5.19 (1.85)	5.13 (1.84)	5.32 (1.87) ***	5.60 (1.85)	4.59 (1.67) ***	4.57 (1.59)	6.75 (1.69) ***
Missing	1042 (7.1%)	666 (6.4%)	376 (8.9%)	487 (5.7%)	555 (9.0%)	97 (1.3%)	35 (1.7%)
<b>Time spent on social media</b>							
M (SD)	2.65 (1.34)	2.63 (1.35)	2.71 (1.30) *	2.89 (1.25)	2.28 (1.38) ***	2.45 (1.36)	3.09 (1.18) ***
Missing	3190 (21.7%)	2053 (19.6%)	1137 (26.8%)	1583 (18.5%)	1607 (26.0%)	183 (2.5%)	48 (2.4%)
<b>School night screen rules</b>							
No	7618 (51.7%)	5073 (48.4%)	2545 (60.0%) ***	4612 (53.9%)	3006 (48.7%) ***	3732 (50.8%)	1105 (55.2%) ***
Yes	6263 (42.5%)	4777 (45.6%)	1486 (35.0%)	3489 (40.8%)	2774 (44.9%)	3264 (44.4%)	783 (39.1%)
Missing	845 (5.7%)	635 (6.1%)	210 (5.0%)	448 (5.2%)	397 (6.4%)	355 (4.8%)	113 (5.6%)
<b>Frequency of social media use before sleep</b>							
M (SD)	3.10 (1.32)	3.04 (1.35)	3.23 (1.23) ***	3.23 (1.22)	2.91 (1.42) ***	2.95 (1.38)	3.38 (1.12) ***
Missing	326 (2.2%)	227 (2.2%)	99 (2.3%)	169 (2.0%)	157 (2.5%)	153 (2.1%)	32 (1.6%)
<b>Meeting online strangers</b>							
Have not	11,743 (79.7%)	8571 (81.7%)	3172 (74.8%) **	7056 (82.5%)	4687 (75.9%)	7227 (98.3%)	1931 (96.5%) ***
Have	105 (0.7%)	60 (0.6%)	45 (1.1%)	53 (0.6%)	52 (0.8%)	42 (0.6%)	37 (1.8%)
Missing	2878 (19.5%)	1854 (17.7%)	1024 (24.1%)	1440 (16.8%)	1438 (23.3%)	82 (1.1%)	33 (1.6%)
<b>Regretting posting content online</b>							
M (SD)	0.34 (0.67)	0.32 (0.65)	0.38 (0.71) ***	0.37 (0.70)	0.30 (0.62) ***	0.23 (0.54)	0.67 (0.89) ***
Missing	4220 (28.7%)	2862 (27.3%)	1358 (32.0%)	2341 (27.4%)	1879 (30.4%)	670 (9.1%)	298 (14.9%)
<b>Exposure to self-harm content online</b>							
M (SD)	1.13 (1.10)	1.08 (1.09)	1.27 (1.13) ***	1.29 (1.12)	0.89 (1.03) ***	0.87 (0.98)	1.81 (1.17) ***
Missing	3906 (26.5%)	2578 (24.6%)	1328 (31.3%)	2110 (24.7%)	1796 (29.1%)	213 (2.9%)	75 (3.7%)
<b>Seeking help online</b>							
No	14,382 (97.7%)	10,250 (97.8%)	4132 (97.4%)	8265 (96.7%)	6117 (99.0%) ***	7260 (98.8%)	1847 (92.3%) ***
Yes	344 (2.3%)	235 (2.2%)	109 (2.6%)	284 (3.3%)	60 (1.0%)	91 (1.2%)	154 (7.7%)

Continuous data comparisons were carried out using the Welch Two Sample t-test. Categorical data comparisons were conducted using Pearson’s Chi-squared test with Yates’ continuity correction. Bonferroni multiple comparison correction across all tests. \**p*<.05. \*\**p*<.01. \*\*\**p*<.001

**Table 2** Spearman correlation matrix for model variables in the full sample

	1	2	3	4	5	6	7	8
1. Anxiety & Depression	-							
2. Loneliness	0.70***	-						
3. Time spent on social media	0.26***	0.18***	-					
4. School night screen rules	-0.06***	-0.04***	-0.16***	-				
5. Frequency of social media use before sleep	0.18***	0.12***	0.62***	-0.22***	-			
6. Meeting online strangers	0.04**	0.02	0.05***	-0.03	0.04**	-		
7. Regretting posting content online	0.27***	0.24***	0.18***	-0.06***	0.19***	0.07***	-	
8. Exposure to self-harm content online	0.42***	0.33***	0.27***	-0.10***	0.22***	0.05***	0.31***	-
9. Seeking help online	0.14***	0.12***	0.04**	0.01	0.02	<0.01	0.09***	0.10***

Bonferroni multiple comparison correction across all tests. \**p*<.05. \*\**p*<.01. \*\*\**p*<.001



**Fig. 2** Structural equation model depicting standardised coefficients ( $\beta$ ) in path analysis of time spent on social media and online behaviours with anxiety, depression, and loneliness. Note: Black lines represent

sent significant associations ( $p < .05$ ), and dashed lines represent non-significant associations ( $p > .05$ )

## Participants

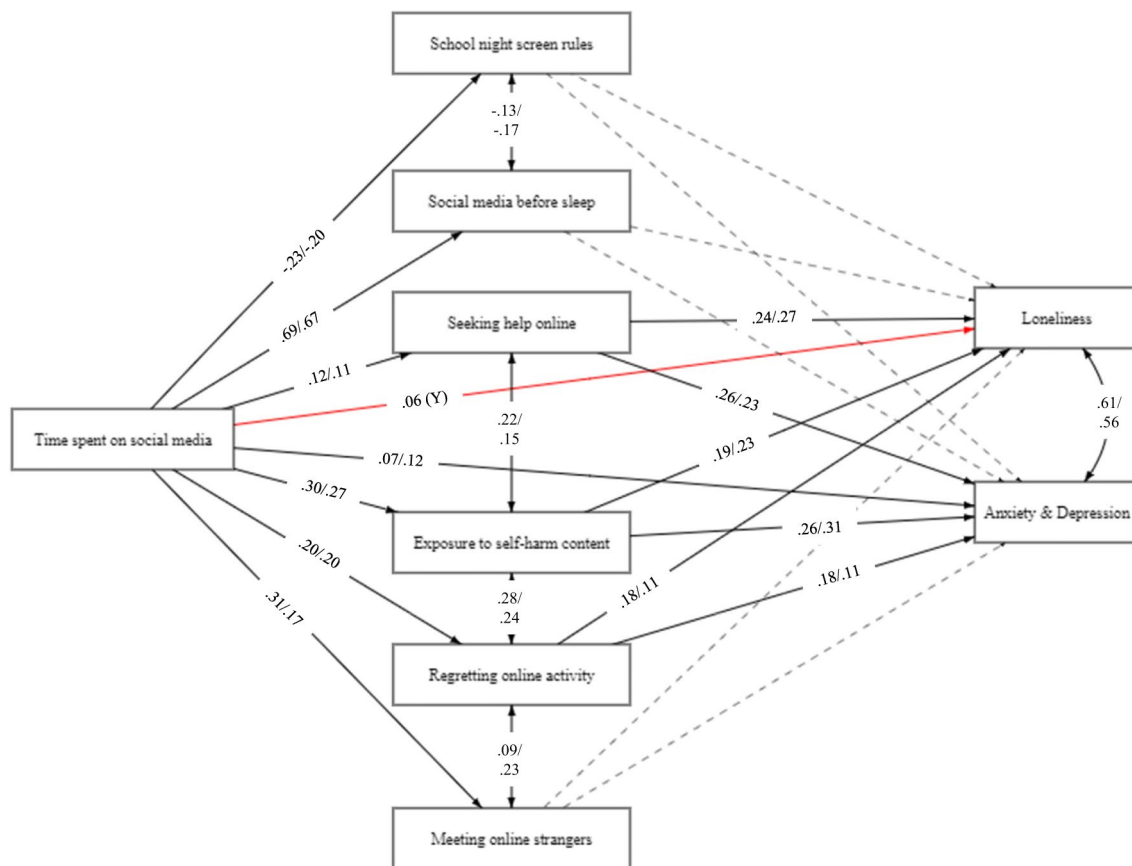
In total, 33,453 students accessed the OxWell survey in 2021. Of this group, 3,240 were removed due to spending less than 10 min on the survey as questions of interest could not be reasonably reached in that time, and 15,409 were removed due to falling outside the school year range of interest (Year groups 8–11). This age range corresponds to the typical secondary school years, covering early and mid-adolescence, a period marked by rapid development in emotional, social, and cognitive domains. This resulted in a sample of 14,804 eligible participants based on pre-defined inclusion criteria (<https://osf.io/4zmg2>). Only participants with data on at least two of the variables in the model were included in the main sample. Thus, 78 were excluded because of missing data, resulting in a final sample of 14,726 (Table S1 in Supplementary Materials 1).

## Measures

The model variables included the number of hours spent on social media per day (0, 1, 2, 3, and 4 or more hours); house

rules about turning off or putting away computers, phones, or other electronics on school nights (Yes/No); frequency of using social media in the hour before intending to go to sleep (never, rarely, sometimes, often, and daily); meeting someone older/an adult in the real world while alone after getting to know them first online (Yes/No); posting or doing anything on the internet that was later regretted (Yes/No); frequency of exposure to self-harm content online (never, once or twice, a few times, weekly, and daily); seeking support for a mental health problem from a website or online forum (Yes/No). The measures included as variables in the current study and their associated coding are presented in Table S2 in Supplementary Materials 2.

**Anxiety and depression** Anxiety and depression symptoms were measured using the Revised Children's Anxiety and Depression Scale (RCADS-25); (Ebesutani et al., 2012). The RCADS is a 25-item self-report questionnaire for children and adolescents aged 8 to 18 that measures broad anxiety symptoms through 15 items and depression symptoms through 10 items. Respondents are asked to indicate how often each item applies to them according to a 4-point Likert



**Fig. 3** Structural equation model depicting standardised coefficients ( $\beta$ ) in path analysis of time spent on social media and online behaviours with anxiety, depression, and loneliness as a function of age. Note. Black lines represent significant associations ( $p < .05$ ), dashed

lines represent non-significant associations ( $p > .05$ ), and red lines represent associations that were only significant in one of the groups. Y=significant in the younger age group (Y8-9) only/O=significant in the older age group (Y10-11) only

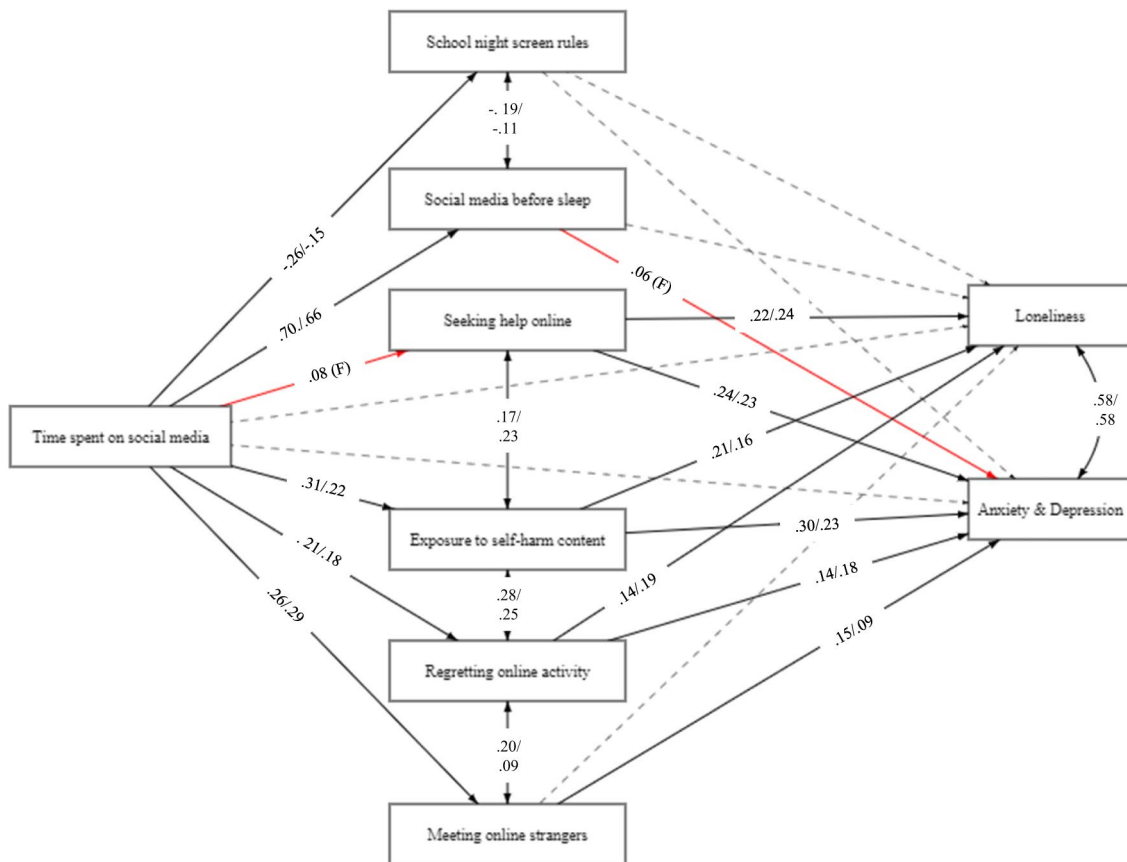
scale ranging from 0 (“never”) to 3 (“always”). The item scores are summed to yield an Anxiety Total score (0 to 45) and a Depression Total score (0 to 30). Higher total scores indicate a more severe level of anxiety or depression. These scores can be subsequently transformed into normative T-scores and used to determine clinical relevance. T-scores below 65 fall within the normative range, whilst those of 70 or higher indicate a score above the clinical threshold (Chorpita et al., 2005). The RCADS-25 is a widely used measure for assessing symptoms of anxiety and depression in adolescents, demonstrating strong internal consistency (Cronbach’s alpha > 0.90) and convergent validity with other established instruments (Chorpita et al., 2005).

**Loneliness** Adolescents also self-report on a short three-item version of the UCLA Loneliness scale (UCLA-SF3; Russell, 1996). This scale comprises three questions that measure three dimensions of loneliness: relational connectedness, social connectedness, and self-perceived isolation. The scale uses three response categories: Hardly ever (1) / Some of the time (2) / Often (3). The scores are then

summed and can range from 3 to 9, with higher scores indicating higher loneliness. The items included in the scale are: (1) “How often do you feel that you have no one to talk to (in person/online/phone)?” (2) “How often do you feel left out?” (3) “How often do you feel alone?” UCLA-SF3 is a reliable tool for measuring loneliness in adolescents, with high internal consistency (Cronbach’s alpha > 0.80) and established construct validity across different populations (Hughes et al., 2004).

**Moderator variables** The moderator variables included gender (male, female/other/prefer not to answer)<sup>1</sup>, year group (years 8–9 and years 10–11), and self-reported self-harm. Participants were asked, ‘Have you ever deliberately self-harmed (for example, by taking an overdose or deliberately injuring yourself in some other way)?’. They were given response categories: ‘Yes’, ‘No’, ‘Prefer not to say’

<sup>1</sup> To avoid excluding young people with non-binary and non-conforming gender identities from our analyses, we combined those who identified as female with those who answered ‘other/prefer not say’ into one group.



**Fig. 4** Structural equation model depicting standardised coefficients ( $\beta$ ) in path analysis of time spent on social media and online behaviours with anxiety, depression, and loneliness as a function of gender. Note. Black lines represent significant associations ( $p < .05$ ), dashed

lines represent non-significant associations ( $p > .05$ ), and red lines in moderation models represent associations that were only significant in one of the groups. F=significant in Female/Other gender group only

and ‘Not sure what this means’. Only those who responded ‘Yes’ or ‘No’ to the self-harm question were included in the self-harm moderation analysis (Supplementary Materials 3 Table S3).

## Statistical analyses

The data was processed, explored, and described using R to answer the first research question. Descriptive information was further compared between gender, age, and self-harm groups, respectively. Continuous data comparisons were carried out using the Welch Two Sample t-test, and categorical data comparisons were conducted using Pearson’s Chi-squared test with Yates’ continuity correction. Spearman correlations were also estimated for all, later modelled, variables. Bonferroni multiple comparison corrections were applied separately for group comparisons and correlation analyses.

Structural Equation Modelling (SEM) in Mplus Version 8.7 was used to answer the second research question. Specifically, the path analysis with Weighted Least Square

Mean and Variance Adjusted Estimator (WLSMV) was used to test the proposed model (Fig. 1). To achieve acceptable model fit, further model adjustments were made based on consideration of the model’s theoretical underpinnings and model improvement as indicated by the chi-square difference test ( $\Delta\chi^2$ ). We used several indices, including the comparative fit index ( $CFI \geq 0.90$ ), root mean square error of approximation ( $RMSEA \leq 0.05$ ), and standardised root mean square residual ( $SRMR \leq 0.05$ ) to determine model fit (Kline, 2023). After establishing the direct paths in the model, the indirect effects of social media on adolescent anxiety and depression symptoms and loneliness via online behaviours were also assessed. All the indirect paths were estimated simultaneously. To avoid model identification at local maxima, each model used a set of 200 random starting values and 1000 iterations.

Multi-group analysis was then conducted to assess whether the relationship between social media, online behaviours, and adolescents’ anxiety and depression symptoms was moderated by their gender, age, and self-harm experiences, respectively. In contrast to simple moderation

analysis, multi-group analysis allows the assessment of moderator effects on all the structural paths of the model rather than a specific hypothesised path. We checked for group differences in associations by comparing a model, where the parameters were allowed to vary between the respective groups (male and female/other/prefer not to say, year 8–9 and year 10–11, adolescents who do and do not self-harm) to a model, where the relevant parameters were constrained to be equal across the groups. The chi-square difference test ( $\Delta\chi^2$ ) was used to compare model fit between nested models. Finally, sensitivity analysis using multiple imputation (MI) to account for the missing data was conducted and presented in Supplementary Materials 4 (Tables S4–5, Figure S1).

## Results

### Sample characteristics and adolescents' online behaviours

Participants' characteristics for the total sample and for each moderator group are presented in Table 1 and Supplementary Materials 5 (Tables S6–7). In total, 58.1% ( $n=8,549$ ) of participants identified as female or other/prefer not to answer and 41.9% identified as male ( $n=6,177$ ). For the total sample, adolescents spent an average of at least 2.70 h on social media daily. Females spent an average of at least 2.89 h on social media per day compared to at least 2.28 h for males. Of the total sample, 42.5% ( $n=6,263$ ) reported that, on school nights, they had rules or set times in their house about when they were supposed to turn off or put away computers, phones, or other electronics. Most adolescents (73.0%,  $n=10,752$ ) reported using social media the hour before they intended to sleep either daily or 3–4 times per week. In total, 15.2% ( $n=2,237$ ) of adolescents reported that they had met a person in the real world that they had got to know first online, but only 0.7% of the sample ( $n=105$ ) reported that this person was older or an adult and that they have met them alone. In total, 19.5% ( $n=2,867$ ) of the sample had posted or done anything on the internet that they later regretted. Of those, 63.6% (1,822) reported that this was a photo/video of themselves, and 32.3% ( $n=925$ ) regretted posting a public comment. Only 2.3% ( $n=344$ ) of adolescents had ever tried to ask for support for a mental health problem from a website or online forum. Nearly half (45.5%,  $n=4,770$ ) of adolescents reported that they had seen self-harm content online.

Across the total sample ( $n=14,726$ ), the mean anxiety and depression score was as expected for a community sample (Chorpita et al., 2005) at 53.90 ( $SD=17.10$ ), with females ( $M=57.90$ ,  $SD=17.20$ ) and those in years 10 and

11 ( $M=56.30$ ,  $SD=17.70$ ) scoring significantly higher than males ( $M=48.20$ ,  $SD=15.20$ ) and those in years 8 and 9 ( $M=53.00$ ,  $SD=16.70$ ), respectively. The mean loneliness score was 5.19 ( $SD=1.85$ ), with females ( $M=5.60$ ,  $SD=1.85$ ) and those in years 10 and 11 ( $M=5.32$ ,  $SD=1.87$ ) again scoring significantly higher than males ( $M=4.59$ ,  $SD=1.67$ ) and those in years 8 and 9 ( $M=5.13$ ,  $SD=1.84$ ), respectively. Only 63.5% ( $n=9,352$ ) of the full sample provided information on whether they had or had not deliberately self-harmed, with 21.4% ( $n=2,001$ ) of those reporting self-harm experience. Of those who reported deliberately self-harming, 79.2% ( $n=1,584$ ) were female and 20.8% ( $n=417$ ) were male. Those who reported having deliberately self-harmed spent more time on social media per day (on average, at least 3.09 h) compared to those who reported that they did not deliberately self-harm (on average, at least 2.45 h).

The Spearman correlations between online behaviours, anxiety and depression symptoms, and loneliness are presented in Table 2. Anxiety and depression scores had a small to moderate positive correlation with all online behaviours, except school night screen rules, which had a small, negative relationship. Loneliness had a small to moderate positive correlation with all measured online behaviours, except school night screen rules, which had a small, negative relationship, and meeting an older adult online, which was not significantly correlated. The Spearman correlation matrix for model variables in the self-harm moderation sample yielded similar associations and is presented in Supplementary Materials 6, Table S8

### Relationship between online behaviours and anxiety and depression symptoms and loneliness

A structural equation model was used to examine associations between time spent on social media and various online behaviours with anxiety, depression, and loneliness. The proposed model (Fig. 1) did not satisfy predefined model fit criteria (Supplementary Materials 7, Table S9). The model, thus, was adjusted to include a covariance between exposure to self-harm content online and regretting posting content online as these behaviours may overlap (e.g., regretting sharing self-harm images), which has resulted in a good model fit ( $RMSEA=0.033$ ,  $CFI=0.984$ ,  $SRMR=0.037$ ). Figure 2 and Table S10 represent the standardised and unstandardised regression coefficients for the direct effects of the final model on the total sample, respectively. Time spent on social media had small to medium significant associations with school night screen rules, seeking help online, regretting posting content online, meeting online strangers, and exposure to self-harm content online, and a large significant association with frequency of social media use before

sleep. Time spent on social media had a very small direct association with loneliness, anxiety, and depression. In addition, seeking help online, exposure to self-harm content online, and regretting posting content online had very small to medium but significant direct associations with loneliness, anxiety and depression. The direct effects between the frequency of social media use before sleep or school night screen rules and loneliness or anxiety and depression predicted by the hypothesised model were not significant, as shown in Fig. 2. The path from meeting online strangers to loneliness was also not significant.

We also investigated whether there were any indirect associations between time spent on social media and loneliness or anxiety and depression via online behaviours. The total indirect effects between time spent on social media and loneliness ( $\beta=0.13$ ,  $B=0.18$ ,  $p<.001$ ) or anxiety and depression ( $\beta=0.18$ ,  $B=2.28$ ,  $p<.001$ ) were significant but also only small (see Table S11 for a complete list of indirect effects).

### Moderation analyses

Full model selection and fit statistics for all moderation analyses are presented in Table S9.

**Moderation by age** Constraining the model to be equal for younger (year 8–9) and older (year 9–10) adolescents significantly worsened model fit ( $\Delta\chi^2(26)=47.06$ ,  $p=.007$ ) compared to the unconstrained model, suggesting that the model differed significantly as a function of age (see Fig. 3 and Table S10 for the standardised and unstandardised coefficients, respectively). Of note, age fully moderated the direct association between time spent on social media and loneliness resulting in a small effect in younger adolescents only. It also moderated the strength of association between time spent on social media and meeting online strangers with a small effect in older adolescents but a moderate association for younger adolescents. Similarly to the main model, the total indirect effects between time spent on social media and loneliness (Y8-9:  $\beta=0.13$ ,  $B=0.18$ ,  $p<.001$ ; Y10-11:  $\beta=0.10$ ,  $B=0.14$ ,  $p<.001$ ) and anxiety and depression (Y8-9:  $\beta=0.18$ ,  $B=2.25$ ,  $p<.001$ ; Y10-11:  $\beta=0.13$ ,  $B=1.85$ ,  $p<.001$ ) were significant but also only small in both age groups (Table S12).

**Moderation by gender** The model also differed significantly as a function of gender,  $\Delta\chi^2(26)=226.71$ ,  $p<.001$  (see Fig. 4 and Table S10 for the standardised and unstandardised coefficients, respectively). Of note, gender fully moderated the association between frequency of social media use before sleep and anxiety and depression, resulting in a small effect in females only. Time spent on social media had a larger

direct association with exposure to self-harm content online for females than for males. The total indirect effects between time spent on social media and loneliness (females:  $\beta=0.15$ ,  $B=0.23$ ,  $p<.001$ ; males:  $\beta=0.09$ ,  $B=0.11$ ,  $p<.001$ ) and anxiety and depression (females:  $\beta=0.22$ ,  $B=3.11$ ,  $p<.001$ ; males:  $\beta=0.11$ ,  $B=1.27$ ,  $p<.001$ ) were significant but only small in both groups (Table S13).

**Moderation by self-harm** The model differed significantly as a function of self-harm experience,  $\Delta\chi^2(26)=143.43$ ,  $p<.001$  (see Figure S2 and Table S10 for the standardised and unstandardised coefficients, respectively). Self-harm fully moderated the direct association between time spent on social media and anxiety and depression, resulting in a small effect in only adolescents who did not report self-harm. The time spent on social media also had a small direct association with meeting online strangers only for those who did not report self-harming but not for those who did self-harm. Notably, neither the direct relationship between time spent on social media and exposure to self-harm content online nor between exposure to self-harm content online and anxiety and depression differed between those who reported self-harming and those who did not. As in previous models, the total indirect effects between time spent on social media and loneliness (self-harm:  $\beta=0.08$ ,  $B=0.09$ ,  $p<.001$ ; no self-harm:  $\beta=0.03$ ,  $B=0.04$ ,  $p<.001$ ) or anxiety and depression (self-harm:  $\beta=0.11$ ,  $B=1.05$ ,  $p<.001$ ; no self-harm:  $\beta=0.1$ ,  $B=1.34$ ,  $p<.001$ ) were significant but also only small in both groups (Table S14).

## Discussion

Our findings suggest that what adolescents do online, rather than when or how much time they spend on social media, relates to anxiety and depression symptoms and loneliness. We simultaneously examined several potential intervening pathways relating adolescents' anxiety, depression, and loneliness to the amount of time they spend on social networking sites and how they engage and interact online. We found support for hypothesised co-occurring mechanisms whereby greater social media use was related to higher exposure to self-harm content online, seeking help online, regretting posting content online, meeting online strangers, frequency of social media use before sleep, and lower presence of school night screen rules. However, only exposure to self-harm content, seeking help online and posting content online that was later regretted related to higher anxiety, depression, and loneliness scores. It should be noted that the direction of these associations is not clear. It is possible that exposure to self-harm content online, engagement in support-seeking forums, and posting regrettable content online

could all lead to higher depression and anxiety or loneliness. Yet, it is just as possible that poorer mental health might lead young people to seek out these online activities in search of support and like-minded individuals or that this relationship is reciprocal and (Valkenburg, 2022; Valkenburg et al., 2006). The weak direct links between time spent on social media and anxiety, depression symptoms, and loneliness were further moderated by age and self-harm history, respectively. For example, the relationship between time spent on social media and loneliness was significant for younger adolescents only. For the total sample, our findings are in line with previous research as we found only weak direct and indirect effects of time spent on social media with anxiety and depression symptoms and loneliness. This finding has been replicated using several cross-sectional and longitudinal data sources. (Kelly et al., 2018).

We also extended previously limited research examining several different online behaviours together in one analytic model (Hamilton & Lee, 2021; Kelly et al., 2018; van den Eijnden et al., 2021). We found that the relationships between time spent on social media and anxiety, depression symptoms, and loneliness were very small and inconsistent when examined together with specific online activities. Instead, exposure to self-harm content, seeking help online, and posting content online that was later regretted related to higher anxiety, depression, and loneliness scores stronger than the time spent on social networking sites in itself. Our findings also indicate that school night screen rules may reduce time spent on social media use and using social media in the hour before sleep. However, when time spent on social media was controlled for, school night screen rules were not associated with lower anxiety, depression, and loneliness, and their correlations were very small when examined individually. Thus, our findings support previous literature showing that household screen and social media rules may be essential in reducing adolescent screen use (Hamilton & Lee, 2021; Pedersen et al., 2022). However, the extent to which this may, in turn, relate to important mental health outcomes remains unclear.

We hypothesised that certain groups of adolescents might be particularly at risk for increased anxiety, depression, symptoms, and loneliness due to their online activity. We found a weak association between time spent on social media and loneliness for younger adolescents only, partially in line with previously identified developmental windows of sensitivity to social media (Orben et al., 2022). We did not find evidence of differences between females and males in hypothesised direct pathways between time spent on social media, anxiety, depressive symptoms, and loneliness. When split by gender, the previously weak association between social media and anxiety, depression symptoms, and loneliness became insignificant. On average, in line with previous

literature, females reported higher anxiety, depression, loneliness, and social media use than males, suggesting group differences in mean level scores rather than associations (Hartas, 2021). However, females who more frequently used social media before sleep and who were exposed to self-harm content online were more susceptible to higher levels of anxiety, depression, and loneliness than males. Surprisingly, our findings on self-harm indicated that there was a weak direct link between time spent on social media and anxiety and depression symptoms only for adolescents who did not report self-harm. This might be explained by a potential ceiling effect, in that adolescents who self-harm report both more time spent on social media and higher anxiety and depression symptoms than those who do not. Overall, the results of this study confirm that the magnitude of the effect between social media use and mental health is contingent on analytic methods and several interacting moderating factors, such as gender and age.

## Limitations

This study's notable strengths are examining online activity using a large-scale sample of UK adolescents and applying analytic methods to discuss moderation and indirect effects. However, results should be interpreted in light of several limitations and considerations. First, the cross-sectional design did not allow for the assessment of temporal associations between variables. This limits the ability to draw inferences about the directionality of observed effects. Mental health outcomes may be associated with online behaviours in a bidirectional manner. Furthermore, in contrast to between-person differences in social media use observed in the current study, within-person variations may be more likely to increase depression and anxiety or decrease life satisfaction (Coyne et al., 2020; Orben et al., 2019; Steinsbekk et al., 2023). Thus, longitudinal research must be prioritised to examine these pathways over time.

Second, it was not possible to include a separate non-binary category of gender in our analyses because the RACDS-25 does not provide a gender-diverse scoring option. To avoid excluding young people with non-binary and non-conforming gender identities from our analyses, we combined those who identified as female with those who answered 'other/prefer not say' into one group. Previous research has identified that, compared to males, females, and other/non-binary youth experience significantly higher anxiety and depression symptoms as measured by the RCADS. (Polo et al., 2023; Sonesson et al., 2024), however, this may have enhanced or reduced potential gender differences in estimated pathways.

Third, whilst the overall sample size was large, some categorical variables only included small numbers of

participants, which may have resulted in inconsistent pathways in moderation analyses. For instance, only a small proportion (0.7%) of participants reported meeting an adult or older person whom they first met online while alone, which likely affected our ability to estimate how that relates to anxiety and depression symptoms or loneliness. Similarly, only a small proportion (1.1%) of those who did not self-harm reported seeking help online, which may explain the lack of a relationship between time spent on social media and seeking help online in the self-harm moderation model. However, adolescents who had self-harmed reported not only seeking help online but also spending more time on social media. Thus, it is also possible that the association between time spent on social media and seeking help online in the main model reflected mean-level group differences between those with and without a history of self-harm that was accounted for in the moderation analysis. It should be noted that, relative to other forms of more formal support, research suggests that adolescents tend not to turn to online resources at times of acute distress. (Geulayov et al., 2022). It is unclear whether this reflects a lack of awareness of these resources or that existing online resources are what young people want at times of distress.

Finally, although this study investigated a broad range of online behaviours, it was not an exhaustive assessment of all forms of online activity or exposures, including cyberbullying and the public or private nature of personal social media profiles. This study did not explore the role of additional protective factors, such as other forms of parental rules regarding the internet (e.g., monitoring internet use, explaining why some websites are inappropriate), self-worth, interpersonal relationships, and belonging, or the potential adaptive effects of social media, such as creating a sense of community, which may buffer the impact of the risk factors observed in this study.

While the limitations discussed, including the cross-sectional design and small subgroups for certain variables, provide important context, they may also influence the strength and generalizability of the observed associations, highlighting the need for cautious interpretation and suggesting avenues for future longitudinal research to confirm and expand upon these findings.

### Recommendations for research and practice

For the field to move forward, research must move away from reductionist approaches that see social media as merely helpful or harmful and instead consider the nuances of for whom, in what ways, and when social media use affects mental health outcomes. Our collective understanding of the risks and benefits of social media use during the critical period of adolescent development would benefit from

further inquiry. In terms of future research, several areas need further elucidation, including examination of a broader range of moderation and indirect effects on expanded risk and protective factors. These may include the various forms of parental involvement (e.g., parental encouragement to explore and learn things on the internet, better parental understanding of the types of social media platforms, websites, and applications (apps) are being accessed to inform discussions with their children, open communication about internet use and experiences of explicit content) and the role of adaptive online interpersonal relationships and a positive school environment. Moving forward, it is also essential to include relevant social media questions in adolescent research, especially longitudinal studies, to examine the impact of various forms of online activity on mental health and wellbeing, e.g., assessment of individual adolescents' social media use and interpersonal relationships.

Our findings are highly relevant to current policy development on guidelines for the safe use of social media and call on the industry to regulate the content adolescents are exposed to online. Given the complexity and nuance of the role of social media and online activity, parents, educators, and mental health care providers might benefit from further guidance on understanding and approaching adolescents' current social media use. Explicit and potentially traumatic content continues to be quickly and widely accessible by adolescents. Technology companies could be at the forefront of providing such protections by, for example, designing safe online environments, prioritising user safety, and minimising the risks associated with exposure to certain social media content due to algorithm-derived content. Rather than imposing general restrictions on social media use, it may be that psychoeducation in homes and schools regarding some of the potential negative impacts of certain online behaviours is needed. Whilst parental involvement in online activities may not be directly associated with adolescent anxiety and depression or loneliness, it still may be an important protective factor in reducing the negative impact of specific online activities on mental health outcomes (Hamilton & Lee, 2021; Kelly et al., 2018; van den Eijnden et al., 2021). Although the onus of mitigating the potential harms of social media cannot sit solely with parents/carers, they can play a key role in reducing some of the negative impacts of different types of online behaviours by encouraging adolescents to limit the content they share on social media, monitor their interactions with strangers online and encouraging open and honest conversations about the risks of certain websites or content that is inappropriate. Clinical, educational, and family settings are all potential points of contact whereby young people could be encouraged to reflect not only on their social media use but also on the impact of online friendships on other aspects of their lives,

including their relationships with peers and online safety. This may involve clinicians asking adolescents routinely ask about online activity as part of medical interviews, including the type of content are they accessing and if they have been traumatised by anything they have seen (Fazel, 2024).

## Conclusion

The influence of social media on adolescent mental health is shaped by complex, interacting factors, including the type of content adolescents consume, the activities they engage in online, the content they post, and parental involvement in their online activities. To better safeguard adolescents' mental health and well-being, a proactive and collaborative approach is needed from policymakers, technology companies, educators, researchers, families, and young people themselves. We recommend that parents engage in open conversations about online experiences, set clear boundaries around screen time, and foster critical thinking about the content their children encounter. Educators can support adolescents by incorporating discussions about safe online behaviours and mental health in the classroom, helping students understand and navigate digital spaces responsibly. Policymakers and technology companies should prioritise the development of guidelines and technologies that enhance user safety, minimise harmful content exposure, and promote responsible online environments. Psychoeducation in homes and schools can empower both adolescents and adults to recognise the risks associated with certain online behaviours and encourage healthier online habits. By adopting these approaches, we can create a safer, more supportive online environment for adolescents and mitigate the potential risks to their mental health.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s12144-025-07643-z>.

**Acknowledgements** We are grateful to the students who took the time to participate in the OxWell student survey as well as the school staff members for the considerable time and effort they put into facilitating the survey. We would like to thank colleagues in local authorities and CCGs, including Chris Price, Jonathan Jones, Donna Husband, Lajla Johansson, Giovanni Ferri, and Janette Fulwood, for their time and support in promoting the survey. We would also like to thank Foster and Brown Research Limited, which provided the infrastructure for OxWell.

**Author contributions** Dr Rohan Borschmann, The University of Melbourne; Dr Blossom Fernandes, London School of Hygiene and Tropical Medicine; Dr Galit Geulayov, University of Oxford; Dr Gaby Illingworth, University of Oxford; Tanya Manchanda, University of Oxford; Dr Karen L Mansfield, University of Oxford; Rasanat Fatima Nawaz, University of Cambridge; Dr Danielle Newby, University of Oxford; Dr Stephen Puntis, University of Oxford; Dr Emma Sonesson,

University of Oxford; and Dr Simon R White, University of Cambridge.

**Funding** This research was funded by the National Institute for Health and Care Research Applied Research Collaboration Oxford and Thames Valley at Oxford Health NHS Foundation Trust and the Westminster Foundation, with support from Liverpool City Council, Frimley Clinical Commissioning Group (CCG), Berkshire West CCG, Buckinghamshire County Council, Oxfordshire County Council and Milton Keynes City Council. We would like to acknowledge the philanthropic support of the donors to the University of Oxford's COVID-19 Research Response Fund. The funders played no role in the writing of the manuscript or the decision to submit for publication. The views expressed in this publication are those of the authors and not necessarily those of the National Institute for Health and Care Research or the Department of Health and Social Care.

**Data availability** Fully deidentified extracts of the data can be provided to academic research collaborators upon reasonable request, following a careful review process by the research team. The study description and materials are available on the Open Science Framework (<https://osf.io/sekhr/>) along with the study protocol (Mansfield et al., 2021). Full data dictionaries can be made available upon approval for access to data extracts.

**Code availability** The code for all analysis and data cleaning are available on request from [oxwell@psych.ox.ac.uk](mailto:oxwell@psych.ox.ac.uk).

## Declarations

**Conflict of interest** None declared.

**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

## References

- Abi-Jaoude, E., Naylor, K. T., & Pignatiello, A. (2020). Smartphones, social media use and youth mental health. *Cmaj*, *192*(6), E136–E141. <https://doi.org/10.1503/cmaj.190434>
- Barry, C. T., Sidoti, C. L., Briggs, S. M., Reiter, S. R., & Lindsey, R. A. (2017). Adolescent social media use and mental health from adolescent and parent perspectives. *Journal of Adolescence*, *61*, 1–11. <https://doi.org/10.1016/j.adolescence.2017.08.005>
- Barthorpe, A., Winstone, L., Mars, B., & Moran, P. (2020). Is social media screen time really associated with poor adolescent mental health? A time use diary study. *Journal of Affective Disorders*, *274*, 864–870. <https://doi.org/10.1016/j.jad.2020.05.106>
- Beyens, I., Pouwels, J. L., van Driel, I. I., Keijsers, L., & Valkenburg, P. M. (2020). The effect of social media on well-being differs from adolescent to adolescent. *Scientific Reports*, *10*(1), 10763.

- Cauberghe, V., Van Wesenbeeck, I., De Jans, S., Hudders, L., & Ponnet, K. (2021). How adolescents use social media to cope with feelings of loneliness and anxiety during COVID-19 lockdown. *Cyberpsychology Behavior and Social Networking*, *24*(4), 250–257.
- Chorpita, B. F., Moffitt, C. E., & Gray, J. (2005). Psychometric properties of the revised child anxiety and depression scale in a clinical sample. *Behaviour Research and Therapy*, *43*(3), 309–322.
- Coyne, S. M., Rogers, A. A., Zurcher, J. D., Stockdale, L., & Booth, M. (2020). Does time spent using social media impact mental health? An eight year longitudinal study. *Computers in Human Behavior*, *104*, 106160. <https://doi.org/10.1016/j.chb.2019.106160>
- Dhir, A., Kaur, P., Chen, S., & Lonka, K. (2016). Understanding online regret experience in Facebook use—Effects of brand participation, accessibility & problematic use. *Computers in Human Behavior*, *59*, 420–430.
- Ebesutani, C., Reise, S. P., Chorpita, B. F., Ale, C., Regan, J., Young, J., Charmaine, H. M. M., & Weisz, J. R. (2012). The revised child anxiety and depression Scale-Short version: Scale reduction via exploratory bifactor modeling of the broad anxiety factor. *Psychological Assessment*, *24*(4), 833–845. <https://doi.org/10.1037/a0027283>
- Fazel, M. (2024). Children's virtual and material upbringing. *The Lancet*, *403*(10438), 1741–1742. [https://doi.org/10.1016/s0140-6736\(24\)00869-9](https://doi.org/10.1016/s0140-6736(24)00869-9)
- Fry, C. (2021). Sleep deprived but socially connected: Balancing the risks and benefits of adolescent screen time during COVID-19. *Journal of Children and Media*, *15*(1), 37–40. <https://doi.org/10.1080/17482798.2020.1858907>
- Gamez-Guadix, M., Borrajo, E., & Almendros, C. (2016). Risky online behaviors among adolescents: Longitudinal relations among problematic internet use, cyberbullying perpetration, and meeting strangers online. *Journal of Behavioral Addictions*, *5*(1), 100–107. <https://doi.org/10.1556/2006.5.2016.013>
- George, M. (2019). The importance of social media content for teens' risks for Self-harm. *Journal of Adolescent Health*, *65*(1), 9–10. <https://doi.org/10.1016/j.jadohealth.2019.04.022>
- Geulayov, G., Borschmann, R., Mansfield, K. L., Hawton, K., Moran, P., & Fazel, M. (2022). Utilization and acceptability of formal and informal support for adolescents following Self-Harm before and during the first COVID-19 lockdown: Results from a Large-Scale english schools survey. *Frontiers in Psychiatry*, *13*, 881248. <https://doi.org/10.3389/fpsy.2022.881248>
- Giumetti, G. W., & Kowalski, R. M. (2022). Cyberbullying via social media and well-being. *Current Opinion in Psychology*, *45*, 101314.
- Hamilton, J. L., & Lee, W. (2021). Associations between social media, bedtime technology use rules, and daytime sleepiness among adolescents: Cross-sectional findings from a nationally representative sample. *JMIR Mental Health*, *8*(9), e26273. <https://doi.org/10.2196/26273>
- Hamilton, J. L., Nesi, J., & Choukas-Bradley, S. (2022). Reexamining social media and socioemotional Well-Being among adolescents through the Lens of the COVID-19 pandemic: A theoretical review and directions for future research. *Perspectives on Psychological Science*, *17*(3), 662–679. <https://doi.org/10.1177/17456916211014189>
- Hartas, D. (2021). The social context of adolescent mental health and wellbeing: Parents, friends and social media. *Research Papers in Education*, *36*(5), 542–560.
- Hughes, M. E., Waite, L. J., Hawkey, L. C., & Cacioppo, J. T. (2004). A short scale for measuring loneliness in large surveys: Results from two population-based studies. *Research on Aging*, *26*(6), 655–672. <https://doi.org/10.1177/0164027504268574>
- Kelly, Y., Zilanawala, A., Booker, C., & Sacker, A. (2018). Social media use and adolescent mental health: Findings from the UK millennium cohort study. *EClinicalMedicine*, *6*, 59–68. <https://doi.org/10.1016/j.eclinm.2018.12.005>
- Kirtley, O. J., Hussey, I., & Marzano, L. (2021). Exposure to and experience of self-harm and self-harm related content: An exploratory network analysis. *Psychiatry Research*, *295*, 113572.
- Kline, R. B. (2023). *Principles and practice of structural equation modeling*. Guilford.
- Mansfield, K. L., Puntis, S., Sonesson, E., Cipriani, A., Geulayov, G., & Fazel, M. (2021). Study protocol: The oxwell school survey investigating social, emotional and behavioural factors associated with mental health and well-being. *British Medical Journal Open*, *11*(12), e052717. <https://doi.org/10.1136/bmjopen-2021-052717>
- Marciano, L., Ostroumova, M., Schulz, P. J., & Camerini, A. L. (2022). Digital media use and adolescents' mental health during the COVID-19 pandemic: A systematic review and meta-analysis. *Frontiers in Public Health*, *9*, 793868.
- Moreno, M. A., & Jolliff, A. F. (2022). Depression and anxiety in the context of digital media. In J. Nesi, E. H. Telzer, & M. J. Prinstein (Eds.), *Handbook of adolescent digital media use and mental health* (pp. 217–241). Cambridge University Press.
- Nagata, J. M., Magid, A., H. S., & Pettee Gabriel, K. (2020). Screen time for children and adolescents during the coronavirus disease 2019 pandemic. *Obesity (Silver Spring, Md.)*, *28*(9), 1582–1583. <https://doi.org/10.1002/oby.22917>
- NHS Digital. (2023). *Mental Health of Children and Young People in England, 2023 - wave 4 follow up to the 2017 survey*. <https://digital.nhs.uk/data-and-information/publications/statistical/mental-health-of-children-and-young-people-in-england/2023-wave-4-follow-up/copyright>. Accessed 2 Sept 2023.
- Ogders, C. L., & Jensen, M. R. (2020). Annual research review: Adolescent mental health in the digital age: Facts, fears, and future directions. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *61*(3), 336–348. <https://doi.org/10.1111/jcpp.13190>
- Ofcom. (2019). *Children and parents: media use and attitudes report 2018*. <https://www.ofcom.org.uk/research-and-data/media-literacy-research/childrens/children-and-parents-media-use-and-attitudes-report-2018>. Accessed 2 Sept 2023
- Orben, A. (2020). Teenagers, screens and social media: A narrative review of reviews and key studies. *Social Psychiatry and Psychiatric Epidemiology*, *55*(4), 407–414. <https://doi.org/10.1007/s00127-019-01825-4>
- Orben, A., Dienlin, T., & Przybylski, A. K. (2019). Social media's enduring effect on adolescent life satisfaction. *Proceedings of the National Academy of Sciences of the United States of America*, *116*(21), 10226–10228. <https://doi.org/10.1073/pnas.1902058116>
- Orben, A., Przybylski, A. K., Blakemore, S. J., & Kievit, R. A. (2022). Windows of developmental sensitivity to social media. *Nature Communications*, *13*(1), 1649.
- Pedersen, J., Rasmussen, M. G., Olesen, L. G., Klakk, H., Kristensen, P. L., & Grøntved, A. (2022). Recreational screen media use in Danish school-aged children and the role of parental education, family structures, and household screen media rules. *Preventive Medicine*, *155*, 106908. <https://doi.org/10.1016/j.ypmed.2021.106908>
- Polo, A. J., Solano-Martinez, J. E., Saldana, L., Ramos, A. D., Herrera, M., Ullrich, T., & DeMario, M. (2023). The epidemic of internalizing problems among Latinx adolescents before and during the coronavirus 2019 pandemic. *Journal of Clinical Child and Adolescent Psychology*, 1–17. <https://doi.org/10.1080/15374416.2023.2169925>
- Pretorius, C., Chambers, D., Cowan, B., & Coyle, D. (2019). Young people seeking help online for mental health: Cross-sectional survey study. *JMIR Mental Health*, *6*(8), e13524.

- Rideout, V., & Robb, M. B. (2022). *Common sense census: Media use by tweens and teens, 2021*. Common Sense Media.
- Russell, D. W. (1996). UCLA loneliness scale (Version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment*, 66(1), 20–40. [https://doi.org/10.1207/s15327752jpa6601\\_2](https://doi.org/10.1207/s15327752jpa6601_2)
- Sala, A., Porcaro, L., & Gómez, E. (2024). Social media use and adolescents' mental health and well-being: An umbrella review. *Computers in Human Behavior Reports*, 14, 100404. <https://doi.org/10.1016/j.chbr.2024.100404>
- Siongers, J., & Spruyt, B. (2024). Navigating the social media seas: Understanding the complex relationship between social media use and adolescent Well-being. *Child Indicators Research*, 17(1), 177–196. <https://doi.org/10.1007/s12187-023-10080-8>
- Soneson, E., O'Leary, S., & Fazel, M. (2024). Trans and gender diverse identities in adolescent health research: Making the most of imperfect data. *BMJ Mental Health* 27(1)
- Steinsbekk, S., Nesi, J., & Wichstrøm, L. (2023). Social media behaviors and symptoms of anxiety and depression. A four-wave cohort study from age 10–16 years. *Computers in Human Behavior*, 147, 1–12.
- Subrahmanyam, K., & Michikyan, M. (2022). Methodological and conceptual issues in digital media research. In J. Nesi, E. H. Telzer, & M. J. Prinstein (Eds.), *Handbook of adolescent digital media use and mental health* (pp. 9–38). Cambridge University Press.
- Taylor, K., & Silver, L. (2019). Smartphone ownership is growing rapidly around the world, but not always equally | Pew Research Center. In <https://www.pewresearch.org/Global/2019/02/05/Smartphone-Ownership-Is-Growing-Rapidly-Around-the-World-But-Not-Always-Equally/> (Issue February). <https://www.pewresearch.org/global/2019/02/05/smartphone-ownership-is-growing-rapidly-around-the-world-but-not-always-equally/>
- Valkenburg, P. M. (2022). Theoretical foundations of social media uses and effects. In J. Nesi, E. H. Telzer, & M. J. Prinstein (Eds.), *Handbook of adolescent digital media use and mental health*, 39–60. Cambridge University Press.
- Valkenburg, P. M., & Peter, J. (2013). The differential susceptibility to media effects model. *Journal of Communication*, 63(2), 221–243. <https://doi.org/10.1111/jcom.12024>
- Valkenburg, P. M., Peter, J., & Schouten, A. P. (2006). Friend networking sites and their relationship to adolescents' well-being and social self-esteem. *Cyberpsychology and Behavior*, 9(5), 584–590. <https://doi.org/10.1089/cpb.2006.9.584>
- van den Eijnden, R. J. J. M., Geurts, S. M., Bogt, T., van der Rijst, T. F. M., V. G., & Koning, I. M. (2021). Social media use and adolescents' sleep: A longitudinal study on the protective role of parental rules regarding internet use before sleep. *International Journal of Environmental Research and Public Health*, 18(3), 1–13. <https://doi.org/10.3390/ijerph18031346>

**Publisher's note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.