Internet Addiction in Adolescents: A Review

Tiffany Martini Field*

Touch Research Institutes, University of Miami/Miller School of Medicine, Miami, Florida, USA

***Corresponding author:** Tiffany Martini Field, Touch Research Institutes, University of Miami/Miller School of Medicine, Miami, Florida, USA. Tel: +13052436781; +13052436790; Email: tfield@med.miami.edu

Abstract

Studies on internet addiction in adolescents published during the years 2014-2017 were found on PubMed and PsycInfo. Predictive factors for internet addiction included parent variables (internet use, depression, heritability), personality traits (self-esteem, self-regulation, perfectionism, empathy, conscientiousness), and psychological problems (attention deficit neuroticism, anxiety, depression). Internet addiction effects included physiological responses (blood pressure, evoked potentials, fMRIs, sleep problems and overweight), psychological problems (depression and suicidal ideation), inferior academic performance, difficult relationships (family and peers), and co-morbid addictions (smoking, alcohol, drug use, cell phone addiction, internet gaming and cyberbullying). The intervention studies found in this recent literature included restricted internet use, internet monitoring by parents and group therapy. Methodological limitations include the lack of a standard internet addiction classification and the reliance on self-report questionnaires that often do not include time spent online and online and offline behaviors as well as potential underlying mechanisms such as social anxiety. Further, most of the studies are cross-sectional, not longitudinal, so that the direction of effects cannot be determined.

Internet Addiction in Adolescents: A Review

One of the first papers on the negative effects of excessive internet use on adolescents' relationships with their parents and peers was published 18 years ago [1]. At that time, the term internet addiction was rarely used and very few papers on that topic appeared in the literature. Since then, hundreds of studies, mostly survey studies, have been conducted around the world. For this review, a literature search was conducted on PubMed and PsycInfo for the years 2014-2017. Exclusion criteria included non-English papers, case studies, under-powered samples and non-juried papers. Although most of the adolescent internet addiction papers during the last few years have focused on risk factors and negative effects of excessive Internet use by adolescents, this review also includes brief summaries on the measures, prevalence and types of internet use as well as the very few studies on interventions.

The signs and symptoms of Internet addiction include compulsive use, withdrawal, tolerance, and adverse consequences [2]. Of the papers reviewed here, approximately a third have used the term Internet addiction, another third have referred to it as problematic Internet use and the final third is distributed across a variety of terms including pathological internet use, excessive internet use, intensive internet use, compulsive internet use, internet dependence, internet addiction disorder, heavy Internet use, high-risk users and internet abuse. This variety of terms reflects the diversity of studies across multiple countries and the relative lack of consensus about how to define internet use. Although some investigators have simply used "greater than two hours per day of internet use for activities other than work or homework" to define internet addiction, most have used a variety of scales, i.e. some 21 instruments that have been developed or adapted as abbreviated scales or as culturally relevant measures.

Measures, Prevalence and Types of Internet Use

The Internet Addiction Test (IAT) developed by Young in 1995 is among the most popularly used measures of internet addiction in adolescents. This 20-item scale includes questions like "How often do you try to hide how long you've been on-line?"," How often do you choose to spend more time on-line over going out with others?" and "How often do you feel depressed, moody or nervous when you are off-line, which goes away once you are back on-line? " Shorter scales including the abbreviated version of the Problematic Internet Use Questionnaire (PIUQ) (6 items) [3] and the Problematic and Risky Internet Use Screening Scale (PRIUSS) (3 items) [4] have also been used in the recent literature on the prevalence of Internet addiction in adolescents. The 3-item scale

is comprised of items on anxiety when away from the internet, loss of motivation when on the internet and feelings of withdrawal away from the internet. However, the authors suggest that positive screens on the 3-item version should then be followed by the use of the 18-item PRUISS.

The prevalence of internet addiction in adolescents has varied significantly depending on the measure used and the country of the research group. For example, the prevalence in a sample of 720 Turkish students on the internet Addiction Scale was 7% (71% men and 29% women) [5]. In another Turkish sample on 271 students using the same scale, the prevalence was 3 times that rate (20%) [6], highlighting the variability of prevalence data. In a sample of 5,005 European adolescents 14% were above the cut off for problematic internet use based on the short (6-item) PIUQ [3]. In a larger sample of 7,351 European adolescents a similar percentage (13%) of adolescents spent more than 20 hours per week on the internet and had high scores on the PIU. A comparison between two different time periods in 5 European countries (Estonia, Germany, Italy, Romania and Spain) showed a 4-7% increase over a two-year period in pathological internet use [7]. Some have argued that heavy use over time should be used as the criterion for internet addiction instead of the self-report scales, but a French survey on 22,945 French and Swiss adolescents suggested that use over time was moderately correlated with scores on internet addiction scales [8].

Culturally appropriate adaptations of the IAT have yielded higher percentages of use. For example, a screening on a sample of 5,366 adolescents from six Asian countries (China, Hong Kong, Japan, South Korea, Malaysia and the Philippines) revealed the highest rate of addiction in the Philippines but only a 5% rate when using the IAT and 4 times that rate when using the Chen Internet Addiction Scale-Revised [9]. The greatest prevalence noted in this literature search was in a sample of 408 Iranian students in which as many as 41% of students had internet addiction based on the IAT [10]. This far exceeds the international average of 15% [11]. Reputedly, pathological internet use occurs more frequently in adolescents than adults and is on the increase in several industrial countries, especially in Asia, North America and Europe [12].

The types of Internet use have varied as a function of demographic variables, for example, gender of user. In a sample of 967 Spanish adolescents, the most frequently used apps included WhatsApp (77%), social networks (70%) and music apps (67%) [13]. The most common use for girls was social networks, WhatsApp, Instagram and listening to music. In contrast, the teenage boys most frequently used the internet to browse the web, Skype, play and watch movies or tv shows. Similar gender differences were noted by another group of researchers including boys spending more time gaming and girls spending more time chatting on the social network [14]. Different motives for internet use have also been studied in a sample of 101 German adolescents

[11]. Based on the Internet Motive Questionnaire for Adolescents (IMQ-A) that assesses social, enhancement, coping and conformity motives, half of the students were high-risk internet users. Although this sample of adolescents primarily used the internet for social motives followed by enhancement and coping motives, the high-risk users accessed the internet more often for coping and enhancement and the low-risk users for social reasons.

Risk Factors

The classification of risk factors or predictor variables is arbitrary in as much as many of the studies on internet addiction in adolescents are correlational and the direction of effects cannot be determined. Although the risk factors are often presented as predictor variables especially in regression and structural equations analysis models, they may also be effects variables, as causality cannot be established. Risk factors can be more clearly noted in longitudinal studies.

However, very few of those appear in this literature that generally features large sample, survey studies that would not lend themselves to follow-up assessments. In the 2014-2017 literature reviewed here, risk factors/predictor variables for Internet addiction can be categorized as demographic variables, parent characteristics, personality traits, psychological problems and multivariate studies that include multiple problems. Demographic variables include gender and age. Parent variables include parent use of the internet, depression and heritability. Personality traits include self-esteem, self-regulation, perfectionism, empathy, consciousness. Psychological problems that have been related to internet addiction in adolescents include ADHD, neuroticism, anxiety, and depression. The multiple problems studies have typically featured comorbid psychological problems, childhood experiences, academic performance and family relationships.

Demographic variables. In a survey study in the Netherlands, 474 adolescents completed the Problematic and Risky Internet Use Screening Scale [15]. The authors were interested in Problematic Internet Use (PIU) which they defined as internet use that is risky, excessive or impulsive in nature and leads to adverse life consequences. The survey revealed that 11% of the adolescents were at risk for PIU and that risk was significantly associated with male gender, increased age and posting on a Social Networking Site (SNS) more than four times a day. However, it was not associated with the number of SNS profiles, SNS preference or the number of online friends. Male gender as a risk factor also emerged in a study on Hong Kong adolescents where the prevalence rates ranged from 17 to 27% [16]. The male adolescents not only had a higher prevalence rate but more internet addictive behaviors than the females. Female students had more problematic internet use in at least one study from Spain [17], and, no gender differences were noted in a study on Turkish students [6].

The usual problems of correlation studies apply to these demographic studies including the lack of control over confounding variables. Regression and structural equations analysis models could have been used in these large sample studies to control for potentially confounding variables and to determine the relative contribution of these variables to the outcome variance on internet addiction in adolescents.

Parent variables. In the literature on parent variables more inferences can be made based on the more robust regression analyses used. Parent variables in this literature search included parent internet use, lack of control, depression and heritability. In a survey on parent internet use, a random sampling of 1,098 parents and their adolescents suggested that 24% of adolescents and 6% of parents could be classified as moderate to severe problematic users of the internet [18]. In their stratified regression analysis, parent problematic internet use was related to adolescent problematic internet use. In a thematic analysis on Australian parents' perceptions of their adolescents' use of the internet, two themes emerged suggesting the parents' sense of loss of control over the family environment and an inability to protect their adolescents from material on the internet [19]. Using logistic regression modelling techniques, a significant association has been noted between moderate to severe depression in the parents and internet addiction in their adolescents (as measured by the Internet Addiction Test) after controlling potential confounding variables [20].

In a heritability study, the Compulsive Internet Use Scale (CIUS) was given to 5,247 monozygotic and dizygotic adolescent twins in the Netherlands [14]. The heritability estimate suggested that 48% of individual differences in the scores could be explained by genetic factors and there were no gender differences on the heritability estimates. While the data from these studies are suggestive, it is unfortunate that the separate studies focused on single variables rather than exploring the group of parent variables in a multivariate study. Conceivably the other measures collected on these very large samples will be presented in future publications.

Personality traits. Self-esteem has been a factor in at least two studies on internet addiction in adolescents. In a regression analysis on data from 408 Iranian students, depression and self-esteem contributed to the variance in internet addiction [10]. In a Chinese study on 911 adolescents, self-esteem and social support were negatively correlated with internet dependence [21]. In this case, social support mediated the relationship between self-esteem and internet dependence. When self-esteem, self-control and well-being have been measured along with problematic internet use, lower levels of each of these variables were predictive of problematic internet net use in a sample of 1552 Chinese adolescents [22].

Other personality traits that have been related to problematic internet use include self - regulation, perfectionistic attitude, empathy and conscientiousness. In a longitudinal study on 801 Spanish adolescents, structural equation modeling revealed that deficient self-regulation at time one predicted an increase in preference for online interactions, mood regulation and negative consequences of the internet at time two (components of problematic internet use) [23]. Problematic internet use at time one predicted an increase in problematic alcohol use at time 2. In a multiple binary logistic regression analysis on a data set from 720 students, male gender, duration of internet usage, depression and perfectionistic attitude were predictors of internet addiction [5]. Perfectionistic attitude was a predictor of internet addiction when gender, depression and duration of internet use were controlled. Lower empathy has also been associated with greater problematic internet use in samples from both China (N=438) and Germany (N=202) [24]. Low conscientiousness has been a predictive factor in at least two studies. In a sample of German adolescents (N=1489), lower conscientiousness was a significant predictor variable for problematic internet use [25]. In a larger sample of German adolescents (N=9,293) low conscientiousness was a significant predictor of internet addiction in both boys and girls [26].

Psychological problems. Psychological problems that appeared in the literature review (2014 - 2017) on internet addiction in adolescents included neuroticism, anxiety, depression, and ADHD. In at least two studies neuroticism has been a significant predictor of problematic internet use. In one of these studies, neuroticism was measured by the Big Five Inventory (N=1489) [25]. In the other study, neuroticism was measured by the Eysenck Personality Questionnaire (N=1211) [27]. In this study, the high use adolescents were also less extraverted.

Anxiety has been a predictive factor in at least two studies. In one of these, higher levels of anxiety were associated with internet addiction, although this association was weakened in classrooms which featured higher levels of extraversion [28]. More specifically, social anxiety disorder has been related to internet addiction and the hikikomori phenomenon (extreme retreat to one's own room) by another group [29]. In a recent review, however, mixed findings have been reported for the association between social anxiety and problematic internet use [30].

Depression has also been noted in several studies on problematic internet use in adolescents. While one study suggested that anxiety "triggered" internet use in boys, girls' internet use was triggered by depression (N=1468 Spanish speaking, Latin-American adolescents) [31]. In a logistic regression analysis of adolescent data from Taiwan (N=2170 senior high school students), depressive symptoms was a significant predictor variable [32]. In a study on 600 Italian students, those with high levels of depression had higher scores on internet addiction severity [33]. In a study on Turkish adolescents with major depression disorder, the rates of problematic internet use were higher than in adolescents who did not have major depression disorder [34]. These findings were

consistent with a longitudinal study showing that depressive symptoms at time one predicted increased preference for online relationships and mood regulation problems at time two after one year [35]. These relationships between depression and components of problematic internet use are perhaps more compelling as they come from a longitudinal study.

Depression has been a mediator between social support and internet addiction in at least one study on 10,158 Chinese adolescents [36]. In this research, 10% of the sample were moderately addicted based on the Youth Internet Addiction Test. Although other factors were considered including parental control, household income, academic performance, access to the internet and online activities, the multivariate logistic regression analysis showed that social support had a significant negative effect on internet addiction with depression mediating that effect. Anhedonia, a key facet of depression that is defined as difficulty experiencing pleasure, has predicted greater levels of compulsive internet use in a longitudinal study with a one-year follow-up assessment [37]. And, rumination, another factor associated with depression, has also been predictive of addictive internet use [38].

Attention deficit hyperactivity disorder (ADHD) comorbid with depression has also been a risk factor for problematic internet use [30]. In this review, strong associations were reported for these three problems. As these authors suggested, mental health problems have led to excessive internet use, but few studies have explored the alternative direction of problematic internet use leading to psychological problems. In another review of the literature using four online databases (CENTRAL, EMBASE, PubMed and PsycINFO) 15 studies met inclusion criteria and were included in a meta-analysis [39]. A moderate association was found between ADHD and internet addiction.

Thus, several psychological problems have been significantly associated with internet addiction. Typically, these have been explored in large sample survey studies based on questionnaires and regression or structural equations analyses have been performed with the psychological problems as predictor variables for internet addiction. Entering internet addiction as a predictor variable for the psychological problems is less frequent in this literature. Because most of these studies are cross-sectional rather than longitudinal, causality in either direction cannot be determined.

Multivariable risk studies. Several multivariate studies have been conducted. Unfortunately, many of them performed correlation analyses, making it difficult to determine the relative importance of the variables as risk factors. Nonetheless, they highlight multifactorial risks for internet addiction in adolescents. Some of these studies focused on comorbid psychological problems while others focused on internet addiction comorbid with other forms of addiction. Emotional problems and their relationships to pathological internet use symptoms were explored in a rare

longitudinal study with a two-year interval [40]. In this European study, based on the Internet Addiction Test, previous pathological internet use symptoms and emotional problems were significant predictors of pathological internet use two years later. Surprisingly, emotional problems predicted pathological internet use above and beyond the influence of previous problematic internet use.

In a Turkish study in which 59% of the 271 students had mild internet addiction scores (39%) or high internet addiction scores (20%), correlation analyses revealed that the severity of internet addiction was correlated with borderline personality features, emotional abuse, depression and anxiety symptoms [6]. In another Turkish sample (N=468) a different group of investigators reported significant correlations between internet addiction and depression, anxiety, attention disorder and hyperactivity symptoms as well as smoking [41]. Internet addiction was not correlated with age, gender, body mass index or family income.

Problematic internet use was noted in 14% of a sample of 5,538 adolescents from Barcelona Spain and was associated with female students, smoking, drinking, marijuana or other drugs, poor academic performance and poor family relationships [17]. Elevated dopamine was a potential underlying mechanism for the multiple addictions shown in this study. In at least one study dopamine levels were elevated in adolescents with high scores versus those with low scores on the Internet Addiction Test, and dopamine levels were correlated with weekly online time, although they were not correlated with the duration of internet use [42]. The results of a binary logistic regression analysis suggested that dopamine levels and weekly online time contributed to a significant amount of the variance on internet addiction scores. These data are perhaps not surprising in that dopaminergic areas of the brain light up during pleasurable experiences and during addictive activities.

Relationships have also been noted between internet addiction and personal relationships and academic performance. In a study on Chinese adolescents (N=755), internet addiction prevalence was 6%, and logistic regression analyses revealed significant associations between internet addiction and interpersonal problems, school-related problems and anxiety symptoms after controlling for demographic characteristics [43]. In a European sample (N=1,444), pathological internet use was noted in 5%, while 15% made cut-off criteria for risky Internet use [44]. Pathological internet use in this sample was related to the termination of a romantic relationship as well as non-optimal academic performance. As in several of these correlation studies, the direction of effects is not known. The latter problems could have led to the pathological internet use or vice versa.

Even more serious problems have been associated with internet addiction including aggression and cyberbullying. Surprisingly, these problems have rarely been noted in the recent literature on internet addiction in adolescents perhaps because there

is a separate literature on cyberbullying, just as there is a separate literature on cell phone addiction. Cyberbullying smoking, alcohol and depression were related to internet addiction in a sample of 1,808 Junior high school students in Taiwan [45]. In a Korean study in which internet overuse was noted in as many as 40% of middle school students, relationships were reported between overuse and attention problems, gender, delinquent behaviors and depressive symptoms, age and aggressive behavior [46]. These authors also reported that the age of initial internet use was negatively correlated with internet addiction and implied that the emotional and behavioral problems of these adolescents preceded their internet addiction.

Negative Effects of Internet Addiction on Adolescents

This section is entitled negative effects inasmuch as no positive effects were noted in the recent literature on adolescent internet addiction. Effects that were found could be categorized as physiological including blood pressure, evoked potentials, fMRI, sleep and overweight data. Psychological variables that appeared as negative effects of internet addiction included depression and suicidal ideation. Behavioral effects included school burnout and inferior academic performance. Relationships with parents were also negatively affected. Several internet addiction studies suggested negative effects that included risk-taking, sexual behavior, smoking, alcohol and drug use. Although, again, most of these studies are cross-sectional as opposed to longitudinal, suggesting that causality cannot be implied and that these are not necessarily negative effects but might also be risk factors.

Physiological effects. Physiological effects noted in the recent literature on internet addiction in adolescents include blood pressure, evoked potentials, fMRIs, sleep and overweight variables. In a study on the relationship between blood pressure and internet use, heavy internet use was defined as more than two hours per day and more than five days a week and elevated blood pressure was defined as systolic or diastolic blood pressure above the 90th percentile [47]. Heavy internet users had more elevated blood pressure as compared to light internet users. Adolescents with problematic internet use have also shown decreased sensitivity as indicated by event-related potentials to both negative and positive feedback during a risk-taking task [48]. In a review on 18 fMRI studies (17 of them from Asia), less than half of the papers reported behavioral differences between internet addiction disorder youth and normal controls [49]. However, all of the studies noted significant differences in cortical and subcortical brain regions involved in cognitive control and reward processing, suggesting that internet addiction may seriously affect brain functions. In a study on male adolescents with internet addiction, fMRIs showed significantly decreased functional brain connectivity and cortical thickness in the right lateral orbitofrontal cortex, suggesting this

may be a neurobiological marker of internet addiction.

At least 4 studies have reported associations between internet addiction and sleep problems. In a cross-sectional study of 3,067 eighth-graders living in Switzerland, internet use was associated with several pain syndromes including back pain and musculoskeletal pain as well as overweight and sleep problems [50]. When the data were entered into logistic regressions, only sleep problems remained significant. Problematic internet use has also been related to sleep disturbance in a sample of 1,772 Chinese adolescents in which 17% met the criteria for problematic internet use based on the Chinese version of the Internet Addiction Test [51]. And males in a sample of 7,533 German adolescents who used internet more than 3 hours a day reported insomnia complaints [52]. In another study that used internet use more than 3 hours a day as a criterion for excessive internet use, 41% of 727 Portuguese adolescents engaged in more than 3 hours a day but the authors only considered 19% of the adolescents internet dependent [53]. In this study, phone and laptop were the main devices used and social networks and online games were the main activities. Internet dependence was associated with mainly Twitter and Instagram use, with self-perceived sleep problems, insomnia and excessive daytime sleepiness. In a study on problematic internet use in 2,010 Korean adolescents, physically active students were less likely to have sleep problems and less likely to be problematic internet users [54]. The inverse relationship between physical activity and problematic internet use was mediated by increased sleep satisfaction. Although internet addiction would conceivably be strongly related to inactivity, it is surprising that very few studies have tapped the physical activity variable.

Overweight is another variable that is seemingly related to the inactivity associated with excessive internet use. Although activity was not reported in a study from Switzerland on 621 adolescents, overweight adolescents were significantly more likely to use the Internet more than two hours per day [55]. As the authors pointed out, internet use could be a reinforcer of already existing overweight. In another study conducted in seven European countries (N=10,287), problematic internet use was associated with a higher risk of overweight/obesity [56].

Psychological problems. Psychological problems associated with internet addiction in the recent literature include depression and suicidal ideation. In a sample of 385 high school students, internet addiction symptoms were associated with traumatic experiences for the male students and depression symptoms for the female students [57]. Excessive internet use was a mediating factor between allergic illnesses and suicidal ideation after adjusting for school and family factors in a study on Korean youth (N=73,238 students) [58]. The 19% rate of suicidal ideation in that sample seems extremely high. In another South Korean sample surveyed by another group of investigators, data from 221,265 middle and

high school students suggested that high risk users as compared to potential-risk users were more likely to report suicidal ideation or attempts [59].

Family relationship problems. Surprisingly very few studies have been conducted on family and peer relationship problems in adolescents with problematic Internet use. The peer and parent relationship problems reported for high internet use adolescents back in 2000 apparently did not inspire new studies (Sanders et al, 2000) [1]. The search for novel problems and the reluctance to conduct replication studies is a problem with this literature. But it is surprising that relationship measures have not been collected in the very large samples of adolescents in the studies reviewed here. Using latent profile analysis, a group of German investigators formed a profile group with pathological internet use from a sample of 1,723 adolescents [60]. The high internet use group showed lower levels of family functioning and more difficult family interactions. Unlike other studies, the results of their latent profile analysis were validated not only by the adolescents' self-reports but also by the adolescents' caregivers' ratings. In a study on 814 Spanish high school students, both family and peer relationships were affected by Internet abuse, and the internet abusers (approximately 25% of the sample) had poorer face-to -face interactions skills than virtual social skills [61].

Peer relationships. Data from a few Facebook studies suggest negative effects of internet addiction on peer relationships. In one study, a Facebook Intrusion Questionnaire was developed based on internet addiction [62]. Facebook intrusion was related to dissatisfaction with peer relationships, to jealous cognitions and to surveillance behaviors. In another Facebook study, research participants were asked to imagine viewing their romantic partners' Facebook [63]. The researchers varied the hypothetical privacy settings and the number of the couples' photos on Facebook. Negative emotions resulted including jealousy, anger, disgust and hurt, especially for the females who felt these more intensely than the males. In a survey of 205 Facebook users, a high level of Facebook use was related to negative relationship outcomes, and these were mediated by Facebook-related conflict, especially among those who had new relationships [64].

Academic performance problems. These have included lower grades and school burnout. Excessive internet use has been associated with lower school grades in a sample of 905 Dutch high school students via an online survey [65]. Mixed-effects regression models were used to assess the mediating effects of psychosocial problems. Compulsive internet use along with being bullied, bullying and smoking were associated with low grades via the mediating effects of psychosocial problems. The Compulsive Internet Use Scale (CIUS) was also used with 417 Chinese adolescents [66]. Male adolescents were more likely to be compulsive internet users, and the CIUS scores were correlated with daily internet use time and negatively correlated with academic performance. Excessive internet use has also been associated with school burnout among Finnish early and late adolescents (N=3338) [67]. Using two longitudinal data waves and structural equation modeling, the data analyses revealed cross-legged paths between excessive internet use and school burnout, with school burnout predicting later excessive internet use and excessive internet use predicting later school burnout. Again, in this sample, more boys experienced excessive internet use and more girls suffered from depression.

Related addictions. Related addictions studies have included cell phone addiction, internet gaming, sexting, cyberdating abuse, cyberbullying and substance abuse. They are briefly reviewed here as they have been significantly highly related to internet addiction in adolescents. Cell phone addiction is significantly related to internet addiction, although it has a distinct user profile, for example, it occurs more frequently in females [68] and especially those with low self-esteem [69]. Like internet addiction, its prevalence has varied (0-38%) depending on the scale used and the location of the research [69]. And, in some countries smart phones are continuously connected to the internet (for example, 89 % time in a sample of 609 Turkish tenth grade students) [70]. As in internet addiction, cell phone addiction has been associated with sleep disturbances, anxiety, depression and substance abuse including smoking and alcohol [68,71].

Internet gaming. Internet addiction and internet gaming have been noted to augment the symptoms of each other in a sample of 509 adolescents [72]. Like internet addiction, internet gaming disorder has been shown to increase functional connectivity density in the dorsal lateral prefrontal cortex [73].

Sexting (the exchange of sexually explicit content via cell phone, internet or social networks) is related to both internet and cell phone addiction. In a Los Angeles study on 1,285 middle school students 5% of students reported sending sexts, and 20% reportedly received sexts [74]. Both groups were more likely to report sexual activity as well as unprotected sex and condom use. In a review of the sexting literature, sexting occurred more in older adolescents, and more individuals reported receiving than sending sexts [75]. Sexting among boys has been related to their perceptions of peer approval, and those perceptions of approval, in turn, predicted increased experience with sexual behavior [76]. Sexting has been more prevalent in males and has related to more online dating violence in a sample of 1,334 adolescents [77]. And sexting has been associated with earlier sexual behavior, bullying, substance abuse, depression and suicide [78]. Sexting, like excessive internet use, has been associated with relational anxiety [79]. In this study, fear of negative evaluation from the dating partner predicted sending nude photos or sexually suggestive messages. Greater social distress when dating was also associated with sexting behaviors.

Cyberbullying is one of the most serious problems associated with internet and cell phone addictions. In a sample of 265 females, 27% of the students had experienced cyberbullying, 17% had experienced depression and 38% met the criteria for problem drinking [80]. Those involved in cyberbullying as bullies had increased odds of both depression and problem alcohol use, while bully victims had increased odds of depression, with the highest odds for those who had received unwanted online or text message sexual advances. In an even younger sample of sixth graders, as many as 15% had experienced cyberbullying at least once [81]. In a very large sample of 8053 students from 30 middle schools and 21 high schools, pathological internet use was noted in 10% of the students and 7% were cyberbullying victims and 7% perpetrators of cyberbullying [82]. In this cross-sectional study, hours of daily internet use on a mobile phone was associated with internet abuse and cyberbullying.

Substance abuse including tobacco, marijuana and alcohol use have been frequently reported among adolescents with internet addiction. In one study on 11,931 European adolescents, 90% of the adolescents had multiple risk-taking behaviors [83]. The strongest associations with pathological internet use were poor sleeping habits and risk–taking behaviors along with tobacco use, poor nutrition and physical inactivity. Similarly, tobacco drug use was reported on a U.S. sample who completed both Young's Diagnostic Questionnaire and the Compulsive Internet Use Scale [84]. In this sample, students who spent more than 25 hours per week on the internet for non-school or non-work-related activities reported internet–associated health and/or psychosocial problems including sleep deprivation, failure to concentrate, academic under-achievement, lack of exercise, lack of face-to-face social interactions and negative mood states. These students also reported that they had first experienced the internet at an average age of nine years and had a problem with internet overuse at an average age of 16.

Swiss adolescents who had high scores on the Internet Addiction Test and averaged 14 years of age (N=3,067) were more likely to be female, to be below average on their academic performance, and to use significantly more drugs including tobacco, alcohol and marijuana [85]. In the same Swiss sample by the same investigators, a backward logistic regression suggested that problematic internet users were more prone to spend their leisure time online, to access the internet via a smart phone or tablet, to be physically inactive, to have less emotional well-being and to smoke [86]. In a survey study from Germany on 1,444 adolescents, approximately 5% of the sample reported both problematic internet use and problematic alcohol use [87]. Conduct problems and depression symptoms were also associated with problematic internet use and alcohol use.

In one of the largest samples from the U.S., adolescents (N=21,170 8th graders and 24,362 10th graders) were asked questions about internet use outside school or work and binge drinking [88]. A dose-response relation was noted between internet use and binge drinking, a relationship that was stronger for the eighth-graders than the 10th-graders.

These effects variables, irrespective of whether they are truly effects variables or whether they are risk factors or comorbidities with internet addiction combine to suggest the need for early interventions, at least before 8th grade. Unfortunately, very few intervention studies have been conducted. Screening for interventions and designing interventions may be difficult partially because many risk factors have been identified which would result in false positives as, for example, depression does not necessarily lead to internet addiction. High-risk profiles need to be identified based on multivariate studies and profile analysis. These countless large-sample effects studies from many countries that include several variables might be reanalyzed for risk profiles. In several studies risks and effects have been reciprocal such that directions of effects are difficult to determine. However, profile analyses might be more informative than correlation analyses for intervention research.

Intervention Research on Internet Addiction in Adolescents

Although only one group assignment intervention therapy study could be found in the recent literature, studies that report parental restriction of internet use and parental monitoring of internet use might also be considered intervention studies. In a study on 2,021 adolescents from Hong Kong, 24% of the adolescents scored high on internet addiction [36]. In a logistic regression, adolescents from low income, divorced families experienced more internet addiction. As the authors noted, adolescents with restricted internet use were almost 2 times more likely to have internet addiction than those who were not restricted. In contrast, parental restrictive mediation has had positive effects in other studies. For example, in a sample of 1,808 junior high school students in Taiwan, the adolescents who reported high levels of parental restrictive mediation were less likely to experience internet addiction or cyberbullying. Internet addiction in this sample was associated with very negative outcomes including cyberbullying and victimization/perpetration, depression, smoking and alcohol consumption.

The protective effects of parental monitoring of internet use were also noted in an online survey of 629 adolescents [89]. In a structural equations model, parental monitoring effects were direct and 26 times greater than parental internet restriction effects. Parental monitoring was associated with reduced rates of online harassment, and lower rates of harassment were indirectly related to limited internet access in the adolescents' bedrooms. In another study, supportive parental monitoring of internet use was related to

less pathological internet use in adolescents [87].

In a group therapy study that could be found in the recent literature on internet use by adolescents, 92 adolescents with internet addiction and their parents were assigned to an experimental group of 6 sessions of group therapy or a waitlist control group [90]. Assessments were made at pre-intervention, post-intervention and a three-month follow-up. As might be expected, a significant decline occurred in both the average score and the proportion of adolescents with internet addiction in the therapy group which was surprisingly maintained at the 3-month follow-up assessment. The reports from the adolescents and their parents suggested that these improvements related to improved parent-adolescent interactions. In a meta-analysis of interventions for internet addiction, integrative therapy had a larger effect size compared to other therapies such as reality therapy and cognitive behavior therapy [91]. In this meta-analysis, interventions that included 9-12 people had larger effect sizes than those who had fewer or more people and interventions that lasted 8 or more weeks revealed larger effect sizes as compared to shorter interventions.

Limitations of the Literature and Future Directions

Survey studies on prevalence, risk factors and effects data comprise most of the recent literature on internet addiction in adolescents. Only a few interventions were noted in this recent literature including restricted internet use and monitoring by parents as well as group therapy. Methodological limitations of this research include the lack of a standard internet addiction classification and the reliance on self-report questionnaires that often do not include time spent online and online behaviors. Smaller sample observational and laboratory studies are needed to understand specific online behaviors and the risk factors associated with internet addiction in adolescents. For example, social anxiety would seem to be associated with internet addiction, yet it has not been reported in these large survey samples.

Further, most of the recent studies are correlational so that direction of effects cannot be determined. The usual problems of correlation studies apply for these studies including the lack of control over confounding variables. Regression and structural equations analysis models could have been used in these large sample studies to control for potentially confounding variables and to determine the relative contribution of these variables to the outcome variance on internet addiction in adolescents.

As internet addiction is associated with so many other demographic, psychological and behavioral problems as well as comorbid addictions, there is a need for more multivariate research and profile/regression/structural equation modeling that can identify the relative variance explained by these variables. Identifying high risk profiles could then be translated into clinical interventions.

It would seem that interventions that have been effectively used with other addictions could be tried with adolescents who are experiencing internet addiction including, for example, the parent monitoring protocols that have been effective, exercise programs, meditation and cognitive behavior therapy. In addition, with internet addiction and other addictions like cell phone addiction, sexting, cyberbullying and substance use occurring even in pre-adolescence, school-based education programs are needed for both parents and students along with teacher and peer monitoring of these addictive behaviors.

The internet and cell-phone technology that was intended for communication and educational purposes has become addictive and problematic for many aspects of the health and well-being of younger and younger adolescents. The survey studies reviewed here have highlighted the prevalence, risks and effects of internet addiction. However, more small-scale empirical studies are needed to explore the specific internet addiction and related addiction behaviors, the personality and non-internet activity profiles of the adolescents and the underlying mechanisms to inform the even more needed early intervention/prevention studies.

References

1. Sanders C, Field T, Diego M, Kaplan M (2000) The Relationship of internet use to depression and social isolation among adolescents. Adolescence 35: 237-242.

2. Jorgenson AG, Hsiao RC, Yen CF (2016) Internet addiction and other behavioral addictions. Child Adolesc Psychiatr Clin N Am 25: 509-520.

3. Demetrovics S, Kiraly O, Koronczai B, Griffiths MD, Nagygyorgy K, et al. (2016) Psychometric properties of the Problematic Internet Use Questionnaire short-form (PIUQ-6) in a nationally representative sample of adolescents. PLoS One. 11: e0159409.

4. Moreno, MA, Arseniev-Koehler, A, Selkie, E (2016) Development and testing of a 3-item screening tool for problematic internet use. J Pediatr 176: 167-172.

5. Senormanci O, Saracli O, Atasoy N, Senormanci G, Kokturk F, et al. (2014) Relationship of internet addiction with cognitive style, personality, and depression in university students. Compr Psychiatry 55: 1385-1390.

6. Dalbudak E, Evren C, Aldemir S, Evren B (2014) The severity of Internet addiction risk and its relationship with the severity of borderline personality features, childhood traumas, dissociative experiences, depression and anxiety symptoms among Turkish university students. Psychiatry Res 219: 577-582.

7. Kaess M, Parzer P, Brunner R, Koenig J, Durkee T, et al. (2016) Pathological internet use is on the rise among European adolescents. J Adolesc Health 59: 236-239.

8. Baggio S, Dupuis M, Studer J, Spika S, Daeppen JB, et al. (2016) Reframing video gaming and internet use addiction: empirical cross-national comparison of heavy use over time and addiction scales among young users. Addiction 111: 513-522.

9. Mak KK, Lai CM, Watanabe H, Kim DI, Bahar N, et al. (2014) Epidemiology of internet behaviors and addiction among adolescents in six Asian countries. Cyberpsychol Behav Soc Netw 17: 720-728.

10. Bahrainian SA, Alizadeh KH, Raeisoon MR, Gorji OH, Khazaee A (2014) Relationship of internet addiction with self-esteem and depression in university students. J Prev Med Hyg 55: 86-89.

11. Bischof-Kastner C, Kuntsche E, Wolstein J (2014) Identifying problematic Internet users: development and validation of the Internet Motive Questionnaire for Adolescents (IMQ-A). J Med Internet Res 16: 230.

12. Wartberg L, Aden A, Thomsen M, Thomasius R (2015) [Relationship between family interactions and pathological internet use in adolescents: A review]. Z Kinder Jugendpsychiatr Psychother 43: 9-17.

13. Reolid-Martinez RE, Flores-Copete M, Lopez-Garcia M, Alcantud-Lozano P, Ayuso-Raya MC, et al. (2016) Frequency and characteristics of internet use by Spanish teenagers. A cross-sectional study. Arch Argent Pediatr 114: 6-13.

14. Vink JM, van Beijsterveldt TC, Huppertz C, Bartels M, Boomsma DI (2016) Heritability of compulsive internet use in adolescents. Addict Biol 21: 460-468.

15. Jelenchick LA, Hawk ST, Moreno MA (2016) Problematic internet use and social networking site use among Dutch adolescents. Int J Adolesc Med Health 28: 119-121.

16. Shek DT, Yu L (2016) Adolescent internet addiction in Hong Kong: Prevalence, change, and correlates. J Pediatr Adolesc Gynecol 29: S22-30.

17. Munoz-Miralles R, Ortega-Gonzalez R, Lopez-Moron MR, Batalla-Martinez C, Manresa JM (2016) The problematic use of Information and Communication Technologies (ICT) in adolescents by the cross sectional JOITIC study. BMC Pediatr 16: 140.

18. Lam LT, Wong EM (2015) Stress moderates the relationship between problematic internet use by parents and problematic internet use by adolescents. J Adolesc Health 56: 300-306.

19. Lewis AJ, Knight T, Germanov G, Benstead ML, Joseph CI, et al. (2015) The Impact on family functioning of social media use by depressed adolescents: A qualitative analysis of the family options study. Front Psychiatry 6: 131.

20. Lam LT (2015) Parental mental health and internet addiction in adolescents. Addict Behav 42: 20-23.

21. Zhang R (2015) Internet dependence in Chinese high school students: Relationship with sex, self- esteem, and social support. Psychol Rep 117: 8-25.

22. Mei S, Yau YH, Chai J, Guo J, Potenza MN (2016) Problematic internet use, well-being, self-esteem and self-control: Data from a high school survey in China. Addict Behav 61: 74-79.

23. Gamez-Guadix M (2014) Depressive symptoms and problematic internet use among adolescents: analysis of the longitudinal relationships from the cognitive-behavioral model. Cyberpsychol Behav Soc Netw 17: 714-719.

24. Melchers M, Li M, Chen Y, Zhang W, Montag C (2015) Low empathy is associated with problematic use of the internet: Empirical evidence from China and Germany. Asian J Psychiatr 17: 56-60.

25. Muller KW, Wolfling K, Beutel ME, Stark B, Quiring O, Aufenanger S, et al. (2018) Insights into aspects behind internet-related disorders in adolescents: The interplay of personality and symptoms of adjustment disorders. J Adolesc Health 62: 234-240.

26. Muller KW, Dreier M, Duven E, Giralt S, Beutel ME, Wolfing K (2017) Adding clinical validity to the statistical power of large-scale epidemiological surveys on internet addiction in adolescence: A combined approach to investigate psychopathology and development-specific personality traits associated with internet addiction. J Clin Psychiatry 78: e244-e251.

27. Tsiolka E, Bergiannaki ID, Margariti M, Malliori M, Papageorgiou C (2017) Dysfunctional internet behavior symptoms in association with personality traits. Psychiatriki 28: 211-218.

28. Stavropoulos V, Gomez R, Steen E, Beard C, Liew L, Griffiths MD (2017) The longitudinal association between anxiety and internet addiction in adolescence: The moderating effect of classroom extraversion. J Behav Addict 6: 237-247.

29. Cerniglia L, Zoratto F, Cimino S, Laviola G, Ammaniti M, Adriani W (2017) Internet addiction in adolescence: Neurobiological, psychosocial, and clinical issues. Neurosci Biobehav Rev 76: 174- 184.

30. Taylor S, Pattara-Angkoon S, Sirirat S, Woods D (2017) The theoretical underpinnings of internet addiction and its association with psychopathology in adolescence. Int J Adolesc Med Health.

31. Oberst U, Wegmann E, Stodt B, Brand M, Chamarro A (2017) Negative consequences from heavy social networking in adolescents: The mediating role of fear of missing out. J Adolesc 55: 51-60.

32. Lin MP, Wu JY, You J, Hu WH, Yen CF (2017) Prevalence of internet addiction and its risk and protective factors in a representative sample of senior high school students in Taiwan. J Adolesc 62: 38-46.

33. Scimeca G, Bruno A, Cava L, Pandolfo G, Muscatello MR, et al. (2014) The relationship between alexithymia, anxiety, depression, and internet addiction severity in a sample of Italian high school students. Scientific World Journal 2014: 504376.

34. Alpaslan AH, Soylu N, Kocak U, Guzel HI (2016) Problematic internet use was more common in Turkish adolescents with major depressive disorders than controls. Acta Paediatr 105: 695-700.

35. Gamez-Guadix M, Calvete E, Orue I, Las Hayas C (2015) Problematic internet use and problematic alcohol use from the cognitive-behavioral model: A longitudinal study among adolescents. Addict Behav 40: 109-114.

36. Wu XS, Zhang ZH, Zhao F, Wang WJ, Li YF, et al. (2016) Prevalence of internet addiction and its association with social support and other related factors among adolescents in China. J Adolesc 52: 103-111.

37. Guillot CR, Bello MS, Tsai J, Huh J, Leventhal AM, et al. (2016) Longitudinal associations between anhedonia and internet-related addictive behaviors in emerging adults. Comput Human Behav 62: 475-479.

38. McNicol ML, Thorsteinsson EB (2017) Internet addiction, psychological distress, and coping responses among adolescents and adults. Cyberpsychol Behav Soc Netw 20: 296-304.

39. Wang BQ, Yao NQ, Zhou X, Liu J, Lv ZT (2017) The association between attention deficit/ hyperactivity disorder and internet addition: A systematic review and meta-analysis. BMC Psychiatry 17: 260.

40. Strittmatter E, Parzer P, Brunner R, Fischer G, Durkee T, et al. (2016) A 2-year longitudinal study of prospective predictors of pathological Internet use in adolescents. Eur Child Adolesc Psychiatry 5: 725-734.

41. Seyrek S, Cop E, Sinir H, Ugurlu M, Senel S (2017) Factors associated with internet addiction: Cross-sectional study of Turkish adolescents. Pediatr Int 59: 218-222.

42. Liu M, Luo J (2015) Relationship between peripheral blood dopamine level and internet addiction disorder in adolescents: A pilot study. Int J Clin Exp Med 8: 9943-9948.

43. Tang J, Yu Y, Du Y, Ma Y, Zhang D, et al. (2014) Prevalence of internet addiction and its association with stressful life events and psychological symptoms among adolescent internet users. Addict Behav 39: 744-747.

44. Koenig J, Fischer-Waldschmidt G, Brunner R, Resch F, Kaess M (2016) [Refuge in digital worlds- the association of critical life events with pathological internet use in adolescents]. Prax Kinderpsychol Kinderpsychiatr 65: 494-515.

45. Chang FC, Chiu CH, Miao NF, Chen, PH, Lee, CM, et al. (2015) The relationship between parental mediation and Internet addiction among adolescents, and the association with cyberbullying and depression. Compr Psychiatry 57C: 21-28.

46. Lee JY, Shin KM, Cho SM, Shin YM (2014) Psychological risk factors associated with internet addiction in Korea. Psychiatry Investig 11: 380-386.

47. Cassidy-Bushrow AE, Johnson DA, Peters RM, Burmeister C, Joseph CL (2015) Time spent on the internet and adolescent blood pressure. J Sch Nurs 31: 374-384.

48. Yau, YH, Potenza MN, Mayes LC, Crowley MJ (2015) Blunted feedback processing during risk-taking inadolescents with features of problematic Internet use. Addict Behav 45: 156-163.

49. Sepede G, Tavino M, Santacroce R, Fiori F, Salerno RM (2016) Functional magnetic resonance imaging of internet addiction in young adults. World J Radiol 8: 210-225.

50. Suris JC, Akre C, Piguet C, Ambresin AE, Zimmermann G, et al. (2014) Is Internet use unhealthy? A cross-sectional study of adolescent Internet overuse. Swiss Med Wkly 144: w14061.

51. Tan Y, Chen Y, Lu Y, Li L (2016) Exploring associations between problematic internet use, depressive symptoms and sleep disturbance among Southern Chinese adolescents. Int J Environ Res Public Health 13: E313.

52. Lange K, Cohrs S, Skarupke C, Gorke M, Szagun B, et al. (2015) Electronic media use and insomnia complaints in German adolescents: gender differences in use patterns and sleep problems. J Neural Transm (Vienna) 124: 79-87.

53. Ferreira C, Ferreira H, Vieira MJ, Costeira M, Branco L, Dias A, et al. (2017) [Epidemiology of internet use by an adolescent population and its relation with sleep habits]. Acta Med Port 30: 524-533.

54. Park S (2014) Associations of physical activity with sleep satisfaction, perceived stress, and problematic internet use in Korean adolescents. BMC Public Health 14: 1143.

55. Barrense-Dias Y, Berchtold A, Akre C, Suris JC (2016) The relation between internet use and overweight among adolescents: A longitudinal study in Switzerland. Int J Obes (Lond) 40: 45-50.

56. Tsistsika AK, Andrie EK, Psaltopoulou T, Tzavara CK, Sergentanis TN, et al. (2016) Association between problematic internet use, socio-demographic variables and obesity among European adolescents. Eur J Public Health 26: 617-622.

57. Schimmenti A, Passanisi A, Caretti V, La Marca L, Granieri A (2015) Traumatic experiences, alexithymia, and internet addiction symptoms among late adolescents: A moderated mediation analysis. Addict Behav 64: 314-320.

58. Lee D, Seo J, Lee CS, Park CS, Kim BJ, et al. (2015) Allergic diseases, excessive internet use and suicidal ideation in Korean adolescents. Compr Psychiatry 62: 100-104.

59. Lee SY, Park EC, Han KT, Kim SJ, Chun SY, et al. (2016) The association of level of internet use with suicidal ideation and suicide attempts in South Korean adolescents: A focus on family structure and household economic status. Can J Psychiatry 61: 243-251.

60. Wartberg L, Kriston L, Kammerl R, Peterson KU, Thomasius R (2015) Prevalence of pathological internet use in a representative German sample of adolescents: Results of latent profile analysis. Psychopathology 48: 25-30.

61. Carballo JL, Marin-Vila M, Espada JP, Orgiles M, Piqueras JA (2015) Internet abuse risk factors among Spanish adolescents. Span J Psychol 18: E94.

62. Elphinston RA, Noller P (2011) Time to face it! Facebook intrusion and the implications for romantic jealousy and relationship satisfaction. Cyberpsychol Behav Soc Netw 14: 631-635.

63. Muscanell NL, Guadagno RE, Rice L, Murphy S (2013) Don't it make my brown eyes green? An analysis of Facebook uses and romantic jealousy. Cyberpsychol Behav Soc Netw 16: 237-242.

64. Clayton RB, Nagurney A, Smith JR (2013) Cheating, breakup, and divorce: Is Facebook use to blame? Cyberpsychol Behav Soc Netw 16: 717-720.

65. Busch V, Laninga-Wijnen L, Schrijvers AJ, De Leeuw JR (2015) Associations of health behaviors, school performance and psychological problems in adolescents in the Netherlands. Health Promot Int 32: 280-291.

66. Dhir A, Chen S, Nieminen M (2015) Psychometric validation of the Chinese Compulsive Internet Use Scale (CIUS) with Taiwanese high school adolescents. Psychiatr Q. 86: 581-596.

67. Salmela-Aro K, Upadyay K, Hakkarainen K, Lonka K, Alho K (2016) The dark side of internet use: Two longitudinal studies of excessive internet use, depressive symptoms, school burnout and engagement among Finnish early and late adolescents. J Youth Adolesc 46: 343-357.

68. De-Sola Gutiérrez J, Rodriguez de Fonseca F, Rubio G (2016) Cell phone addiction: A review. Front Psychiatry 7: 175.

69. Pedrero Perez EJ, Rodriguez Monje MT, Ruiz Sanchez De Leon JM (2012) [Mobile phone abuse or addiction. A review of the literature]. Addicciones 24: 139-152.

70. Ayar D, Bektas M, Betkas I, Akdeniz Kudubes A, Selekoglu Ok Y, Sal Altan S, et al. (2017) The effect of adolescents' internet addiction on smartphone addiction. J Addict Nurs 28: 210-214.

71. Bruni O, Sette S, Fontanesi L, Baiocco R, Laghi F, et al. (2015) Technology use and sleep quality in preadolescence and adolescence. J Clin Sleep Med 11: 1433-1441.

72. Pontes HM (2017) Investigating the differential effects of social networking site addiction and internet gaming disorder on psychological health. J Behav Addict 13: 1-10.

73. Du X, Yang Y, Gao P, Qi X, Du G, Zhang Y, et al. (2017) Compensatory increase of functional connectivity density in adolescents with internet gaming disorder. Brain imaging Behav 11: 1901-1909.

74. Rice E, Gibbs J, Winetrobe H, Rhoades H, Plant A, et al. (2014) Sexting and sexual behavior among middle school students. Pediatrics 134: e21-8.

75. Klettke B, Hallford DJ, Mellor DJ (2014) Sexting prevalence and correlates: a systematic literature review. Clin Psychol Rev 34: 44-53.

76. Doornwaard SM, ter Bogt TF, Reitz E, van den Eijnden RJ (2015) Sex-related online behaviors, perceived peer norms and adolescents' experience with sexual behavior: Testing and integrative model. PLos One. 10: e0127787.

77. Morelli M, Bianchi D, Baiocco R, Pezzuti L, Chirumbolo A (2016) Sexting, psychological distress and dating violence among adolescents and young adults. Psicothema 28: 137-142.

78. Ahern NR, Mechling B (2013) Sexting: serious problems for youth. J Psychosoc Nurs Ment Health Serv 51: 22-30.

79. Weisskirch RS, Drouin M, Delevi R (2016) Relational anxiety and sexting. J Sex Res 31: 1-9.

80. Selkie EM, Kota R, Chan YF, Moreno M (2015) Cyberbullying, depression, and problem alcohol use in female college students: a multisite study. Cyberpsychol Behav Soc Netw 18: 79-86.

81. Peskin MF, Markham CM, Shegog R, Temple JR, Baumler ER, et al. (2016) Prevalence and correlates of the perpetration of cyber dating abuse among early adolescents. J Youth Adolesc 46: 358-375.

82. Tsimtsiou Z, Haidich AB, Drontsos A, Dantsi F, Sekeri Z, Drosos E, et al. (2017). Pathological internet use, cyberbullying and mobile phone use in adolescence: A school-based study in Greece. Int J Adolesc Med Health.

83. Durkee T, Carli V, Floderus B, Wasserman C, Sarchiapone M, et al. (2016) Pathological internet use and risk-behaviors among European adolescents. Int J Environ Res Public Health 13: E294.

84. Li W, O'Brien JE, Snyder SM, Howard MO (2015) Characteristics of internet addiction/pathological internet use in U.S. University students: A qualitative-method investigation. PLoS One 10: e0117372.

85. Rucker J, Akre C, Berchtold A, Suris JC (2015) Problematic internet use is associated with substance use in young adolescents. Acta Paediatr 104: 504-507.

86. Piguet C, Berchtold A, Akre C, Suris JC (2015) What keeps female problematic internet users busy online? Eur J Pediatr 174: 1053-1059.

87. Wartberg L, Brunner R, Kriston L, Durkee T, Parzer P, et al. (2016) Psychopathological factors associated with problematic alcohol and problematic Internet use in a sample of adolescents in Germany. Psychiatry Res 240: 272-277.

88. Mu KJ, Moore SE, LeWinn KZ (2015) Internet use and adolescent binge drinking: Findings from the monitoring the future Study. Addict Behav Rep 2: 61-66.

89. Khurana A, Bleakley A, Jordan AB, Romer D (2015) The protective effects of parental monitoring and internet restriction on adolescents' risk of online harassment. J Youth Adolesc 44: 1039-1047.

90. Liu QX, Fang XY, Yan N, Zhou SK, Yuan XJ, et al. (2015) Multi-family group therapy for adolescent internet addiction: exploring the underlying mechanisms. Addict Behav 42: 1-8.

91. Chun J, Shim H, Kim S (2017) A meta-analysis of treatment interventions for internet addiction among Korean adolescents. Cyberpsychol Behav Soc Netw 20: 225-231.