Journal of Applied Research on Children: Informing Policy for Children at Risk

Volume 13
Issue 1 *The Importance of Sleep for Child Wellbeing*
Article 5

2022

# Problematic online gaming. Is it real and does it matter to our teenagers?

Kevin Kaplan MD
*Baylor College of Medicine*, kakaplan@texaschildrens.org

David Spielberg
*Lurie Childrens*, dspielberg@luriechildrens.org

Binal Kancherla
bskanche@texaschildrens.org

Daniel Glaze
*Texas Children's Hopsital*, dgglaze@texaschildrens.org

O'Brian Smith
*Baylor College of Medicine*, esmith@bcm.edu

*See next page for additional authors*

# Problematic online gaming. Is it real and does it matter to our teenagers?


## Authors

Kevin Kaplan MD, David Spielberg, Binal Kancherla, Daniel Glaze, O'Brian Smith, Timothy Vece, and Marianna Sockrider

## INTRODUCTION

Gaming was introduced in 1972 with the Magnavox Odyssey and has grown into a 159.3 billion dollar per year industry encompassing computers, consoles, smart phones, and handheld devices.[1] The global pandemic due to COVID-19 increased the percentage of individuals participating in video games.[1] Two thirds of adults and three fourths of children currently play video games, which accounts for 227 million Americans.[2] With the use of video games as a widespread recreational activity, the effect upon teenagers has become a growing concern. Video games have been linked to psychiatric and social problems, aggressive behavior, attention difficulties, hyperactivity, scholastic difficulty, obesity, poor eating habits, learning impairment, and sleep disturbances.[3,4] Internet gaming disorder is becoming a public health concern,[5] recognized by the American Psychiatric Association and included in the DSM-5.[6] Gaming disorder was also included in the World Health Organization's International Classification of Diseases (ICD-11).[7] Players can develop problematic behaviors such as withdrawal, loss of control, and conflict associated with interpersonal relationships, work and/or school commitments.[8] Internet gaming disorder may be linked to other behavioral factors in children. This study explores correlations between a positive screen for problematic online gaming and rates of daytime sleepiness, risk of depression, and quality of life. We hypothesized that a significant proportion of teenagers in our general population will meet criteria for problematic online gaming, and that problematic gaming is associated with negative health and behavioral impacts.

## PARTICIPANTS AND METHODS

### Study Design

We conducted a cross-sectional survey study at a high school using a self-reported survey consisting of demographic and health history information in addition to a set of validated questionnaires.

### Measures

Problematic interactive media use was assessed using the Problematic Online Gaming Questionnaire (POGQ) Short Form[9], which is a 12-question, 5-point Likert scale measure. The questionnaire assesses preoccupation, overuse, immersion, social isolation, interpersonal conflicts, and withdrawal. Scores of 32 or greater indicate a positive screen for problematic online gaming with a sensitivity of 96% and a specificity of 97%,

with Cronbach alpha 0.91. The measure was developed and validated in teenage students in a nationwide survey in Hungary. The study has not been validated in a US population but has been validated in other populations and languages.[10] Daytime sleepiness was assessed using the Cleveland Adolescent Sleepiness Questionnaire,[11] which is a 16-item Likert scale measure with a maximum score of 80 and with an alpha of 0.89. A score greater than 46 is considered abnormal, indicating increased daytime sleepiness. Risk of depression was screened for using the Kutcher Adolescent Depression Scale.[12] This scale, which is a 6-item item Likert scale measure, has a sensitivity of 92%, specificity of 72%, and alpha of 0.80. Quality of life was assessed using the PedsQL 4.0,[13] which is a 26-item Likert scale measure with a total score of 100. Higher scores indicate a reduced quality of life in respondents, with a Cronbach alpha of 0.88 when administered to children.

**Subjects**

Approval was obtained through the Institutional Review Board at Baylor College of Medicine and the school district's research and accountability office. The school's principal allowed enrolled students to volunteer to participate in the study. All 745 students attending this public urban magnet high school (grades 9-12) were offered enrollment in the study. A total of 745 surveys were distributed. Exclusion criteria included inability to read or speak English, due to lack of validated questionnaire forms in other languages, or enrollment in special needs classes. However, as the school was a magnet program, all of the enrolled students met eligibility criteria.

The demographics of the student body of the magnet public school were 13.1% Caucasian, 16.8% African American, 30% Asian, and 37.1% Hispanic at the time of the study. This varied from the demographic of the urban school district as a whole, which reported a population of 9.9% Caucasian, 22.4% African American, 4.4% Asian, and 61.7% Hispanic. The differences between the two school populations are due to the school being a magnet program. The results of the study are reflective of this cohort and may not represent the city population as a whole.

The study was presented to all students by the primary investigator. Every student in attendance was given a survey packet that included an introductory letter and a consent form to be signed by a parent or guardian. After obtaining consent from a parent or guardian, subjects completed the survey packet at home without supervision or intervention of the study team.

Packets were returned to the school for collection by the primary investigator. As an incentive, subjects who completed the survey and returned it were entered into a raffle for gift cards.

### Statistical Analysis

Data were analyzed using IBM SPSS version 21 (IBM Corporation, Armonk, NY) and SAS Version 9.4 (SAS Institute, Cary, NC). Figures were also generated with Prism 9.4.0 (Graphpad Software, San Diego, CA). Demographic data were analyzed using cross table variable analysis with chi square testing for 2x2 tables and Fisher exact test for larger tables. Continuous data were compared between groups utilizing the student's t-test. Generalized linear models were utilized for multivariable analyses.

Not every subject answered every question in the study surveys; thus, the sample size varies some by item. However, if subjects' POGQ responses were incomplete, their results were omitted from the analysis. If subjects did not answer questions relating to demographics, depression screen, quality of life, or daytime sleepiness, those particular sections were not included in the analysis; missing data were left blank rather than imputed. Significance was defined as a p value ≤ 0.05.

## RESULTS

Surveys were returned by 377 of 745 eligible subjects (51%). Subject characteristics are found in Table 1. The prevalence of positive screening for problematic online gamine was 11.4% (43 of the 377 subjects). The prevalence of positive screening for internet gaming disorder varied between grades (10.6% of freshmen, 19% of sophomores, 6% of juniors, and 12% of seniors) ($p = 0.048$). There were no significant differences between subjects screening positive and subjects screening negative for problematic online gaming in subjects' ages, number of advanced placement classes, or ethnicity (Table 1).

Males were more likely to screen positive for problematic online gaming than females (OR 3.25, $p=0.0002$) (Table 2). Subjects screening positive for problematic online gaming were significantly more likely to play video games on a computer (OR 6,62, $p<0.001$) as opposed to a phone, a tablet or handheld device, or a gaming console (Table 2). Teenagers screening positive for online problematic gaming were also significantly more likely to play online games interacting with other individuals (OR 3.71 $p=0.01$) (Table 2). Subjects who tested positive for problematic online

gaming were also significantly more likely to have a parent who plays video games (OR 2.75, p=0.006) (Table 2).

Subjects with a positive screen for problematic interactive media use spent significantly more time playing video games than negatively screening subjects on school nights (p<0.001) and on weekends (p<0.001) (Figure 1). Positive screening teens spent less time doing homework than their peers (p=0.003), and in this group, those committing more hours to gaming spent fewer hours on homework (Figure 2). The amount of time spent watching television, either on school nights or weekends, and quantity of caffeine consumed did not differ between the groups.

Subjects with positive problematic online gaming screens were more likely to snore than students who did not meet criteria for problematic online gaming (21% vs. 9%; p=0.026) (Table 3). Other health conditions screened for including diabetes, heart disease, seizure disorders, renal disease, asthma, learning disorders, attention deficit disorder/attention deficit hyperactivity disorder, or any sleep diagnosed disorder showed no significant difference between the two groups (Table 3).

Subjects with a positive screen for problematic online gaming had significantly different responses to both depression screening and quality-of-life scales (Table 4). Those with a positive POGQ screen had higher rates of a positive depression screen (OR 2.93, p=0.001) and an 8-point higher (ie, worse) quality-of-life score (p<0.0001) compared to those screening negative. In the cohort as a whole, rates of increased daytime sleepiness were higher in those with a positive screen for problematic online gaming, but this was not significant (OR 1.91, p=0.08). Notably, across all three domains--daytime sleepiness, rates of depression screens, and quality of life--the effect of a positive POGQ screen was accentuated in females (Table 4). POGQ screening did not correlate with the Kutcher screen in males, but females with a positive POGQ had 3.4-fold odds of increased daytime sleepiness compared to females with a negative POGQ screen (p=0.02, Figure 3). While higher rates of depression screens were seen across all subjects with a positive POGQ screen, this effect was accentuated in females, in whom the POGQ predicted 4.7-fold odds of a positive depression screen (p=.0015) compared to 2.5-fold odds in males (p=0.04) (Figure 4). While the PedsQL score tended to be higher (i.e., worse) in all subjects with a positive POGQ screen, females had, on average, a 4.2-point higher PedsQL after accounting for POGQ screening. Put another way, males had a 6.9-point increase in PedsQL if they had a

positive POGQ screen; females had a 12.5-point increase in PedsQL with a positive POGQ screen (Table 4).

## DISCUSSION

Video games have evolved from pixilated squares bouncing back and forth between digitized paddles to life-like three dimensional avatars interacting in on-line worlds. As video games permeate our society, their effects on users have been a topic of growing interest. Among American teens, 88% had access to a home computer, 84% had a gaming console, and 95% had access to a smart phone.[14,15] Video game usage appears to be ubiquitous in society breaking through socio-economic, racial, and geographic boundaries. Various video games have been both vilified and/or praised for different negative and positive effects they may have on their users.[16] The idea that gamers can have problematic interactive media use is a controversial topic. In Asian countries, where deaths among gamers playing in marathon gaming sessions secondary to pulmonary embolism or severe dehydration have occurred, the concept of problematic online gaming is being addressed as a public health concern. Recent recognition of gaming issues in both the DSM-5 and ICD-11 highlights the increased recognition of this issue within the medical community. Nevertheless, despite public concerns, millions of users continue spend hours gaming on and offline.

### Problematic Online Gaming Prevalence (11.9%)

Previous studies have suggested that problematic interactive media use is present in a significant minority of video game players (0.8-29.7%) depending on nationality.[5,6,9,17] In the Unites States, it is estimated that 9.4% of users may be affected by problematic gaming.[14] Difficulties in diagnosing problematic online gaming include cultural variation and the lack of standardized definitions standardized screening tools.[3,18,19] For the purpose of our study, we selected the Problematic Online Gaming Questionnaire Short Form as it is a validated measure for problematic online gaming in teenagers who play video games.[9] Our results show a slightly higher prevalence of problematic online gaming at 11.9%. Our results suggest that internet gaming disorder is present in our urban high school cohort at a slightly higher rate compared with other United States cohorts.[20]

### Problematic Online Gaming Correlates Health Outcomes

Similar to previous reports, more males screened positive for problematic online gaming and those who played online using a computer.[21]

Freshman (10.9%) and seniors (12%) had similar positive rates while sophomores' prevalence was higher (19%) and juniors were found to have a lower (6%) incidence of problematic gaming disorder. Given that there were similar numbers sampled in each grade, one possible explanation of this finding may be differences in academic workload in different grades. This hypothesis will require confirmation in a larger sample of high school students.

### Characteristics of Players Screening Positive for Problematic Online Gaming

Player's screening positive for problematic online gaming report that they play a significant more amount of time playing games both on weekdays and on weekends than their peers. One would expect gamers to prioritize their time to play if they have internet gaming disorder. The concern is what activities these students sacrificing to increase their time gaming. They did not report limiting television time. Instead, students screening positive for problematic online gaming reported spending a significantly less amount of time doing homework than their peers. More students spent longer hours on homework if they spent less time gaming; conversely, no students who spent more than four hours daily gaming reported spending greater than 3 hours on homework (Figure 2). Although not measured in our study, academic performance and SAT scores have been shown to negatively correlate with time spent playing video games.[22]

Teenagers who met criteria for problematic online gaming were significantly more likely to have a parent who plays video games (Table 2). Our study could not identify whether this reflects a genetic predisposition versus cultural norms (i.e., gaming as a learned behavior). Prior studies have shown that parenting style and behaviors have been associated with problematic gaming disorder in children.[23]

### Problematic Online Gaming, Psychosocial Scales, and Gender

Previous studies have postulated the paradox that problematic online gaming could lead to depression or that depressed individuals are more likely to spend a significant amount of time playing video games[4]. Our data indicate significant impacts of problematic online gaming on both rates of positive depression screening and on quality-of-life scores. This supports that there may be meaningful negative impacts of problematic gaming for students. These findings appear to be magnified among female students. Females screening positive for problematic online gaming show a positive depression score in 65% of females compared to 42% of males with a

positive POGQ. Similar concerning gender differences existed in the quality-of-life measures. Gender considerations for problematic gaming disorder will be an important point for future investigations examining the psychosocial impacts of gaming.

### Problematic Online Gaming and Daytime Sleepiness

Students with a positive screen for problematic online gaming were more likely to report higher levels of daytime sleepiness than students who did not screen positive for problematic online gaming (Figure 4). Students screening positive also showed a significant increase in snoring (Table 3). Sleep disordered breathing has been shown to lead to health changes such as poor cognitive function and hyperactivity in children. Previously published reports have shown an increased association between children with attention deficit hyperactivity disorder and problematic internet gaming.[24] As snoring typically occurs in stage 3 and rapid-eye-movement sleep, it is possible that these players are spending more time in a different sleep stages than their peers.[25] The rates of attention deficit hyperactivity disorder and sleep disorders were too low in this study to examine relationships between them. While we examined only self-reported snoring, future studies utilize polysomnography and/or actigraphy further explore the relationship between problematic gaming behaviors and sleep quality and potential disorders.

## What This Study Adds

This study looks at correlations between problematic online gaming and a range of behavioral and lifestyle scales in a cohort of U.S. teenagers. Our findings support our original hypothesis that problematic online gaming is prevalent a cohort of American teenagers. Teenagers screening positive for problematic online gaming were shown to have increased risk of depression and lower quality of life when compared to their peers, with more marked effects seen in females. Females also had higher rates of increased daytime sleepiness in association with problematic gaming. The ongoing expansion of digital media only further supports the need to understand impacts on developing youths.

## Study Considerations

Limitations and weaknesses of this study include the fact that it was a self-reported survey that can be influenced by the participants' own biases. With a survey return rate of 51%, a selection bias may be present

with gamers being either more or less likely to participate in the study questionnaire. The study focused on a single magnet high school and the results may not represent the community as a whole. A magnet school necessarily selects for academically competitive students, although such schools do cross socioeconomic classes. Cultural and socioeconomic biases could also have been impacted as the questionnaire was only presented in English. The study focused on a single measurement at a certain point in time. Digital technologies continue to expand, and changes in societal activities due to the ongoing COVID-19 pandemic will likely only further complicate understanding the effects of digital gaming in developing children. A consensus among experts to further define a tool to measure problematic online gaming will help increase standardization and reliability of various reports.

## CONCLUSION

United States teenagers in a large urban public magnet school screened positive for problematic online gaming at a rate greater than 10%. This study was conducted using students from a magnet school and thus are the highest achieving academic students in the public school system. Students who screened positive for problematic online gaming were significantly more likely to be male, play online games via a computer, and to have a parent who plays video games. Problematic online gamers are more likely to and spend a significant amount of time playing video games while not decreasing the amount of time they spend watching television. Teens at risk for internet gaming disorder do appear to spend less time doing homework despite presumed similar academic workloads. Although chronic disease does not appear to affect problematic interactive media use rates, students who screened positive for problematic online gaming report that they snore more than their peers.

Positive screens for problematic online gaming are found to have a significant correlation with higher risk of depression and lower quality of life in teenagers. Increased daytime sleepiness also trended with internet gaming disorder but was present but at a non-significant level. It appears that, although males are more likely to screen positive for problematic online gaming, girls are affected to a greater degree in regards to risk of depression and daytime sleepiness. This finding suggests that females who have internet gaming disorder may have greater behavioral and health impacts than their male counterparts.

This study suggests that problematic interactive media use is present in our population and that teens screening positive for internet gaming disorder have increased risks of depression and lower quality-of-life scores than their peers. More research is needed to further assess the importance of problematic online gaming and possible effects upon our children.

Table 1. Demographic data of study participants

| | Total students n (%) | Positive screen for problematic online gaming n (%) | Negative screen for problematic online gaming n (%) | Chi square/ Fisher exact test analysis |
|---|---|---|---|---|
| Total student body | N=377 | 43 (11.4) | 334 (88.6) | |
| Gender | N=374 | | | p<0.001 |
| Male* | 132 (35.3) | 26 (19.7) | 106 (80.3) | |
| Female | 242 (64.7) | 17 (7.0) | 225 (93) | |
| Age (y) | N=359 | | | p=0.15 |
| 13 | 5 (1.4) | 0 (0) | 5 (100) | |
| 14 | 92 (25.6) | 9 (9.8) | 83 (90.2) | |
| 15 | 102 (28.4) | 16 (15.7) | 86 (84.3) | |
| 16 | 77 (21.4) | 4 (5.2) | 73 (94.8) | |
| 17 | 78 (21.7) | 9 (11.5) | 69 (88.5) | |
| 18 | 5 (1.4) | 0 (0) | 5 (100) | |
| Grade | N=377 | | | p=0.035 |
| 9th grade | 113 (30) | 10 (8.8) | 103 (91.2) | |
| 10th grade* | 94 (25) | 18 (19.1) | 76 (80.9) | |

| | | | | |
|---|---|---|---|---|
| 11th grade | 86 (23) | 5 (5.8) | 81 (94.2) | |
| 12th grade | 84 (22) | 10 (11.9) | 74 (88.1) | |
| Race/ethnicity | N=377 | | | p=0.08 |
| Caucasian | 38 (10.1) | 4 (10.5) | 34 (89.5) | |
| African American | 72 (19.1) | 3 (4.2) | 69 (95.8) | |
| Hispanic/Latino | 93 (24.7) | 11 (11.8) | 82 (88.2) | |
| Asian | 154 (40.8) | 20 (13.0) | 134 (87.0) | |
| Mixed | 20 (5.3) | 5 (25) | 15 (75) | |
| Advanced placement classes | N=364 | | | p=0.55 |
| None | 140 (38.5) | 19 (13.6) | 121 (86.4) | |
| One | 102 (28) | 9 (8.8) | 93 (91.2) | |
| Multiple classes | 122 (33.5) | 14 (11) | 108 (88.5) | |

* Denotes statistical significance.

Table 2. Predictors of positive screen for problematic online gaming

| **Predictors** | **Odds of POGQ screen OR (95% CI)** | **p-value** |
|---|---|---|
| Male vs female | 3.25 (1.69-6.24) | 0.0002 |
| Computer vs other device | 6.62 (2.86-15.31) | <0.001 |
| Gaming with online-only interaction | 3.71 (1.29-10.66) | 0.01 |

| | | |
|---|---|---|
| Parent playing video games | 2.75 (1.31-5.79) | 0.006 |

Table 3. Relationship between problematic gaming screen and health conditions

| **Predictors** | **Odds of POGQ screen OR (95% CI)** | **p-value** |
|---|---|---|
| Snoring | 2.82 (1.23-6.44) | 0.003 |
| Any sleep disorder | * | 1 |
| ADD or ADHD | 3.24 (0.61-17.25) | 0.18 |
| Learning disorder | * | 1 |
| Asthma | 0.67 (0.20-2.28) | 0.78 |
| Diabetes | * | 1 |
| Heart disease | 3.98 (0.35-44.81) | 0.3 |
| Seizures | * | 1 |
| Renal disease | No cases | * |

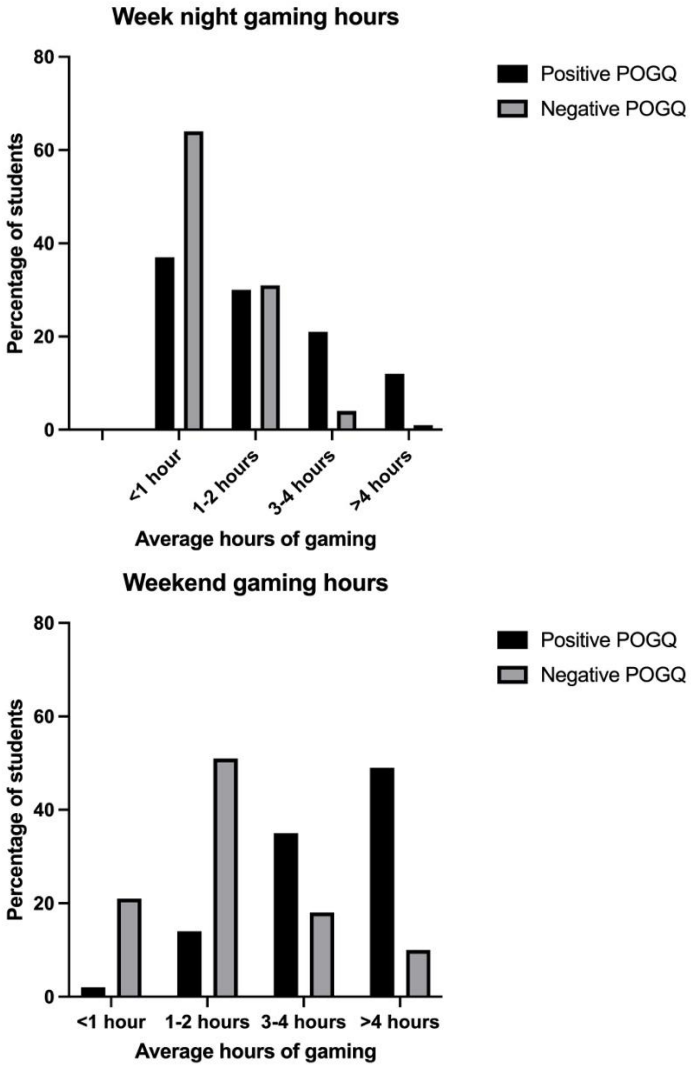
*Cannot be calculated.

Table 4. Relationship between positive screening for problematic online gaming and results of sleep scales (CASQ), depression screening (Kutcher), and quality of life (PedsQL). This is further subdivided by sex for each category.

| | Increased daytime sleepiness (positivity rate) | | OR for increased sleepiness with + POGQ | Positive depression screen (positivity rate) | | OR for positive depression screen with + POGQ | PedsQL (average score) | | Mean difference with + POGQ |
|---|---|---|---|---|---|---|---|---|---|
| POGQ - | 73/331 | | | 87/331 | | | 15.0 | | |
| Male / female | 17/106 M | 56/225 F | | 24/106 M | 63/225 F | | 12.6 M | 16.1 F | |
| | | | | | | | | | |

| POGQ+ | 15/43 | | 1.91 (NS) | | 22/43 | | 2.93 (p=0.001) | | 23.1 | | +8.1 (p<0.0001) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Male / female | 6/26 M | 9/17 F | NS M | 3.4 F | 11/26 M | 11/17 F | 2.5 M | 4.7 F | 19.5 M | 28.6 F | +6.9 M | +12.2 F |

Figures 1. Average hours of gaming per night on weeknights (top graph) and weekends (bottom graph), depending on POGQ screening result.





DOI: 10.58464/2155-5834.1493

Figure 2. Average hours spent per day on homework, depending on hours spent gaming, in the cohort with a positive POGQ score.

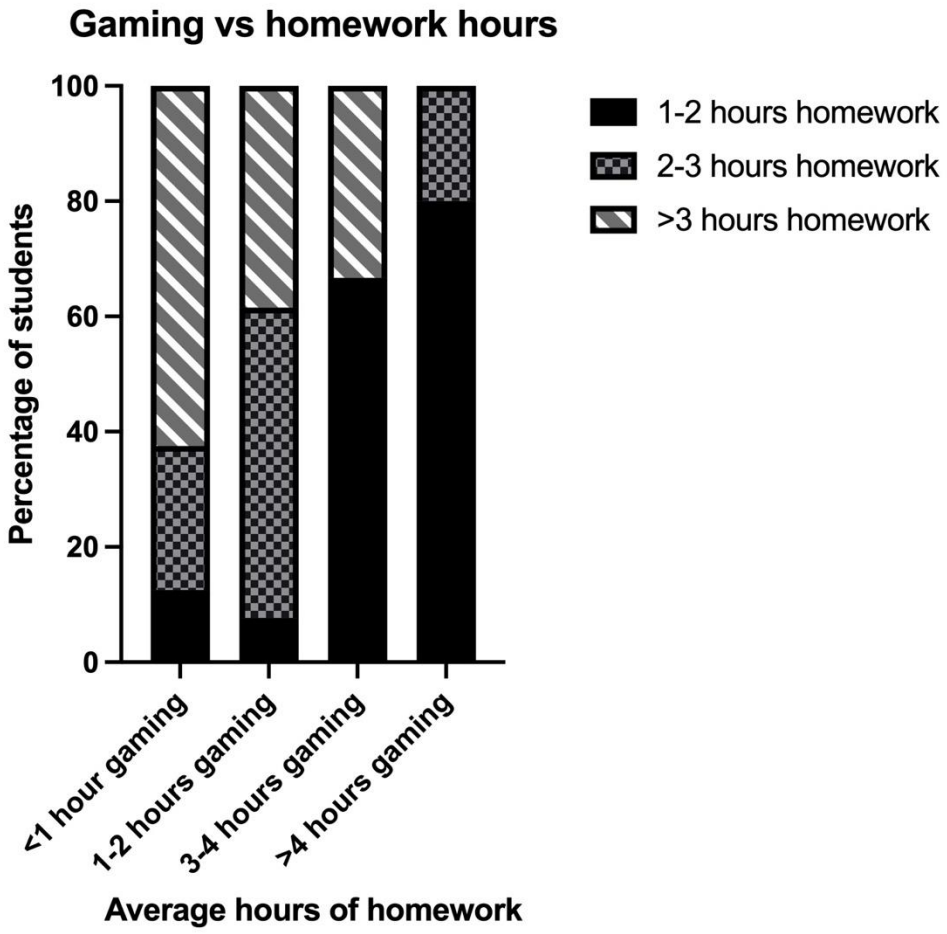


Figure 3. Percentage of subjects with a Kutcher screen indicating increased daytime sleepiness, cohorted by gender and POGQ result.

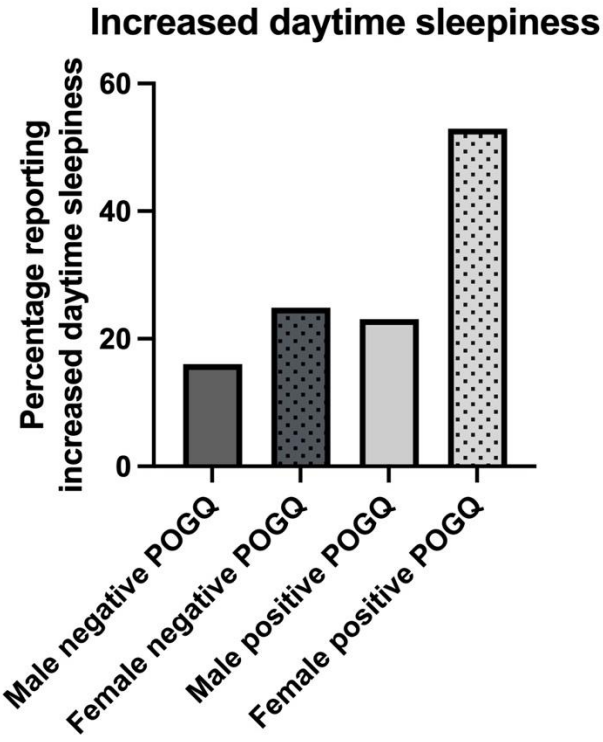
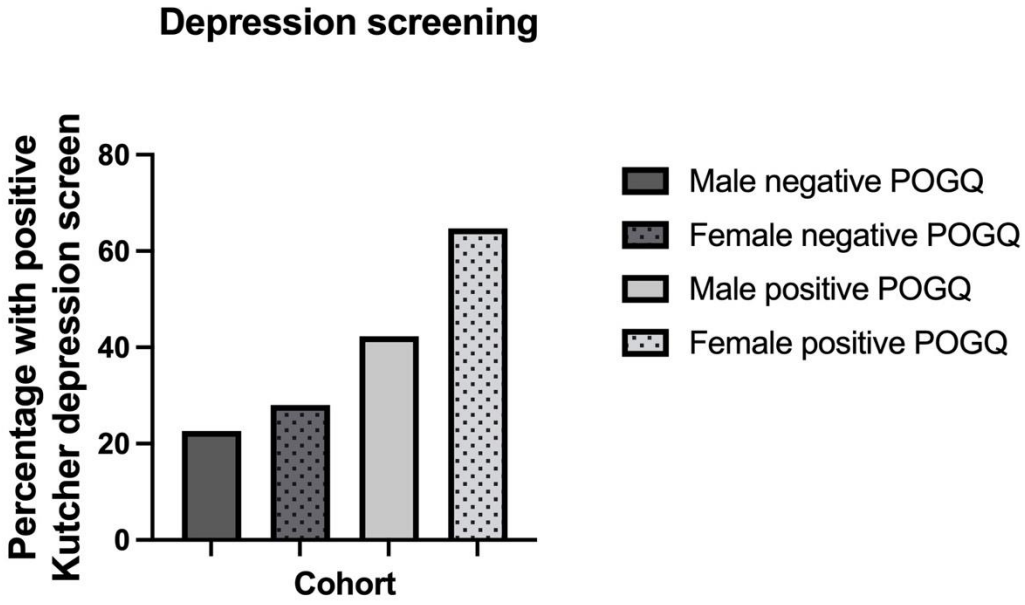


Figure 4: Percentage of subjects screening positive for depression, cohorted by gender and POGQ screening result.



REFERENCES

1. International Trade Administration. Media and entertainment: video games sector. Accessed July 14, 2022. https://www.trade.gov/media-entertainment-video-games-sector

2. Entertainment Software Association. 2021 essential facts about the video game industry. Accessed July 13, 2022. https://www.theesa.com/resource/2021-essential-facts-about-the-video-game-industry/

3. King DL, Haagsma MC, Delfabbro PH, Gradisar M, Griffiths MD. Toward a consensus definition of pathological video-gaming: a systematic review of psychometric assessment tools. *Clin Psychol Rev*. 2013;33(3):331-342.

4. Ferguson CJ, Olson CK. Video game violence use among "vulnerable" populations: the impact of violent games on delinquency and bullying among children with clincally elevated depression or attention deficit symptoms. *J Youth Adolesc*. 2014;43(1):127-136.

5. Petry NM, O'Brien CP. Internet gaming disorder and the DSM-5. *Addiction*. 2013;108(7)1186-1187.

6. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. 2013.

7. World Health Organization. International classification of diseases, 11th revision (ICD-11). Accessed July 13, 2022. https://icd.who.int/browse11

8. King, DL, Delfabbro PH. Issues for DSM-5: video-gaming disorder? *Aust N Z J Psychiatry*. 2013;47(1):20-22.

9. Papay O, Urban R. Nagygyorgy K, et al. The development and application of the Problematic Online Gaming Questionnaire (POGQ) and its short form (POGQ-SF). *J Behav Addict*. 2013;2:27-27.

10. Inoue K, Yokomitsu K, Irie T, Matsuyama M, Tanaka M. The validation and reliability of a Japanese version of the Problematic Online Gaming Questionnaire (POGQ-J). *Addict Sci Clin Pract*. 2021;16(1):69.

11. Silsbury JC, Drotar D, Rosen CL, Redline S. The Cleveland Adolescent Sleepiness Questionnaire: a new measure to assess excessive daytime sleepiness in adolescents. *J Clin Sleep Med*. 2007;3(6):603-612.

12. LeBranc JC, Almudevar A, Brooks SJ, Kutcher S. Screening for adolescent depression: comparison of the Kutcher Adolescent Depression Scale with the Beck Depression Interventory. *J Child Adolesc Psychopharmacol*. 2002;12(2):113-126.

13. Varni JW, Seid M, Kurtin PS. PedsQL 4.0: reliability and validity of the Pediatric Quality of Life Inventory Version 4.0 Generic Core Scales in healthy and patient populations. *Med Care*. 2001;39(8):800-812.

14. Pluhar E, Kavanaugh JR, Levinson J, Rich M. Problematic interactive media use in teens: comorbidities, assessment, and treatment. *Psychol Res Behav Manag*. 2019;12:447-455.

15. Douglas A, Bailey K, Bavelier D, et al. Internet gaming disorder in children and adolescents. *Pediatrics*. 2007;140(suppl 2):S81-S85.

16. Granic I, Lobel A, Engels RCME. The benefits of playing video games. *Am Psychol*. 2014;69(1):66-78.

17. Wittek CT, Finseras TR, Pallesen S, et al. Prevalence and predictors of video game addiction a study based on national representative sample of gamers. *Int J Ment Health Addict*. 2016;14(5):672-686.

18. Darvesh N, Radhakrishnan A, Lachance CC, et al. Exploring the prevalence of gaming disorder and internet gaming disorder: a rapid scoping review. *Syst Rev*. 2020;9(1):68.

19. Rehbein F, Kleimann M, Mossle T. Prevelance and risk factors of video game dependency in adolescence: results of a German nationwide survey. *Cyberpsychol Behav Soc Netw*. 2010;13(3):269-277.

20. Gentile D. Pathological video-game use among youth ages 8 to18: a national study. *Psychol Sci*. 2009;20(5):594-602.

21. Peters CS, Malesky LA. Problematic usage among highly-engaged players of massively mulitplayer online role playing games. *Cyberpsychol Behav*. 2008;11(4):481-484.

22. Anand V. A study of time management: the correlation between video game usage and academic performance markers. *Cyberpsychol Behav*. 2007;10(4):552-559.

23. Lo BCY, Lai RNM, Ng TK, Wang H. Worry and permissive parenting in association with the development of internet addiction in children. *Int J Environ Res Public Health*. 2020;17(21):7722.

24. Mathers CL, Morrell HER, Molle JE. Video game addiction, ADHD symptomatology, and video game reinforcement. *Am J Drug Alcohol Abuse*. 2019;45(1):67-76.

25. Higuchi S, Motohashi Y, Liu Y, Maeda A. Effects of playing a computer game using a bright display on presleep physiological variables, sleep latency, slow wave sleep, and REM sleep. J Sleep Res. 2005;14(3):267-273.