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# Associations of binge gaming (5 or more consecutive hours played) with gaming disorder and mental health in young men





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## BRIEF REPORT



## ABSTRACT

**Background:** Video gaming is a popular activity among young people. Time spent with gaming was found to be only moderately associated with gaming disorder. However, patterns of binge gaming (playing more than 5 h consecutively) were rarely considered in research on gaming. This study explores how binge gaming frequency is related with gaming disorder and mental health. **Methods:** The sample came from the Cohort study on substance use risk factors (C-SURF) and comprised 5,358 young men aged 28.26 years (SD = 1.27). ANCOVA was conducted to estimate the association between binge gaming frequency (gaming at least 5 h consecutively) and gaming disorder (measured with the Game Addiction Scale) as well as indicators of mental health. **Results:** A total of 33.3% of the sample engaged in binge gaming at least once in the previous year, and 6.1% at least weekly. Frequency of binge gaming was associated with gaming disorder score in a linear dose-response relationship (linear trend = 2.30 [2.14, 2.46]) even if adjusted for time spent gaming (linear trend = 1.24 [1.03, 1.45]). More frequent binge gaming was associated with lower life satisfaction and sleep quality, and with more major depression and social anxiety disorder symptoms. **Conclusions:** Binge gaming patterns, especially daily or almost daily binge gaming, are important to consider with regard to gaming disorder and mental health. Asking about binge gaming may be a promising screening question for gaming related problems. Encouraging regular breaks from gaming may be a valuable prevention strategy to reduce negative outcomes of gaming.

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## KEYWORDS

Gaming, Binge gaming, Gaming disorder, mental health, Switzerland



## INTRODUCTION

Excessive computer gaming and gaming disorder (GD) is a matter of growing concern and received a lot of attention with the recent inclusion of gaming disorder in the ICD-11 (World Health Organization, 2019). Time spent gaming (hours spent per week) is only moderately associated with GD and not sufficient to understand problematic gaming (Demetrovics & Király, 2016). Therefore, patterns of use should be investigated. Little is known how patterns of gaming are associated with GD and related outcomes. This study explores in a large sample of young Swiss men the concept of binge gaming (BG, playing 5 or more hours consecutively) and investigates its association to GD and mental health indicators.

Conceptually, bingeing refers to episodes of excessive consumption in a short period, often accompanied by a loss of control and is associated with negative consequences for the individual engaging in bingeing behaviours (De Feijter, Khan, & van Gisbergen, 2016; Gmel, Kuntsche, & Rehm, 2011; Griffiths, 2006). Binge drinking for example is a popular concept in the alcohol field, usually defined as drinking a certain amount (usually between 4 and 8 depending on the study) on a single occasion (Gmel et al., 2011; Wechsler, Dowdall, Davenport, & Rimm, 1995). It is also a central element of the widely used AUDIT and AUDIT-C Screener (Saunders, Aasland, Babor, De la Fuente, & Grant, 1993) for alcohol use disorder. Even beyond the average alcohol use per week (volume; Rehm et al., 2010), binge drinking was found to be associated strongly with many negative alcohol-related outcomes (Ham & Hope, 2003; Kuntsche, Kuntsche, Thrul, & Gmel, 2017), and it also an important dimension to be considered for the estimation of alcohol related morbidity and mortality, especially injuries (Rehm et al., 2010). The concept of bingeing has also been used for other excessive behaviours that have been associated with negative consequences such as binge eating (American Psychiatric Association, 2013), binge watching television series (Flayelle et al., 2020), binge gambling (Cowlshaw, Nespoli, Jebadurai, Smith, & Bowden-Jones, 2018; Griffiths, 2006; Nower & Blaszczynski, 2003; Werle, Schroeder, Wolz, & Svaldi, 2021), binge internet use (Flayelle et al., 2020; Gatineau, 2021) and BG (Mahapatra, Sharma, Amudhan, & Anand, 2021). Binge episodes are considered important behavioral markers, in order to avoid the development of more severe long-term consequences, such as addiction (Cowlshaw et al., 2018; Griffiths, 2006).

The link between time spent gaming (TSG) and gaming disorder was found to be rather weak (Baggio et al., 2016; Demetrovics & Király, 2016; Pontes, Schivinski, Kannen, & Montag, 2022). In analogy to binge drinking, it may be hypothesized for gaming that a measure of BG may be relevant for negative consequences associated with intense gaming. Frequent BG may be specifically associated with specific problems, notably less time for sleep, negligence of other activities etc. Arguably, immersion into the gaming world may also be higher during very long gaming sessions,

which may again increase the loss of control while decreasing the salience of activities in offline world, thus leading to preoccupation with gaming, an important marker of gaming disorder (Lemmens, Valkenburg, & Peter, 2009).

If confirmed, BG could become a significant marker to detect those who are starting to experience negative consequences due to their gaming. As a result, early intervention programs could be deployed more quickly. It is therefore important to develop the concept of BG. To the best of our knowledge, the concept of BG has not been investigated empirically.

## AIMS

The first aim of the study was to investigate the prevalence of BG in a large sample of young Swiss men. The second aim was to test whether BG is associated with GD as well as with other mental health indicators and to test whether these associations with BG remain significant if adjusted for TSG. We hypothesized that frequency of BG is positively associated with GD and negatively with mental health and sleep quality in a dose-response relationship.

## METHODS

### Sample

Our sample came from the Cohort Study on Substance Use Risk Factors (C-SURF), designed to examine substance use patterns and related factors among young Swiss men (Gmel et al., 2015, 2021; Studer et al., 2013). Enrolment for the baseline assessment took place during the mandatory recruitment procedures for military service for all young Swiss men in the year 2010/11. Young men were enrolled at three of the six national military recruitment centres, which covered 21 of Switzerland's 26 cantons. A total of 7,556 participants gave their written informed consent (Gmel et al., 2021). Participation in the study was independent of whether participants served in the army or not. Participants filled out questionnaires at home, either online or on paper. Data for the present study was collected in the fourth wave (April 2019–November 2020), when participants were on average 28.26 (SD = 1.27) years old. Twelve participants were excluded due to missing values, the final sample size was 5,356.

### Measures

Gaming disorder was measured with the 7-item Game addiction scale (Khazaal et al., 2016; Lemmens et al., 2009). The items were for example “how often did you play longer than intended”, and response options were “never” (0), “rarely” (1), “sometimes” (2), “often” (3) and “very often” (4), and the total score ranged from 0 to 28. Cronbach's alpha was 0.841.

TSG was measured by two questions: the frequency of gaming (recoded to days per year) and the hours played on a



day when they played. The product of the frequency and quantity as hours played per week was calculated (range 0–96 h).

BG was measured as the frequency of gaming at least 5 h consecutively in one occasion (excluding short breaks for biological needs). Response options were never, less than monthly, monthly, weekly, multiple times per week, daily or almost daily. This question was adapted from the Canadian WebAdo survey (Dufour et al., 2018).

Life satisfaction was assessed using the Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985) (range 5–35; Cronbach's alpha = 0.911). Sleep quality was measured with the Pittsburgh Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) (range 0–20). The severity of major depression symptoms over the last two weeks was measured using the Major Depression Inventory (range 0–50; Cronbach's alpha = 0.908; WHO–MDI) (Bech, Rasmussen, Olsen, Noerholm, & Abildgaard, 2001). Symptoms of social anxiety disorder (SAD) during the previous week were assessed using the Clinically Useful Social Anxiety Disorder Outcome Scale (Dalrymple et al., 2013) (range 0–48; Cronbach's alpha = 0.930).

### Statistical analysis

To test the association between BG and GD, life satisfaction, sleep quality, depression and social anxiety disorder scores, ANCOVA models were estimated in SPSS 27 for differences between groups of participants (no gaming, gaming without binge, binged less than monthly, monthly, weekly, multiple times per week, daily or almost daily). Criterion variables were z-standardized (mean = 0, variance = 1). Parameters for mean differences between groups were estimated with the HC3 (heteroscedasticity consistent) robust estimator. In a first step, differences between groups of participants with different BG frequencies were tested. In a second step, models were adjusted for TSG to test whether BG frequency was still associated with BG. Partial eta-squared was estimated for BG to estimate its unique effect on top of covariates, respectively TSG. To test whether there was a dose-response relationship across categories of BG frequencies, linear trends were estimated using the polynomial contrast function. Linear trend and partial eta-squared were estimated among gamers only.

### Ethics

All participants were required to give their written informed consent. The Human Research Ethics Committee of the Canton Vaud (Protocol No. 15/07) approved the research protocol.

## RESULTS

A third of the sample (33.3%) engaged in BG at least once in the past year, and 6.1% at least weekly (Table 1). ANCOVA models (Table 2, Fig. 1) showed that BG frequency is associated with GD ( $F_{5, 3940} = 467.7$ ;  $P < 0.001$ ) and that

Table 1. Descriptive statistics

	<i>n</i>	Mean (SD)/%
<b>Age</b>	5,356	28.26 (1.27)
<b>Language</b>		
French	3,111	58.1%
German	2,245	41.9%
<b>Gaming frequency</b>		
never	1,407	26.3%
less than weekly	1,771	33.1%
weekly	1,365	25.5%
daily or almost daily	813	15.2%
<b>Mean hours played per week</b>	5,356	4.06 (7.95)
<b>Time spent gaming (TSG)</b>		
no gaming	1,408	26.3%
0–0.2 h	634	11.8%
0.2–0.5 h	624	11.7%
0.5–1.5 h	541	10.1%
1.5–3.5 h	640	11.9%
3.5–7.5 h	652	12.2%
7.5–15.5 h	439	8.2%
15.5–30 h	347	6.5%
more than 30 h	71	1.3%
<b>Binge gaming (BG)</b>		
did not play	1,408	26.3%
never	2,163	40.4%
less than monthly	1,057	19.7%
monthly	399	7.4%
weekly	179	3.3%
multiple times per week	104	1.9%
daily or almost daily	46	0.9%
<b>Gaming disorder (GD)</b>		
mean score	5,356	2.47 (3.68)
Prevalence		
no	5,107	95.4%
yes (4 items at least sometimes)	249	4.6%

there was a linear dose-response relationship (linear trend 2.30 [2.14, 2.46]) between BG frequency and GD scores. Compared to the participants who did not engage in BG, participants engaging less than monthly in BG showed significantly higher GD scores (mean difference = 0.67 [0.61, 0.73], and this increased to 2.90 [2.41, 3.39] for those with daily or almost daily BG. These associations between BG frequency and gaming disorder score were attenuated but still significant after adjustment for TSG (hours per week), with the linear trend decreasing to 1.24 [1.03, 1.45] after adjustment (Table 2). BG explained 37.2% of the variance in GD scores, of which 14.4% were on top of TSG.

Furthermore, those who played games without engaging in BG had not significantly different or more favourable (for social anxiety disorder) indicators of mental health than those who did not play games at all (Table 2). However, for those who engaged in BG, there was a strong linear dose-response relationship between BG frequency and mental health indicators, with the largest association found for daily or almost daily BG. For all mental health indicators, these associations were attenuated after adjustment for TSG, but remained significant. BG had a significant unique contribution on top of TSG for life satisfaction (1.2%), sleep

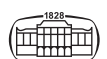




Table 2. Association of binge gaming (BG) frequency with gaming disorder and indicators of mental health: results of ANCOVA (mean difference [95% CI]), unadjusted and adjusted for time spent gaming (TSG)

	No gaming	Gaming without BG	Less than monthly BG	Monthly BG	Weekly BG	Multiple times per week BG	Daily or almost daily BG	Partial eta-squared for BG	Linear trend for BG
<b>Gaming disorder</b>									
unadjusted <sup>a</sup>	na	ref.	<b>0.67</b> [0.61, 0.73]	<b>1.35</b> [1.23, 1.46]	<b>1.75</b> [1.57, 1.93]	<b>2.12</b> [1.83, 2.40]	<b>2.90</b> [2.41, 3.39]	37.2%	<b>2.30</b> [2.14, 2.46]
adj. for TSG <sup>b</sup>	na	ref.	<b>0.56</b> [0.50, 0.63]	<b>1.03</b> [0.90, 1.17]	<b>1.19</b> [0.97, 1.42]	<b>1.26</b> [0.91, 1.60]	<b>1.63</b> [1.09, 2.16]	14.4%	<b>1.24</b> [1.03, 1.45]
<b>Life satisfaction</b>									
unadjusted <sup>a</sup>	0.02 [-0.05, 0.08]	ref.	<b>-0.21</b> [-0.28, -0.14]	<b>-0.46</b> [-0.57, -0.34]	<b>-0.62</b> [-0.79, -0.45]	<b>-0.90</b> [-1.14, -0.66]	<b>-1.36</b> [-1.75, -0.98]	6.5%	<b>-1.08</b> [-1.27, -0.90]
adj. for TSG <sup>b</sup>	-0.01 [-0.08, 0.05]	ref.	<b>-0.16</b> [-0.23, -0.09]	<b>-0.31</b> [-0.44, -0.18]	<b>-0.36</b> [-0.56, -0.17]	<b>-0.50</b> [-0.79, -0.20]	<b>-0.76</b> [-1.21, -0.31]	1.2%	<b>-0.58</b> [-0.83, -0.34]
<b>Sleep quality index</b>									
unadjusted <sup>a</sup>	-0.06 [-0.12, 0.01]	ref.	<b>0.09</b> [0.02, 0.16]	<b>0.33</b> [0.22, 0.44]	<b>0.37</b> [0.21, 0.53]	<b>0.41</b> [0.20, 0.62]	<b>0.71</b> [0.37, 1.05]	2.2%	<b>0.55</b> [0.36, 0.74]
adj. for TSG <sup>b</sup>	-0.04 [-0.11, 0.02]	ref.	<b>0.07</b> [-0.01, 0.14]	<b>0.27</b> [0.14, 0.39]	<b>0.26</b> [0.08, 0.45]	<b>0.25</b> [-0.01, 0.51]	<b>0.47</b> [0.06, 0.87]	0.6%	<b>0.35</b> [0.09, 0.60]
<b>Depression</b>									
unadjusted <sup>a</sup>	0.05 [-0.02, 0.11]	ref.	<b>0.12</b> [0.05, 0.19]	<b>0.32</b> [0.21, 0.43]	<b>0.48</b> [0.30, 0.65]	<b>0.66</b> [0.39, 0.92]	<b>1.57</b> [1.14, 1.99]	5.1%	<b>1.15</b> [0.96, 1.33]
adj. for TSG <sup>b</sup>	0.06 [-0.04, 0.13]	ref.	<b>0.10</b> [0.02, 0.17]	<b>0.25</b> [0.13, 0.38]	<b>0.36</b> [0.16, 0.56]	<b>0.47</b> [0.16, 0.79]	<b>1.30</b> [0.80, 1.78]	1.6%	<b>0.92</b> [0.67, 1.17]
<b>Social anxiety disorder</b>									
unadjusted <sup>a</sup>	<b>0.10</b> [0.03, 0.17]	ref.	0.07 [0.00, 0.14]	<b>0.24</b> [0.13, 0.35]	<b>0.34</b> [0.16, 0.51]	<b>0.37</b> [0.13, 0.60]	<b>0.57</b> [0.20, 0.94]	1.5%	<b>0.46</b> [0.28, 0.65]
adj. for TSG <sup>b</sup>	<b>0.10</b> [0.03, 0.17]	ref.	<b>0.08</b> [0.00, 0.15]	<b>0.27</b> [0.14, 0.40]	<b>0.38</b> [0.16, 0.60]	<b>0.44</b> [0.16, 0.72]	<b>0.67</b> [0.22, 1.12]	0.9%	<b>0.55</b> [0.30, 0.79]

Note: <sup>a</sup>Model only adjusted for age and linguistic region. <sup>b</sup>Model adjusted for age and linguistic region, and additionally for time spent gaming (TSG, hours per week). Criterion variables have been z-standardized and coefficients represents mean differences in standard deviation between the category of interest and the reference group (gaming without binge gaming). Partial eta-squared and linear trend as estimated without the no gaming category. na: no coefficient was estimated as the GD score for non-gamers is always 0. Bold coefficients are significant at  $p < 0.05$ .

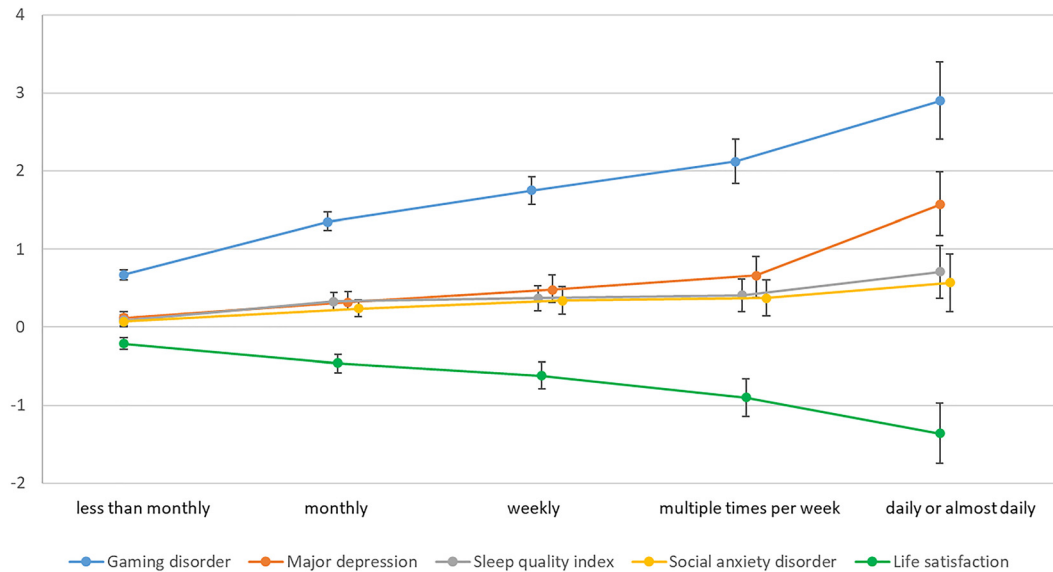


Fig. 1. Association of binge gaming frequency (reference group: no binge gaming) with gaming disorder and indicators of mental health

quality (0.6%), depression (1.6%) and social anxiety disorder (0.9%), and the linear trend remained significant after adjustment for TSG.

## DISCUSSION

Occasional binge gaming (playing 5 or more hours consecutively) is prevalent in our sample of young men, with about a third having binge gamed at least once in the previous year. At least weekly BG was less widespread (6.1%), and 0.9% binge gamed daily or almost daily. While GD scores were increased in all levels of BG frequency, this association was strongest for those engaging daily or almost daily in BG, thus there was a strong linear dose-response relationship between BG frequency and GD scores. Importantly, these associations remained significant if adjusted for TSG, although they were attenuated, indicating that the effect of BG on GD is in part confounded with TSG. Nevertheless, BG is associated with gaming disorder independently of TSG and should be considered on top of TSG when investigating the links between gaming behaviour and gaming disorder. Similar to earlier findings regarding other binge behaviours (Flayelle et al., 2020; Kuntsche et al., 2017), frequency of BG was related in a dose-response relationship with lower mental health, sleep quality and life satisfaction.

Overall, BG may be a potential marker of harms that may occur prior to the development of a gaming problem and of an unhealthy relationship with games. Playing 5 h or more on one occasion may increase immersion in the virtual world of the game and overstimulate rewards circuitries, which may decrease interest in offline activities, and cause mental fatigue. Gaming was also found to be associated with poor sleep (Lam, 2014), and especially long gaming sessions may decrease time available for sleep and sleep quality.

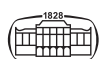
In the long term, such factors may be associated with lower mental health. Playing without BG, i.e. with regular and extended breaks, may reduce these negative effects of BG and be more compatible with a healthy lifestyle.

## Limitations

Our sample consisted of only young men. More research in samples also including women and a broader age range is required. Only one cut-off for BG was measured. Distributions of the outcomes deviated from normality. This was partly corrected by using robust estimators and should not have impacted our conclusions due to large sample size. The cross-sectional nature of our study does also not allow to draw conclusions about the direction of causality, longitudinal research would therefore be valuable.

## CONCLUSIONS

BG frequency is associated with GD, mental health problems and poor sleep quality, even on top of TSG. BG may be a promising concept deserving further attention in research on gaming and gaming related problems. BG patterns should be assessed along with TSG, and BG could even be a valuable single-item screening question for gaming related problems. Further research is needed to establish the best threshold for hours spent gaming on one occasion to define BG. As regards the Swiss situation, it appears that BG is widespread and does deserve attention with respect to its implications for public health, especially in light of its association with mental health. Those engaging in BG may benefit from a screening for gaming related problems and/or targeted preventive interventions. Promising strategies for preventing negative consequences of BG may include



promoting regular breaks from gaming to limit the time spent on gaming on a single occasion.

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**Conflict of interest:** The authors report no financial or other relationship relevant to the subject of this article.

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