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Ph.D. THESIS

INTERNET GAMING DISORDER IN ADOLESCENTS: PARENTAL CONTRIBUTIONS AND MENTAL HEALTH CORRELATES

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*Notes.*_____

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A. Articles

1. Published from thesis:

- **Coşa, I. M.,** Dobrean, A., Georgescu, R. D., & Păsărelu, C. R. (2023). Parental behaviors associated with internet gaming disorder in children and adolescents: A quantitative meta-analysis. *Current Psychology*, 42(22), 19401-19418**.** https://doi.org/10.1007/s12144-022-04018-6 (IF: 2.8)
- **Coşa, I. M.,** Dobrean, A., & Balazsi, R. (2024). Measurement Invariance of the Lemmens Internet Gaming Disorder Scale-9 Across Age, Gender, and Respondents. *Psychiatric Quarterly*, 95(1), 137-155. https://doi.org/10.1007/s11126-024-10066-x (IF: 3.5)

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B. Conferences

- **Coşa, I.M.**, Dobrean, A., (2019) Parental behaviors factors for internet gaming disorder in children and adolescents and emergent adults: A quantitative meta-analysis – Preliminary results. Poster presentation at the EACLIPT 2019, Dresden, Germany, October 31 – November 2, 2019
- **Coşa, I.M.**, Dobrean, A., (2019) Factori parentali implicați în adicția de jocuri video, la copii, adolescenți și adulți emergenți: o meta-analiză cantitativă. Open Paper presentation at APR National Conference 2019, Cluj-Napoca, Romania, 22-24 November 2019
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Key Words: Internet Gaming Disorder; parental factors; Lemmens Internet Gaming Disorder Scale-9; measurment invariance; network analysis; adolescents;

CHAPTER I. THEORETICAL BACKGROUND

The primary objective of the thesis implied a multilevel examination of the mechanisms underlying Internet Gaming Disorder (IGD) symptomatology in adolescents, with a focus on the predisposing and cognition components. Additionally, another main goal of the thesis was to enhance the methodology underlying evidence-based assessment of IGD symptomatology among adolescents.

IGD, also referred to as "video game addiction," "gaming disorder," "pathological video gaming" or "problematic video game use," is defined as `the use of the Internet for games, often with other players, that leads to clinically significant impairment or distress regularly` (American Psychiatric Association, 2013). According to the Diagnostic and Statistical Manual, Fifth Edition (DSM-5), five to nine proposed criteria must be present within a 12-month period to be considered problematic. Similarly, in 2019, under the name Gaming Disorder (GD), the World Health Organization included it as a mental disorder in the eleventh revision of the International Classification of Diseases (World Health Organization (WHO), 2019). Both the *DSM-5* and *ICD-11* require the presence of clinically significant distress before proposing a diagnosis (*Table 1.1).*

Table 1.1

DSM-5 and ICD-11 Criteria for defining IGD or GD

Symptoms/Criteria	*DSM-5*	*ICD-5*
Preoccupation: Gaming is the dominant activity in daily life	*	
Withdrawal after no gaming: symptoms such as irritability, anxiety, and sadness	*	
Tolerance: increasing time spent gaming to arrive at excitement	*	
Unsuccessful attempts to control gaming	*	*
Loss of interest in other activities that are not related to gaming (e.g., past hobbies)	*	*
Continued usage despite psychological problems	*	*
Deceiving family, friends, and therapists related to the amount of time spent gaming	*	
Negative consequences (e.g., job loss)	*	

As the literature emphasizes, both operationalizations, namely the DSM-5 and the ICD-11, are consistent with each other (kappa=0.80, $p<0.001$) and direct the assessment of problematic gaming (Higuchi et al., 2021; King et al., 2020; Yen et al., 2022). However, a comparison between the two diagnostic systems (N=7,022 first-year students) indicated that the 12-month prevalence of IGD estimated with DSM-5 is twice as much as the estimated GD with ICD-11 (Borges et al., 2021). Moreover, the ICD-11 criteria failed to identify almost half of the identified IGD cases based on DSM-5. This is problematic when identifying possible treatment seekers using ICD-11 (Adamkovič et al., 2023; Borges et al., 2021; Starcevic et al., 2020). Additionally, some symptoms proposed by the DSM-5 are highly relevant in identifying problematic gamers (e.g., continued use of games), while others` relevance (e.g., preoccupation or withdrawal) is relative (Adamkovič et al., 2023; Gomez et al., 2022; Yuan et al., 2022a). Therefore, further understanding how the DSM-5 criteria interact with each other and potentiate the occurrence of IGD symptomatology remains a forefront problem

.

1.1. Prevalence of IGD in adolescence

Previous epidemiological studies suggest that IGD represents a serious concern among minors (i.e., under 18 years old) when compared to adults (over 18 years old) (Darvesh et al., 2020; Fam, 2018). This assertion finds reinforcement in the most recent scoping review commission by WHO (i.e., Darvesh et al., 2020; Fam, 2018), which sought to delineate the global prevalence rates of IGD using both the *ICD-11* and *DSM-5-specific* criteria.

Moreover, IGD is more prevalent in male adolescents (i.e., 6.8%, 95% CI = 4.3%-9.7%), rather than in female adolescents (i.e., 1.3%, 95% CI = 0.6%-2.2%.) as reported in Fam`s (2018) meta-analyses. Also, existing literature suggests that higher prevalence rates in youth can be found in countries such as Asia (9.9%, 95% CI = 1.0%-21,5%) compared to Europe (3.9%, 95% CI = 2.8%-5.3%) or other regions (e.g., Aastralia: 4.4, 95%, CI = 1.9%-7.4%) (Fam, 2018).

While the prevalence rates are elevated in this population, little is known about the underlying causes of IGD development and maintenance (Wang et al., 2019). Moreover, it is essential to exercise caution when addressing these prevalence values. Specifically, the literature highlights limitations in both the assessment of IGD and the overall methodological rigor of the studies conducted (Kim et al., 2022; King et al., 2020; Stevens et al., 2020).

1.2. Consequences of IGD in adolescents

1.2.1. Mental health problems

Adolescents who engage in excessive gaming often face various mental health issues. Cross-sectional studies indicate that IGD is linked to anxiety disorders, such as social phobia and depression (King et al., 2019; Paulus et al., 2018; Yen et al., 2014). The relationship between IGD and mental health is complex, with some studies showing a bidirectional relationship between anxiety and IGD (Kim et al., 2022) and others indicating that IGD may predict internalizing and externalizing problems (Richard et al., 2022). Additionally, higher ADHD symptoms are associated with higher IGD symptomatology and vice versa (Salerno et al., 2022). Excessive gaming is also linked to increased suicidal ideation, suicide attempts (Erevik et al., 2022), psychotic symptoms (Huot-Lavoie et al., 2023), and greater usage of drugs and alcohol (Brunborg et al., 2014).

1.2.2. Physical health problems

IGD is associated with various health issues in adolescents, including reduced physical activity and poorer eating habits, which can lead to obesity (Puolitaival et al., 2020). Both male and female adolescents who spend excessive time gaming report decreased physical fitness and unhealthy eating patterns (Alghadir et al., 2021; Subu et al., 2021). IGD is also linked to higher Body Mass Index (BMI), regardless of gender (Alghadir et al., 2021; Subu et al., 2021)

Additionally, high IGD symptomatology correlates with increased occurrences of pain in the wrist, back, and neck (Cankurtaran et al., 2022), as well as headaches, eye problems, hearing issues, and sleep disturbances (Bener et al., 2019). Continuous gaming for extended periods is associated with visual impairment and physical fatigue (Lee et al., 2019).

1.2.3. Academic and Economic problems

Both cross-sectional and longitudinal studies reported that IGD is associated with lower academic performance in adolescents across the world (Brunborg et al., 2014; Hawi et al., 2018; Macur & Pontes, 2021; Paulus et al., 2018). For example, a large cross-sectional study on children (N= 1704, age:11-17 years old) revealed that an addiction tendency to the internet and electronic gaming is inversely associated with academic achievement. Similarly, following students over one year, Benjet et al. (2023) showed that preexisting IGD symptomatology at baseline was associated with severe school impairment and poor social life.

Economically, problems from addictive gaming in Korea cost around $3.5B annually, despite addicted users generating $3.7B in revenue (Cho et al., 2018).

Noticeably, following the upside trend in the prevalence of IGD in adolescents, several countries have adapted specific policies to combat it (Király et al., 2018). Countries like South Korea and China have implemented policies to limit gaming among minors, such as shutdown systems and fatigue monitoring, alongside international efforts by gaming companies to allow parental controls and issue warning messages (Király et al., 2018; Long et al., 2022). However, these services function

without a general consensus or guideline on the best practices (i.e., prevention or intervention programs) for IGD symptomatology in adolescents.

1.3. Etiology of IGD in adolescence

The etiology of IGD in adolescence is multifaceted, involving gaming-related, individual, and environmental factors. Király et al. (2023) provide a comprehensive overview, identifying key factors that contribute to the development and maintenance of IGD:

a) Game-related factors:

Games vary in their addictiveness, with genres like multiplayer online role-playing games (MMORPGs), shooters, and real-time strategy games employing operant conditioning and social interactions to keep players engaged (Barnett & Coulson, 2010; Chen et al., 2020). Monetization techniques such as microtransactions and loot boxes also increase player engagement through the "sunk-cost effect" (Király et al., 2023).

b) Individual Factors

Individual factors include demographics, personality traits, motivational factors, comorbidities, genetic predispositions, and neurobiological processes. Males and adolescents are more prone to IGD, while personality traits such as neuroticism, impulsivity, and sensation seeking increase risk. Psychopathological conditions like depression, anxiety, and ADHD are strong predictors of IGD, though the direction of these associations is unclear (Gentile et al., 2017; Hyun et al., 2015; Salerno et al., 2022). Motivations like escapism, achievement, and social fulfillment also contribute to IGD, along with neurobiological factors like dopamine release and specific genetic polymorphisms (Deneen et al., 2022).

c) Environmental Factors

Environmental influences include family dynamics and peer relationships. Protective factors against IGD include positive parent-child relationships and classroom integration, while conflict, neglectful parenting, childhood maltreatment, and bullying increase risk (Schneider et al., 2017).

While no single factor is sufficient to cause IGD, psychopathological conditions are the strongest predictors (Ferrari et al., 2022). Most research has focused on gaming-related and individual factors, with environmental factors needing further exploration. Understanding the role of social agents like parents and peers is crucial for developing effective prevention and treatment programs for adolescents with IGD.

1.4. Parental factors and their Role in IGD

Parents are the primary caregivers, and it is well known that they play an important part in developing and maintaining internalizing and externalizing problems and addictive disorders in adolescence (Yap et al., 2014a, 2017; Yap & Jorm, 2015). The comprehensive theoretical model of McLeod et al. (2007a), further developed by Yap et al. (2014b) proposes two core dimensions of parenting: warmth/rejection and control. These dimensions were examined either individually or in conjunction, often manifesting as distinct parenting styles. Beyond these core dimensions, Yap et al. (2014b) also emphasize the key role of monitoring and interparental conflict in adolescents` mental health.

According to Yap et al. (2014b), warmth is characterized by the level of emotional support and nurture provided by the parents. Conversely, withdrawal and aversiveness represent a lack of parental involvement and acceptance of the adolescent. While warmth is associated with positive outcomes in adolescence (Schneider et al., 2017), withdrawal and aversiveness enhance the risk of further IGD symptomatology in adolescence (Chen et al., 2020).

The control component reflects the extent to which parents either encourage autonomy or dependence in their offspring. Autonomy-granting is associated with positive youth development, while overinvolvement has adverse effects (Schneider et al., 2017; Sugaya et al., 2019).

Additionally, parenting styles are the result of the interplay between warmth and control dimensions. Consequently, there are four parenting types that are commonly encountered based on these two dimensions: *authoritative, permissive, neglecting,* and *authoritarian* (Baumrind, 1991). Notably, the authoritative style is the most effective in preventing IGD (Abedini et al., 2012; Krossbakken et al., 2018; Schneider et al., 2017).

Furthermore, monitoring, as proposed by (Yap et al., 2014a) refers to the extent to which parents are aware of their offspring's activities, friendships and whereabouts.

Not least, interparental conflict, seen as the degree of interparental hostility coupled with heightened and frequent dissatisfaction expressed within the marital relationship (Yap et al., 2014a) increases the risk of developing adolescent psychopathology (i.e., internalizing and externalizing problems) (Cummings et al., 2012).

1.5. Theoretical models of IGD

One of the early theoretical frameworks of IGD proposed by Davis (2001) discussed the cognitive mechanisms underlying it. Based on his theory, the interplay between maladaptive cognitions and dysfunctional behaviors intensifies or maintains the symptomatology of problematic internet use. Specifically, Davis (2001) argues that two categories of distorted automatic cognitions (i.e., thoughts about self and thoughts about the world) are present in people with any specific problematic internet use (e.g., IGD). Moreover, Davis (2001) cognitive theory mentions a series of factors that act as contributors (i.e., predisposing factors) for IGD, such as the preexisting psychopathology (e.g., anxiety or depression) or the lack of social support perceived (e.g., from family or friends).

Considering the complex etiology of IGD and Davis's (2001) pioneering work, Brand et al. (2016, 2019) extended the existing theory and proposed a more integrative framework for explaining the development and maintenance of IGD symptomatology. The I-PACE (Interaction of Person-Affect-Cognition-Execution) model, explains the development of IGD through the interaction of various factors. It emphasizes (P) predisposing factors such as genetic predispositions, personality traits, early childhood experiences, and psychopathological conditions like depression and social anxiety. The model also considers (A) affective processes, including emotional states and stress, and (C) cognitive processes, such as maladaptive thoughts and beliefs. Executive functions (E), particularly decision-making and inhibitory control, play a crucial role in regulating behavior. The model posits that gratification and compensation experiences from gaming reinforce these behaviors. Over time, the interaction of these factors leads to stronger associations between triggers, cognitive and emotional responses, and gaming behavior, ultimately resulting in habitual and potentially addictive patterns.

1.6. Assessment of IGD

The assessment of IGD represents a topic of increased debate in the field, considering that 77.9% of the variance in IGD prevalence rates is due to the assessment tools used (Stevens et al., 2020). Specifically, there is no universally accepted *gold standard tool* to assess IGD, but rather, the field has an overproduction of similar instruments (King et al., 2020). Specifically, 32 instruments were identified by King et al., (2020), and only five instruments were sound in terms of psychometric properties, conceptual and practical considerations. Recently, even these instruments were found to have minor caveats at the level of how some items operationalized the described criteria in DSM-5 (Karhulahti et al., 2023).

1.7. Limitations of the state of the art

Through our examination of the current field, we found several caveats that we will further discuss:

Firstly, despite the higher prevalence rates of IGD in adolescents (e.g., 8.8%, 95% CI: 7.5%–10.0%) (Gao et al., 2022) and the negative consequences associated with it in youths (e.g., sleep disturbance, lower academic performance, increased anxiety or depression) (Hawi et al., 2018; Islam et al., 2020; Kim et al., 2022; Wartberg, Kriston, et al., 2019), there is still little understanding of the factors that determine and maintain IGD symptomatology. A closer look at the proposed risk and protective factors indicated that environmental factors, specifically parental ones, are the less studyed components in relation to IGD symptomatology, in adolescents. While several parental dimensions were recognized to be relevant for IGD symptomatology (Schneider et al., 2017), there is a notable absence of a quantitative summary of the relationship between specific parental factors and IGD symptomatology in youths. Thus, affecting the interpretation of the results of existing interventions for IGD (e.g.,Krossbakken et al., 2018), which included parental components.

Further, of all the parental factors researched until now in relation to IGD symptomatology, the most controversial link is the one with attachment to parents. Particularly, on one side, attachment to parents was found to have a bidirectional relationship with IGD in adolescence (Teng et al., 2020). On the other side, researchers argued that this connection holds true only in some circumstances, such as the presence of a mediator (e.g, self-esteem) (Kim & Chun, 2022a; Nielsen et al., 2020; Teng et al., 2020). Although negative automatic thoughts are known as a mechanism of change in the link between parental attachment and child and adolescent mental health psychopathology (Irfan & Zulkefly, 2023), no study has evaluated it, in the link between parental attachment and IGD symptomatology.

In addition, in Romanian, there is no evidence-based assessment tool for IGD in adolescents. Although a recent study conducted in a Romanian sample of adolescents identified 22% of them with clinical IGD symptomatology (Maftei & Enea, 2020). Therefore, having an assessment tool adapted for this population is essential for the further assessment and treatment of IGD symptomatology in Romanian adolescents. Internet gaming disorder scale (IGDS) represents a short-nine items, reliable and valid instrument whose factor structure was found to be sound across different Western cultures (King et al., 2020). However, its factorial model has never been studied in a collectivist, non-Western culture (King et al., 2020). Additionally, the measurement invariance of IGDS has not been evaluated across gender, age, and responder (parent and adolescent) (King et al., 2020). Thus, evaluating if items are understood similarly across different groups of people is essential. This will further enhance the validity of the scales and ensure that comparisons between groups are trustworthy.

While IGD was recognised as a disorder in ICD-11 (World Health Organization (WHO), 2019)), in DSM-5 it still represents a condition that requires further research before being considered a standalone disease (American Psychiatric Association, 2013). Additionally, the DSM-5 proposed criteria for IGD have been found to have different levels of relevance in the occurrence and maintenance of it, with some symptoms acting like central nodes in the network of symptoms, namely loss of control or continued use of gaming despite the problems caused by it, while others lack consistency in terms of their relevance (Adamkovič et al., 2023; Karhulahti et al., 2023). Similarly, the diagnostic accuracy of the nine symptoms for IGD is not equivalent, with some criteria having high clinical relevance (e.g., craving gaming; loss of control) and others having lower diagnostic accuracy (e.g., deceiving) (Müller et al., 2019). Therefore, one debate that holds true among researchers is related to the number of symptoms that would better describe the IGD condition in the case of an update of the DSM-5 diagnostic manual. Additionally, further research is required to better understand how these criteria are presented in an adolescent population, how they interact with each other, and how they enhance the presence of IGD diagnostics in adolescents.

Not least, comorbidities have been linked to IGD symptomatology in adolescence (Gao et al., 2022; Salerno et al., 2022). Additionally, from the perspective of the I-PACE theoretical framework (Brand et al., 2019), mental health conditions are considered to be possible predictors of the occurrence and maintenance of IGD symptomatology. However, the interplay between the psychopathology conditions and IGD symptomatology is little understood. Specifically, using the network approach (Borsboom & Cramer, 2013) would delineate which mental health conditions are relevant and potentiate the occurrence of IGD symptomatology in adolescence.

CHAPTER II. RESEARCH OBJECTIVES AND OVERALL METHODOLOGY

The current thesis's general aims were twofolded. First, the thesis aimed at investigating the mechanisms underlying IGD symptomatology among adolescents from a multilevel perspective (the I-PACE framework). Specifically, we focused on the role of predisposing (P) and cognition (C) components in understanding the occurrence and maintenance of IGD symptomatology. The second general aim of the thesis was to improve the methodology in the field of evidence-based assessment of IGD symptomatology among adolescents. In this sense, four studies have been conducted for the current thesis.

2.1. Specific objectives

The first specific aim of our research was to provide a comprehensive overview of the role of parental factors in IGD symptomatology among adolescents. As the literature on the relationship between parental dimensions and IGD symptomatology in adolescence is in its infancy, there is a clear need for a quantitative synthesis to better understand the possible risks and protective parental factors. To attain this goal, we conducted a quantitative meta-analysis of 38 studies investigating the association between parental predictors and IDG symptomatology and explored possible moderators. (Study 1).

The second aim of our study had a methodological focus, given the caveats found around the assessment of IGD symptomatology. Particularly in Study 2, we aimed to adapt, validate and investigate the psychological properties of the Lemmens` Internet Gaming Disorder scale (IGDS) on a Romanian sample of adolescents. In this attempt, we had two main objectives: 1) investigating the factor structure of the scale on a Romanian sample of adolescents and their parents 2) evaluating the measurement invariance of the scale across age, gender and respondents (i.e., parents and youths).

The third specific aim was to investigate the cognitive mechanisms through which parental predisposing factors, namely parental and peer attachment, contribute to adolescents IGD symptomatology. More specifically, in Study 3, we tested the indirect effects of parental and peer attachment on IDG via adolescents' negative automatic thoughts.

In our last study (Study 4), we were interested in understanding how the main adolescent mental health problems interact and enhance IGD symptomatology in youths. In this endeavor, we used a network analysis approach in which we first tested the stability of IGD symptomatology in a Romanian adolescent sample, followed by evaluating the network structure that combined the total score of IGD as measured with IGDS and the main adolescents mental health problems as measured with the Youth Self Report (YSR).

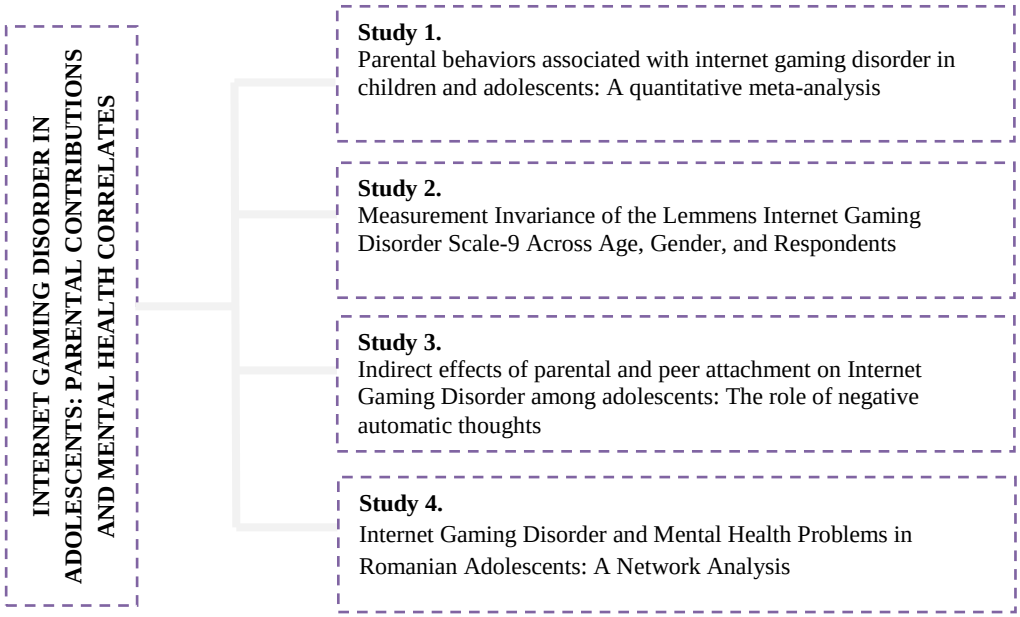

Fig.2.1 General structure of the Ph.D. thesis

CHAPTER III. ORIGINAL RESEARCH

3.1. Study 1: Parental behaviors associated with internet gaming disorder in children and adolescents: A quantitative meta-analysis[1]

3.1.1 Introduction

Over the past decades, online games have gained popularity, with estimates that by 2023, more than 3 billion individuals will use the Internet mostly for playing (Statista, 2021). Studies looked at upholding factors and consequences of such behaviour and showed that limited online gaming experience is associated with an increment in cognitive abilities, motivation, and social functioning (Granic et al., 2014). However, excessive gaming was linked with psychosocial problems (e.g. aggression, loneliness), and addictions (e.g., alcohol; Internet gaming disorder - IGD); especially in children and adolescents (Darvesh et al., 2020; Sugaya et al., 2019). In addition, adolescents who have internalizing and/or externalizing issues are more likely to exhibit IGD symptomps, and their risk of developing IGD rises if the internalizing problems began in childhood and persisted into adolescence (Richard et al., 2022).

The chain reaction of these reports was the inclusion of IGD in 2013, as a condition for further study in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and officially adopted at the World Health Assembly in May 2019 as a diagnosis in the 11th edition of the International Classification of Diseases (World Health Organization (WHO), 2019). The IGD behaviour was described as the recurring gaming behaviour which negatively impacts the everyday functionality. In this definition recurring gaming behaviour was described as the increased interest in Internet games over the past few months, with significant amounts of time spent playing, and withdrawal symptoms when Internet gaming is restricted, while affecting everyday functionality was understood as missing opportunities in life and interference with the normal routine and basic self-care (e.g, sleep, hygiene), real-world social interactions (e.g., meeting friends), and relevant responsibilities (e.g., family responsibilities).

Etiology and prevalence of IGD

Joining the above definition, previous large-scale studies suggest that IGD is more prevalent in children and adolescents under 18 than in older people (Darvesh et al., 2020; Sugaya et al., 2019). Specifically, a scoping review (Darvesh et al., 2020) commissioned by the World Health Organization showed that the global prevalence rate of IGD is between 0.26-38% in children and adolescents among the general population and between 7.93-11.44% in youths among the IGD clinical population. In addition, higher prevalence rates of IGD occur in Asia (6%-21%), than in Europe and America (1%-5%) (Saunders et al., 2017) and among boys (3.1-10.4%) than girls (0.3-1.2%) (Sugaya et al., 2019).

However, despite the upward trend of IGD prevalence (Fam, 2018) and the negative intra and interpersonal consequences (King & Delfabbro, 2017), the course of IGD development is still elusive with a range of factors (i.e., neurobiological, psychological, environmental and family factors) highlighted to impact both the development and maintenance of it (Bonnaire et al., 2019; Chung et al., 2019; Lee et al., 2021; Saunders et al., 2017). Specifically, the existing literature appears to bring greater support to the relationship between intrapersonal factors, such as personality characteristics, emotional regulation, co-occurring disorders, and IGD (Fumero et al., 2018; Mestre-Bach et al., 2022), while interpersonal-environmental factors (e.g., social support, family factors, game related factors) are less explored (Schneider et al., 2017). Nevertheless, interpersonal-environmental factors, particularly different parental factors (i.e. parent status, the parent-child relationship, parental influence on gaming behaviour, family environment) have been hypothesized to be relevant in occurrence and maintenance of IGD, in adolescents (Bonnaire et al., 2019; Mestre-Bach et al., 2022; Schneider et al., 2017).

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[1] This study has been published: Coșa, I.M., Dobrean, A., Georgescu, R.D. *et al.* Parental behaviors associated with internet gaming disorder in children and adolescents: A quantitative meta-analysis. *Curr Psychol* **42**, 19401–19418 (2023). https://doi.org/10.1007/s12144-022-04018-6

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Theoretical Background on Parental Factors and IGD

When it comes to parent behaviour, the current theoretical frameworks outline the existence of both specific parental behaviors and parenting styles relevant for adolescents` mental health. The theoretical model proposed by McLeod et al. (2007), and further refined by Yap et al. (2014) for parental factors associated with internalized problems proposes two core elements of parenting: warmth/rejection and control. The two dimensions have been investigated directly, or interecting with each other (i.e., parenting styles). In addition, apart from these components, the model described by Yap et al. (2014) discusses the influence of monitoring, and inter-parental conflict as key factors in adolescents` mental health.

The warmth/rejection component of parenting is discussed by Yap et al. (2014) as the extent of parental activities which provide support to the youths, by enhancing a sens of security, encouraging and approving them. In the IGD literature, emotional comfort and nurturing provided by parents (i.e, warmth) has been significantly associated with positive outcomes (i.e., decreased IGD behaviors/substance use and greater psychological adjustment). Similarly, positive and loving experiences within the family setting have been discussed to protect youth against game addiction (Wu et al., 2016). Contrarily, withdrawal (i.e., the lack of parental involvement, or emotional support offered), and aversiveness (i.e., lack of parental acceptance) have been significantly associated with increasement of behavioral addictions (i.e. IGD, problematic phone use) (Chen et al., 2021; Sugaya et al., 2019).

Moreover, the other core element described by Yap et al. (2014), is the control component, referred to as either the extent to which parental activities interfere with youths' autonomy (i.e., autonomy granting), or encouraging dependence (i.e., overinvolvement). Parents` attempts to control adolescents` activities by lessening their autonomy are associated with lower youth positive development (Cao et al., 2020). Also, previous studies showed that a family environment characterized by conflicts and poor relationships between family members, increases the risk of behavioral addictions (e.g., internet addiction, and IGD) (Schneider et al., 2017).

In addition, parenting literature acknowledged the contribution of both individual parental factors (i.e., warmth/rejection; control) but also the synergistic effects (e.g., parenting styles) on a child's well-being. Consequently, Baumrind, (1991) describes the four widespread discipline-related parenting styles as: authoritarian, permissive, neglecting, and authoritative styles. Previous findings indicated that families that maintain elevated levels of control and warmth are more successful preventing a variety of hazards (e.g., IGD, externalizing problems) (Krossbakken et al., 2018; Schneider et al., 2017).

Additional parental factors which may interfere with the youths' wellbeing described in parenting literature are interparental conflict, and monitoring. Interparental conflict is characterized by the frequency and intensity of marital dissatisfaction, and the extent to which parents express hostility towards each other (Yap et al., 2014b). Adolescents living in a family environment marked by elevated levels of interparental conflict are well known to be at higher risk of developing mental health problems (i.e., internalizing, and externalizing problems) (Cummings et al., 2012).

Yap et al. (2014) describe monitoring as the extent to which parents are aware of their children's whereabouts, habits, and friendships without making a qualitative distinction in this parental practice. However, the general parenting literature on media usage broadens on this conceptualization and distinguishes between different types of media monitoring (i.e. mediation): active monitoring (i.e., evaluative, prearming and discussing in order to promote critical thinking about media), restrictive monitoring, defined as setting appropriate rules, regulations, and limits on child media exposure, and coviewing (i.e., consuming media content together) (Collier et al., 2016; Padilla-Walker et al., 2020). According to a meta-analysis of the link between parental mediation and child outcomes, coviewing and restricted mediation were both substantially associated with media use (r= -.06, p<.01; r= .09, p<.01), but active mediation was not $p>.05$ (Collier et al., 2016).

As such, when it comes to the IGD development and parental factors the most researched factor is by far the parent-child relationship (Mestre-Bach et al., 2022; Schneider et al., 2017), suggesting that greater family conflicts, lower warmth and affection in the family are predicting IGD symptomatology increase (Bonnaire & Phan, 2017; Cuong et al., 2021; King & Delfabbro, 2017). In the same vein, Schneider et al. (2017) review on parental factors and IGD, foreground these results regarding parent-child relationship. Beyond parent-child relationship, other subcategories of parental

factors depict contradictory results (e.g., family functionality, communication, monitoring are both positive and negative associated with IGD) (Brandhorst et al., 2021; Chiu et al., 2004; Yen et al., 2007). These mixt results can be explained by different theoretical approaches. For example, family functionality is described in some studies as family support, help, and level of emotionality in the family, while others see it as the level of harmony and interaction in the family (Brandhorst et al., 2021).

Consequently, the degree to which parental factors are related to IGD is still up for debate and a subject of great theoretical interest in light of the aforementioned limitations of the current literature. Adressing this gap, will bring evidence of which parental factors have a more important contribution on IGD symptomatology, and could effectively be targeted in family-based intervention.

Nevertheless, some early interventions have targeted parental factors (e.g., family cohesion (Han et al., 2012), monitoring (Krossbakken et al., 2018), these factors were chosen in the absence of a theoretical model or a meta-analytical study estimating the mean effect size of the association between parental factors and IGD. To date, there is only one review that ended the search in July 2016 (Schneider et al., 2017), which aimed to look at the broader category of parental variables. The results indicated that poorer parent-child relationships are associated with greater gaming problems, which highlights that parental involvement is a deciding factor in the development and maintenance of IGD behaviour. However, although the review took the IGD literature a step further, by clarifying which are the family factors more prone to be associated to IGD behaviour, there is still missing the magnitude of the associations for further inclusion of these factors into prevention or intervention studies.

Aim of the study

The present meta-analysis aim to examine the magnitude of the relationship between parental factors and IGD. This study has two main objectives: (a) to evaluate whether specific parental factors are differently associated with the overall IGD behaviour, and (b) to test whether the link between specific parental factors and IGD behaviour is influenced by both continuous (i.e., age, sample size, publication year, study quality) and categorical (i.e., gender, the technological development level of the country) moderators.

3.1.2. Method

Protocol

The protocol was preregistered in PROSPERO (CRD42019143381) and the meta-analysis was carried out in line with the Preferred Reporting Items for Systematic Review and Meta-Analyses Protocols (PRISMA-P) statement (Moher et al., 2015).

Identification and Selection of studies

A systematic search in PubMed, PsycINFO, Proquest, Scopus, Web of Science, and Cochrane databases was conducted on April 15, 2019, and updated on January 28, 2021, using the following search terms: (online gaming OR internet gaming OR game*) AND (addict* OR dependence* OR problem* OR excessive OR disorder*) AND (family* OR parent* OR mother* OR father* OR grandma* OR grandpa* OR caregiver* OR siblings* OR sister* OR brother*). In addition, a manual search of the references in the narrative and systematic reviews was conducted. In EndNote, duplicated references were excluded and the remaining articles, titles and abstracts were reviewed. The remaining articles were assessed full-text, based on the inclusion/exclusion criteria.

Inclusion and exclusion criteria

Observational studies examining the association between parental factors and IGD were included. Studies were included if the object of study was Internet Addiction, only if it was specified that the Internet was used to play games. The specific inclusion criteria were: 1) studies with the focus on IGD or symptoms of problematic internet gaming use that 2) measured at least one parental factor that was relevant to the study, 3) published in a *peer-reviewed* journal, and 4) written in English or German, focusing on 5) children, adolescents (≤18 years old), and 6) offering enough information to compute effect sizes. The exclusion criteria considered were: any other outcomes that were not of interest (i.e., family factors that are not relevant to the study, only Internet addiction), and study population - above 18 years old.We also excluded the intervention and longitudinal studies that do not assess the association between parental factors and IGD at baseline.

Data extraction

The following data were extracted from each study: study characteristics (study name, authors, publication year, country of origin, country technology developmental level, sample size, study design), study sample characteristics (mean age, gender, type of game played), method of assessment, for both internet gaming disorder and parental factors, and country technology developmental level.

Coding

Each parental measure was coded by two independent researchers, with any disagreement solved by consultation with a third researcher, into the categories described by Yap et al. (2014). Namely, the parental factors considered were the two broad parental dimensions: warmth/rejection (i.e., withdrawal, aversiveness, warmth) and control (i.e., overinvolvement and autonomy-granting), and three supplementary themes: interparental conflict, monitoring, restrictive monitoring, and parental styles (i.e., permissive, authoritarian, authoritative and inconsistent parenting).

Quality assessment

Two independent researchers assessed the methodological quality of the included studies against the fourteen criteria of the *NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies* (QA) (NIH, 2014). The degree measure of agreement was evaluated by computing Kappa (Munoz & Bangdiwala, 1997).

The Meta-Analytic Approach

As we expected high heterogeneity, we employed a random-effects model. The primary analysis pooled unadjusted correlations from cross-sectional studies (or data from longitudinal studies at baseline) focusing on the association between each parental factor and the youth IGD symptoms. In those cases where the correlation coefficient was not available, we firstly contacted authors for the primary data. When the available data was not provided, the effect sizes were estimated from other available statistics, such as: *t*-value and sample size for correlation; or odds ratios with confidence intervals, as recommended by Borenstein et al. (2010).

The heterogeneity of effect sizes was assessed using the I^2 (Higgins et al., 2003). All analyses were performed using Comprehensive Meta-Analysis (CMA v. 2.2.064) and a *p*-value of less than 0.05 was considered significant.

Moderation analyses and sensitivity analyses

To improve the applicability of our estimations, we performed a series of sensitivity and subgroup analyses: exclude outliers. Continuous moderators were tested using unrestricted maximum likelihood meta-regression analyses, while categorical moderators were tested using a mixed-effect meta-analytic test for those association with at least four studies in each group (Fu et al., 2011). Further we looked at the moderated effect of mean age and technology development level of the country/region (i.e., the ability of the country to create and use technology measured with this four dimensions: human skills, diffusion of technology, adopting modern technology, and creating technology) (Incekara et al., 2017). Specifically we look at three categories: Leader (high on all four dimensions), potential leaders, they distinguish by the leader's group due to limited level of creating technology, and dynamic adopters (i.e. they have severe problems in developing new technology) (Incekara et al., 2017). We also tested gender (the percentage of male participants), sample size, and year of publication as moderators. Nevertheless, the quality of the studies was also deemed a potential moderator, since low quality studies were associated with high effect sizes (Zhang et al., 2013). Moreover, due to the high heterogeneity between IGD evaluations (King et al., 2020), assessing either the presence of the disorder, or the risk of it, the type of assessment was included in the subgroup analyses as a measure of the clinical status of the population.

Small study effects

Publication bias was assessed by visually inspecting the funnel plot for the primary outcome categories and employing the trim and fill procedure of Duval & Tweedie (2000). For associations with at least 10 ESs, we also conducted Eggers' test of the intercept to test the symmetry of the funnel plot (Egger et al., 1997).

Ethics

The study does not require ethical approval because the methodology of the current meta-analysis is based on published research and the original data are anonymous.

3.1.3. Results

Selection and inclusion of studies

Initially, 6082 records were identified (5071 remaining after duplicates were removed). After the inspection of the abstract and title, 4897 studies were excluded. We retrieved the full text of the remaining 174 articles. Subsequently, 43 articles met our inclusion criteria, 8 of which reported associations from multiple regression analyses. Following contact with the original authors for these studies, we obtained the correlation coefficients three of them (Bonnaire & Phan, 2017; Cheng, 2019; Sahin et al., 2019). For the remaining 5 articles, the authors did not provide data, thus leaving a total of 38 studies included in the meta-analysis (*Fig. 3.1*).

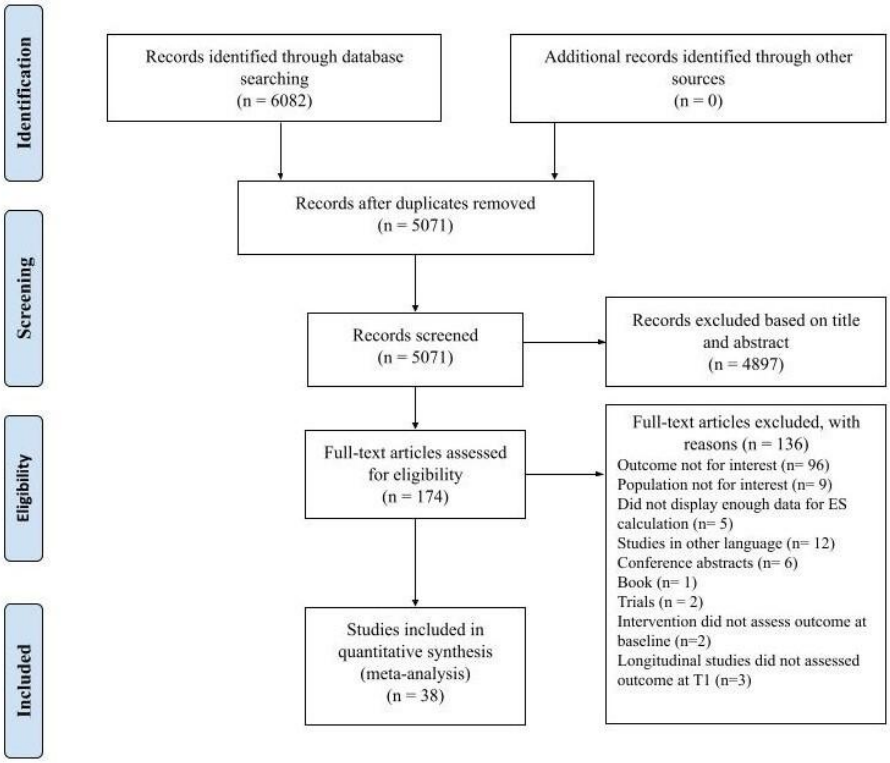

Fig. 3.1 PRISMA flow-diagram of the study selection process

Characteristics of included studies

The 38 studies included in the analysis had 47.362 participants, and were published between 2011 and 2020. The mean age based on the 29 studies offering this information was 13, whereas the other studies only reported in what grade the students were (grades 3 to 12). Two studies only targeted male participants (Hwang et al., 2020; Yuh, 2018), whereas the others had mixed samples. In the 36 studies providing information regarding the participants' gender, 54.24% were male. The type of game that participants played was specified in one study: Pokémon Go (Cheng, 2019), whereas the others only classified games as mainly internet computer or mobile games. Only 3 studies provided clinical samples (Hwang et al., 2020; Koc et al., 2020; Vadlin et al., 2016). Out of 38 studies looking at parental factors, 31 assessed the warmth component. On the other hand, the least analysed parental factors were: parental styles (i.e., authoritarian, authoritative, permisive), which were assessed in only one study (Abedini et al., 2012), and inter-parental conflict (2 studies) (Bonnaire & Phan, 2017; Koc et al., 2020). Regarding the country/region technology developmental level, 22 studies were conducted in regions that are leaders in terms of technology development (e.g., France, Singapore), 10 studies looked at potential leaders (e.g., Mainland China, Taiwan), 1 study was carried out in a region from the dynamic adopters group (i.e., India) (Malik et al., 2020) and for 5 of the countries/regions (Abedini et al., 2012; Cheng, 2019; Kwon et al., 2011; Wu et al., 2016; Yuh, 2018) we could not

report the technology developmental level, since Incekara et al. (2017) had not assessed them in his study. Two studies assessed IGD with ad hoc questions (e.g., "About how many hours a day do you play PC-games or TV-games (PlayStation, Xbox, GameCube etc.) in your free time?" (Brindova et al., 2014), while the other 36 used a valid assessment tool such as tests/scales/questionnaires.

Quality assessment of the included studies

We identified 7 studies of high quality, more than 10 points on QA (NIH, 2014), 22 studies of fair quality, between 7 and 10 points on QA (NIH, 2014) and 9 studies of inadequate quality, less than 7 points on QA (NIH, 2014). Inter-rater reliability for the overall quality of the study scoring assessed by the two reviewers was high, Kappa=.803 (p<.001).

Overall effect size (Table 3.1)

The effect sizes of the association between each specific parental factor and IGD are presented in *Table 3.1*.

Table 3.1

Effect Sizes for the association between parental factors and IGD

Effect Size	k	r	95% CI	*p*-value	I^2 %
Autonomy-granting	5	0.090	0.018, 0.161	0.014	80
Authoritative parenting	1	NA	NA	NA	NA
Authoritarian parenting	1	NA	NA	NA	NA
Aversiveness	10	0.129	0.026, 0.229	0.014	96
Outliers excluded [a]	7	0.116	0.013, 0.217	0.027	93
Interparental conflict	2	NA	NA	NA	NA
Restrictive monitoring	4	0.083	0.031, 0.135	0.002	45
Monitoring	6	0.152	0.071, 0.230	<0.01	93
Overinvolvement	7	0.196	0.098, 0.291	<0.01	92
Permissive parenting	1	NA	NA	NA	NA
Warmth	31	0.135	0.087, 0.182	<0.01	96
Outliers excluded [b]	28	0.117	0.070, 0.164	<0.01	94
Withdrawal	7	0.280	0.168, 0.384	<0.01	92
Outliers excluded [c]	5	0.262	0.180, 0.340	<0.01	85

Note: k= number of effect size estimations;
r= Effect size estimation as pearson correlation coefficieNt;
CI = Confidence Interval; I^2 = Heterogeneity index; NA= not applicable
[a] outliers: Jang & Ryu (2016); Lin et al. (2020); Malik et al. (2020)
[b] outliers: Chang & Kim (2020); Hong & Do (2020); Sahin et al. (2019)
[c] outliers: Hwang et al. (2020); Koc et al. (2020)

Subgroup and meta-regression analyses

To improve clinical utility and explore the heterogeneity between studies, we performed subgroup and meta-regression analyses only for the association between warmth and IGD, since Fu et al. (2011) and Cochrane's handbook (Higgins et al., 2020) suggest a minimum of four studies per group for subgroup analysis, and a minimum of 10 studies for each study level, for meta-regression analysis.

Analyses showed that the country's level regarding technological development was not a significant moderator for the association between warmth and IGD (p=0.196). Similar results were found for study quality (p=0.364) and population clinical status (p=0.441). Moreover, publication year was negatively associated with the effect size, with a slope of -0.009, 95% CI [-0.012, -0.005], p<.001, for warmth and IGD (N=31). Sample size positively predicted the effect size of the

association between warmth and IGD (N=31), slope=0.000, 95% CI [0.000,0.000], $p<.001$. However, the percentage of males ($p=0.731$) and the mean age ($p=0.376$) did not moderate the association.

Small study effects

Guidelines for the interpretation and examination of the funnel plot, suggest at least 10 studies per analysis (Sterne et al., 2011); therefore, the inspection of the funnel plot was performed only for the association between warmth and IGD. No sources of small study effects were identified. The trim and fill procedure identified no studies that would produce changes in the effect size of the association between warmth and internet gaming disorder.

3.1.4. Discussions

In the present meta-analysis, we confirm the link between specific parental factors and IGD. We found significant small to medium effect sizes between specific parental factors (i.e., autonomy-granting, aversiveness, restrictive monitoring and monitoring, overinvolvement, warmth and withdrawal) and IGD.

Withdrawal and IGD

The largest effect size was identified for the association between withdrawal and IGD, meaning that lack of parental emotional support and interest in child activities shown by the parent is associated with high IGD symptomatology in teenagers. The current results are in line with both cross-sectional (Wartberg et al., 2017) and longitudinal studies (Jeong et al., 2020) and one possible explanation for these results could be found in the social compensation hypothesis, which emphasizes the compensatory role of games, for the offline social difficulties (e.g., Wartberg et al., 2017)

Overinvolvement and IGD

The next effect size observed was for the relationship between overinvolvement and IGD, meaning that excessive parental involvement in children's activities was associated with higher IGD symptomatology. Our results are in line with those of a prior meta-analysis on a related behavioural addiction (i.e., Internet addiction) that reported a positive low-medium effect size ($r=.211$, 95% CI, 0.190, 0.231) between negative parental behaviours and Internet addiction (Li & Lei, 2018). Moreover, the overinvolvement component in our study implies a type of control (i.e., psychological control) associated with negative outcomes. A large three-wave longitudinal study (N= 908) emphasizes the bidirectional relationship that exists between parental psychological control and IGD in teens, with a stable direct effect observed over time only for the path between parental control and IGD (Lin et al., 2020). Therefore, parental control is not only a strong predictor of later IGD, but also adolescents behavioral addictions (i.e. IGD) increases for a period of time the parental psychological control.

Monitoring and IGD

Furthermore, monitoring, defined as parent`s knowledge of adolescents' activities, whereabouts and friends was associated with IGD behaviours, showing significant but small effect size. In other words, parental higher levels of information about their teens' were associated with lower levels of IGD. As literature on parental monitoring and IGD is inconsistent, with studies showing both its effective and ineffective role in reducing IGD (Su et al., 2018), our result brings fresh knowledge to the widespread inconsistency, pinpointing it as an important protective factor for IGD.

Warmth and IGD

Another relevant result retrieved is the confirmation of the association between warmth and IGD symptomatology. We have found a significant association between elevated levels of pleasant interactions/positive attitudes expressed by the parents towards their teenagers and a lower IGD symptomatology. It is well known that the lack of emotional warmth from parental figures is associated with a lack of psychological adjustment in youths and an increase in both the internalizing and externalizing problems (Yap et al., 2014b). Additionally, the literature shows that pathological gamers tend to perceive the family environment and communication with the parents more negatively (Eksi et al., 2020; Liau et al., 2015). Consequently, teenagers seek refuge in the virtual world of games.

In addition, further interventions augmented with this parental component could benefit from the present results as both gender and age were found not to be moderators for the association between warmth and IGD. Furthermore, as there are no differences in the magnitude of association

between warmth and IGD in teenagers at risk of developing IGD compared to teenagers diagnosed with IGD, this component should be targeted in further preventive/treatment programs. Besides, country's/region's level of technological development did not prove to be a significant moderator. Therefore, further programs could be designed independently to the country region when targeting warmth component.

Aversivness and IGD

Looking at the association between aversiveness (i.e., parental hostility toward the adolescent, and lack of parental acceptance) and IGD, our results show a significant correlation. This result is not surprising, since the literature pinpoints that poor parent-child relationships and an abusive environment increases the likelihood of IGD severity in children (Sugaya et al., 2019). Also, cross-sectional studies support the negative link found between parental rejection and IGD. Therefore, aversiveness, similarly to withdrawal and overinvolvement, should be considered a risk factor for developing IGD, in children and adolescents. However its effect might be prone to change considering different youth psychological variables (i.e. anxiety, core self-evaluation).

Autonomy-granting and IGD

Moreover, a significant link was observed between autonomy-granting and IGD. Parents high in autonomy-granting (i.e., encouraging choices and adolescents independence), are associated with low levels of IGD. This result is consistent with the literature covering the control dimension in teens, showing that high age-specific independence is strongly associated with reduced externalizing problems (Kunz & Grych, 2013). From a theoretical point of view, autonomy-supportive parental practices could be explained through self-determination theory (i.e. individual autonomy seen as an essential need for optimal functioning) (Padilla-Walker et al., 2020). However, when targeted in an intervention program, the autonomy-granting would best be considered jointly with the sub-dimension of overinvolvement. Both sub-dimensions of control (overinvolvement and autonomy-granting) are particularly salient in adolescence (Silk et al., 2003).

Restrictive monitoring and IGD

The last parental component that showed a significant but small association with IGD was restrictive monitoring. As literature regarding the relationship between rules, regulation of gaming and IGD is heterogeneous, with studies showing both negative correlations (e.g., Bonnaire & Phan, 2017; Rehbein & Baier, 2013; Su et al., 2018) but also positive correlations (e.g., Kalmus et al., 2015; Wu et al., 2016), our findings provide new insights on the persistent inconsistency and identify it as a significant IGD protective factor. According to prior research and in line with self-determination theory, parental monitoring style is of much importance. Adolescents of parents that promote autonomy while maintaining time and content restriction have lower negative outcomes related to media use (Padilla-Walker et al., 2020). However, it should not be disconsidered that the restrictive monitoring accounts differently depending on the age of youths (Rodríguez-Meirinhos et al., 2020).

Implications

In light of the findings of the current meta-analysis, this study advances the research literature, by showing for the first time that specific parental factors do matter on occurrence and maintenance of IGD. Particularly, autonomy-granting, both monitoring dimensions and a warm environment are protective parental components, whereas aversiveness, overinvolvement and withdrawal are risk parental factors.

On a practical level, parental factors could be considered jointly with intrapersonal factors when developing intervention and prevention programs for IGD. Considering the pioneering work done in the field concerning interventions in IGD, as well as our results, we would suggest that targeting specific parental factors might increase the efficacy of the already implemented interventions for IGD.

Furthermore, given the debate around the regulations related to excessive game play in adolescents (i.e. Mainland China; South Korea) (Kattula et al., 2021; Király et al., 2018), we argue that effective policy measures should consider the role of parents in the development and mantainance of IGD symptomatology.

Nevertheless, at a parental level, these results may help parents understand that they should focus more on creating a warm and supportive environment, enhancing parent-child communication and self-regulation when dealing with IGD symptomatology in their offspring.

Limitations

The present results should not be seen as equivocal, and before assimilating parental factors into psychological interventions, it is important to question the impact associated with the number of studies included and the high heterogeneity percentages around our estimations. Thus, we need to consider the fact that except for the warmth factor, our associations were based on a small number of studies. Consequently, in view of the recommendations of Fu et al. (2011), our results should be seen as inceptive, not confirmatory, and further studies should be employed before drawing strong conclusions. In addition, except for the restrictive monitoring dimension, all associations correlated with high heterogeneity, which only partially decreased in sensitivity analyses. Not least, future research could extend the age gap and consider also how parental factors are related with IGD during emerging adulthood.

3.1.5. Conclusions

In conclusion, although our results are inherently linked by the methodological flaws of primary studies, the current meta-analysis is the first to assess the association between specific parental factors and the IGD symptomatology. We identified both protective and risk parental components, with the stronger links found between two specific parental factors (i.e., withdrawal, overinvolvement) and IGD. Considering theis results, we argue that these specific dimensions should be detected early, and further prevention/intervention programs could be carried out both to prevent and reduce the occurence of IGD in adolescence. Besides, in accordance with the current literature movement we emphasize the importance of a systemic oriented approach to IGD treatment, so that both individual level but also interpersonal factors can be used to guide treatment and policy measures. Nonetheless, parents should prioritize fostering a loving and supportive atmosphere in the family that encourages child disclosure, and self-regulation to prevent IGD symptomatology.

3.2. Study 2: Measurement Invariance of the Lemmens Internet Gaming Disorder Scale-9 Across Age, Gender, and Respondents[2]

3.2.1. Introduction

The proliferation of internet access worldwide (i.e., 63% of the world population used the Internet in 2021 (The World Bank, 2023)) and the heightened usage of Internet services during the Coronavirus Disease 2019 (COVID-19) pandemic (e.g., 40% to 100% increase during lockdown period (Branscombe, 2020)) raised concerns about problematic Internet use (i.e., generalized or specific) (Lin, Ratan, et al., 2023; Ruckwongpatr et al., 2022). Although behavioral addictions became public health concerns, by now only gaming (after gambling) was considered by the American Psychiatric Association as "Internet gaming disorder" (IGD), being a condition for further study in the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; (American Psychiatric Association, 2013)), and by the World Health Organization (WHO) as "Gaming Disorder" (GD) as a formal diagnosis in the eleventh edition of the International Classification of Diseases (ICD-11; (World Health Organization (WHO), 2019)). Although various terms, like "internet gaming problems", "pathological online gaming", "video-game addiction" or "gaming disorder" are used interchangeably to define aspects related to IGD, this paper refers to it as recurrent gaming behavior (online or offline), which is characterized by an impairment of everyday functionality over the course of a year (Wang et al., 2019).

Prevalence and consequences of IGD

IGD prevalence rates in the general population varied by regions (ranging from 0.21% in Europe to 57.50% in the Western Pacific), gender (0.21% to 57.50% for males, and 0.25 to 26.09 for females), and age groups (0.21% to 55.27% for adults; 0.26% to 38.00% for both adolescents and children) (Darvesh et al., 2020).. In a Romanian sample of 139 adolescents (10–14 years), 22% of them had been identified with clinically relevant IGD symptoms (Maftei & Enea, 2020). Although for many youths, playing games moderately can be considered harmless or even beneficial at a cognitive, emotional and social level (Alimoradi et al., 2022; Granic et al., 2014; Raith et al., 2021), for some adolescents excessive playing was associated with several health problems (Männikkö et al., 2020), namely, increased psychological distress (Kakul & Javed, 2023; Lin, Potenza, et al., 2023), sleep disturbance (Bener et al., 2019; Lin, Potenza, et al., 2023), sedentary and poor eating habits (or obesity) (Kamolthip et al., 2023; Puolitaival et al., 2020). Moreover, IGD symptomatology was associated with several mental health problems (e.g., anxiety, depression, substance used disorder, attention deficit hyperactivity disorder) (Chang et al., 2023; Kakul & Javed, 2023; Lee et al., 2023) and poor academic performance (Benjet et al., 2023; Islam et al., 2020). Thus, it is crucial to properly identify adolescents who are at risk or who exhibit IGD symptomatology in order to lessen the complex effects on youths` wellbeing.

IGD assessment

Given the wide range of prevalence rates, IGD has been the subject of debate in the literature regarding its recognition as a mental disorder, diagnosis, and optimal screening and assessment approaches (Griffiths, 2016; Vaccaro & Potenza, 2019; Wang et al., 2019). King et al. (2020) argued in their meta-analyses that this fluctuation in prevalence rates could be attributed to measurement issues. Firstly, the review emphasizes the overproduction of conceptually similar tools (i.e., over 30), which leads to increased uncertainty among researchers and practitioners, in this field regarding the standard measurement of IGD. Secondly, King et al. (2020) foreground the problems concerning the evaluation of the tools from psychometric points of view, which is most commonly done by the same researchers who created them. Thus, the quality of the results is highly problematic. Moreover, the review addressed the importance of sampling, which warrants closer attention since different instruments favored different results (i.e., assessing non-convenience samples showed the highest prevalence rates). Likewise, Stevens et al. (2020) highlighted in his meta-analysis that 77.97% of the variance across IGD prevalence estimates is due to the choice of screening tool used, with some

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instruments endorsing the highest prevalence rates (i.e., Lemmen Internet gaming disorder-9 scale, Gaming Addiction Identification Test, and Problematic Videogame Playing scales). Inadequate measurements for IGD have serious implications for the quality of research conducted in the field, the identification of clinically significant gamers, as well as for policy decisions based on the clinical studies related to it.

However, after critically evaluating 32 available IGD tools, based on conceptual, psychometric properties, and practical considerations, King et al. (2020) identified five instruments (e.g., Internet Gaming Disorder Scale-9 items (Lemmens IGD-9) (Lemmens et al., 2015)) with strong empirical support, across both Western and Eastern countries.

When assessing children and adolescents for IGD, it is essential for clinicians to use short, reliable, and validated instruments. One such tool is the Lemmens Internet Gaming Disorder Scale (IGDS), which addresses the inconsistencies found around IGD in terms of psychometric properties (King et al., 2020). IGDS is a short 9-item dichotomous scale (yes/no), developed based on *DSM-5* (American Psychiatric Association, 2013) criteria for IGD, and it is used for screening purposes. IGDS is translated into different languages, and it is used both in cross-sectional and longitudinal studies (Baiumy et al., 2018; King et al., 2020; Sioni et al., 2017; Stockdale & Coyne, 2018; Wartberg, Kriston, & Kammerl, 2017; Wartberg, Kriston, Kramer, et al., 2017; Wartberg, Zieglmeier, et al., 2019). According to the empirical results IGDS has a one-dimensional factor structure, with good reliability (α=0.83) and criterion validity (King et al., 2020; Lemmens et al., 2015). Moreover, it is the only self-assessment tool that has a standardized version for an external rating of IGD (i.e., parental rating), adapted by Wartberg et al. (2019). The parent version (i.e., the Parental Internet Gaming Disorder Scale - PIGDS) replicates, in a sample of German parents (N=985), the factorial structure and the good psychometric properties (i.e., high convergent validity; good reliability coefficient, KR20 coefficient was 0.86) found for IGDS in the original study of Lemmens et al. (Lemmens et al., 2015).

Despite the wide applicability of IGDS and PIGDS in different clinical and prevalence studies (King et al., 2020; Stevens et al., 2020; Wartberg et al., 2017; Wartberg et al., 2019), and the good psychometric properties they hold, the proof of measurement invariance (MI) is still missing (King et al., 2020). Furthermore, the factorial structure of the scales has not been tested on a wide range of samples, including those from non-Western European countries. Examining MI is an essential aspect of instrument validation, as it reflects the extent to which the instrument used (i.e., IGDS, PIGDS) has the same meaning across all respondents, regardless of their group membership. Hence, using an instrument that has no proof of MI across the groups studied might show distorted findings. The comparison between the groups of interests based on such an instrument can be confounded by differences in measurement and scaling properties, not in real differences across groups (Putnick & Bornstein, 2016). Addressing this gap is of high importance, since it will provide insightful results regarding the construct stability, across gamers of different genders, and ages, measured with these instruments.

Aim of the study

To address these needs, we investigated the psychometric properties of both versions of the scale (i.e., parent/youth) in the Romanian language. Specifically, we aimed to analyze the factorial structure of IGDS and PIGDS by testing an a priori one factor model and to investigate MI across age, gender, and respondents (i.e., parent/youth) in a Romanian sample of adolescents and one of their parents.

3.2.2. Materials and Methods

Participants and Procedure

A convenient sample of 697 adolescents (59.6% girls) and their parents (mothers=43.9%) were recruited between June and October 2019 from five Romanian highschools. Adolescents were students in grades five to twelve, with a mean age of 14.98 years (*SD*= 2.006, range: 11–19 years old). To test cross-age MI, two age groups were created: younger children (≤ 13 years old: *N*=371 for IGDS, and *N*=234 for PIGDS), and older children (> 13 years old: *N*=290 for IGDS, and *N*=155 for PIGDS). The categories have been chosen based on the Romanian academic cycle: secondary school, highschool or vocational highschool. Furthermore, 62.8% of adolescents played games on their

mobile phones as their primary technology device, with puzzle games being the most popular game type (22.5%).

When looking at the caregivers, 45.9% of them were married, and most of them had finished at least highschool (Mothers: 39.1%, Fathers: 36.9%).

Procedure

Trained researchers conducted a survey in students' classrooms using a standardized data collection process. Formerly, we obtained written consent from each highschool director as well as from parents. The assessment for adolescents took place in the classroom in the presence of a trained research assistant, who explained the objective of the study, gave instructions about how the students and their parents should complete the questionnaires and made sure the youths did not miss any answers. Parents were asked to fill out their questionnaires at home and return them to school within four days. The total response rate for students was 100%, while for parents it was 56.09% (391 out of 697).

The questionnaires used were first translated from English into Romanian by a Romanian researcher, and then back-translated into English by a second native Romanian-speaking researcher. The back-translation and the original English version were then compared for accuracy.

Measures

The Internet Gaming Disorder Scale (IGDS) is a nine-item screening scale (Lemmens et al., 2015) designed to measure Internet Gaming Disorder by evaluating the nine criteria for IGD as presented in DSM-5 (American Psychiatric Association, 2013) (e.g. *preoccupation*: “have there been periods when you were constantly thinking about a game while at school or work?”).The dichotomous answers (1="yes", 0="no") are used to assess each item. An overall IGDS score was calculated from the nine items, with a higher score indicating a higher risk of IGD. Following Lemmens et al. (2015), adolescents who answered "yes" to five or more out of the nine questions were classified as having higher risk levels of IGD. The internal consistency in our study was acceptable (α=0.772).

The Parental Internet Gaming Disorder Scale (PIGDS) is a parent-reported rating scale and was developed by Wartberg et al. (2019), who adapted into German the nine questions of the IGDS to fit parental assessment. It was used in our study to assess adolescents` IGD during the past 12 months as reported by their parents. The dichotomous responses (1=“yes”, 0=”no”) of IGDS were preserved in the parental version. Likewise, the responses from the nine questions are summed, and higher scores indicate higher risk levels of IGD. The internal consistency in our study population was acceptable (α=0.781).

A demographic questionnaire was used to assess sample characteristics such as age, gender, type of device used to play, and the type of game played by the youth. In the case of the parents, we evaluated their educational status, the nature of their relationship with the youth, and their current relationship status (i.e., married/single/widow).

Statistical Analysis

To provide reliability evidence for the scores Cronbach`s alpha coefficients were calculated using IBM SPSS Statistic 23. Then, the factorial structure of the instruments was evaluated in a series of Confirmatory Factor Analyses (CFA), while MI across gender, age, and type of informant with MGCFA (i.e., Multigroup Confirmatory Factor Analysis). All analyses were conducted in Mplus 8.0 (Muthén & Muthén, 2017). As multiple approaches exist for testing MI (Bowen & Masa, 2015), we focused on the procedures most appropriate for invariance testing with ordinal variables. The guidelines proposed by Bowen & Masa (2015) include two options for testing MI (i.e., a 4-step approach, and a 3-step approach) within a structural equation modeling (SEM) framework by using CFA (Putnick & Bornstein, 2016; Widaman & Reise, 1997). In the 4-step approach, factor loadings and thresholds are tested and constrained separately, while in the 3-step approach, they are constrained simultaneously. Despite that both methods of testing MI lead to similar results, authors emphasize that the 3-step approach is a more conservative and wise option, since measures are more likely to be found noninvariant across groups (Bowen & Masa, 2015). Therefore, we constrained and freed them together, reducing the number of measurement models that were tested through MGCFA (Bowen & Masa, 2015). Thus, after identifying the baseline model fit for each group, we tested the configural model by imposing no constraints (residual variances were fixed to 1.0). Then the fit of the final configural model was compared with the scalar model (Bowen & Masa, 2015).

As the items exhibit a multivariate, non-normal distribution weighted least squares with means and variances adjusted (WLSMV) estimation with theta parameterization was used in carrying out both CFA and MGCFA (Beauducel & Herzberg, 2006; C.-H. Li, 2016).

The overall model fit was found to be good if χ^2 was statistically non-significant, CFI >.95, TLI >.95, and RMSEA <.05 (Hu & Bentler, 1999), and acceptable if CFI >.90, TLI >.90, and RMSEA <.08 (Browne & Cudeck, 1992).

The presence of MI was supported if delta χ^2 ($\Delta\chi^2$) was nonsignificant. However, as literature recognizes the impact of large sample sizes on chi-square (Hoelter, 1983), the decision on model fit comparison was made by computing the changes in the goodness-of-fit indices (i.e. ΔCFI, ΔRMSEA, and ΔTLI). Values of ΔCFI ≥.010, enhanced by a change in ΔRMSEA ≥.015 would show a significant worsening of the model fit (i.e., noninvariance) (Cheung & Rensvold, 2002; Svetina et al., 2020). Moreover, a value of ΔTLI ≤.05 would show a nonsignificant change in the model fit.

3.2.3. Results

Descriptive statistics for IGDS and PIGDS

The results for the youth version of the scale indicated that item 6 had the highest percentage of missing data (5.6%), while item 4 had the lowest rate of missing data (5.2%). The internal consistency of IGDS was acceptable (α=.772).

For the parent version of the scale, the highest percentage of missing data was found in item 5 (44.6%), while items 1, 2, 6 and 8 had the lowest rates of missing data (44.2%). The results indicated acceptable internal consistency for PIGDS (Cronbach Alpha =.781).

Additionally, the adolescents whose parents did not report the data (G1) on PIGDS were compared with those who completed the survey (G2) in terms of adolescent IGD symptomatology reported, age, and gender. Results indicated significant differences between adolescents whose parents did not complete the survey (M_{G1}=1.979, SD_{G1}=2.129) and those who did complete it (M_{G2}=1.556, SD_{G2}=1.920) for IGD symptoms reported t(583.838)=2.631, p=.009. Similar significant differences were found for age t(695)=2.202, p=.028 (M_{G1}=15.168, SD_{G1}=2.059 and M_{G2}=14.832, SD_{G2}=1.953) and for gender t(630.715)=-3.603, p<.001 (M_{G1}=.519, SD_{G1}=.500 and M_{G2}=.655, SD_{G2}=.476). More specifically, missing data from parents comes more frequently for adolescents that reported higher scores on IGDS, for older adolescents and for boys.

Confirmatory factor analysis (Table 3.2)

We examined a one factor model (each item loads on a single latent variable) for IGDS, as well as for PIGDS, for the whole sample. The fit statistics are presented in *Table 3.2.* The model showed an adequate fit for both IGDS data and PIGDS data. The standardized loadings of the items for IGDS varied from .545 to .848, while for PIGDS from .561 to .885, and all of them were higher than the absolute value of .30. Globally, the values of the factor loadings were higher for the PIGDS, than for the IGDS.

Table 3.2.

CFA Fit Indicator Values for the One-Factor Model

		N	$\chi 2$	df	CFI	TLI	RMSEA [90% CI]
CR							
Overall		697	33.113	27	.996	.995	.019 [.000 , .037]
Gender	Female	392	41.050*	27	.974	.965	.036 [.008, .058]
	Male	263	25.023	27	1.000	1.005	.000 [.000, .044]
Age	≤ 13	371	33.608	27	.993	.991	.026 [.000, .051]
	> 13	290	20.526	27	1.000	1.013	.000 [.000, .030]
PR							
Overall		389	26.419	27	1.000	1.001	.000 [.000 , .039]
Gender	Female	253	27.563	27	.999	.999	.009 [.000, .050]
	Male	133	28.637	27	.994	.992	.021 [.000, .072]
Age	≤ 13	234	18.562	27	1.000	1.017	.000 [.000, .025]
	> 13	155	27.016	27	1.000	1.000	.002 [.000, .063]

Note. CR= child report using Internet Gaming Disorder Scale; PR=parent report using Parental Internet Gaming Disorder Scale; CFA= confirmatory factor analysis; $\chi 2$ = chi-square *df*= degree of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; CI = confidence interval; *N*= sample size;

*$p < .05$.

Measurement Invariance (Tabel 3.3)

MI across age, gender and respondents were tested using MGCFA for both the IGDS and PIGDS scales. Firstly, we tested the one-factor model fit for each subgroup using CFA for ordinal data. The results (see *Table 3.2.*) indicate that the one factor model fits the data well. All goodness-of-fit indicators (i.e. CFI, TLI, and RMSEA) depicted good values, and chi-square in all cases was non-significant (Hu & Bentler, 1999). Secondly, we proceed to evaluate the MI, by testing only configural and scalar (strong) invariance. We did not specify the metric invariance since, as was described in the procedure by Dimitrov (Dimitrov, 2010), it is already a prerequisite for testing strong invariance. Results can be found in *Table 3.3.*

Table 3.3.

Results of Measurement Invariance Using Multigroup Confirmatory Factor Analysis for the Youth and Parents` Samples

	Configural Invariance					Scalar Invariance								
	df	X^2	CFI	TLI	RMSEA	*df*	X^2	CFI	TLI	RMSEA	ΔX^2	ΔCFI	ΔTLI	ΔRMSEA
CR														
Gender	54	67.482	.988	.984	.028 [.000, .047]	62	77.430	.986	.984	.028 [.000, .045]	9.948	-.002	0.000	.000
Age	54	53.955	1.000	1.000	.000 [.000, .035]	62	71.537	.994	.993	.022 [.000, .041]	17.582*	-.006	-.006	-.007
PR														
Gender	54	59.105	.995	.993	.022 [.000, .052]	62	66.913	.995	.995	.020 [.000, .049]	7.808	.000	.002	-.002
Age	54	47.346	1.000	1.009	.000 [.000, .035]	62	64.178	.998	.997	.013 [.000, .046]	16.832*	-.002	-.012	.013
Respondent	125	146.952	.992	.990	.016 [.000, .026]	133	177.991	.983	.980	.022 [.013, .030]	31.039*	-.009	-.010	.006

Note: CR= child report using the Internet Gaming Disorder Scale; PR=parent report using the Parental Internet Gaming Disorder Scale*; df* = degree of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; *ΔX2* = chi-square difference; ΔCFI = CFI difference; ΔRMSEA = RMSEA difference.

**p* < .05.

Measurement Invariance across gender

The results for MGCFA for cross-gender MI are presented in Table 3.3. The Configural model showed good fit indicators for both scales (IGDS and PIGDS). Therefore, both youth and parent versions of the Romanian Scales were best described by the one factor model, across gender.

Scalar invariance (i.e., the factor loadings and thresholds were simultaneously constrained) showed good model fit for both IGDS and PIGDS. The comparison between the scalar and configural model exhibits the presence of scalar invariants in both versions of the questionnaires ($\Delta\chi^2$=9.948, p>.05 for child version, and $\Delta\chi^2$=7.808, p>.05) across gender. The difference in fit indices obtained by subtracting the CFI, RMSEA and TLI of the configural model from the CFI, RMSEA and TLI of the scalar invariance model showed strong evidence of scalar invariance between gender groups.

Measurement Invariance across age

Similar patterns of results were found for MI in the case of age (see *Table 3.3*). Configural invariance results across age showed that both IGDS and PIGDS Romanian versions were best described by the one factor structure across age groups.

When looking at scalar invariance the results exhibit a good model fit for both IGDS and PIGDS across age. However, the chi-square differences suggested that scalar invariance does not holds across age groups ($\Delta\chi^2$= 17.582, p<.025 child version, and $\Delta\chi^2$= 16.832, p<.05 parent version). Following the decision pattern for MI, changes in CFI and RMSEA were considered in determining the scalar invariance of the scales. Moreover, we also expected changes in TLI. Results in this case show scalar invariance across age. ΔTLI values indicated presence of scalar invariance only in the case of child version of the scale (ΔTLI=-.006)

Measurement Invariance across respondents

Favorable fit indicators of the configural model upheld the unifactorial structure of the scales (IGDS and PIGDS) among respondents (parent and child). As scalar invariance was not sustained by $\Delta\chi^2$ ($\Delta\chi^2$=31.039, p<.01), we also examined ΔCFI, and ΔRMSEA for deciding about the scalar invariance of the scales. Results (Tabel 3.3.) support that scalar invariance was present also in the case of respondent type (i.e. parent or child).

Latent mean differences

Based on the establishment of the full scalar invariance across gender, age and respondents we next compared the latent mean differences across these groups for both questionnaires. Results for IGDS of the latent mean differences among gender revealed that boys had a higher score than girls (t=-9.897, p<.001, and Cohen`s $d$= -1.191). However, for PIGDS, the comparison of latent mean differences showed a different pattern, males having lower scores than girls ($t$=-2.778, $p$=.006, Cohen`s d=-2.437). Adolescents reported higher rates of IGD (t=-5.006, p<.001, Cohen`s $d$= -0.599) than preadolescents. Finally, parents (compared with adolescents) reported significantly higher rates of IGD ($t$=-6.577, $p$<.001, Cohen`s d=-0.658).

3.2.4. Discussion

The aim of the present study was to investigate the psychometric properties of the Lemmens` instrument measuring IGD (both youth and parent versions), in a sample of Romanian adolescents and their parents. Specifically, we tested the one factor model proposed by the author of the IGD scale, and we tested for the first time the MI across age, gender, and respondents.

Our results support the original one factor solution for both versions of the instruments (youth/parent), across age, gender, and respondents. Moreover, the magnitude of the items loading on IGD factor was greater for the parent version, with a similar pattern of loading for both data sets. Thus, our results are comparable with prior research that confirmed the one factor structure of the instruments (Evren et al., 2017; Wartberg et al., 2019). Additionally, the IGDS/PIGDS show good internal consistency, making them reliable measures of IGD symptomatology.

Another aspect that has been investigated for the first time was the MI across age, gender, and respondents for the Romanian version of the instruments (IGDS/PIGDS). Both versions revealed MI, which means that the differences between groups (i.e., males vs. females; younger vs. older adolescents; parent vs. youths) are not due to measurement artifacts, but due to real differences in the construct measured (i.e. IGD). This result was supported since we obtained strong invariance (i.e. scalar), which means that regardless of the group, the items of IGDS and PIGDS will be understood and interpreted similarly. As scalar invariance is a minimum condition for having valid comparisons

of the latent means across groups (Vandenberg & Lance, 2000), and as we found full scalar invariance across all groups, we emphasized the existence of differences in the latent attribute (IGD), beyond the measurement artifacts that could occur when comparing groups based on the IGD scale. As so, the results concerning the comparison of the latent means, were in line with prior literature, with boys reporting higher rates of IGD than girls, and adolescents being more prone for it than children (Darvesh et al., 2020; Fam, 2018). Despite the high agreement between parents and their offspring regarding IGD assessment found in Wartberg et al. (2019) study, our results show that parents will report higher scores when evaluating IGD, than their children. Additionally, adolescents with parents who did not complete the survey reported significantly higher scores on IGDS, were slightly older and were mainly male. This result is not surprising, considering that several parental factors (e.g., parental monitoring or warmth) are protective against adolescent IGD symptomatology (Cuong et al., 2021; Schneider et al., 2017) and older boys tend to be more at risk for developing IGD symptomatology (W. Su et al., 2020).

Although these study results show promising psychometric properties for Lemmens` instruments, it is important to consider them in the larger context of the IGD conceptualization debate (Adamkovič et al., 2023). While this instrument is based on the DSM-5 proposed symptoms Karhulahti et al. (2023) recent review argued that few of its items have modest content validity (e.g., item 2, describing tolerance- "the need to spend increasing amounts of time engaged in internet games"(American Psychiatric Association, 2013)). However, according to the same review, Lemmens` instrument is not an isolated case, as all available IGD identified instruments (13 DSM-5 based instruments, and four ICD-11 based tools) failed to achieve a high level of validity in the operationalization of the diagnostic manuals assessment criteria, with one exception, the Gaming Disorder Test (GDT) (Karhulahti et al., 2023). It is noteworthy, however, to mention that the GDT relies on ICD-11 criteria, which, in terms of diagnostic utility is debatable, as it fails to identify the majority of treatment seekers due to its higher threshold (Adamkovič et al., 2023; Starcevic et al., 2020; Yen et al., 2022). Thus, to make a comprehensive evaluation, it will be important to consider all aspects of psychometric properties, including content, construct and reliability information.

Consequently, in the broader picture of psychometric properties, the current results offer support in the usability of Lemmens` scales, with both practical and theoretical implications as follow (1) we provide evidence that both instruments based on DSM-5 proposed symptoms are reliable in Romanian language; (2) IGDS and PIGDS are valid instruments that can be used to make meaningful comparisons between different groups; (3) we ensured that differences in the prevalence of IGD, as measured by IGDS, are not due to scalar invariance-dependent methodological errors. Furthermore, our findings provide a solid response to past research, underlining the necessity for a common IGD evaluation practice to ensure that IGD prevalence is comparable across nations (Kim et al., 2022; Stevens et al., 2020). Therefore, our results are setting up the stage for cross-cultural research. In terms of practical and clinical significance, validating the IGDS and PIGDS in the Romanian population provides practitioners with a valid, easy-to-use, and brief assessment instrument for IGD that collects information from both the adolescent and their parents. In addition, we provide evidence for the instruments' MI in an Eastern European country, characterized by a collectivistic cultural profile (Hofstede et al., 2010).

Limitations and future directions

The present study has several limitations that need to be addressed. First and foremost, this study is a cross-sectional study that does not allow us to make inferences about the scale's accuracy when assessing IGD over time. So, future studies should focus on evaluating the longitudinal MI of the scales (IGDS and PIGDS). Secondly, we have a low rate of children retrieving the scale filled by their parents, with mainly mothers answering it. As interparental agreement varies with the age of the children when reporting internalizing and externalizing problems, with mothers reporting more behavioral and emotional problems (Achenbach et al., 1987; Chiorri et al., 2016; Mellor et al., 2011), future research should focus on analyzing the MI of PIGDS, across parents.

Another important aspect which the study has not taken into consideration was the level of adolescent involvement in gaming through smartphones. As smartphone addiction continues to be a debatable condition (Lin et al., 2023; Tan, 2023) and the prevalence of gaming through this type of technology increased over time (Lin, et al., 2023; Poetar et al., 2023; Tan, 2023; Yang et al., 2023) understanding the interplay between these two types of engagement remains crucial, especially in

terms of assessing smartphone addiction (Nurmala et al., 2022) or IGD while the gaming is done through a smartphone.

3.2.5. Conclusion

In conclusion, the present version of the scales (i.e. youth and parents) revealed good reliability. Moreover, we confirmed in the Romanian sample the factorial structure proposed by the authors of the instruments (i.e. one factor structure) (Lemmens et al., 2015; Wartberg et al., 2019). Despite the strong support for the factorial structure, our results show for the first time that the scales are invariant across age, gender, and respondents. This result is important since it provides evidence that boys and girls, preadolescents and adolescents or parents and youth understand the items in similar ways, offering meaningful comparisons between groups. Therefore, our findings bring a significant contribution to the IGD research, theory and practice, by identifying valid instruments with solid psychometric properties that can be used in screening preadolescents and adolescents for IGD symptomatology.

3.3. Study 3: Indirect effects of parental and peer attachment on Internet Gaming Disorder among adolescents: The role of negative automatic thoughts

3.3.1. Introduction

Adolescents under the age of 18 account for 6.6% of the global problem of problematic video gaming, with greater rates among males (3.1%–10.4%)) (Darvesh et al., 2020; Kim et al., 2022; Sugaya et al., 2019). Negative consequences include worse academic performance, heightened social anxiety, and sleep deprivation (Gentile et al., 2017; Haberlin & Atkin, 2022) . As a result, in 2019 the World Health Organization (WHO) included gaming disorder (GD) in ICD-11, and in 2013 the American Psychiatric Association added Internet Gaming Disorder (IGD) to the DSM-5 for additional research. The term "internet gaming disorder" (IGD) refers to a condition wherein a person plays games continuously for more than a year and experiences significant negative effects on their key life functions.

Previous research has emphasized the role of attachment with parents and peers as a key protective factor for behavioral addictions (i.e., Internet Addiction and IGD) in adolescents (Qi et al., 2022; Schneider et al., 2017). Specifically, Schneider et al. (2017) review pinpoints that a poor parent-child relationship (i.e., lacking warm interactions, few activities done in the family) is associated with higher IGD symptomatology. Similarly, Nielsen et al. (2020) review identified that attachment to parents (e.g., parent-child closeness, secure attachment, feeling accepted) is negatively correlated with IGD, yielding a small effect size. Likewise, a recent meta-analysis on parental factors and IGD indicated that enhancing a sense of security and giving emotional support (i.e., warmth) to adolescents acts as a protective factor against IGD, while a lack of emotional support and communication offered (i.e., withdrawal) acts as a risk factor for IGD (*r* between 0.134 and 0.280) (Coşa et al., 2022). Contrarily, (Nielsen et al., 2020) identify several studies that have yielded non-significant associations between attachment figures and IGD. Moreover, some research findings indicate that the impact of parental attachment on IGD is not direct but rather through mediating pathways such as self evaluation (Throuvala et al., 2019), self-control (Malik et al., 2020), or social stigma (Kim & Chun, 2022b).

Considering the inconsistent outcomes concerning the impact of parental and peer attachment on IGD symptomatology during adolescence, along with the limited understanding of underlying mechanisms, we argue that further research is warranted.

Attachment and IGD

According to attachment theory, each child forms enduring internal working models (IWM) related to them and others based on their childhood experience with their primary caregivers (Armsden & Greenberg, 1987; Umemura et al., 2018). Moreover, the `attachment hierarchy` (Umemura et al., 2018) highlights that attachment relationships experienced with multiple figures (i.e., mother, father, and peers) may differ from each other, with some of which holding greater significance than others (Clarke et al., 2020).

Furthermore, literature on the relationship between paternal, maternal, and peer attachment and IGD showed mixed results. For example, Teng et al. (2020), through a cross-lagged panel model, reported that neither father nor mother attachment predicted subsequent IGD. However, a bidirectional relationship was observed between peer attachment and IGD, with peer attachment negatively predicting IGD. In a similar manner, paternal devotion was negatively correlated with IGD, while maternal devotion was not significant (Rehbein & Baier, 2013).

Given the mixed results and the distinct function of attachment with mothers, fathers, and peers during adolescence, it underscores the importance of examining each type of attachment individually when investigating their contribution to IGD.

Negative Automatic Thoughts as mediatore factor between attachment to parents, peers and IGD

Cognitive distortions, acknowledged as robust predictors of adolescents psychopathology (e.g., internalizing and externalizing problems; IGD) (Beck, 1967; Bodi et al., 2021; Haagsma et al., 2013; Schniering & Rapee, 2002) are known to be saliently linked to Bowlby's IWM (Platts et al., 2002). Integrating both theories, securely attached children will develop healthy cognitive schemas (Beck, 1967), and IWM (Bowlby, 1982), that involve beliefs in the reliability of others, a perception of the child as valuable and lovable, and confidence in their ability to explore the world around them.

Conversely, adolescents with insecure attachment tend to harbor adverse self-interpretations, expect negative interactions with others and the world, and are prone to rumination (Beck, 1967; Bowlby, 1982; Coffman & Swank, 2021). Moreover, Beck, (1967), Schniering & Rapee (2002) argued that adolescents with clinically significant problems can be differentiated from healthy individuals as they interpret their experiences in a rather negative manner.

Building on Beck's cognitive model, Davis (2001) pioneering work proposed dysfunctional cognitions as core factors contributing to pathological Internet Use and IGD. Specifically, cognitive distortions about self (e.g., self-doubt, low self-efficacy, and negative self-appraisal), world (e.g., the internet is seen as a safe place), and rumination (e.g., negative repetitive thinking about gaming) are considered sufficient factors to cause and maintain IGD. Essentially, adolescents with this pattern of thinking hold a pessimistic perception of themselves and may rely on the Internet (e.g., games) to seek positive social interaction. Also, gaming might act as a coping mechanism for managing emotional distress (Bodi et al., 2021; Haagsma et al., 2013). Supporting this notion is the evidence highlighting that individuals with lower self-esteem favor online interactions as they perceive them as less dangerous than face-to-face encounters (Bodi et al., 2021; Karaca et al., 2020). Similarly, Peng & Liu (2010) found, by conducting path analysis, that maladaptive cognitions, shyness and depression are positively related to IGD. Similarly, the presence of these cognitive distortions was associated with an increased number of IGD symptoms that can persist over time (Forrest et al., 2017; Zhou et al., 2012).

Taken together, parental and peer attachment contribute to IGD. However, existing research often treats parental attachment as a singular construct, and when individual relationships (i.e., mother, father, peer attachment) are examined, conflicting results arise. Furthermore, there's a dearth of evidence regarding the mechanisms driving these associations. Although cognitive mechanisms are known to be linked with both attachment to parents and peers, and IGD, there is a lack of investigation related to their role in the linkage between attachment figures and IGD. This lack of clarity extends to interventions for IGD, as a standardized approach remains elusive (Chen et al., 2023; Costa & Kuss, 2019).

Aim of the study

To address these needs, the present study aims to investigate the indirect effects of attachment to parents (i.e., mother and father) and peers on Romanian adolescents` IGD symptomatology through the mediating role of negative automatic thoughts. Therefore, it was predicted that the quality of attachment to mother, father, and peers will be negatively associated with adolescents` negative automatic thoughts, which in turn will be positively associated with IGD symptomatology in adolescents.

3.3.2. Methods

Participants

The data from this cross-sectional study were collected from a conventional sample of 697 adolescents (59.6% girls) enrolled in five Romanian highschools. The age of participants ranged from 11 to 19 years old (M=14.98, SD=2.006). The students were in grades five to twelve and 93.11% of them were of romanian ethnicity, while 2.43% were of other ethnicity (e.g., hungarian, rroma), while the rest did not display their ethnicity. Moreover, 62.8% of youths preferred playing games on their mobile devices, while adolescents' preferred game type was puzzle games (22.7%). The mean sleeping hours per night reached by adolescents was 8.04 (*SD*=1.011), while the mean academic grade obtained for the first semester of school was 8.78 (*SD*=1.132).

Procedure

Before data collection, the necessary permissions were secured from school boards, and subsequently, the informed consent of parents was obtained. Adolescent assessment occurred between June and October 2019, within the classroom setting under the supervision of a trained research assistant. The research assistant explained the study's purpose and adolescents` rights to discontinue at any time and provided instructions for completing the questionnaires. The participants took between 40-60 minutes to complete the booklet containing the questionnaires.

Ethics

All procedures were approved by the Research Ethics Board of Babeș-Bolyai University and conducted according to the Declaration of Helsinki and its later amendments or comparable ethical standards. All subjects were informed about the study, and parents provided informed consent.

Measures

The Internet Gaming Disorder Scale (IGDS) is a nine-item dichotomous answer (1="yes", 0="no") screening scale (Lemmens et al., 2015) designed to measure the nine criteria for IGD as proposed in DSM-5 by the (American Psychiatric Association, 2013). According to Lemmens et al. (2015), adolescents who answered "yes" to a minimum of five questions are at greater risk of IGD. The scale was adapted in Romanian and depicted acceptable internal consistency (α=0.772).

The Inventory for Parent and Peer Attachment - Revised (IPPA- R) (Gullone & Robinson, 2005) was used to assess the quality of attachment to mother, father, and peers in terms of trust, communication, and alienation. Specifically, the parental section has 28 items and the peer subscale has 25 items. Respondents are required to assess the extent to which each item applies to them on a three point scale. Therefore, scores can range from 28 to 84 for parental subscales and from 25 to 75 for peers, with high scores indicating a secure attachment. IPPA - R depicted good psychometric properties (Armsden & Greenberg, 1987; Gullone & Robinson, 2005). Similarly, in our study, the internal consistency was good for all subscales (i.e., mother: α=.912; father: α=.929; peers: α=.899).

The Children's Automatic Thoughts Scale-Negative/Positive (CATS-N/P) developed by (Hogendoorn et al., 2010) is a five-point scale ("not at all"=0 to "all the time"=4) consisting of 50 items aimed at assessing negative and positive self-cognitions in youth individuals. Five ten-item subscales can be calculated by adding item scores (Physical threat, Social threat, Personal failure, Hostility and Positive Thoughts). Higher scores on each subscale reflect elevated negative or positive thoughts. Moreover, CATS-N/P permits the calculation of a total score to represent the amount of negative thought among adolescents. Therefore, the positive items are not calculated for it. The good psychometric properties obtained by CATS-N/P in previous studies (Balan et al., 2018; Hogendoorn et al., 2010) persisted, with internal consistency reaching α=.893.

Demographic questionnaire in which information related to the age, gender, type of game played, number of hours slept, ethnicity, and final grades of adolescents were collected.

Data Analyses

Data screening, descriptive statistics, and bivariate correlations were performed in SPSS (22.0), while path analyses for testing model fit were carried out in Mplus 8.0 (Muthén & Muthén, 2017). Moreover, the normality assumption was assessed through the examination of univariate and multivariate skewness and kurtosis. Absolute values of skewness greater than 3 and absolute values of kurtosis greater than 10 indicated the presence of extreme values in the data set (Kline, 2005). Multivariate normality assumption was tested with the web application (i.e., http://psychstat.org/kurtosis) proposed by (Cain et al., 2017).

According to the analysis, 65% of the participants successfully completed the entire set of questionnaires. As missing values ranged from 6.3% (IGDS scores) to 16.01% (CATS N/P scores), we also performed Little's MCAR test to verify the mechanism of missingness, since it warrants a greater impact on the results obtained (Dong & Peng, 2013). Given that the pattern of missing data was completely random (χ2 = 49.577, df =65, $p > .05$), and the data set exhibits a multivariate, non-normal distribution (Mardia Skewness = 8.236, p<.01, and Mardia Kurtosis = 49.842, p<.01) full information maximum-likelihood (FIML) estimation was used in estimating model fit (Cham et al., 2017; Dong & Peng, 2013; Enders, 2001).

The importance of the mediating role of negative automatic thoughts in the link between attachment quality and IGD symptomatology was examined using bootstrap analysis (i.e., 1000 random re-samples with 95% confidence intervals). Further, the model data fit (Weston & Gore, 2006) was assessed using several fit indicators: chi-square statistics (χ^2), The Comparative Fit Index (CFI), The Root Mean Square Error of Approximation (RMSEA) and The Standardized Root Mean Square Residual (SRMR). Good fit is indicated if the chi square was non-significant, CFI had values greater than .95, and the RMSEA and SRMR values were smaller than .05 (Hu & Bentler, 1999). The significance of the direct and unstandardized indirect effects were also analyzed in the path analysis.

3.3.3. Results

Descriptive and correlation analyses (Table 3.4)

The mean, the standard deviation, skewness, kurtosis and the bivariate correlation matrix are presented in Table 3.4. All variables were significantly correlated with each other, except for the relationship between father attachment and IGD (p>.05). Specifically, attachment to parents (mother

and father), and peers was negatively associated with both adolescents` negative automatic thoughts, and with IGD symptomatology, while adolescents` automatic thoughts were positively correlated with adolescents IGD symptomatology. The magnitude of the associations between variables was small (i.e., values between .1-.3) or medium (i.e., values between .3-.5), with one exception the association between attachment to the father and attachment to the mother, which was large (Cohen, 1988).

Table 3.4

Descriptive Statistics and Correlations for Study Variable

	n	*M*	*SD*	*SK*	*KU*	1	2	3	4	5
1. Mother Attachment	515	71.282	9.019	-1.039	.956	-				
2. Father Attachment	515	67.713	11.153	-.739	-.034	.572**	-			
3. Peers Attachment	515	61.509	8.093	-.729	.038	.310**	.278**	-		
4. Negative automatic thoughts	515	40.367	25.481	1.189	1.535	-.488**	-.419**	-.303**	-	
5. IGD	515	1.803	2.114	1.448	2.165	-.133**	-.078	-.254**	.327*	-

Note. M= mean; SD= standard deviation; SK=skewness; KU=kurtosis;
*p<.05. **p<.01

Negative automatic thoughts as mediator (Table 3.5)

The indirect effect was examined via the heightened levels of negative automatic thoughts. The fit indices revealed that the model fit the data well: $\chi^2(df = 3)=17.983$, $p = .000$, CFI=.930, RMSEA=.098, 90%CI (Confidence Interval) (.058, .145), SRMS=.048. The model specifications for the direct and indirect effects and corresponding unstandardized values are detailed in Table 3.5. Results indicate that all estimated paths were statistically significant. Similarly, all indirect effects achieved statistical significance. Notably, the relationship between attachment to parents (i.e., mother and father) and peers and IGD was mediated by negative automatic thoughts. As both direct and indirect paths are significant, adolescents` negative automatic thoughts partly mediate the linkage between attachment agents and IGD.

The variance in IGD symptomatology explained by the quality of each individual attachment relationship and negative automatic thoughts is 10%.

Table 3.5

Unstandardized bootstrap estimates of direct and indirect effects with 95% CI and significance test

	Estimate	95% CI		*p*
		LL	*UL*	
Direct efect				
Mother Attachment ⟶ Negative automatic thoughts	-.883	-1.162	-.604	<.01
Father Attachment ⟶ Negative automatic thoughts	-.474	-.699	-.249	<.01
Peers Attachment ⟶ Negative automatic thoughts	-.472	-.709	-.235	<.01
Negative automatic thoughts ⟶ IGD	.026	.018	.035	<.01
Indirect Effects				
Mother Attachment ⟶ IGD	-.023	-.033	-.013	<.01
Father Attachment ⟶ IGD	-.012	-.020	-.005	<.01
Peers Attachment ⟶ IGD	-.012	-.021	-.004	.017

Note. IGD= Internet Gaming Disorder; CI= Confidence Interval; *LL*= lower limit; *UL*= upper limit.

3.3.4. Discussion

As predicted, the findings revealed that negative automatic thoughts serve as a path that links the quality of attachment relationships to IGD symptomatology in adolescence. Specifically, the quality of attachment to both mother, father, and peers exhibits a negative association with adolescents' negative automatic thoughts, which in turn is positively linked with IGD symptomatology. Consistent with previous research, attachment quality to social agents acts as a protective factor against both: adolescents' IGD symptomatology and the development of cognitive vulnerabilities (Kim & Chun, 2022b; Nilsson et al., 2022; Paschke et al., 2021). In addition, these results about the link between attachment figures and IGD symptoms contribute to a better comprehension of prior research, which exhibits inconsistent outcomes (Kim & Chun, 2022b; Nilsson et al., 2022; Teng et al., 2020). Moreover, the results are in line with both attachment (Bowlby, 1982, 2005) and cognitive theoretical frameworks (Beck, 1967; Bowlby, 2005; Davis, 2001). Securely attached youths are more likely to foster cognitive patterns characterized by optimism, self-worth, and trust in relationships and in the world and have a greater ability to seek and offer support. Also, secure cognitive models developed in interaction with parents are known to be linked with qualitative friendships in adolescents (Allen et al., 2004; Bowlby, 2005; Shomaker & Furman, 2009).

Conversely, insecure adolescents are more prone to a negative pattern of thinking about themselves and others, which further leads to lower resilience to life`s difficulties and increases the chances of developing psychological problems (e.g., anxiety, depression, and addictions) (Bowlby, 1982; Davis, 2001; Irfan & Zulkefly, 2023; Kovács et al., 2022). Specifically, adolescents with trust difficulties are less willing to talk about their problems with parents and friends and have poor abilities to regulate their emotions (Shomaker & Furman, 2009; Zimmermann, 2004). Therefore, they might favor game play to escape unpleasant emotions or situations, and use gaming as a coping mechanism (Gentile et al., 2017).

In terms of practical implications, this study outlines the importance of targeting adolescents' cognitive vulnerabilities in IGD interventions (Chen et al., 2023; Kuss & Griffiths, 2012; Stevens et al., 2019). Specifically, modifying negative thinking about oneself, others, and the world has proven to play an important role in youths' IGD symptomatology.

To date, Cognitive Behavioral Therapy (CBT) outperforms other interventions in reducing IGD symptomatology, but only in the short term (Chen et al., 2023; Stevens et al., 2019). Morover, Bonnaire et al., (2019) acknowledge that family components are especially useful in adolescents IGD interventions. Therefore, in line with previous research, we argue that adding a social component (promoting close relationships with family and friends), to the CBT intervention might increase its efficacy. Additionally, prevention programs that foster mental health literacy about IGD among youth and parents can be further developed.

At the parental level, fostering a warm environment for adolescents, where healthy communication and trust are developed might act as a protective factor against IGD development (Schneider et al., 2017).

On the other side, several limitations have to be considered when interpreting the results of this study. Firstly, the nature of the study is cross-sectional. Future longitudinal data would be of valuable importance to better understand the causality of the assessed association (i.e., quality of attachment, negative automatic thoughts, and IGD). Although previous studies indicated possible bidirectional effects, this holds true only for one dyadic relationship (i.e., peer attachment and IGD) (Teng et al., 2020). Thus, poor quality bonds with peers may foster adolescents IGD symptomatology, but IGD presence might also later affect the quality of friendships. Another limitation of the study is that the data were collected solely through adolescents' self-reports. Further studies could collect data from multiple informants (e.g., parents, peers, and teachers) for a comprehensive understanding of the phenomenon. Moreover, assessing the specific content of the cognitions in the relationship between attachment figures and IGD could bring further insights and help tailor future interventions (King & Delfabbro, 2016).

3.3.5. Conclusion

This study is the first to emphasize the impact of individual attachment relationships (i.e., mother, father, and peers) with adolescents on IGD symptomatology. Also, the results illustrate that adolescents' cognitive vulnerabilities (i.e., negative automatic thoughts) act as an important link between them. The findings are consistent with both Beck's cognitive model and Bowlby's attachment theory used to explain youth psychopathology. Further prevention and intervention studies should consider negative automatic thoughts as the primary target, along with fostering healthy and secure relationships with parents and peers.

3.4. Study 4: Internet Gaming Disorder and Mental Health Problems in Romanian Adolescents: A Network Analysis

3.4.1. Introduction

Internet Gaming Disorder (IGD) represents repeated and constant engagement in games through the Internet (alone or with other players), provoking distress and affecting the everyday functionality of a person (American Psychiatric Association, 2013) and it encompasses preoccupation with gaming, withdrawal symptoms, increased tolerance, unsuccessful attempts to control usage, loss of interest in other activities, functional impairment, deception, escapism and mood relief associated with playing. To warrant a diagnosis, a minimum of five criteria must be presented over the course of a year, and the person has to have impairments in everyday functionality during this time (American Psychiatric Association, 2013).

IGD symptomatology is associated with several child and adolescent mental health diseases. Notably, the presence of psychopathology acts as the strongest predictor for IGD, accounting for 7% to 15% of the variance (Andreassen et al., 2016; Ferreira et al., 2021). Specifically, cross-sectional studies using diverse methodologies show that there is a high comorbidity with anxiety, depression, attention-deficit/hyperactivity disorder (ADHD) or conduct disorders (Gentile et al., 2017; Koncz et al., 2023; Wei et al., 2022). Also, gamers with a `*High-Distress Comorbidity*` profile (i.e., increased anxiety, depression and stress) have heightened IGD symptomatology (Kovacs et al., 2022). Similarly, longitudinal data supports the presence of possible bidirectional relationships between these psychopathological conditions and IGD (Kim et al., 2022; Salerno et al., 2022).

One comprehensive theory underpinning the association between psychopathology and IGD is the Interaction of Person-Affect-Cognition-Execution (I-PACE) (Brand et al., 2016, 2019). According to the I-PACE model, IGD is the result of the interaction between predisposing individual factors interact with affective and cognitive responses, the presence of expectancy, and the use of dysfunctional coping strategies. Further, this pattern of interactions enables decision-making and execution. By engaging in gaming, youths gain gratification and compensation that will later reinforce the former predisposing factors (e.g., psychopathology). In other words, IGD symptomatology is the result of a vicious circle in which gaming is used as a coping strategy for the psychological distress (e.g., anxiety, depression) experienced by someone.

Although there is substantial empirical evidence that documents the deleterious effect of IGD, the progress in the field might be hindered by the disputes concerning to measurement of the construct. Despite assessments based on DSM-5 and ICD-10 criteria yielding highly similar results (kappa=0.80, $p < .001$) (Higuchi et al., 2021;Yen et al., 2022), several concerning issues have been raised. Firstly, (1) there is an overproduction of instruments with items based on different operationalizations of the symptoms (King et al., 2020); (2) all the valid DSM-5 instruments (13 instruments) have items with low content validity (Karhulahti et al., 2023); and (3) only one ICD-11 instrument (Gaming Disorder Test) out of the four valid tools identified managed to completely cover the operationalization of the criteria as described by the diagnostic manual (Karhulahti et al., 2023). In this context, network analysis has been suggested as a potential methodological approach that can overcome these issues.

Network analysis was conducted with scales that were both based on DSM-5 and ICD-11 conceptualizations. Unsurprisingly, the analysis conducted on the different scales yielded divergent results. The pattern of variation was higher for those symptoms measured with a DSM-5 based instrument (Adamkovič et al., 2023).

Although the current literature acknowledges comorbidities of IGD with other mental health symptoms (Kim et al., 2022; Teng et al., 2021), the understanding of IGD construct and its interplay with mental health problems is in its infancy.

Aim

Based on a network approach, this study has several aims. First, we aim to estimate the network structure of IGD symptoms and how they interplay with each other in a Romanian sample of adolescents. Second, we aim to explore and identify the relationship between the IGD symptomatology and the emotional and behavioral problems associated with it (i.e., anxiety, depression, somatic problems, attention deficit problems, oppositional defiant problems or conduct problems) among Romanian adolescents.

3.4.2. Methods

Participants and procedure

Between June and October 2019, a convenience sample of 697 adolescents (59,6% girls; Mean age = 14.98; age range 11-19 years old) were recruited from five Romanian highschools (grades five to 12), after providing parental consent for participating. Prior to data collection, we obtained consent from the school board to enter the classrooms. Then trained researchers explained the study objective and gave instructions related to the completion of several questionnaires, with two of them being of interest for this study: The Internet Gaming Disorder Scale (Lemmens et al., 2015) and Youth Self-Report 11-18 (Achenbach & Rescorla, 2001).

Ethics

The study obtained research ethics approval from the Research Ethics Committee of Babes-Boyai University and is in accordance with the Declaration of Helsinky.

Measures

IGD symptomatology

We used The Internet Gaming Disorder Scale (IGDS) (Lemmens et al., 2015), the Romanian version. It is a short, nine-item dichotomous answer (1="yes", 0="no") screening scale, evaluating the nine criteria for IGD as presented in the DSM-5 (American Psychiatric Association, 2013). According to Lemmens et al. (2015), adolescents who answered "yes" to a minimum of five questions are at greater risk of IGD. The internal consistency in our study was acceptable (α=0.772).

Adolescent psychopathology

The Youth Self Report (YSR), authorized Romanian translation, was used to assess adolescents` self-reported emotional and behavioral problems. Adolescents complete a series of 112 items by answering them on a three-point Likert scale. Although YSR is organized in several subscales, in this study we included only the DSM-5 oriented subscales: affective problems (including dysthymia and major depression) (α=0.815); anxiety (e.g., GAD, SAD, and Specific Phobia) (α=0.749); somatic problems (α=0.779); Attention Deficit/Hyperactivity Problems (e.g., Hyperactive-Impulsive and Inattentive types) (α=0.746); oppositional defiant problems (α=0.686), and conduct problems (α=0.840) (Achenbach et al., 2001).

Demographic questionnaire

The demographic characteristics of our population were assessed using a set of questions related to the age and gender of the participants.

Data analysis

The statistical analyses were performed in RStudio (RStudio Team, 2019). After completing the descriptive statistics, the percentage of missing data patterns was examined, and missing values were handled through listwise deletion (Graham, 2009). Next, the univariate and multivariate normality assumptions were assessed by evaluating the skewness and kurtosis. Absolute values of skewness greater than 3 and absolute values of kurtosis greater than 10 were deemed unacceptable (Kline, 2005). Moreover, Cronbach`s α were computed for the scales used with SPSS (22.0) (Gadermann et al., 2019).

To assess the aims of this study, two networks were estimated. Initially, we evaluated the interplay between the symptoms of IGD. Subsequently, we mapped a network for IGD (measured with IGDS) and the adolescent`s psychological problems as evaluated by the YSR subscales. The networks were estimated using pairwise Markiv random field (PMRF; Costantini et al., 2015), namely IsingFit (Epskamp et al., 2018). The second network was estimated with huge method which is appropriate for continuous variables and accounts for minor departures from normality assumptions (Epskamp et al., 2018). To increase the interpretability, the *least absolute shrinkage and selection operator* (LASSO; (Tibshirani, 1996), with a tuning parameter set to 0.25, was implied. LASSO allows network regularization, making it simpler and promoting sparsity. Notably, the model selection was based on the *extended Bayesian information criteria* (EBIC). Furthermore, we estimated centrality using expected influence (EI) (Robinaugh et al., 2016). EI is considered to be more appropriate than other centrality indices (e.g., strength, closeness, and betweenness) as it differentiates between positive and negative edges and accounts for a node`s cumulative influence in a network (Robinaugh et al., 2016). Additionally, edge weight accuracy was scrutinized through nonparametric bootstrapping to compute the 95% confidence intervals (CI), and the stability in centrality indices was estimated with the correlation stability coefficient (CS-coefficient), using a case-dropping subset

bootstrapping framework (Epskamp et al., 2018). A wide 95% CI indicates poor accuracy around edges and, therefore, lower network stability (Epskamp et al., 2018). Similarly, CS-coefficients lower than 0.25 imply lower stability in centrality indices (Epskamp et al., 2018). Finally, nonparametric bootstrapping was also performed to identify the significant differences between edges and nods.

3.4.3. Results

Data screening

The percentage of missing data at the item level of IGDS was between 5.17% and 5.6%. After computing the sum of each YSR subscale, the percentage of missing data was 7,3%, while for IGDS's total score was 6.3%. Therefore, we performed listwise deletion in both networks, as the expected loss of power and bias are considered to be trivial (Graham, 2009). The skewness and kurtosis values for the IGDS total score were 0.11 and -0.59.

IGD symptoms network (Fig. 3.2)

While all the nods were associated positively with one another, only *Preoccupation* (item 1; igds_1_vs) was significantly distinctive between the symptoms (i.e., significantly more central than 89% of the other nodes) and had highest number of connections within the network. Additionally, in terms of edge weight accuracy, 95% CIs around most edge weights are large, meaning that most of them did not differ from each other significantly. However, the CS-coefficient for the EI value [*CS*= 0.362] was acceptable, indicating a interpretable network structure.

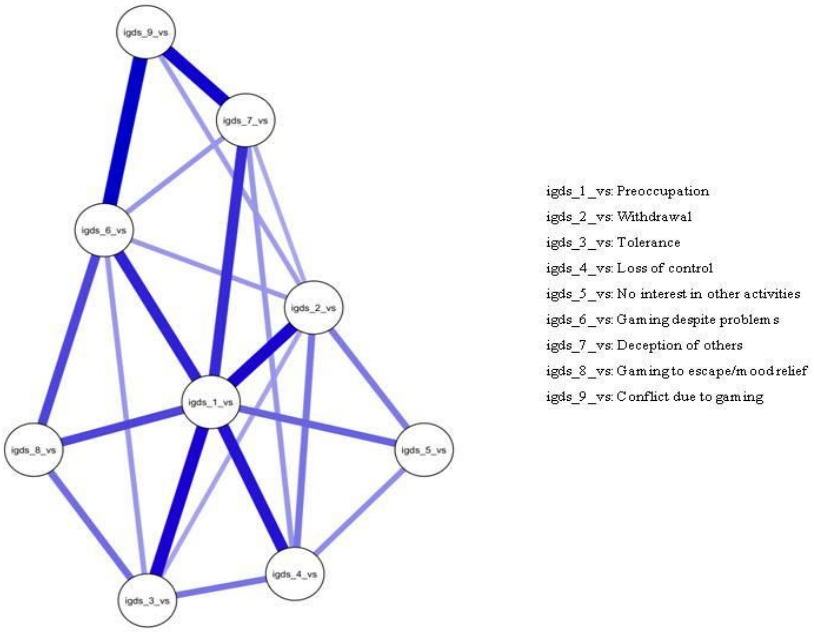

Fig. 3.2 Estimated Network Model for IGD (the items of IGDS)

IGD and adolescent mental health problems network (Fig. 3.3)

The second network estimated the combined IGD total score and YSR subscales total score. The 95% CI indicates a high accuracy for the edge weights, with excellent CS-coefficient for EI [*CS*= 0.75] and edges [*CS*= 0.75], depicting a stable network structure. Depression followed by Conduct Problems were the main central nods in the network (significantly more central than 71% and 29% of the nods). The estimation of edge strength revealed that the edge between IGD and Conduct Problems was significantly stronger than 38% of the other edges. Although we have a connection between IGD and Somatic Problems, between IGD and Oppositional Defiant Problems, and IGD and Attention Deficit Problems, they were not significantly stronger than the other edges.

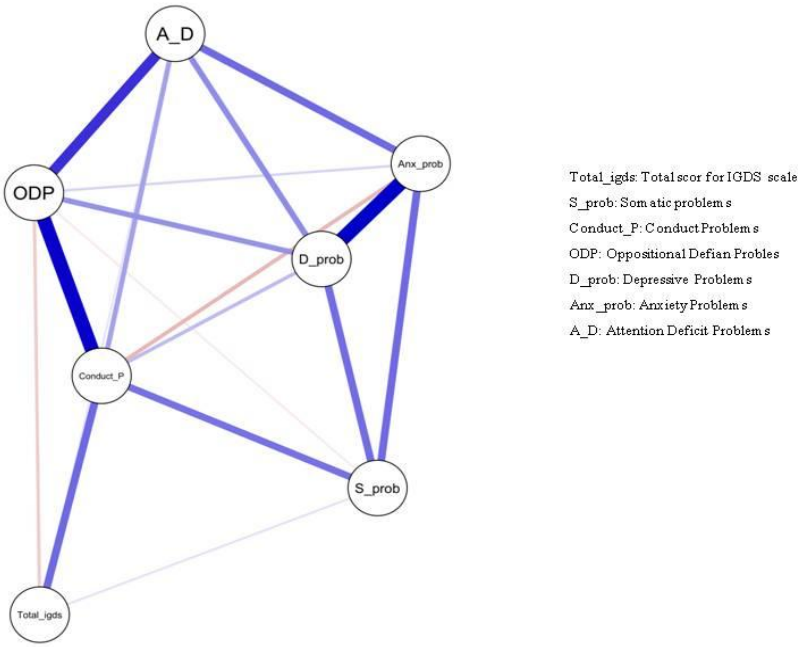

Fig. 3.3. Estimated Network Model for IGD and Adolescent Mental Health Problems (total score)

3.4.4. Discussion

The current study examined two network structures, namely the one of IGD symptoms and the one looking at the interplay between the IGD (i.e., total score) and the main child and adolescent mental health problems associated with it (i.e., anxiety, depression, somatic problems, attention deficit problems, oppositional defiant problems or conduct problems) in a Romanian adolescent sample.

IGD symptoms network

The IGD network model reveals that *Preoccupation* (*"During the last year, have there been periods when all you could think of was the moment that you could play a game"*) was the most central node in our model, while the other symptoms did not distinguish among themselves. Likewise, *Preoccupation* measured with the same instrument (Lemmens et al., 2015) emerged as a central symptom in a previous study on a large number of Chinese adolescents (*N* = 1,362) (Sit et al., 2023). Similar results were also found in a group of Chinese university students (*N*=341) (Yuan et al., 2022b), where *Preoccupation* was measured with the Internet Gaming Disorder Questionnaire (Petry et al., 2014). However, when the symptom was assessed in a culturally diverse sample (*N*= 2846 digital players and *N*= 746 esports players) using the Internet Gaming Disorder Scale 9–Short Form (Pontes & Griffiths, 2015) it had a moderate centrality (Adamkovič et al., 2023) in the network. Therefore, it is possible that only specific aspects of how preoccupation is operationalized are relevant in the context of IGD, given that its definition can influence its centrality in the model (Adamkovič et al., 2023; Karhulahti et al., 2023). A similar explanation can be applied to the lack of centrality and importance found for the other symptoms in the model. Specifically, items such as loss of control (igds_4_vs), continued use despite problems (igds_6_vs), and withdrawal (igds_2_vs) were found to undergo shifts in centrality based on variations in the operationalization of these items (Adamkovič et al., 2023; Karhulahti et al., 2023). In our study, these nodes were found to be indistinguishable from each other.

In conclusion, as measured with IGDS (Lemmens et al., 2015) *Preoccupation* could be considered an important and influential symptom in producing and maintaining IGD in adolescents, while the importance of the other symptoms remains questionable given the mixed results found in the literature.

The network structure between IGD and adolescent mental health problems

We found a stable network structure in which depression acted as a central condition within the network, followed by conduct problems. In terms of the relations between the IGD total score and the mental health conditions, it is surprising that only one edge distinguished itself within the web of interactions: the one between IGD and conduct problems. Additionally, IGD was connected to Somatic Problems and Oppositional Defiant Problems but the edges' significance was indistinguishable. These results express both alignment and disparity with past theoretical frameworks and research. Our results are consistent with the integrative theoretical framework, namely the I-PACE model, which highlights the importance of vulnerability factors in the development and maintenance of IGD symptomatology (Brand et al., 2016, 2019). In this case, a possible hypothesis is that only "Conduct Problems" represent an important psychopathological vulnerability condition for IGD. Similarly, the current findings are in accordance with another theoretical framework that postulates that preexisting externalizing vulnerabilities (e.g., conduct problems, antisocial behaviors) increase the risk of IGD symptomatology for some adolescents (Benarous et al., 2019; Richard et al., 2022). According to the same theory, there is also an internalizing pathway (e.g., emotional dysregulation, anxiety/depression) towards IGD (Benarous et al., 2019; Richard et al., 2022). However, our current results show indistinguishable relationships between IGD and internalizing problems (e.g., Anxiety, Depression). This is surprising given that past research has identified an intercorrelation between IGD symptomatology and anxiety and depression symptomatology (Sit et al., 2023; Yang et al., 2023).

Thus, according to the present study results, youths with a pattern of conduct problems could have higher chances of developing a more severe presentation of IGD symptomatology. Therefore, targeting conduct problems in interventions could have chain reactions in the network, subsequently reducing IGD symptomatology in some adolescents. This result could effectively improve the current assessment of IGD symptomatology in adolescence, giving guidelines on identifying other possible conditions associated with it.

Study limitations and further directions

The current study results should be interpreted with caution, given a series of limitations. Firstly, the IGD network structure was showing only moderate stability for edge weights, and only preoccupation was identified as a central symptom. Thus, the findings should be interpreted with caution in this case. Secondly, both network structures were evaluated on a community sample of middle-aged adolescents. Therefore, these results might be different in the case of clinical communities or other age groups (e.g., early or young adults). On the other hand, as the current study used only cross-sectional data and network analyses assume a causal system between mental disorders, causality in this case can not be securely assumed. Therefore, future research could evaluate this assumption by conducting network analyses on longitudinal data. Moreover, the data collection process implied self-reported measurements. Future studies could benefit from using a more diverse data collection system (e.g., collecting data through interviews or ecological momentary assessment). Additionally, our analyses were performed at the group level and might not be applicable at an individual level. Another question that could benefit from further investigation is related to the different patterns of symptom interaction between IGD and conduct problems. Although we identified a connection between these two conditions, our analyses were performed at the level of the total score for these mental health disorders. Finally, IGD network structure is dependent on symptom operationalization, and we assessed it with a DSM-5 instrument. Further research should investigate its stability when assessing it with other recognised DSM-5 instruments (Pontes et al., 2014) or other validated ICD-11 tools.

3.4.5. Conclusions

Despite the fact that the current study had several limitations, our findings provide incipient results on the pattern of interactions between the IGD total score and other adolescent mental health problems, revealing conduct problems as central conditions. Additionally, evaluating the IGD symptoms structure depicted *Preoccupation* as the central symptom, indicating its relative importance in assessing IGD with a DSM-5 validated instrument. Thus, practitioners should pay attention when adolescents have conduct problems and reveal a pattern of preoccupation with gaming, as they might have higher chances of increased IGD symptomatology.

CHAPTER IV. GENERAL CONCLUSIONS AND IMPLICATIONS

4.1. General Conclusions

IGD represents a phenomenon of significant importance in the current behavioral addiction field. It has relatively high prevalence rates among adolescents (Darvesh et al., 2020) and it was associated with negative short- and long-term consequences in youths (Gao et al., 2022; Gentile et al., 2017). As literature has emphasized, IGD symptomatology is the result of a complex interplay between: personal factors (P), affective (A) and cognitive (C) responses to specific triggers (internal or external), and behavioral execution (E) components (Brand et al., 2016, 2019). However, the relationship between specific factors from the model, such as parental factors, mental health conditions, or cognitive patterns and IGD symptomatology is still lacking in understanding. Specifically, the caveats found in the literature were addressed in the current thesis, using a multilevel framework (I-PACE model), through four studies. An overview of the main findings will be further presented.

In Study 1, we aimed to provide a comprehensive overview of the magnitude of the association between specific parental factors and IGD symptomatology in adolescence. Additionally, we evaluated possible moderators for these links. The results of the meta-analyses revealed that parents who encourage autonomy in youths, provide warmth and use monitoring practices in accordance with adolescent age protect their offspring from developing IGD symptomatology. Opposingly, parental behaviors such as aversiveness, overinvolvement in youths' lives, or withdrawal acted as risk factors for IGD symptomatology in adolescence. However, the magnitudes of the effect sizes were found to be small to moderate, and heterogeneity remained high even after controlling for possible moderators. Additionally, no moderators were found for the link between the warmth factor and IGD symptomatology in adolescence.

Next, in Study 2, we aimed to adapt and test the proposed one-factorial model of Lemmens` Internet Gaming Disorder Scale (IGDS) and its parent version (PIGDS). Additionally, we evaluated their measurement invariance across age, gender and respondents in a Romanian sample of adolescents.Our study confirmed through good fit indices (e.g., CFI, RMSEA, TLI) that the original one-factor model (IGD) proposed by the author was preserved for the Romanian version of the scales. Further, the results on measurement invariance revealed full scalar invariance for IGDS and PIGDS across age and gender. Similarly, we obtained measurement invariance across respondents (parents and youths). The comparisons of latent means across groups (i.e., age, gender and respondent) replicated most of the differences already mentioned in the literature.

In the third study, we concentrated our attention on exploring possible mechanisms underlying the link between parental factors and IGD symptomatology. Therefore, in this cross-sectional study, we aimed to evaluate the role of negative automatic thoughts in this association. Particularly, we examined the indirect effect of attachment to parents (i.e., mother and father) and peers on IGD through adolescents' negative automatic thoughts. The results indicated that poor attachment dynamics with both mother and father increase the likelihood of negative automatic thoughts, which heightens the presence of IGD symptomatology in youth. A similar pattern was found for attachments bound to peers.

Finally, in Study 4, we investigated another important predictor of IGD, in accordance with the I-PACE model, namely the presence of other psychopathologies. Specifically, we aimed to evaluate the pattern of interaction between the main mental health conditions in adolescence (measured with YSR) and the IGD total score using a network approach. Before delving into this examination, we evaluated the proposed DSM-5 criteria for IGD and how they interact with each other, using a similar methodology. The results reveal that both proposed networks (i.e., Network 1: IGD symptoms; Network 2: IGD and mental health conditions) were stable in a Romanian sample of adolescence. Additionally, in Network 1, *Preoccupation* was the most central node in the model. In the second network, the main mental health condition connected to IGD was conduct problems.

4.2. Implications of the Thesis

4.2.1. Theoretical Implications

The present thesis has several theoretical implications. Namely, three of our studies (Study 1, Study 3 and Study 4) provided support in favor of the I-PACE theoretical framework in explaining the occurrence and maintenance of IGD symptoms. Particularly, these studies evaluated the *P*-component (i.e., *Person Core Characteristics*) from the integrative model (i.e., parental dimensions and psychopathology).

Firstly, through Study 1, we provided, for the first time, evidence related to the importance of parental dimensions in relation to IGD symptomatology in adolescence. We identified both specific protective and risky parental behaviors for IGD symptomatology. Specifically, having a warm and supportive environment emerged as a relevant protective parental component for IGD. Therefore, in Study 3, we advanced our knowledge of this particular link by evaluating negative automatic thoughts as a possible underlying mechanism. As a first attempt, this study evaluated the linkage between the *P*-component (parental and peer attachment) and IGD while investigating the *C*-component (*cognitions*) as a possible mediator. The findings indicated that poor attachment to social agents (i.e., mother, father, peers) acts as a possible distal transdiagnostic factor contributing to elevated IGD symptomatology in adolescents. Additionally, negative automatic thoughts may be considered a relevant mechanism explaining this link. The findings are in line with other research on various child and adolescent mental health disorders (e.g., bullying, other types of addictions), promoting it as a possible transdiagnostic mechanism.

In Study 4, the focus was on the interplay between IGD symptomatology and the *P*-component (i.e., psychopathology). Additionally, we evaluated the stability of the IGD symptoms in a Romanian adolescent sample. The results revealed that the proposed IGD model was stable in Romanian adolescence, and *Preoccupation* emerged as the most influential symptom in the system. Moreover, for the first time, we revealed that conduct problems represented a central mental health condition that interacted with IGD in adolescence. Thus, we showed for the first time that adolescents with conduct problems that showed a pattern of increased preoccupation with gaming might be more prone to increased IGD symptomatology.

4.2.2. Methodological implications

In terms of methodological advances, Study 1 represented the first meta-analysis synthesizing the magnitude of the association between parental dimensions and IGD symptomatology in adolescence. Through this study, we addressed the caveats found in the past systematic review conducted on this topic and constructed a solid plan analysis accordingly. First, in the past systematic review, the parental factors were assessed without a solid theoretical background. Thus, we coded parental dimensions according to the theoretical framework of McLeod et al. (2007a) further refined by Yap et al. (2014a). Additionally, we accounted for a series of moderators and applied specific analyses to decrease the chances of having biased results. The protocol of this study was pre-registered (i.e., PROSPERO) and the data set was made available (i.e., Open Science Framework, OSF).

In the next study, we addressed the gap around the evidence-based assessment of IGD symptomatology. Using confirmatory analysis, we tested the one-factor structure of IGDS - a scale that can be completed by both youths and parents. Additionally, we implied MG-CFA to test for the measurement invariance of the scales across age, gender and respondents. Our results revealed that IGDS (parent and adolescent versions) had good psychometric properties and were found to be able to provide meaningful comparisons between youths of different ages, genders, and even between the respondents (parent and youth). The data set employed for this study was published online on a data repository (i.e., OSF).

In Study 3, the main methodology advance is related to implying path analysis to test the role of negative automatic thoughts in the relationship between attachment to social agents (mother, father and peers) and IGD symptomatology in adolescence. This approach allowed us to test possible mechanisms of change. The data set was published online on a data repository (i.e., OSF).

In the last study, the methodology's strength came from using, for the first time, a network analysis. We took advantage of this approach to test both the IGD symptomatology model in a Romanian sample of adolescence and the interplay between IGD symptomatology and the main

adolescent mental health psychopathology. Similar to the other studies, in this case, the data was published online on a data repository (i.e., OSF).

4.2.3. Clinical and practical implications

Beside the theoretical and methodological implications, this thesis has a series of clinical and practical implications for both clinicians and parents.

The findings from the first study revealed valuable information regarding the role of parental factors in the occurrence and maintenance of IGD symptomatology in adolescence, identifying a series of protective and risky parental behaviors. Thus, we believe that the efficacy of prevention and intervention programs for IGD will increase if relevant parental components (e.g., parental overinvolvement) are also targeted. Additionally, we consider that these results are also valuable for policymakers who want to regulate excessive game play. Particularly, effective regulations should consider parental involvement in the IGD etiology. Last but not least, we provide valuable insights at the parental level. Specifically, parents who create a warm and supportive environment, communicate effectively with their adolescents, and promote autonomy-granting will protect their offspring from developing IGD symptomatology.

Considering the results of Study 2, practitioners in Romania have for the first time free access to a short, reliable and valid instrument for screening IGD symptomatology in adolescents. Additionally, IGDS (parent and child versions) can be used to make valid comparisons in terms of IGD symptomatology across male or female adolescents and younger or older youths. Moreover, practitioners can assess IGD from multiple sources, namely youths and their parents, thus increasing the understanding of the current IGD symptomatology status in youth. Identifying adolescents at risk of IGD represents an important step for any practitioner before considering any decisions in terms of diagnosis and further intervention plan.

Through the findings from Studies 3 and 4, we provided practitioners with new insights on the potential mechanisms identified at multiple levels. Specifically, the results from Study 3 revealed that clinicians providing interventions or prevention programs for IGD symptomatology should focus on improving the quality of their attachment to different social agents (both parents and peers). Additionally, interventions should modify adolescents' negative automatic thoughts. Nevertheless, parents should pay attention to creating a warm and supportive environment that facilitates the development of qualitative attachment bonds with their offspring. Also, parents should pay attention to the ideas that youths develop with regards to themselves and the world around them. Moreover, friendships are relevant in adolescence, and they tend to be formed in school settings. Therefore, programs delivered in school should be focused on forming adolescents skilled in forming qualitative friendship bonds.

In study 4, we revealed that *Preoccupation* should be primarily targeted in intervention and prevention programs. Another important result was that conduct problems emerged as the only mental health conditions that interacted with IGD in a significant way. Thus, practitioners identifying an adolescent with IGD symptomatology should also assess them for cooccurring conduct problems. Additionally, in this particular case, interventions should also target conduct problems, as they will have a chain reaction on adolescent IGD symptomatology.

4.3. Limitations and Future Directions

Although the current thesis had implications at the theoretical, methodological and practical levels, the main results should be interpreted in light of a series of limitations.

First, in Study 1, the estimated effect sizes, with one exception (i.e., warmth and IGD link), were based on a limited number of studies. Therefore, the results could only be seen as preliminary (Fu et al., 2011). Additional research should be undertaken before drawing strong conclusions. Moreover, all the identified correlations, with one exception (i.e, restrictive monitoring and IGD association), had high heterogeneity. Although we performed a series of sensitivity analyses, the increased heterogeneity remained constant. This result could be due to several variables, namely the sample characteristics, the diverse instruments used to assess IGD, and parental dimensions. Future research addressing IGD should imply an internationally accepted definition for it. Additionally, identifying gold standard measures for IGD represents another caveat lacking consideration in the

IGD literature. Nevertheless, extending the age gap to emerging adulthood might bring further insights on the link between parental dimensions and IGD symptomatology.

Another important caveat is the cross-sectional design implied in Studies 2, 3 and 4, which limits the understanding of the current findings. Particularly, although IGDS (parent and child versions) revealed good psychometric properties (Study 2), future research should evaluate its accuracy when assessing IGD over time (i.e., testing longitudinal invariance). Due to the nature of cross-sectional data used in Studies 3 and 4, causality inferences can not be securely assumed. Therefore, for drawing causal inferences, longitudinal data is imperative. This will further expand our understanding of the temporal sequences of associations (attachment quality, negative automatic thoughts and IGD symptoms) and the role of the proposed mechanism (negative automatic thoughts). Additionally, the causal interplay between mental disorders (i.e., IGD and main adolescent mental health conditions) will be secured.

In Studies 2 and 4, the sample consisted of healthy adolescents. Therefore, we can not generalize the results to clinical populations. Future research should assess measurement invariance (MI) across clinical and non-clinical populations. Specifically, MI could be performed for the IGDS scales (parent and youth scales) and the network models tested in Study 4. Another limit for Study 2 was the small number of parents willing to complete the survey, with higher rates of mother answers. Therefore, MI should be expanded for PIGDS across parents.

A common limitation of the last two studies (Study 3 and 4) represents the data collection method implied (i.e., self-report instruments). Therefore, to reduce this possible bias and other methodological limits of the field, future research should imply different assessment methods for IGD and the variable of interest.

In conclusion, considering both the implication and the limits of the current thesis, we are confident that our work expanded the current knowledge on the mechanisms underlying IGD symptomatology, by applying a multilevel perspective on its etiology.

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