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Fahy, AE; Stansfeld, SA; Smuk, M; Smith, NR; Cummins, S; Clark, C (2016) Longitudinal Associations Between Cyberbullying Involvement and Adolescent Mental Health. *The Journal of adolescent health*, 59 (5). pp. 502-509. ISSN 1054-139X DOI: <https://doi.org/10.1016/j.jadohealth.2016.06.006>

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**Word count:** 5973

**Involvement in cyberbullying and adolescent mental health and well-being:  
Longitudinal results from the Olympic Regeneration in East London Study**

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Conflicts of interest

SC is supported by a National Institute for Health Research (NIHR) Senior Research Fellowship. The ORiEL Study is funded by the NIHR Public Health Research Programme (Grant number: 09/3005/09). The views and opinions expressed therein are those of the authors and do not necessarily reflect those of the Public Health Programme, NIHR, NHS or the Department of Health.

## Abstract

### **Background**

Few longitudinal studies have examined the impact of cyberbullying involvement as a cybervictim (i.e. a target of cyberbullying), a cyberbully (i.e. someone who perpetrates cyberbullying), or as a cyberbully-victim (i.e. someone who both perpetrates and is the target of cyberbullying) on adolescent mental health. Some evidence suggests cybervictims and cyberbully-victims report greater depressive symptoms than uninvolved peers, but to date there is no longitudinal research examining the impact of cyberbullying involvement on adolescent social anxiety symptoms or positive mental well-being. This study examines longitudinal associations between cyberbullying involvement and adolescent mental health in the form of depressive symptoms, social anxiety symptoms, and positive well-being.

### **Methods**

Longitudinal analyses were carried out on a sample of 2480 participants in the Olympic Regeneration in East London (ORiEL) study to examine the impact of baseline (aged 12-13) cyberbullying involvement (as a cybervictim, cyberbully, or cyberbully-victim) on adolescent depressive symptoms, social anxiety symptoms, and mental well-being one year later.

### **Results**

At baseline a high proportion of participants reported involvement in cyberbullying as cybervictims (13.6%), cyberbullies (8.2%), and cyberbully-victims (20.4%) over the past year. Cybervictims and cyberbully-victims were significantly more likely than their uninvolved peers to report symptoms of depression and social anxiety at follow-up, before and after adjusting for gender, ethnicity, socioeconomic status, school, and baseline mental health. Cybervictims and cyberbully-victims were significantly more likely to report low

(compared to average) well-being after adjustment for gender, ethnicity, socioeconomic status, and school.

### **Conclusions**

This study emphasises the high prevalence of cyberbullying and the potential of cybervictimisation as a risk factor for future depressive symptoms, social anxiety symptoms, and below-average well-being among adolescents. Future research should identify protective factors and possible interventions to reduce adolescent cyberbullying.

*Keywords:* adolescence, mental health, depression, social anxiety, well-being, cyberbullying

In parallel to definitions of traditional bullying, cyberbullying may be understood as “an aggressive, intentional act carried out by a group or individual, using electronic forms of contact, repeatedly and over time against a victim who cannot easily defend him or herself” (P. K. Smith et al., 2008, p. 376). However, cyberbullying is different from face-to-face bullying, and should be researched in its own right (Shapka & Law, 2013). Repetition, intentionality, and power imbalance – central to traditional bullying definitions – are complicated by features of online communication (Livingstone & Smith, 2014). The permanence of online messages means a single act of online harassment may be repeated when viewed or distributed by others, regardless of the original perpetrator’s intention. In addition, cyberbullying among adolescents tends to occur in online environments lacking adult supervision and unrestricted to any specific geographical location, possibly preventing those victimised from escaping its impact (Hinduja & Patchin, 2007).

Involvement in traditional bullying is an established risk factor for poor mental health (e.g. Arseneault, Bowes, & Shakoor, 2010). In 2014, rates of cyberbullying victimisation in the Net Children Go Mobile study exceeded rates of traditional forms of bullying (12% versus 9%) (Livingstone et al., 2014). Prevalence rates vary by population, definition, and measurement used (Livingstone & Smith, 2014). To date, studies of cyberbullying have primarily involved cross-sectional data with cyberbullying involvement linked to psychosocial risk factors and mental ill-health (Bottino, Bottino, Regina, Correia, & Ribeiro, 2015). Cross-sectional studies have found links between exposure to cyberbullying and depressive symptoms, though findings in relation to other mental disorders have been mixed (Hamm, Newton, Chisholm, & et al., 2015); longitudinal research is needed to explore temporality and lasting mental health effects (Nixon, 2014) and to strengthen the case for a causal mechanism by which cyberbullying impacts mental health.

Adolescents may be involved in cyberbullying as cybervictims (i.e. targets of cyberbullying), cyberbullies (i.e. those who perpetrate cyberbullying), or as cyberbully-victims (i.e. those who both perpetrate and are targets of cyberbullying). Bully-victims represent the smallest category of involvement in traditional bullying whereas cyberbullying studies suggest that this is a more frequent group (Mishna, Khoury-Kassabri, Gadalla, & Daciuk, 2012) with poorer mental health than cybervictims (Gamez-Guadix et al., 2013). Few studies have compared outcomes for cybervictims, cyberbullies, and cyberbully-victims within a single cohort and to our knowledge there are no such longitudinal studies, a gap addressed in the current study.

Findings from the sparse longitudinal research available indicate significant mental health problems associated with cyberbullying involvement. Machmutow, Perren, Sticca, and Alsaker (2012) found that cybervictimisation at baseline was significantly associated with depressive symptoms at follow-up (6 months) after adjusting for gender, traditional bullying, age, and coping strategies among 765 Swiss adolescents. Baseline cybervictimisation was also associated with depressive symptoms at follow-up among 845 Spanish adolescents (Gamez-Guadix et al., 2013).

To date, longitudinal research on this topic has primarily focused on constructs related to mental illness – specifically depressive symptoms or broad measures of psychological distress (e.g. the total score of the Strengths and Difficulties Questionnaire used by Bannink et al. (2014)). The impact of cyberbullying on other mental health outcomes remains unexamined. Victims of traditional bullying have reported higher levels of social anxiety (i.e. extreme shyness resulting from anxiety related to the prospect or experience (real or imagined) of being evaluated by peers) than uninvolved peers but few studies have explored associations between cyberbullying involvement and social anxiety (Hamm et al., 2015), and there have been no longitudinal studies. It is also important to consider a two continua model

of mental health which focuses on both mental illness and mental well-being as two distinct (though related) constructs (Westerhof & Keyes, 2010). It is plausible that involvement in cyberbullying may have a detrimental effect on adolescent well-being by impacting their ability to cope with stressors, or to fulfil their potential in school and home environments. This is the first study to examine longitudinal associations between cyberbullying involvement and adolescent mental well-being.

It was hypothesised that involvement in cyberbullying (as a cybervictim, cyberbully, or cyberbully-victim) at baseline would be associated with increased symptoms of depression and social anxiety, and lower mental well-being scores at follow-up compared to those uninvolved in cyberbullying.

## Methods

### Study design and Participants

The Olympic Regeneration in East London (ORiEL) study was designed to evaluate the impact of urban regeneration associated with the London 2012 Olympic Games on a prospective cohort of adolescents in East London (N. R. Smith et al., 2012). Data was collected from 3105 Year 7 students (aged 11-12) across 25 randomly selected schools in four East London boroughs in 2012. These adolescents were followed up in 2013 and 2014. Baseline cyberbullying measures were collected from participants at Wave 2 (aged 12-13) and follow-up measures at Wave 3 (aged 13-14). Students new to participating classes were eligible for inclusion at subsequent waves, thus expanding the cohort. Overall response rate at baseline was 84% (n=3214). Of these, 77% (n=2480) provided follow-up data.

### Ethical considerations

Head teachers provided informed consent. Adolescents were enrolled via passive parental consent – parents were given an information sheet in advance and could opt their adolescent out of the study at each wave. Adolescents actively assented to participate at each wave. Ethical approval was granted for the ORiEL project through Queen Mary University of London Ethics Committee (QMREC2011/40), the Association of Directors of Children's Services (RGE110927) and the London Boroughs Research Governance Framework (CERGF113).

### Measurement Instruments

**Positive well-being.** Well-being was assessed by the Warwick-Edinburgh Mental Well-being Scale (WEMWBS) (Tennant et al., 2007) – a 14 item (5 response category) self-report measure of hedonic and eudaimonic subjective well-being in the past two weeks,



validated for use with adolescents (Clarke et al., 2011). Scores ranged from 14 (lowest well-being) to 70 and showed good reliability in our sample: Cronbach's  $\alpha$  - baseline =0.88 (n=2231) and follow-up =0.90 (n=2307). As per the approach of Stranges, Samaraweera, Taggart, Kandala, and Stewart-Brown (2014) WEMWBS scores were categorised as "average well-being" (within one SD of the mean), "below average well-being" (more than one SD below the mean), and "above average well-being" (more than one SD above the mean).

**Depressive symptoms.** The Short Moods and Feelings Questionnaire (SMFQ) assessed depressive symptoms (Angold, Costello, Messer, & Pickles, 1995). Scores on this 13 item (3 response category) self-report measure range from 0 to 26 and scores  $\geq 8$  indicate significant clinical depressive symptoms. This cut-off has been shown to discriminate clinically referred depressed child psychiatric subjects from unselected subjects in a general population sample (Angold et al., 1995). The SMFQ showed high reliability: Cronbach's  $\alpha$  - baseline =0.90 (n=2324) and follow-up =0.91 (n=2386).

**Social anxiety.** Social anxiety was measured using the three item (5 response category) self-report Mini Social Phobia Inventory (Mini-SPIN) (Connor, Kobak, Churchill, Katzelnick, & Davidson, 2001). Scores ranged from 0 to 12. A score of  $\geq 6$  indicates significant symptoms of social anxiety. This cut-off has good psychometric properties for screening social phobia in adolescents in the general population (Ranta, Kaltiala-Heino, Rantanen, & Marttunen, 2012). The Mini-SPIN showed high reliability in this sample: Cronbach's  $\alpha$  - baseline =0.80 (n=2079) and follow-up =0.84 (n=2325).

**Cyberbullying involvement.** A six item (six response category) scale used by Ybarra, Diener-West, and Leaf (2007) assessed cyberbullying involvement. This scale included three cybervictimisation and three cyberbullying items. Participants who reported

any instance of victimisation and no instances of perpetration over the past year were coded as “cybervictims”, those who reported no instances of victimisation and at least one instance of perpetration over the past 12 months were coded as “cyberbullies”, and those who reported at least one instance of victimisation and one instance of perpetration over the past year were coded as “cyberbully-victims”. The cybervictimisation items showed high reliability in this sample: Cronbach’s  $\alpha$  - baseline =0.89 (n=1749) and follow-up =0.88 (n=2255); as did the cyberbullying perpetration items: Cronbach’s  $\alpha$  - baseline =0.91 (n=1737) and follow-up =0.89 (n=2244).

**Covariates.** Gender, ethnicity and socioeconomic status (SES) were identified as covariates a priori from the literature. Participants reported their ethnicity using a Census-based question adapted to capture the characteristics of the highly ethnically diverse East London population (see Table 1).

The 4-item Family Affluence Scale II (FAS II) measured SES (Boyce, Torsheim, Currie, & Zambon, 2006) categorised as low (score=0,1,2), medium (scores=3,4,5) or high affluence (scores= 6,7,8,9). As in other studies (Boudreau & Poulin, 2009; Molcho et al., 2007), this scale showed poor internal consistency at baseline ( $\alpha$  =0.37) and follow-up ( $\alpha$  =0.36). Given the poor internal consistency, an additional measure of self-reported free school meals status was also included.

### **Analysis Plan**

**Missing data.** Missing data ranged from 0.0% to 31.9%. Participants with missing data at both baseline and follow-up on either all mental health variables or all social media variables were excluded, as were participants who moved schools and those without ethnicity information as it was not deemed possible to impute these variables based on the available data (n=166 (6.3%) excluded in total). Exploring the missing data patterns yielded no

evidence against the hypothesis that the missing data mechanism is “Missing At Random” (MAR). We imputed the data using multilevel multiple imputation under the MAR assumption in the REALCOM software (Carpenter, Goldstein, & Kenward, 2011) which uses a joint multivariate normal modelling approach through the Markov Chain Monte Carlo (MCMC) method.

We imputed with 2 levels (1<sup>st</sup>=wave and 2<sup>nd</sup>=pupil), a third level for school was not possible due to computational limitations in the REALCOM software so school was included as a fixed effect. In addition to the variables listed in the method, the following variables were included in the imputation: perceived peer and family social support scales (Zimet, Dahlem, Zimet, & Farley, 1988), parental monitoring (Frick, 1991), parental involvement in school, lifetime experience of bullying, total number of negative life events, and mother’s employment status. We used a ‘burn in’ period of 35,000 iterations, followed by 25,000 iterations producing a dataset every 500th iteration, resulting in 50 imputed datasets. The MCMC chains were examined and found to converge.

**Analytic approach.** Rubin’s rules (Rubin, 1987) were applied to combine estimates from the imputed datasets. Analysis was conducted in Stata (Version 12) (StataCorp., 2011). An epidemiological approach using a series of binary (for depression and social anxiety) and multinomial (for mental well-being) logistic regression models was used. Unadjusted models regressed each of the mental health outcomes on cyberbullying involvement. These models were then adjusted for gender, ethnicity, SES, and school. Finally, models were additionally adjusted for baseline mental health.

## Results

**Loss to follow-up.** Females were less likely than males to be lost to follow-up (Odds Ratio (OR)=0.77, 95% Confidence Interval (CI) [0.65, 0.91]) while participants who reported their ethnicity as Black Caribbean (OR=1.59, 95% CI [1.08, 2.34]) and those who received free school meals (OR=1.32, 95% CI [1.12, 1.57]) were more likely than White UK students or those without free school meals to be lost to follow-up. No other socio-demographic factors were associated with study retention. The social media and mental health measures were not significantly associated with loss to follow-up.

**Socio-demographic characteristics.** The socio-demographic characteristics of the study participants at baseline and follow-up are presented in Table 1. The longitudinal sample contains a higher proportion of males (55.2%) than females (44.8%). The largest ethnic groups include White UK (16.9%), White other (15.2%), Asian Bangladeshi (15.4%), Black African (10.6%), and Black other (11.2%). At baseline, 37% reported receiving free school meals, while 58% reported having low or moderate family affluence. School sample size within the longitudinal sample ranged from 75 to 184 students.

**Cyberbullying involvement.** At baseline, 42.2% of participants reported involvement in cyberbullying in the previous 12 months – 13.6% as cybervictims, 8.2% as cyberbullies, and 20.4% as cyberbully-victims. Involvement as cyberbully-victims was significantly lower among females (17.1%) than males (23.0%; RRR=0.76, 95% CI [0.60, 0.96]).

**Adolescent mental health.** At follow-up, 24.8% of participants reported depressive symptoms, 28.5% reported social anxiety symptoms, 15.4% reported below average well-being, and 15.6% reported above average well-being. Females were significantly more likely to report symptoms of depression (OR=2.13, 95% CI [1.75, 2.61]), social anxiety (OR=1.75, 95% CI [1.45, 2.13]), and below-average well-being (RRR=1.56, 95% CI [1.24, 1.98]) than

males and less likely than males to report above average well-being (RRR=0.66, 95% CI [0.54, 0.89]).

**Table 1**

**Cyberbullying Involvement and Depressive Symptoms**

Cybervictims were almost twice as likely as uninvolved participants to report depressive symptoms at follow-up in the unadjusted and adjusted models (unadjusted OR=1.96, 95% CI [1.45, 2.67]; adjusted OR=1.95, 95% CI [1.40, 2.71]). After additionally adjusting for depressive symptoms at baseline, cybervictims were still significantly more likely to report significant depressive symptoms one year later (OR=1.44, 95% CI [1.00, 2.06]). In addition, baseline cyberbully-victims were over twice as likely to report significant depressive symptoms at follow-up in the unadjusted (OR=2.14, 95% CI [1.66, 2.76]) and adjusted model (OR=2.42, 95% CI [1.83, 3.19]). After further adjusting for baseline depressive symptoms the effect becomes smaller though remains significant (OR=1.54, 95% CI [1.13, 2.09]). There was no significant difference in reports of depressive symptoms at follow-up for cyberbullies at baseline compared to their uninvolved peers, see Table 2 (ethnicity/SES coefficients included in Supplementary Table 1).

**Table 2**

**Cyberbullying Involvement and Social Anxiety Symptoms**

As illustrated in Table 3 (see Supplementary Table 2 for ethnicity/SES coefficients), cybervictims were 1.68 (95% CI [1.27, 2.22]) times more likely to report social anxiety symptoms at follow-up than those uninvolved in cyberbullying and this effect remained in the adjusted model (OR=1.72, 95% CI [1.28, 2.30]) and the model adjusted for baseline social anxiety (OR=1.52, 95% CI [1.11, 2.07]). Similarly, cyberbully-victims were also 1.52 (95%

CI [1.19, 1.94]) times more likely than those uninvolved at baseline to report significant social anxiety symptoms at follow-up in the unadjusted model. The effect sizes were similar in the adjusted (OR=1.63, 95% CI [1.26, 2.10]), and fully adjusted models (OR=1.44, [1.10, 1.89]). Being a cyberbully at baseline was not significantly associated with reports of social anxiety symptoms at follow-up.

**Table 3**

### **Cyberbullying Involvement and Mental Well-Being**

Cybervictims were significantly more likely than their uninvolved peers to report below average well-being relative to average well-being at follow up. This was significant in the unadjusted (RRR=1.55, 95% CI [1.09, 2.21]) and adjusted (RRR=1.54, 95% CI [1.06, 2.24]) models. In addition, baseline cyberbully-victims were 1.65 (95% CI [1.19, 2.28]) times more likely than their uninvolved peers to report below average relative to average well-being at follow-up in the unadjusted model. This effect was similar in the adjusted model (RRR=1.73, 95% CI [1.23, 2.45]). Associations with below average well-being at follow-up were no longer significant after adjusting for baseline well-being for victims (RRR=1.28; 95% CI [0.86, 1.91]) or bully-victims (RRR=1.38; 95% CI [0.95, 1.99]). There was no significant difference in well-being for cyberbullies compared with those uninvolved in cyberbullying.

No significant differences were observed between cybervictims and those uninvolved in cyberbullying in terms of their risk of reporting above average relative to average mental well-being. However, cyberbully-victims were significantly less likely to report above average relative to average mental well-being both in the unadjusted (RRR=0.68, 95% CI

[0.48, 0.96]) and adjusted models (RRR=0.63, 95% CI [0.44, 0.90]). Longitudinal associations between being a cyberbully-victim and reporting above average mental well-being were no longer significant after adjustment for baseline mental well-being. In addition, there were no significant differences in reports of above average mental well-being between those involved as cyberbullies and those not involved in cyberbullying (see Table 4; ethnicity/SES coefficients in Supplementary Table 3)

#### **Table 4**

## Discussion

Consistent with our hypothesis, cybervictims and cyberbully-victims were significantly more likely to report symptoms of depression and social anxiety than their uninvolved peers, even after adjusting for covariates (gender, ethnicity, SES, and school), and baseline mental health. Both cybervictims and cyberbully-victims were significantly more likely to report below average well-being, while only cyberbully-victims were significantly less likely to report above average well-being. The differences in mental well-being were no longer significant after adjusting for baseline well-being which may be attributed to the stability in the well-being measure over time.

Findings related to depressive symptoms are consistent with those of Gamez-Guadix et al. (2013) where baseline cybervictimisation was associated with depressive symptoms at follow-up. The finding that cybervictims and cyberbully-victims are more likely than their uninvolved peers to report social anxiety symptoms over time extends previous cross-sectional findings (Juvonen & Gross, 2008) and offers support for continued research into the impact of peer victimisation online and adolescent social anxiety. Though associations between cyberbullying and mental well-being have not previously been examined specifically, the finding that cybervictims and cyberbully-victims are more likely to report below average well-being is theoretically supported and consistent with our study hypothesis.

From a theoretical perspective, Sullivan (1953) posited that early adolescent friendships fulfil the need for belonging, companionship, and intimacy and therefore shape adolescent well-being. Peer victimisation, in contrast, has been associated with negative outcomes including increased depression, anxiety, and loneliness compared to non-victimised peers (Hodges & Perry, 1996). In terms of social anxiety, research on traditional bullying has emphasised the need to explore links with adolescent social anxiety given that stressful



environments including peer victimisation are believed to be main contributors to the development of this disorder during adolescence (Storch, Masia-Warner, Crisp, & Klein, 2005). The findings of this study extend longitudinal research on peer victimisation to an online context by illustrating the association between cybervictimisation and poor outcomes across multiple mental health domains.

Our results suggest similar effect sizes for cybervictims and cyberbully-victims in terms of depression, social anxiety, and mental well-being. This is in contrast with Gamez-Guadix et al. (2013) whose findings suggested more negative outcomes for bully-victims. It is possible that this discrepancy may be attributed to participant age differences (13-17 years at baseline compared to 12-13 years in this study). For example, Campbell, Slee, Spears, Butler, and Kift (2013) highlighted the research literature suggesting that older adolescents tend to report higher levels of involvement in cyberbullying than traditional forms of bullying. Higher frequency of involvement among older adolescents may lead to more pronounced negative effects on mental health.

Findings of this study also suggest that perpetrators of cyberbullying are not prone to internalising symptoms, as reports of depression, social anxiety, and well-being in this group are similar to reports of those uninvolved in cyberbullying. However, perpetration of cyberbullying may show greater associations with externalising problems such as aggression, substance abuse, and delinquency, which have not been the focus of this study. For example, Fletcher et al. (2014) found that, cross-sectionally, compared to uninvolved adolescents, cyberbullies were more likely to report conduct problems and hyperactivity but they did not report poorer well-being.

Cyberbullying prevalence rates were high in this study with 42.2% of participants reporting involvement in cyberbullying in the previous 12 months; the majority (20.4%) of

these involved as cyberbully-victims. The large prevalence of cyberbullying involvement reported in this study is due to the lenient frequency criterion (at least once or twice in the past 12 months) but it suggests that cybervictimisation – even at low levels - may be a risk factor for future adolescent mental health problems. These rates of cybervictimisation are consistent with other studies using similar measures (Ybarra et al., 2007). In addition, we found that cyberbullying involvement was significantly greater among males. Tokunaga (2010) highlighted the inconsistent research findings relating to gender involvement in cyberbullying. Our finding that males are more likely to be involved is less common (Calvete, Orue, Estévez, Villardón, & Padilla, 2010), however, in our study males were more likely to be cyberbully-victims, a group often not explored specifically in cyberbullying research. The finding that the bully-victim group represented the largest group involved in cyberbullying is consistent with previous cyberbullying studies (Gamez-Guadix et al., 2013). However, much cyberbullying research fails to distinguish this group and focuses exclusively on victimisation or perpetration but not the overlap between the two.

### **Limitations and strengths**

The main strengths of this study include its use of longitudinal adolescent data, a representative sample of adolescents, and standardised and validated measures of mental health. In addition, the examination of depression, social anxiety, and mental well-being enables us to compare findings across multiple domains of adolescent mental health. To the best of our knowledge this is the first study to explore longitudinal associations between cyberbullying and adolescent mental health in the UK.

Other strengths of this study include the high retention rate across waves (77%); the large sample size which increases statistical power to detect effects; and the inclusion of several adjustment factors including gender, ethnicity, SES, school, and baseline mental health.

Previous longitudinal research in this field has been limited by poor study retention (Bannink et al., 2014), sample sizes of less than 1000 participants (Machmutow et al., 2012) and lack of adjustment factors (Gamez-Guadix et al., 2013).

Though the use of multiple imputation methods to address issues of missing data and reduce bias is a strength of this study, current limitations in the REALCOM software only allow for multilevel imputation at two levels which meant that school had to be included as a fixed rather than random effect in analytic models. In addition, interaction terms could not be included in the imputation due to limitations of the REALCOM software so an examination of the moderating effect of gender was not possible. To overcome the poor Cronbach's alpha observed for the FAS II measure of SES, we additionally adjusted models for free school meals status. However, it is possible that analyses remain underadjusted for SES.

### **Conclusion**

This study contributes to our understanding of associations between cyberbullying involvement and adolescent mental health by demonstrating that cybervictims and cyberbully-victims (but not cyberbullies) are more likely to report depressive and social anxiety symptoms and below-average well-being at follow-up compared to their uninvolved peers. Future studies should examine externalising and internalising problems simultaneously to investigate comprehensively the longitudinal mental health impact of cyberbullying involvement. In addition, the role of perceived social support, particularly from peers, should be examined to determine the extent to which social support may buffer adolescents against the negative mental health outcomes associated with cybervictimisation.

These findings have several implications. First, given the high prevalence of cyberbullying and its associations with future mental health problems, it is important for clinicians to address cyberbullying experiences when assessing mental health in adolescents.

Second, this study provides UK data on the longitudinal associations between cyberbullying involvement and poor adolescent mental health. Third, given the high prevalence of cyberbullying involvement it is important for this issue to be tackled in schools and there is a need for effective interventions to reduce cyberbullying prevalence. As a potential risk factor for future mental ill-health, these findings emphasise the need for public health researchers and practitioners to address the problem of cyberbullying.

**Key Points**

- Prevalence of cyberbullying is increasing though longitudinal empirical research into its impact on adolescent mental health is still in its infancy.
- This study builds upon previous research finding that cybervictims and cyberbully-victims are more likely to report significant depressive symptoms than those uninvolved at a one year follow-up.
- This study extends the current literature to suggest that cybervictimisation is also associated with increased odds of social anxiety and increased risk of below-average mental well-being one year later.
- Given its high prevalence and links with future mental health problems, it is important for clinicians and mental health practitioners to address cyberbullying experiences when assessing mental health in adolescents.

**Acknowledgements**

We are grateful for the support of the schools, parents and students involved in this study. We also thank Daniel Lewis, Claire Thompson, Ellen Flint, the wider ORiEL research team, and the field team, including Vanathi Tharmaratnam, Danielle House, Bukola Thompson, Shaneka Foster, Lianne Austin, and Rebecca Evans.

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1 **Table 1: Socio-Demographic Characteristics of Study Participants**

<b>Gender</b>	<b>N (%)</b>	
Male	1370 (55.2)	
Female	1110 (44.8)	
<b>Ethnicity</b>		
White: UK	418 (16.9)	
White: Other	377 (15.2)	
White: Mixed	203 (8.2)	
Asian: Indian	95 (3.8)	
Asian: Pakistani	97 (3.9)	
Asian: Bangladeshi	382 (15.4)	
Asian: Other	86 (3.5)	
Black: Caribbean	114 (4.6)	
Black: African	262 (10.6)	
Black: Other	278 (11.2)	
Other	168 (6.8)	
<b>Free school meals status</b>	<b>Baseline: N (%)</b>	<b>Follow-up: N (%)</b>
No	1536 (63.1)	1658 (67.8)
Yes	900 (36.9)	786 (32.2)
<b>FAS</b>		
Low	173 (7.2)	117 (4.9)
Medium	1210 (50.7)	1228 (51.2)
High	1006 (42.1)	1056 (44)

2 **Note:** Mixed ethnicity= combination of at least one white and one non-white ethnic group;

3 Other categories=White, Asian, or Black ethnic groups not otherwise specified

4 **Table 2: Longitudinal Associations between Cyberbullying and Depressive Symptoms**

		Model 1			Model 2			Model 3		
		OR	p-val	95% CI	OR	p-val	95% CI	OR	p-val	95% CI
<b>Cyberbullying involvement</b>	<b>Not involved†</b>	1.00	-	-	1.00	-	-	1.00	-	-
	<b>Cybervictim</b>	<b>1.96</b>	<b>&lt;0.001</b>	<b>[1.45,2.67]</b>	<b>1.95</b>	<b>&lt;0.001</b>	<b>[1.40,2.71]</b>	<b>1.44</b>	<b>0.048</b>	<b>[1.00,2.06]</b>
	<b>Cyberbully</b>	1.21	0.323	[0.83,1.77]	1.27	0.246	[0.85,1.92]	1.16	0.515	[0.75,1.79]
	<b>Cyberbully-victim</b>	<b>2.14</b>	<b>&lt;0.001</b>	<b>[1.66,2.76]</b>	<b>2.42</b>	<b>&lt;0.001</b>	<b>[1.83,3.19]</b>	<b>1.54</b>	<b>0.006</b>	<b>[1.13,2.09]</b>
<b>Gender</b>	<b>Male†</b>				1.00	-	-	1.00	-	-
	<b>Female</b>				<b>3.44</b>	<b>&lt;0.001</b>	<b>[2.75,4.29]</b>	<b>2.88</b>	<b>&lt;0.001</b>	<b>[2.27,3.65]</b>
<b>Depressive symptoms</b>	<b>Not depressed†</b>				1.00	-	-	1.00	-	-
	<b>Depressive symptoms</b>							<b>6.39</b>	<b>&lt;0.001</b>	<b>[5.05,8.09]</b>

5 *Model 1: Unadjusted; Model 2: Adjusted for gender, ethnicity, SES, & school; Model 3: Additionally adjusted for baseline depressive symptoms;*

6 *OR=Odds Ratio, CI= Confidence Interval*

7 **Table 3: Longitudinal Association between Cyberbullying Involvement and Social Anxiety Symptoms**

		Model 1			Model 2			Model 3		
		OR	p-val	95% CI	OR	p-val	95% CI	OR	p-val	95% CI
<b>Cyberbullying involvement</b>	<b>Not involved†</b>	1.00	-	-	1.00	-	-	1.00	-	-
	<b>Cybervictim</b>	<b>1.68</b>	<b>&lt;0.001</b>	<b>[1.27,2.22]</b>	<b>1.72</b>	<b>&lt;0.001</b>	<b>[1.28,2.30]</b>	<b>1.52</b>	<b>0.009</b>	<b>[1.11,2.07]</b>
	<b>Cyberbully</b>	0.79	0.240	[0.53,1.17]	0.80	0.276	[0.53,1.20]	0.85	0.438	[0.55,1.29]
	<b>Cyberbully-victim</b>	<b>1.52</b>	<b>0.001</b>	<b>[1.19,1.94]</b>	<b>1.63</b>	<b>&lt;0.001</b>	<b>[1.26,2.10]</b>	<b>1.44</b>	<b>0.008</b>	<b>[1.10,1.89]</b>
<b>Gender</b>	<b>Male†</b>				1.00	-	-	1.00	-	-
	<b>Female</b>				<b>1.91</b>	<b>&lt;0.001</b>	<b>[1.55,2.34]</b>	<b>1.68</b>	<b>&lt;0.001</b>	<b>[1.35,2.08]</b>
<b>Social Anxiety symptoms</b>	<b>Not socially anxious†</b>				1.00	-	-	1.00	-	-

	<b>Social anxiety symptoms</b>											<b>3.91</b>	<b>&lt;0.001</b>	<b>[3.12,4.89]</b>
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8 *Model 1: Unadjusted; Model 2: Adjusted for gender, ethnicity, SES, & school; Model 3: Additionally adjusted for baseline social anxiety;*

9 *OR=Odds Ratio, CI= Confidence Interval*

10 **Table 4: Longitudinal Association between Cyberbullying Involvement and Mental Well-Being**

	Below Average Well-being - RRR [95% CI]			Above Average Well-being - RRR [95% CI]		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
<b>Not involved†</b>						
<b>Cybervictim</b>	<b>1.55*</b> [1.09,2.21]	<b>1.54*</b> [1.06,2.24]	1.28 [0.86,1.91]	0.71 [0.49,1.03]	0.70 [0.48,1.03]	0.83 [0.55,1.24]
<b>Cyberbully</b>	1.09 [0.63,1.90]	1.09 [0.62,1.92]	1.07 [0.59,1.93]	0.96 [0.63,1.48]	0.91 [0.59,1.42]	1.01 [0.63,1.62]
<b>Cyberbully-victim</b>	<b>1.65**</b> [1.19,2.28]	<b>1.73**</b> [1.23,2.45]	1.38 [0.95,1.99]	<b>0.68*</b> [0.48,0.96]	<b>0.63*</b> [0.44,0.90]	0.77 [0.53,1.13]
<b>Male†</b>						
<b>Female</b>		<b>1.87***</b> [1.42,2.46]	<b>1.61**</b> [1.21,2.16]		<b>0.54***</b> [0.41,0.70]	<b>0.58***</b> [0.44,0.77]

<b>Below average well-being</b>			<b>5.75***</b> <b>[4.28,7.72]</b>			<b>0.33**</b> <b>[0.17,0.65]</b>
<b>Average well-being†</b>						
<b>Above average well-being</b>			<b>0.47* [0.25,0.89]</b>			<b>4.56***</b> <b>[3.41,6.09]</b>

- 11 \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ ; Model 1: Unadjusted; Model 2: Adjusted for gender, ethnicity, SES, & school; Model 3: Additionally
- 12 adjusted for baseline well-being; Base outcome: Average well-being (within 1SD of mean); RRR=Risk Ratio, CI= Confidence Interval