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Association Between Time Spent for Internet Gaming, Grade Point Average and Internet Gaming Disorder Risk Among Medical Students

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Abstract The negative and positive consequences of internet games were less explored among medical students' population. The aim of this current study was to investigated the association between time spent for playing internet games and Grade Point Average (GPA) as well as Internet Gaming Disorder (IGD) risk among medical students. A total of 438 students in academic year 2016-2017 completed the self-report questionnaire, that covered socio-demographic information, GPA, time spent for internet gaming/day, and IGD screening. The statistical analysis used χ^2 test. The average age of the respondents was 20.2 ±1.57 year. The respondents comprised of 37.13% male and 62.87% female students. The percentage of male and female players was 97.5% and 93.8% respectively. Male students were more at risk of IGD (29.56%) compared to their female counterparts (10.04%). Although time spent for internet gaming/day was associated with IGD risk ($p<0.001$), it was not associated with GPA ($p=0.501$). There was no significant GPA difference between students who played internet games <3 hours/day and >3 hours/day and those who never play at all. Further study is required to explore the factors related to GPA among medical students.

Introduction

Internet develops rapidly in the last decade. Almost anything can be easily accessed using gadgets including internet games. Playing internet games has been at the center of scientific investigations by researchers and practitioners alike since many studies reported addiction among its players (Ko *et al*., 2009; King & Delfabbro, 2014). Although there has been no consensus among studies concerning the term for internet games and how to evaluate internet games addiction, American Psychiatric Association has recognized Internet Gaming Disorder in Diagnostic and Statistical Manual of Mental Disorders (DSM-V) as a condition that requires further research (Wei *et al*., 2012; Pontes & Griffiths, 2015; American Psychiatric Association, 2013; Kuss *et al*., 2017). In Indonesia, a study investigating online games addiction among Junior and Senior High students in four cities indicated an addiction level as high as 10.15%. This should be a cause for alarm since there is a greater likelihood that the figure did not accurately represent the reality of online games addiction in Indonesia (Jap *et al*., 2013).

In the context of Medical students, a study has been conducted on addiction to the use of internet in general, not to internet games specifically (Haque *et al.*, 2016). Meanwhile, research examining the use of games among medical students population put

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emphasize on the benefit of using educational games in medical education (Kron *et al*., 2010). Medical students' population is more vulnerable because they face a wider range of difficulties during their study. This put them at higher risk to stress than students of other programs (Aamir *et al*., 2017). Previous studies maintained that stress in this student population is caused by tight schedule, overwhelming number of study materials for examination, parents expectation, lack of leisure time, and inter-personal problems (Abraham *et al*., 2009; Sathidevi, 2009). Stress may have an effect on GPA, mental health, and quality of life in general (Backovic *et al*., 2013; Saeed *et al.,* 2016; Sohail, 2013). Some studies consistently reported that prevalence of stress was common among medical students. This may develop into depression that may trigger idea for suicide (Bamuhair *et al.*, 2015; Honney *et al*., 2010; Sohail, 2013).

Positive coping mechanism such as playing sport or music may reduce stress level *(Fares et al*., 2016). Doing an enjoyable activity may increase dopamine neurotransmitter in the part of the brain that controls rewards and emotions (Blood & Zatorre, 2001; Salimpoor *et al.*, 2011). Wide dopaminergic transmission in the brain ensures that enjoyable activities may affect emotions, reward-motivation, cognition, study, memory, and behavior (Alcaro *et al*., 2007; Shohamy *et al*., 2005). Playing games is one of many activities which may increase the production of dopamine neurotransmitter in the brain. The first study concerning dopamine and gaming activity by Koepp et al., (1998) stated that the binding affinity between dopamine and its receptors in the brain doubles when one play games. This study serves as the foundation for other studies exploring the potential of gaming in reducing stress, stabilizing emotions, and relaxation (Granic *et a*l., 2014; Jones *et al*., 2014).

The role of time spent for playing games has gained significance since Durkin & Barber (2002) reported that depression is lower in individuals that played computer games 2-5 days per week (low computer use), not in those who did not play computer games at all or even in those who played 6-7 days per week (high computer use). Continuous participation in enjoyable activities would modify the system of reward circuitry in the brain. Such modification lowered sensitivity to reward which resulted in tolerance, withdrawal and impacts on daily life (Adinoff, 2004). Adinoff's claim was molecularly supported by the study of Hou et al. (2012) which found a decrease in the number of dopamine transporters as well as the volume of bilateral corpus striatum in individuals with internet addiction disorder as observed by using single photo emission computed tomography (SPECT).

The general impacts of time spent for internet gaming on GPA has been reported by Ventura, et al., (2012) who maintained that there was a significant GPA difference between students who played internet games for 11-50 hours per week and those who played for 1-10 hours per week. Therefore, we saw the need to explore the positive and negative consequences of time spent for internet gaming on the GPA of students, particularly of medical program. Thus, the current study aimed at finding out the association between time spent for internet gaming and GPA as well as Internet Gaming Disorder risk among students of medical program.

Methods

Research Design and Respondents

The study used descriptive cross-sectional design. The population was all students (from First to Fourth year) of Medical Program, Faculty of Medicine, University of Brawijaya, who were actively registered in academic year 2016/2017

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(n=925). Students who did not completely fill out the questionnaire were excluded from the study. The study had been approved by research ethics committee of Faculty of Medicine, University of Brawijaya. The objective of the study was properly presented to the students and informed consent was provided. Students signed the informed consent and completed the questionnaire voluntarily and anonymously.

Instrument

Questionnaire was used as instrument in the study. The respondents filled out the questionnaire independently. The questionnaire elicited socio-demographic information, GPA (in 1-4 scale) and time spent for internet gaming(hours/day). Risk of Internet Gaming Disorder was screened using Personal Internet Gaming Disorder Evaluation-9 (PIE-9). This concise questionnaire detected IGD risk using 5-point Likert scale with (1) never, (2) rarely, (3) sometimes, (4) often, and (5) very often. Students who responded with (4) often and (5) very often on five or more items were classified as at risk of IGD (Pearcy *et al*., 2016).

Statistical Analysis

Data were compiled using Microsoft Excel. Statistical analysis was performed using *Statistical Package for the Social Sciences* (SPSS) software Version 16 (IBM Corporation, Armonk, NY, USA). Socio-demographic data and gaming activity was analyzed using descriptive statistics. Respondents with IGD risk were coded 1, while those not-at-risk were coded 2. GPAs <3.00 were coded 1 and GPAs >3.00 were coded 2. Time spent for playing internet games was categorized as <3 hours/day and >3 hours/day. Association between time spent for internet gaming and GPAs was analyzed using X^2 test. GPA difference between students who played internet games and those who did not were computed using Kruskal-Wallis statistical test, with significance level at $p < 0.05$.

Result and Discussion

Out of 925 students, 439 students filled out the questionnaire completely, thus set the level of participation at 47.4%. The age ranged from 17 to 25 years old, with an average age of 20.2 ±1.57 years old. The percentage of male and female respondents was 37.13% and 62.87% respectively. The number of respondents saying in boarding house/dormitory was 64.69%. Majority of students (82.95%) claimed that their study in Medical programs was intrinsically motivated. Only 11.16% of the respondents stated that they studied medical science because their parents wanted them to. It is interesting to note that playing internet games is common among the respondents (95.22%), with 18.2% respondents at risk of IGD. Details of IGD distribution by sex is presented in table 1.

Table 1 indicates that male students (29.6%) were at higher IGD risk than female (10.1%). Distribution of IGD risk percentage in First, Second, Third, and Fourth year students was 32%, 12%, 11, and 15% respectively. A half of those who were at IGD risk were at 20-22 years age range.

Table 1. Number of respondents playing internet games and IGD risk by sex.

Sex	Total Respondents n=	Total Gamers n=	Total IGD n (%)
Male	163	159	47 (29.6)
Female	276	259	26 (10.1)

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Table 3. Cross tabulation between time spent for internet gaming and IGD risk.

Time spent for internet gaming/day	IGD Risk (n)		P value
	Yes	No	
< 3.00	50	312	P < 0.001
> 3.00	26	30	

We did not find any significant association between time spent for internet gaming and GPA (table 2). However, time spent for internet gaming is significantly associated with IGD risk (table 3). There was no significant GPA difference among respondents who did not play games, those who played games less than 3 hours/day, and those who spent more than 3 hours/day for internet gaming (table 4).

Table 4. Respondents' GPA and time spent for internet gaming

Internet Gaming	Never	< 3 hours/day	> 3 hours/day	P value
GPA (Median)	3.16	3.14	3.13	P = 0.113

The study revealed a high percentage of students playing internet games. This raises the need to anticipate the negative effect of internet gaming on academic performance since psychological condition and positive coping mechanism for stress play pivotal roles in achieving better academic performance (Trucchia, 2013). The positive effect of games on mood has been described in a study by Russoniello *et al*., (2009). Record of brain activity using Electroencephalography (EEG) indicated that after a subject played casual video game (Solitaire for Windows XP), there was a balance between right/left alpha power of the brain which entails mood stability and relaxation. The increase of extracellular dopamine during gaming activity may activate reward system in the brain which gives rise to happiness in game players (Juárez *et al*., 2016; Koepp *et al*., 1998). In addition, dopamine also has positive effect on learning process, motivation, and memory formation in hippocampus (Shohamy & Adcock, 2010).

Those benefits however, are produced on the condition that games are played in controlled duration. Excessive internet gaming activity may develop into internet gaming disorder whose symptoms include preoccupation, tolerance, and withdrawal syndrome. All of these may have negative impacts on daily life such as job loss, career problems, and interpersonal relationship. Individuals with IGD cannot control or stop their gaming habit although they are aware of the negative effect of the activity (American Psychiatric Association, 2013). Such difficulty arises because decreased pleasure-inducing activity results in lower dopamine function which, in turn, causes seeking behavior (Blum et al., 2012). Our study supports the mechanism by indicating the relationship between time spent for gaming activity and IGD risk.

It is interesting that in our study time spent for internet gaming is not associated with students' GPA. Furthermore, there is no difference in GPA between students who do not play internet games and those who do, either for < 3 hours/day or for > 3 hours/day. GPA as one form of academic performances may be affected by various factors, one of which is motivation. Motivation is classified into intrinsic and extrinsic. Intrinsic motivation comes from within the individuals, while extrinsic motivation is derived from external

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factors (Ryan & Deci, 2000). Studying at Medical program because one's parents want him/her toys categorized into the latter. A previous study reports a significant positive association between autonomous motivation and GPA in medical students (Isik *et al*., 2017). As mentioned in the result, the motivation of majority of students in our study (82.95%) to study at medical programs comes from within themselves. This may explain why there is no association between time spent for playing internet games and GPA.

On another note, in our study the percentage of IGD on male students is almost twice as many as that of female students. This is in line with the a study by Sublette & Mullan (2012) which reports that male internet gamers have higher addiction score than female gamers. Male players are also more susceptible to the negative effects of internet games than their female counterparts. Difference in motivations behind playing internet games is assumed as the reason why internet gaming addiction is more prevalent in male players. Another finding of the study is that there is a higher IGD risk in first year students. First year students of Medical program tend to have higher stress level than students of second, third, and fourth year (Racic *et al*., 2017). The first year of education at university makes for a crucial period because students are faced with life changing situation such as living away from parents and adaptation to higher education level (Mattanah *et al*., 2004).

Conclusion and suggestion

Although time spent for internet gaming is not associated with GPA of students of Medical Program, a further study is required to investigate factors affecting the students' GPAs as well as the association between time spent for internet gaming and GPAs of students of other programs.

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