



Relationships between parental attitudes, family functioning and Internet gaming disorder in adolescents attending school



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ABSTRACT

While recent data suggest a high prevalence of adolescent with Internet gaming disorder, little is known about interpersonal factors that contributes or protect to this disorder. Thus, the aim of this study was to examine the relationships between parental attitudes, adolescent perception of family functioning and Internet gaming disorder (IGD) and explore gender differences. From a sample of 434 adolescents attending school ($n = 434$; age 13.2 years), 383 non-problematic gamers (NPG, 196 males; 187 females) were compared with 37 problematic gamers (PG, 29 males; 8 females). Family functioning was assessed with the Family Relationship Index and parental attitudes with a questionnaire measuring rules, access to video games, monitoring and banning of video games. NPG have a better family cohesion while PG have more family conflict and a poorer family relationship. While rules about gaming use are important in males, for females, banning is associated with IGD. For both sex, parental monitoring, conflicts and family relationship are associated with IGD. These findings highlight the strong influence of parental attitudes and family functioning on the occurrence of IGD in adolescents and their gender specificities. Thus, prevention programs need to take into account the importance of parents, parenting and gender specificities.

1. Introduction

Playing video games is currently one of the most popular leisure activities of children and adolescents. For most of them, this activity remains recreational but clinicians and empirical studies have reported that some children and adolescents present pathological symptoms, which are similar to other well-described addictive disorders (Gentile, 2009; Kuss and Griffiths, 2012). Indeed, many similarities have been found between video game disorder and addictive disorder. For example, recent studies have showed similar neural mechanisms between videogame playing and drug abuse (see Weinstein and Lejoyeux, 2015 for review) or between Internet gaming disorder (IGD) and pathological gambling (Fauth-Bühler and Mann, 2015). Based on the DSM-5-section 3 proposed criteria for IGD (APA, 2013), results of a cross-national survey conducted in seven European countries (representative sample of 12,938 adolescents, aged between 14 and 17 years old) revealed that 1,6% meet full criteria for IGD and 5,1% were at risk for IGD by fulfilling up to four criteria (Müller et al., 2015). The French Pelleas study reveals an even higher prevalence of 12%

(Obradovic et al., 2014). Prevalence rates of IGD and at risk adolescent for IGD, confirm the necessity for developing prevention and intervention programs, but also to further characterize those adolescents with a risky usage patterns (Müller et al., 2015). As mentioned by Müller et al. (2015), it is important to find out about the factors (e.g. personality traits, social factors) that exacerbate the gaming habits in adolescents (e.g. risk factors) and those indicative for remission (e.g. protective factors).

For many years, clinicians and researchers have identified parental attitudes and the quality of family relationships as strong protective factors in the emergence of addictive disorders, especially in adolescents (Waldron et al., 2013; Steinberg, 2014; Blustein et al., 2015; Strunin et al., 2015; keijsers, 2016). Concerning IGD, research is still in its early stage. Indeed, low parental support (Baier and Rehbein, 2009), elevated use of video games by parents, divorce or separation of parents (Batthyany et al., 2009), and single-parent families (Rehbein and Baier, 2013) have been associated with IGD. Nevertheless, there is still a scarcity of research investigating the pertinence of family systems theory in the understanding of adolescent addictive behaviors (Denton

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and Kampfe, 1994; Rotunda and Doman, 2001; Collins et al., 2007), especially in adolescents presenting IGD. Recent studies on Internet addiction indicated that these subjects evaluated their family functioning more negatively (Senormanci et al., 2014) and have lower family adaptability and family cohesion than the non-addicted one (Yan et al., 2014). Thus, family functioning is associated with problematic Internet use among adolescents in both sexes (Wartberg et al., 2014). However, Internet addiction includes several diverse behaviors and thus lacks some degree of scientific agreement about its conceptualization. To our knowledge, only one study have investigated family functioning in adolescents with IGD (as well as Internet addiction and substance use disorder). Results showed that a low paternal adaptability (excluding that of the mother) is a common variable that emerges as a significant predictor of different addictive behaviors, including IGD (Tafa and Baiocco, 2009). Family adaptability (i.e. regulation aspects of the family) appeared to be a better predictor than cohesion (the emotional bonds) to identify problematic behaviors. These authors concluded that good family relationships are important protective factors. In fact, adequate emotional sharing, high flexibility in rules, and good levels of satisfaction of all family members contribute to adolescents' well-being and prevent the development of addictive disorders in adolescents.

Studies linking parental attitudes and the family system approach to adolescent IGD are still rare. Furthermore, no studies have been conducted on a French population of gamers. Thus, the aim of this research is to explore the relationships between parental attitudes about gaming (rules about video game use, access to video games at home, monitoring and banning video games), family functioning (global family relationship, and cohesion, conflict, emotion expressiveness sub-dimensions) and IGD in French adolescents attending school. In previous studies, gender differences have rarely been investigated. Since gender affects the relationship between some dimensions of family functioning and problematic behaviors like dysfunctional eating in adolescents (Laghi et al., 2016), it seems an important factor to examine. Thus, as far as possible, gender differences are explored in this study.

Although the term and the definition of Internet gaming disorder are still being debated, we have chosen to use the terms "Internet gaming disorder" (IGD) and "problematic gamers" (PG) in this study.

2. Methods

2.1. Participants and procedure

Five Parisian suburban schools agreed to participate in the study and a total of 437 secondary-school pupils were included. Of these, 3 were then excluded because of missing items on the Game Addiction Scale. The total sample used in the data analysis was therefore 434 adolescents: 231 males (53.2%) and 203 females (46.8%), with an average age of 13.2 (SD = 0.5) for the males and 13.1 (SD = 0.5) for the females.

The study was approved by all the school principals. Furthermore, an active consent was given by the adolescents and a passive consent was obtained from the adolescents' parents (parents were informed by letter and could refuse their child's participation by returning the consent). All participants were assured that their answers would not be shown to their teachers or parents but only to the principal investigator of the study. All participants gave their written informed consent. On the day of the survey, the data collector read aloud the aim of the survey during a single class period. If they had any questions, participants were invited to raise their finger and ask the investigator present in the classroom.

The ethics committee of Paris Descartes University (CERES) approved the study.

2.2. Measures

2.2.1. Demographic data

Only age and gender were reported in the questionnaire.

2.2.2. Gaming use

The questionnaire included questions about the number of screens at home, game-playing behavior (e.g. amount of time spent on Internet and playing video games from Monday to Friday after school and during the weekend) and playing style (e.g. type of video game played and whether gamers played in MMO, meaning massively multiplayer online).

The questionnaire also incorporated the short version of the Game Addiction Scale for Adolescents (GAS) to evaluate gaming disorder (Lemmens and Valkenburg, 2009). This seven-item scale is one of the most frequently used instruments for measuring gaming disorder in adolescents. Each item represents one of the following criteria: salience, tolerance, mood modification, withdrawal, relapse, conflict and problems. Responses are scored on a five-point Likert scale ranging from 1 ("never") to 5 ("very often"). The 7-item GAS showed a good internal consistency and a good concurrent validity.

As recommended by the authors (Lemmens et al., 2009), four "validated" items (a validated item means a response > 2 (sometimes or more)) correspond to problematic use of video games. This cutoff point is in line with the polythetic format applied in the DSM-IV (APA, 1996), i.e. at least half of the criteria indicate that the subject's video game use is problematic. On this basis, two groups were formed: problematic gamers (PG) and non-problematic gamers (NPG).

2.2.3. Parental attitudes

Several parental attitudes to gaming use were investigated. The participants were asked four questions with three possible answers (never or rarely; sometimes; often): At home, I have a free and easy access to video games; My parents set some rules about gaming use in terms of time of use, time of playing during the weekend and type of video game played; My parents have already forbidden me to play video games for a while; I have already played video games late at night (meaning after midnight). The first three questions concern parental rules about gaming and the last one concerns parental monitoring.

2.2.4. Family functioning

The Family Relationship Index (FRI) was used to assess family relationships. This 27-item tool, derived from the Family Environment Scale (90 items), evaluates three sub-scores: family cohesion, family expressiveness (of feelings and emotions) and family conflict (Moos and Moos, 1986; Hoge et al., 1989). Subscale scores are formed from the mean of the nine items, while the FRI score (which represent the family relationship) is formed from the mean of the three subscores, with conflict weighted negatively. Adequate levels of internal consistency and test-retest reliability have been reported for the three subscores. The French version of the FRI was validated and showed a good internal consistency for cohesion (0.79) and conflict (0.71) but a weak one for expressiveness (0.55) (Untas et al., 2011). Thus, it is recommended to test the internal consistency, especially for the expressiveness subscore, and if necessary to remove three items from family expressiveness and use a 24-item version.

Most of the studies investigating family functioning have used the Family Adaptability and Cohesion Evaluation Scale (FACES), which assesses by a 20-item self-report questionnaire two aspects of family behavior: cohesion and adaptability (Olson, 1986). This scale is one of the most widely applied family assessment tools, and has been used in the United States and cross-culturally (Kouneski, 2000). Nevertheless, it has two main drawbacks: no evaluation of conflict, which appears to be relevant in addictive disorders, and the fact that it measures both perceived and ideal descriptions of a family system, which requires completing it twice which appeared difficult with young adolescents.

This seemed too long for our population. In fact, short, fast scales must be used with adolescents (Maiano et al., 2007) to prevent them giving up or responding randomly (Coste et al., 1997) and to reduce the social desirability bias to which adolescents are particularly prone (Gaetan et al., 2014).

In our study, internal consistencies almost reached the threshold of acceptance for the cohesion and conflict sub-scores ($\alpha=0.75$ and $\alpha=0.70$, respectively). Nevertheless, internal consistency was very weak for the expressiveness subscore with or without the three items (items 14, 20 and 23) as raised by Untas et al. (2011) ($\alpha=0.23$ and $\alpha=0.36$, respectively). Thus, we did not use the expressiveness subscale due to its poor internal consistency.

2.3. Statistical analysis

First, univariate analyses were conducted: PG and NPG were compared and, as far as possible, gender differences analyzed. A one-way analysis of variance was used to assess mean differences in continuous variables. For categorical data, differences in percentages were compared with the chi-squared test. A p -value < 0.05 was used as a test of significance with a Bonferroni adjustment for multiple comparisons.

Second, multivariate analyses were conducted: linear stepwise hierarchical regressions were carried out with the GAS total score as the dependent variable. The regressions were first made for the whole sample, and then stratified by gender.

Two variables were not included in the regression: (i) the amount of time spent on Internet during the weekend because it involves several behaviors (social network, email, music, etc.); (ii) the type of game played because of the small number of females. In the first stage, we have entering video game variables: number of screens at home, amount of time playing video games during the week and the weekend, whether gamers were playing in MMO fashion and parental attitudes to gaming. In the second stage, we have entering FRI scores. The family relationship score being calculated from the FRI sub-scores and to respect the rules of collinearity, we have tested two models. One with FRI sub-scores (cohesion and conflict) and one with the FRI total score (family relationship).

The adjusted R^2 coefficient represents the extent to which the outcome is predicted by the independent variables included in each model.

All statistical analyses were carried out with SPSS software (version 20).

3. Results

3.1. Gaming data

Using the GAS, 8.8% of the whole sample are classified as PG ($n = 37$). In this group, males are over-represented (78.4% males vs. 21.6% females, $p = 0.001$).

Gaming data for the whole sample ($n = 434$ including 37 PG and 383 NPG) are presented in Table 1. PG have significantly more screens at home than NPG. PG spend significantly more time during the weekend on Internet, and more time during the week and weekend on video games than NPG. While there are no gender differences in PG, NPG males spend more time on video games than females (during the week and the weekend). Except for management games (e.g. the Sims), which appeared to be played more by females than males, all the other types of video game are significantly more played by males. The only difference between PG and NPG emerged for the shooter games, which are more played by males. PG played more in MMO fashion while in the NPG group, this is a male tendency.

3.2. Parental attitudes and family functioning

Parental attitudes and the scores of the Family Relationship Index for the whole sample, the PG and the NPG, are presented in Table 2.

Concerning parental monitoring, more PG have already played video games late at night (after midnight) than NPG and this result is particularly true for males (gender differences were not applicable in PG). No significant differences appeared between PG and NPG and between males and females concerning the free and easy access to video games. With regard to rules about gaming use in terms of time of use, time of playing during the weekend and type of video games played, no differences appeared between PG and NPG. In the total sample and the NPG group, males have more rules about video games than females (gender differences were not applicable in PG). Finally, more NPG have already been banned from playing video games than PG. In the total sample and the NPG group, more males have been banned from playing video games by their parents than females. Gender differences were not applicable in the PG group. Nevertheless, more PG females have been banned from playing video games than males.

Concerning family functioning, NPG have a significantly better family cohesion than PG while PG have significantly more family conflict than NPG and a poorer family relationship than NPG. Gender differences appeared only in the total sample and NPG group: family cohesion and family relationship were better in males than in females. Females reported more family conflict than males.

3.3. Factors associated with problematic gaming

In the whole sample (without considering gender), factors associated with IGD in the first model ($F = 9.640$, $df (1, 330)$, $p = 0.002$, $R^2 = 31.20$) are: time spent on video games during the week and the weekend ($\beta = 0.126$, $p = 0.043$ and $\beta = 0.199$, $p = 0.002$ respectively), banning video games ($\beta = -0.191$, $p < 0.001$), playing late at night ($\beta = 0.179$, $p < 0.001$), playing in MMO fashion ($\beta = 0.167$, $p = 0.001$), and cohesion ($\beta = -0.142$, $p = 0.002$). In the second model, factors associated with IGD ($F = 15.351$, $df (1, 307)$, $p < 0.001$, $R^2 = 34.10$) are: time spent on video games during the week and the weekend ($\beta = 0.166$, $p = 0.011$ and $\beta = 0.172$, $p = 0.011$ respectively), playing late at night ($\beta = 0.212$, $p < 0.001$), banning video games ($\beta = -0.151$, $p = 0.002$), playing in MMO fashion ($\beta = 0.127$, $p = 0.014$), rules about video game use ($\beta = -0.144$, $p = 0.003$) and family relationship ($\beta = -0.185$, $p < 0.001$).

Tables 3, 4 shows the stepwise hierarchical regressions in males and females. In males and in the first model ($F = 7.026$, $df (1, 177)$, $p = 0.009$, $R^2 = 21.0$), time spent on video games during the weekend ($\beta = 0.313$, $p < 0.015$), playing late at night ($\beta = 0.1622$, $p = 0.025$), and cohesion ($\beta = 0.181$, $p = 0.009$) are positively associated with IGD. In the second model ($F = 9.578$, $df (1, 166)$, $p = 0.002$, $R^2 = 25.0$), time spent on video games during the weekend ($\beta = 0.316$, $p < 0.001$) and playing late at night ($\beta = 0.200$, $p = 0.006$) are positively associated with IGD while setting rules about video game use ($\beta = -0.165$, $p = 0.017$) and family relationship are negatively associated with IGD ($\beta = -0.211$, $p = 0.002$).

In females and in the first model ($F = 11.534$, $df (1, 149)$, $p = 0.001$, $R^2 = 36.0$), time spent on video games during the week ($\beta = 0.170$, $p = 0.014$), free access to video game ($\beta = 0.162$, $p = 0.015$), playing late at night ($\beta = 0.322$, $p < 0.001$), and conflict ($\beta = 0.231$, $p = 0.001$) are positively associated with IGD, while banning video games is negatively associated with IGD ($\beta = -0.306$, $p < 0.001$). In the second model ($F = 11.304$, $df (1, 138)$, $p = 0.001$, $R^2 = 31.0$), playing late at night ($\beta = 0.333$, $p < 0.001$) is positively associated with IGD, while banning video games ($\beta = -0.288$, $p < 0.001$) and family relationship ($\beta = -0.246$, $p = 0.001$) are negatively associated with IGD.

Table 1
Univariate linear regression.

Predictors	Total sample (n = 434)		Males (n = 231)		Females (n = 203)	
	β (95% CI)	p value	β (95% CI)	p value	β (95% CI)	p value
Nb screens/home	β = 0.186 (0.090–0.277)	p < 0.001	β = 0.1237 (0.108–0.366)	p < 0.001	β = 0.163 (0.018–0.253)	p < 0.001
Nb min/day VG M-F	β = 0.317 (0.005–0.009)	p < 0.001	β = 0.258 (0.003–0.008)	p < 0.001	β = 0.244 (0.003–0.012)	p < 0.001
Nb min/day VG WE	β = 0.410 (0.005–0.008)	p < 0.001	β = 0.365 (0.003–0.007)	p < 0.001	β = 0.268 (0.004–0.013)	p < 0.001
Playing MMO	β = 0.352 (2.497–4.217)	p < 0.001	β = 0.217 (1.054–4.174)	p = 0.001	β = 0.203 (0.652–3.530)	p = 0.005
Free access to VG	β = 0.110 (0.138–1.960)	p = 0.024	β = 0.143 (0.129–2.845)	p = 0.032	β = 0.109 (0.234–1.816)	p = 0.129
Rules about VG practice	β = -0.130 (-2.312 to -0.353)	p = 0.008	β = -0.084 (-2.276–0.497)	p = 0.208	β = -0.051 (-1.723–0.813)	p = 0.483
VG ban	β = -0.228 (-4.556 to -1.901)	p < 0.001	β = -0.126 (-3.569–0.076)	p = 0.060	β = -0.370 (-6.427 to -3.044)	p < 0.001
Playing late at night	β = 0.331 (3.166–5.562)	p < 0.001	β = 0.295 (2.148–5.346)	p < 0.001	β = 0.300 (2.096–5.570)	p < 0.001
FRI						
Cohesion	β = -0.179 (-5.619 to -1.546)	p = 0.001	β = -0.197 (-8.135 to -1.443)	p = 0.005	β = -0.289 (-5.951 to -1.918)	p < 0.001
Conflict	β = 0.179 (1.594–5.693)	p = 0.001	β = 0.239 (2.428–8.926)	p = 0.001	β = 0.232 (1.270–5.667)	p = 0.002
Family relationship	β = -0.193 (-8.958 to -2.522)	p = 0.001	β = -0.262 (-15.278 to -4.420)	p < 0.002	β = -0.255 (-7.931 to -1.825)	p = 0.002

Table 2
Parental attitudes about gaming and family functioning.

	Non-problematic gamers (NPG)				Problematic gamers (PG)				NPG vs. PG						
	Total (n = 383) n %	♂ (n = 196) n %	♀ (n = 187) n %	p value ♂ vs. ♀	Total (n = 37) n %	♂ (n = 29) n %	♀ (n = 8) n %	p value ♂ vs. ♀							
Parental monitoring															
Yes	50 13.0	36** 18.4	14 7.5	0.001	14*** 37.8	11 37.9	3 37.5	NA	< 0.001						
No	334 87.0	160 81.6	173** 92.5		23 62.2	18 62.1	5 62.5								
Free access to VG															
Yes	173 45.1	83 42.3	90 48.1	NS	18 48.6	15 51.7	3 37.5	NA	NS						
No	211 54.9	113 57.7	97 51.9		19 51.4	14 48.3	5 62.5								
Rules about VG practice															
Yes	114 29.8	75 ***38.3	39 21.0	< 0.001	16 43.2	14 48.3	2 25.0	NA	NS						
No	269 70.2	121 61.7	147***79.0		21 56.8	15 51.7	6 75.0								
VG ban															
Yes	43 11.2	32** 16.4	11 5.9	0.001	11 29.7	5 17.2	6 75.0	NA	0.004						
No	340 88.8	163 83.6	176** 94.1		26 70.3	24 82.8	2 25.0								
FRI scores															
Cohesion	M 0.76**	SD 0.23	M 0.79*	SD 0.21	M 0.73	SD 0.26	p = 0.024	M 0.62	SD 0.28	M 0.65	SD 0.24	M 0.51	SD 0.40	NS	0.002
Expressiveness	0.51	0.17	0.50	0.16	0.53	0.19	NS	0.47	0.20	0.47	0.21	0.51	0.21	NS	NS
Conflict	0.29	0.23	0.25	0.22	0.32**	0.24	p = 0.006	0.41**	0.23	0.39	0.19	0.49	0.34	NS	0.004
Family relationship	0.66**	0.16	0.69**	0.13	0.64	0.18	p = 0.009	0.58	0.19	0.59	0.17	0.57	0.29	NS	0.009

FRI: Family Relationship Index; VG: video game; NA: not applicable.

4. Discussion

Our study aimed to investigate the relationships between parental attitudes about gaming use, family functioning perceived by young adolescents and IGD and explore gender differences.

Three major findings emerged from this investigation: 1) Compared to NPG, PG had significantly more screens available at home, they spent significantly more time during weeks and weekends on video games, and they played more in a MMO fashion (especially first person shooter games). There are more PG who have played late at night and who were

Table 3
Factors associated with problematic gaming in males (hierarchical stepwise regression).

Predictors	Model 1				Model 2			
	A	SE	β (95% CI)	p value	A	SE	β (95% CI)	p value
Nb min/day VG WE	0.004	0.001	0.313 (0.002–0.006)	< 0.001	0.004	0.001	0.316 (0.002–0.006)	< 0.001
Rules about VG practice					-1.770	0.732	-0.165 (-3.216 to -0.324)	0.017
Playing late at night	2.102	0.927	0.162 (0.273–3.931)	0.025	2.662	0.948	0.200 (0.791–4.532)	0.006
FRI								
Conflict	4.263	1.608	0.181 (1.089–7.437)	0.009			-0.211 (-12.859 to -2.842)	0.002
Family relationship								
R ²	21.0				25.0			

Nb min/day VG WE = Number of minutes per day playing video games during the weekend; VG = video game; FRI: Family Relationship Index.

Table 4
Factors associated with problematic gaming in females (hierarchical stepwise regression).

n = 203	Model 1				Model 2			
	A	SE	β (95% CI)	p value	A	SE	β (95% CI)	p value
Nb min/day VG M-F	0.005	0.002	0.170 (0.001–0.009)	0.014				
Free access to VG	1.203	0.489	0.162 (0.237–2.169)	0.015				
VG ban	–3.951	0.876	–0.306 (–5.683 to –2.219)	< 0.001	–3.700	0.917	–0.288 (–5.51 to –1.886)	< 0.001
Playing late at night	3.924	0.813	0.322 (2.317–5.530)	< 0.001	3.764	0.821	0.333 (2.141–5.387)	< 0.001
FRI								
Conflict	3.374	0.993	0.231 (1.411–5.337)	0.001	–4.734	1.408	–0.246 (–7.519 to –1.950)	0.001
Family relationship								
R ²	36.0				31.0			

VG = video game; Nb min/day VG M-F = Number of minutes per day playing video games during Monday to Friday after school; FRI: Family Relationship Index.

banned from playing video game by their parents. PG had a lower family cohesion, more family conflicts and a poorer family relationship than NPG; 2) The time spend on video games (week and weekend), playing after midnight, and playing in a MMO fashion are positively associated with IGD. Rules about video game use, punishment for gaming use, cohesion and family relationship are negatively associated with IGD; 3) Some factors associated with IGD are different in males and females.

Before discussing this findings, it is interesting to note that in agreement with the literature on IGD (Mentzoni et al., 2011), the results of our study show that the prevalence of IGD is particularly high during adolescence (8.8% in this study) and that males are over-represented among PG (Rehbein et al., 2010; Gentile et al., 2011; Rehbein and Baier, 2013; Müller et al., 2015).

Without considering gender, the time spent on video games (week and weekend) was associated with IGD. In a longitudinal German study following a group of school students, although gaming time predicted IGD in a model that only included media usage variables, the effect disappeared in the full longitudinal model (Rehbein and Baier, 2013). The cross-sectional nature of our study does not enable the long-term effect of this variable to be tested. Nevertheless, this factor differ by gender. In the NPG group, males spend twice the time on video games during the week and the weekend than females. Time spend on weekend is associated with IGD but only for males while time spend during the week is associated with IGD only for females. This result is interesting in terms of prevention. Indeed, for young males, it is important to find other weekend leisure than only playing video games. For young females, it is important to limit gaming time during the week. Nevertheless, as pointed out by Seok and DaCosta (2014) with the frequency of play, although PG spend a lot of time playing video games, this factor (time of play) cannot be used as a criterion for identifying IGD.

Without considering gender, playing in MMO fashion was associated with IGD. Several studies have highlighted the addictive potential of MMORPG (massively multiplayer online role-playing games) (Stetina et al., 2011; Hussain et al., 2012; Müller et al., 2015). Beyond the importance of the type of video game played (not investigated in this study), our results show that the online multiplayer aspect of gaming is important. In fact, this result highlights the addictive nature of the accessibility, visibility and high potential of never ending use that Internet provides and the addictive aspect of associating with other gamers (e.g. guilds). Furthermore, this result combined with those on family functioning, emphasizing that problematic use could be seen as a coping strategy more than compulsive behavior (Kardefelt-Winther, 2014). Indeed, adolescents with broken family relationship may tend to play MMORPG in order to get benefit from social interaction and to escape from a dysfunctional family environment. Gaming use would be a way for adolescent to cope with family dysfunctions. The gamers could experiment other warmth social interaction with his guildmates. Nevertheless, this factor is no more

significant when taking gender into consideration. In males and in females, parental attitudes and family functioning appeared more significant.

While the number of screens available at home was high for both males and females, PG had significantly more screens available at home than NPG but the number of screens at home was not associated with IGD. In a research on Australian adolescents (Smith et al., 2015), accessibility was not a key factor associated with IGD. Nevertheless, our results showed that this assertion is true for males but not for females. For females, the free and easy access to video game is positively associated with IGD and this result matches the fact that the weekly gaming time is associated with IGD in females. Thus, for the females, the accessibility is a risk factor to a heavy game use.

Without considering gender, parental attitudes appeared to be a strong predictor of IGD, in particular: (i) rules about the use of video games (negatively associated with IGD); (ii) punishment for gaming use (negatively associated with IGD), which probably implies noncompliance about gaming-use rules; (iii) parental monitoring to ensure that their child does not play video games too late (positive association with IGD). A recent study highlighted the absence of a main effect of parental restrictions on child video-gaming (Choo et al., 2015), contradicting researchers and practitioners regarding setting restrictions on the time, place, and content of child video-gaming to prevent excessive gaming or reduce symptoms (Chiu et al., 2004). In fact, punishment or restriction, so to say the ability of parents to prohibit gaming use, is important for females only and this parental attitude could prevent excessive gaming while for males, rules about gaming use prevent them from IGD (which is not the case in females). Males seem to benefit from clear rules about gaming use like time to begin and time to end gaming with an important parental vigilance.

Compared to NPG, PG had a lower family cohesion, more family conflicts and a poorer family relationship. Furthermore and without gender consideration, cohesion and family relationship are negatively associated with IGD. As suggested for Internet addiction (Young and Rogers, 1998; Young, 2004; Senormanci et al., 2014), IGD could disrupt family functioning by leading to problems in the users' daily lives and relationships with other family members. By the same time, disrupted families could push the adolescent to escape by fleeing into the virtual world. Indeed, disrupted family functioning, particularly cohesion and family relationships, renders individuals vulnerable to IGD (Park et al., 2008). Han et al. (2012) emphasized the therapeutic aspect of family cohesion. Improvement in perceived family cohesion following 3 weeks of treatment was associated with an increase in the activity of the caudate nucleus in response to affection stimuli and was inversely correlated with changes in on-line game playing time. Their findings suggest that family cohesion may be an important factor in the treatment of IGD. Nevertheless, taking gender into consideration nuanced this result. Indeed, cohesion is no more significant in males and females regressions, and family conflicts appeared as an important factor for both sex given that this factor is positively associated with

IGD. One hypothesis is that the escape function of gaming in regard of family conflict is central for both sex and that cohesion could be a consequence of IGD. Whatever the case, cohesion is an important aspect to be taken into account in treatment of IGD.

Our results, in agreement with those of Chiu et al. (2004) and with those of Chien-Hsin et al. (2009) on Internet addiction, show that parental monitoring is a major inhibitor of IGD in both males and females. Indeed, compared to NPG more PG have played late at night on video games and this parental attitude is negatively associated with IGD in males and females. In agreement with previous findings, in males and females, family relationship appeared as a key factor for the occurrence of IGD (Chiu et al., 2004; Choo et al., 2015). Indeed, a disrupted parent-child relationship appeared to be a strong predictor of pathological symptoms of IGD in a longitudinal study (Choo et al., 2015). Several clinicians have hypothesized that playing video games is an attempt by adolescents to suppress or avoid negative feelings generated by poor family functioning. Thus, video gaming could be a refuge for suffering adolescents. Incidentally, IGD is frequently associated with depression (Brunborg et al., 2014). Thus, this virtual refuge could make things worse, or at least would not solve the disrupted family functioning. It would be interesting in further research to evaluate the feelings associated with family dysfunction and then investigate the motivation and function of video games linked to family dysfunction.

Choo et al. (2015) suggested that beyond the fact that video-gaming is a gendered phenomenon (and thus that pathological gamers are predominantly male), the etiology of adolescent pathological symptoms of video-gaming differ by gender. The results of our study show that this is truer for parental attitudes than about family functioning, which is similar for males and females. However, this result could be due to the scale used to assess family functioning. Thus, it would therefore be interesting to investigate further the potential gender differences in parent-adolescent relationships with other scales assessing other facets of family functioning.

This study has some limitations that should be addressed. The first is the small size of our sample (434 participants). As suggested by some authors, a small sample increases the risk that the relevance of some specific factors remains undiscovered (Rehbein and Baier, 2013). Thus, it is possible that some differences (or lack of differences) are due to something artificial - sample size - rather than real. There is a need to replicate these results in larger groups of participants. This is particularly true for females who were under-represented in our PG sample. Thus, gender differences were sometimes impossible to investigate. The second limitation is the use of a cross-sectional design. Thus, causal relationships between the variables could not be identified. Thus, this study cannot clarify the causes of IGD. Third, as pointed out before, another limitation of this study is the absence of sociodemographic data, especially family configuration (e.g. single parent family) but also economical and educational status of the participants' parents. Indeed, studies have shown that socio-economic status increased IGD (Toker and Baturay, 2016). Furthermore, parental attitudes must be evaluated in more detail. For example, we were unable to confirm whether the banning of gaming was a consequence of non-compliance with parental rules regarding the use of video games. Moreover, the current study aimed to assess the influence of family functioning on IGD. However, we observed only the adolescent's perception and not the parents' perception of family functioning. Furthermore, because several studies have shown that depression is associated with IGD (as an antecedent but also a consequence) (Stetina et al., 2011; Wei et al., 2012; Brunborg et al., 2014; Liau et al., 2015; Vadlin et al., 2016), it should have been interesting to evaluate depression but also adjusted regression analyses for depression. One last limitation refers to the scales used. Cronbach's α of the family expressiveness of the FRI was very low and questioned the relevance of this subscore for this population. First, it is much more difficult to have reliable instruments in such a young group than in adults and second, at this age the immaturity of some brain areas (Steinberg, 2007), particularly related to emotion expression, could

explain the difficulty for a young adolescent to evaluate this dimension accurately in his/her family.

5. Conclusions

The high prevalence of IGD in our study and in the literature data indicates that this disorder is not a transient phenomenon of adolescence (Gentile et al., 2011; Rehbein and Baier, 2013) and highlights the need to develop specific prevention programs and public education about Internet gaming use and take gender into consideration. Our main findings on parental attitudes and family functioning emphasize the importance of including the adolescent's family in these programs. These prevention programs should acknowledge not only the importance of the quality of the parent-child relationship (including the fact that family conflicts is an important risk factor) and parental monitoring in the development of pathological symptoms of IGD, but also the importance of adapting parenting by gender: setting rules about gaming use for males, the appropriate consequences when these rules are not respected for females (i.e. punishment of gaming use) (Granic and Patterson, 2006) and do not leave video games open for females. As Smith et al. (2015) suggested, there is a need for more empirical studies to examine the influence of protective parenting practices. Finally, our results also highlights the relevance of family therapy for adolescents who consult for IGD and the necessity to adapt therapeutic modalities with gender. Thus, research on treatment related-gender specificities need to be addressed. Indeed, it is not sure that what is effective for male is also effective for female. Because girls with IGD are exceptional, they could be exceptional for other reasons.

Conflicts of interest

None.

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