

Epidemiology of Pathological Online Games Use and Its Effect on Anxiety and Insomnia in Chinese Ethnic Minorities Adolescents

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Abstract

Background: The growing popularity and frequency of online games use has resulted in a large number of studies reporting various mental problems associated with its abuse in adolescents. In this article, we examined the prevalence of pathological online games use (POGU) and explored the associations of the POGU with anxiety and insomnia symptoms with minority youth in China.

Methods: 1494 students completed a questionnaire of Problematic Online Gaming Questionnaire Short-Form (POGQ-SF), Generalized Anxiety Condition items (GAD-7), and the Athens Insomnia Scale (AIS). Chi-square and binary logistic regression analysis were used to explore the association between pathological online games and anxiety/insomnia.

Results: 356 (23.83%) respondents reported they had pathological online games use. Chi-square analysis shows that gender, grade, marital status of parents and exercise situation were significantly associated with POGU. Binary logistic regression analysis showed that those who had POGU were at significantly higher risk for anxiety and insomnia, compared to those who without POGU.

Conclusion: We found a high incidence of POGU and a positive association among anxiety, insomnia and POGU. Thus, special focus should be paid to those who have suffered POGU. And, it is worth addressing the adverse effects of POGU on anxiety and insomnia.

Background

For adolescents, online gaming has become a centrally important sociocultural practice[1]. Despite the positive cognition functions of gaming[2], most scholars agree that it is potentially harmful to pathologically use the video games, causing adolescents negative consequences[3]. Recently, the World Health Organization (WHO) included gaming disorder in their International Classification of Diseases (ICD-11)[4]. Gaming disorder (GD) is defined as a pattern of gaming behavior ("digital gaming" or "video gaming") characterized by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences[5]. GD shares similarities with internet gaming disorder (IGD), which the American Psychiatric Association (APA) labeled as a condition requiring further studies in their Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013). In a word, there's a lot of similar statement to interpret the adverse consequences of gaming, such as Internet addiction[6], Internet addiction disorder[7], smartphone addiction[8], problematic online game use or gaming[9, 10], and Internet game addiction[11]. Due to there are many terms to describe a similar phenomenon, we prefer to use the term Problematic Online Gaming Use (POGU). The prevalence of POGU in adolescents has been reported between 0.6% and 19.9% in recent meta-analysis[12]. Studies have reported that young age and male gender are risk factors for POGU[13]. Furthermore, adolescents exposed to unstably parental relation and parental absence which means low family function or left behind children are more vulnerable to POGU[14–17]. Similarly, status as an only child is more likely to report POGU than others[18, 19]. A recent meta-analysis has reported that, POGU is positively correlated with many physical health-related effects, such as somatisation, hand and wrist pain, decreased levels of physical activity, cardiovascular stress reaction, and sleep problems[20]. These harmful influences will interfere daily life activities[21]. Additionally, POGU behaviors can result in a series of negative psychosocial repercussions including cognitive functions (e.g., memory, attention), socializing, depression, anxiety, and other addictions[22–26]. Furthermore, chronic physical illness has been found to be associated with an increased risk of mental health problems[27], it is particularly significant to study the psychological problems related to POGU. So, the past few decade has seen increased research interest into POGU, and a number of research teams have made substantial efforts to define the prevalence of POGU and related mental problem[28]. However, few prior studies have examined the effects on anxiety and insomnia among Chinese ethnic minorities adolescents. Therefore, it is crucial to evaluate the influence on ethnic minorities adolescents.

One of the most common mental disorders during adolescence, anxiety's prevalence is increasing in adult populations[29]. Anxiety may be amplified by this reduction in real-world confidence, creating negative emotional states that impede real-life social interactions and task completion[30]. One study has found that, the degree of addictive video game use has been found to be related to anxiety disorders[31]. Furthermore, potential factors of anxiety have been identified as well, such as age, gender and parental absence[32–34].

Insomnia problems have become a challenge for adolescents worldwide. Previous studies have found that insomnia starts to emerge during adolescence, with the prevalence ranging from 19.3–40% in the youth population[35, 36]. Adolescent insomnia tends to be chronic, and frequently co-exists with or precedes the onset of psychiatric illnesses[37]. There is a considerable systematic review in 2014 showing that insomnia could lead to a number of negative consequences including daytime impairments, poor academic performance, pain, cardiovascular, cardiometabolic impairments, mental/emotional dysfunction[38]. In addition, POGU, age (≥ 16 years), gender (female) and parental absence also have been considered as risk factors for insomnia[39–41].

A number of studies have investigated the prevalence of pathological online games and explored its relationship to mental and physical issues among adolescents globally, but similar research in Chinese ethnic minorities was left uninvestigated. The primary purpose of this study was to investigate the prevalence of pathological online games in ethnic minorities. The second purpose was to describe the differences of gender, grade,

marital status of parents, exercise situation, whether only child, place of residence and parental absence situation in these POGU groups. The third purpose was to analysis the relationship between POGU and anxiety and insomnia and identify related risk factors.

Methods

Participants

A cross-sectional study was conducted in September 2019 at three schools (two junior highs and a senior high school) in Guangxi, China. 1494 students rolled in this study finally. Inclusion criteria included: 1) aged 12-18 years; 2) from Zhuang nationality; 3) had not a history of mental disorders or severe physical illness. The sample included 764 (48.8%) junior high school students and 730 (51.1%) senior high school students. Among them, 712 (47.6%) are male and 782 (52.3%) are female. The average age of the respondents was 14.9 ± 1.5 years old. All methods were thoroughly explained to each participant. All subjects completed the questionnaire in a classroom during class time and collected it in class. All patients provided written informed consent to the study. This study was conducted following the Declaration of Helsinki and was approved by the Institutional Ethical Committee of Guangxi Medical University (Approval number:20160302-13).

Measurements

Participants' general information

This questionnaire was used to collect basic information regarding age, grade(senior high school/junior high school), gender (male/female), marital status of parents (stable/unstable), place of residence (city/rural), only child (yes/no), parental absence ('Did either of your parents ever leave home before you were 18 years old?' yes/no), exercise situation ('Did you exercised in the past week' yes/no).

Problematic Online Gaming Questionnaire Short-Form(POGQ-SF)

The scale consists of 12 entries, Each entry is scored five points, "1" means "never ", "2" means "very little ", "3" means "occasionally ", "4" means "often ", "5" means "always ", A total of 32 points \geq the scale, as a screening of pathological online games using the player's demarcation value[42]. The application of POGQ-SF has good reliability and validity in china[43] and foreign countries[10].

Generalized Anxiety Condition(GAD-7)

The scale consists of 7 items, which are mainly used as screening tools for anxiety disorders. It can be used to evaluate the severity of anxiety symptoms :0~4 points for no clinical significance of anxiety ,5~9 points mild, 10~14 moderate, more than 15 points severe[44].

Athens Insomnia Scale (AIS)

The AIS was developed by Soldatos and colleagues to assess the severity of insomnia based on the ICD-10 diagnostic criteria. It is a self-reported questionnaire consisting of 8 items; the first 5 items assess difficulty with sleep induction, awakening during the night, early morning awakening, total sleep time, and overall quality of sleep, while the last 3 items pertain to the sense of well-being, overall functioning and sleepiness during the day. The usual time frame for responding is the last month. Each item of AIS can be rated 0-3, with 0 corresponding to no problem at all and 3 to very serious problem. The AIS has been widely used, with an Cronbach's α of 0.90[45].

Results

The prevalence of pathological online games use and general demographic data

Of the 1494 participants, 1138 (76.17%) reported that they had not pathological online games use, and 356 (23.83%) reported they had pathological online games use. Those who had pathological online games use had the highest rate of male (35.67%), followed by those who parental relation is unstable (32.60%) and no exercise(31.64%). Table 1 summarize these results.

Table 1
Demographic characteristics of pathological online games use

pathological online games use				
Variables	Total	Yes	No	χ^2
Gender				105.158***
male	712	458(64.33)	254(35.67)	
female	782	680(86.96)	102(13.04)	
Grade				5.299*
Senior high school	730	575(78.77)	155(21.23)	
junior high school	764	563(73.69)	201(26.31)	
Marital status of parents				
stable	1313	1016(77.38)	297(22.62)	8.723**
unstable	181	122(67.40)	59(32.60)	
Only child				3.155
yes	319	231(72.41)	88(27.59)	
no	1175	907(77.19)	268(22.81)	
Place of residence				0
rural	1122	854(76.11)	267(23.80)	
city	372	284(76.34)	89(23.92)	
Parental absence				3.675
yes	845	628(74.32)	217(25.68)	
no	649	510(78.58)	139(21.42)	
Exercise situation				11.320**
yes	1219	950(77.93)	269(22.07)	
no	275	188(68.36)	87(31.64)	
*p<0.05				
**p<0.01				
***p<0.001				

Single-factor analysis of anxiety/insomnia

In terms of anxiety levels, 762 (51.0%), 499 (33.4%), 147 (9.8%), and 86 (5.7%) respondents displayed no anxiety, mild, moderate, and severe levels of anxiety, respectively. We used the chi-square test to determine differences in anxiety levels among variables. Statistical significance was found among anxiety levels, pathological online games use, gender, and parental absence (Table 2).

Table 2 Differences in anxiety/insomnia status according to variables

	Total	Anxiety				χ^2	Insomnia			χ^2
		No	Mild	Moderate	Severe		No	Suspiciously	Yes	
pathological online games use						52.890 ^{***}				90.861 ^{***}
no	1138	632(55.5)	363(31.8)	95(8.3)	48(4.2)		274(24.0)	481(42.2)	383(33.6)	
yes	356	130(36.5)	136(38.2)	52(14.6)	38(10.6)		27(7.5)	115(32.3)	214(60.1)	
						44.284 ^{***}				15.002 ^{***}
female	782	339(43.3)	287(36.7)	97(12.4)	59(7.5)		129(16.4)	316(40.4)	337(43.0)	
male	712	423(59.4)	212(29.7)	50(7.0)	27(3.7)		172(24.1)	280(39.3)	260(36.5)	
						6.157				17.424 ^{***}
senior high school	764	407(53.2)	233(30.4)	80(10.4)	44(5.7)		177(23.1)	268(35.0)	319(41.7)	
junior high school	730	355(48.6)	266(36.4)	67(9.1)	42(5.7)		124(16.9)	328(44.9)	278(38.0)	
status of parents						6.229				4.542
stable	1313	683(52.0)	430(32.7)	123(9.3)	77(5.8)		273(20.7)	527(40.1)	513(39.0)	
unstable	181	79(43.6)	69(38.1)	24(13.2)	9(4.9)		28(15.4)	69(38.1)	84(46.4)	
parental supervision situation						6.876				4.821
yes	1219	630(51.6)	413(33.8)	110(9.0)	66(5.4)		251(20.5)	497(40.7)	471(38.6)	
no	275	132(48.0)	86(31.2)	37(13.4)	20(7.2)		50(18.1)	99(36.0)	126(45.8)	
parental involvement						6.551				0.432
yes	319	176(55.1)	89(27.8)	31(9.7)	23(7.2)		61(19.1)	126(39.4)	132(41.3)	
no	1175	586(49.8)	410(34.8)	116(9.8)	63(5.3)		240(20.4)	470(40.0)	465(39.5)	
parental residence						4.193				4.565
rural	1122	588(52.4)	361(32.1)	111(9.8)	62(5.5)		240(21.3)	237(38.9)	445(39.6)	
city	372	174(46.7)	138(37.0)	36(9.6)	24(6.4)		61(16.3)	159(42.7)	152(40.8)	
parental absence						8.374 [†]				11.987 [†]
yes	845	411(48.6)	284(33.6)	97(11.4)	53(6.2)		146(17.2)	337(39.8)	362(42.8)	
no	649	351(54.0)	215(33.1)	50(7.7)	33(5.0)		155(23.8)	259(39.9)	235(36.2)	

†

001

In addition, the chi-square test was also used to determine differences in insomnia levels among variables. In terms of insomnia levels, 301(20.1%), 596(39.8%), and 597(39.9%) respondents displayed no insomnia, suspiciously, and insomnia levels of insomnia, respectively. Table 3 demonstrates the results. Statistical significance was found among insomnia levels, pathological online games use, gender, grade, and parental absence (Table 2).

Table 3
Adjusted odds ratios (ORs) for anxiety/insomnia associated with relevant variables and pathological online games use.

variable	Anxiety			Insomnia	
	Mild	Moderate	Severe	suspiciously	Yes
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
pathological online games use					
no	1	1	1	1	1
Yes	2.39(1.783,3.203)***	4.253(2.770,6.532)***	6.929(4.131,11.621)***	2.935(1.858,4.637)***	7.841(5.011,12.271)***
Gender					
male	1	1	1	1	1
female	2.102(1.645,2.686)***	3.461(2.418,5.483)***	4.981(2.932,8.459)***	1.653(1.235,2.212)**	2.623(1.933,3.560)***
Grade					
junior	—	—	—	1	1
Senior	—	—	—	1.625(1.215,2.175)**	1.115(0.825,1.506)
Parental absence					
no	1	1	1	1	1
yes	1.059(0.839,1.335)	1.496(1.025,2.183)*	1.207(0.775,1.930)	1.195(0.896,1.593)	1.454(1.080,1.958)*
*p<0.05					
**p<0.01					
***p<0.001					

Multivariate logistic regression analysis of anxiety/insomnia

To anxiety, chi-square test results of statistically significant variables were included in multivariate logistic regression analysis. The dependent variable was anxiety level, whereas the independent variables were pathological online games use, gender, and parental absence. The normal level of anxiety was used as the reference level. For mild and severe anxiety groups, pathological online games use and gender were positive relation (OR: 2.012-6.929, all $p<0.05$). For moderate anxiety groups, pathological online games use, gender, and parental absence were positive relation (OR: 1.496-4.253, all $p<0.05$). Those who had pathological online games use (OR=1.697, $p<0.001$) were at significantly higher risk for severe anxiety, relative to those who did not have pathological online games use (Table3).

To insomnia, chi-square test results of statistically significant variables were included in multivariate logistic regression analysis. The dependent variable was insomnia level, whereas the independent variables were pathological online games use, gender, grade, and parental absence. The normal level of insomnia was used as the reference level. For suspiciously insomnia groups, pathological online games use, gender and grade were positive relation (OR: 1.625-2.935, all $p<0.05$). For insomnia groups, pathological online games use, gender and parental absence were positive relation (OR: 1.454-7.841, all $p<0.05$). Those who had pathological online games use (OR=7.841, $p<0.001$) were at significantly higher risk for insomnia, relative to those who did not have pathological online games use(Table3).

Discussion

Prevalence and demographic distribution of pathological online games use

Our study found that approximately 24% of Chinese adolescents have pathological online games use. This result seems to be significantly higher than a previous research reported in South Korea, which showed that the rate of Internet addiction in the population was about 20.3% (using IAT) [46]. It also means that the prevalence reveals an increasing trend year by year[47]. One of possible explanations for the assessment tool is different. Exploration is needed when drawing comparisons among different countries and periods of survey due to the complexity of POGU and linguistic differences in addition to the variation of assessment tools and criteria. Although our study areas are the same place, the prevalence varied according to demographics: there was a very high prevalence of Pathological online games use among male which is consistent with past study suggesting that males are at higher risk than females[16, 48]. This suggests that men may be more vulnerable to addiction in general[46]. However, the situation seems to have changed[49]. For instance, in 2020, Arpaci revealed that female undergraduate students had significantly

higher POGU scores than male students[50] and Chung et.al reported that female was at a significantly higher risk of smartphone addiction[51]. And Tang et. al reported that the prevalence of social networking addiction in males and females was 27.8% and 37.3%, respectively[52]. There may be a important reason for this phenomenon that female students mainly use the Internet for social interaction,while male students prefer to use the Internet for online games[53]. In addition,those who reported parental relation are unstable also have a high incidence of POGU. In a unstable family environment which means there is limited time to build a relationship with the children, adolescents may resort to accessing the Internet to relieve the psychological insecurities[54]. Furthermore, adolescents who not do exercise situation is more vulnerable to internet addiction. This is not surprising given that this group lacks face-to face communication and likely stay indoor activities, which makes mobile phones become a more important part of their lives, leading to the occurrence of pathological online games use.

Association between pathological online games use and anxiety

Our study found that POGU was a very strong risk factor for anxiety(whether it is mild, moderate or severe); this result is similar to previous research showing that anxiety symptoms was positively related the severity of POGU[55]. Youth with IA also reported more anxiety symptom[56, 57]. Maladaptive and excessive Internet use may result in or further amplify anxiety symptoms[58]. It is not surprising that higher rates of anxiety are found among POGU users as a result of a perceived and perhaps overwhelming obligation to remain constantly connected to various online games through their phones[59]. Because the Internet and games are ever-present, it may be difficult for some addiction users to disconnect. Additionally, the reason for this finding may be that overuse of Internet can be seen as a rewarding behavior and that it can be employed as an insufficient coping strategy against anxiety by learning mechanisms[60]. And, people who engage in POGU may consequently isolate themselves, and neglect to engage in behavioral activity that is important to psychological health[61]. As a result of such social isolation and decreased behavioral activity, people engaging in POGU may suffer from anxiety symptoms as a consequence. Our finding that female was a risk factor for anxiety was similar with the study that female students were suffered from significantly higher levels of anxiety than male[62]. The anxiety score of any given person is the product of both biological and psychological factors and their interaction[63]. It's not just that female may be more likely to report their symptoms but that the cyclical fluctuations of estrogens enhance the response to stress, which confers susceptibility to depression and anxiety[64]. Another finding is that parental absence was also a risk factor for moderate anxiety. Besides, we think that parental absence may lead to POGU because the absence of parents leads to adolescents lack of control over Internet use, resulting in Internet addiction. As Yen reported, all pathological online games use use behaviors and anxiety are influenced by family interactions and POGU would increase the risk of anxiety[22]. Gerra suggested the possibility that neglected by parents may partially contribute to a complex neurobiological derangement including HPA axis and dopamine system dysfunctions, playing a crucial role in addictive and affective disorders susceptibility. In a word, A variety of evidence have demonstrated that adolescents with parental absence and neglect showed symptoms of anxiety[65].

Association between the pathological online games use and insomnia

We found that POGU led to a higher risk of insomnia. This is consistent with previous study showcasing that the excessive use of Internet has a crucial role in initiating and increasing sleep problems among adolescents[66]. One explanation of this high correlation suggests that the indirect effect of smartphone addiction by poor self-regulation and bedtime procrastination on sleep quality[67]. And a few physiological mechanisms may partly explain this finding. Previous research reported that school-aged children with POGU have higher sympathetic activity and lower parasympathetic activity and overall autonomic activity[68]. Furthermore, acute sleep deprivation was associated with decreased parasympathetic activity[69]. In addition, some technical mechanisms may partly explain this result. The bright light exposure and radiation from the electronic device may suppress the release of melatonin and delay the circadian rhythm[70]. That is, blue light from smartphones may suppress their sleep-promoting hormones (e.g., melatonin)[71]. In addition, exposure to bright light has been associated with the suppression of melatonin secretion and delayed sleep and wakefulness, which can increase consciousness and sleep disturbances[72].

We also found those who were senior high school students with POGU had over a one-fold increase in suspiciously insomnia, compared to those who had not POGU. One explanation of this phenomenon suggests that there is a dramatic change in sleep as a normal developmental process,during adolescence. As adolescents get older, their sleep wake stage tends to delay, sleep time decreases, and sleep architectural changes, such as slow wave sleep and slow wave activity decrease[73]. While the large part of these sleep changes across adolescence are shown to be a consequence of normal brain development in adolescence, more prevalent causes of sleep problems, especially short sleep duration, caused by exogenous reasons.[74]. So, effective early intervention for adolescents with POGU is essential for improving their mental health and solving sleeplessness.

In addition, the present study specifically examined whether the parental absence was risk factors for insomnia in adolescents, and found that exposure to parental absence leads to a higher risk of insomnia. These results are the same as previous studies[41]. The link between parental absence and insomnia can be explained that, absence of parents means poor supervision of children, and teens have poor self-control and are unable to follow a good sleep schedule. These may be more likely to adopt behaviors that impair sleep, such as using their smartphones before sleep and spending excessive time on the internet[39, 75].

In summary, pathological online games use increases the risk of anxiety and insomnia. Due to different demographic measures, POGU has different effects on anxiety and insomnia, and presents increasing forms to different degrees of anxiety. The high incidence of POGU among

adolescents emphasizes the need for parents and schools to offer strong supervision and emotional support. For adolescents with POGU, effective early intervention for smartphone should be valued. Furthermore, parents and schools should timely find out when teenagers have symptoms of anxiety or insomnia, and give timely and early emotional support and understanding.

Limitation

Several limitations should be noted. First, we used a cross-sectional approach, which was unable to make causal inferences between POGU and anxiety or insomnia. Second, we used a convenience sampling method to conduct this research in three high schools in Guangxi Province, China. Thus, the sample can not represent all adolescents and might not be generalized to a conventional population. Third, as the assessments of POGU, anxiety and insomnia were based only on the self-reported perspectives of teenagers, there is also a chance of recall bias on the part of participants. In addition, the assessment tool of POGU we used was not detailed enough to evaluate the severity, duration, or sequence of occurrence of the addiction. Fourth, some potentially important factors relating to POGU, anxiety, and insomnia were not collected adequately and thus could not be considered in statistical analyses. For example, parenting styles and parental monitoring of smartphone use may affect adolescents' POGU behaviors. The present research is mainly exploratory in order to highlight the relationship between POGU and anxiety as well as insomnia. It is necessary to conduct a further large sample research to obtain the causality of the relationship identified and the impact of various variables.

Conclusion

Our research reported the incidence of POGU is generally very high in the Chinese ethnic minorities adolescents population. POGU has a considerable effect on anxiety and insomnia. POGU is a very strong risk factor for anxiety (whether it is mild, moderate or severe) and insomnia. Therefore, we recommend that game and smartphone use should be carefully monitored in adolescents. And, it is essential to offer psychological support for those adolescents who have POGU disorder as they are likely to suffer from anxiety and insomnia. In addition, there remains a need for a larger scale research to determine not only causality, but also other potential variables that might modify the relationship.

Abbreviations

POGU: pathological online games use; POGQ-SF: Problematic Online Gaming Questionnaire Short-Form; GAD-7: Generalized Anxiety Disorder Scale-7; AIS: Athens Insomnia Scale; ICD-11: International Classification of Diseases 11th edition; GD: Gaming disorder; IGD: Internet gaming disorder; APA: American Psychiatric Association; DSM-5: Diagnostic and Statistical Manual of Mental Disorders Fifth Edition

Declarations

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Authors' contributions

QYW, SJZ and YLP designed the study and supervised the data collection; QYW drafted the manuscript; SJZ, YLP, HH and FLC undertook data collection; QYW and SJZ conducted the statistical analyses; QYW, SJZ, WWY, QHL, SBP and CYT assisted with the interpretation of results and revision for intellectual content. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics approval and consent to participate

Our study was conducted following the Declaration of Helsinki and was approved by the Institutional Ethical Committee of Guangxi Medical University (Approval number: 20160302-13). The informed written consent were obtained from all the participants.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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