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Internet use, cyberbullying: impacts on psychosocial and psychosomatic wellbeing among Chinese adolescents

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Internet use and cyberbullying: impacts on psychosocial and psychosomatic wellbeing among Chinese adolescents

Abstract

The use of the internet for entertainment has increased hugely over the last decade among Chinese adolescents, but the psychosocial impacts remain unclear. The aims of this study are to explore the associations between internet use, cyberbullying and psychosocial wellbeing among Chinese adolescents. Questionnaires were completed in the classroom setting by 3378 middle school students aged 11 to 16 years old ($M = 13.58$, $SD = 0.87$) in three provinces representing eastern, central and western China. Key findings included: 1) Internet use of over 3 hours per day was associated with higher prevalence of anxiety [OR = 1.6, 95% CI (1.1, 2.2), $p = 0.006$], depression [OR = 2.1, 95% CI (1.7, 2.6), $p < 0.001$] and psychosomatic health problems, such as abdominal pain [OR = 2.4, 95% CI (1.8, 3.3), $p < 0.001$]. 2) Boys were much more likely to play online games. 3) Moderate time of gaming was overall beneficial to well-being. 4) Cyberbullying was common, with 37.5% admitting involvement. 5) Bully-victims were most vulnerable to mental and psychosomatic health problems, and only-bullies were the least vulnerable group. Our findings suggest moderate internet use for entertainment is not detrimental to mental health, but excessive use is. Schools should promote adolescents' responsible use of the internet and incorporate anti-cyberbullying programs into the curriculum.

Keywords: Internet use for entertainment; Cyberbullying; Psychosocial well-being; psychosomatic illness

1 Introduction

There are increasing concerns about the impacts of leisure internet use, including duration and types of activity, on the psychosocial wellbeing of Chinese adolescents

(M. Zhou & Ding, 2021). Psychosocial well-being is a superordinate construct that refers to emotional and psychological well-being, as well as social and collective well-being (Eiroa-Orosa, 2020). But there is limited evidence for the relationship between internet use and well-being in adolescents, and especially for specific activities such as cyberbullying which is of particular concern. So this study explored the relationships between adolescents' use of the internet in terms of duration and activities with a focus on cyberbullying and adolescents' psychosocial and psychosomatic wellbeing.

Today's generation of children and adolescents are growing up immersed in media, including broadcast and interactive media (Moreno et al., 2016). Broadcast media includes television and movies. Interactive media includes social media and video games in which users can both consume and create content. Social media provides platforms for users to create an online identity, communicate with others, and build social networks. Video games remain very popular among children and adolescents, especially among boys, with 84% of boys aged 13-17 years in the U.S. reporting playing video games online (Lenhart, 2015). In the Pew survey of internet use in the U.S., 92% of adolescents aged 13-17 years go online daily and 24% describe themselves as "constantly connected" to the Internet (Lenhart, 2015).

Cyberbullying is defined by Olweus as bullying performed by electronic means such as mobile phones or the internet (Olweus, 2012). Cyberbullying is regarded as the intentional and repeated harm by others, through the use of smartphones, computers, tablets and other internet-connected devices. Cyberbullying differs from traditional bullying in a number of ways: cyberbullying can happen anywhere at any time, cyber perpetrators can remain anonymous, and cyberbullying can quickly reach a larger "audience" (Låftman, Modin, & Östberg, 2013).

1.1 Internet use among Chinese adolescents

In July 2021, internet penetration among children and adolescents aged 6 to 18 years in China was reported at 95%, with no difference between urban and rural areas (*Research Report on Internet Behavior of Chinese Youth in 2020, 2021*); 83% had their own device, and 92% used the internet through smartphones. A 2017 study among adolescents aged 11 to 18 years reported the majority of them (84%) used the internet for entertainment and communication, whereas only 16% used it for homework or study (Karacic & Oreskovic, 2017).

There is a wealth of literature about the potential benefits and risks of internet use among children and adolescents. On the positive side, they can access information to inform and educate themselves, they can develop and maintain supportive relationships, and develop a sense of belonging and self-esteem through keeping connected with friends and being involved in diverse communities (Dina Borzekowski, 2006; "Pros and Cons of technology for teenagers. It's all about balance.," 2020). During the severe lockdowns for COVID-19 all around the world, the internet has been the only means of socialising for adolescents, as well as a means to continue education (Núñez-Gómez, Larrañaga, Rangel, & Ortega-Mohedano, 2021). On the negative side, exposure to violence and risk-taking behaviours, negative stereotypes, cyberbullying, inappropriate online information, as well as excessive use (especially for gaming) may impede development of real social skills, and reduce physical activity ("Internet Use in Children," 2015; "Screen Time and Children," 2020).

1.2 Associations between excessive internet use and health problems

In 2001, the American Academy of Paediatrics has recommended no more than two hours of screen time per day for children and teenagers. However, the internet is now integrated into daily life. Therefore, there is no strict recommendation about the number of hours children should be allowed to use devices, and the newest guidelines offer a more flexible approach, such as establishing reasonable time limits for using

the internet or screens (A. Morin, 2021). But, there are growing concerns about dependence on devices, with internet use for activities such as online gaming and social media sometimes even replacing face-to-face communication (Sangmoon Kim & Oh, 2018).

There is also growing evidence for the effect of excessive internet use on eyesight (causing myopia), time spent on homework, personality development, and well-being ("China cracks down on "spiritual opium", teenagers can only play online games for three hours on weekends," 2021). A number of studies have shown that overuse of the internet is associated with physical health problems, poor school performance, problems with family relationships, poorer social connections, and other negative consequences, such as emotional symptoms (e.g., anxiety and unhappiness), and peer relationship problems (e.g., having few friends and being bullied) (Kumar et al., 2019; Q.-X. Liu, Fang, Deng, & Zhang, 2012; Moreno et al., 2016). A review including 20 studies from China, South Korea, the UK, US, Norway and Turkey, showed an association between internet overuse and depression, anxiety, attention deficit and hyperactivity disorder (ADHD), and aggression in children and young adults (Carli et al., 2013). Online video games such as "Honor of Kings", "Peace Elite", and "Onmyoji" have been likened to "new drugs" and "spiritual opium" by Chinese authorities ("China cracks down on "spiritual opium", teenagers can only play online games for three hours on weekends," 2021). To address the problem of excessive online gaming, in August 2021, all online game companies in China were required to restrict access to online games for under 18 year-olds to one hour per day on weekends and holidays, or a total of 3 hours per week ("Resolutely prevent minors from indulging in online games," 2021).

1.3 Cyberbullying Prevalence

The internet has also led to the phenomenon of cyberbullying. Most of the research on the prevalence of cyberbullying has focused on cyber bullies and cyber

victims, without reporting cyber bully-victims (Buelga, Martínez-Ferrer, & Cava, 2017). A review reported that the global prevalence of childhood and adolescent cyber victimization ranges from 14% to 57.5%, with perpetration ranging from 6% to 46.3%. Online teasing and insulting were found to be most common (Zhu, Huang, Evans, & Zhang, 2021). It also suggested that variables including age (Alvarez-Garcia, Carlos Nunez, Garcia, & Barreiro-Collazo, 2018; H. K. Morin, Bradshaw, & Kush, 2018), sex (Alhajji, Bass, & Dai, 2019; Hong, Kim, Thornberg, Kang, & Morgan, 2018; H. K. Morin et al., 2018), ethnicity (Alhajji et al., 2019), health status (Alhajji et al., 2019; Hong et al., 2018; H. K. Morin et al., 2018), past experience of victimization (Alvarez-Garcia et al., 2018; Hong et al., 2018; H. K. Morin et al., 2018), emotional intelligence (Alvarez-Garcia et al., 2018; Campbell, Slee, Spears, Butler, & Kift, 2013), parent-child relationship (Hong et al., 2018), and school culture (Holfeld & Leadbeater, 2017; Hong et al., 2018) were associated with cyberbullying. A global review suggested cyberbullying victimization rates among children and adolescents ranged between 20% and 40%, with females at higher risk (Aboujaoude, Savage, Starcevic, & Salame, 2015). A scoping review including 159 studies suggested the highest median prevalence of cyber victims was found in Canada (23.8%), and China (23.0%), while the lowest was observed in studies from Australia (5.0%), Sweden (5.2%), and Germany (6.3%) (Brochado, Soares, & Fraga, 2017). It also suggested that there is some inconsistency in the literature with regard to the role of gender in cyberbullying, with some studies showing that victimization rates are higher among girls (Alhajji et al., 2019; H. K. Morin et al., 2018), while others report that rates are higher among boys (Hong et al., 2018; Li, Sidibe, Shen, & Hesketh, 2019).

1.4 Associations between cyberbullying and psychosocial well-being

Cyberbullying may have particularly negative impacts on the well-being of adolescents (Soyeon Kim, Boyle, & Georgiades, 2017). A number of cross-sectional

and longitudinal studies have reported increased levels of anxiety and depression, as well as eating disorders, sleep deprivation, suicidal thoughts and suicide attempts in cyber victims (Fahy et al., 2016; Mateu et al., 2020; Zhu et al., 2021). A study from Singapore reported that cyber victims had more internalizing problems, such as anxiety or depression, whereas both cyber bullies and cyber bully-victims reported more externalizing problems, such as aggressive behaviour (Ong et al., 2021). Studies among adolescents from Norway and Finland showed an association between both traditional bullying and cyberbullying, and psychosomatic symptoms such as headache and abdominal pain (Natvig, Albrektsen, & Qvarnström, 2001; Sourander A, 2010).

The impacts of cyberbullying on psychosocial and psychosomatic problems are still understudied in China. There is very little empirical evidence about the leisure time internet use of Chinese adolescents, and its association with psychosocial and psychosomatic well-being. Lack of evidence, and hence even awareness, around the effects of cyberbullying are particularly concerning. So this study had three aims: (1) to explore internet use, in terms of preferences and duration, among Chinese adolescents; (2) to explore the prevalence and risk factors for cyberbullying; (3) to explore the association between internet use, cyberbullying and adolescents' psychosocial wellbeing. This study only focused on the use of internet as leisure time activity and not its use for study.

2 Material and methods

2.1 Participants

The study was conducted in middle schools in three provinces in China, representing eastern, central and western China respectively. Zhejiang is a wealthy eastern coastal province with a population of 65 million, Henan is a lower middle-income central province with 99 million people, and Chongqing is a higher middle-

income municipality with a population of 32 million (Statistics, 2020; H. P. B. o. Statistics, 2022; Z. P. B. o. Statistics, 2022). The survey was conducted among middle school students aged 11 to 16 years in urban and rural areas of the three provinces. Stratified cluster sampling was used for sample selection.

We aimed to achieve a sample size of 1200 in each province. In Chinese middle schools, there are 3 academic years. The sampling unit was the class, so the number of classes enrolled depended on class size. Classes were randomly selected within the schools. Sample selection is shown in table 1.

Table 1. Sample distribution

Province	Selected schools	Average class size	Selected classes in each of the three academic year
Zhejiang	2 urban, 2 rural	40	3
Henan	1 urban, 2 rural	75	2
Chongqing	1 urban, 3 rural	50	2

2.2 Measures

We designed a self-completion questionnaire which drew on questions from previous research in China and other countries (Fahy et al., 2016; Låftman et al., 2013; Li et al., 2019; Z. K. Zhou et al., 2013). The draft questionnaire was then piloted among 30 children from the target age group, who were also asked to provide specific feedback about clarity, appropriateness, and any omissions. The final questionnaire had four parts:

(1) Sociodemographic and background information comprised: gender, age, grade, location of school (urban or rural), boarding status (yes or no), household composition (both parents, one parent, neither parent), family economy status

(retrieved from school records and then categorised into three levels-good, fair, poor), parents' occupations, assessment of relationship with mother and father (good, fair, poor), academic performance (top 20%, medium 60%, bottom 20%) self-reported by the participants (very frequent testing means that children are very well aware of their school performance. Test results with class rankings are publicised).

(2) Internet use (Z. K. Zhou et al., 2013): ownership of internet-connected devices (yes or no), main device of internet use (smartphone, computer, tablet), duration of playing online per day on weekdays (<1h, 1-2h, ≥3h), and at weekends (<1h, 1-2h, ≥3h), preferences of playing online (communication, watching video, playing games, browsing internet shops).

(3) Traditional bullying: 1) In the past year, have you ever been bullied (e.g., physical bullying, verbal bullying, exclusion, threats) in school? 2) In the past year, have you bullied others (e.g., physical bullying, verbal bullying, exclusion, threats) in school? Response options were yes, no, don't know.

(4) Cyberbullying: 1) teasing/insulting, 2) online spread of rumours, 3) exposure of private information, 4) exclusion from online groups, 5) online threats, as perpetrator or victim in the last year (Fahy et al., 2016; Låftman et al., 2013; Li et al., 2019). In the present study, the Cronbach alpha reliability coefficient for the five items of cyber victims was 0.76, and for the five items of cyber perpetrators, 0.77. The responses created four categories of cyberbullying: 1) "only-bully" for those giving positive responses to bullying question but not victimisation questions, 2) "only-victim" for those giving positive responses to victimisation but not bullying, 3) "bully-victim" giving positive responses to bullying and victimisation, 4) "not involved" negative responses to both.

(4) Psychosocial symptoms: questions asked about feelings in the last year: 1) sad or down, 2) depressed (no energy or motivation), 3) anxious (Låftman et al., 2013; Li et al., 2019). Psychosomatic questions included 1) headaches, 2) abdominal

pain, 3) sleep problems in the last year. The response options were: never, rarely, sometimes, often, always.

2.3 Procedure

First, we contacted the headteachers of 16 middle schools, eight urban and eight rural, all of whom we had previously collaborated with on other research. We explained the purpose and content of the survey. Eleven schools agreed to participate, including four urban and seven rural schools as shown in Table 1. The reasons given for refusal were inability to create time in the curriculum for a survey and not being “interested” in this research. Second, a letter was sent to the students' parents or caregivers, explaining the investigation and requesting their written consent for their children's participation in the study. Third, research assistants underwent two 2-hour training sessions about the content of the questionnaire and how to deal with students' queries and difficulties, so that they were comfortable and competent to conduct the survey in the school setting. Paper questionnaires were administered in the classroom. Research assistants explained the purpose and content of the survey to students and answered queries. Students' participation was voluntary and all data was anonymous. Questionnaire completion took up to 30 minutes. The survey was conducted from May to September, 2018. Ethical approval was obtained from the Ethics Committee of Zhejiang University School of Public Health (protocol number ZGL201803-2).

2.4 Statistical analyses

Data analysis was performed with SPSS 24.0. First, we generated descriptive statistics on the sociodemographic information, internet use, cyberbullying involvement, and psychosocial wellbeing. Second, we used Pearson's chi-square tests to examine the associations between psychosocial wellbeing and sociodemographic characteristics, internet use and bullying variables. Cramer's V was used to show the effect size. Third, we carried out logistic regression to identify

independent predictors of psychosocial and psychosomatic wellbeing while adjusting for confounders. The psychosocial (sad/depressed/anxious) and psychosomatic (headache/abdominal pain/sleep problems) symptoms are all ordinal categorical variables. “Cyberbullying involvement” is an unordered categorical variable with four classifications. To examine the association between psychosocial, psychosomatic symptoms and cyberbullying involvement/duration of playing online, ordinal logistic regression was conducted controlling for key variables. If the test of parallel lines ($p > 0.05$) in the ordinal logistic regression was not satisfied, multinomial logistic regression was used.

3 Results

3.1 Sociodemographic and background information of participants (Table 2)

We distributed 3990 questionnaires, and 3842 were received. In total, 464 questionnaires were excluded mainly for missing key variables and obvious erroneous responses, such as contradictory responses to similar questions. The final sample of 3378 adolescents represented an overall response rate of 85%. The sample comprised 1226 (36.3%) respondents from Zhejiang province, 1132 (33.5%) from Henan province, and 1020 (30.2%) from Chongqing.

There were some major differences between urban and rural children: 77% of rural children boarded at schools during weekdays, compared with 13% of urban children; 10% of rural children reported poor family economic status, compared with 3.5% of urban children; only 50% of rural children lived with both their parents (mainly because one or both parents had migrated for work), compared with 83% of urban children.

Table 2. Sociodemographic and background information of participants n (%)

	Total (3378)	Urban (1293)	Rural (2069)	χ^2	Cramer's V	P
Gender						
Male	1749(52)	674(52.1)	1075(52)	0.009	0.002	0.924

Female	1613(48)	619(47.9)	994(48)			
Age (mean=13.58, SD=0.87)						
11-13	1603(48.1)	698(54.3)	905(44.3)	31.6	0.097	< 0.001
14-16	1727(51.9)	588(45.7)	1139(55.7)			
Province						
Zhejiang	1226(36.3)	700(54)	526(25.3)	351.5	0.323	< 0.001
Henan	1132(33.5)	405(31.3)	727(34.9)			
Chongqing	1020(30.2)	191(14.7)	829(39.8)			
Boarding						
Yes	1740(52.3)	168(13.1)	1572(77.1)	1298.5	0.625	< 0.001
No	1585(47.7)	1119(86.9)	466(22.9)			
Family economic status						
Poor	219(7.4)	44(3.5)	175(10.3)	232.9	0.28	< 0.001
Average	2245(76.2)	857(68.7)	1388(81.7)			
Rich	481(16.3)	346(27.7)	135(8)			
Academic performance						
Top 20%	930(28.7)	404(32.4)	526(26.3)	14.6	0.067	0.001
Medium	1761(54.3)	647(52)	1114(55.7)			
Bottom 20%	553(17)	194(15.6)	359(18)			
Household composition						
Both parents	2117(62.7)	1080(83.3)	1037(49.8)	407.8	0.347	< 0.001
One parent	737(21.8)	168(13)	569(27.3)			
Neither parent	524(15.5)	48(3.7)	476(22.9)			
Relationship with mother						
Good	2100(71.4)	920(73.8)	1180(69.7)	18.87	0.08	< 0.001
Average	686(23.3)	286(23)	400(23.6)			
Poor	154(5.2)	40(3.2)	114(6.7)			
Relationship with father						
Good	1927(65.9)	831(66.9)	1096(65.1)	1.46	0.02	0.483
average	801(27.4)	334(26.9)	467(27.7)			
poor	197(6.7)	77(6.2)	120(7.1)			

3.2 Internet use among respondents (Table 3)

Of the total, 3169 (94%) used the Internet, and 2807 (83.4%) had their own internet-connected devices, with smartphone used by 85%, computers by 33%, and tablets by 13%. The results below exclude the use of the internet for study and homework. On weekdays, 12.5% of rural children and 7.6% of urban children spent at least 3 hours online per day. At weekends, 57% of rural children and 36% of urban

children did so. Most common types of internet use were: 2750 (83%), for communication, 1913 (57%), for watching video, and 1777(53%), for playing games. There were gender differences: males spent more time playing online games, while females were more likely to browse internet shops. The difference between males and females on the preference for online social communication was minor.

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Table 3. Internet use among respondents n (%)

	Total (3378)	Urban (1293)	Rural (2069)	χ^2	Cramer's V	P	Male (1739)	Female (1607)	χ^2	Cramer's V	P
Have your own internet-connected device											
Yes	2807(83.4)	1074(82.9)	1733(83.6)	0.285	0.009	0.593	1451(83.3)	1341(83.3)	0.001	0.001	0.97
No	560(16.6)	221(17.1)	339(16.4)				291(16.7)	268(16.7)			
Use internet											
Yes	3169(93.8)	1216(94)	1953(94.4)	0.002	0.001	0.962	1636(93.6)	1517(94.2)	0.58	0.013	0.446
No	205(6.1)	79(6.0)	126(6.1)				112(6.4)	93(5.8)			
Devices for using internet (multiple choices)											
Smartphone	2863(84.8)	1053(81.3)	1810(87)	20.2	0.077	<0.001	1431(81.9)	1416(87.9)	23.6	0.084	<0.001
Computer	1116(33)	494(38.1)	622(29.9)	25.03	0.086	<0.001	694(39.7)	415(25.8)	74.57	0.15	<0.001
Tablet	437(12.9)	293(22.6)	144(6.9)	175.1	0.23	<0.001	230(13.2)	206(12.8)	1.18	0.02	0.553
Duration of playing online per day on weekday											
<1h	2447(72.9)	959(74.2)	1488(72.1)	22.97	0.08	<0.001	1249(71.9)	1188(74.1)	4.84	0.04	0.089
1-2 h	553(16.5)	236(18.3)	317(15.4)				286(16.5)	265(16.5)			
\geq 3h	357(10.6)	98(7.6)	259(12.5)				203(11.7)	150(9.4)			
Duration of playing online per day on weekend											
<1h	61 (18.4)	314 (24.3)	302 (14.7)	141.2	0.2	<0.001	301(17.4)	314(19.5)	9.86	0.054	0.007
1-2 h	1088 (32.4)	509 (39.3)	579 (28.1)				534(30.8)	548(34.1)			
\geq 3h	1651 (49.2)	471 (36.4)	1180 (57.3)				897(51.8)	745(46.4)			
Preferences of online use											
Communication	2750(82.6)	1046(81.5)	1731(83.3)	1.66	0.02	0.198	1413(81.3)	1348(83.9)	4.003	0.035	0.045

Watching video	1913(56.9)	739(57.6)	1174(56.5)	0.413	0.01	0.52	1026(59)	880(54.8)	6.122	0.043	0.013
Playing games	1777(52.9)	651(50.7)	1126(54.2)	3.724	0.033	0.054	1281(73.7)	489(30.4)	626.55	0.43	<0.001
Browsing internet shops	695(20.7)	249(19.4)	446(21.5)	2.023	0.025	0.155	241(13.9)	451(28.1)	102.75	0.175	<0.001

3.3 Prevalence of cyberbullying among respondents (Table 4)

Overall 1268 (37.5%) reported that they were involved in cyberbullying, including only bully, 145 (4.3%), only victim, 689 (20.4%), and bully-victim, 434 (12.8%). Male students were 2.6 times more likely to report as only bullies and 2.2 times as bully-victims. Students spending ≥ 3 hours/day playing online at weekends were 3.9 times more likely to report as only bullies, 1.6 times as only victims and 4.7 times as bully-victims. Students reporting a poor relationship with mother were 4.1 times more likely to report as only bullies, 1.8 times as only victims and 2.7 times as bully-victims. Students reporting a poor relationship with father were 3 times more likely to report as only bullies, 2 times as only victims and 3.3 times as bully-victims.

Table 4. Cyberbullying and its associations

	Only bully (145)			Only victim (689)			Bully-victim (434)		
	N (%)	Crude OR (95%CI)	<i>p</i>	N (%)	Crude OR (95%CI)	<i>p</i>	N (%)	Crude OR (95%CI)	<i>p</i>
Gender									
Male (1749)	101(5.8)	2.6 (1.8-3.7)	<0.001	363(20.8)	1.25 (1.1-1.5)	0.012	285(16.3)	2.2 (1.8-2.7)	<0.001
Female (1613)	43(2.7)	1.0		321(19.9)	1.0		144(8.9)	1.0	
Area									
Rural (2082)	94(4.5)	1.3 (0.9-1.9)	0.118	476(22.9)	1.6 (1.3-1.9)	<0.001	284(13.6)	1.4 (1.1-1.7)	0.005
Urban (1296)	51(3.9)	1.0		213(16.4)	1.0		150(11.6)	1.0	
Boarding									
Yes (1740)	81(4.7)	1.5 (1.0-2.0)	0.033	412(23.7)	1.7 (1.4-2.1)	<0.001	262(15.1)	1.8 (1.4-2.2)	<0.001
No (1585)	62(3.9)	1.0		266(16.8)	1.0		163(10.3)	1.0	
Duration of playing online per day on weekday									
≥ 3 h	27(7.6)	3.1 (1.9-4.9)	<0.001	88(24.6)	1.7 (1.3-2.3)	<0.001	71(19.9)	2.4 (1.8-3.3)	<0.001
1-2h	35(6.3)	2.1	<0.001	112(20.3)	1.2	0.209	85(15.4)	1.6	0.001

		(1.4-3.2)			(0.9-1.5)			(1.2-2.0)	
<1h	83(3.4)	1.0		482(19.7)	1.0		273(11.2)	1.0	
Duration of playing online per day at weekend									
>=3h	92(5.6)	3.9	<0.001	347(21)	1.6	<0.001	315(19.1)	4.7	<0.001
		(2.1-7.2)			(1.3-2.0)			(3.3-6.9)	
1-2h	38(3.5)	2.0	0.047	225(20.7)	1.2	0.088	80(7.4)	1.5	0.081
		(1.0-3.8)			(1.0-1.6)			(1.0-2.2)	
<1h	12(1.9)	1.0		111(18)	1.0		34(5.5)	1.0	
Relationship with mother									
Poor	16(10.4)	4.1	<0.001	37(24)	1.8	0.005	30(19.5)	2.7	<0.001
	(154)	(2.3-7.4)			(1.2-2.7)			(1.7-4.3)	
Average	32(4.7)	1.6	0.026	158(23)	1.5	<0.001	138(20.1)	2.5	<0.001
	(686)	(1.1-2.5)			(1.2-1.9)			(2.0-3.2)	
Good	77(3.7)	1.0		403(19.2)	1.0		217(10.3)	1.0	
	(2100)								
Relationship with father									
Poor	16(8.1)	3.0	<0.001	46(23.4)	2.0	<0.001	46(23.4)	3.3	<0.001
	(197)	(1.7-5.4)			(1.3-2.8)			(2.3-4.9)	
Average	31(3.9)	1.2	0.402	200(25)	1.7	<0.001	134(16.7)	2.0	<0.001
	(801)	(0.8-1.9)			(1.4-2.1)			(1.5-2.5)	
Good	77(4)	1.0		345(17.9)	1.0		203(10.5)	1.0	
	(1927)								

3.4 Psychosocial and psychosomatic wellbeing (Table 5)

Of the total, 828 (25%) reported they often or always felt sad or down, 594 (18%) often or always felt depressed, 408 (12.5%) anxious in the last year. In terms of psychosomatic symptoms, 437 (13%) reported they often or always had headache, 549 (16.6%) abdominal pain, 533 (16%) sleep problems in the last year. Table 5 reports the prevalence of sadness, depression, anxiety, headache, abdominal pain and sleep problems by gender, area and boarding status. Overall, females were more likely to report all the symptoms. No significant difference was found between urban and rural students for sadness, depression and anxiety, but urban students were more likely to report psychosomatic symptoms- headache, abdominal pain and sleep problems. Boarders were more likely to report sadness, depression, anxiety and sleep problems.

Table 5. Prevalence of psychosocial and psychosomatic symptoms among respondents N (%)

	Total (3311)	Gender				Area					Boarding status					
		Female (1583)	Male (1707)	χ^2	Cramer's V	<i>p</i>	Urban (1251)	Rural (2055)	χ^2	Cramer's V	<i>p</i>	Yes (1714)	No (1539)	χ^2	Cramer's V	<i>p</i>
Sad				131.7	0.2	<0.001			2.68	0.03	0.262			28	0.09	<0.001
Never/rarely	1208(36.5)	442(27.9)	763(44.7)				477(38.1)	731(35.6)				554(32.3)	631(41)			
Sometimes	1270(38.4)	628(39.7)	635(37.2)				461(36.9)	809(39.4)				687(40.1)	563(36.6)			
Often/always	828(25)	513(32.4)	309(18.1)				313(25)	515(25.1)				473(27.6)	345(22.4)			
Depressed				11.2	0.06	0.004			0.41	0.01	0.816			9.78	0.055	0.008
Never/ rarely	1764(53.5)	798(50.5)	959(56.3)				664(53.1)	1100(53.7)				876(51.2)	855(55.7)			
Sometimes	942(28.5)	476(30.1)	462(27.1)				355(28.4)	587(28.6)				495(28.9)	434(28.3)			
Often/always	594(18)	306(19.4)	283(16.6)				232(18.5)	362(17.7)				341(19.9)	247(16.1)			
Anxious				132.2	0.2	<0.001			0.23	0.008	0.892			10.6	0.057	0.005
Never/ rarely	2042(62.3)	819(52.3)	1215(71.7)				780(62.8)	1262(62)				1010(59.6)	994(65.1)			

Sometimes	827(25.2)	494(31.5)	329(19.4)				308(24.8)	519(25.5)				456(26.9)	363(23.8)		
Often/always	408(12.5)	254(16.2)	150(8.9)				155(12.5)	253(12.4)				230(13.6)	171(11.2)		
Headache				39.6	0.11	<0.001			16.57	0.07	< 0.001		1.98	0.025	0.372
Never/ rarely	1700(51.3)	737(46.5)	956(55.9)				636(50.6)	1064(51.8)				868(50.6)	802(52)		
Sometimes	1174(35.5)	589(37.2)	578(33.8)				417(33.2)	757(36.8)				628(36.6)	529(34.3)		
Often/always	437(13.2)	259(16.3)	176(10.3)				203(16.2)	234(11.4)				220(12.8)	211(13.7)		
Abdominal pain				120.4	0.19	<0.001			9.22	0.05	0.01		0.16	0.007	0.924
Never/ rarely	1753(53.1)	695(44)	1049(61.5)				637(50.8)	1116(54.5)				904(52.8)	817(53.1)		
Sometimes	1001(30.3)	530(33.5)	467(27.4)				378(30.1)	623(30.4)				516(30.2)	469(30.5)		
Often/always	549(16.6)	355(22.5)	191(11.2)				239(19.1)	310(15.1)				291(17)	254(16.5)		
Sleep problems				15.5	0.07	<0.001			7.55	0.05	0.023		25.32	0.09	<0.001
Never/ rarely	2006(60.6)	906(57.3)	1092(63.9)				779(62.1)	1227(59.7)				971(56.5)	1002(65.1)		
Sometimes	769(23.2)	406(25.7)	359(21)				260(20.7)	509(24.8)				441(25.7)	317(20.6)		
Often/always	533(16.1)	270(17.1)	259(15.1)				215(17.1)	318(15.5)				306(17.8)	219(14.2)		

3.5 Impacts of duration of internet use and cyberbullying on wellbeing of Chinese adolescents (Table 6)

Table 6 shows the adjusted ORs for duration of internet use and cyberbullying on mental and psychosomatic wellbeing of the respondents, while adjusting for gender, area (urban/rural), boarding status, relationship with mother, and relationship with father. After adjustment spending ≥ 3 hours/day playing online [OR = 1.6, 95% CI (1.3, 1.9), $p < 0.001$], bully-victims [OR = 2.5, 95% CI (2.0, 3.1), $p < 0.001$], only-victims [OR = 2.1, 95% CI (1.8, 2.5), $p < 0.001$] was significantly associated with an increased risk of sadness. Spending ≥ 3 hours/day playing online [OR = 2.1, 95% CI (1.7, 2.6), $p < 0.001$], only-bullies [OR = 1.6, 95% CI (1.1, 2.3), $p = 0.01$], bully-victims [OR = 2.1, 95% CI (1.7, 2.6), $p < 0.001$], only-victims [OR = 1.9, 95% CI (1.6, 2.3), $p < 0.001$] was significantly associated with an increased risk of depression. Spending ≥ 3 hours/day playing online [OR = 1.6, 95% CI (1.1, 2.2), $p = 0.006$], bully-victims [OR = 1.7, 95% CI (1.2, 2.4), $p = 0.005$], only-victims [OR = 2.1, 95% CI (1.6, 2.8), $p < 0.001$] was significantly associated with an increased risk of anxiety. Spending ≥ 3 hours/day playing online [OR = 2.2, 95% CI (1.6, 3.0), $p < 0.001$], bully-victims [OR = 2.1, 95% CI (1.5, 3.0), $p < 0.001$], only-victims [OR = 2.0, 95% CI (1.5, 2.7), $p < 0.001$] was significantly associated with an increased risk of headache. Spending ≥ 3 hours/day playing online [OR = 2.4, 95% CI (1.8, 3.3), $p < 0.001$], only-bullies [OR = 1.6, 95% CI (1.1, 2.3), $p = 0.007$], bully-victims [OR = 1.7, 95% CI (1.4, 2.2), $p < 0.001$], only-victims [OR = 1.5, 95% CI (1.2, 1.8), $p < 0.001$] was significantly associated with an increased risk of abdominal pain. Spending ≥ 3 hours/day playing online [OR = 1.9, 95% CI (1.4, 2.6), $p < 0.001$], bully-victims [OR = 2.2, 95% CI (1.6, 3.0), $p < 0.001$], only-victims [OR = 1.7, 95% CI (1.3, 2.2), $p < 0.001$] was significantly associated with an increased risk of sleep problems. Bully-victims and only-victims consistently showed higher risks of

sadness, depression, anxiety, headache, abdominal pain, and sleep problems than only-bullies.

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Table 6. Adjusted ORs for association between duration of playing online, cyberbullying and mental, psychosomatic wellbeing

Sad/down(often/always) (828)		Depressed(often/always) (594)		Anxious(often/always) (408)		Headache(often/always) (385)		Abdominal pain (often/always) (497)		Sleep problems (often/always) (481)		
Adjusted OR (95%CI)	<i>P</i>	Adjusted OR (95%CI)	<i>P</i>	Adjusted OR (95%CI)	<i>P</i>	Adjusted OR (95%CI)	<i>P</i>	Adjusted OR (95%CI)	<i>P</i>	Adjusted OR (95%CI)	<i>P</i>	
Duration of playing online per day on weekend												
>=3h (1618)	1.6(1.3-1.9)	<0.001	2.1(1.7-2.6)	<0.001	1.6(1.1-2.2)	0.006	2.2(1.6-3.0)	<0.001	2.4(1.8-3.3)	<0.001	1.9(1.4-2.6)	<0.001
1-2h (1064)	1.03(0.85-1.26)	0.74	1.2(0.99-1.5)	0.068	0.88(0.6-1.3)	0.482	1.04(0.73-1.5)	0.839	1.2(0.86-1.7)	0.282	1.2(0.9-1.7)	0.225
<1h (601)	Ref		Ref		Ref		Ref		Ref		Ref	
Cyberbullying involvement												
Only bully (143)	1.4(0.98-2.0)	0.065	1.6(1.1-2.3)	0.01	1.1(0.6-2.0)	0.753	1.4(0.8-2.5)	0.23	1.6(1.1-2.3)	0.007	1.6(0.96-2.5)	0.074
Bully-victim (428)	2.5(2.0-3.1)	<0.001	2.1(1.7-2.6)	<0.001	1.7(1.2-2.4)	0.005	2.1(1.5-3.0)	<0.001	1.7(1.4-2.2)	<0.001	2.2(1.6-3.0)	<0.001
Only victim (673)	2.1(1.8-2.5)	<0.001	1.9(1.6-2.3)	<0.001	2.1(1.6-2.8)	<0.001	2.0(1.5-2.7)	<0.001	1.5(1.2-1.8)	<0.001	1.7(1.3-2.2)	<0.001
No (2062)	Ref		Ref		Ref		Ref		Ref		Ref	

Ref=reference category

Adjusting for gender, residence, boarding status, relationship with mother, relationship with father.

4 Discussion

To our knowledge, this is the first study exploring the impacts of both internet use for entertainment and cyberbullying on psychosocial and psychosomatic wellbeing among middle school students in mainland China. This study makes a contribution to the emerging literature: 1) Boys were much more likely to play online games and moderate levels of videogaming may actually contribute to well-being. 2) Cyberbullying is common: 37.5% of the respondents admitted involvement. 3) Internet use of over 3 hours per day was associated with various mental and psychosomatic health problems. 4) Bully-victims were most vulnerable to mental and psychosomatic health problems, followed by only-victims, and only-bullies were the least vulnerable group.

4.1 Internet use for entertainment among respondents

Almost all the respondents used the internet for activities other than study, and 85% of students used the internet through smartphones. These adolescents played online mainly for social communication, playing games, and watching videos. There were gender differences in the preferences: boys spent more hours playing online and were much more likely to play online games, consistent with studies among Indian and Australian adolescents (Kumar et al., 2019; Thomas & Martin, 2010). Girls were more likely to browse online shopping websites and use social communication networks in their leisure time. High internet use occurred mostly at weekends; few students used internet on weekdays because schools have rules restricting children's internet use, with students often forbidden from bringing smartphones or other internet-connected devices into school. Access to online learning materials comes through teachers sharing content on a monitor through one laptop.

There was no difference between urban and rural children in access to internet or online devices, mostly smartphones, but rural children spent more time online. This may be because many rural children were not living with parents and their activities were less likely to be monitored. There is also evidence that urban parents were more

aware of the negative effects of excessive internet use, and so were more likely to control its use (Bartau-Rojas, Aierbe-Barandiaran, & Oregui-González, 2018; Sorbring, 2014).

4.2 Risk factors for cyberbullying

In our study, about 37.5% of the respondents were involved in cyberbullying, with male students more likely to be involved. This finding is in line with other studies in Chinese societies including Taiwan, Hong Kong and mainland China (Chang et al., 2014; Wong, Chan, & Cheng, 2014; Z. K. Zhou et al., 2013). In contrast, studies among adolescents in other countries such as the US and Sweden reported few gender differences for cyberbullying (Slonje & Smith, 2008; Williams & Guerra, 2007). We found students who spent more time playing online were more likely to be involved in cyberbullying, which is consistent with previous studies from central China, Canada and Spain (Mishna, Khoury-Kassabri, Gadalla, & Daciuk, 2012; Navarro, Serna, Martínez, & Ruiz-Oliva, 2013; Z. K. Zhou et al., 2013).

Our findings also suggested that poor relationships with parents are associated with involvement in cyberbullying. This is consistent with previous studies in Taiwan and UK, which reported that difficulties with parental relationships predicted conduct problems, including cyberbullying (Chang et al., 2014; Oldfield, Humphrey, & Hebron, 2016). It has been shown that effective parent-child communication, help and support from parents, and positive family atmosphere are critical in fostering adolescents' healthy psychosocial wellbeing, including empathic and positive behaviours, which reduces their engagement in cyberbullying (Chan & Wong, 2015).

4.3 Associations with mental and psychosomatic wellbeing

We found an association between spending ≥ 3 hours/day playing online and a higher frequency of reported sadness, depression, anxiety, headache, abdominal pain, and sleep problems. This is consistent with previous studies (Bélanger, Akre, Berchtold, & Michaud, 2011). A study among adolescents aged 11 to 16 years in Anhui province suggested that high screen time (> 2 hours a day) was a risk factor for

depression and anxiety (Cao et al., 2011). A meta-analysis reported the dose–response association of screen time and depression in children and adolescents (M. Liu, Wu, & Yao, 2016). It suggested screen time of > 2h/day is associated with a higher risk of depression, less use with a lower risk, and with the lowest risk being 1 h/day, so a J-shaped relationship. A study among Swiss 16 to 20 year olds showed a U-shaped relationship between intensity of internet use and poorer mental health: with use of 1 to 2 hours/day associated with lowest depression scores, while internet use of over 2 hours/day, and less than 1 hour/week associated with higher depression scores (Bélanger et al., 2011).

We found a number of differences between the sexes. Boys spent more time playing online, but reported fewer mental and psychosomatic symptoms than girls. Boys were much more likely to play online games, 74% compared with 30% of girls. A 2020 study suggested that experiences of competence and social connection with others through playing video games may contribute to people’s well-being (Przybylski, 2020). Besides, those who derived enjoyment from playing were more likely to report experiencing positive well-being. A review concluded that moderate levels of videogame play can have a positive influence on well-being, with improved emotional regulation, and stress reduction (Jones, Scholes, Johnson, Katsikitis, & Carras, 2014). It also suggested moderate videogame play has been associated with better outcomes than either excessive play or a lack of play.

Compared to students not reporting cyberbullying, bully-victims were around twice as likely to report mental and psychosomatic symptoms including sadness, depression, anxiety, headache, abdominal pain and sleep problems. Only-victims were 1.5-2.1 times more likely to report these six symptoms, while only-bullies were associated with two of them—depression and abdominal pain by 1.6 times respectively. Bully-victims were more vulnerable to mental and psychosomatic symptoms than only-victims. One explanation is that victims with poorer mental health are more likely to respond to victimization by bullying others (Gámez-Guadix, Orue, Smith, &

Calvete, 2013). A study among Finnish adolescents aged 13 to 16 years reported cyber only-victims and bully-victims are more likely to report psychiatric and psychosomatic problems, including headache, recurrent abdominal pain, and sleeping difficulties (Sourander A, 2010). It also suggested that cyber bully-victims are the most troubled group.

Only-bullies are the least vulnerable group to mental and psychosomatic symptoms. A longitudinal study of cyberbullying among adolescents in UK suggested that only-victims and bully-victims were significantly more likely to report depression and social anxiety symptoms than only bullies or uninvolved peers (Fahy et al., 2016). Cyber bullies can remain anonymous and distant, and are less likely to observe the immediate consequences of their behaviours. This may explain why cyber bullies were less prone to internalizing symptoms, which may be attributable to online disinhibition effects and reduced empathy (Steffgen, König, Pfetsch, & Melzer, 2011). A study among Australian adolescents also reported cyber bullies didn't think their bullying was cruel or that it had an impact on the victims (Campbell et al., 2013).

Several limitations should be mentioned when interpreting the findings. First, the use of self-report is likely to lead to social desirability bias, with possible under-reporting, especially of bullying, given its highly sensitive nature. Second, the study design was cross-sectional, and reverse causation is possible that depressed or anxious children are more likely to spend longer on the internet. Third, there were only two questions about duration of playing online, and only four online activities in this survey. Future studies should include more details on length of time spent on a wider range of activities. Finally, the leisure time internet use and cyberbullying prevalence may be correlated within the same class or school, and analysis could have been expanded to take into account this clustering using a hierarchical model.

5. Conclusions

Our findings suggest that 1) Boys were much more likely to play online games and moderate levels of videogaming are not detrimental to well-being, but spending more than 3 hours per day playing online was associated with various mental and psychosomatic health problems. 2) Cyberbullying is common: 37.5% of the respondents admitted involvement. 3) Bully-victims were most vulnerable to mental and psychosomatic health problems, followed by only-victims, and only-bullies were the least vulnerable group. There are clear implications.

Moderate videogame play should be allowed for adolescents aged 11-16 year olds. Children and adolescents should be encouraged to use the internet moderately, report inappropriate or offensive behaviour, block cyberbullies. The current strict restriction on adolescents' access to online games to one hour per day only on weekends or holidays should be reconsidered, since moderate use of videogames may not be harmful for adolescents, and maybe beneficial (Adachi & Willoughby, 2015).

Schools should promote responsible use of the internet through teaching students to behave online in an ethical and respectful way, and protect their own privacy ("Digital citizenship: teens being responsible online," 2021). A 2021 study among Chinese 12-16 year olds reported that schools do not provide education about cyberbullying (Li & Hesketh, 2021). Education authorities should require schools to pay attention to cyberbullying, as well as school bullying, as well as the adverse impacts on children's well-being. Incorporating an understanding of empathy into anti-cyberbullying programmes has been shown to reduce incidence of cyberbullying (Steffgen et al., 2011). In fact empathy can be taught through programmes such as Social Emotional Learning, which has been shown to help children understand their emotions and improve their interactions with others. Social and Emotional Learning has been adopted in several countries such as U.S, the UK, Singapore and Brazil to help students acquire the skills and knowledge to manage themselves and their relationships effectively and improve personal and social well-being ("Collaborative for Academic, Social, and Emotional Learning (CASEL)," 1994; Jayman, Ohl,

Hughes, & Fox, 2019; Ong et al., 2021; Silva et al., 2018). This could be adapted for China.

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- Boys play online games more and moderate videogaming was beneficial to well-being.
- Internet use of over 3 hours per day was associated with psychosocial symptoms.
- Cyberbullying is common: 37.5% of the respondents admitted involvement.
- Bully-victims were most vulnerable to psychosocial and psychosomatic symptoms.
- Only-bullies were the least vulnerable to psychosocial and psychosomatic symptoms.

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